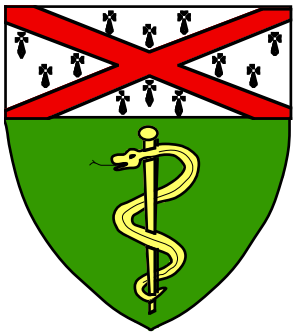
Autopsy Service Manual



Department of Pathology

Yale University School of Medicine
Yale-New Haven Hospital
Bridgeport Hospital
VA-Connecticut - West Haven

2014

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General Introduction

The Yale Pathology Autopsy Service investigates disease by postmortem study of tissues and clinical records. This investigation is crucial to the continuing education of the hospital's medical staff, for obtaining important epidemiological information, as a quality control mechanism for the hospital, and to provide teaching material for pre- and post-graduate training.

The Yale Medical School department of pathology provides autopsy services for Yale-New Haven Hospital, Bridgeport Hospital, and the West Haven branch of the VA Connecticut Healthcare System. In addition, the New Haven-based staff also provides morgue services for Yale-New Haven Hospital.

The autopsy is the ultimate outcomes measure device for use in the hospital's quality control and quality assurance programs. The "autopsy" is not merely the evisceration and dissection of the organs; it begins with the review of the medical record and continues through the writing of the clinical-pathological correlation and the presentation of the case at clinical conferences. Communication of the results to the clinical team and correlation of the autopsy findings with the clinical history is what makes the pathologist a consultant and not a technician.

Mission of the Autopsy Service

- To thoroughly evaluate the presence and extent of human disease in patients succumbing to those diseases, and to evaluate the effectiveness of therapeutic procedures, for the benefit of patient families, our staff, and the future practice of medicine
- To educate our housestaff, housestaff and medical staff in other departments, and medical students in the physical manifestation of human disease and in post-mortem examination procedures
- To develop quality assurance data and outcomes measures statistics for the Yale-New Haven Hospital and Bridgeport Hospital

Resident Competencies *(Updated 2014)*

The Accreditation Council for Graduate Medical Education (ACGME) has defined six areas in which residents in training are expected to achieve proficiency. The major goals and objectives for the residents in each of these competency areas during their training on the autopsy service are delineated below, including additional competencies for the senior resident on the service:

Patient Care: Residents must demonstrate a satisfactory level of diagnostic competence and the ability to provide appropriate and effective consultation in the context of pathology services. This includes:

- determining that an autopsy permit is valid, that permission has been given by an appropriate individual, and noting any restrictions
- recognizing when a particular case falls under the jurisdiction of the medical examiner office
- adhering to and applying universal precautions in the day-to-day activities in the autopsy room
- becoming proficient in the standard techniques for the identification, external examination, evisceration and dissection of adults, children, and fetuses, preserving anatomic relationships and connections as appropriate (first two months)

- understanding the differences between the Virchow and the Letulle/Rokitansky autopsy approaches and the advantages/disadvantages of each
- understanding when it is appropriate and preferable to deviate from standard evisceration and dissection technique to better demonstrate the pathology in a particular case
- generating appropriate differential diagnoses based upon gross examination of organs and tissues, and perform the appropriate histologic and special studies needed to resolve those differentials
- recognizing patterns of anatomic changes across organ systems as being related to a single underlying disease process
- completing autopsy provisional and final reports in a timely fashion
- utilizing the "autopsy status board" and the autopsy checklist to assist in the completion of cases
- becoming proficient in specialized dissection techniques, performing them without prompting when the details of the case call for a specialized approach (second two months). These would include removal of the brain and spinal cord as a connected unit, preservation of the inferior vena cava and portal vascular systems, removal of the eyes, dissection of the mesenteric vessels, dissection of the biliary tree, etc.
- in a graduated fashion over the four months of the rotation, acquiring the ability to perform a complete autopsy examination independently
- completing accurate cause of death statements and evaluating the accuracy of death certificates

Senior Resident:

- training junior residents in the techniques of autopsy evisceration and dissection
- obtaining experience running a medical service
- mediating as needed between the attending pathologist and junior residents on the service
- being fully aware of the details of on-going and pending cases
- understanding what constitutes a medical examiner reportable case, and appropriately bringing such cases to the attention of morgue staff an assisting in clarification of medical examiner jurisdiction
- proofreading junior resident write-ups in a timely fashion, providing direction, constructive criticism, and assistance
- as needed due to case load or junior resident staffing, taking primary responsibility for cases, including writing the report for such cases
- maintaining the "autopsy status board" and supervising the use of the autopsy checklist as means of tracking and completing cases

Medical Knowledge: Residents must demonstrate knowledge about established and evolving biomedical, clinical and cognate sciences and application of this knowledge to pathology. This includes:

- demonstrating an ability to glean from the medical record the pertinent clinical questions to be addressed during the autopsy examination
- demonstrating an understanding of the clinical correlates and manifestations of pathology identified at autopsy
- learning to photographically document an autopsy case, including all abnormal and pertinent normal findings

- writing a well organized, thorough, and educational summary which addresses the clinical questions and draws upon recent advances (as documented in the literature) in our understanding of the particular disease processes manifested in the case

Practice-based Learning and Improvement: Residents must be able to demonstrate the ability to investigate and evaluate their diagnostic and consultative practices, appraise and assimilate scientific evidence and improve their patient care practices. This includes:

- actively seeking out additional clinical information by consulting patient information systems within the department and hospital
- using on-line literature searching resources to identify recent advances in our understanding of the disease processes manifested in the autopsy cases
- monitoring their own case distribution (adults vs. pediatric/fetal) to assure a broad-based exposure to the variations in technical and diagnostic skills based on patient age
- regularly attending departmental gross presentations in order to maximize exposure to the anatomic manifestations of different disease processes
- accepting and learning from constructive feedback and guidance from those in a position to provide such input, including attending physicians, laboratory supervisors and housestaff colleagues
- preparing case presentations for the monthly autopsy conferences
- preparing of articles for the monthly journal clubs

Senior Resident:

- intervening in complicated cases to assist the coordination of obtaining history and special studies
- attending all gross presentation of cases
- maintaining the "autopsy status board" and supervising the use of the autopsy checklist as means of tracking cases
- preparing case presentations for the monthly autopsy conferences as well as reviewing junior resident presentations
- preparing articles for the monthly journal clubs

Interpersonal and Communication Skills: Residents must be able to demonstrate interpersonal and communication skills that result in effective information exchange and teaming with other health care providers and patient families. This includes:

- effectively conversing about general pathology with clinicians, housestaff, and medical students
- contacting members of the clinical team and/or private primary care providers for the patients, and or patient family members, as necessary, prior to beginning the autopsy and eliciting appropriate key information about the patient's medical history and specific questions to be addressed during the autopsy
- learning to present a concise, organized clinical summary of the patient to the attending pathologist prior to the autopsy and organ review, including pertinent negative information
- re-contacting members of the clinical team upon completion of the autopsy to discuss findings and, as needed, obtain additional clinical correlation for pathology identified at autopsy

- learning to draw upon the assistance of technicians, students, and fellow residents during the performance of the case without losing control of the case and with the understanding that the responsibility for all aspects of the case remains with the primary resident
- writing a well organized, understandable, grammatically correct report which reports findings and educates without being overly critical or inflammatory
- demonstrating an ability to prepare and present cases at inter and intradepartmental conferences, appropriately summarizing the clinical history and selecting appropriate gross and microscopic photographs for presentation
- effective teaching of fellow residents (second and subsequent months on service), pathology assistant students, and medical students in various aspects of autopsy practice and the pathologic evaluation of organs and tissues
- documenting phone and other consultations during which important patient information is elicited or provided

Senior Resident:

- coordinating communication with members of the clinical team and/or private primary care providers to provide feedback as to autopsy findings
- learning to delegate responsibility to junior residents and technical staff without compromising patient care
- effective teaching of junior residents, pathology assistant students, and medical students in various aspects of autopsy practice and the pathologic evaluation of organs and tissues

Professionalism: Residents must demonstrate a commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population. This includes:

- demonstrating unconditional respect for patients, clinical colleagues, and the medical profession
- responding promptly when on service and/or covering and promoting the efficient, thorough, and expeditious performance of that case so as not to compromise family funeral arrangements
- demonstrating an understanding of the importance of preserving patient privacy and confidentiality in the performance of their duties
- interacting with fellow residents, assisting as needed to promote efficient running of the autopsy service
- demonstrating an ability to view the clinical case from the point of view of the clinicians with the information available to them at the time, and not simply with the full knowledge of the autopsy findings
- interacting with clinical colleagues in a non-confrontational and professional manner when issues of appropriateness of clinical care are discussed
- demonstrating an ability to speak to family members about the autopsy in general and about the findings from an autopsy the resident has performed. This includes assisting in obtaining informed consent from family members for performance of an autopsy

Systems-based Practice: Residents must demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to draw on system resources to provide pathology services that are of optimal value. Pathologists occupy a unique position within health care delivery. Free from the day-to-day details of direct patient care delivery, pathologists have the opportunity and obligation to analyze and explore human disease. Residents must acquire the ability to assume this role by learning to:

- collaborate with other members of the health care team to improve patient care
- promote the practice of evidence based health care delivery, drawing upon literature and other investigative work
- educate our clinical colleagues in diagnostic criteria and anatomic manifestations of human disease
- use special procedures judiciously to assure accurate diagnoses without wasting or misusing health care resources
- accurately and appropriately identify and enter "Clarifications/Discrepancies" from each autopsy case into the clinical information system to allow inclusion in institutional quality assurance programs
- participate actively in programs assuring the quality of health care, including presentation of cases at morbidity and mortality conference
- demonstrate an awareness of regulations such as CLIA (Clinical Laboratories Improvement Act) and HIPAA (Health Insurance Portability and Accountability Act) Privacy and Security rules, and assure compliance with these rules to improve the health care delivery system
- promote and participate in obtaining tissue for research which will advance our understanding of human disease, without compromising patient care or patient rights

Resident Supervision while on the Autopsy Service

The ACGME defines four levels of resident supervision: direct supervision, indirect supervision with direct supervision immediately available, indirect supervision with direct supervision available, and oversight. Residents new to the autopsy service must be directly supervised during the performance of their first **three fetal/neonatal autopsies, their first three adult autopsies, and their first three brain removals.** The supervising individual can be an attending pathologist, a Pathologist Assistant, or a more senior resident who has been determined to be qualified to supervise junior residents. "Performance" refers to the technical procedures of evisceration and dissection, as well as photography and assimilation of key information from the medical record. Direct supervision is to be documented on the "Resident Supervision Documentation Form" available from the program's web site. The supervisor should verify that the resident is, at the very least, competent in those items on the Competency Checklist that are indicated with an asterisk. Once the Supervision Documentation form is completed, it should be turned in to the program director for filing in the resident folder. At this point, the resident progresses to being allowed to perform autopsies with indirect supervision with direct supervision available (meaning that the supervising person is available by phone).

Throughout the course of their autopsy training, it is the responsibility of each resident to demonstrate their ability to perform each of the procedures listed on the Resident Competency Checklist for Autopsy Pathology (available on the program's web site). As each of these is demonstrated, the supervising individual should initial the appropriate box on the Checklist. Once the checklist is completed, the form should be turned in to the Director of the Autopsy Service. At that point, the director of the service, using this information in combination with faculty evaluations of that resident's performance while on the service and input from supervising staff, will determine if/when that resident is qualified to progress to being able to provide supervision for other residents performing autopsies.

Organization and Personnel *(Updated 2014)*

The members of the autopsy service include the director, attending staff, senior resident, junior house officers, autopsy manager, autopsy technicians, Pathologist Assistant students, University of New Haven Forensic Science students, and transcriptionists. The director oversees all aspects of the service. The autopsy manager, who is a certified Pathologist Assistant, coordinates morgue activities, provides technical assistance, supervises the autopsy technicians, and coordinates the interaction of the autopsy service with other hospital departments. The manager is also in charge of coordinating the education of the rotating Pathologist Assistant students and forensic science students, and for overseeing the building and maintenance of the department's gross teaching collection. **The day-to-day medical issues are managed by the assigned senior resident, who should think of the autopsy service as "his" or "her" service.** Proper handling of autopsy cases, training of the junior residents, and coordinating the dissemination of autopsy findings through communication with clinical teams and presentation of cases at conferences is the responsibility of the senior resident on the service. This is not to say that the senior resident should actually present each and every case himself or herself. Learning how to properly train and delegate these responsibilities to the junior residents while at the same time assuring the quality and completeness of those tasks is an important part of the senior resident's training while on the service. Issues that the senior resident does not feel qualified to address directly should be referred to the attending pathologist (if it is a case related issue) or to the director of the autopsy service. Matters relating to service policies are decided by the autopsy director, in consultation with the autopsy manager, the director of anatomic pathology, and the chairman of the pathology department.

Kisha A. Mitchell, MD	Director of the Service, Assistant Professor
Arthur Belanger, MHS, PA/ASCP	Manager
Antonio Lopes	Autopsy Technician III
Charles Hand	Autopsy Technician II
Allison Boilard	Autopsy Technician II
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Raffaella Morotti, MD	Pediatric Pathology, Associate Professor
Alexander Vortmeyer, MD	Neuropathology, Associate Professor
Anita Huttner, MD, PhD	Neuropathology, Assistant Professor
Demetrios Braddock, MD, PhD	Associate Professor
Jose Costa, MD	Professor
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Jeffrey Sklar, MD, PhD	Professor
A. Brian West, MD	Professor

The Yale Autopsy Process

Proper performance of the autopsy, including obtaining permission, the actual dissection, the cleanup, documentation, signout, and reporting is not an individual effort but rather the result of a coordinated effort on the part of multiple individuals. Nonetheless, the primary house officer (usually a first year anatomic pathology resident) must adopt the "primary care physician" role in coordinating and following through on all of these steps, whether or not they perform each step themselves.

Brief Overview of the Autopsy Process *(Updated 2014)*

- Check the autopsy permit. Performing an autopsy without a valid autopsy permit constitutes "assault and battery" and is legally punishable as such.
- Review the chart
- Call a member of the clinical team, especially anyone listed on the autopsy permit
- Review the death certificate, calling attention to your attending any potential discrepancies or inaccuracies
- Discuss the case with your senior resident and attending
- Be sure that Neuropathology and the Yale Pathology Tissue Services have been contacted about the case
- Start the autopsy checklist
- Perform the external examination; photographs and x-rays may be needed
- Open the body cavities and perform the in situ examination
- Perform the evisceration and dissection
- Collect specimens for stock jar
- Photograph the case
- Perform any needed special procedures (freezing of tissue, special fixatives, frozen sections, etc.)
- Lay the case out on the presentation trays
- Review the case with the senior resident before the attending pathologist arrives. Sketch out a proposed PAD.
- Call any members of the clinical team who have asked, via the permit, to be present during the organ review
- Present the case to the attending pathologist
- Select blocks for rush processing by histology, as applicable
- Discuss with the attending how the PAD should be structured and, together with the senior resident, enter the PAD into the computer. Also enter into the computer the organ weights and measures (these print on the PAD) and any clinical-pathological clarifications/discrepancies identified during the initial examination.
- Call the clinical team members and discuss the autopsy findings with them. It is especially important to call any one who requested, on the autopsy permit, that they be called after the case
- Dictate the clinical history and gross description
- Enter the case on the autopsy status board
- The following morning, meet briefly with the attending pathologist to review any additional organs and rush histology. Go over the printed PAD and make any necessary changes. Discuss

with the attending what additional questions need to be answered to complete the workup of the case.
- Submit additional sections for histology
- When they are ready, review the slides yourself first, then with the senior resident
- Review the slides for the case with the attending pathologist. This should occur within two weeks of performing the autopsy.
- Complete the paperwork for the case. Once done, it should go first to the senior resident for review. After incorporating any suggested changes, print out a new copy and give it to the attending for review.
- When all of the corrections have been made in the computer system, place the report onto the attending pathologist's signout worklist. Be sure it is clear whether the attending plans to sign out the case himself/herself, or whether the attending will simply approve the final copy, in which case the manager of the autopsy service should then sign out the report in the computer system.
- File the case folders in the residents' room
- **The time between the date of the autopsy and the final signing out of the case should be less than 30 and should not exceed 60 days!**

Detailed Overview of the Autopsy Process *(Updated 2014)*

The "autopsy process" is complicated and has many steps. These are enumerated in the pages that follow:

- For the most part, first year anatomic pathology residents are the principal "prosectors" for an autopsy. At times of increased case load or decreased staffing due to illness or vacations, the senior resident or a Pathologist Assistant may be the primary resident for an autopsy. In general, autopsies are taken on a rotating basis between the two junior residents assigned to the service, but the senior resident may elect to assign cases in some other order if warranted by case distribution and available personnel. Coverage schedules for weekend autopsies are at the discretion of the anatomic pathology chief resident(s).
- First and foremost, check the autopsy permit. It is the responsibility of the primary resident for the case, and only that person's responsibility, to be sure the permit is valid. Note any restrictions. Also note any members of the clinical team who wanted to be contacted to be present during the autopsy. See that they are contacted with an approximate start time for the case. A folder with copies of all necessary forms and checklists will be given to you before the autopsy begins.
- Review the paper chart and the electronic medical record. Pay particular attention to the names of the clinical team members at all levels of training. Try to form an impression as to what the major clinical problems and questions were. Take notes as needed. You may keep the paper chart for a maximum of 24 hours, after which time IT MUST BE RETURNED TO MEDICAL RECORDS. Do not sequester the paper charts at your desk. Medical records needs to have the chart to "close" and scan the medical record, and it will be needed by the medical staff for dictation of the final discharge summary. To return charts, simply place them on the shelf at the entrance to the Autopsy Residents' room. If you need the chart back right away, let an autopsy technician know so that they can fill out one of the red forms

present in the chart return area and place it with the chart. The chart will be taken to medical records, coded, and returned to you within 24 hours. If you don't think you need the chart back right away, but later realize you need it again, the autopsy technicians can have the cart re-pulled for you in a matter of hours.

Note that as YNHH moves progressively toward adoption of a full electronic medical record, less and less information is actually remaining available in the paper chart. Be sure to consult electronic resources for the most complete and up-to-date clinical information.

- Call a member of the clinical team. If necessary, call more than one. Ideally, their names should be available on the autopsy consultation request form, but this is not always the case. The technicians can help you track down names and beeper numbers. No matter how complete the medical record appears, it rarely tells the whole story. Specifically ask the clinicians what particular problems they would like addressed. Invite the clinicians to attend the autopsy or subsequent organ review, and make any reasonable effort to accommodate them. *Be sure to pass along to the technicians the names of anyone with whom you speak; the technicians will be sure that their names are added to the list of individuals to receive copies of the reports. Any information gleaned that is not otherwise documented, should be entered in a phone note (template available electronically) and saved in the case folder.*
- Discuss the case with senior resident on the service. Arrive at an understanding as to what special procedures should be performed. Inform the technicians of any special material which you will need for the autopsy.
- In most cases, contact the pathology attending for the case. Some attendings may prefer to rely upon the senior resident to perform the pre-case advisory role, especially on weekends. Be sure to know your attending's preference. When in doubt, call.
- For any case which will include removal of the brain, call the Neuropathology service. They may want the brain to be handled in a special way. Have all relevant neuropathology history and/or questions at your disposal.
- Prior to the case, the autopsy technician should call a representative from the Tissue Procurement section of Yale Pathology Tissue Services (YPTS). The senior resident should be familiar enough with the needs of the case to make provisional decisions about what tissue might be available from the case and be prepared to discuss this with YPTS. YPTS will maintain a list of which investigators need what type of tissue.
- Always check to be sure that the body which has been placed on the table is the body you are supposed to be autopsying. This is the responsibility of the primary resident. A checklist is present in the resident folder given to you by the technicians which is to be signed by both the technician and the resident attesting that each has independently verified the identity of the body on the table. Note on the external exam worksheet and in the autopsy report the location and content of each ID tag, as well as any personal belongings such as rings or other body jewelry.
- For fetuses and neonates, the placenta may accompany the body to the morgue. These are typically examined in surgical pathology as surgical specimens. Check with your attending for any exceptions. If the placenta is to be examined in surgical pathology, make sure they are informed that this is part of an autopsy so that they can expedite the evaluation. Not uncommonly, the cause of a fetal death may be in the placenta rather than the fetus itself. Be sure to refer to the placenta specimen by case number in the autopsy report.
- The autopsy technician will weigh and measure the body, enter these values into the computer, and printout a worksheet for the case.

- Perform the external examination. *Any significant external lesions on the body should be photographed*. Consider photographing the ID on the patient and, if not disfigured, the face of the patient, for possible future verification of the patient's identity. Note any jewelry on the body and any tattoos. For all fetuses, perinates, and neonates, external photographs should routinely be taken of the anterior, posterior, and lateral aspects of the body, paying particular attention to any dysmorphic features of the face, genitalia or extremities. If significant dysmorphic features are present these should be carefully documented with photographs and evaluation by clinical genetics may be sought. Also, make sure the body height measured and entered by the autopsy technician matches the crown-heel length which you measure.
- All fetuses and neonates with possible skeletal abnormalities should receive a X-Ray. This can be done using the faxitron machine in the autopsy service or , for small fetuses the KubTech in surgical pathology. If any skeletal abnormalities are discovered (or known to exist from previous in-utero studies), the body may need to be brought to radiology for a more complete skeletal survey. Be sure to take a digital photograph of the X-rays so that these images will be available in the clinical image repository.
- Open the body, and take any needed cultures. Cultures need to be taken early in the autopsy to decrease the chance of contamination. Check for a pulmonary embolus before doing too much manipulation of the thoracic contents.
- Perhaps the most important part of the autopsy is the in situ examination. This is performed after the body cavities have been opened but before any organs have been removed. Most of the pathology in a case is discovered at the time of the in situ examination. Check the position of each of the organs, as well as the size, consistency, and connections to other structures. Verifying correct connections of the vascular structures is particularly important for fetal and neonatal autopsies, where significant abnormalities in the "hook-up" of various organs may exist and may not yet have been diagnosed clinically. *Photograph any important findings during the in-situ examination using the portable camera and lights*.
- Perform the evisceration and dissection. In general, both junior residents on service, as well as the senior resident, should be gowned and dressed for the autopsy and help dissect. An autopsy technician should be present during the entire autopsy. Remember that when you are the primary resident for the case, the autopsy room is your room. You are in charge of everything that goes on in that room, and are ultimately responsible for everything that happens. Do not let things get out of hand. Helpers are useful in that the autopsy process goes more quickly and it is generally more enjoyable, but you are responsible for any errors that they make. If an organ is not handled properly, it is unacceptable to say that it was someone else's fault. Be sure that you perform the dissection on those organ systems that are key to the case. Because of their experience, the autopsy technicians may have helpful advice about how to handle certain situations, but you must make sure that you are making the decisions. They will respond to your direction, but in a vacuum will step forward to fill an organizational void. The senior resident should help you to maintain control of the room and guide your decision making process when they fear you are about to do something you may later regret.
- There is no single "right way" to do an autopsy. A number of standard procedures exist (discussed later), but you should adapt those procedures to the needs of the case, with the goal of providing the best possible demonstration of the pathology. Over the course of your training, be sure to become familiar with both the "en bloc" and "en masse" techniques (note, however, that a "en masse" dissection should be performed for all fetal/pediatric autopsies).

You should ultimately be able to perform every procedure, including removal of the brain, by yourself, but you do not need to learn every procedure during your first autopsy.

- Do not rush through the case. Take your time and do careful dissections. Take pride in your work. The quality of the dissection is an indication of your skill.
- Routinely freeze a piece of liver from every case. For fetuses, also freeze a piece of skin, and muscle, and if possible collect a sample of bile. You may need this for some metabolic analysis, and it is often difficult to predict in advance when this will be needed, so we do this routinely for each case.
- Relatively rapidly, try to get a piece of each major organ into a "stock jar" of formalin. The sooner the tissue is placed in fixative, the better the histology will be preserved. This tissue should be used for the "routine" sections of each organ.
- Autopsy Room Etiquette:
  - NEVER NEVER NEVER leave a sharp instrument unattended or place it on the autopsy table. All sharps (scalpels, needles, knives) should be either in your hand or on the instrument table above the patient's body.
  - Keep everything clean - there is no excuse for working in a mess, or for leaving a mess behind you. Keep your work area clean. Keep your instruments clean. If you have to transfer an organ from one location to another (to photograph it, for example), place it in a container so as not to leave a trail of blood on the floor behind you.
  - Be considerate of those who will be cleaning up after you. Contain your messes, and rinse down tables and instruments before blood dries on them.
- *Photograph the case well*. This is best done throughout the case rather than waiting for the end. Routine photographs should be taken of all the major organs, and additional photographs taken of any gross pathology. The autopsy technicians and Pathologist Assistant student can help you with this.
- *Designate teaching cases*. Cases with pathology appropriate for teaching should be so designated during the autopsy. The autopsy technicians and Pathologist Assistant student can help you with this.
- Always remember that the person you are autopsying is a person, and deserves an appropriate level of respect. The body will be returned to the family for burial. For some family members, every piece of tissue is important. Retain only that tissue which is important for diagnostic, educational, or research purposes. All other tissue, including small fragments of adipose tissue, must be saved, collected, and sent to the funeral home with the body. See the section on "Retention and Storage of Organs/Tissue" for more information.
- The autopsy service is a good opportunity to familiarize yourself with frozen sections. With the assistance of the senior resident, consider doing frozen sections on lesions to be better able to formulate the diagnoses in the PAD.
- If the brain has been removed, it should be handled as instructed by the neuropathologist you contacted prior to beginning the case. In some cases, adult brains will be perfused with formalin. The technicians can do this, but you should know whether or not it was done and if not, why not.
- After the case, organize your thoughts, select organ slices for the case presentation, and lay the case out on the presentation trays. By convention, the lungs and heart are usually included in the presentation display in their entirety. If the liver and spleen are normal, only one slice of each need be included. Any lesions from the intestines should be displayed. Otherwise, if they are normal, representative sections from the small and large intestine will suffice (the

cecum is a good choice). Do not display the entire bowel if it is normal. On the other hand, if the bowel is ischemic, be sure you have preserved the mesentery, and open the mesenteric arteries and veins (arteries on one side of the mesentery, veins on the other). If you are not sure whether or not something is "normal", include it on the presentation trays.

- *If the case is to be reviewed fresh, be sure representative sections have been taken and quickly placed in formalin so that the histology will be preserved*. If the organs have been fixed prior to the presentation, rinse them first by submerging them individually in a tub of running water to remove most of the formalin before laying them out on the presentation trays.
- The senior resident should review the organs with you to be sure everything has been properly dissected. This should be done BEFORE the attending pathologist arrives, not as he is walking into the room. *Be sure any lesions have been photographed* since the attending may want to cut into them and then it will not be possible to get a photograph of the uncut lesion. Consider which organs should have photographs included in the PAD and make sure those photographs have been taken.
- Be sure to get the senior resident or PA to initial your Competency Checklist, as needed, for any new techniques which you have demonstrated during the case.
- If there is time before the organ presentation, sketch out a proposed PAD. This is often conveniently done on the drawing board in the autopsy room.
- Present the case to the attending pathologist. Ideally, this should be done the same day as the autopsy, but for weekend cases will usually be the following Monday. Be sure that the majority of the "mess" from the case has been cleaned up from the tables. If you finish the case while the technicians are still present, they will help clean the room. If your dissection runs later and they have already left for the day, rinse down all of the instruments and tables yourself, and turn off running water. There should be forceps, probes, a knife, and scalpel blades available during the case presentation.
- The case presentation should be considered a formal medical conference. **Everyone on service should be present at the case presentations** (junior residents, senior resident, medical students, P.A. students, and post-sophomore fellows). Begin with a *brief* presentation of the clinical history, including any pertinent past medical history and relevant negatives. Be sure to include the impression of the clinical team as conveyed to you in your consultation with them prior to the case. Then briefly describe relevant external findings on the body (you do not need to itemize every scar unless relevant) and general elements about the in situ examination which are not reflected in the dissected organs such as amounts of fluid in various cavities, the presence of adhesions, etc.. Then proceed through a presentation of the organs in a systematic fashion. By convention, one usually presents the heart first, then the lungs, trachea, thyroid, esophagus, stomach, pancreas, gall bladder, liver, spleen, bowel, aorta, kidneys, bladder, adrenals, and then the reproductive organs. You should know the weights of all of the organs without having to refer to your notes.
- During the case presentation, up to **five blocks may <u>and should</u> be selected for "rush" processing by histology**. Sections from these blocks will be available by 10AM the following morning. This is a very useful way to increase your confidence about diagnoses in the PAD.
- After the presentation, discuss with the attending how the PAD should be structured.
- Photograph any lesions pointed out by the attending that you have not already photographed. Be sure to place any tissue that is still fresh into formalin. Any tissue that is no longer needed

for diagnostic, educational, or research purposes should be added to the tissue which is to be sent to the funeral home with the body.

- Together with the senior resident, enter the PAD into the computer. You will also need to enter the organ weights. Follow the format for the PAD as discussed elsewhere in this manual. The senior resident should make sure that the proper format is used, and that the content accurately reflects the discussion with the attending at the case presentation. Senior residents should not take this responsibility lightly. Senior resident names will be included on the reports as well.
- Record any significant clinical-pathological clarifications/discrepancies in the computer. These may be modified later as needed, but it is important to get them into the computer system early so they may be used in the quality assurance programs for the hospital in a timely fashion.
- Call the clinical team members and discuss the autopsy findings with them. If it is late and the clinical team members are no longer in-house, call them the following day. Everyone whose name was listed on the consultation request form, and anyone with whom you discussed the case should get a phone call. This should ideally come from the primary resident on the case, but initially the senior resident may want to make some of these calls or at least be available nearby to field any questions for which the junior resident does not yet have sufficient training to answer.
- Dictate the clinical history and gross description, using the formats discussed elsewhere in this manual. This should be done the same day as the case, to prevent confusion with possible other cases the following day. Enter the case on the autopsy status board.
- The following morning, cut and lay out any organs requiring overnight fixation or decalcification, such as decalcified coronary arteries. Have a printed version of the entered PAD available, and collect any rush sections from histology.
- Meet briefly with the attending pathologist to review any additional organs and rush histology. Go over the printed PAD and make any necessary changes. These changes will need to be made in the computer. Two other discussions need to occur. First, discuss with the attending what additional questions need to be answered to complete the workup of the case. A few minutes spent here outlining the course of the rest of the workup can greatly facilitate the processing of the case. Secondly, determine how the attending wants to handle the signout of the PAD. In all cases, the resident will need to make the changes to the preliminary PAD entered in the computer system. Then three options are available, at the attending's discretion. Most of the attendings familiar with the computer system will elect option 1. The majority of the others will prefer option 2. Under special situations, option 3 may be selected.
    1. The resident completes the changes in the computer, marks the procedure as complete, and places the PAD onto the attending's signout worklist.
    2. The resident prints out the PAD, takes it to the attending pathologist for approval, and, when approved, informs the manager of the autopsy service that the PAD for the case can now be signed out.
    3. The attending decides to allow the senior resident to determine when the PAD is ready to be signed out. At that time, either the junior resident or the senior resident informs the manager of the autopsy service, who signs out the case in the computer system.
- Submit additional sections for histology. **This should be done no later than the day following the autopsy**. Autopsy cases should be treated with the same "importance" as if they were a large surgical case. When submitting sections for histology, there should be a set of cassettes available with the case accession number already printed on them. Use these. You do not have to use all of them, and in many cases you may need to make more. (If you have any left

over, place them with the brain for use after brain cutting.) You will also have to add "designations" to each cassette, identifying what tissue you have placed in it. Use standard cassette designations and be sure to include descriptions for each designation. The "Histology Block Wizard" will help you do this. Routine sections should include (these are in addition to any lesions found):

Lungs (one from each lobe; include hilar region)
Larynx/Trachea - for pediatric cases, include the thyroid gland
Heart (left and right ventricle, one section including atrium and valve if abnormal)
Coronary Arteries (maximal stenosis - 1 cassette for each of the three major coronary arteries) NOTE: This is not needed for most pediatric cases
Esophagus at the gastroesophageal junction
Stomach
Small Bowel (1 section from duodenum and terminal ileum)
Colon and Rectum
Liver (both right and left lobes – one deep, one including capsule)
Pancreas (both head and tail)
Spleen
Kidneys (one section from each)
Bladder
Gonads (testes or ovaries and uterus and cervix)
Adrenals (one section from each)
Thyroid Gland (unless included with larynx)
Thymus (Pediatric cases only)
Bone Marrow (rib and/or vertebrae)
Lymph Nodes (random sampling)
Muscle (psoas, diaphragm)
Eyes (both - include cornea and posterior pole (retina and optic nerve))

- Any organs or portions of organs identified by the attending or autopsy manager as desirable for the teaching collection should be identified during the autopsy and following the autopsy, placed in a separate container and labeled appropriately. Additional tissue from each organ should be placed in a small stock jar that will be stored and accessible for retrieval as needed for a period of at least six months. The remainder of the organs not needed for sectioning should be stored until presented at the weekly autopsy conference and then may be discarded (refer to the section on tissue storage for guidelines).
- Dictated clinical histories and gross descriptions should be typed into the computer system by the transcriptionist within 24 hrs. of when they are dictated. If this is not happening, inform the director of the autopsy service. The resident can handle any needed changes or corrections in one of two ways: either make these changes yourself in the computer system (be sure to run a spell check when you are done) or print up a copy, make the changes on the draft, and give that draft to the autopsy transcriptionist to make the changes for you.
- Keep on top of your cases, being mindful of how much time you have remaining on the autopsy rotation, and what rotation you will be on next and your likelihood of having free time during that rotation. Utilize the autopsy status board and checklist to do so. Review the slides yourself first, then with the senior resident as needed. Make notes on your impressions of the slides. The senior resident is likely to suggest some special stains that should be obtained prior to reviewing the slides with the attending. You may need to do literature searches or otherwise educate yourself about the disease processes in your patient. Also, be sure to pull out of the files the slides from any relevant prior surgical material examined from the patient. Enter your proposed FAD into the computer, and at least outline how you will convert your clinical history into a Clinical Pathological Summary (CPS). Samples are included elsewhere

in this manual. When all of the material and special stains are ready, make arrangements to review the slides with your attending. **THE SLIDE REVIEW SESSION WITH THE ATTENDING PATHOLOGIST SHOULD TAKE PLACE NO LATER THAN TWO WEEKS FOLLOWING THE AUTOPSY, AND IDEALLY WITHIN ONE WEEK.**

- At the slide review with the attending, you should have a printed copy of the PAD and your proposed FAD. Review the slides for the case, and take notes on the attendings comments to include them in your microscopic descriptions. Finalize the content of the FAD and agree upon the structure for the discussion in the CPS. Some attendings prefer that the resident come to the slide review with the CPS already written up. Be sure to discuss this with your attending when scheduling the session.
- Type in any needed changes to the FAD yourself. You may dictate the Clinical Pathologic Summary and the microscopic descriptions, but most residents have found it easier to type these in themselves. Be sure to correct any errors in the transcription of your previously dictated clinical summary and gross descriptions. The best way to handle microscopic descriptions as well as ancillary studies is to integrate them into your gross descriptions for each of the organs. For example: "The left lower lobe of the lung showed multiple foci of consolidation. Histologically, an acute necrotizing bronchopneumonia, characterized by alveolar airspaces distended by a necrotizing neutrophilic infiltrate, was present with Gram-positive cocci identified on special stains. Cultures taken at autopsy were positive for Staphylococcus aureus." OR "Cut section of the uterus revealed a well circumscribed white swirling mass grossly and microscopically compatible with a leiomyoma."
- Do not delay in completing the paperwork for the case after you have reviewed the slides with the attending pathologist. The attending should get the final report from you within one week of the signout session.
- Make any necessary changes or additions to the clinical-pathological clarification/discrepancy listing in the computer.
- Be sure you have entered the case into the ACGME's online case log system.
- For cases which will include a formal neuropathology consultation, a neuropathology addendum should be included with the final autopsy report. If the neuropathology consultation is not yet entered when you are ready to send out the report, contact the neuropathology attending about possibly expediting their consult, especially if there are significant neuropathology findings. If they are not able to produce their consult quickly, and especially if there are no significant neuropathology findings, DO NOT WAIT FOR THEIR REPORT. Send yours out without their consult.
- When you feel the report is completed ***and you have both run a spell check on and carefully proof-read each part of the report,*** print out a "final working draft" and give it to the senior resident on the case to review. It is very important for senior residents to take this part of the process seriously. Remember, your name is also on the report. This is your opportunity to instruct the junior residents in the finer points of report preparation and interpretation of the pathology. Also, be sure that the format of the report is appropriate and follows the conventions established by the director of the autopsy service. If only a few changes are made, this copy with the changes can go to the attending pathologist on the case. If there have been major changes, the junior resident should make these changes in the computer and print a new copy for the attending.
- Give a copy of the entire working draft report to your attending to review. The attending should receive this report within one week of the signout session. They will return this copy to you

with changes and corrections that you can either make yourself in the computer (faster) or submit to the transcriptionist for them to correct (easier). If major corrections have been required, it is probably a good idea to print out another draft copy and have your attending look it over again. When giving the new copy to the attending, always include the copy upon which they made their corrections so they can focus their attention on areas which they did not like the first time.

- Don't let your attendings forget about these reports. If you do not get them back within a couple of days, respectfully remind the attending that you are eagerly awaiting their comments.
- When all of the corrections have been made, the case is ready for signout. After making the final changes, select the "Mark case as complete and send to pathologist for signout" option in the computer and send the case to the attending pathologist's signout worklist. For pathologists who use the computer frequently, all you will have to do is place the last marked up copy into their mailbox as a signal to them that the case is in their worklist and ready for signout. However, if the pathologist does not routinely use the computer, you will need to print out one last copy, get the pathologist to approve it, and then inform the autopsy service manager that the case is now ready to be electronically signed out in the computer system.
- The case will remain on the resident's and attending's active case list until is has been marked as signed out. If you have placed the case in the attending's worklist, but they have not signed it out, call them to inquire about the delay. **The time between the date of the autopsy and the final signing out of the case should ideally be less than 30 and should not exceed 60 days!**

Neuropathology Experience on Autopsy *(Updated 2014)*

The autopsy service affords residents a unique opportunity to learn normal and pathologic neuroanatomy, in preparation for proper handling of surgical neuropathology specimens. Residents on the autopsy service thus are expected to use this opportunity to get deeply involved in grossly and microscopically evaluating the brains from autopsy cases.

Typically, the central nervous system evaluation from autopsy cases is signed out with one of the neuropathologists rather than the attending otherwise covering the autopsy service. These results are reported in a "Neuropathology" procedure addendum to the main case report. However, if the results of the Neuropathology examination are significant and available at the time the main part of the case is signed out, discussion of those findings should be included in the Final Anatomic Diagnosis and the Clinical-Pathological Summary.

Brains are examined and cut at one or more weekly Brain Cutting Conference with a neuropathologist. Ideally, the residents who originally did the autopsies on those patients whose brains are being cut would be present at this conference, and then follow through on the evaluation of that brain as part of their evaluation of the entire case. In practice, however, because brains are sometimes fixed for approximately two weeks before they are cut, the resident will often have rotated to another service when the brain from one of their autopsy cases comes to brain cutting conference. In these cases, so as not to disrupt the resident's experience on the other service, responsibility for the gross examination at Brain Cutting Conference, microscopic examination, signout, and reporting of the CNS portion of that autopsy case will transfer to the senior resident who is currently on the autopsy service at the time the brain is cut (but, as with the autopsy cases, will then remain with the primary prosecting resident regardless of which service the resident

rotates on to). On the day of the autopsy, unless otherwise indicated by the neuropathology attending on service, brains will be infused with formalin for fixation. The prosecting resident will, after consultation with the neuropathology attending, determine the proposed date of sectioning, which should be entered on the autopsy status board. All clinical summaries, including the neurologic history, where relevant, should be completed in CoPath in conjunction with, if not before, the Provisional Anatomic diagnosis. The senior autopsy resident will be responsible for presenting the relevant clinical history during brain cutting and should assure that such history is available at the time of brain cutting. On Wednesdays, the senior resident will, in conjunction with the autopsy room staff, prepare and distribute the list of brains that have not yet been sectioned in cases where the prosecting resident is no longer on the autopsy service. The list will be updated, if necessary, on the day before the brain cutting, which will take place on Fridays at 2:30pm The autopsy senior resident will attend the brain cutting conference, take photographs, dictate the gross description and submit sections for histology in the name of the prosecting resident. The primary prosecting resident will schedule slide review with the attending neuropathologist to facilitate preparation of the neuropathology final report. The senior autopsy resident will also attend the slide review, if they are available. Every attempt should be made to have neuropathology reports complete for review by the primary autopsy pathologist before completion of the FAD, for incorporation as appropriate. At a minimum, significant findings at brain cutting should be communicated to the primary autopsy pathologist. **Be reminded that the neuropathologist on service determines if brains will also be cut at times outside of Fridays at 2:30pm. The senior resident should be prepared to coordinate with the neuropathologist in this instance. The junior residents will attend, if they are currently on the autopsy service and they are available.**

Additional Rules for Special Situations *(Updated 2014)*

Weekend Cases

- For each weekend and holiday, the service is covered by two "junior" residents and an on-call senior resident. The scheduled junior residents cover autopsies for YNHH, Bridgeport Hospital, and the Veterans Administration Connecticut Hospital in West Haven. Bridgeport Hospital autopsies are performed at YNHH (the patient will be transported); VA autopsies are performed at the VA. The first scheduled resident takes the first case (at either facility) each day. Therefore, if there is one case on Saturday and another case on Sunday, both cases are done by the first covering resident.
- Prior to the weekend, touch base with the senior resident on call for surgical pathology. On-call senior residents should contact the attending and find out how they can be reached over the weekend. If the junior resident performing the autopsy has not completed the requisite number of autopsies under direct supervision, the on-call senior resident (or other qualified supervisor) will have to be physically present in the autopsy room to supervise the junior resident.
- Despite rumors to the contrary, statistical studies have shown that we only do about 2/7ths of our autopsies on the weekends.
- At the Yale morgue, at least one technician will be there each day of the weekend. Usually, a second technician, a first year pathology assistant student and occasionally a forensic science intern will also be present. If a second technician is not physically present, then one, usually the manager of the service, is available as backup.

- Whenever possible, the senior resident who was on-call over the weekend should be present at the case presentation, which typically occurs on Monday morning. When this is not feasible because of the responsibilities of other rotations, that resident should "sign out" to the senior resident on the autopsy service so that they are familiar with the case.

Brain Only Cases

Occasionally, the Yale Autopsy Service performs autopsies that are restricted to examination of the brain only. In some instances, these will be cases autopsied at another institution for which the fixed brain is sent to Yale for evaluation. In other instances, the patient will be autopsied at Yale, but only the brain will be removed. These cases are usually cases of particular interest to the neuropathologists. The limited nature of the examination alters, somewhat, the flow of the "autopsy process" for these cases.

Since the major portion of the pathological examination for brain only autopsies is done by the resident taking responsibility for the brain at the Brain Cutting Conference, in conjunction with the attending running the Brain Cutting Conference, that resident, usually the senior autopsy resident, becomes the primary resident for the entire brain-only autopsy; after signing out the brain with the neuropathology attending, they will be in the best position to write the FAD and CPC for the case and allow more rapid completion of the paperwork. However, since many of these cases are performed while the funeral director is waiting for the body, and since it is often unclear at the time of the autopsy which resident will assume responsibility for the case at the time of the Brain Cutting Conference, the assistance of the residents on the autopsy service may be needed.

The "division of labor" for brain only autopsies will usually be as shown below (ideally, the last two columns will be the same person). Remember, however, that the entire case is ultimately the responsibility of the resident assuming responsibility for the brain when the brain is cut:

Autopsy Senior Resident	Autopsy Junior Resident	Resident "Taking" the case at Brain Cutting Conference
• Get the permit from the family, with the assistance of the autopsy service technical staff • Determine which junior resident on the service will assist with the case; ideally this should be the resident who will assume responsibility for the case at Brain Cutting; otherwise, fairly distribute the workload • Work with the service manager to assure the PAD is signed out in a timely fashion	• For cases in which the service receives a body from which we will remove the brain, obtain whatever clinical history is available and enter it into the CPS field for the case in CoPath. • Perform external exam on the body and brain; dictate this or enter it into CoPath • Contact the neuropathology attending	• Cut the brain; add the description of the cut brain to the gross description section in the report • Submit slides for histology • Signout the slides and case with the neuropathology attending • Write the FAD and CPS • Assure that the case is ultimately signed out in a timely fashion

The flow of events in a brain only case should be essentially as follows:

- Many of these cases come from outside of Yale, so a telephone autopsy permission will generally need to be obtained. The resident and/or senior resident on the autopsy service should be involved in this process. In some instances, the manager of the service may help out with this.

- Since a chart is often not available for review, the resident and/or senior resident will probably need to contact the family or the patient's physician to get as much of the clinical information as possible. It is often convenient to get information from the family when taking the autopsy permission over the phone. Information obtained by the resident or senior resident on autopsy should be entered as "notes" into the CPS field for the case in CoPath, along with phone numbers of individuals to contact for more complete information. For cases in which an already removed and fixed brain arrives on the service for examination, much of this information can probably be obtained from the person sending the brain to Yale for consultation.
- Contact the neuropathology attending before beginning the case. They often like to be present when the brain is removed, and may take fresh tissue for special studies.
- Perform a complete external examination of the body, not just of the head. A first year resident on the autopsy service will usually be asked to help out by performing this portion of the examination and either dictating or typing the findings into the "Autopsy Findings" field for the case in CoPath. The autopsy findings will be limited to the external examination and the gross examination of the uncut brain and cranial cavity. Any gross findings from the cut brain (when presented at brain cutting conference) will be added later by the resident assuming responsibility for the case at the Brain Cutting Conference.
- Discuss the gross findings of the brain with the neuropathologist and formulate whatever conclusions are possible. The brain weight is very important.
- Prepare a PAD. The manager of the autopsy service can assist with this process. This will generally consist just of the brain weight and the external findings. In cases in which the external appearance of the brain is unremarkable, the technical staff can enter a standard format PAD, but the senior resident on the autopsy service may need to assist them with that. Include a cause of death statement, as determined by the clinical history and death certificate. Add a note following the cause of death statement, such as the following: "NOTE: This autopsy was limited, per family request, to examination of the brain. The gross findings in the brain are compatible with the clinical diagnosis of Alzheimer's disease, but need to be confirmed histologically. Because of the limited examination, the Cause of Death Statement is based on the clinical history."
- If straight-forward, the PAD may be signed out by the service manager on behalf of the neuropathology attending. For more complicated cases, the PAD should be signed out in the computer in the usual way by the neuropathology attending.
- The ultimate clinical pathological summary portion of the report should be completed by the resident assuming responsibility for the case at the Brain Cutting Conference.
- When the brain slides have been signed out with the neuropathology attending, the "Neuropathology Consultation" portion of the report will be written and entered into the Pathology Information System.
- Based on the neuropathology findings, the resident who assumed responsibility for the case should write an FAD and CPS. The note indicating that the cause of death statement was based on the clinical history should be retained in the FAD, but any reference to preliminary diagnoses should be removed or explained. Alternatively, a note should indicate why no cause of death statement may be issued. The CPS should contain a one to two sentence summary of the neuropathology report. Since the complete neuropathology report will be included in the final autopsy report, it is not necessary to re-itemize each of the findings from the neuropathology report in the CPS.

• Show the report to the neuropathologist. If they are happy with the content, mark it complete and place the case onto the neuropathologist's signout worklist.

Bridgeport Hospital Cases

The Yale Medical School Department of Pathology provides professional staffing and services for the pathology department at Bridgeport Hospital. These responsibilities include coverage of the autopsy service. The Yale-New Haven Hospital based autopsy staff (residents and attendings) cover Bridgeport Hospital cases. Arrangements have been made with a funeral home to transport to the Yale morgue the bodies of all Bridgeport Hospital patients to be autopsied. These patients should arrive with copies of the relevant portions of the patient's medical record. Additional medical history can be obtained by accessing their electronic medical records system. The autopsies are performed by the residents as if the death were at Yale-New Haven Hospital.

All Bridgeport autopsies (as with all Bridgeport pathology cases) will be accessioned into CoPath (the pathology information system at Yale-New Haven Hospital). The processing of the case will be performed in CoPath just as a Yale-New Haven Hospital case would be handled, and the CoPath system will produce the official report(s) and will document the official turnaround times for the cases. Once signed out in CoPath, Autopsy Reports (both the PAD and the FAD) are electronically transferred to the Cerner Clinical Information System at Bridgeport Hospital where they will be available for viewing by the Bridgeport Clinical Staff.

VA Connecticut – West Haven Cases

The Yale Medical School Department of Pathology collaborates with the VA in providing professional staffing and services for the pathology department at the West Haven branch of the VA Connecticut Healthcare System. These responsibilities include coverage of the autopsy service. The Yale-New Haven Hospital based autopsy staff (residents) cover VA autopsy cases. These cases are done at the VA hospital, and a VA-based pathologist will be the attending pathologist for the case. During the normal work week, the residents on the Autopsy rotation(s) cover the VA autopsy cases. On weekends and holidays, the residents assigned to cover the autopsy service on these days will cover these cases. The procedure for weekend/ holiday coverage follows below:

- VA triage office (203-932-5711 x3131) will call Yale autopsy and fax them the permit and the autopsy request. They will also call if the nursing supervisor tells them that an autopsy is being pursued but a permit is not yet available. They are very helpful with phone numbers.
- All other issues (how to obtain an autopsy, what is a valid permit) are referred to the VA pathologist on call (who will refer them to the VA CT website which has the appropriate documents).
- The PA student who is rotating at Yale autopsy may be part of the team (subject to overall needs of the Yale autopsy service).
- When Yale autopsy has been faxed the permit, the resident can call the VA pathologist on call to discuss case. Assuming no problems are identified, the Yale resident will then call PMS to arrange a start.
- If PMS is not available, the autopsy may be deferred until they are. This should be discussed with the attending on call.
- The cut off time should be consistent with Yale practice, however, should consider that it

may be more efficient to finish the case that day rather than to push it to another, possibly busier day.

- PMS contact information: Paul Marcuson, Office 860-675-1103, pager 860-260-2512, cell 860-463-0658.
- The VA pathologists are Robert Homer, Susan Fernandez, Xuchen Zhang and Alexa Siddon. All pagers / cell phones are available via the Yale pathology contact websites. The VA pathologists call schedule is available in the Morgue office.
- The VA autopsy suite is inspected by Dr. Homer weekly and should have appropriate instruments, cameras, fixative, PPE, etc. In some cases, a senior resident may be needed to provide some instruction during case. If a conflict as to resources arises (more autopsies than residents), this can be negotiated in a collegial manner on a case by case basis.
- Typically, the case is reviewed the next business day at the VA, but in some cases, the VA attending may be willing to come in on the weekend to review case.

All VA autopsies will be accessioned into the VA's medical record system, and that will be the official reporting system for those autopsy reports. Since the VA system is not accessible remotely from Yale by the pathology residents, residents typically type their PAD, FAD, CPC, and Autopsy Findings and email them to the administrative staff at the VA, who transfers the text into the VA computer system.

Residents who participate in autopsies at the VA are required to keep track of the amount of time they spend on this activity. This includes performing the autopsy, dissecting the tissue, previewing the slides, signing out the slides with the attending, and working on the reports. Report these hours, by case number, to the Manager of the Autopsy service at Yale who will collect this information and provide it to the service Director.

Retention and Storage of Organs/Tissues *(Updated 2014)*

One of the major questions which first year anatomic pathology residents often face, especially early in their training, is "How much tissue should I save from this autopsy case, and where/how should I store it?" Clearly, the answer to that question will vary from case to case, and any "rule" which is made must always be subject to modification based on the needs of the particular case in question.

It is neither practical nor appropriate to retain and store all of the tissue from all of the cases. Following the autopsy, family members will make arrangements for the burial of the patient. For many family members, it is important that the body be as "complete" as possible. In some cases, the family may specifically limit, via the autopsy permission form, which organs and/or tissues may be retained. Be sure to check this information carefully before beginning the autopsy. If the family allows the pathologists to determine which tissue needs to be retained for diagnostic, educational, or research purposes, this does not mean that we retain everything. Selecting what tissue to retain needs to be a thoughtful process. Retention of tissue caries with it an obligation to examine and evaluate that tissue. In addition, there is simply not enough storage space to save all of the tissue from each case. Therefore, you must decide which tissue needs to be saved and which does not. This is a medical decision, and should be made by the resident(s), not the technicians. Any tissue not specifically needed for one of the purposes indicated above should be sent with the body to the funeral home.

There are several points during the autopsy process at which decisions as to the disposition of tissue need to be made. In all cases, any limitations imposed by the family via the autopsy permission form override the conventions discussed below.

- While performing the autopsy dissection, representative small blocks of tissue should be taken from each organ and placed immediately in formalin (stock jar). Tissue continues to autolyse throughout the entire autopsy process, and maximal preservation of the histology requires placing the tissue in formalin as soon as possible.
- The first decision point about what tissue to save and what to discard is made while doing the autopsy dissection. Keep in mind the presentation of the organs to the attending. Any abnormal findings need to be preserved for the presentation. Normal tissue, however, does not always need to be preserved in its entirety. For example, if the liver is normal, there is no reason to save the entire liver. Only one or two representative slices need to be presented, so only one or two representative slices need to be saved. Ideally, these slices should include the inflow and outflow tracts of the liver. Any tissue which is not to be retained should be placed in a specially designated storage bag, should be kept separated from waste material such as paper towels, and should be collected by the technician and stored with the body so it can be sent to the funeral home.
- After the case presentation to the attending pathologist, additional tissue may be determined to be normal and no longer needed for further evaluation. This tissue should be added to the container of tissue to be sent to the funeral home with the body.
- Any tissue which is to be retained for diagnostic, educational, or research purposes should be fixed in formalin. This is usually done in a combination of large trays of formalin and in buckets. Be sure that each container is properly labeled with the correct case number. Remember that to fix properly, the formalin to tissue ratio should be 10:1. Tissue may be stored in this fashion for up to one weekday, by which time the case should have been "cut in". Do not store the trays or the buckets in the autopsy room since the room may be needed at any point for another autopsy. Place all of the trays and buckets on a cart and transport it to the cut-in room. No unfixed tissue should be stored in the cut-in room (only formalin fixed tissue).
- Tissue stored in the fixation trays takes up a lot of space. It cannot be left in the autopsy rooms, which must be turned over for the next case. It also cannot be stored in the cut-in room, which is too small to accommodate multiple cases. Therefore, it is very important that the cases be cut in and placed in storage containers before the end of the day after the autopsy.
- When "cutting in" the autopsy case, you should draw first upon the tissue blocks which were placed rapidly in formalin in the stock jar, since the histology of that tissue will be better preserved. Additional sections can then be taken from the organ blocks in the trays.
- As you are cutting in the case, the decision about which tissue must still be saved needs to be revisited. The following factors will affect your decision:
    - Is this case going to be presented at an autopsy conference?
    - Is there an organ or organ block from this case which is a particularly good demonstration of a lesion and which should become part of the teaching collection?
    - Is the entire case a particularly good demonstration of a disease process such that the entire case should be saved as a teaching case?
    - Is this potentially a medical-legal case which may warrant more conservative handling?

- Place tissue to be saved in storage buckets. Be sure to label the buckets **on the sides of the container** with the case number, since the tops of the buckets can get confused and switched if buckets from two different cases happen to be open at the same time. Any tissue no longer needed should either be added to the tissue to be sent to the funeral home with the body (if the patient has not yet been picked up by the funeral home) or should be placed in appropriate containers for incineration.
- If the case is routine, one "brain-bucket" of tissue plus one smaller stock jar is usually sufficient material to save.
- If the case is a particularly interesting routine case, two "brain-buckets" of tissue may be saved (in addition to the bucket which actually contains the brain).
- If there is a "teaching collection" worthy specimen in the case, it should be placed in a separate container and identified to the teaching collection technician or the manager of the autopsy service. This tissue will not actually become part of the teaching collection until your autopsy case is signed out, so if you need access to this tissue again later it will be available. Since tissue for the teaching collection is stored separately, do not increase the number of storage buckets used for the rest of the case. Be sure to indicate on the storage buckets for the rest of the case that the heart, for example, has been stored with the teaching collection.
- If the entire case is "teaching collection" worthy, clean excess fat and unneeded tissue off the important blocks and place all relevant tissue in special containers for the teaching collection. In these cases, only a small stock jar needs to be kept as storage for the rest of the case.
- For cases to be presented at autopsy conference (these will be identified by the senior resident or the attending), an extra storage container may be used until the day of the conference, and then the above criteria should be used and the additional tissue appropriately discarded.
- For potential medical-legal cases, consult your attending as to how much and which tissue(s) should be stored.

In general, the storage containers will be kept in the cut-in room for one month after the case. After that, the tissue is moved to the cooler for longer term storage, as warranted. If you need to retrieve tissue that has been transferred to the cooler, contact one of the technicians. **After three months has passed from the date of signout, the tissue will be discarded.** If there is any reason not to discard tissue after this period of time, you must clearly identify the tissue and the reason to the manager of the autopsy service.

Time Course for the Autopsy

As discussed above, the autopsy should be treated with the same importance as a surgical specimen and should not be allowed to "sit" until you have nothing else to do. The following guidelines represent the MAXIMUM amount of time that should elapse between when the routine autopsy is performed and when each step occurs:

Organ review with attending	12 hours
Sending out of the PAD	24 hours (noon of next business day)
Call clinicians to discuss results	24 hours (noon of next business day)
"Cutting in" the case for histology	36 hours (end of next business day)
Reviewing the slides with the attending	2 weeks

Completed report to the attending	2.5 weeks
Final signout of the case	3 weeks

Summary of Individual Responsibilities *(Updated 2014)*

The following list is not intended to be all-encompassing but rather to serve as a sort of check-list to reiterate some of the key and/or often overlooked responsibilities of the individuals involved in the autopsy process. These responsibilities do not end when your autopsy rotation ends but rather follow you until the case has been completely signed out.

Junior Resident Responsibilities

- Verify that the autopsy permit is valid.
- Discuss the case with at least one member of the clinical team prior to performing the autopsy.
- Be sure the technician has entered into the computer the names of all of the clinical team members so that they all receive copies of the report.
- Discuss the case with the senior resident and then the pathology attending prior to performing the autopsy. If others are to assist in the autopsy (medical students, pathologist assistants or pathologist assistant students), it is appropriate to include them in these discussions.
- Remember that you must have direct supervision for your initial three autopsies of each type. Assure that that supervision is present, and that the supervisor sign-off on your Supervision Documentation form.
- Assure that accurate photographic documentation of the case is completed.
- Lay out the case on trays for the organ presentation. Any organs that have been in formalin need to be thoroughly submerged in a container of running water before laying them out on the presentation trays. Be sure the room is in an appropriate state for a conference (i.e., discard or put away soiled materials and excess dissected soft tissue, rinse down the tables, turn off all running water). Go over your dissection with the senior resident before the attending arrives.
- Enter the PAD into the computer following (or ideally, prior to) presentation of the case to the attending.
- Routinely select up to 5 cassettes for "rush processing" to allow incorporation of these findings into the PAD. If necessary, a limited number of special stains can also be requested rush.
- Contact the members of the clinical team (especially anyone with whom you discussed the case prior to performing it and also the individual who secured the autopsy permission) as soon as possible after the case to provide them with verbal feedback of your findings.
- Follow through on the brains for your cases, even if you rotate off service. Make sure your brains are presented at brain cutting conference, and try to attend if your new service obligations permit. Review the microscope slides as needed with neuropathology.
- Expect to be involved in any presentation of your cases at conferences within and/or outside of the department. Ideally, the junior resident should be presenting his or her cases at these conferences.
- Do not forget about your autopsy cases or simply "let them sit" until the next time you are on a light rotation. The College of American Pathologists, the organization that is responsible for accreditation of our training program, requires that final autopsy reports be mailed within 60 days of the autopsy.

- Keep up with your Competency Checklist. Monitor items that have not been checked off, and look for opportunities to perform those procedures. All of the items should be checked off before you complete all of your rotations on the autopsy service.
- Keep the record of your autopsy cases in the ACGME online Case Log system up to date.
- Although most cases which arrive for autopsy after 3PM are held over until the following day, there are rare occasions when an autopsy may need to be performed after that point, even perhaps in the middle of the night. Therefore, when you are on the autopsy rotation, you should try to make yourself available 24 hours a day, and be reachable by beeper at all times.
- If you are one of the residents covering the autopsy service over a weekend or holiday, be sure to check with the senior resident and the attending on-call before the weekend begins. Reach an understanding of if and how the attending can be reached over the weekend. Make sure you are available by beeper or by phone at all times. If you think you may be out of range, call in every hour or so to make sure there is nothing requiring your attention.

Senior Resident Responsibilities

- Be available and prepared to address any and all medical issues which arise while assigned to the service. Matters for which you do not have the proper experience should be referred to the attending on the case (for case specific concerns) or the director of the autopsy service
- This service MUST be covered by a senior resident at all times. In addition, because of the potential need to go to the VA Hospital to perform an autopsy, the service cannot be cross-covered by the resident on hot-seat or on frozens during the first half of the academic year. If you are not available for any reason, you must arrange for coverage prior to your departure, and clearly inform the morgue staff who is covering for you.
- Monitor the junior residents to be sure they are progressing at an appropriate pace and fulfilling their responsibilities. As needed, provide direct supervision for the junior residents for their first three cases of each type, and document that supervision on their Supervision Documentation form.
- Assign cases to the residents on the service in an equitable manner.
- Assist junior residents in interpreting clinical records, seeking additional information (e.g. lab, radiology) and contacting clinicians involved. On the basis of information obtained, determine the best approach to each particular autopsy. Pay particular attention to clinical questions to be answered, viral and bacterial cultures to be obtained and any other special tissue requirements (e.g. fresh tissue for EM, tumor or genetic studies, liver for Carnoy's, lymph nodes for B5).
- Make sure that the Attending for the case is appropriately notified (Attendings vary in the degree to which they wish to be involved in the autopsy, and this may change on the weekend). It is advisable to discuss this with each Attending at the beginning of their rotations on service. Most Attendings would like to be called after the clinical information has been gathered but before the autopsy starts. (NB: The Attending for weekend autopsies is the Attending on service the following Monday.)
- When necessary due to case load or junior resident staffing, the senior resident should assume primary responsibility for cases, including completing all of the paperwork/reports for such cases. Usually, after each junior resident assigned to and present on the service has received two cases on any given day, and there is still another case to do, the senior resident should take a case.
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- Supervise any post-sophomore fellows on the service. In some instances, the post-sophomore fellow may be allowed to assume primary responsibility for a case, but the senior resident must supervise the post-sophomore fellow during every aspect of the case.
- Be available to discuss the case with the junior resident prior to performing the autopsy. Provide advice as to technique and special procedures.
- Make sure the technicians have contacted a member of the Yale Pathology Tissue Services tissue procurement team prior to the beginning of the case. This is particularly important in cases in which neoplasms are suspected. You should be familiar enough with the case to be able to give an initial assessment as to which tissues are likely to be available from the case for research purposes.
- Be available to assist the junior resident(s) during the autopsy, train them in appropriate autopsy techniques, and encourage the use of special procedures such as frozen section and specimen x-ray where indicated.
- Gradually transfer increasing independence and responsibility for the case to the junior resident
- Be mindful of the status of the Competency Checklist for each of the residents on the service, and look for opportunities for the residents to demonstrate their competence in each of the items on the list
- Act as diagnostic consultant for the junior residents, discussing differential diagnoses for any lesions encountered.
- Make a special effort to teach any medical students or other "visitors" who may be present in the room during the autopsy.
- Be sure tissue is frozen where appropriate, for diagnostic and research purposes. This includes all tumors. Tissue should be frozen either by a Yale Pathology Tissue Services representative/designee or by yourself. These tissues must be transported to the -80°C freezer the day of the autopsy or left in the cryobath since the cryostat goes through a thaw-refreeze cycle every evening.
- Review the case with the junior resident after he or she has laid out the organs but before the attending arrives to review the case. Be sure everything has been dissected properly and completely, and that the room is in a presentable state for review of the case.
- Assist in the preparation of the PAD. Be sure it is accurate, complete, and in the proper format. Be sure to discuss with the attending what your role in the signout of the PAD will be.
- Be available to review the slides for the case with the junior resident and to assist them in preparing any conference presentations of the case within or outside of the department.
- Review the final report with the resident before it goes to the attending for review. Assure that the report is complete, accurate, and in the proper format. Remember, your name is on this report as well.
- "Encourage" the junior resident, as needed, to have the final autopsy report completed and ready for the attending within 3 weeks of the autopsy.
- If at all possible, the weekend senior resident on-call for surgical pathology should be present for the Monday morning review of the case with the attending and follow through with assisting the junior resident in preparing the PAD. When responsibilities of another service make this impossible, be sure to "sign-off" on the case with the autopsy senior resident so that they can perform these tasks.
- Coordinate interdepartmental morbidity and mortality conferences as necessary

- Coordinate the weekly gross conference, including case selection. The Conference may be conducted on autopsy or surgical material on an alternative basis, depending on the availability of cases.
- Circulate the list of brains to be cut each Friday, by Wednesday of that week. Be responsible for coordinating Brain cutting (see Neuropathology section)..

Attending Pathologist Responsibilities

- Be available, by beeper, 24 hrs a day when you are on service. If you do not have your own beeper, contact the service manager to get the "attending on call" beeper BEFORE 5PM Friday on the day you start on service. Being available includes, at the least:
  - Being available to the junior and senior residents to discuss the case prior to the autopsy, and recommend any special procedures which are appropriate for the case. Depending upon how "special" the procedure is, you may need to become actively involved in arranging that procedure. IT IS INAPPROPRIATE TO BE OUT OF TOWN WHEN YOU ARE ON SERVICE, unless you have arranged coverage.
  - Be available during the autopsy dissection to deal with unexpected findings if they should arise.
  - Review the organs with the junior residents, senior resident, and all other medical personnel assigned to the service. This review should occur the afternoon of the case, ideally at ~4 PM. For weekend cases, the review is usually done on Monday morning. Make sure that ALL RESIDENTS ON SERVICE are in attendance at the presentations. Instruct all assembled in the pathology demonstrated by the case, including especially any unique contributions which your background allows you to make. Discuss the content of the PAD with the residents. Identify which "rush" sections should be submitted so that the PAD can be >95% complete and accurate.
  - Follow through on your cases and be sure the PAD is signed out in a timely fashion, almost always before the end of the first business day on which the autopsy is performed. Whenever appropriate, be sure to include digital images in the autopsy report. This increases the value of the report to the clinicians. However, be circumspect in selecting images for inclusion. Since family members often end up seeing the autopsy report, avoid images which members of the family might find disturbing or offensive.
  - Be available during reasonable hours and be reasonably flexible in the scheduling with the resident of the slide review for the case. Slide reviews should be done within 2 weeks of the autopsy, preferably within one week.
- Assist the resident in preparing presentations of any of your cases that are to be discussed at a conference. You should attend any conference in which one of your cases is being discussed.
- Ensure that the items on the Autopsy Checklist are being completed.
- When given a completed autopsy report by the resident, review it, make corrections, and return it to the resident as quickly as possible, usually within 24 hours. Be sure to verify:
  - that the medical content of the report is accurate, including the detailed findings and correlation discussion
  - that the prose portions of the report are written in grammatically correct English
  - that the format of the report is consistent with the standards for the service
  - that organ weights have been entered into the "Organ Weights and Measures" module
  - that appropriate entries have been made for "Clarifications and Discrepancies" for the case

- When signing out cases electronically, be sure to include appropriate images to supplement the textual discussion for the case
- Keep track of your cases, and make every effort possible to be sure they are completed and signed out within 30 days of the autopsy, as required by the College of American Pathologists.
- For any case which is older than 60 days, the manager of the autopsy service must be given a copy of correspondence between you and the clinicians on the case (email is acceptable) explaining the reason for the delay in the completion of the case (e.g., awaiting special procedure, awaiting outside consultation)
- Attend organizational meetings of the autopsy attending staff, as arranged by the director of the autopsy service.
- Participate, on a semiannual basis, in the College of American Pathologists Autopsy Pathology Educational Program for proficiency assessment.
- Be aware of all service policies, as itemized in the Autopsy Service Manual, and abide by them.

Autopsy Manager Responsibilities

- Oversee all aspects of morgue and autopsy operations at Yale-New Haven Hospital and autopsy operations for Bridgeport Hospital.
- Become personally involved in any case for which there is a question about the validity of the autopsy permission.
- Assist in the training of residents in autopsy techniques, provide direct supervision of the residents as needed, and signoff on their Resident Supervision and Competency Checklists.
- Take primary responsibility for training rotating pathologists assistant students and other students
- Maintain mechanisms to assure the accuracy of accession information into CoPath
- Be available to sign out PADs and Final Reports as requested by attending and resident staff.
- Follow-up daily on any PAD which is over two days old and which is not signed out
- Follow-up in advance to obtain written documentation of communication between the requesting physician and attending pathologist for any case which is not signed out within 60 days.
- Each week, prepare and discuss with the autopsy director and/or assistant director the weekly autopsy/morgue service report
- Run and distribute weekly active case lists for all attendings, identifying the 10 oldest cases
- Prepare and distribute the monthly and quarterly reports
- Host other visitors to the service as approved by the service director
- Assist, as needed, with the examination of electively terminated fetuses processed as surgical specimens

Autopsy Technician Responsibilities

- Correctly identify cases for autopsy and notify the resident and senior resident of the case. Personally communicate to them any restrictions specified on the autopsy permit.
- Prepare the autopsy room for the case. This includes not only the instruments for the case, but the photography station, Faxitron (if needed) and any special materials required (e.g., for cultures, etc.).
- Check the body (particularly the neck region) with the Geiger counter for the possibility of radioactive implants. Weigh the body, transfer it to the autopsy table, and measure the length.
- Accession the autopsy into the computer. Be sure to enter the body height and weight. A minimum of 2 members of the clinical team, and preferably 3-4, should be entered for the case. This may require making phone calls to track down names and/or addresses.

- Print out the "working draft" for the autopsy case. This will include normal ranges for the organ weights (based on the entered patient height and weight) as well as any previous pathology reports on the patient, such as surgical or cytology reports.
- Contact Yale Pathology Tissue Services to inform them of the case. This is usually done by beeper. Do this for all cases, including weekend cases. Be sure to record on the log when the page was made for each case, and whether or not there was a response. When a Yale Pathology Tissue Services representative calls back, you should be able to provide them with the age and sex of the patient, the post-mortem interval, and the cause of death. Any other medical questions, in particular relating to the possible availability of tissue from the case for research purposes, should be referred to the resident(s).
- Contact other ancillary personnel who might wish to be present during the autopsy, as indicated by the manager of the autopsy service.
- Verify the ID on the body about to be autopsied and sign the autopsy checklist. Be sure the resident does the same.
- Be available in the autopsy room throughout the autopsy to assist the medical staff by performing ancillary services as requested. These services might include inflating a lung, running a bowel, photographing specimens, removing the brain, removing the eyes, labeling containers, and even assisting in the dissections.
- Obtain tissue for routine freezing from the resident and bulk freeze the tissue. This should be stored away and retrievable if needed.
- Participate, with the autopsy manager, in the development and incorporation of new techniques and special procedures into the autopsy process. Where necessary, train the residents in these procedures.
- Pay attention to the needs of the medical staff, especially in instances where those needs cannot be immediately addressed by the contents of the autopsy room. If you identify any changes or improvement which might expedite the autopsy process, bring them to the attention of the autopsy manager.
- When the body has been eviscerated, clean up and close the body and transfer it back to the morgue cooler.
- Clean up the autopsy room throughout the case and when the case has been completed.
- Inform the funeral home, as needed, that the body is ready for release.
- Complete any necessary paperwork for cultures taken at autopsy and transport the specimens to the microbiology and/or cytogenetics laboratory.
- Digital images should be transferred from the digital camera into the computer system no later than the morning following the autopsy. In the rare instance in which traditional 35mm photographs may have been taken, assemble any film from the case and arrange for its developing.
- Check the cryobath for any tissue that might have been frozen from the case. This tissue must be transferred to the -70°C freezer as soon as possible, both because it will better preserve the tissue and also because the cryobath is quite small and cannot accommodate more than a few tissue blocks. Be sure to properly log the tissue from the case.

Transcription Unit Responsibilities

Autopsy cases need to be treated with THE SAME PRIORITY as surgical or cytology cases.

The senior resident on the autopsy service should be the primary contact person for the transcriptionist. The senior resident on the autopsy service should be able to address most of the

issues that may arise. However, for general issues pertaining to policy, the transcriptionist should contact the director of the autopsy service.

The major duties of and policies pertinent to the transcriptionist are summarized below.

- Autopsy reporting work is a primary responsibility, not something to be done only when there is nothing else to do. All dictations pertaining to the autopsy service are to be typed into the computer within 24 hours of when they are dictated (or, for dictations done over the weekend, before the end of the day on Monday). All written corrections to autopsy reports are to be typed into the computer within 24 hours of receipt.
- Respond promptly to any requests by YNHH clinicians for copies of reports. Add their names to the list (in the computer) of individuals to receive the final reports for that case.
- Except under very unusual circumstances, we do not mail reports to patient's families.
- Under no circumstances should you verbally discuss the content of the reports with a clinician, or anyone else for that matter. If they are a YNHH physician, you may send them a copy of the report, but any verbal communication related to the content of the report should be referred to the resident on the case.
- Keep track of the neuropathology reports, and get them into the computer as soon as possible so they can go out with the final autopsy reports.
- Each Friday morning, print out and distribute to the residents their list of active cases.
- Wherever and whenever possible, identify inefficiencies in the report generation process and discuss these with the director of the service so that the process can be improved and streamlined.

Housestaff "Credit" for Autopsy Cases

With the decreasing number of autopsy cases being performed worldwide, ways are being sought to "share" the educational experiences available from each case, and to share the "credit" for these cases when it comes to board applications. In order for the credit to be meaningful, it must be apportioned in a fair and consistent way. Therefore, the following policies have been established as guidelines. However, the ultimate decision for any case resides with the attending pathologist for the case. Any consistent deviation from the guidelines listed below should be reported to the autopsy service director for review.

There are three "fields", all multi-instance, which can contain the name(s) of pathologists. In each case, the order of the names IS significant, to the extent that the first resident and first attending listed in each field are designated the "primary" resident and "primary" attending pathologist. Each field is discussed separately below, followed by a discussion of how each field is used differently in "Brain Only" autopsies.

Gross Pathologist(s) / Prosector(s)

This field is predominantly to list the involvement of residents/fellows in the case, and is the field searched when the computer generates a list of cases in which a resident/fellow participated. The primary resident on the case should be listed **first** in this field. In general, this will be the junior resident assigned to the case.

In some cases, ONLY the primary resident will be listed for the case. However, in many instances, the senior resident on the service or the other junior resident may also be listed. For

purposes of "credit", the Accreditation Council for Graduate Medical Education (ACGME) has defined the elements of the case in which a resident MUST participate in order to receive credit for that case. These are:

1) review of the history and circumstances of the death
2) external examination of the body
3) gross evisceration/dissection
4) review of the microscopic and laboratory findings
5) preparation of the written description of the gross and microscopic findings
6) development of the opinion on the cause of death
7) review of the final autopsy report with teaching staff

A resident must participate in ALL seven of these elements to be listed as having participated in the case. Per ACGME rules effective July 2007, at most two residents can share credit for an autopsy. If the other junior resident on the service participates in all of the seven components of the case, and the attending pathologist agrees, that resident should be listed second in the Gross Pathologist field and the case will count as a shared case for that resident. If the other junior resident on service does not participate in all of the above seven elements, then the senior resident on the service may share credit for the case, but again must participate in all seven elements to be eligible to receive this credit. A senior resident should not be listed simply because their name was on the schedule.

All pathology residents are required to log each of their autopsy cases into an online, internet based Case Log System of the ACGME at www.acgme.org. This should be done AT LEAST monthly.

Residents should NOT be listed in the Gross Pathologist/Prosector field if their involvement is limited to a procedure associated with the case (such as the Neuropathology evaluation). Instead, they should be listed as a "Procedure Pathologist" for that procedure (see below).

Attending / Primary Pathologist(s)

The primary pathology attending for the case should be listed first in this field. Other attending pathologists may be included, at the discretion of the primary attending pathologist. However, it is generally NOT appropriate to list a pathologist simply because they reviewed or were consulted for an interpretation on two or three slides from the case. Residents and fellows are generally NOT listed in this field unless they functioned in the capacity of an attending pathologist for the case, in which case another "real" attending pathologist who is taking legal responsibility for the case must also be listed. For technical only cases, the service director is usually listed.

Procedure Pathologist(s)

This multi-instance field, which exists for each procedure associated with the autopsy case (with the exception of the Provisional Anatomic Diagnosis), should contain the names of the attending pathologist and resident/fellow responsible for that particular procedure. The primary attending pathologist should be listed first, followed by the primary resident, followed by any additional attending or resident pathologists involved directly with the procedure. The most common procedure for autopsy cases is the Neuropathology Evaluation. The attending neuropathologist should be listed first, followed by the resident who assumed responsibility for the neuropathology portion of the case at Brain Cutting Conference. In general, the primary resident

and primary pathologist for the main autopsy case, is NOT listed. A similar practice should apply to Electron Microscopy, Immunofluorescence, Molecular Diagnoses, and other procedures.

"Brain Only" Autopsy Cases

As described above under "Additional Rules for Special Situations", subsection "Brain Only Cases", brain only cases have a different workflow than other cases, and therefore credit is apportioned differently. In general, the neuropathology attending will be listed as the first procedure pathologist (for the Neuropathology Evaluation) and the first primary case pathologist. The resident who assumed responsibility for the neuropathology portion of the case when the brain was cut at Brain Cutting Conference will be the second procedure pathologist listed, and will also be the first gross pathologist listed for the case (i.e., the "Primary" resident for the case). If a different junior resident on the autopsy service assisted with the external examination, they should only be listed if they also, later, participate in the brain-cutting conference AND review the microscopic slides for the case. If they meet these requirements, they are usually listed as the second gross pathologist for the case but are NOT listed as a procedure pathologist. The senior resident on the autopsy service is generally not listed under any of the pathologist fields.

Fetal Autopsy Cases *(New 2012)*

The American Board of Pathology requires residents to participate in at least 50 autopsy cases to be deemed qualified to sit for the Anatomic Pathology portion of the primary certification examination. Because of growing concern that the bulk of the autopsy experience for some of the residents applying for the exam consisted of low gestational age fetuses which died in utero and for which a substantial examination is not possible, the American Board of Pathology developed criteria for using fetal autopsies to meet the autopsy requirement. These go into effect for residents applying for the 2013 examination.

1. Definition: A fetal autopsy is one that is performed on a fetus dying in-utero or born dead.
2. For a fetal autopsy to satisfy the autopsy requirement of the American Board of Pathology, the following criteria must apply:
    - There must be an autopsy consent signed for a complete autopsy. This is not the same as an anatomical disposal.
    - The fetus must be intact.
    - Examination of the placenta must be part of the autopsy report
3. No more than a total of 5 fetal autopsies that have no anatomic, congenital, infectious, or genetic abnormalities (Final Anatomic Diagnosis = intra-uterine fetal demise) can count toward the 50 required autopsy cases.
4. No more than 2 fetal autopsies on macerated fetuses can count toward the 50 required autopsy cases.

Technical Procedures

Universal Precautions

Because the potential infectivity of patient blood and body fluids can't always be known, the Centers for Disease Control (CDC) has recommended the use of appropriate barrier protections to prevent parenteral and mucous membrane transmission of diseases to health care workers. Yale-New Haven Hospital and Yale University have implemented UNIVERSAL PRECAUTIONS on all patients. These policies apply to the Autopsy Section of the Department of Pathology, and are strictly followed.

Areas of the department where blood and body products are handled are designated as biohazard areas. The Centers for Disease Control and Prevention (CDC) has set guidelines for Biosafety Level criteria. Most of the Autopsy suite (including the restrooms) is designated BL2 (Biosafety Level 2). Biosafety Level 2 is similar to level 1 and is suitable for work involving agents of moderate potential hazard to personnel and the environment. It differs in that laboratory personnel have specific training in handling pathogenic agents and are directed by competent scientists. In addition, access to the laboratory is limited when work is being conducted, extreme precautions are taken with contaminated sharp items, and certain procedures in which infectious aerosols or splashes may be created are conducted in biological safety cabinets or other physical containment equipment. For complete details, refer to the "Biosafety in Micro biological and Biomedical Laboratories" manual, 3rd edition, published by the US Department of Health and Human Services, Public Health services for the Center for Disease Control and Prevention. This is available in the morgue. Regulations require that:

- Supervisors shall limit access to areas designed as BL2.
- Eating, drinking, smoking and application of cosmetics are not permitted in the BL2 areas. Food must be stored in food storage cabinets and refrigerators outside the work area.
- PPE (personal protective equipment) must be worn when handling tissue, blood, and body fluids or the containers holding these materials.
- Everything within the BL2 area should be considered contaminated. This includes the telephones and camera. Do not touch these without wearing gloves.

All personnel entering an area where unfixed tissue, blood and body fluids are being examined, or the possibility of exposure to blood and body fluids, should wear Personal Protective Equipment (PPE). Minimum requirements are:

- Hand protection to include latex or vinyl gloves, double layered. Kevlar gloves to minimize the possibility of sharp injury are available and usage is encouraged.
- Shoe covers are to be worn while in Autopsy rooms.
- Street clothes are to be covered by at least a long sleeved lab coat. Scrubs, gowns, sleeves and aprons are preferred for more involved work.
- Head covering, masks and eye covering are needed during invasive procedures to limit exposure due to the high chance of splash. Full cover face shields should be worn during high activity.

All personal protective equipment should be changed immediately if it becomes grossly contaminated with blood or body fluids. Disposables are to be placed in appropriate containers in the room in which contamination occurs. Scrubs should be placed in the scrub bin in the changing

rooms. All PPE is to be removed and placed in a proper receptacle prior to leaving the biohazard area.

All tissue is to be fixed in neutral buffered formalin before it is allowed to be removed from the BL2 area.

Hands are to be washed with soap and water before leaving the work area; before handling doorknobs; before eating, drinking, smoking, applying makeup, or changing contact lenses; before using lavatory facilities; and before all other activities which involve contact with any part of the body.

Cleanliness in the Autopsy Suite

The best way to prevent the spread of contamination is to clean up all spills immediately when they occur. There is absolutely no reason to be working in a bloody mess. Keep the table and instruments clean at all times, stopping as often as necessary to rinse off blood or other soft tissue. Water should be running on the table throughout the case. All "waste" tissue should be placed in a container, not simply piled up somewhere nearby. Do not dissect each organ in a different part of the room. When transporting an organ from one place to another, such as the scale or the photography station, place it in a container rather than dripping blood across the room. Clean up the photographic station after each use.

Sharps Biosafety

Learn early on to have the highest regard for sharps. You should know at all times where each sharp in the room is located. Instruments are to be handled with care and kept visible at all times. Never place a scalpel or knife on the autopsy table; all sharps should be either in your hands or on the instrument table above the patient's legs. Care must be taken when removing scalpel blades and when using needles. It is hospital policy NOT to recap any needle, since that is when most needle sticks occur. Discarded sharps are to be placed in special receptacles located in each room.

Frozen Section Biosafety

Frozen sections pose a high risk because freezing does not inactivate infectious agents. Extreme care should be used when performing frozen sections, especially on known infectious cases. Use standard PPE with extra concentration on protecting the hands from the possibility of cuts. Freezing propellants under pressure should not be used for frozen sections as they may cause spattering of droplets. Instead, freeze tissue by covering it with OCT and placing in an isopentane bath. Keep the cryostat cover partially closed while tissue is being cut. When done, all scraps of tissue and paraffin should be removed and disposed of properly. The inside of the cryostat should be wiped down with 95% ethanol. Extreme care should be taken when handling microtome knives. Kevlar or metal mesh gloves should be worn when changing blades. Store the blade in proper receptacle. If the blade is dull or damaged, return it to histology for sharpening or replacement.

Special Handling of Known Infectious Cases

In many cases, the infectious nature of a case will be known in advance. This will include cases such as hepatitis, acquired immunodeficiency syndrome, etc. No "special training" is required for these cases, since the practice of universal precautions will provide the appropriate protection. However, to decrease the likelihood of a barrier violation, some special precautions are

taken. Visitors are not allowed. The number of individuals who come in contact with body tissues is kept to a minimum. A minimum number of instruments is used, and a "circulator" (usually the senior resident) is designated to get additional instruments or material as needed. The circulator assists and communicates and remains uncontaminated. All members of the team should wear goggles or a plastic face shield, disposable caps, masks, booties, coveralls, and two pairs of gloves. Kevlar or high density plastic gloves are available. All tissues and instruments should be retained on the autopsy table. A single scalpel is used at any given time and only by the prosector; scissors are blunt tipped. All instruments are placed on the table and picked up only by the prosector, who announces any repositioning of the scalpel. The autopsy should be completed without interruption and no one will leave the room wearing contaminated garb.

The autopsy itself is not compromised. Excessive trimming and dissection is generally avoided, however. Acquisition of unfixed tissue by critical technologies is minimized. Frozen sections are performed only if the potential benefits outweigh the potential risks. All of the organs should be placed in formalin for a short period of time prior to being rinsed and laid out on the presentation trays for attending review.

Special Considerations for Tuberculosis Cases

Tuberculosis is transmitted by aerosolization of the infective organisms. Take special care to avoid aerosolization. When the risk of forming fine droplets is high, such as when using the bone saw, use an N-95-TB filter mask.

Special Considerations for Suspected Creutzfeldt-Jakob Cases

Because of uncertainty about the infectious nature of Creutzfeldt-Jakob disease (CJD), special precautions are taken for autopsies on patients who have died from this disorder or from an undiagnosed encephalopathy which may have resulted from a "slow virus". Elements in the clinical history which should raise the suspicion of CJD include a rapidly progressive dementia, dementia of less than three years total duration, dementia with seizures, or prior human growth hormone treatment.

The following is from a guideline produced by the College of American Pathologists for handling C.J. cases:

"If there is any suspicion of CJD, the autopsy should be limited to the brain only. Follow universal precautions against conventional bloodborne agents; cut-resistant gloves are preferable. Wear a mask and eye shield, although there is no evidence that CJD is transmitted by aerosols or by nonpenetrating mucosal contamination. Confine all tissues and fluids (including running water) to the table. Do not contaminate the outer surface of the container. Clearly label the container as infectious. At the conclusion of the autopsy, wash the area of the incision and any other contaminated skin surfaces with freshly opened undiluted commercial bleach (sodium hypochlorite). After 10 minutes, wash off the bleach with water. Decontaminate hard surfaces and surgical instruments with bleach or 2 normal sodium hydroxide. Fix the intact brain in formalin at least 10 days prior to cutting. Agitate the tissue blocks (including at least one section from each cortical lobe, basal ganglia plus cerebellum) in at least 50-100 mL of 95-100% formic acid for one hour and then return to formalin for two days prior to embedding."

The practice at Yale evolves to match our increasing understanding of this disease. We also enlist the help of the National Prion Disease Pathology Surveillance Center in Cleveland, OH.

Radiation Safety

Some patients receive implant of radioactive material for local control of malignancies. In rare cases, these will not have adequately decayed to background radiation levels prior to the patient's death. All bodies to be autopsied are scanned with a low energy gamma-radiation detector before they are brought into the autopsy room, with particular attention paid to the head and neck region. If the detector shows an elevated radiation level, radiation safety should be contacted for further guidance.

Under normal circumstances, the radioactive material is confined to small "seeds" which are often embedded within a suture; removal of the seeds removes the radiation. Extreme care must be taken not to violate the integrity of the seeds. Cutting into a seed not only contaminates the instruments and surrounding tissue, but also may aerosolize the radiation (usually I^{125}). If this should happen, hold your breath, leave all of the instruments on the scene, and leave the room. Contact radiation safety. Restrict your movements until it can be determined whether or not you have been contaminated.

Accidental Exposure

An "exposure" includes exposure to blood or body fluids by a cut or a needle stick or a splash to a mucous membrane (eyes, nose, mouth) or to non-intact skin.

If you should accidentally cut yourself during an autopsy or while cutting in a case, or should suffer a needle stick, the following procedure should be followed:

- Don't panic. Stop what you are doing. If possible, identify the object on which you cut yourself and be sure it is stored (in case of a knife) or disposed of (in case of a needle or scalpel blade) in such a way as it does not pose a threat to any one else.
- Wash the affected area (skin) well with soap and water for 15 minutes. If a mucous membrane exposure occurred, flush with running water for 15 minutes.
- Seek immediate treatment. During the day, YNHH employees (residents are employees of the hospital) should contact employee health at (203) 688-2462. Yale University employees should contact (203) 432-0123. After hours, call the YNHH emergency department at (203) 688-2222.
- As soon as possible, contact the manager of the unit where the incident occurred. This person is responsible for filing an incident report and is available to assist you in follow up.
- Think about how you might modify your techniques to limit future exposure. The technicians have many years of experience and can help you with this.

The Autopsy Dissection - Adult

There is no one "right" way to do an autopsy. There are a number of established procedures, and you should learn as many as possible, but always be prepared to adapt any procedure to the specific needs of the current case. In general, it is a good idea to try to do at least one "new" thing with each of your autopsy cases.

The pages which follow briefly describe "typical" autopsy dissections. Only a cursory discussion of the procedure will be given here, as these will be demonstrated in great detail by the senior resident, attendings, and technicians. Different procedures are given for adult and pediatric

cases. You will notice many similarities between these procedures, but some important differences as well. For example, whereas coronary artery atherosclerosis is an important aspect of all adult cases, it is rarely an issue for pediatric cases. Possible congenital anomalies, on the other hand, are much more important for pediatric cases.

Two general dissection techniques are used at Yale. In the "en bloc" approach, the majority of the dissection is done in situ, the organs being removed singly or in organ system blocks from the body. In the "en masse" technique, all of the organs are removed together as one organ block, and then that block is dissected to remove the individual organs or organ system blocks. The end result of the two techniques is identical.

External Examination

Note how the patient is identified, and verify you are about to autopsy the correct patient. Your dictated external examination should indicate how you knew you were autopsying the correct patient. Consider photographing the patient ID to document the patient identity. In addition, note the color of the skin, hair, and eyes. Look for edema or palpable masses. Note any injuries, scars, tattoos, lines, tubes, etc.

Opening the Body

The body is opened with a "Y" shaped incision with the tips of the "Y" at each shoulder, the base at the pubis, and the intersection at the xyphoid. For adult women, the upper portion of the "Y" tends to be more "U" shaped, passing inferior to the breasts. The abdominal incision is made in the midline, deviating slightly to the left or right around the umbilicus. If the patient has had previous abdominal surgery, there may be adhesions between the bowel and the anterior abdominal wall. Be careful not to cut into the bowel when opening the abdomen. After reflecting the skin upward, the chest plate is removed by cutting the ribs lateral to the costochondral junction. Give yourself plenty of room to access the thoracic contents. When the ribs have been cut with a rib cutter, reflect the chest plate upward from below, cutting against the underside of the rib cage to remove the soft tissue adhesions.

The *in situ* Examination

This is perhaps the most important part of the autopsy. After you have opened the thoracic and abdominal cavities, perform a thorough examination of the organs while they are still in place. What you find will allow you to plan the remainder of the dissection. Begin by noting the character and volume of any fluid collections (pleural cavities, abdominal cavities, pericardial sac). Remove the fluid. Then systematically examine each organ, noting any abnormalities in location, size, shape, etc. Also verify that the connections of the organs to each other are correct. Most adhesions can be "lysed" simply by careful separation with your hands. This is not the time to be using a scalpel.

Place a towel or wet paper towels over the cut edges of the ribs to prevent accidental puncture of your gloves.

Obtain any cultures that will be needed.

Open the pulmonary artery in situ (pinch the left atrium and cut distal to the pinch) and examine (with your finger) for the presence of any large pulmonary emboli in the saddle position or in either main pulmonary artery.

Organ Removal: The "En Bloc" Technique

Open the pericardial sac superiorly to expose the origin of the great vessels. The heart is removed by cutting across the inferior vena cava and then reflecting the heart upward to expose the pulmonary veins. Cut these at the pericardial surface. Then, while pulling up on the heart, cut the superior vena cava, pulmonary arteries, and aorta. The aortic valve should remain with the heart, but the arch and arch vessels should remain behind in the body. Remove each lung by cutting across the trachea close to the carina, leaving as much of each mainstem bronchus with the lung as possible.

Remove the small and large bowel by double clamping or tying the duodenum as it emerges from the retroperitoneum at the ligament of Treitz. Cut between the two clamps, and then separate the bowel from the mesentery along its length. This cut is usually made close to the bowel. However, if there are any ischemic appearing sections of bowel, leave the corresponding mesentery attached to the bowel in those areas. Proceed through the entire small bowel, cecum, and colon, undoing the loops in the sigmoid. Tie off or clamp the sigmoid where it again becomes retroperitoneal near the rectum and then cut across the lumen, leaving the tie or clamp behind but pinching the lumen you are removing to prevent spilling the bowel contents into the abdominal cavity.

Dissect the gallbladder from the liver (perform an in situ cholecystectomy) maintaining the connections from the gallbladder to the cystic duct to the common bile duct to the duodenum. You will need to cut across the common hepatic duct. Remove the liver by cutting the vessels at the hilum. Remove the spleen.

Remove the adrenal glands. These may be difficult to find in the retroperitoneal fat superior to the kidneys. The right adrenal is flatter and slightly more inferior than the left. The left adrenal is just beneath and below the head of the pancreas - reflecting the pancreas anteriorly will allow you to find it, and will free up the pancreas for later removal with the stomach block. Clean off the associated fat BEFORE weighing them.

Remove the "stomach block". This consists of the esophagus, stomach, duodenum, pancreas, and gallbladder with the common bile duct. The mesentery may also be removed with this block. The celiac trunk and superior mesenteric artery are the only major connections that need to be cut to release this block - all of the other connections are soft tissue and peritoneum. Begin inferiorly with the clamped end of the duodenum. Reflect this anteriorly and superiorly, cutting along the anterior aspect of the aorta. When you reach the diaphragm, cut from the side of the esophagus to the anterior edge of the diaphragm, separating the diaphragm in two. Continue separating the esophagus from the vertebral column and trachea up to the pharynx and cut across the attachment.

Remove the diaphragm if needed.

The neck organs should now be freed up by careful dissection of the skin. Identify the common carotid arteries bilaterally and tie them off. Cut across the larynx superior to the thyroid cartilage. Remove the larynx, thyroid, and trachea as a block.

The aortic arch, thoracic and abdominal aorta down past the bifurcation into the common iliac arteries, the renal arteries, kidneys, ureters, and bladder (collectively the urinary block) are removed from the body together with the rectum and the prostate (males) or uterus, ovaries, and vagina (females). The aorta is reflected downward after cutting the arch vessels. Then, make vertical incisions through the peritoneum along the lateral abdominal walls. The kidneys are shelled out of the retroperitoneum from lateral to medial, dissecting along the posterior abdominal wall to the midline. Be careful not to cut the ureters. Free up the bladder by "peeling" its anterior surface

from the pelvic rim down to the urethra. Free the inferior pelvic structures by blunt dissection followed by cutting across the rectum and prostatic urethra or vagina. At this point, only the common iliac arteries and soft tissue connects the block to the body. Cut these to remove the block. For males, open the inguinal canal, retract the testes into the abdominal cavity, and excise them.

Organ Removal: The "En Masse" Technique

Begin by freeing up the neck organs by carefully dissecting the skin. Identify and tie off the common carotid arteries. Cut across the larynx above the thyroid cartilage. If removal of the tongue is desired (as in pediatric cases), place your scissors on the anterior surface of the trachea, penetrate into the mouth just behind the mandible, and then extend this incision laterally and posteriorly in both directions, keeping the cut close to the pharynx wall and taking care not to cut the carotids (cut medial to the carotids). Free the diaphragm by cutting along the lateral and posterior wall to the midline. The bowel should now be removed as described above for the "en bloc" technique. Then, free up the pelvic organs anteriorly and posteriorly as described above. Make horizontal (i.e., inferior to superior) incisions through the peritoneum along the lateral abdominal walls. This will allow you to remove the retroperitoneal organs with the posterior peritoneum and the abdominal organs without stripping the lateral peritoneum. The entire organ block is removed by lifting (with one hand) the trachea/larynx/aorta and reflecting inferiorly while cutting (with the other hand) along the vertebral column. After the bifurcation of the aorta, cut the common iliac vessels bilaterally to release the block.

Once the block has been removed, individual organs and organ blocks need to be separated. Begin by placing the block with the posterior surface up and locate and remove the adrenal glands. Then, from the anterior surface, separate the organs and organ blocks as described above for the "en bloc" technique.

Completing the Evisceration

After the organs have been removed from the body, do not forget to thoroughly inspect the posterior wall of the thoracic and abdominal cavities for other lesions. In addition, you will also need to shave a fragment of bone and marrow off the vertebral column, Additional marrow can be expressed from the ribs. Muscle and nerve, as needed, can also be taken. The spinal cord can be removed by cutting with the bone saw into the spinal canal on each side posterior to the vertebral bodies. If indicated and special arrangements have been made, the leg veins may be dissected. If they are not to be dissected, they should routinely be milked for the presence of thrombi. A sample of skin can be taken along the thoracic/abdominal incision.

Removal of the Brain and Eyes

An incision is made from the region of the mastoid process just behind one ear, extending coronally to the mastoid process of the other ear. The skin and muscle are then reflected off the periosteum anteriorly to a line about 1 cm. above the eyebrows. The posterior scalp is reflected to the occipital protuberance. The skull cap is cut using a bone saw following a line horizontally on both sides from the center of the forehead to the base of the mastoid process. Often, a notch is cut at the center of the forehead to allow more stable repositioning of the skull cap after removal of the brain. The second cut is made over the posterior superior surface of the skull such that the angle this cut forms with respect to the initial cut is >90° when viewed from either the left of right side. Control of the saw is necessary so that the brain and meninges are not lacerated. The calvarium can then be removed.

The meninges and brain are inspected and any abnormalities recorded. The brain is removed by gently drawing back the frontal lobes so that the optic and olfactory nerves are visible. The optic nerves and internal carotid arteries are cut along with the stalk of the pituitary gland. While supporting the brain, the temporal lobes are lifted and the tentorium is cut with scissors or a scalpel blade, exposing the cerebellum and pons. With continued support of the brain, the cervical spinal cord is cut as far down as possible. The brainstem, pons and cerebellum are guided out with one hand, with the second hand supporting the cerebral hemispheres. Any remaining attached dura is cut.

The pituitary is removed by fracturing the sella turcica to allow intact removal.

The eyes can be removed either anteriorly or posteriorly. Anterior removal requires incising the conjunctiva circumferentially around the limbus, hooking and cutting each of the extraocular muscles, and then cutting the optic nerve. Posterior removal involves opening the roofs of the orbits either with the bone saw or a chisel. The globe is then removed after cutting the extraocular muscles and optic nerve. Remember that the globe will be attached anteriorly to the eyelids by the conjunctiva. Be extremely careful not to damage the eyelids when cutting this connection.

Dissection of the Individual Organs and Organ Blocks *(Updated 2014)*

For each organ or block, begin by dissecting off any fat or other soft tissue and identifying all of the structures in the block. Leaving unnecessary fat on the organs is sloppy dissection and may obscure important pathology.

Heart: The coronary arteries must be examined and dominance should be determined. The coronary arteries should be cross-sectioned 2-3mm intervals. If the arteries are not calcified, this can be done directly on the surface of the heart. This allows the location of any lesions to be precisely determined. Typically, however, the coronary arteries are calcified, and cutting across them would crush them and introduce too many artifacts for an accurate evaluation. Therefore, they have to be decalcified before they are cut. Since you do not want to decalcify the entire heart, calcified coronary arteries should be dissected away from the heart. You may wish to inject them with radio-opaque material first and x-ray the vasculature in situ. To remove the vessels, it is easiest to first expose them along their length by removing the overlying pericardial fat. Separating the root of the pulmonary trunk from the aorta helps expose the origins of the arteries. Remove the entire ostium from the base of the aorta with the coronary artery, following the major branches as far as possible. Keep the LAD and circumflex connected to each other to better allow distinguishing the left circulation from the right. Fully fix the coronary arteries BEFORE decalcifying them. (The next day, cut them at 2-3 mm intervals and lay them out for the attending in the correct anatomic arrangement so the cross sections are visible.)

Several choices exist for dissecting the heart. For ischemic heart disease, which is commonly an issue, with the anterior wall facing upward, one option is to three cross-sectional slices, 1 cm thick, of the ventricles from ventricular apex to mid-ventricular level. These cuts should be all the way through, separating the slices. This approach has the advantage of allowing more of the myocardium to be examined, and allows infarcts to be mapped. The base of the heart is then dissected in the direction of blood flow, as described below. Alternatively, the entire heart can be dissected in the direction of blood flow. This method should be used if there is no reason to suspect ischemic heart disease, and is mandatory for congenital heart diseases where you want the heart to remain in one piece. First, separate the pulmonary trunk from the aorta down to the base of each. This will prevent you from cutting across the pulmonary artery later when you open the left ventricular outflow tract. Open the right atrium with a horizontal cut from the inferior vena cava to

the tip of the right atrial appendage, keeping the superior vena cava intact, for potential future examination of the sinoatrial node. Open the right ventricle by cutting from the right atrium along the posterior surface of the heart with an incision at the mid posterior wall, parallel to the septum. You may wish to use a long, sharp knife for this cut, inserting it through the tricuspid valve and pushing it out the apex of the ventricle, cutting toward the base. Open the right ventricular outflow tract with an incision anterior to the anterior papillary muscle of the tricuspid valve (the right ventricle is opened posteriorly, the outflow tract anteriorly). The cut through the pulmonary valve should be between two cusps, not through one. Open the left atrium with a horizontal incision that connects the right and left pulmonary veins, continuing the incision to the tip of the left atrial appendage. Open the left ventricle with an incision in the lateral wall, between the two papillary muscles. Make the left ventricular outflow tract incision with the anteroseptal wall on the dissection table, with the knife immediately behind the anterolateral papillary muscle. Using a scalpel, extend the incision to the aortic valve. Turning the heart back over, continue the outflow tract incision (using scissors might be better), cutting through the commissure between the right and left coronary cusps of the aortic valve. [Remember, both cuts from the atrium to the ventricle are on the posterior side of the heart, whereas both cuts from the ventricle to the outflow tract is on the anterior surface of the heart.] Finally, use a knife to make a transverse slice through the septum from the apex toward the base.

Lungs: The lungs can be cut in one of two ways. Routinely, one is inflated (usually the right) and the other is cut fresh. To inflate a lung, formalin is pumped in along the airways until the lobes expand to full size. The lung is then submerged in formalin and allowed to fix. If you do this near the beginning of the autopsy, the lung may be ready to cut by the time you are finished with the rest of the dissection. Otherwise, fix the inflated lung overnight. Serial 1 cm thick sections are made sagittally from the hilum using a cutting board. To cut the lung fresh, the lung is placed hilum side up and the bronchial tree is opened along its branches with scissors, extending the cuts as far peripherally as possible. Then, flip the lung over (hilum side down) and make a cut between the lobes to enter the pulmonary artery. The pulmonary vasculature is then opened out to the periphery along its branches on this side. Finally, long, partial thickness horizontal cuts are made through the pulmonary parenchyma, being careful not to cut completely through.

Thyroid and Trachea: Remove the thyroid from the trachea by beginning posteriorly on each side and dissecting anteriorly. Be sure to remove associated muscle. Breadloaf each lobe horizontally. The trachea is opened along the posterior surface from the carina through the larynx.

Liver and Spleen: Make horizontal 1-2 cm thick slices so that the cut section has the largest surface area possible.

"Stomach Block": For routine cases, open the esophagus down to the stomach, and extend this cut into and through the stomach along the greater curvature. Note the volume and character of the gastric contents. Continue this cut to the pylorus and stop. Next, open the gallbladder, noting the volume and consistency of the bile. Probe the common bile duct into the duodenum, and leave this probe in place. After cleaning the fat and vessels off the pancreas, make vertical transverse cuts from the tail, progressing toward the head. Approximately halfway through the tail, insert a probe through the main pancreatic duct distally into the duodenum. Fillet the head of the pancreas by cutting along this probe. The ends of the two probes will now be in the duodenal lumen and will be marking the location of the ampulla. Continue opening the duodenum from the pylorus cutting along the side opposite the ampulla. Then, open the common bile duct along its length to the ampulla. This will require cutting across a portion of the duodenal wall.

Gut: Open the small and large bowel along its length, usually near the mesenteric insertion. Deviate this cut as necessary to avoid cutting through any palpable mucosal mass lesions. Open out the cecum to the appendix.

"Urinary Block": This block generally has a large amount of associated fat which must be removed, but carefully to avoid cutting any important structures. Begin by opening the rectum in place to identify its extent, and then dissecting the rectum off the block. For females with reproductive organs still in place, separate the uterus with ovaries and vagina from the bladder. The connective tissue between the vagina and the bladder is often very dense but can be cut with scissors in small increments. The vagina, cervix, and uterus should be cut by opening at 3:00 and 9:00 up through the fundus. The ovaries are each sectioned longitudinally.

The remaining urinary block consists of the aorta, kidneys, ureters, bladder, and a large amount of fat and soft tissue. Superiorly, remove the fat from the aorta (usually easiest along the anterior surface, sacrificing the inferior vena cava and renal veins) down to the level of the renal arteries, and then expose these out to the kidneys. Beware of duplicate renal arteries. Identify the ureters so as not to cut across them (inserting long probes into the ureters can help with this), and then remove the remainder of the fat from around the kidneys. If no renal mass lesions are suspected, this can be done by cutting into the fat surrounding the kidney from the lateral aspect and making an incision into the lateral renal capsule. Insert your finger between the renal cortex and capsule, and strip the capsule off around the kidney toward the hilum. Taking care not to damage the renal vessels, cut off the excess fat. If a renal mass is present (such as a renal cell carcinoma), this approach is NOT recommended since the capsule needs to be preserved over the lesion to assess capsular invasion. Instead, slowly dissect away the perirenal fat until the kidney and its capsule are exposed.

Removing the excess fat from around the bladder can be complicated since the ureters take a circuitous route into the bladder. The limits of the bladder can be better defined by injecting it with formalin to distend it, and then cutting off the fat which hangs off of it. This fat will include the pelvic venous plexus, an important source of pulmonary emboli, so be on the lookout for thrombosed vessels. Once cleaned off, open this block as follows. Place the block anterior side down. Open the aorta posteriorly by cutting between the left and right vertebral arteries and extending out both common iliac arteries. If you have not already done so, incise the renal capsule laterally and strip it toward the hilum, cutting it off there. Be sure, however, to preserve the capsule overlying any mass lesion. Bivalve each kidney completely through, leaving the ureter and renal artery attached to the anterior half (the posterior half is completely removed). The bladder is opened by cutting into the dome and then out the urethra along the anterior surface. For males, flip the bladder over again and make transverse cuts into the prostate from the posterior surface. Finally, open the ureters along their length from the pelvises to the bladder.

For the adrenals, make parallel vertical cuts into the gland. The testes are bivalved by cutting completely through (creating two pieces each). The cut should pass through the epididymis.

Eyes: The eyes should fix in formalin for at least 24 hrs before cutting. Begin by first examining the globe externally. Examine the cornea for lesions. Look into the pupil. A native lens will become cloudy following formalin fixation, so don't interpret this as a cataract. On the other hand, if the lens remains clear following formalin fixation, it is probably an artificial lens. There are many ways to cut the globe. The best is probably transversely, in a coronal plane. This separates the anterior half of the eye from the posterior half. You can then examine the anterior half from behind, noting the position of the lens and any iris or ciliary body lesions. Take a section through the middle of the optical axis for histology. The posterior pole appearance should be much

like that through an ophthalmoscope. Photograph any lesions for comparison to prior fundus photographs. Take a section of any lesions. If no lesions are seen, take a section which includes the optic nerve and the fovea.

Brain: The brain is typically cut after complete fixation, usually during the brain cutting conference and with the Neuropathologist present. Remove the vessels of the circle of Willis, preserving connections and orientation. Remove the brainstem and cerebellum by cutting the peduncles as cephalad as possible; this will be at the level of the substantia nigra. Divide the cerebrum into an anterior and posterior half by making a coronal section through the mammillary bodies using a sharp, clean knife. Slice each half by making serial coronal sections, each about 1 cm thick. Lay the sections out on a tray covered with paper towels, orienting each slice with the anterior aspect facing up, and arranged from anterior to posterior. Make serial sections of the brainstem either with cerebellum attached or cut the cerebellar peduncles and section the cerebellar hemispheres separately.

The Autopsy Dissection - Pediatric (<18 years)

Pediatric autopsies include fetuses >20 weeks gestation or any gestational age if an autopsy is requested and properly consented, neonates (first 28 days of life), infants (first year of life) and children/adolescents (until age 18). Autopsies on fetuses and neonates, in particular, require a different approach that takes into consideration three additional elements of the examination specific to these age groups: 1) evaluation of external dysmorphic features 2) identification/confirmation of anatomical malformations/deformations 3) consideration of ancillary tests which may corroborate a suspected diagnosis and/or address the relative risk of inheritance (see the "Recommendations for Special Situations" section below for additional information). Finally the absence of certain abnormalities should be documented, as they constitute important "pertinent" negatives.

For all fetal and perinatal deaths, consideration of the placenta should be part of the examination. If the placenta is examined separately as a surgical specimen, pertinent findings (or lack thereof) should be documented in the fetal autopsy report. As needed, microscopic slides from the placenta should be obtained and reviewed as part of the fetal autopsy examination.

The following is a description of the dissection process for pediatric cases. These guidelines are best applied to fetuses and neonates, but can also be used in any pediatric case. Other useful references are the AFIP fascicle entitled Perinatal Autopsy Manual by Marie Valdes-Depena and Dale Huff, the book Pediatric Pathology by J.T. Stocker and L.P. Dehner (1992), Chapter 1; and the article by K. Bove and the autopsy committee of the College of American Pathologists entitled "Practice Guidelines for Autopsy Pathology: The Perinatal and Pediatric Autopsy" in Arch. Pathol. Lab Med., **121:** 368 (1997). In addition to those measurements generated by the computer, reference values may be found in Textbook of Fetal and Perinatal Pathology by J.S. Wigglesworth and D.B. Singer, Chapter 2; and the appendices of Volume II of Pediatric Pathology by J.T. Stocker and L.P. Dehner (1992), p. 1261. These books are available in the Autopsy Residents' Room.

External Examination and Description

In addition to the general external features that are examined in adults, the following external features should also be specifically noted. For INTRA-UTERINE fetal deaths, the degree of maceration should be evaluated as it can be useful in assessing the postmortem interval.

Remember that the changes of maceration are non-putrefactive and result from immersion in amniotic fluid. Therefore, the use of the term "maceration" is not applicable to live-born neonates. In addition to the skin changes, intermediate length duration maceration (1-7 days of retention) may show overlapping skull bones at the sutures and laxity of joints, including a gaping mouth.

The external examination should then start with the head and progress caudally. An external photograph should always be taken, and in addition any anomalies should be specifically documented with photographs. The scalp should be inspected and any abnormal hairline pattern should be noted; also examine the size of the fontanels and the skull formation. Record the position of the ears relative to an imaginary line drawn at the level of the palpebral fissure. The inner and outer canthal distances and interpupillary distance should be measured. The pupils should be examined as to equality, regularity, and size; and the sclerae and conjunctivae should be observed. Icterus in infants is best ascertained in the sclerae. Patency of the choanae should be checked. Examination of the mouth should include the presence/absence of a cleft lip or palate, the state of dentition, noting any contents in the mouth, atrophy, or hypertrophy, especially of the tongue. The internipple distance should be noted. In newborns, the status of the umbilicus should be noted. Changes noted in the extremities should include any variations in length or position, the presence of clubbed/rocker bottom feet, and the number and development of the digits. Examine palmar creases. External genitalia should be carefully assessed and documented with photographs if abnormal or ambiguous. The anus should be checked for patency. Standard measurements include body weight, crown-heel length, crown-rump length, head circumference, chest circumference, abdominal circumference, foot length, and anterior fontanel.

Initial Incision

The standard incision is a modified Y-shaped incision or U-shaped incision, with the thoracic part of the incision lying below the level of the nipples, but close enough to one of the nipples so that breast tissue and skin may be taken. In females, especially above the age of five, the incision is only extended up to the axillary region; and with those females with well-developed breasts, the initial incision should lie just above the breast tissue with the apex of the incision at the xyphoid process. On females below the age of five, the incision can be extended up to the shoulders. When the initial incision is made, the degree of hydration, muscular development, and the thickness of the adipose tissue are noted. A restricted autopsy may determine the type and extent of the incision used. In fetus and neonates, the abdominal incision should go around the umbilicus leaving a skin ellipse around it and maintaining the connection between the umbilical vessels and the liver. If feasible the umbilical vessels should be checked for patency. If an umbilical catheter is present, it should be kept in place. Incision of the scalp is made in a coronal plane connecting one mastoid with the other over the convexity. The sutures are easily cut in a fetus or neonate, and the skull bones reflected. In an older child, the skullcap is removed following sawing. In most cases, the spinal cord is removed by an anterior approach.

Examination of the Abdominal Contents *in situ*

The amount of ascites and its appearance are noted, and cultures are taken if indicated. Look for malrotations, hernias, organomegaly, or peritonitis. Describe the position and integrity of the diaphragm. If the urinary bladder is distended, measuring the height of its fundus above the symphysis pubis is a good way to quantitate the distention. Note the presence and position of a spleen (or spleens), and the other abdominal viscera. The ureters should be examined *in situ.* Look for the presence of intra-abdominal testes.

Description of the Thoracic Contents *in situ*

Note the size and lobation of the lungs and document any pleural contents. If necessary, one may take fluid for culture. The base of each lung should reach the diaphragm level with the apex of the heart. If the lungs appear smaller, document this photographically. The transverse diameter (CT ratio) of the pericardial sac and the internal transverse diameter of the thorax should be recorded. The pericardium is then opened, and any alterations in the great afferent and efferent vessels of the heart are carefully noted. Blood and lung cultures are taken before the organs are manipulated. The thymus should be removed before proceeding with the rest of the evisceration. To remove the thymus, proceed from caudally to cranially with scissors using a "blunt" technique. Dissect the thymus from the pericardium, paying attention to identify the innominate vein. The vein should cross from left to right and connect to the superior vena cava. The absence is indicative of a persistent left superior vena cava and may signal other cardiac abnormalities. When size allows, pay attention to the presence and size of the azygous vein. Any anomalies which can be demonstrated *in situ* should be photographed.

Ligation of Vessels and Removal of the Block

Fetal and perinatal cases should routinely be eviscerated using an "en masse" technique to preserve anatomical relationships and connections. Usually the "block" includes the tongue. While obtaining the tongue and pharyngeal structures is highly desirable (and mandatory if an upper airway malformation/obstruction is suspected), consideration should be given to the parents' wishes, diagnostic indications and expertise of the prosector. If the tongue is not removed, cut above the hyoid bone and proceed caudally keeping the knife blade close to the vertebral bodies. Remove the chest block, diaphragm, stomach, bowels, pancreas, spleen, kidneys, adrenals, vessels and all posterior and lateral tissue attachments to the body wall. The pelvic organs are taken in the same block, cutting the rectum as low as possible. Once the organ block is removed, take a piece of psoas muscle as a representative sample of skeletal muscle. Removal of spinal cord and brain is typically performed under the supervision of the neuropathologist covering autopsy service.

Dissection and Description of Organs/Systems

The entire block should be laid on a moist surface with the posterior aspect facing the prosector. The esophagus should be identified and a probe placed into it. Then, open the esophagus by cutting along the probe on the POSTERIOR aspect, longitudinally, and examine for the presence of any fistula connecting the esophagus and the trachea. If there is no fistula, the esophagus should then be dissected from the trachea and left with the stomach block. Transect the trachea just below the level of the lower poles of the thyroid; there is no need to dissect the thyroid off the larynx/trachea.

Respiratory System: The lungs are left attached to the bronchi and heart at this point. The bronchial situs should be noted. A description of the lungs begins with the pleural surfaces including the lobation and consistency of the lungs. If lung tissue is needed for ancillary studies (EM, cultures, etc.), it should be taken as soon as possible. The lungs, with the tracheobronchial tree still attached, should then be perfused with 10% buffered formalin in a gentle fashion through the trachea until mild pulmonary distention is observed. Do not put a clamp on the trachea; the formalin will stay in the lung if the inflation is done slowly. At this point, the lungs and trachea and bronchi should be immersed in formalin and allowed to fix, possibly overnight. After fixation, the trachea should be cut laterally on a coronal plane (anterior and posterior halves), and these cuts should be continued along the main bronchi. The lungs are then also cut coronally, in anterior and

posterior halves; parallel sectioning of the lungs should be made, from the hilar region to the pleural surface. These sections may be made incomplete, keeping intact the pleura on one side to maintain the general anatomy of the block. A description of the cut surface should include any consolidations and the distribution of the changes. A statement as to the bronchi and size and number of pulmonary vessels should be included.

Cardiovascular System: Dissection of the heart can begin in-situ, since it is often easier to establish appropriate connections of the great vessels when the heart and lungs are still in place. If the fetus is small, the dissection can be done under a dissecting scope. In cases where abnormal connections or other congenital heart disease is found, the heart and lungs should remain attached; otherwise, the lungs can be separated from the heart, and weighed. ALWAYS leave the aorta down to the level of the diaphragm attached to the heart. The heart and great vessels should be opened following the flow of blood, unless previous surgery has been performed. In those cases, read the operative notes carefully to understand which type of procedure has been performed and proceed evaluating if the connections made are intact and patent. In all other cases, proceed following the direction of blood flow. The first incision is from the superior vena cava through the right atrium, and into the inferior vena cava. A cut is then made from the right atrium through the tricuspid valve along the posterior right ventricle to the apex of the right ventricle, just adjacent to the ventricular septum. The incision is then extended from the apex of the right ventricle, along the anterior wall, adjacent to the ventricular septum to the infundibulum, pulmonary trunk, and into the left pulmonary artery. At this point, be careful and avoid continuing the cut from the pulmonary trunk into the *ductus arteriosus*, which is commonly patent in neonates. The left atrial appendage is then opened, and the incision is extended into the left pulmonary veins. The right pulmonary veins are probed. The left ventricle is then opened along the posterior wall, through the mitral valve, along the lateral wall of the left ventricle to the apex of the left ventricle. A cut is then made from the apex of the left ventricle to the aortic valve. This incision is made adjacent to the ventricular septum, along the anterior wall, and behind the anterior leaflet of the mitral valve. The pulmonary trunk must be dissected away from the aortic trunk just above their origins, and the arch and thoracic aorta are opened.

The aortic arch and thoracic aorta are left attached to the heart. Check for aortic coarctation: in children, the location of the coarctation is typically pre-ductal (on the aortic arch proximal to the connection of the ductus arteriosus). In describing the heart, it is best to begin with a general description of the configuration and relative sizes of the chambers. The coronary arteries should be examined *in situ*, verifying the location of the coronary ostia and the distribution of the arteries on the surface of the heart. In the vast majority of cases, the coronary arteries do not need to be dissected from the heart, and serial sectioning of the heart is unnecessary. The state of the myocardium is recorded. The thickness of the right ventricular wall and the left ventricular wall are also recorded. At the end of the heart description, the circumferences of all valves are recorded in centimeters. Measurements of the diameter of the ascending aorta, pre- and post-ductal aortic arch, ductus arteriosus, and pulmonary trunk are of value in newborns. Note the ostia of the celiac, superior mesenteric, renal, and inferior mesenteric arteries, and the location and patency of the inferior vena cava. If an umbilical artery catheter has been used, check the iliac arteries and aorta for thrombi.

Gastrointestinal System: The tongue is cut sagittally and the pharynx is opened posteriorly. Check to status of the mucosa and the relative thickness of the tongue muscle. Cut the pharynx at the same time with the larynx. Open the esophagus before detaching it from the trachea (to check for possible tracheoesophageal fistulae); dissect the esophagus from the diaphragm at the level of

the hiatus and pull it down to the abdominal cavity. The diaphragm can be preserved intact to evaluate hernias or other defects, and the esophagus is kept with the stomach. Open the stomach along the greater curvature and continue to the duodenum beyond the ampulla of Vater. Check for adequate bile draining by compressing the gallbladder until bile comes out from the ampulla. Cut the duodenum at the level of the ligament of Treitz and remove small and large bowel in one piece, attached to the mesentery. Remove the omentum. Cut the ileum 2-3 cm before the ileocecal valve. Open the large bowel. The contents of the gastrointestinal tract are noted. The serosal surface, muscular wall, and mucosal surface are examined. The mesentery is saved. Any anomalies, constrictions, atresias, or ectopic tissue are described and photographed. The liver is weighed, and its shape is noted. The capsular surface and parenchyma are described. Cut the liver transversely (this gives you the opportunity to examine the maximum surface area) and keep the most superior slice to examine the venous drainage pattern. Each slice should be of no more than 1 cm in thickness. The portal vein, hepatic veins, and hepatic artery are examined and described. The gall bladder is opened and the contents are described. The common, cystic, and hepatic bile ducts are described with respect to dilatation/patency. In cases where biliary tree abnormality is suspected, submit the entire extrahepatic biliary tree by serially sectioning it. The relationship of the pancreas to the spleen should be noted. The pancreas is dissected from the duodenum only after the bile ducts have been examined. Special attention should be paid to pancreatic malformations (annular, division, short, etc.), and photographs should be taken *ex-situ* after preparation of the specimen.

Genitourinary System: The weight and shape of each kidney is recorded. In neonates and young infants, it is very important to keep in its place the capsule of the kidneys, in order to assess the presence of incomplete glomerulogenesis. Do not strip the capsule. The cortical surfaces are examined, and the average thickness of the cortex and medulla are noted and described. The number of renal pyramids is noted. The calyces, pelvises, and ureters are examined. The urinary bladder is examined, its contents are described and the condition of its mucosa is noted. The thickness of the wall is measured. The urethra is examined. In cases of suspected urinary flow obstruction, remove the urethra en bloc with the urinary bladder. The testes should be measured, and their cut surfaces described. The epididymis, vas deferens, and seminal vesicles should be examined. The ovaries should be examined, measured, and described. The uterus and the fallopian tubes should be opened and described.

Hematopoietic System: The thymus should be examined, and its shape and weight should be noted. Any ectopic thymic tissue also should be described. If no thymic tissue is found grossly, the neck and the superior chest should be examined extensively for thymic tissue and the entire anterior mediastinal tissue with pericardium should be taken for microscopic study. The bone marrow should be examined, and the vertebral bodies, which are split longitudinally should be examined for congenital defects, as well as the condition of the bone marrow. A portion of the vertebral bone marrow and rib (including costochondral junction) are fixed in 10% buffered formalin. Any lymphadenopathy is noted, the lymph nodes described, and sections taken. The spleen is weighed and described. Any accessory spleens are noted and described. If multiple spleens are present, these are described, measured, weighed together, and determined whether they lie on each side or one side of the dorsal mesogastrium. The spleen must be cut longitudinally, exposing the maximum surface area. Thin sections are required for appropriate fixation.

Endocrine System: The shape and weight of each adrenal gland, and appearance on cut section should be noted.

Inchildren, the thyroid gland is removed from the trachea, weighed, and described. In fetuses, the thyroid gland should be left with the trachea, fixed in formalin, and cross-sections

through the gland and trachea are submitted at a later time. Where indicated, an attempt to sample the parathyroids should be made.

Cranium, Brain, and Spinal Cord: Careful handling of brain and spinal cord without tugging and pulling is essential during removal to avoid easily produced artifacts. The state of the dural sinuses and the cranial bones should be checked, any abnormal sutures or any clots in the sinuses should be recorded, and the middle ears and mastoid air cells should be examined if abnormal. Any defects or anomalies of cranial fossae or bones at the base of the skull should be photographed. The dura mater, cerebral falx and tentorium should be checked and described. In cases of trauma or meningitis, the dura should be stripped from the calvarium and from the skull base, and the cranial bones examined for fractures or defects. In all cases, the olfactory bulbs and tracts should be identified and removed intact. The patency of the internal carotid arteries, if necessary, may be determined by injecting water into the internal carotid arteries near their origins. The pituitary gland is always taken. The fresh brain should be weighed, and the external surface of the brain and spinal cord should be described at this time. The brain is fixed in 10% buffered formalin. The brain and spinal cord are cut, and examined in detail after fixation. In some cases, perfusion-fixation of the removed brain with 10% formalin through the basilar and carotid arteries, or by injection through the anterior fontanel, may speed the fixation process if needed. The brain is further fixed by immersion in 10% formalin at the end of the perfusion. In aborted fetuses, it is often useful to inject formalin through the anterior fontanel to allow some fixation of the brain prior to removal.

Recommendations for "Special" Situations

Some findings and/or abnormalities require alteration of the standard dissection techniques, both to prevent losing valuable information and to allow better demonstration of the pathology (and better photographs). In some cases, additional ancillary studies are warranted. Some of these are listed here, although this is clearly not intended to be an all-inclusive list. Consult your senior resident and attending for advice.

- For dissection and display of **vascular lesions**, keep the vessel attached to its most relevant associated organs for photography and display (e.g. superior vena cava in SVC syndrome - leave on heart; hepatic vein thrombosis, portal vein thrombosis, leave on liver, etc.)
- Leave **surgical anastomoses** and prostheses of all varieties intact for display and confirmation of a successful surgical repair
- Leave, if possible, **important tubes** in place if there are relevant clinical questions (e.g. T tube in common bile duct, Swan-Ganz catheter if complications are suspected)
- Be aware of special exams required, e.g. looking specifically at mesenteric arteries in case of **bowel infarction**; observing flow through carotid arteries in cases of **cerebral hemorrhage or infarction**.
- In case of a **dissecting aneurysm**, leave the aortic arch and thoracic aorta attached to the heart
- Do not open through **obstructed or stenotic lumens** such as vessels or viscera; cut around the obstruction
- Think about regional lymph node dissection when examining specific **tumors** (e.g. axillary nodes in case of breast cancer)
- **Chromosomal studies/karyotype**: The majority of fetuses or neonates from in-house will have tissue for a karyotype already submitted by the clinician. If not the resident should check with

the clinician if needs to be done at autopsy. If an unexpected malformation is found, a karyotype should be considered. Skin is the preferred specimen. No matter who initiates such testing (the pathologist or the clinician) a requisition form MUST be completed by the clinician. If needed, they can obtain the most up-to-date version of the requisition form from the cytogenetics lab's website (http://medicine.yale.edu/labs/cytogenetics/www/index.html). The tissue should be placed in RPMI or HEPES. If these are not available, contact the cytogenetics lab to obtain media; do not immerse in saline. Chromosome microarray analysis can also be used as a salvage procedure in tissues with cell culture failure or for an additional test for submicroscopic abnormalities.

- **Congenital Heart Disease**: Describe the heart in situ. Dissect and determine the course of afferent and efferent vessels. Keep the heart and lungs together, and keep the aorta attached to the heart. Photograph in situ any structure which may be damaged or lost in the evisceration and dissection process, such as a vegetation. Consult your senior resident and/or attending as to whether or not chromosomal studies should be done, or whether there is a need to freeze heart muscle.
- **Infectious Disease:** Take cultures of all exudates in addition to routine cultures. Save fresh, uncontaminated tissue, urine, feces, tracheal swabs, etc., in -70° freezer if unsure about need to send for viral culture. A piece of tissue for culture is superior to a swab. Take serum for possible serology.
- When **inborn errors of metabolism** are suspected, collect samples of the liver and skeletal muscle for flash freezing (-70°C) for subsequent enzyme assays. This tissue should be frozen as soon as possible after death, and may even require coming in in the middle of the night. Keep a sample of bile at 4°C. Also, place specimens of liver, kidney, skeletal muscle, and heart in glutaraldehyde for electron microscopy. Fibroblast culture for cytogenetics may be needed; consult the genetics fellow.
- In cases of suspected **Genitourinary Tract Malformations** or **Cystic Kidney Disease**, carefully remove in continuity the genitourinary tract from the urethral meatus to the kidneys. In cases of urethral stenosis, it is useful to inflate and fix urinary bladder with formalin prior to opening. After *ex situ* examination, serial cross sections of the lower urinary tract, from the prostatic urethra distally, are useful.
- The brain and spinal cord may be removed in one piece in cases of **spina bifida**. In general, the spinal canal is opened anteriorly. Careful observation of the level of medulla and cerebellum relative to foramen magnum and spinal canal is indicated because of the high incidence of associate **Arnold-Chiari** malformation. It is also useful to dissect out the spina bifida vertebrae with the spinal cord.
- For patients who have received cardiac, pulmonary, renal, liver, or other organ **transplants**, always preserve the anastomotic sites with the transplanted organ. Photograph the organ and the anastomoses. A portion of the allograft should be frozen in OCT, and additional tissue snap frozen if needed. Also, fix a small piece in glutaraldehyde for possible electron microscopy. If any infectious lesions are suspected, take appropriate cultures.
- In infants with **ambiguous genitalia**, photograph the external genitalia and the internal genitalia in situ. The entire genitourinary system should be taken. Chromosome studies are usually indicated.
- For known or suspected **skeletal muscle disease**, multiple samples of skeletal muscle should be obtained. It helps to place the specimens on a piece of a wooden tongue depressor to prevent shrinkage of the tissue during fixation. Portions of muscle and nerve should be snap-frozen.

Samples of peripheral nerve should also be obtained, and similarly stretched on wooden tongue blades before fixation. Blocks of right and left diaphragm are important to include in the study, properly labeled and stretched before fixation. Muscle and nerve segments should also be saved in glutaraldehyde for possible ultrastructural studies. Autonomic prevertebral sympathetic ganglia may be important to include in the study. Discuss selection of muscle groups to be sampled with attending pathologist.

- Most **unexplained deaths** will be autopsied at the medical examiner's office. However, if one of these cases is done at Yale, be sure to collect blood, urine, CSF, fresh frozen liver, and fresh frozen brain. A urine dipstick should be done as a routine screening on any patient who arrives in the emergency department in asystole or who dies at home.
- For infants with a **skeletal dysplasia**, the most important information is obtained from radiological studies, which include a skeletal survey. For small fetuses, the appropriate equipment is available in Surgical Pathology. For larger fetuses/neonates, the skeletal survey should be done in the Radiology Department, and can be arranged by phoning one of the pediatric radiologists. In addition, a long bone, vertebra, and rib should be sampled to include cartilage, growth plate, and bone. After decalcification, longitudinal sections should be submitted. Genetics needs to be consulted regarding sampling of tissues for special studies.

Gross Photography

It is often difficult to predict, when doing a case, what the level of clinical interest will be in that case, or what interesting findings may later turn up, or what legal proceedings may arise, perhaps years later. There are few things more intellectually embarrassing than being asked to present an autopsy case at a clinical conference and having no gross photographs to show. Document your cases well photographically. EVERY AUTOPSY CASE must be well photographed. All major organs (heart, lungs, liver, kidneys, brain) should be photographed **routinely**, even if they are normal, to document that they are normal. All abnormalities should be photographed. Be sure to take both low magnification and high magnification photographs of lesions.

The autopsy service uses exclusively digital photography. This has the advantage that you can tell right away whether or not you have taken a good picture. In addition, the images can be "immediately" accessed from anywhere in the department, and the photographs cannot be lost. Images can be incorporated into the provisional and/or final autopsy reports, increasing the educational value of those reports. The digital camera can be used both for *in situ* photographs and for copy-stand work.

- Know how the camera works. Know what all the little buttons do. If you are not sure, don't assume that they are all set right - ask.
- KEEP THE CAMERA CLEAN! Although the autopsy camera is water-resistant, it cannot be submerged in water or other solvents to be cleaned. Dirty cameras are more likely to break, and are impossible to get fixed.
- When cutting through an organ, don't saw through it with a short knife. Use the longest knife available and make long, smooth slices.
- Dissect off extraneous fat from the specimen before photographing.

- Align the long axis of the specimen with the long axis of the photograph, and zoom in so the specimen fills the field. Do not leave a lot of blank space surrounding the specimen.
- Be sure the background is clean and free of blood or other fluid.
- Include a size reference in the photograph, usually a ruler, but wherever possible it should NOT overlap the specimen, so that it can be cropped out later if needed. The corners are a good place for these. The size reference should be in the same plane of focus as the lesion being photographed.
- For irregular specimens, it is often helpful to use wet paper towels behind portions of the specimen (out of sight) to bring the lesion and surrounding tissue into the same plane of focus.
- Do NOT photograph both halves of a cut specimen (the "open-book photograph"). Both cut surfaces contain the same information, simply mirrored. As a result, you loose half of the field and gain nothing. However, it is perfectly acceptable to photograph both halves of, for example, a bisected kidney, if one half is placed to show the cut surface and the other placed to show the external surface.
- **Lesions should be routinely photographed at two magnifications**, a low power shot to see where the lesion is in the organ, and then a zoomed in photograph showing the detail of the lesion. Don't assume that one can always "blow up" the low power shot - the image quality is generally too poor with digital photographs.
- Don't forget to photograph significant lesions identified on external examination. The camera can be removed from the copy stand for this purpose (remember, keep the camera clean).

Freezing Potentially Diagnostic Tissue

A number of critical diagnostic procedures require fresh frozen tissue simply because they do not work on formalin fixed tissue. It is very important that the resident (with the help of the senior resident) be aware of these procedures and when they might be needed so that appropriate tissue can be prepared and stored while it is still available. Some of these situations are listed above under "Recommendations for Special Situations", and include in-born errors of metabolism, any case requiring lymphoid marker studies (e.g. lymphomas or vasculitides), emerging infectious diseases, glomerulonephritides, and other immune complex mediated disorders. In addition, liver tissue should be routinely frozen from all autopsy cases, and liver, muscle, and placenta should be routinely frozen from all fetal and pediatric cases. It NEVER hurts to freeze tissue. If it is not needed, it will not be used. If fresh frozen tissue is needed but unavailable, a diagnostic opportunity, usually this patient's last opportunity, is lost forever.

Tissue is frozen in the "histobath", a refrigerated "water" bath containing liquid isopentane cooled to -60 °C (which is why it contains isopentane rather than water). Except when actively freezing specimens, the lid needs to be kept on the histobath (cryobath) to prevent condensation. Do NOT freeze or store frozen tissue in the cryostat (the instrument used to cut frozen sections), since that instrument goes through a freeze-thaw cycle each evening.

There are essentially two methods of freezing tissue, depending upon what special procedure you are most likely going to have performed on it.

Bulk Freezing of Tissue

This approach is most appropriate whenever the special procedure to be performed most likely will NOT involve cutting a section. Examples include biochemical analyses, microbial

culture, tissue culture, and RNA harvesting. Freezing is very straight-forward. Simply place a piece of fresh tissue in a standard histology cassette. Be sure the cassette is labeled with the case number and with the tissue source (e.g. liver, placenta, etc.). Then, drop the entire cassette into the isopentane cryobath and leave it there. The autopsy technicians will retrieve it and place it in the -70 °C freezer.

Freezing of Tissue in O.C.T.

When the special procedures most likely to be performed on the tissue require cutting a section, the tissue needs to be frozen in O.C.T. compound. Examples include lymphoid lesions for marker studies and kidneys for glomerulonephritides. Tissue is placed in a cryomold which has been labeled with the autopsy case number and the tissue type. The tissue is then covered with O.C.T. compound, and then "floated" (actually, suspended, since it will sink if you let go of it) in the isopentane of the cryobath to allow it to freeze from the bottom up (if you simply drop it in, it will freeze from the outside inward, crushing the tissue). Once frozen, the entire cryomold can be dropped into the cryobath. The autopsy technicians will retrieve it and place it in the -70 °C freezer.

Tissue Procurement for Research

It is the general policy of the autopsy service, keeping in line with policies of the department as a whole, to support ongoing research efforts within the university by making available, whenever possible, human tissue for approved and/or future investigations. Such procurement will be done only when it does not in any way interfere with the diagnostic goals of the service and when appropriate family permission has been obtained. The following guidelines summarize the current procedure for obtaining autopsy tissue for research purposes or other special procedures.

- All requests for tissue for research purposes are to be made with the tissue procurement team of Yale Pathology Tissue Services (YPTS). Their staff will verify that appropriate human investigation committee approval has been obtained and will maintain a list of tissue requested by investigators. Where necessary, the investigators will provide for the training of the YPTS personnel as to special procedures necessary for tissue procurement, and will provide special materials necessary, as arranged by YPTS.
- Prior to beginning each autopsy case, the autopsy technician on the case will contact a member of Yale Pathology Tissue Services and inform them that there is an autopsy case. General information such as the patient's age, sex, post-mortem interval, and suspected cause of death, as well as any autopsy restrictions will be communicated. Any decisions about the possible availability of tissue for research should be deferred to the senior resident on the case (or the junior resident). The tissue procurement team member will reference the list of tissues desired (this list may be supplemented by tissues desired by YPTS for ongoing or potential future use), and the senior resident will make a preliminary decision as to whether or not that tissue will be likely to be available from the case in question.
- At an appropriate time, a representative from Yale Pathology Tissue Services will arrive in the autopsy facility. Tissue will be provided as available (based upon the diagnostic needs of the case and the extent of the autopsy permission) by the resident in charge of the case, and the YPTS representative will handle the preparation, labeling, storage, and ultimately the

distribution of that tissue to investigators. The YPTS representative may also assist in the special preparation of tissue for diagnostic purposes.

- It is the responsibility of the resident on the case to be sure that any tissue potentially needed for diagnostic purposes is properly frozen. Although YPTS may be able to help with this process, the resident must be prepared to do this themselves. The protocol for freezing this tissue is described elsewhere in this manual. Tissue potentially needed for diagnostic purposes will be kept in a separate location by the autopsy service until the autopsy case has been signed out, at which time it will be turned over to YPTS or disposed of.

Other "Special Techniques"

Frozen Sections

The use of frozen sections to establish the diagnosis of a lesion is encouraged, especially when such information may alter the way in which the remainder of the autopsy is handled. This will often allow a more complete and informative PAD.

Radio-opaque Dyes

Radio-opaque dyes are available for injection use. This is an excellent way to demonstrate vasculature and/or vascular lesions. Although most commonly used to examine the coronary arteries, this technique can also be applied to other tissues.

X-rays

A digital X-ray (Kubtec) machine exists in surgical pathology for roentgenographic examination of specimens. This machine can take both x-rays and gross photographs. All fetuses should routinely be x-rayed for skeletal abnormalities. Bony lesions or other calcified lesions may also be so examined. Finally, radiographs can be used in conjunction with vascular injections with radio-opaque dyes. For more complex cases, skeletal surveys can be coordinated with radiology.

Tetrazolium Red

The triphenyltetrazolium chloride (TTC) test, also known as "tetrazolium red", supplements gross examination of the myocardium in determining the presence and extent of a myocardial infarct. It is a colorimetric test for succinic dehydrogenase activity. This enzyme catalyzes the oxidation of succinic acid to fumaric acid in the Krebs cycle. TTC, which is colorless, is reduced to a dark red dye in the presence of this enzyme activity, which is present in intact myocardium, even for up to 12 hours post mortem. Viable myocardium stains a dark red by this technique, whereas necrotic myocardium remains unstained.

Fresh heart slices are prepared in the standard bread-loaf fashion, cut to less than 1.0 cm in thickness. Selected slices are "submerged" in the reagent medium and kept in a light-free environment at 37°C for 30-45 minutes. Place the slice in the solution on top of a piece of gauze to prevent the tissue from settling to the bottom of the pan and excluding the reagent. The slices should also be turned over once or twice during the incubation to assure adequate exposure of the tissues to the reagent. After the assay, the slices are preserved by routine formalin fixation.

Please note that although this test is available, it is not always reliable. This test can be used as a guide to assist you in selecting sections for histologic examination, but should not be considered as a replacement for a thorough histologic study.

Bacterial Cultures

If the post-mortem interval is relatively short (<18hrs), important information can be obtained from post-mortem blood cultures. Cultures of individual tissues and abscess cavities are useful for even longer post-mortem intervals. It is not necessary to repeat cultures that were taken shortly before death, but the autopsy gives one a unique opportunity to directly assess the involvement of specific tissues in the infectious process.

Bacteriology specimens must have the patient's name, unit number and tissue source. Forms, available in the autopsy room as well as in the microbiology lab should be filled out completely with "Autopsy" listed as the "service". Bacteriologic cultures should be transported as soon as possible to the microbiology laboratory (688-2460), which is located on the sixth floor of the Park Street Building (PS656). The autopsy technicians should handle the labeling and transport of these cultures.

Common cultures are taken as follows:

Blood Cultures: Usually the inferior vena cava is exposed and a red hot spatula is applied to a wide surface of the vessel for several seconds. A sterile needle is then inserted through the sterilized area. Blood is withdrawn and inoculated into both anaerobic and aerobic blood culture media. Ideally 5-10 ccs should be inoculated into each bottle. If no blood can be withdrawn, try applying light pressure to the liver. Alternatively, a similar approach can be used on the pulmonary artery.

Tissue Cultures: After searing the exposed surface of the organ to be cultured, a sterile scalpel blade is used to cut out and remove a portion of the tissue and transfer it to a sterile container.

Abscesses: Abscesses or other localized infections are usually best cultured using a cotton-tipped swab culture set containing transport media.

Viral Cultures

Viral cultures are easier to take than bacterial since it is not as crucial to maintain a sterile field. Approximately 3/4 cc of tissue is placed in viral culture transport medium, which is kept refrigerated and which has an expiration date. The transport medium contains antibiotics to limit bacterial contamination.

Virology specimens should be transported to the virology laboratory (688-3524), from 8:00 a.m. - 5:00 p.m., Monday - Saturday, located on the sixth floor of the Park Street Building. After hours, specimens can be stored overnight in viral culture medium.

Although most viral infections rapidly become disseminated, there are certain “high yield” sites from which cultures are more likely to be positive when an infection is present. These are virus specific:

Adenovirus	Kidney, rectal swab
Herpes Simplex	Brain (temporal lobe)
Varicella-Zoster	Lung
CMV	Liver
Enterovirus	Throat (early); stool (weeks- months)
Rhinovirus	Respiratory tract

Togavirus	Brain
Influenza	Lung
Parainfluenza	Lung
Mumps	Throat
RSV	Lung

Electron Microscopy

Tissue from autopsy cases can be submitted for electron microscopy. This is particularly useful for poorly differentiated tumors or metastases with unknown primaries, and in certain congenital metabolic disorders. Rare or unusual tumors, even though specifically diagnosed, can be submitted if not previously studied for their "interest" or educational value. You should probably consult your senior resident and/or attending before doing this.

Tissue to be examined by electron microscopy should be cut into small pieces no larger than 1mm. 5-10 such fragments should be placed in 3% glutaraldehyde, which is available in the autopsy suite for this purpose. The specimens can then be transported to the EM lab at a later time. It never hurts to put aside in glutaraldehyde tissue for possible activation at a later time.

Immunofluorescence

Fresh tissue can be kept cold or frozen until sectioned prior to staining with fluorescently labeled antibody. Immunofluorescent staining can be requested through the histology lab. Such studies are relatively uncommon in Autopsy practice, but may be useful for diagnosing renal disorders or some special skin lesions. Consult your senior resident or attending for advice.

Brain Perfusion

The service has the equipment necessary to perfusion-fix removed brains. This has the advantage of not only providing better fixation but also in allowing the brains to be cut sooner. To do this successfully, care must be taken when removing the brain to preserve as much of the internal carotid arteries as possible.

Asbestos Fibers

A lot of techniques have been developed to try to facilitate identification of asbestos fibers in lung tissue at autopsy. The simplest method is to get routine lung sections, stain them for iron (asbestos fibers tend to become coated with iron over time), and hunt. This can be very time consuming and has a relatively low yield. Therefore, a few techniques can be used to enhance the likelihood of finding these fibers. One is to make a fresh cut into unfixed lung tissue, touch the surface firmly with a glass slide, and then fix the slide in alcohol. Send the slide for iron staining. If asbestos fibers are present, they are usually easier to find because there is no background of lung tissue. However, if the lung is very congested, the slides can be very bloody and this makes finding the fibers a little more difficult. An alternative approach is to “concentrate” the fibers by digesting them. Take a few grams of either fresh or fixed lung tissue and place it in 100% bleach. This will digest all of the organic material. The residue is sent to cytology where it is centrifuged and made into a slide which can then be H&E stained or stained for iron.

Others

The development and use of other special techniques such as polymerase chain reaction examination of tissues is strongly encouraged. Consult your attending pathologist or the director of the autopsy service.

Molecular Diagnostics Experience

The practice of pathology is evolving. Decades ago, examination of the H&E slide was essentially the only tool pathologists used to make their diagnoses. Greater appreciation of the subtle differences between otherwise similar entities was necessary to arrive at the correct diagnosis. Histochemical and then immunohistochemical stains greatly improved the accuracy and reproducibility of these diagnoses, and these techniques have now become part of the routine evaluation of many cases. Understanding disease at a molecular level has resulted in even newer diagnostic tests, further expanding the repertoire of tools available to the diagnostic pathologist. These tests are also being incorporated into the daily life of the pathologist. Pathologists must become versed in the details of many of these techniques in order to be more adept at interpreting them, as well as to understand their limitations and pitfalls.

To provide residents with a practical, real-life experience in some of these new advanced diagnostic techniques, two approaches are used.

1) All residents during their first year of AP training will do a one-week formal “rotation” through the clinical molecular diagnostics lab. They are expected to shadow daily activities in the molecular diagnostics lab, including attending the Friday afternoon signouts. This is a flexible experience.

2) Each resident is encouraged to identify and pursue an advanced diagnostic workup on at least two of their autopsy cases throughout the year. Faculty on the service will assist in identifying appropriate cases. The advanced workup could include looking for a particular polymorphism, gene deletion, enzyme abnormality, etc. Some funds will be available to pursue these workups, although the cost of this non-reimbursable activity must be taken into account in selecting an appropriate workup. If the results are deemed reliable, they should be incorporated into the formal autopsy report, either as part of the routine report or as an addendum. An appropriate discussion of the significance of the findings should be included.

The Autopsy Report

Within 24 hours of the autopsy, a provisional autopsy report consisting of the provisional anatomic diagnosis and the organ weights and measures is sent out to the members of the clinical team involved in the care of the patient. The final autopsy report should follow within 4 weeks and consists of the final anatomic diagnosis, the organ weights, the clinical-pathological summary, a detailed description of the autopsy findings, and the Neuropathology consult. The format of these reports and each of their sections has been carefully designed based upon a number of years of experience. Whereas you are encouraged to express your creativity by composing eloquently flowing sentences in the clinical-pathological correlation portion of the report, it is not your prerogative to create "alien" documents with different formats.

The Provisional Anatomic Diagnosis (PAD)

The Provisional Anatomic Diagnosis is our first written communication of the autopsy findings to the clinical teams. In many ways, this is perhaps the most important document produced by the service. For many clinicians, it is THE autopsy report, since by the time the final report is available they may not even remember the details of the patient. In contrast, the PAD is received within days of the death. Not only is it excellent positive feedback to the clinician for having requested the autopsy, but it is also the best opportunity to provide feedback which may alter the clinician's interpretation of the case.

To be effective, the information in the PAD must be clearly presented in a consistent format and should be organized in such a way as to represent a medical interpretation of the anatomic findings. In preparing a PAD, it is important to keep in mind that each of the three words "provisional", "anatomic", and "diagnosis" are key to defining the appropriate content for this report.

Provisional: This is a preliminary document based on incomplete data. One does not have to be certain of a diagnosis to include it on the PAD. Although caution is always advisable, it is important not to be so cautious in writing this document that it becomes of no use to the clinician because it contains no definitive information. The best PADs require little to no modification to convert them into FADs (Final Anatomic Diagnoses).

Anatomic: We are performing an anatomical examination, and as such clinical history and clinical diagnoses should NOT be included in PADs unless they are essential to an understanding of the cause of death or of the anatomic findings. Examples of pertinent clinical diagnoses would include: diabetes mellitus, disseminated intravascular coagulation, sepsis, acquired immunodeficiency syndrome, Wolfe-Parkinson-White arrhythmia, or malignant hypertension. Do NOT list clinical symptoms. Except in rare instances, maternal obstetric history is NOT appropriate in the PAD. Surgical history should be reported as an anatomic diagnosis: "Surgical Absence, Appendix", NOT as "Clinical History of Appendectomy".

Diagnosis: An autopsy is not a laboratory test in which we merely provide a list of findings and leave interpretation to the clinician. An autopsy is a medical consultation, and as such, every effort should be made to make diagnoses, not descriptions. For example:

Rather than:	**Use:**
Consolidation of the lung	Bronchopneumonia
Diffuse hepatic fibrosis and regeneration	Cirrhosis
Bilateral trilobed lungs	Right Pulmonary Isomerism

There will occasionally be times when the gross findings together with the clinical history are not sufficiently diagnostic, and a descriptive statement will be necessary. Although the frequency of this should be minimized by careful use of the rush histology service, some times it may be unavoidable. In these cases, the description should be qualified with a statement in parentheses indicating what additional information is needed to make the diagnosis, usually "(histology pending)". In such cases, it may also be appropriate to add a "(see note)" comment and then, in the note, to indicate what you feel will be the most likely diagnosis. Other appropriate qualifying statements would include "(cultures pending)" or "(frozen section diagnosis)". Obviously, all of these qualifying statements (except possibly the "see note") should be removed when the PAD is converted to the FAD.

With the above "rules" in mind, the format for PADs should be as shown:

- Most important UNDERLYING DISEASE PROCESS with the key anatomic diagnoses in FULL CAPITAL LETTERS and a hanging indent for subordinate lines
  - Sequela of above, indented one tab stop, also with important ANATOMIC DIAGNOSES in FULL CAPITAL LETTERS
  - Sequela of above
    - Sequela of Sequela (indented another tab stop)

- Next most important UNDERLYING DISEASE PROCESS which is not directly related to the above disease process
  - Sequela of above

- Other IMPORTANT ANATOMIC DIAGNOSES in decreasing order of importance; use full capital letters for important diagnoses
- Other IMPORTANT ANATOMIC DIAGNOSES
- Incidental anatomic diagnoses (use upper and lower case letters)
- More incidental diagnoses
- More incidental diagnoses, including surgical absences

CAUSE OF DEATH:
  PRIMARY UNDERLYING CAUSE OF DEATH, leading to
    INTERMEDIATE CAUSE OF DEATH (if known), leading to
    INTERMEDIATE CAUSE OF DEATH (if known), leading to
    IMMEDIATE CAUSE OF DEATH

NOTE: If desired, a note can be added at the end of the PAD to specifically address a clinical question or concern which is not directly answered in the diagnoses and cause of death statements, such as "The primary tumor source cannot be unequivocally identified" or "There is no anatomic evidence to support the clinical diagnosis of appendicitis". Notes are also an appropriate place to indicate that the autopsy examination was restricted. For example, "Examination at autopsy was limited to the organs of the chest, per family request."

For fetal autopsies or still births **ONLY**, in which the calculated age for the patient will be zero days old, a single introductory line should be added at the beginning of the PAD using the following format:

____ gm FEMALE/MALE FETUS
(small/appropriate/large for the clinical gestational age of ___ wks),
Body weight---------(nl--_)
Crown-heel--------(nl)
Foot length--------(nl)

Additional General Rules-of-thumb for the PAD

1. Diagnoses should be listed in approximate order of clinical importance. In general, the underlying disease process leading to the patient's demise is listed first.
2. Sequelae of a disease process are listed beneath that disease process, indented by one tab stop. Listing a finding as a sequelae of a disease process indicates that, in the opinion of the pathologist, that finding was brought about as a direct or indirect result of the disease process. Thus, "Acute Myocardial Infarction" could be listed under "Arteriosclerotic Cardiovascular Disease" or alternatively could be listed under "Upper Gastrointestinal Hemorrhage" which itself could be a sequela of "Alcoholic Cirrhosis". In organizing the PAD, it is often easier to first make a list of all of the findings, and then begin to group them into a cause-and-effect relationship.
3. When listing a finding, list the diagnosis first, followed by a comma, and then the site or organ in which that finding was present, including laterality when appropriate. For example, rather than "Left kidney with cortical adenoma", say "Cortical Adenoma, Left Kidney". When the site is apparent from the diagnosis, it is not necessary to specifically state the site (e.g., "Cholelithiasis" or "Necrotizing Bronchopneumonia, bilateral").
4. Abnormalities of size/weight should be accompanied by the actual size or weight, in parentheses (e.g., "Cardiomegaly (450 gms)"). If this is a child or fetus, it is often helpful to include a normal range based on the patient's weight.
5. List only abnormal findings. A patent ductus arteriosus is a significant finding in a two year old, but should not be included in the PAD for a fetus.
6. When unsure of a diagnosis you expect to be sure of later, include a qualifying statement in parentheses, such as "(histology pending)" or "(cultures pending)" or "(frozen section diagnosis)"
7. Be compulsive, and list every "abnormal" finding. Don't forget to include abnormalities discovered during the external examination, such as jaundice, amputations, emaciation, anasarca, etc.
8. Avoid using abbreviations unless they are so commonly used in all fields of medicine as to be completely unambiguous. Common abbreviations for units such as "gms" or "wks" are acceptable.
9. Finally, every rule of thumb has some acceptable exception, based on the particulars of a given case, but these should be recognized as exceptions and resorted to only when necessary.

The CAUSE OF DEATH Statement:

United States Vital Statistics dutifully records Causes of Death as listed on death certificates from all US jurisdictions. This information is used to track changing trends in diseases and is often

cited in arguments for funding allocations for medical research and for actuarial statistics used by insurance companies. It is a generally held belief among autopsy pathologists that the information obtained from death certificates is so inaccurate as to be essentially useless. A large part of this is because interns and residents are rarely instructed in the proper way to fill out a death certificate and often do not even know what the correct definition of "The Cause of Death" is.

The Yale autopsy service routinely includes a "Cause of Death" statement on all PADs and FADs. This serves multiple purposes. Whereas the list of findings should be restricted to what we find at autopsy, the cause of death statement is an opportunity to include important clinical information that contributed to the patient's death. The Cause of Death Statement represents pathology's "bottom line" interpretation of the importance and significance of the autopsy findings and the most likely sequence of events leading to the patient's death. Its presence reinforces the concept that the autopsy is a "professional consultation", not a laboratory test. Our role is not simply to list findings, but to interpret those findings in light of the available history. Finally, by writing a Cause of Death statement, we extend our educational mission by properly demonstrating how "Cause of Death" statements are to be written.

As defined by the National Center for Health Statistics in conjunction with the College of American Pathologists, the "cause of death", also known as "the underlying cause of death" is defined as the disease, condition, or occurrence that initiated the train of morbid events leading ultimately to the patient's death. The key word in this definition is **initiated**. Thus, in someone who dies from pericardial tamponade resulting from cardiac rupture following a myocardial infarction due to coronary artery atherosclerosis, the "Cause of Death" is "Coronary Artery Atherosclerosis". The other events are the referred to as intermediate and immediate causes of death.

One of the common misconceptions about cause of death statements is that they should not be given unless one is 100% certain. That is not true. A cause of death statement does not have to stand up to the rigors of a scientific publication; rather, it is a statement of "best medical opinion". Upon completion of an autopsy, with access to the complete clinical history for the patient, the pathologist is in the best position to formulate the "best medical opinion" as to the cause of that patient's death.

In most cases, the cause of death statement will contain no more information than is present in the list of anatomic diagnoses. However, important clinical history may appropriately be included in the cause of death statement that would be inappropriate in the anatomic diagnoses (e.g. "Acetaminophen Overdose" or "Accidental Needle Stick")

It is important to remember that risk factors are not generally appropriate as a cause of death. One potential pitfall in trying to backtrack to the initiating event in the sequence of events leading to the patient's death is to end up with a risk factor. For example, for an individual dying of cryptococcal meningitis acquired because of an immunocompromised state resulting from HIV infection contracted because of IV drug use, the cause of death is Acquired Immunodeficiency Syndrome; intravenous drug use is a risk factor.

The Cause of Death statement should appear in every provisional and final anatomic diagnosis. If, following gross examination of the organs and examination of the rush histology slides, it is felt that insufficient information exists to make a best educated medical opinion as to the cause of death, one can list "PENDING FURTHER STUDIES" in the Cause of Death field for the provisional anatomic diagnosis. If, even after complete microscopic and laboratory investigation of the death, the cause still remains unknown, the Cause of Death statement should reflect this (e.g. "INTRAUTERINE FETAL DEMISE OF UNEXPLAINED ETIOLOGY").

Examples of PADs

The following are examples of PADs, which illustrate a number of the points discussed above. They should be used as a guide when creating the PAD for a new case.

If no major autopsy findings are identified the PAD should follow this general outline:

Intrauterine fetal demise of male/female fetus at –week Gestational Age

Small /large/ appropriate / growth
Body weight
Crown-heel
Foot length
Maceration changes
No dysmorphic features
No gross anatomic abnormalities

Placenta (S13-xy)

Karyotype pending

If major abnormalities are identified the outline should give precedence to those and related abnormalities in a sequential order (see below).
Maceration changes and growth can be stated if relevant

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150 g MALE FETUS (appropriate for clinical gestational age of 19 wks.), with:

- HETEROTAXIA
  - Dextrocardia
  - Hypoplastic right ventricle, pulmonary trunk and arteries, and ductus arteriosus
  - Right atrial isomerism
  - Left pulmonary isomerism
  - Nearly symmetrical liver with left lobe comprising 40-45% of the liver mass
  - Hypoplastic spleen (0.15 g; Normal=0.2 g)

CAUSE OF DEATH:
MULTIPLE CONGENITAL CARDIAC ABNORMALITIES leading to
ELECTIVE TERMINATION OF PREGNANCY

Note: The clinical diagnosis of asplenia syndrome is not supported by the anatomic findings.

- IMPERFORATE ANUS
  - Acute HEMORRHAGIC INFARCTION, Brainstem
  - Diffuse ischemic changes, frontal and parietal lobes, brain
  - ACUTE TUBULAR NECROSIS, kidneys
- Undescended testes, bilateral
- Generalized lymphoid hyperplasia
- Mild chronic esophagitis
- Surgical Absence, heart, aorta, liver, gallbladder, spleen (harvested for transplant)

CAUSE OF DEATH:
IMPERFORATE ANUS, requiring
SURGICAL CORRECTION, complicated postoperatively by
EMBOLIZATION OF THE BASILAR ARTERY, resulting in
BRAINSTEM INFARCTION

- POORLY DIFFERENTIATED DIFFUSE ADENOCARCINOMA of the STOMACH (LINITIS PLASTICA type), with multiple METASTASES: LUNGS, peri-gastric, mediastinal, hilar and carinal LYMPH NODES, both OVARIES (Krukenberg tumor), MYOMETRIUM, and CERVIX
  - Large vessel THROMBOEMBOLUS, right upper lobe of lung
  - Bilateral serous pleural effusions (right: 1.2L; left: 2.0L)
  - Right ventricular dilatation and hypertrophy, heart
  - Chronic passive congestion, liver
  - Dilated azygous veins
- EXTENSIVE BILATERAL PNEUMONIA, with:
  - Marked chronic active interstitial pneumonia
  - Focal acute bronchopneumonia
- Multiple hemangiomas, liver
- Infarcted leiomyoma, uterus
- Rathke's pouch cyst, median lobe of the pituitary
- Extramedullary hematopoiesis, liver and spleen

CAUSE OF DEATH:
POORLY DIFFERENTIATED ADENOCARCINOMA OF THE STOMACH, leading to
EXTENSIVE METASTASES TO THE LUNGS leading to
EXTENSIVE BILATERAL PNEUMONIA

- ATHEROSCLEROTIC CARDIOVASCULAR DISEASE with:

- 100% atherosclerotic occlusion of the proximal right coronary artery and ›95% atherosclerotic occlusions of the proximal left anterior descending and circumflex coronary arteries
- Acute MYOCARDIAL INFARCTION (24-48 hrs. old) involving the anterior ventricular septum and the left ventricular anterior wall
- Biventricular dilated cardiomyopathy with cardiomegaly (860 g)
  - Pulmonary edema and pleural effusions, bilateral
  - Chronic passive congestion and centrilobular necrosis, liver
- Multiple small scars, lateral left ventricular wall and septum
- Status post atrial-ventricular sequential pacemaker placement
- Severe atherosclerosis, distal abdominal aorta

- ISCHEMIC ENTERITIS with focal transmural bowel infarction without perforation
- Focal ACUTE BRONCHOPNEUMONIA, left lower lobe, lung
- Mild to moderate PANACINAR EMPHYSEMA
- Arterio- and arteriolonephrosclerosis, bilateral
- Multiple subcapsular simple cysts (3-7 cm), kidneys
- Multiple small (‹0.3 cm) cortical adenomas, kidneys
- Superficial gastritis
- Focal steatosis, hilum of liver
- Adenomatous polyp, descending colon

CAUSE OF DEATH:
ATHEROSCLEROTIC CARDIOVASCULAR DISEASE, leading to
ACUTE MYOCARDIAL INFARCTION

- MYELOBLASTIC LEUKEMIA, in relapse
  - Disseminated FUSARIUM FUNGAL INFECTION, with:
    - Multiple cutaneous lesions
    - Granulomata, liver, lung, and retina bilaterally
    - Abscess, right testis
  - HEMOSIDEROSIS, transfusional, involving the liver, spleen, pancreas, bowel mucosa, and thyroid
  - Focal Alveolar hemorrhages, all lung lobes

- CORONARY ARTERY ATHEROSCLEROSIS
  - PLAQUE DISRUPTION AND DISSECTION, right coronary artery
    - Recent MYOCARDIAL INFARCT, posterior left ventricular septum
    - Ventricular dilatation, left and right ventricles, heart
    - Pleural effusions, bilateral
  - Focal scarring, posterior left ventricle

- Chronic Cholecystitis with Cholelithiasis
- Venous angioma, left superior temporal gyrus, brain
- Hydrocele, left scrotal sac
- Atrophy, bilateral testes

- Focal calcifications, prostate

CAUSE OF DEATH:
MYELOBLASTIC LEUKEMIA, complicated by
MULTIPLE RELAPSES, treated with
CHEMOTHERAPY, complicated by
DISSEMINATED FUSARIUM FUNGAL INFECTION, resulting in
DIFFUSE PULMONARY HEMORRHAGE

The Final Anatomic Diagnosis (FAD)

The Final Anatomic Diagnosis (FAD) follows the same format as the PAD. In the ideal case, no modification will be required to the PAD to produce the FAD. Often, however, small adjustments need to be made.

Guidelines for the FAD (in addition to those for the PAD)

1. All entries in the FAD should be diagnoses. If a diagnosis is still unclear despite the full work-up of the case and thus a descriptive diagnosis is used, it should be followed by "(See Note)" and a note should be added after the Cause of Death Statement indicating why a definitive diagnosis cannot be made and suggesting, where possible, the most likely diagnosis.
2. Any references to pending studies should be removed from the FAD, with the possible exception of the Neuropathology consult.
3. A Cause of Death Statement should be included in all FADs even if the cause of death remains unknown. If this is the case, indicate this in the statement (e.g., "INTRAUTERINE FETAL DEMISE OF UNKNOWN ETIOLOGY" or "DILATED CARDIOMYOPATHY OF UNCLEAR ETIOLOGY (See Note)".

The Clinical-Pathological Summary (CPS)

The **C**linical-**P**athological **S**ummary (CPS) is the equivalent of the "final consult note" for the clinical consultation services in that, together with the Final Anatomic Diagnosis, it constitutes not only a summary of your findings but also your medical interpretation of those findings. Most readers will read only the FAD and the CPS of the final autopsy report.

Historically, the autopsy reports from the Yale Department of Pathology had two separate sections for the Clinical Summary and the Clinical-Pathological Correlation (CPC). However, since the first third of the CPC usually ended up being a restatement of the clinical summary, these two sections have been combined into one "document" currently termed the Clinical-Pathological Summary (CPS).

Objectives

The CPS has multiple objectives, all of which should be kept in mind when writing this portion of the final autopsy report:

- Summarize the key elements of the clinical history and clinical course, especially in relation to the terminal disease process
- Summarize the important autopsy findings, including the gross and microscopic examination as well as special studies
- Correlate the autopsy findings with the clinical course and symptoms
- Drawing on the clinical and anatomic findings, construct a sequence of events linking the underlying disease process (the cause of death) to the patient's ultimate demise
- Briefly discuss and educate the reader about the major pathological entity and its usual clinical course, emphasizing those features which make this particular case a "classic example" or an "exception"

It is important to remember that the "autopsy" part of **the CPS should not simply be a short version of the Autopsy Findings section of the report; rather, it should be a long version of the FAD**. Do NOT simply discuss the findings in the order you uncovered them - the clinicians reading the report do not know or care in what order the autopsy dissection is done. Rather, construct a disease based discussion of the findings. Start with the most important underlying disease process, and describe its sequelae. Describe the findings in the order in which they likely evolved in the patient, emphasizing etiological relationships rather than the autopsy process. Integrate and correlate a discussion of the clinical findings associated with the anatomic findings.

Guidelines for Content and Format of the CPS

1. There is no appropriate length for a CPS. It should be as long as is necessary to say what needs to be said, and no longer. By convention, the CPS is typically written in the past tense (except for general statements of fact/truth, which are always in the present tense).
2. The clinical summary is an important part of the CPS, but is not the most important part. It should be complete, but not exhaustive. When reviewing the patient's chart prior to the autopsy, it is important to learn as much about the clinical history as possible. However, it is neither necessary nor appropriate to include everything you have learned in the summary. Concentrate on those elements for which there is (or should be) an anatomic correlate, the major clinical diagnoses, and any unexplained clinical signs and symptoms. Also include pertinent negatives. Obviously, major events in the clinical history such as coronary artery bypass surgery or prior resection of a tumor should always be included. Incidental appendectomies, admission sodium levels, and resolved clinical conditions should not be included unless they have a bearing on the cause of death or a major underlying disease process. Don't over-do it. As a general rule of thumb, **if the clinical summary exceeds one half of the total length of the CPS, it is too long** or the correlation and discussion are too short.
3. The clinical summary should be chronological. It should end with the patient's death.
4. The first paragraph after the clinical summary should start: "At autopsy,...". This allows a reader familiar with the clinical history to quickly identify the start of the autopsy discussion.
5. It is often most convenient and efficient to combine the summary of autopsy findings with the correlation of those findings to the clinical history.
6. Do not disregard or ignore significant clinical symptoms that remain unexplained by the anatomic findings. Rather, specifically state that there is no definite explanation and, if possible, propose a likely etiology (e.g., "The source for the pulmonary emboli could not be identified, but the most likely origin is the deep veins of the lower leg.")

7. Somewhere in the discussion should be included your interpretation as to the most likely sequence of events linking the initiating cause of death with the patient's ultimate demise.
8. Be sure to address specifically any questions asked on the consultation request or in conversations with your clinical colleagues.
9. A brief discussion of the pathologic entity is often appropriate, since educating our clinical colleagues is one of our missions. However, the CPS is a report, not a textbook, so be brief and relevant. Also, do not patronize the reader. Remember, your audience is composed of physicians as well. Statements such as "a myocardial infarct occurs when the oxygen demands of the tissue exceed that provided by the coronary blood supply" are unnecessary. However, discrete reminders are not inappropriate (e.g., "A cardiac arrhythmia, relatively common in the post-infarct period, was the most likely terminal event.")
10. References can and should be listed in appropriate cases. They indicate that you have reviewed the recent literature on an unusual case, and add credibility to your discussion. However, don't simply provide a reading list – list only those references pertinent to your discussion, and be sure to site the appropriate reference in the discussion.
11. Always remember, **this is a medical and potentially legal document**. As such:
    - Wild speculations are not appropriate.
    - Subjective comments about the patient's lifestyle are not appropriate.
    - Derogatory comments about the quality or appropriateness of medical care are not appropriate. Once the outcome of a treatment selection is known (and, for autopsies, that is often a bad outcome) it is easy to determine whether or not a procedure was a "good idea". It is a completely different story when the patient is alive, not getting better despite your best efforts, and you don't know why. Discrepancies between the anatomic findings and clinical diagnoses as well as complications of any therapeutic intervention should be discussed, but do so in a professional and objective manner.

Sample Clinical-Pathological Summaries

Clinical-Pathological Summary:

The patient is the product of the first pregnancy in a 26 year-old white female with a seizure disorder and a history of nephrotic syndrome. Because the mother was taking Tegretol, she was followed in the high-risk OB clinic. Routine ultrasound performed at 17 weeks and 5 days revealed cardiac abnormalities and a possibly absent spleen, and a diagnosis of asplenia syndrome was made. The mother elected to terminate the pregnancy by prostaglandin induction.

At autopsy, fetal size and weight were consistent with ~18 week gestational age. Dextrocardia, right atrial isomerism, and a hypoplastic right ventricle and pulmonary arteries were present. The right atrium appeared to communicate only with the left atrium via an atrial septal defect, although the presence of a microscopic communication with the hypoplastic right ventricle cannot be excluded. Venous connections were normal. Both lungs were bilobed. The liver was more symmetrical than normal with the left lobe comprising 40-45% of the liver mass. The spleen was present but somewhat small in comparison to the other organ weights. No other anomalies were present.

The cardiac abnormalities and increased symmetry of the heart, lungs, and liver are features of the "asplenia syndrome", but some discrepancies exist, the most notable of which is the fact that the spleen is present and is nearly the normal weight for body weight, although microscopic analysis suggests that some of this weight is secondary to increased congestion. In addition, the lungs show left isomerism rather than the more usual right isomerism, and there was no evidence of anomalous pulmonary venous return.

In summary, this 17 week-old fetus was noted to have significant cardiac abnormalities by ultrasound and the pregnancy was electively terminated.

Van Mierop, L., I. Gessner, and G. Schiebler. (1972) "Asplenia and Polysplenia Syndromes". Birth Defects. Vol VIII(5) pp 36-44.
Bergsma, D., editor. "Asplenia Syndrome", in Birth Defects Compendium, 2nd edition. p. 127.

Clinical-Pathological Summary:

The patient was the 5 lb., 9 oz. female product of a twin gestation (twin A), delivered by an uneventful spontaneous vaginal delivery at 37 weeks gestation to a mother whose pregnancy was complicated only by a culture positive for group B Streptococcus at 28 weeks. The perinatal course was uneventful, and the patient went home two days after delivery. She returned at 9 days of age with a two day history of decreasing feeds, lethargy, and hypothermia. She was admitted with a blood pressure of 50/palpable, respirations of 52, pulse of 150, and a temperature of 94 F. EKG showed decreased left ventricular voltages. Laboratory values were remarkable for a hematocrit of 38.3, a WBC of 7.7K, and a CPK level of 681 with 28% myocardial bands. A diagnosis of probable viral myocarditis was made and a pharyngeal culture later grew enterovirus.

Detailed echocardiography studies the following day revealed left atrial enlargement, 3+ mitral regurgitation, poor left ventricular function, an akinetic postero-lateral left ventricular wall, and a hyperdynamic septum. Serial studies were consistent with an evolving postero-lateral left ventricular infarct. The patient also developed seizures, and a lumbar puncture revealed 42 white blood cells with 27% lymphocytes, 66% monos, and 7% granulocytes, 5 red blood cells, and a protein of 130. EEG studies showed marked abnormalities consistent with a viral encephalopathy. Head ultrasound revealed echodense areas in the right parietal cortex and the corpus callosum, but a CT examination of the head failed to reveal hemorrhage or infarction. Cardiac catheterization, performed at two weeks of age revealed severe left ventricular dysfunction, 4+ mitral regurgitation, a left to right atrial shunt, low cardiac output, increased left ventricular end diastolic pressure, and normal coronary arteries. The following day, she underwent an abrupt decrease in perfusion. Echocardiography revealed a mid-muscular ventricular septal defect at the level where prior inflammation had been noted, resulting in a right to left shunt of blood. The patient's pulmonary hypertension, high FIO_2 requirement, and small size made her a poor candidate for heart transplant.

Multiple episodes of respiratory and circulatory decompensation followed which were felt to be probable extensions of the myocardial infarction. EEG exam remained abnormal. Despite several days of continued improvement, the patient developed recurrent respiratory distress requiring positive end expiratory pressure and seizure activity recurred despite therapeutic Phenobarbital levels. Worsening cardiac output and arrhythmias were further complicated by pericatheter thrombosis of the superior vena cava resulting in upper body congestion, increased intracranial pressure, increased head circumference, and bulging fontanels. Blood cultures were positive for Staphylococcus. The thrombosis was treated with a urokinase infusion with some improvement. Nonetheless, she developed a right lung infiltrate that progressed to "white out" the entire right lung, and an infiltrate developed in the left lower lobe. Liver function tests became elevated. On the 34th day of life, extensive life support measures were discontinued at the parents' request and the patient died.

At autopsy, the myocardium of the left ventricular free wall was nearly completely destroyed except for focal subendocardial sparing and patches of viable myocardium. The left ventricle was markedly dilated and the wall was thin. The right ventricle and the interventricular septum were uninvolved, and there was no evidence of a ventricular septal defect. Dystrophic calcification of much of the necrotic wall had occurred, and foci of chronic inflammatory cells remained. This is indicative of a resolved myocarditis, and autopsy cultures and electron microscopy failed to reveal the presence of residual virus. Despite this, the extensive myocardial damage undoubtedly produced severe left ventricular dysfunction, and much of the systemic perfusion was likely to be occurring from the right ventricle through the patent ductus arteriosus.

Coxsackie B virus is the most common cause of viral myocarditis in the newborn, and is fatal in approximately 50% of the cases. Not uncommonly, myocyte destruction is restricted to the left ventricle, resulting in chamber dilatation and congestive heart failure. Calcification usually begins about nine days after the onset of the illness. Systemic involvement is common, with the brain being the most common other organ involved, followed by liver, pancreas, and adrenals.

Clinically, this patient showed evidence of cerebral involvement, with seizures, an abnormal EEG, and an elevated white count in the CSF. At autopsy, however, there was only minimally increased lymphocyte infiltration in the meninges, only a few microglial nodules in the parenchyma, and diffuse, mildly ischemic changes in the white matter. No significant active inflammation was noted. Thus, if an encephalitis was present, it also had largely resolved prior to the patient's demise. The liver showed only acute congestion with mild focal centrilobular necrosis, but no evidence of ongoing or resolved viral infection. The pancreas and adrenals were normal.

The immediate cause of death in this patient was numerous septic emboli to the lungs with extensive hemorrhagic infarction, acute and chronic pneumonia, and pulmonary edema. A pleuritis was also present. The source of these septic emboli was the large thrombus in the superior vena cava that extended back into both brachiocephalic veins and into the right atrium. Multiple foci of Gram-positive cocci were present within this thrombus, which most likely formed initially around the indwelling catheter. Emboli were also found in portions of the lungs, which were neither infarcted nor inflamed. Despite the right to left shunt of blood through the patent ductus arteriosus, there was no

evidence of significant systemic embolization. In particular, the kidneys failed to show any embolic infarctions. Focal thrombi were noted in the esophagus, but these may have been related to the extensive pleuritis and pneumonia present. The presence of a non-occluding thrombus in the ductus arteriosus may have served as a filter to extensive infarction by this route.

In summary, although the patient's myocarditis and possible encephalitis appear to have resolved, there was marked destruction of the heart with significant left ventricular impairment. The right atrial thrombosis with showering of both lungs with septic thromboemboli led to hemorrhagic infarcts and extensive bilateral pneumonia, resulting in insurmountable respiratory compromise.

Woodruff, JF. Viral Myocarditis, a review. The American Journal of Pathology, Vol 101, No 2, pp 425-483.

Clinical-Pathological Summary:

The patient was a 5 year-old white female who was well until three days prior to admission when she developed flu-like symptoms with a headache and fever. This progressed to severe abdominal pain with vomiting, and she complained of being unable to see. She was brought to St. Joseph's Hospital where a white blood count of 253K was noted. She was transferred to Yale-New Haven Hospital.

On admission, she had marked lymphadenopathy involving the cervical, submandibular, axillary, and inguinal lymph nodes. Hepatosplenomegaly was noted, as well as diffuse ecchymoses and a right third nerve palsy (right pupil fixed and non-reactive at 7 mm). Laboratory values were remarkable for a hematocrit of 19.8, a platelet count of 33K, and a white blood count of 309K with 94% blasts. Additionally, the PT was elevated at 30.1 (3x control), fibrin split products were greater than 40, fibrinogen was less than 50 mg%, and the LDH was elevated at 5390. A bone marrow aspirate revealed total replacement by blasts. Flow cytometry later returned CD3+, HLA-DR+, My4+, consistent with a myelomonocytic acute myelogenous leukemia. A CT scan of the head showed multiple hyperdense areas in both hemispheres consistent with extensive intracerebral hemorrhage. Neurologically, the patient was obtunded with little response to noxious stimuli.

She was treated with exchange transfusions and chemotherapy, but developed an acute deterioration of her neurological status the following day, despite hyperventilation and mannitol use. Repeat CT showed increased bleeding into the hemispheres and the mid-brain. The patient was felt to have no chance of a meaningful neurological recovery, and at the family's request, was extubated and died three days after her initial presentation.

At autopsy, there was extensive multifocal intracerebral hemorrhage, predominantly on the right, involving the frontal, parietal and occipital lobes. The upper brainstem was also involved. All of the ventricles were filled with blood clots, and the third and fourth ventricles were dilated. The right half of the brain was swollen with protrusion across the midline, and the right uncal gyrus showed focal necrosis. There was more extensive necrosis throughout the cerebral parenchyma, particularly involving the white matter. This extensive cerebral damage was unquestionably the immediate cause of death in this patient. Microscopically, there was focal leukostasis and multifocal hemorrhages. In many cases, perivascular hemorrhage was seen around unobstructed vessels. Hemorrhage in this patient was almost certainly due to a combination of leukostasis, thrombocytopenia, and DIC, all of which were present.

The lungs showed marked arterial and venous leukostasis, with tumor cells filling and distending medium sized pulmonary vessels and excluding red cells. There was extensive tumor involvement of the liver, spleen, thymus, bone marrow, Peyer's patches of the gastrointestinal tract, and throughout all of the lymph nodes, with marked extranodal extension of tumor. The multiple focal pulmonary alveolar hemorrhages, cutaneous purpura, and epicardial and pleural petechial hemorrhages are manifestations of the depressed platelet count. The kidneys showed diffuse osmotic nephrosis secondary to high dose mannitol administration in an attempt to control the intracerebral pressure.

In summary, this 5 year-old girl developed a rapidly progressive non-lymphocytic leukemia with diffuse systemic involvement, leukostasis, and massive intracerebral hemorrhages resulting in her death.

Clinical-Pathological Summary:

The patient was a 19 year-old white male Yale undergraduate who had been in excellent health his whole life, and was a three sport varsity athlete in high school. During a routine screening physical exam at age 17 required for acceptance of an appointment to the Naval Academy, a heart murmur and an abnormal EKG were detected. Subsequent workup revealed a non-obstructive concentric hypertrophic cardiomyopathy. His blood pressure was normal. Echocardiography revealed left ventricle posterolateral thickening to 22 mm, mild mitral and aortic regurgitation, and no significant systolic anterior motion of the mitral valve. Outflow velocity was reduced at 1.8 meters per second. The patient was completely asymptomatic, with no chest pain, palpitations, or syncopal episodes. There is no family history

of heart disease: echocardiograms of the mother and father were negative, and an EKG of an older brother (23 years old) was also normal.

He was placed on Verapamil SR, initially 240 mg qd and then 120 mg qd, with endocarditis prophylaxis and was advised not to engage in athletic activities. Nonetheless, less than a year later he was playing basketball with friends and collapsed on the court. He was found in ventricular fibrillation when paramedics arrived, and defibrillation x 2 resulted in asystole. On arrival in the ER, blood gases were 7.01/87/15/9%. Intubation, multiple pressors, and pacemaker placement failed to restore a cardiac rhythm or spontaneous respirations.

At autopsy, limited to examination of the heart, the heart was enlarged at 680 g almost entirely due to marked concentric left ventricular hypertrophy, with a maximal wall thickness of 2.5 cm. There were multiple foci of fibrosis in the myocardium of the left ventricle, particularly near the apex. The septum protruded slightly into the left ventricular outflow tract just below the aortic valve, with overlying endocardial fibrosis presumably secondary to apposition of the septal wall and the anterior leaflet of the mitral valve during systole. Multiple foci of myofiber disarray were identified in the septum and lateral left ventricular wall. No significant coronary artery disease was present, although the left anterior descending coronary artery coursed much of its length within the myocardium rather than on the epicardial surface.

Sudden death during strenuous activity is common in patients with this form of hypertrophic cardiomyopathy and is felt to be secondary to acute outflow tract obstruction and/or cardiac arrhythmias. This obstruction is usually functional, with the hypertrophied left ventricle being unable to meet the cardiac output demands of the increased physical activity because of the increased chamber compliance and prolonged filling time. The exact mechanism by which the arrhythmia occurs is not clear. They are more common in patients with extensive hypertrophy rather than purely septal hypertrophy, and occur with increasing frequency with increasing left ventricular wall thickness. The risk of arrhythmia may be related to the total amount of abnormal myocardium present.

The cause of hypertrophic cardiomyopathy is generally believed to be genetic, although both hereditary and sporadic forms exist. Mutations linked to this spectrum of diseases have been isolated to the structural genes for myocardial myosin and to mutations within the mitochondrial genome, as well as a variety of other genetic loci. It is likely that the pleomorphic morphological and clinical presentations of the spectrum of diseases collectively referred to as "hypertrophic cardiomyopathies" is a manifestation of the multiplicity of genetic events that can result in its development.

Intramural coronary arteries have also been associated with sudden death during exercise. However, this can also be an incidental finding, and when associated with sudden death there is usually a history of angina.

This patient had concentric hypertrophy with at least an intermittent complete occlusion of the outflow tract. He developed a confirmed arrhythmia while engaging in physical activity and died as a result.

Lazzeroni, E., et al. (1989) Severity of arrhythmias and extent of hypertrophy in hypertrophic cardiomyopathy. Am. Heart J. 118:734-738.

Spirito, P., and Marron, B. (1990) Relationship between extent of left ventricular hypertrophy and occurrence of sudden cardiac death in hypertrophic cardiomyopathy. J. Am. Coll. Cardiol. 15:1521-1526.

Tanigawa, G., et al. (1990) A molecular basis for familial hypertrophic cardiomyopathy: an alpha/beta cardiac myosin heavy chain hybrid gene. Cell 62:991-998.

Ozawa, T., et al. (1990) Multiple mitochondrial DNA deletions exist in cardiomyocytes of patients with hypertrophic or dilated cardiomyopathy. Biochem. Biophys. Res. Comm. 170:830-836.

Morales, A., et al. (1980) The mural left anterior descending coronary artery, strenuous exercise and sudden death. Circulation 62:230.

Clinical-Pathological Summary:

The patient was a 73 year-old black male with a history of chronic obstructive pulmonary disease, silicosis, hypertension, a positive PPD, and congestive heart failure. He developed TB and silicosis at age 50 while working at a foundry. His tuberculosis was treated with INH for one year, but he reinitiated INH therapy fifteen years later when he became steroid dependent because of his pulmonary disease. He was retired, a non-smoker, and was unable to walk one block without shortness of breath.

He was admitted complaining of shortness of breath of 1 1/2 days duration with a cough productive of clear sputum. Blood pressure was 145/64, pulse 124, and oxygen saturation 89% on room air. Diffuse expiratory wheezes were present bilaterally. His white blood count was 15.7K with no significant left shift (patient is on chronic prednisone therapy). Blood gases on 10 L of oxygen were 7.36/54/132. Chest x-ray showed suprahilar masses bilaterally and massive pulmonary fibrosis. Two days after admission, he developed a right spontaneous pneumothorax treated with two chest tubes.

During his hospitalization, he progressed to multi-system failure despite aggressive antibiotic and cardiac pharmacological therapy. He required intubation and ventilation, but became markedly hypotensive with sedation. A Swan-Ganz catheter was electively placed. His blood pressure remained unstable, with intermittent supraventricular

tachycardia into the 190's. Pulmonary artery pressure was elevated to 80/30 with a wedge pressure of 23. An echocardiogram showed severe right ventricular failure. His urinary output decreased and his creatinine became elevated. On hospitalization day 14, bowel sounds were noted to be reduced, and his abdomen became distended. A nasogastric tube withdrew 175 ccs of brown heme-positive secretions. X-rays of the abdomen revealed a dilated cecum to 10 cm and a CT scan was consistent with probable large bowel obstruction. Volvulus could not be ruled out. Colonoscopic decompression was attempted revealing large amounts of stool in the descending colon. The mucosa was normal where visualized, but the colonoscope could not be advanced beyond 70 cm (splenic flexure). Blood cultures remained negative, but 3 of 4 sputum cultures grew Hemophilus parainfluenza and Serratia marcescens. The patient became anuric, septic, and anemic. He was placed on DNR status, and died on the 17th day of hospitalization.

At autopsy, there was marked bullous emphysema of the right lung, explaining the spontaneous right pneumothorax. The cut surfaces showed extensive hyaline fibrosis, and numerous silica particles were seen on polarization microscopy, confirming the clinical diagnosis of silicosis. The remaining pulmonary parenchyma showed marked emphysema. The chronic fibrosis in the lungs increased the pulmonary vascular resistance, resulting in right heart dilatation and hypertrophy, mild pulmonary atherosclerosis, and chronic passive congestion with centrilobular necrosis in the liver. Despite the clinical history of tuberculosis, no evidence of active disease was present at autopsy.

The immediate cause of death in this patient was the extensive bronchopneumonia that compromised his already marginal respiratory status. Multiple microorganisms, including fungi, were identified on special stains. Additionally, the distal ileum was infarcted, with full thickness acute inflammation but no evidence of perforation. This certainly represents a potential source of infection, and the patient was almost certainly septic at the time of his death, although the prolonged postmortem interval precluded documentation of this sepsis at autopsy. Fecal impaction was present, but examination of the large bowel revealed no physical obstruction and no evidence of volvulus.

The bladder was markedly dilated with urine secondary to improper placement of the Foley catheter. Thus, the patient was most likely not anuric terminally. There was no hydroureter or hydronephrosis, and the kidneys showed no significant abnormalities.

In summary, this 73 year-old black male with chronic obstructive and restrictive pulmonary disease secondary to emphysema and to silicosis with accompanying fibrosis developed an extensive bronchopneumonia, distal small bowel infarction, and functional large bowel obstruction. His death was due to hypoxia and sepsis.

Clinical-Pathological Summary:

The patient was a 53 year-old white male with acute myeloblastic leukemia who presented 3 months prior to his death with a right sided chest ache. He was initially referred to Yale four years earlier with pancytopenia and a diagnosis of "refractory anemia with excess blasts" was made. He developed progressive neutropenia and thrombocytopenia, and at age 50 was admitted for his first induction chemotherapy. He was in remission for just over 1 yr. when he relapsed and was re-induced. He relapsed again seven months later and underwent another course of chemotherapy, complicated by persistent fevers, sepsis, and an HSV infection of the mouth. He later developed a perirectal abscess and appendicitis. He was not felt to be a good candidate for bone marrow transplant.

Six months before his final admission, he relapsed again, presenting with pancytopenia and sepsis. His fourth relapse occurred 3 months later and he was re-induced with an uncomplicated hospital course. He was discharged, but represented to the emergency room early the next morning with right sided chest pain radiating to his upper arm. His vital signs were normal. He had a WBC of 500 (53% lymphocytes, 42% blasts, 1% myelocytes, 1% segs, 3% monos), hematocrit 26, and platelets 31K. Serial CPK's ruled out a myocardial infarction. Amylase and lipase levels were transiently elevated to 200 and 4.3. A diagnosis of cholecystitis, cholelithiasis, and probable gallstone pancreatitis was made.

The patient's extended hospital course was complicated by multiple transfusions, temperature spikes and an inability to bring the myeloblastic leukemia under control. Experimental drug protocols were used. Despite multiple antibiotic therapy, he developed a systemic Fusarium infection which was refractory to amphotericin B. The disseminated infection resulted in multiple skin lesions and involvement of the eyes bilaterally. The patient was also noted to have an episode of multiple pulmonary emboli, mainly in the posterior right upper lobe, which resolved following therapy. In early January, a decision was made to cease all further therapy and provide comfort only. The patient stabilized after withdrawal of care, although his mental status was compromised; he was arousable and responded to voice and pain. Approximately one month later the patient was found apneic and unresponsive.

At autopsy, there were multiple cutaneous lesions scattered over the extremities and trunk which on microscopic examination consisted of large, deep granulomata with yeast hyphal forms, necrosis, and numerous giant cells. Similar lesions were found in the liver and in the right testis. The eyes, previously removed by ophthalmology,

showed granulomatous destruction of the retinas and fungus present in the vitreous humor bilaterally. Examination of the bone marrow revealed that the myeloblastic leukemia was in relapse at the time of the patient's death.

There was high grade atherosclerotic stenosis of all three main coronary arteries and evidence of chronic ischemic injury to the myocardium. Additionally, there was a recent plaque dissection in the right coronary artery in which fungi were seen. This event most likely resulted in the patient's ultimate demise. The posterior left ventricular wall and septum showed evidence of acute myocardial injury. The 2 liters of pleural effusion and dilatation of both ventricles of the heart indicate significant cardiac failure at the time of death. Finally, the lungs showed focal intra-alveolar hemorrhages with some associated immature acute inflammatory cells, consistent with an early pneumonia.

Also notable at autopsy was marked hemosiderosis, undoubtedly due to the patient's history of numerous blood transfusions, with large amounts of hemosiderin present in the liver, spleen, pancreas, bowel mucosa, thyroid, and the bone marrow. However, there was no evidence of cellular destruction secondary to iron overload.

Disseminated Fusarial infection is a grave prognostic sign in the immunocompromised patient, resulting in death in the large majority of the cases. The most frequent sites of involvement, in decreasing order of frequency, are the skin, lungs, blood, kidneys, eye, GI tract, heart, spleen, CNS, and liver. Involvement of other organs, including the testes, have been reported. This pattern of involvement is distinctly different from that seen with Aspergillus, which, for example, is only rarely seen in the skin and almost never cultured from the blood. There is a strong association between disseminated Fusarial infection and indwelling intravascular catheters, which appear to form a nidus for continued infection. Approximately one third of the Fusarium species isolated clinically are resistant to amphotericin B in vitro, although the correlation between in vitro sensitivity and in vivo response to therapy is not very good.

In summary, this 53 year-old male with a disseminated Fusarial infection, including sepsis and undoubtedly increased demands for cardiac output, developed an extension of the former ischemic injury to his heart, congestive heart failure, and multifocal pneumonia. He died as a result.

Richardson, S.E., et al. (1988) Disseminated Fusarial Infection in the Immunocompromised Host. Rev. Infect. Dis. 10:1171-1181.

Clinical-Pathological Summary:

This 63 year-old white male suffered an acute myocardial infarction and died of a post infarct arrhythmia.

He had suffered a myocardial infarction at age 46 and at age 59 had an angiographically confirmed pulmonary embolus to the left lower lobe. He had been suffering from increasing congestive heart failure and decreasing baseline exercise tolerance.

He presented to the YNHH ER complaining of 2 days of chest pain of increasing severity and frequency, with associated shortness of breath and nausea. He was seen by his private physician and started on digoxin and Lasix for presumed congestive heart failure. That night, however, he developed night sweats and more severe pain and came to the emergency room. On admission, he had jugular venous distention to 6 cm and bibasilar crackles over the lung fields. Lab values were remarkable for an elevated CPK to 526 with 7.7% myocardial bands. Serial CPK's were decreasing with 3-4% myocardial bands. EKG showed new precordial and lateral ST segment depressions indicative of new lateral ischemia since his most recent EKG. A diagnosis of myocardial infarction was made, and he was treated with diuresis, nitrates and heparin. The following day, he became acutely hypotensive with increasing heart rate. Atrial fibrillation was noted and successfully cardioverted to a normal sinus rhythm. Progression of the congestive heart failure required intubation for adequate oxygenation. On his third hospital day, the patient went into ventricular tachycardia at and lost consciousness. Attempts at cardioversion and CPR were unsuccessful.

At autopsy, the myocardium showed posterior septal and left ventricular scarring consistent with his prior myocardial infarcts. The lateral wall showed extensive myofiber necrosis with numerous neutrophils, consistent with an acute infarction 48-72 hours old. Death was most likely secondary to a post-infarct arrhythmia.

A large thrombus was found in the right atrium. This was not likely to be clinically significant, as no emboli were identified in either lung. This thrombus may, however, have played a role in the patient's earlier pulmonary embolus. The lungs did show early multifocal bronchopneumonia, probably secondary to the congestive heart failure which resulted from the left ventricular infarct. The biventricular dilatation and bilateral pulmonary congestion, edema, and pleural effusions indicate that a significant degree of failure existed.

The small carcinoid tumor discovered incidentally at autopsy in the right middle lobe of the lung was asymptomatic and probably of no clinical significance, although a small percentage of these tumors do metastasize.

Autopsy Findings

This portion of the autopsy report details the gross and microscopic findings from the external examination, evisceration, dissection, and subsequent microscopic examination of the tissues removed. The text should be predominantly descriptive in nature, although drawing conclusions from the descriptions in the form of diagnoses is appropriate as well. Be comprehensive and complete, but avoid unnecessary wordiness. Include both positive and negative findings, since this report may be drawn upon years later to rule in or rule out other possible diagnoses.

Although the gross and microscopic finding will be integrated in this portion of the autopsy report, the two "parts" are prepared at different times. The gross description is dictated the same day the autopsy is performed. After examination of the histology, the microscopic descriptions can either be dictated (with sufficient instructions to the transcriptionist so they are properly integrated into the proper places), hand written onto a draft copy of the gross description, or entered into the computer directly by the resident.

A variety of philosophies exist as to how best to approach this portion of the autopsy report. Since many of the phrases used to describe normal organs are "canned", there is a temptation to use fill-in-the-blank forms or pre-entered computer generated text. Although this approach has the advantages of complete descriptions, faster turnaround times, and fewer typographical errors, there are several disadvantages as well, key among them the temptation to dictate as normal things which you did not examine, or to not include a slight variation because it is easier to use the canned text. In addition, the credibility of the text is compromised when every gross description is nearly identical. We have found that a compromise approach works best. The resident dictates from a guide that contains key phrases and prompts for important information, including pertinent negatives, and the transcriptionist has the same guide available when typing from the dictation. This improves the accuracy of the transcription, while allowing the resident complete freedom to deviate from the standardized text whenever warranted.

By convention, the Autopsy Findings is written in the present tense. This is historical, harking back to the times when there was a microphone hanging in the autopsy room, and the person doing the autopsy would dictate what they were doing and their findings while they were doing the autopsy. It turns out that this form of dictation often results in rambling summaries with less focused content, so we have chosen to have the residents dictate the case afterward from notes.

Hints and Recommendations:

- Dictate from notes, not just from memory. The best way to dictate the gross description of an organ is to use your notes to recall in your mind a mental image of what the organ looked like, and then describe what you see. For this to work, you need to have seen all the organs. Even if you have many pairs of hands helping you do the dissection, be sure you look at each organ personally before the organs are discarded. Also, the digital images you took from the case are available on-line for your review.
- Size, shape, color, consistency and texture are the mainstays of anatomic description.
- Think about what you are going to say before you say it. Dictate in complete sentences.
- Use a standard format for the dictation, and dictate your findings in a standard order, regardless of the order in which you did your actual dissection.

- Include relevant negatives. In particular, think about the clinical differential diagnoses in your particular case, and which negative findings help to exclude elements of that differential; include those negatives in your dictation.
- Dictate your gross description the same day you do your autopsy. The telephone dictation system allows you to do this from home later that night if you prefer. If you wait until the next day, and there is another autopsy to do that day, you run the risk of forgetting which mental image of the liver you have in your head goes with which case.
- Do NOT dictate as normal something which you did not examine or don't remember examining. Some residents assume that if they did not make note of any abnormalities, then there must not have been any. This is a very dangerous practice, and essentially represents falsification of the medical record. When in doubt, go back to the gross organs and review them, or consult others who were in the room at the time.
- When you deviate from the "standardized guide", be sure to speak clearly and spell out uncommon words. This is especially important when what you are dictating is close to what is on the guide, but not exactly what is on the guide. There is a risk of the transcriptionist missing the difference, and you may not pick it up when you proofread the typed version. Emphasize negatives (such as "the anastomosis is intact and *no* hemorrhage is noted").
- Avoid saying an organ is "normal" without qualifying the usage. Once you have cut an organ out of the patient and opened it up, it is no longer "normal". Rather, use "unremarkable" or "without significant abnormalities" or "contains no grossly identifiable lesions" or "normal in color, size and shape".
- Avoid unnecessary words. Do not say "The bile is green in color" because it is not likely to be green in anything but color. "The bile is green" is sufficient.

The pages that follow contain dictation guides for use in dictating adult gross descriptions and perinatal gross descriptions (a separate guide exists for perinatal cases because of the different needs of these cases). A copy of each guide should be available in the residents' room. Finally, a sample of the "Autopsy Findings" portion of a final autopsy report is presented, generated using the adult dictation guide. Note the formatting used for the version in the final report - this is the standardized format that all such reports should follow. Note also how the microscopic descriptions (added later) are integrated into each section of the report and do not form their own sections.

Gross Autopsy Findings - ADULT

[*Introduce yourself and the case to the transcriptionist:*
Hi. I will be dictating the gross autopsy findings for case number A__-___. The patient's name is _____. I am the primary resident on the case and my name is ____. The pathology attending for this case is _____ and the senior resident is _____. I am using the ADULT dictation guide.]

EXTERNAL EXAMINATION
The body is that of an (elderly, middle aged, young) (well nourished, cachectic, obese) [race] [sex] measuring ___ cm in length and weighing _____ lbs (kgs).
The patient is identified by ID tags present on (his/her) _____, which are labeled _____
The autopsy permission (is unrestricted, restricts the autopsy to examination of the _____).
(Lines, catheters)
(Incisions, puncture wounds)
(Scars, Tattoos, Jewelry)
His/her skin is otherwise unremarkable (dry, jaundice, purpura)
His/her hair is ([color], absent) and shows (a normal distribution, a bitemporal balding pattern, etc.). (A mustache and/or beard are present, He is unshaven).
The irises are [color], and the pupils are (equal at ____ mm, unequal with the left measuring ____ mm and the right measuring ____ mm). (Conjunctiva, sclera, etc. if abnormal)
(Mouth, teeth, neck, chest and abdominal contours)
(The breasts are symmetrical and palpation reveals no masses; gynecomastia, masses, nipple retraction)
The genitalia is that of a normal (circumcised?) (adult, child) [sex] (and the testes are present bilaterally in the scrotal sac) (undescended, hydrocele)
The configuration of the extremities and the dorsum are unremarkable (edema, amputations, scoliosis).

BODY CAVITIES
A Y-shaped incision is made using nonsterile technique.
The mediastinum is (in the midline, deviated to the right/left).
The thymus is not grossly identified in the anterior mediastinal fat (enlarged).
(Interstitial edema or emphysema)
(Rib fractures are noted in .....)
The pleural surfaces are smooth, shiny, and transparent.
The right pleural cavity contains ___ cc of _____ fluid, and the left contains ___ cc of _____ fluid.
(Adhesions, plaques, bullae, tumors)
The pericardial sac is (smooth, rough, distended, etc.) and contains ____ cc of (serous, serosanguinous, cloudy) fluid.
(The pulmonary trunk is opened in situ. No thrombi are found.)
The peritoneal cavity contains ____ cc of _____ fluid.
The abdominal organs are in their normal positions and are of grossly normal appearance. (hepatosplenomegaly, dilated loops of bowel)
(Adhesions, masses, perforations)
The peritoneal surfaces are smooth and glistening. (serositis, infarcted bowel)

HEART
The heart weighs _____ gms. The external configuration is normal. The pericardial and epicardial surfaces are smooth.
The coronary arteries course over the surface of the heart in the normal distribution.
The posterior circulation is (right, left) dominant.
The coronary arteries are dissected from the heart and serially cross-sectioned. OR The coronary arteries are transected at half cm intervals on the surface of the heart.
The posterior circulation is (right, left) dominant.
The left main .... left anterior descending ... left circumflex.....right coronary artery.....show..... (approximately __% atherosclerotic stenosis focally ___ cm from the ostium, thrombosis, no hemodynamically significant lesions)

(After formalin fixation,) the ventricles are serially sectioned from the apex and the base of the heart is dissected in the direction of blood flow. OR The heart is opened in the direction of blood flow.
The endocardial surfaces are grossly unremarkable. (hemorrhages, thromboses)
The foramen ovale is (closed, probe patent, patent).
The valves are smooth and delicate and of the usual anatomical configuration (thickened, hemorrhagic, calcified, stenotic, etc.).
Circumferences of the tricuspid, pulmonic, mitral, and aortic valves are ___, ___, ___, and ___ cm, respectively.
The pulmonary and aortic outflow tracts are normal. (aneurysms, VSD, atherosclerosis)
No chamber dilatation or hypertrophy is present.
The left ventricular free wall is ___ mm thick, and the right ventricle measures ___ mm.
The myocardium is homogeneous red-brown on cut section. (scars, hemorrhage, necrosis, fat infiltration)

AORTA
The great vessels arise from the heart and the aorta in their usual configuration.
There is (mild, moderate, severe) atherosclerosis in the arch, thoracic, and abdominal aorta.
(Aneurysms)

RESPIRATORY SYSTEM
There is no hemorrhage within the soft tissues of the neck.
The laryngeal mucosa, vocal cords, and tracheal mucosa are normal. (erythema, exudate, inflammation, ulceration, tracheostomy, edema)
The left lung weighs ___ gms and the right lung weighs ____ gms.
The lungs show proper lobation. (abnormal lobation, surgical absence)
The (left, right) lung is examined fresh.
Hilar dissection reveals the bronchial tree and pulmonary arteries to be of normal configuration and without gross lesions. (mucus plugs, bronchitis, dilatation, thrombi, webs, tumor, atherosclerosis, emboli)
Hilar lymph nodes are unremarkable.
On serial sectioning, the parenchyma is soft, tan-red and crepitant. No gross lesions are identified. (consolidation, congestion, hemorrhages, abscesses, bullae)
The (left, right) lung is inflated with formalin prior to (sagittal) sectioning.
No gross lesions are apparent on the cut surface of the parenchyma. (emphysema, infarcts, hemorrhages, consolidation, tumors, honeycombing)
The bronchi, vessels, and lymph nodes are unremarkable (thromboemboli, webs)

ESOPHAGUS, STOMACH, and DUODENUM
The esophagus has the usual folded mucosal pattern. (ulceration, mucosal metaplasia, varices, constriction)
The stomach contains ____ cc of (partially digested) (bile stained) (food, liquid). The gastric mucosa and wall are grossly unremarkable. (post-mortem autolysis)
The duodenum is normal.

LIVER and GALLBLADDER
The liver weighs ____ gms. The capsule is smooth and the edges are sharp.
(The surface of the liver contains .....)
The cut surface shows grossly normal architecture (regenerative nodules, cirrhosis, chronic passive congestion, tumors, hemangioma)
The parenchyma is [color] and (of normal consistency, firm, soft).
The gallbladder contains approximately ___ cc of [color] bile and [number] [color] [shape] stones (ranging in size from ___ to ___ mm).
The wall thickness and mucosal pattern are normal.
The extrahepatic biliary system is normal in architecture.
No stones are present within the cystic duct. (impacted stones)
The common bile duct is opened to the ampulla of Vater. It is patent and has a normal circumference and mucosa.

PANCREAS
The size and consistency of the pancreas are unremarkable.
On cut section the lobular architecture and color of the parenchyma are grossly normal. (pseudocyst, fat necrosis, hemorrhage, tumor, fibrosis)
(There is marked autolysis.)
The pancreatic duct, examined to the ampulla of Vater, is grossly unremarkable.

SPLEEN
The spleen weighs _____ gms.
The capsular surface is unremarkable. (calcified granulomas, tumor, infarct)
On cut section, the color, consistency, and red and white pulp are all within the normal range. (diffluent, abscess, tumor)

SMALL BOWEL
The small bowel contents are liquid and grossly unremarkable (bloody)
The mucosal surfaces and bowel wall show no gross lesions (dusky discoloration, hemorrhage, ulcerations, enteritis, dilated lacteals, mural fibrosis, tumors, lymphoid hyperplasia, serosal nodules)
[*Description of any abnormalities should include locations and extent of involvement*]
Examination of the superior mesenteric artery and vein, and their branches, reveals (no evidence of atherosclerosis or thrombosis, [grade] atherosclerosis, focal thrombosis, etc.)
[*If any focal lesions were identified in the bowel mucosa, specifically describe the state of the mesenteric vascular system supplying that portion of bowel*]

LARGE BOWEL and RECTUM
The appendix is (identified in its normal position arising from the cecum, absent).
The large bowel and rectum contain a moderate amount of semi-solid fecal material.
No gross abnormalities of the mucosa are noted (polyps, ulcers, colitis, blood)
(No, a few, several, many) (uncomplicated, inflamed, impacted) diverticula are noted in the (descending, sigmoid) colon.

KIDNEYS
The left kidney weighs ____ gms and the right kidney weighs ____ gms.
The renal artery ostia are patent bilaterally (stenosed, occluded)
The kidneys are normal in position and shape (persistent fetal lobation, horseshoe, masses/tumors, scars).
(The [left/right] kidney contains [number] cortical cysts containing clear fluid, and range in size from ___ to ____ mm]
The renal capsules are (thin and translucent, thickened) and (strip with ease from, are tightly adherent to) the (red-brown, pale), (smooth, finely granular, coarsely granular, irregular) cortical surfaces.
The cut surface shows a cortex of normal thickness (thinned to ____ mm) which is (normal in color, pale, hemorrhagic).
(Tumors, infarcts)
The corticomedullary border is sharply demarcated and the medulla is congested.
The mucosa of the renal pelvis, and the peripelvic tissues, are grossly unremarkable (hemorrhage, retroperitoneal sarcomas)

URETERS and BLADDER
The ureters are opened along their length. They are unobstructed and without mucosal lesions.
The distal ureters are probe patent into the bladder.
The bladder contains ____ cc of (clear, cloudy) urine.
The bladder mucosa is normal (injected, trabeculated), and the wall is of normal thickness.

PROSTATE and TESTES
Prostate size and configuration is normal. (nodular hyperplasia, infarcts, urethral compression, stones)
The cut surface reveals normal glandular and stromal architecture.
The seminal vesicles are unremarkable.
The testes are present in the scrotum and are normal in size.
The left and right testis weigh ____ and ____ gms, respectively.
On cut section, the surface is brown with seminiferous tubules which strip easily.
(Penile lesions/masses)

OVARIES and UTERUS
The Fallopian tubes and ovaries are (identified bilaterally, surgically absent). The ovaries have a lobulated white appearance and are (normal in size, atrophic) bilaterally. The cut sections (are grossly unremarkable, reveal _____ (surgically absent, cysts, endometriosis, tumors)
The uterus is normal in position, size, and shape. (surgically absent, cysts, leiomyomas)
The endocervical canal, uterine cavity, and myometrium are grossly unremarkable. (polyps, cysts, leiomyomas, ulceration, tumors)
(Vaginal lesions/masses)

BREASTS
The breasts show mild to moderate fibrocystic changes, but are without masses or grossly palpable calcifications.

THYROID (and PARATHYROIDS)
The thyroid gland weighs ____ grams.
The organ has a typical bilobed shape and occupies the normal position anterior to the trachea. (asymmetry, atrophy, tumor)
The cut surface is smooth, brown red, and grossly unremarkable. (nodular hyperplasia, calcifications, hemorrhage, inflammation)
(A parathyroid dissection yields ___ small, yellow green glands with an aggregate weight of ____ gms.)

ADRENALS
The adrenals occupy their normal positions at the superior poles of the kidneys and are of normal configuration.
The left adrenal weighs _____ gms and the right adrenal weighs _____ gms.
The cortex and medulla are sharply demarcated; the cortex is yellow and the medulla is gray throughout. (cortical hyperplasia, nodules, calcification)

LYMPH NODES
Lymph nodes in the mediastinum and abdomen are unremarkable (enlarged, matted)

BONE and MARROW
The lumbar vertebral bodies show a (mild, moderate, marked) degree of osteoporosis.
The cortical bone and trabeculae are (otherwise) unremarkable.
There is ample red bone marrow present.

EYES
The eyes are removed (anteriorly, posteriorly) and fixed in formalin prior to sectioning.
The corneas are clear. The irises are intact. The lenses (are, are not) visible through the pupils (and appear clear / cloudy).
No deformities of the globes are present.
The globes are opened by (coronal, horizontal) sectioning.
The lenses are in their proper location (artificial lens, anterior/posterior chamber).
The posterior poles show no lesions (hemorrhages, papilledema, cupping of the optic disc, etc.).

(MISCELLANEOUS)

SKULL and BRAIN
The calvarium is removed following anterior reflection of the scalp.
No abnormal fluid collections are present in the epidural or subdural spaces (hematomas, tumors)
The skull is grossly unremarkable. (fractures, tumors)
(The pituitary gland is grossly unremarkable.)
The brain weighs _____ gms. There is mild opacification of the meninges.
No subarachnoid lesions are present. (hemorrhage, exudate)
The gyri and sulci have the normal configuration. (atrophy, edema, flattening)
There is no evidence of herniation. There is no focal softening.
The blood vessels of the Circle of Willis show (mild, moderate, severe) atherosclerosis.

See the Neuropathology Addendum for further details.
OR
Following formalin fixation the brainstem is removed and the hemispheres are sectioned coronally. There is good gray-white demarcation.
The ventricular configuration is normal and the ventricles are free of gross lesions.
The basal ganglia, brainstem, and cerebellum appear normal.
Representative histologic sections from the hippocampus and the frontal cortex are unremarkable.

[*Let the transcriptionist know you are done dictating:*
That concludes the dictation of the gross description for autopsy A__-___. Thank-you.]

Gross Autopsy Findings – PEDIATRIC/PERINATAL

[*Introduce yourself and the case to the transcriptionist:*
Hi. I'm going to be dictating the gross autopsy findings for case number A__-___. The patient's name is _____. I am the primary resident on the case and my name is ____. The pathology attending for this case is _____ and the senior resident is _____. I am using the PEDIATRIC dictation guide.]

EXTERNAL EXAMINATION
The body is that of a ____ gm [race] [sex] (fetus, neonate, infant, child) with (no, Grade I, Grade II, Grade III) maceration.
The patient is identified by ID tags present on (his/her) _____
The autopsy permission (is unrestricted, restricts the autopsy to examination of the _____).

The crown-rump length is ____ cm and the crown-heel length is _____ cm.
Head, chest, and abdominal circumferences are _____, _____, and _____ cm, respectively.
Hand and foot lengths are _____ and _____ cm.
The head is (normally) shaped and has a biparietal diameter of _____ cm.
The anterior (and posterior) fontanel(s) (is, are) open and measure(s) ____ x _____ and _____ x _____ cm. (The posterior fontanel is closed.)
The facies is unremarkable: in particular, the eyelids are (fused shut / open), the nares are probe-patent, the ears are normally positioned, and the lips, tongue, and palate show no evidence of clefting. (Describe any abnormalities)
The intercanthal distance is ____ cm.
The limbs are normally formed and the hands and feet show the normal numbers and development of digits. (malrotations, dislocations, rocker-bottom foot deformity, palmar creases, polydactyly, syndactyly, clynodactyly)
The chest and abdomen are unremarkable, with normally positioned nipples, an internipple distance of ____ cm, and an umbilical cord which measures _____ cm in length.
The neck, vertebral column, and sacrum are normal.
The anus is probe-patent.
The external genitalia are (ambiguous, those of a normal male/female).

(Lines, catheters)
(Incisions, puncture wounds)
(Scars, Tattoos)
The skin is otherwise unremarkable (dry, jaundice, birthmarks)
(*Describe any radiographic abnormalities*)

IN SITU EXAMINATION
The body is opened with a modified Y-shaped incision
The thymus is normally lobated, is located in the midline of the superior mediastinum, and weighs _____ gms.
The trachea is in the midline.
The heart is located in the (left, right) thoracic cavity with the apex pointing toward the (left, right). The cardiac-thoracic ratio is ___:___.
The left and right pleural cavities contain ____ and _____ cc of [color] [clarity] fluid.
(dextrocardia, diaphragmatic hernias, organomegaly)
The pericardial sac contains (minimal, _____ cc of) (serous, bloody) fluid.
The great vessels, including the aorta, pulmonary artery and veins, and superior and inferior vena cava, show normal position and connections. In particular, the pulmonary trunk is located anterior and to the left of the aorta at the base of the heart, the systemic venous return is through the superior and inferior vena cava to the right atrium, and the pulmonary venous return is to the left atrial chamber. The aortic arch and descending aorta are left sided, and the three aortic arch branches are normally positioned. (specifically describe any abnormalities; for any abnormal vessels, describe origin, course, and destination of the vessels; specific abnormalities to look for include left sided superior vena cava, right sided aorta, anomalous right subclavian artery, anomalous pulmonary venous return)
The peritoneal cavity contains _____ cc of [color] [clarity] fluid.

The abdominal and pelvic organs are in their normal anatomical locations and without gross abnormalities. In particular, the liver and spleen show appropriate laterality, the gut is normally rotated with a mesenteric insertion which runs from the left upper quadrant to the right lower quadrant, and there are no strictures or dilatations in the loops of bowel. (organomegaly, malrotation of the gut, polysplenia, asplenia)

HEART and VASCULAR SYSTEM

The heart weighs _____ gms and there is appropriate asymmetry of the atrial appendages (left atrial isomerism, right atrial isomerism). [*NOTE: the anatomic right atrial appendage is triangular and has a broad attachment to the right atrium; the anatomic left atrial appendage is hook shaped and has a narrow attachment to the left atrium*]
The epicardial surface is smooth and glistening.
The coronary arteries show the normal distribution. The ostia are normally situated.
The ductus arteriosus is (closed, probe patent).
Left and right ventricular free walls of the heart measure _____ and _____ mm, and no septal defects are present. (membranous vs muscular septal defects)
The valves are normally formed. Circumferences of the tricuspid, pulmonic, mitral, and aortic valves are ___, ___, ___, and ___ cm, respectively.
The aorta shows no coarctation. The ostia of the celiac, superior mesenteric, renal, and inferior mesenteric arteries are patent.

RESPIRATORY SYSTEM

The epiglottis, uvula, and laryngeal mucosa are unremarkable.
The trachea is normally formed. There are no luminal connections to the esophagus.
The diaphragm is intact and normally positioned.
The lungs are __(color)__, have normal lobation, and weigh _____ gms combined (or __ and __ gms, respectively). The pleural surface is unremarkable.
The mainstem bronchial pattern appears to be normal. The cut surface shows _____.

GASTROINTESTINAL SYSTEM

The cut surface of the submandibular gland is unremarkable.
The esophagus is normally positioned, and the mucosa is unremarkable.
The stomach is normal.
The small and large intestine measure approximately _____ and _____ cm in length, and are without gross abnormalities. (focal atresia, Meckel's diverticulum)
The liver weighs _____ gms, and both the external and cut surfaces are unremarkable.
The gallbladder is present (and contains a small amount of green fluid). The configuration of the extrahepatic biliary system is normal. The system is patent and non-dilated.
The pancreas measures _____ cm in length and has a normal cut surface.

ENDOCRINE SYSTEM

The thyroid is located in the midline (and weighs _____ gms). The external and cut surfaces are normal.
The left and right adrenal glands weigh _____ and _____ gms, and have a normal cut surface.

HEMATOPOIETIC and LYMPHOID SYSTEM

The spleen weighs _____ gms and is unremarkable.
Lymph nodes and bone marrow are unremarkable.
The thymus weighs _____ gms and shows a normal parenchyma on cut section.

GENITOURINARY SYSTEM

The left and right kidneys weigh _____ and _____ gms and show normal lobation, blood supply, and ureteral connections to the bladder. No dilatations of the pelves, ureters, or bladder is present. The cut surface of the kidneys is normal. The cortex measures ____ cm, and the medulla measures ___ cm x ____ cm.

The testes are located (intraabdominally, within the inguinal canals, within the scrotal sac) and have a combined weight of _____ gms.

OR

The uterus, ovaries, and fallopian tubes are of normal configuration.

MUSCULOSKELETAL SYSTEM
No abnormalities of the bones, joints, or muscles are recognized.
The bones, marrow, and joints are grossly unremarkable.

CENTRAL NERVOUS SYSTEM
No scalp defects are noted. The skull is normally shaped.
The scalp is reflected anteriorly and the skull opened by separation of the sutures.
(No abnormal fluid collections, hematoma, marked scalp edema) is present.
The cranial contents have a combined weight of _____ gms (and show marked autolysis).
Two cerebral hemispheres are identified showing (no, minimal, substantial) gyri and sulci formation. The cerebellum and brainstem are present and normally developed.

See the Neuropathology Addendum for further details.
OR
Following formalin fixation, the hemispheres are sectioned coronally.
The brain is soft and gelatinous.
Gray-white demarcation is (present, absent).
The ventricles, cerebrum, basal ganglia, and cerebellum show no focal lesions.

PLACENTA
The placenta weighs _____ gms and measures _____ x _____ cm.
The membranes are normal in appearance (meconium staining), and insert marginally (circumvalate/circummarginate with approximately __% of the placenta present excorialis).
The umbilical cord measures ____ cm in length and contains (three) vessels.
It inserts _____ cm from the nearest placental margin (on a disc which measures ___ x ___ cm)
The maternal surface is complete.
Cut section reveals no gross lesions.

[*Let the transcriptionist know you are done dictating:*
That concludes the dictation of the gross description for autopsy A__-___. Thank-you.]

SAMPLE "Autopsy Findings" (ADULT)

EXTERNAL EXAMINATION

The body is that of an elderly, mildly obese white female measuring 165 cm in length and weighing 170 lbs (77 kg). The patient is identified by ID tags present on her left wrist and right great toe. The autopsy permission is unrestricted.

The patient has an intravenous line on the dorsal aspect of her right hand. A Foley catheter is in place. No scars are identified. There is a localized purpura at the entry site for the intravenous line. Her skin is otherwise unremarkable. Her hair is brown. The irises are blue, and the pupils are equal at 5 mm. Her teeth are absent. The chest and abdomen show normal contours. The breasts are symmetrical and palpation reveals no masses. The genitalia is that of a normal adult female. The configuration of the extremities and the dorsum are unremarkable.

BODY CAVITIES

A Y-shaped incision is made using nonsterile technique. The mediastinum is in the midline. The thymus is not grossly identified in the anterior mediastinal fat. No rib fractures are noted. The pleural surfaces are smooth, shiny, and transparent. The right and left pleural cavity each contain approximately 150 cc of serous fluid. A moderate number of fibrinous adhesions are present bilaterally between the parietal and visceral pleura, but these are easily separated indicating minimal if any fibrosis. The pericardial sac contains 25 cc of serous fluid. The pulmonary trunk is opened in situ. No thrombi are found.

The peritoneal cavity contains 300 cc of straw-colored fluid. The abdominal organs are in their normal positions and are of grossly normal appearance. The peritoneal surfaces are smooth and glistening.

HEART

The heart weighs 280 gms. The external configuration is normal. The pericardial and epicardial surfaces are smooth.

The coronary arteries are transected at half cm intervals on the surface of the heart. The posterior circulation is right dominant. The left main, left anterior descending, left circumflex, and right coronary arteries show no hemodynamically significant lesions.

The heart is opened in the direction of blood flow. The endocardial surfaces are grossly unremarkable. The foramen ovale is probe patent. The valves are grossly unremarkable. Circumferences of the tricuspid, pulmonic, mitral, and aortic valves are 5.5, 4.4, 6.0, and 4.8 cm, respectively. The pulmonary and aortic outflow tracts are normal. No chamber dilatation or hypertrophy is present. The left ventricular free wall is 21 mm thick, and the right ventricle measures 7 mm. The myocardium is homogeneous red-brown on cut section. Histologic examination of random sections shows no abnormalities.

AORTA

There is mild atherosclerosis in the arch, thoracic, and abdominal aorta.

RESPIRATORY SYSTEM

The laryngeal mucosa, vocal cords, and tracheal mucosa are grossly and histologically normal.

The right lung weighs 260 gms and the left lung weighs 220 gms. The lungs show proper lobation. The left lung is examined fresh. Hilar dissection reveals the bronchial tree and pulmonary arteries to be of normal configuration and without gross lesions. Hilar lymph nodes are unremarkable. On serial sectioning, the parenchyma is soft, tan-red and crepitant. No gross or microscopic lesions are identified. The right lung is inflated with formalin prior to sagittal sectioning. No gross lesions are apparent on the cut surface of the parenchyma. The bronchi, vessels, and lymph nodes are unremarkable. Histologic examination of random sections reveal no lesions.

ESOPHAGUS, STOMACH, and DUODENUM

The esophagus is normal. The stomach contains approximately 400 cc of partially digested food. The gastric mucosa and wall are grossly unremarkable. Microscopic examination reveals post-mortem autolysis. The duodenum is normal.

LIVER and GALLBLADDER

The liver weighs 1200 gms. The capsule is smooth. The cut surface shows grossly normal architecture, a green parenchyma of normal consistency, and unremarkable histology.

The gallbladder contains approximately 20 cc of green bile and no stones. The wall thickness and mucosal pattern are within normal limits. The extrahepatic biliary system is normal in architecture. No stones are present within the cystic duct. The common bile duct is patent and has normal circumference and mucosal pattern.

PANCREAS

The size and consistency of the pancreas are unremarkable. On cut section the lobular architecture and color of the parenchyma are grossly normal. Histologic examination shows marked autolysis. The pancreatic duct, examined to the ampulla of Vater, is grossly unremarkable.

SPLEEN

The spleen weighs 180 gms. The capsular surface is unremarkable. Cut section reveals a diffluent red parenchyma with poor demarcation of the red and white pulp. Microscopic examination is unremarkable.

SMALL BOWEL

The small bowel contents are liquid and grossly unremarkable. The mucosal surfaces contain occasional dilated lacteals, and there is moderate lymphoid hyperplasia in the terminal ileum. The bowel wall and serosa are unremarkable. Histologic examination reveals no pathology.

The proximal superior mesenteric artery shows mild atherosclerosis at its origin from the abdominal aorta. The distal branches and the mesenteric vein are not examined.

LARGE BOWEL and RECTUM

The large bowel and rectum contain a moderate amount of semi-solid fecal material. There is a 1.5 cm diameter spherical pedunculated polyp in the transverse colon. Histologic examination reveals a tubular adenoma with mild dysplasia. There are a small number of uncomplicated diverticula in the sigmoid colon. No other gross or microscopic abnormalities of the mucosa or wall are identified.

KIDNEYS

The right kidney weighs 150 gms and the left kidney weighs 145 gms. The renal artery ostia are patent bilaterally and follow a tortuous course from their origins at the aorta to the hilum of each kidney. The kidneys are normal in position and shape. A single 4 cm diameter subcapsular cyst is present on the upper pole of the left kidney. It contains clear fluid. The renal capsules are thin and translucent and strip with ease from the smooth, red-brown, finely granular, cortical surfaces. The cut surface shows a cortex of normal thickness. The corticomedullary border is sharply demarcated and the medulla is congested. Histologically, there is moderate arterio- and arteriolonephrosclerosis and focal global glomerulosclerosis. The mucosa of the renal pelvis, and the peripelvic tissues, are grossly unremarkable.

URETERS and BLADDER

The ureters are unobstructed and without mucosal lesions. The distal ureters are probe patent into the bladder, which contains ~50 cc of yellow urine. The mucosa is grossly normal and histologically shows mild chronic inflammation. The bladder wall is normal in thickness.

OVARIES and UTERUS

The Fallopian tubes and ovaries show no gross lesions. The ovaries are atrophic bilaterally and grossly and microscopically normal on cut section.

The uterus is normal in position, size, and shape. The endocervical canal contains a small amount of mucus. Opening with subsequent gross and microscopic examination of the endometrium and myometrium reveals an atrophic endometrium and a 2 cm diameter leiomyoma in the anterior myometrium with central infarction and hyalinization.

The vagina is unremarkable.

BREASTS

The breasts show mild to moderate fibrocystic changes, but are without masses or grossly palpable calcifications. Microscopic examination shows sclerosing adenosis, stromal fibrosis, and apocrine metaplasia.

THYROID

The thyroid gland weighs 8.2 grams. The organ has a typical bilobed shape and occupies the normal position anterior to the trachea. The cut surface is smooth, brown red, and grossly and histologically unremarkable.

A parathyroid dissection is not performed.

ADRENALS

The adrenals occupy their normal positions at the superior poles of the kidneys and are of normal configuration. The right adrenal weighs 2.0 gms and the left adrenal weighs 2.1 gms. The cortex and medulla are sharply demarcated; the cortex is yellow and the medulla is gray throughout. Microscopic examination is unremarkable.

LYMPH NODES

Lymph nodes in the mediastinum and abdomen are unremarkable.

BONE and MARROW

The lumbar vertebral bodies show a moderate degree of osteoporosis. The cortical bone and trabeculae are otherwise unremarkable. The bone marrow shows ~30% cellularity with all three cell lines present.

EYES

The eyes are removed posteriorly and fixed in formalin prior to sectioning. The corneas are clear. The irises are intact. Each lens is visible through the pupil and appears slightly cloudy. No deformities of the globes are present.

The globes are opened by coronal sectioning. The lenses are in their proper location. The posterior pole shows no lesions.

SKULL and BRAIN

The calvarium is removed following anterior reflection of the scalp. No abnormal fluid collections are present in the epidural or subdural spaces. The skull and pituitary gland are grossly unremarkable.

The brain weighs 1100 gms. There is mild opacification of the meninges. No subarachnoid lesions are present. The gyri and sulci have the normal configuration. There is no evidence of herniation. There is no focal softening. The blood vessels of the Circle of Willis show mild atherosclerosis, especially in the basilar artery.

Following formalin fixation the brainstem is removed and the hemispheres are sectioned coronally. There is good gray-white demarcation. See the Neuropathology Addendum for further details.

Neuropathology Evaluation

All of the brains evaluated at autopsy should be presented to the neuropathologist at brain cutting conference. It is important to have the appropriate neurological history available when presenting the brain for consultation.

The workflow for evaluating the brain has been previously described. At the autopsy or the brain cutting conference, the neuropathologist will decide whether or not a formal consultation report is needed. If the patient had no neurologic symptoms and examination of the cut brain reveals no specific lesions, a formal neuropathology evaluation may not be indicated. In that case, two representative sections should be taken: one from the hippocampus and one from the frontal lobe, and if these are normal, a formal neuropathology report is not written. The resident responsible for the brain should inform the resident on the main part of the case (ideally, the same person, but often not) of the findings from the gross examination, if any, for inclusion in the main autopsy report.

If the patient had significant neurological symptoms, or if examination of the cut brain reveals any gross pathology (or examination of the representative microscopic sections of an otherwise normal appearing brain shows some pathology), a formal Neuropathology Evaluation will be performed. This is reported as a “procedure” and as such the result is included in the final

autopsy report. Ideally, this should be available to you when you sign out your case. Include these findings in the FAD and the CPS, but you do not need to repeat them in the Autopsy Findings section, which should be comprised of your own observations.

If the Neuropathology Evaluation is delayed and the remainder of the case is ready to sign out, especially in cases where the brain was grossly unremarkable, do not wait for the neuropathology report but rather have the main portion of the case signed out and mailed to the clinicians.

When the Neuropathology Evaluation is completed for a brain only autopsy, complete the case within 24 hours as described above under "Overview of the Autopsy Process, Special Rules for Brain-Only Cases".

Clinical-Pathological Clarifications/Discrepancies

The Joint Commission for the Accreditation of Health Care Organizations (JCAHO) requires that the results of autopsies be incorporated into the quality assurance program of the hospital. Therefore, we have established a system for recording in our pathology information computer system all clinical-pathological clarifications/discrepancies from each autopsy performed. Autopsy Clarification/ Discrepancy information is recorded to document instances in which *the autopsy examination added to, clarified, or altered the clinical understanding of the case*. It should **not** be approached as a punitive activity but rather as an educational one. It is an important quality assurance activity for the hospital and validates the existence of the autopsy service.

Clarification/Discrepancy information must be entered for EVERY autopsy case, even if only to indicate that there were no unexpected findings. Information should be entered as soon as possible, ideally at the time the PAD is entered, and then modified as needed as the workup of the case continues. While the information is preliminary, the status of the Clarification/Discrepancy review should be "Pending". When the information is completed, change the status to "Complete". It should be completed before the case is sent to the attending pathologist for signout, so that the attending may edit the information at electronic signout.

Each clarification/discrepancy is graded by assigning it to one of four "Levels":

0. Used to indicate that this case had no clarifications or discrepancies. When used, it should be the only Level listed for the case. Do NOT list any findings with a Level 0 clarifications/discrepancy.

I. **Major unexpected finding or clarification contributing to the patient's death.** These major findings include any principal underlying disease which contributed to the patient's death. They may or may not have been treated if known prior to the patient's death. (e.g., malignant neoplasms which contributed to or caused the death, large pulmonary emboli, major infections)

II. **Major unexpected finding or clarification which did not contribute to the patient's death.** These are major disease processes that may have eventually required treatment or contributed to the patient's death. (e.g., an undiagnosed malignant neoplasm, cirrhosis, or aneurysm which did not contribute to the patient's death)

III. **Minor unexpected finding or clarification contributing to the death of the patient.** These are secondary findings related to a principal underlying disease, therapeutic

intervention, or diagnostic procedure. (e.g., hemorrhage, unsuspected metastases of a clinically known primary)

IV. **Other minor unexpected finding or clarification which might have eventually required treatment.** (e.g., cholelithiasis, diverticulosis)

Incidental findings which would likely never have required treatment (such as simple renal cysts) need not be reported.

The information recorded is used for multiple purposes, including identifying cases for teaching conferences in other departments. Information is reviewed by the director of the service, and provided quarterly to hospital administration and department chiefs.

Education on the Autopsy Service

Residents on the autopsy service are expected both to become educated and to participate in the education of others. As with any "on the job training", most of the learning and teaching will be informal during the conducting of the day's business. In addition to these interactions, however, a number of more formal educational forums exist.

Conferences

Daily Case Review Conferences

This is a working and teaching conference during which free discussion among all members present is encouraged. All of the "medical" staff assigned to the service should be present for this conference (junior residents, senior resident, medical students, P.A. students, and post-sophomore fellows). Attendance at this conference is required for any resident hoping to get credit for the case. In addition, attendance by members of the clinical team should be strongly encouraged. This is the conference during which the major autopsy findings are discussed in correlation with the clinical history. The discussion and teaching experience will be enhanced for all to the degree that all available data, knowledge of previous diagnoses and surgical specimens, and rigorous dissection and observation of lesions are brought to bear to formulate the PAD.

Organs should be presented on trays and/or in pans on towels or in water and covered with moist towels (to prevent drying of organs) or lids (deep pans). Usually 3-4 trays is sufficient. Organs are arranged in sequence of presentation. By convention, one tray will usually contain the heart, lungs, trachea, and thyroid, a second will contain the GI block, liver, spleen, and bowel, and a third will contain the aorta, kidneys, adrenals, and GU organs.

Begin your presentation with a *brief* discussion of the clinical history. Try to do this without relying on notes. It is usually best to start with the patient's age and a one sentence summary of the illness resulting in his ultimate demise. Then review pertinent past medical and social history, recent previous hospitalizations, and the most recent presentation/admission. Concentrate on those components of the workup and hospital course which will have a direct bearing on the anatomic findings. It is not necessary to go into detail about problems which were corrected and resolved prior to death, but they should be mentioned if major (e.g., sepsis). Timing of events should be given not as dates but rather in relation to the patient's final presentation or demise (e.g., "the patient presented to the emergency room two weeks prior to his death complaining of chest pain"; "his cardiac status was improving slowly until 5 days after admission when his blood pressure dropped suddenly"). Your history should include the results of any previous relevant specimens processed in pathology. Conclude with the events leading up to the patient's death, and the impression of the clinical team as to the major on-going problems in the patient. The entire clinical presentation should take only a few minutes. You do not need to mention everything you know. After presenting the clinical history, allow the attending and others to ask additional questions. Don't make up answers: it is better to say "I don't know that" or "I will have to look that up" rather than to give wrong information.

Then briefly describe relevant external findings on the body (you do not need to itemize every scar unless relevant) and general elements about the in situ examination which are not reflected in the dissected organs such as amounts of fluid in various cavities, the presence of adhesions, etc.. Then proceed through a presentation of the organs in a systematic fashion, as laid out on the trays. You should know the weights of all of the organs, and whether or not those weights are normal, without having to refer to your notes. State your impressions as to the identity

and significance of lesions. The attending will lead the discussion of differential diagnoses. After all of the organs have been presented, discuss how all of the findings fit together and relate this to the clinical history. Up to five blocks should be selected for "rush" processing by histology to confirm important anatomic diagnoses and include them in the PAD.

Neuropathology Brain Cutting Conference

This weekly working/teaching conference is the forum in which a Neuropathologist cuts and reviews brains after fixation. Medical students and members of the clinical team may attend this conference. Since this conference is an important part of your training in neuropathology, all residents on the autopsy service are expected to attend, even if they do not have a brain to present. Currently, all brains are reviewed. If there are significant gross findings, and/or if the patient had significant neurological symptoms, the brain will be "adopted" by the neuropathology team who will submit sections and ultimately prepare a formal consult report will be included in the autopsy report (Neuropathology Consultation).

It is important that brains be cut in timely fashion because of the long processing time. Soak brain in running water beginning the afternoon preceding brain cutting in order to remove excess formalin. The autopsy technicians should help you with this.

At the conference, you will be asked to give a brief clinical history for the patient and provide the brain weight. Note any lesions pointed out grossly by neuropathology and include them in the "Autopsy Findings" portion of your report. If appropriate, these findings should also be included in the FAD for the case. Consult your attending.

Autopsy Case Presentation Conference

This conference is held approximately monthly and is to be attended by all the pathology residents and those faculty who attend on the autopsy service. At this hour-long conference, three residents will each be expected to present one of their autopsy cases. The purpose of this conference is for residents to gain experience preparing and presenting a complete case, interpreting the pathologic findings in that case, and assembling those interpretations into an explanation of the sequence of events leading up to the patient's death. Throughout your career, you will be required to present cases at various clinical conferences. You must be able to do this quickly and convincingly.

Each presentation should be no more than 20 minutes, including time for questions and answers. The presentation should consist of a PowerPoint "lecture" with numerous images from the case being presented. Begin with the clinical history as available at the time of the autopsy (including relevant laboratory results), and then proceed through demonstration of the findings, supported by appropriate gross and histologic photographs (don't simply state the findings or list the findings – support with morphologic evidence). Include pertinent negative findings, but it is not necessary or appropriate for you to show every picture you have taken of the case. Interpret each disease process, with a brief discussion of the differential diagnosis where appropriate. Finally, assemble the findings with respect to causal relationships, correlating with the clinical information, to tell the story of the patient's death, connecting the underlying disease process(es) with the actual death. Include the text of the Final Anatomic Diagnosis and the Cause of Death statement from the autopsy report. The discussion can include brief teaching points about the disease process(es) present in the patient, but should focus on the case being presented rather than a generic discussion of the disease. Plan for the presentation to run no more than 15 minutes, leaving 5 minutes for questions.

It would be appropriate to discuss your case and your presentation with the attending pathologist on the case.

Autopsy /Forensic Pathology Journal Club *(New 2014)*

This conference is held approximately monthly and is to be attended by all the pathology residents and those faculty who attend on the autopsy service. At this hour-long conference, one resident is expected to review and present an original article that pertains to autopsy and/or forensic pathology. The purpose of this conference is for residents to present a peer reviewed article that demonstrates knowledge gleaned from or applied to the autopsy that has utility on a larger scope.

Each presentation should be no more than 60 minutes, allowing for time for questions and answers.

Additional Clinical Conferences

A number of additional conferences exist in which you will be expected to participate. These are run by other departments, and are variably termed CPCs (clinical-pathological correlations), M&Ms (morbidity and mortality), discharge conferences, or simply firm conferences. The formats for these conferences vary and are determined by the service running the conference. However, you should expect to present the pertinent autopsy findings at any conference in which one of your autopsy patients is discussed, regardless of which rotation you are currently on. These presentations will generally be photographically based rather than involving wet tissue. This is your main opportunity to interact with the clinical teams, to demonstrate your knowledge of pathology, and to make your contribution to ongoing patient care at the hospital.

Medical Student Teaching

Houseofficers have several opportunities to teach medical students while assigned to the Autopsy Service. This should be considered a privilege and not a task.

For part of the year, post-sophomore fellows may be assigned in rotation to the Autopsy Service. Initially, these fellows will be assigned to cases with first-year houseofficers or the senior resident. Ultimately, post-sophomore fellows will function as primary Pathology houseofficers under the close supervision of the senior resident.

During the medical school pathology course, medical students may attend autopsies as a tutorial assignment and/or faculty members may request attendance by students at the autopsy review conference. In other instances, faculty may request that a houseofficer assist students in preparing case histories, organ presentations, and literature reviews for peer teaching conferences. Please make every effort to make them not only feel welcome, but to make the experience an exciting educational opportunity.

Teaching Collection *(Updated 2014)*

The Autopsy Service is potentially a rich source of specimens for the department's teaching collection. Keep this in mind when doing your dissections, and bring any appropriate specimens to

the attention of the teaching collection technician or the manager of the service by designating the case or selecting organs on the white board. Whenever possible, one of these individuals will notify you prior to the beginning of the case of the need for a particular specimen and the potential appropriateness of that particular case to produce such a specimen. Dissect the specimen in such a way as to preserve connections to neighboring structures, and to produce sufficient removed tissue to allow adequate diagnostic evaluation of the specimen (submitting tissue for histology) using only the removed tissue. Store fixed specimens in an appropriate sized container labeled with the case number and "save for teaching". The specimen will be saved and available for a couple of weeks in case additional diagnostic tissue is needed. It will also be available for use in a resident gross conference.

Other Administrative Matters

The Autopsy Permission

Performing an autopsy without a valid permission is a violation of the patient's rights and is a prosecutable offense. It is the primary house officer's responsibility to personally review the autopsy permission form and verify that it is valid.

Permission for autopsy is usually obtained by the clinical team prior to the arrival of the patient in the morgue. The YNHH autopsy permission form, which is on the back side of the "Autopsy Consultation Request Form", requires the signature of two individuals to be valid. One signature must be the YNHH staff member (usually the attending physician or a resident) who obtained the permission from the family, and the second signature is usually of the family member (next of kin) assuming responsibility for the burial. In some cases, the permission will be taken verbally or over the phone. This form of permission is also valid PROVIDED the permission was witnessed by a second YNHH staff member and that witness has signed the consent form.

In some cases, such as cases brought in from outside for autopsy, you may be asked to obtain or witness a telephone autopsy permission for one of your cases. This involves reading a "standard" permission statement and making sure the family member understands the statement and agrees to it. Answer whatever questions the family member may have. You do not need to describe the process to them in graphic detail, but you should in no way mislead them as to any of the procedures involved. Do not make promises about your findings which you may not be able to keep.

Except under unusual circumstances, autopsy permission obtained prior to the patient's death are not valid, so be sure to compare the time of the permission with the time and date of death. In addition, a patient may not sign his or her own autopsy permission. Any problems with the validity of the autopsy permission should be brought to the attention of the manager of the service.

The family may rescind the autopsy permission at any point prior to the beginning of the autopsy case. Such requests by the family should be immediately brought to the attention of the manager of the service and noted on the permission form. Be sure to record the name of the individual rescinding the permission and the time the department was notified. If the person rescinding the permission is different from the person who gave permission, the general procedure is to hold the autopsy until those two individuals can discuss the matter and come to an agreement.

Be sure to note any restrictions which may appear on the autopsy permit. Make sure everyone in the autopsy room is aware of those restriction and adheres to them. Any ambiguities as to the patient's wishes should be clarified by contacting the physician who obtained the permission before beginning the autopsy, noting the clarification on the form, and signing (with the date and time) the added clarification.

Even an autopsy with "no restrictions" does not give you the freedom to deface the body or make any incisions which might impair the ability of the funeral director to embalm the body. For the most part, special permission is required to enter the extremities. Consult the autopsy manager and the pathology attending if you feel it medically indicated to perform any "unusual" procedures.

Medical Examiner Cases

Connecticut has a centralized Medical Examiner system. Essentially all medical legal autopsies are performed at the Chief Medical Examiner's office in Farmington. It is important to be aware of the criteria for medical examiner reportable cases (examples include deaths within 24 hours of admission or during an invasive procedure or in the recovery room following surgery, deaths due to drub abuse, trauma, or any non-natural disease process, etc.). If, prior to beginning an autopsy on a YNHH patient, your chart review identifies aspects of the clinical history which suggest that the case might fall under the jurisdiction of the medical examiner's office, inform your senior resident and/or the autopsy manager immediately. In most cases, the local assistant medical examiner will be contacted to rule on the disposition of the case. If the local assistant ME is not reachable, the Office of the Chief Medical Examiner should be contacted.

During one or your rotations on the autopsy service, you will do a two week rotation at the Chief Medical Examiner's office in the Bronx, New York. This office is run by Dr. Jim Gill, a former Yale resident, who provides teaching for the residents while they are on this rotation.

Use of Autopsy Material for Research

Yale is an academic center, and as such we strongly encourage research and the creation of links between research and clinical medicine. Autopsies potentially provide an abundance of tissue for research. The use of human material for research purposes requires a formal approval of the use by the Human Investigations Committee (HIC). All requests for autopsy tissue are to be processed through the Tissue Procurement Division of the Yale Pathology Tissue Services Program, which will maintain verification of HIC approval and handle the other administrative aspects of the tissue distribution. Details of the procurement process are described elsewhere in this manual.

In unusual cases, investigators needing fresh tissue or wanting to investigate new procedures on bodies may receive approval to take part in the autopsy. This requires the expressed approval of the director of the autopsy service, who will handle the administrative aspects of the investigation. Under no circumstances should residents or staff release any tissue or allow anyone access to the body except Yale Pathology Tissue Services personnel or investigators specifically designated to you by the director of the autopsy service.

Quality Assurance

Intradepartmental

The department has a multi-component quality assurance program, and the autopsy service is part of that program. A combination of quality control (QC) measures, quality assurance (QA) measures and total quality management (TQM) are incorporated. Briefly, QC examines the accuracy and reproducibility of the test (i.e. are our diagnoses correct and to some extent standardized) while QA examines the efficacy and efficiency of the entire process from accessioning of patient to communication of findings/reporting. TQM ensures that the program is modulated and upgraded with a constant feedback loop.

The quality assurance parameters examined for the autopsy service include turn-around time for provisional anatomic diagnoses, turnaround time for final anatomic diagnoses, enrollment in a College of American Pathologist's approved proficiency testing program, autopsy rates, and random review of autopsy cases.

Interdepartmental

In addition to intradepartmental assessment, the Joint Commission for the Accreditation of Health Care Organizations (JCAHO) requires that the results of autopsies be incorporated into the quality assurance program of the hospital as a whole. One way this is done is to present autopsy cases at a variety of interdepartmental conferences. This occurs in a variety of settings and venues.

We have also established a system for recording in our pathology information computer system all clinical-pathological clarifications/discrepancies from each autopsy performed. A clarification/discrepancy refers to any instance in which the autopsy revealed pathology which was unsuspected clinically, misdiagnosed clinically, or which significantly clarified the clinical differential diagnosis. This information should be entered into the computer system as soon as possible, preferably with the PAD. It may be modified at any time afterward until the case has been signed out. This information will be included in regular reports to the Hospital Quality Assurance Committee and the Hospital's medical board, and will be incorporated into case-based teaching in other departments.

CORONARY ARTERY STENOSIS

When assessing the degree of coronary artery stenosis, remember that it is the fraction of the normal **cross sectional area** still patent which is relevant, NOT the fraction of the diameter.