1 General Approach to Surgical Pathology Specimens

Safety in the Surgical Pathology Laboratory

The key to safety in the surgical pathology laboratory is to recognize that this area is a dangerous place. A variety of noxious chemicals are routinely used in the surgical pathology laboratory, and tissues infected with the human immunodeficiency virus (HIV), hepatitis viruses, mycobacteria, and other agents enter through its doors on a daily basis. Not only are these infectious agents present in the laboratory, but their transmission is also facilitated by the frequent handling of bloody tissues and the routine use of surgical blades, knives, saws, and other sharp instruments. Clearly, the surgical pathology laboratory is no place to ''let down one's guard'' by becoming careless or distracted. Rather, safety in the work area should become an ingrained habit, and universal precautions should be exercised with all specimens.

Protective Gear

The prosector should regard all tissues as potentially infectious, not just those tissues removed from patients known to have an infectious disease. For the protection of oneself and for the safety of others, the prosector should wear protective gear in the cutting area at all times. Protective gear prevents contact of potentially infectious materials with the skin and mucous membranes, and it diminishes the transfer of infectious material outside of the surgical pathology laboratory. At the very least, protective gear should include surgical scrubs, waterproof shoe coverings, a surgical gown and/or waterproof forearm wraps, gloves, a cap, a mask, and eye protection. A waterproof apron should also be worn to prevent the absorption of fluids onto the clothing and skin. Hands should be protected by well-fitting surgical gloves. To prevent seepage of fluids, two pairs of gloves are preferred to one pair, and these gloves should be changed frequently. Keep in mind that even two pairs of gloves will not protect against punctures and cuts. Fine mesh metallic or synthetic gloves that are cut-resistant are recommended in those instances where one is unfamiliar with the use of a sharp instrument or when one is dissecting a specimen with sharp edges (e.g., a bone resection). Soiled or bloody garments and coverings should not be worn outside of the cutting area.

Disposal of Instruments and Trash, and Storage of Specimens

In order to avoid inadvertent wounds, there should be no more than one blade in the dissection field at any one time. Needles, razor blades, scalpel blades, and other sharp disposable objects should be promptly discarded into appropriate containers following their use. Trash items soiled with blood or other potentially infectious materials should be discarded into designated biohazard containers located in the cutting area. Upon completion of the dissection, the specimen should be stored in a container with adequate formalin. Specimen containers should be wiped clean of any potentially infectious materials, securely closed to prevent leakage, accurately labeled, and stored in a designated storage area.

In cases of known viral hepatitis, HIV infection, or tuberculosis, the cutting area should be washed clean and wiped with a disinfectant such as dilute bleach, and a biohazard label should be affixed to the specimen container.

Radioactive Specimens

With the increasing use of radioactive materials as a means to identify sentinel lymph nodes, the proper handling of radioactive materials has become an increasing concern in the surgical pathology laboratory. Although the risk of significant radiation exposure associated with these sentinel lymph nodes is believed to be very low, each institution should nonetheless develop written procedures for handling all radioactive specimens. These procedures should be developed in conjunction with the institution's radiation safety officer and should encompass issues related to the labeling, transportation, processing, storage, and disposal of radioactive specimens. The radiation safety officer is also responsible for training pathology personnel regarding safety issues. Do not be shy about contacting your institution's radiation safety office if you have questions about general policy issues or specific concerns regarding a radioactive specimen.

Fundamentals of Dissection

At first glance the challenges facing the surgical pathology cutter appear almost insurmountable. The types of specimens that come across the cutting table seem endlessly diverse, and the complexity of these specimens may at times be perplexing. To top it off, each specimen, whether a simple needle biopsy or a convoluted composite resection, must be handled with equal care and precision. How then does one confidently and effectively function in the surgical pathology laboratory, given the bewildering diversity and complexity of specimens that enter its doors? Where does one even begin?

For any specimen, the best place to begin is at the end. Even before making the first cut, take time to visualize the end result of your work, the surgical pathology report. Consider the issues that need to be addressed in that report, and then plan a dissection of the specimen that will help address these important issues. While it is true that no two specimens are exactly alike, you will find that the questions they pose are remarkably similar. Even the most complex of specimens can be reduced to three fundamental issues: *What structures are present? What is the nature of the pathologic process? How extensive is that process?* If you are not familiar with the important issues for a given organ, the Association of Directors of Anatomic and Surgical Pathology have an excellent website that summarizes the important diagnostic and prognostic issues for many of the major tumor types (www.panix.com/~adasp/). Regardless of the complexity or novelty of the specimen, these issues can be efficiently addressed by a systematic four-step approach. By mastering these four fundamental steps of surgical dissection, the surgical pathology cutter will be well equipped to tackle even the most intimidating of specimens with confidence.

Step 1. Specimen Orientation

If the surgical pathology report is the end result of the dissection, specimen orientation might be regarded as a road map by which to reach that ultimate destination. With orientation, an otherwise confusing conglomerate of tissue is placed in its proper clinical and anatomic context and appreciated as a structural unit. Then a proper course of dissection can be chartered. Without orientation, specimen dissection can proceed speedily but may never reach its desired aims.

The Requisition Form

Orientation is usually thought of in terms of the structural anatomy of the specimen. While these anatomic considerations certainly are important, a specimen must also be understood in terms of its clinical context. No specimen should be dissected in a ''clinical vacuum''; rather, a strategy for the dissection of any specimen should be directed by the clinical history. For example, a uterus removed for leiomyomas is handled very differently from one removed for cervical cancer. Fortunately, clinical orientation usually does not require a full review of the patient's medical chart. Instead, a pertinent clinical history can often be succinctly communicated through a requisition form (Appendix 1-A). The requisition

form should accompany every surgical specimen. It identifies the patient and the type of specimen, provides relevant clinical history, and alerts the prosector to specific biohazards. Referring physicians are responsible for providing this clinical information. Sometimes the information on the requisition form may not be complete, or a case may be so complex that additional clinical information is required. These situations may necessitate a review of the medical chart, evaluation of imaging studies, and/or direct communication with the requesting clinician. Do not be shy or timid; if in doubt, call the clinician.

Anatomic Orientation

The anatomic orientation is best appreciated at the outset of the dissection while the specimen is still intact. The further the dissection progresses, the more difficult it can become to reconstruct and orient the specimen. Even when the specimen is entirely intact, orientation is not always a simple task. Unlike the surgeon viewing the specimen as it is situated in the patient, the prosector frequently cannot fully appreciate the anatomic context of the isolated specimen lying on the cutting table. Nonetheless, two steps can be taken to overcome this obstacle and confidently orient the specimen: *appreciation of anatomic landmarks* and *communication with the surgeon*.

Anatomic landmarks can be thought of as consistent features (a shape, a contour, a structure, etc.) that serve to indicate a specific structure or designate a position. For example, the uterus can be correctly oriented by the relative positions of its peritoneal reflections, and the orientation of the eye may be guided by the insertion of a specific extraocular muscle. Before proceeding with any dissection, the prosector should be familiar with the anatomy of a specimen and should be able to recognize and interpret its unique anatomic landmarks. Toward this end, an anatomy atlas should be within easy reach of the cutting table.

Sometimes, even with the guidance of an anatomy atlas, the prosector may not be able to orient the specimen. Either the specimen is too complex, or it simply does not possess any useful anatomic landmarks. In these instances, communication with the surgeon takes on a very important role. This communication may take one of several forms. Sometimes a surgeon will use tags, sutures, and/or an accompanying diagram to designate important structures or locations on a specimen. At other times, specimen orientation may require direct communication with the surgeon.

Step 2. Dissecting the Specimen

The Cutting Station

The cutting station should be clean and orderly. Most routine dissections require a ruler, a scale, a scalpel with disposable blades, scissors, forceps, a probe, and a long sectioning knife. At the beginning of each day, the prosector should make certain that these tools are well maintained, clean, and within easy reach. Between dissections, these instruments and the cutting table itself should be rinsed clean of fluids and tissue fragments. This practice will help eliminate contamination of a specimen with tissue fragments from a prior dissection. Similarly, sectioning blades should be rinsed regularly during a dissection so that fragments of a friable tumor are not inadvertently transferred throughout the specimen or to other cases. Nothing is worse than not being sure if a minute fragment of cancer on a slide was a "pickup" from another case.

No more than a single specimen should be on the cutting table at any one time. Although it may seem time efficient to work on multiple specimens simultaneously, this dangerous practice openly invites the loss and mislabeling of specimens. For example, a small biopsy specimen is easily overlooked and discarded when overshadowed by a large and messy specimen on the same cutting table, while specimens of similar size and shape may easily be confused and mislabeled.

Handling of Tissues

While all tissues are to be handled cautiously and gently, small specimens in particular are susceptible to ill-treatment. Small and delicate tissue fragments may be crushed during transfer to a tissue cassette, they may desiccate if not placed in fixative in a timely manner, and they even may be lost during processing if they are not easily seen.

These problems can be minimized by adhering to a few simple guidelines:

1. Small specimens should never be forcibly squeezed between the ends of a forceps or the tips of the fingers. Instead, small specimens should be gently lifted from the specimen container using the end of a wooden applicator stick or pickups. Alternatively, small specimens can be filtered directly into a tissue bag, avoiding instrumentation altogether.
2. Small specimens should be quickly placed in fixative. Ideally, most small specimens (i.e., less than 1 cm) should reach the surgical pathology laboratory already in fixative. This requires that physician offices, biopsy suites, and operating rooms be supplied with appropriate fixatives, and that all personnel involved be instructed as to their proper use. Sometimes delays in fixation are necessary, as when a frozen section is required or when special tissue processing is indicated. In these instances, the tissue should be kept damp in saline-soaked gauze. Never leave small tissue fragments exposed to the air on the cutting table, and never place these small fragments directly on a dry paper towel. These practices are sure to hasten tissue desiccation.
3. For extremely small specimens, the journey from specimen container to histologic slide is a treacherous one, and they may be lost at any point along the way. For this reason, it is a wise practice to identify these small tissue fragments first and then mark the fragments so that they can be found more easily by the histotechnologist. Before the specimen container is even opened, check its contents for the size and number of tissue fragments, and record these in the gross description. If no tissue is seen or if inconsistencies with the requisition form are noted, carefully open the specimen container and thoroughly examine its surfaces (including the undersurface of the lid) for adherent tissue fragments. If no tissue is found or if discrepancies persist, the submitting physician should be notified immediately, and the outcome of this investigation should be documented in the surgical pathology report.

Once all of the tissue is identified in the specimen container, efforts should be taken to ensure that it safely reaches the histology laboratory and that it is easily identified for embedding and sectioning. Minute tissue fragments should be wrapped in porous paper or layered between porous foam pads before they are placed in the tissue cassette. Before these fragments are submitted to the histology laboratory, they can be marked with eosin or mercurochrome so that they are easier for the histotechnologist to see.

Inking the Specimen

Various inks and colored powders can be used to mark critical points on the specimen. These dyes and powders may help orient both the gross specimen and the histologic section. For example, colored tattoo powder sprinkled on the outer surface of a cystic mass can be used to distinguish between the outer and inner aspects of the cavity. Similarly, India ink can be painted on the surgical margins so that they can be easily recognized at the time of histologic examination. Indeed, many times the critical distinction of whether a neoplasm extends to the surgical margin depends entirely on the absence or presence of ink.

Given the important implications of an inked surface, these inks should be carefully and judiciously applied to the gross specimen. Keep in mind that just as the effective use of inks can facilitate the histologic interpretation, the careless and improper use of these inks can befuddle the microscopic findings. Consider, for example, the implications of sloppily applied ink that runs across a surface where it does not belong. The following guidelines outline the proper application of inks:

- If possible, apply ink before sectioning the specimen.
- Do not use excessive ink.
- Dry the surface of the specimen with paper towels before applying ink. When applied to a dry surface, ink is more likely to stick to the desired surface and less likely to run onto other areas of the specimen.
- Allow the ink to dry before further processing the specimen. Do not cut across wet ink, as the knife is likely to carry the ink onto the cut surface.

Opening and Sectioning the Specimen

The manner of opening and dissecting specimens is variable, depending on the type of specimen and the nature of the lesion. Bone marrow biopsies may simply be placed directly into a tissue cassette without any further manipulation, while the dissection of complex bone resections

may require a multistep process involving special chemical reagents, imaging machines, and bone saws. Although this manual provides specific dissection guidelines for most of the specimens you will encounter, a few general guidelines underlie many of the instructions.

First, localize the lesion before sectioning the specimen. One effective way to localize the lesion is simply to palpate the specimen. For example, a small peripheral lung tumor may be readily appreciated simply by palpating the lung parenchyma, and a colorectal tumor can usually be detected by probing the lumen of the specimen with a gloved finger. Sometimes further measures are needed to localize the lesion. Review of specimen radiographs, for example, may be necessary to uncover the size and location of a lesion when it involves a bone. Once the lesion is localized, the specimen can be sectioned in the plane that best demonstrates the pathology.

Second, open the specimen in such a way as to expose the lesion while maintaining its relationships to surrounding structures. In general, the walls of hollow structures (e.g., large bronchi, stomach, intestines) should be opened along the side opposite the lesion to maintain the structural integrity of the lesion and to preserve important anatomic relationships. For tumors involving solid organs, the specimen should be cut along the longest axis of the tumor to demonstrate the tumor's greatest surface area.

Third, remember to dissect and examine the entire specimen. Often, the dissection is so focused on a localized lesion that the rest of the specimen is not examined. Incomplete dissections represent lost opportunities to fully disclose the extent of a lesion and to uncover unsuspected pathologic processes.

Fixing the Specimen

Before tissue is processed in the histology laboratory, it should be well fixed. Some institutions prefer to fix the specimen before it is dissected and sampled, while other institutions would rather you dissect and sample the specimen in the fresh state. Each method has its advantages and disadvantages. Specimen fixation greatly facilitates tissue sectioning. For example, tissue fixation permits thin sectioning of fatty tissues, and it helps to preserve the structural detail of thin-walled cysts, mucosa-lined organs, and friable tumors. One major disadvantage of specimen fixation is simply that it takes time. Fixation of larger specimens may require submersion in formalin for a full day or longer. Delays caused by fixation can be eliminated by dissecting and sampling the specimen while it is fresh. Although this practice may compromise the quality of the histologic sections, it can significantly reduce case turnaround time. Another major disadvantage of specimen fixation is that certain diagnostic studies require fresh, unfixed tissues. This demand for unfixed tissues is rapidly expanding owing to recent advances in genomic assays that require undegraded DNA and/or RNA (see Chapter 3). Most of the dissection descriptions in this manual include a step for fixation. Simply skip this step if your institution does not fix specimens before dissection or if fresh tissue needs to be collected for appropriate studies.

Even when one chooses to fix a specimen, a limited dissection of the fresh specimen is usually necessary. Fixative will not diffuse into the center of an unopened specimen, especially if the specimen is large and fatty. To overcome this, hollow organs and large cysts should be opened and solid tissues should be sectioned. Furthermore, a limited dissection is usually needed to expose a lesion if fresh tissue is required for frozen section evaluation, ancillary diagnostic studies (e.g., cytogenetic studies, flow cytometry), research purposes, or storage in a tissue bank. These important decisions regarding the distribution of tissue must be made while the specimen is fresh, not after the specimen has been submerged in fixative. A detailed description of the various fixatives available and their uses is given in Chapter 2.

Storing the Specimen

The tissue remaining after a specimen has been thoroughly dissected and sampled should not be discarded. Instead, it should be stored in such a way as to ensure easy retrieval and reconstruction of the specimen. Tissues for storage should be placed in a well-sealed container that holds enough fixative to cover the specimen. For a given case, separate parts should be stored in separate containers. Each container should be clearly labeled with the surgical pathology number, the part number, the patient's name, the patient's medical record number, and a biohazard warning when indicated. Specimens that may be of special interest, either from a teaching, diagnostic, or medicolegal perspective, should be so designated

and stored in a permanent storage area. Medical devices likewise should be placed in a properly labeled container and segregated into an area where they can be stored for long periods of time and easily retrieved. Unlike routine tissue specimens, storage of these prosthetic devices does not require fixation.

When preparing a specimen for storage, anticipate the need to return to the specimen at a later time, either to review the gross findings or to submit more sections for histology. Although the specimen may be quite fragmented and distorted following its dissection, efforts should be made to reconstruct the specimen before placing it on a storage shelf. There are many examples of how this can be done. Lymph nodes and their associated soft tissues can be separately wrapped and labeled according to their respective regional levels. Residual slices of a serially sectioned organ can be fastened together in their original positions. Important landmarks can be designated with tags or safety pins. These simple methods of reconstructing the specimen can become invaluable later, when, for example, you have to return to a colectomy to find more lymph nodes, to a prostatectomy to submit additional slices of prostate tissue, or to a mastectomy to sample a specific quadrant of the breast.

Step 3. The Gross Description

Correlation between the macroscopic and microscopic findings is important when evaluating a specimen and rendering a diagnosis. Just as glass slides represent a permanent record of the histologic findings, the gross description represents a permanent record of the specimen's macroscopic features. The goal of the gross description is threefold. First, it serves as a descriptive report that enables the reader to reconstruct the specimen mentally and envision the location, extent, and appearance of the pathologic process. Second, it serves as a slide index, enabling the pathologist to correlate each slide to a precise location on the specimen. Third, it accounts for the distribution of the tissue, documenting how a specimen has been apportioned for various diagnostic and research purposes.

To help reconstruct an image of a specimen, the gross description must be logical, factual, and succinct. A logical description is one that follows an orderly sequence. The first sentence should identify the patient and the specimen. It should tell the reader who the patient is, what the specimen is, and what structures are present. The description should then move from one individual component of the specimen to another in a methodical progression. Proceed from overall to specific, from abnormal to normal, and from relevant to ancillary. The best way to avoid a description that is fragmented and chaotic is to dictate after the specimen has been dissected and examined. This approach allows one to gather all of the information, then integrate the gross findings into a narrative that is comprehensive and complete.

A factual description is one that records the objective characteristics of the specimen. With few exceptions, these characteristics include the size, weight, color, shape, and consistency of the specimen and any specific lesions. Among these, size is particularly important. For example, in resections of neoplasms, the size of the neoplasm is critical in staging the tumor, and the distance from the edge of the tumor to the surgical margin may help to determine the adequacy of excision and the need for adjuvant therapy. For excisions of parathyroid glands, the important distinction between a normal and proliferative gland is made on the basis of the gland's weight.

Quite commonly, the gross description is so diluted by trivial details and technical minutiae that the important macroscopic features are not easily recognized by the reader. A concise dictation is one that ignores this minutiae and records only information that serves to achieve the three goals of the gross description. A leaner description can often be achieved by cutting the fat from two areas of the gross description. First, eliminate verbose descriptions of normal anatomy. Descriptions of normal structures should be restricted to pertinent negative findings and to terse statements about size, color, consistency, and shape that help reconstruct the appearance of the specimen. Second, do not describe the mechanics of the dissection. These technical details are already laid out in the dissection manual and do not belong in the gross dictation unless they clarify the histologic findings or unless your dissection deviates from routine methods (e.g., inflation of a lung with formalin).

Another important function of the gross description is its role as a slide index (Appendix 1-B). The slide index places each histologic slide

in its appropriate anatomic context. Consider, for example, the importance of knowing whether a section of a neoplasm was sampled from the center of a tumor or from the margin of surgical resection. Only the prosector knows for sure where and how the specimen was sampled, and it is the prosector's responsibility to communicate this information in the gross description. This information should be summarized at the end of the gross description in the form of a slide index. The slide index should state the number of pieces submitted in each tissue block, the designations used to identify each tissue block, and the precise meanings of these designations. Tissue designation should strive for simplicity, rationality, and standardization. The designations themselves should use as few letters or numbers as possible, but the meanings of these designations should be specific. For example, two sections of tumor could be designated ''TA'' and ''TB,'' respectively. Remember that slides are frequently sent to other hospitals for consultation, and so these designations also need to be clear to someone not familiar with your institutional idiosyncrasies.

The gross description should also document the distribution of tissue for diagnostic and/or research purposes. Sometimes tissue may be sent for ancillary diagnostic studies including electron microscopy, cytogenetics, and flow cytometry. In some instances fresh tissue may be frozen and stored in a tissue bank so that it can be retrieved at a later time, or tissue may be requested by various laboratories for research purposes. Not only is it important to supervise (under the guidance of a pathologist) the distribution of these tissues, but it is also important to document in the gross description where the tissue has been sent and for what purposes.

Other methods may be used to supplement the description of the macroscopic findings. Among them, photography (see Chapter 4) plays an especially versatile role. Indeed, recent advances in computer technology have expanded the role of photography as an adjunct to the gross dictation. Digital images of the gross specimen can be stored as electronic files, which can be readily retrieved for publication or research purposes or simply to clarify the gross description. Liberal photography is a practice that is to be encouraged as an effective supplement to the gross description.

Finally, remember that the gross description is a legal document, so the typed gross description should be proofread as carefully as the final diagnosis.

Step 4. Specimen Sampling

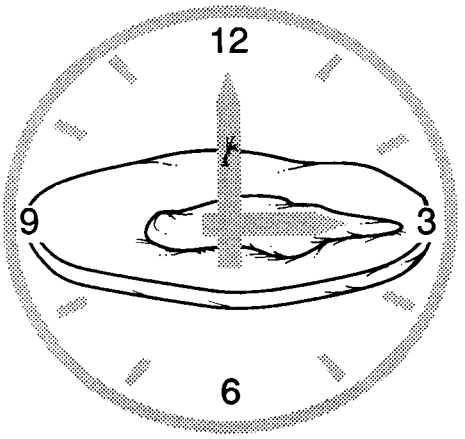
Mindless sampling of a specimen introduces errors at two different extremes. At one extreme, tissue sampling is inadequate, either because the number of sections is too few or the quality of sections is too poor. In these instances, important issues cannot be adequately addressed in the surgical pathology report. Forgetting to assess a surgical margin, failing to determine the extent of local tumor infiltration, and neglecting to check for metastases to regional lymph nodes are common examples of inadequate sampling. At the other extreme, tissue sampling can be excessive. An inordinate number of tissue sections may exact a costly toll on the resources of the surgical pathology laboratory.

The key to an approach that is both economical and thorough is *selective sampling*. Selective sampling is a strategic approach which attempts to maximize the information that can be obtained from a given tissue section. As opposed to random and indiscriminant sampling of a specimen, tissue sampling that is selective increases the information that can be obtained histologically, and it requires fewer sections to do so. Appendix 1-C lists some fundamental guidelines for selective tissue sampling.

Sampling a Tumor

The goals of tumor sampling go beyond the question of ''What is it?'' Tumor sampling is concerned not just with the type of a tumor but also with its histologic grade and the degree to which it has extended into surrounding structures. A tumor should be sampled with the objective of addressing all three of these issues.

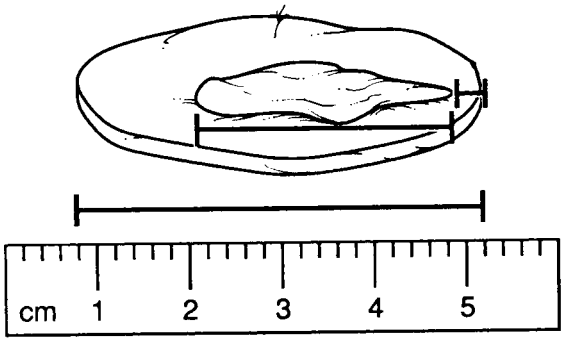
In general, most sections of a tumor should be obtained from its periphery. This peripheral zone is often the best preserved region of a tumor, while the central zone is frequently so necrotic that it yields no useful histologic information. In addition, the tumor's periphery demonstrates the interface of the tumor with adjacent tissues. This interface zone may provide evidence regarding where a tumor has arisen (e.g., colorectal carcinoma arising in a pre-existing villous adenoma);



Fundamentals of Specimen Dissection

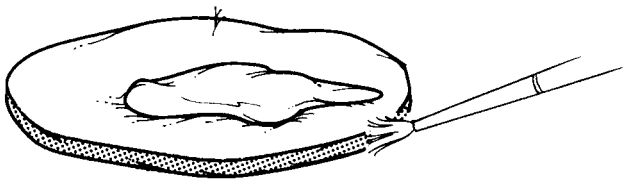
1. Orient

Use anatomic landmarks and/or surgical designations to help orient the specimen. In the illustration, the surgeon has placed a suture at the 12-o'clock position of the skin ellipse.



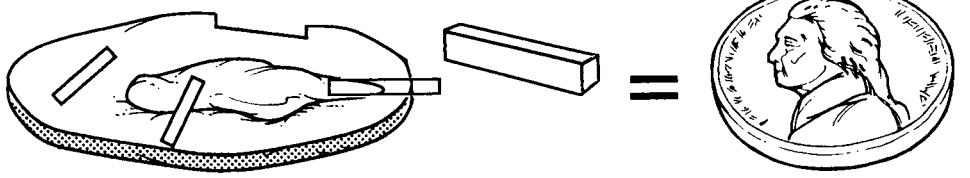
2. Measure

Size is one of the most important parameters to document in the gross dictation. Include not only the overall dimensions of the specimen but also the size of the lesion and its distance from the surgical margin.



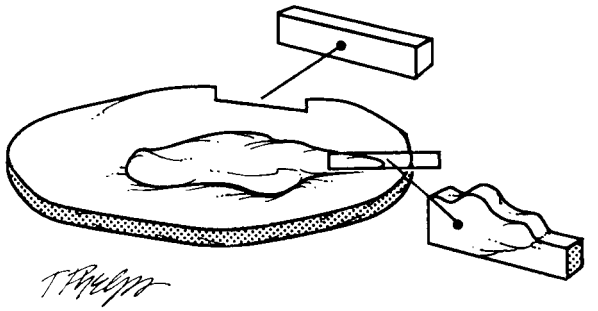
3. Ink

Application of ink to the cut surface of the specimen is a good way to mark the resection margin.



4. Sample

Adequately sample the specimen. Include sections of the lesion, normal tissue, and the margins. Sections should be no bigger than the diameter and thickness of a nickel.



5. Assess Margins

A perpendicular section is a good way to evaluate the margin when it is closely approached by a lesion. This section shows the distance of the lesion to the edge of the specimen. A parallel section evaluates a larger surface area of the margin, and it may be used to evaluate a margin that is not closely approached by the lesion.

important clues about the biologic behavior of the tumor (e.g., transcapsular invasion of a follicular thyroid carcinoma); and information regarding the degree of local tumor invasion (e.g., depth of invasion of a cancer into the wall of the colon).

Questions frequently arise regarding the number of sections that should be taken of a tumor. Unfortunately, there is no single answer, since the appropriate number of sections depends on the type of specimen. For example, a single section from a solitary liver nodule may be sufficient to confirm that it is a metastasis, but such limited sectioning of a solitary thyroid nodule may not allow distinction between a follicular adenoma and a follicular carcinoma. Despite this tremendous variability between specimens, a few general considerations should guide the sampling of a tumor. First, when trying to assess the histologic type and grade of a neoplasm, be sure to sample all areas of the tumor that, on gross inspection, appear different. Even strict adherence to rigid rules such as ''one section per 1 cm of tumor'' may not be adequate if the sections are not selectively taken from areas of the tumor that appear grossly distinct. Second, sections of large cysts should be taken from areas where the cyst wall appears thickened or where the cyst lining has a complex appearance (e.g., shaggy, papillary excrescences). Sections from these areas are most likely to reveal the proliferative areas of the cyst lining and to demonstrate tumor infiltration of the cyst wall. Third, when concern exists about malignant transformation within a benign lesion or premalignant process, the lesion should be extensively if not entirely submitted for histologic evaluation. A number of examples fall under this category, including mucinous cystic neoplasms of the ovary and pancreas, adenomas of the gastrointestinal tract, Barrett's esophagus with dysplasia, *in situ* transitional carcinoma of the urinary bladder, and many others.

Sampling a Margin

The margin is the edge or the boundary of the specimen. It represents the plane where the surgeon has sectioned across tissues to remove the specimen from the patient. The surgical margin may be free of disease; that is, a rim of uninvolved tissues may surround a pathologic lesion that has been completely resected. Alternatively, the lesion could extend to the edge of the specimen, implying that the lesion has not been completely removed. Clearly, the status of a surgical margin is an important indicator of the potential for the disease to recur and of the need for further therapy. Therefore, the assessment of these margins, both grossly and microscopically, is of considerable importance.

As illustrated, margins can be sampled in one of two ways: They can be taken as either as perpendicular section or a parallel section. A perpendicular section is one taken at a right angle to the edge of the specimen. In this type of section, the true margin is present at one of the two ends of the section. The advantage of a perpendicular section is that it can be used to demonstrate the relationship of the edge of the tumor to the margin. A perpendicular section allows the important distinction between a lesion that truly extends to the margin and a lesion that very closely approaches but does not involve the margin. Since only a small surface area of the margin is represented in a perpendicular section, the margin must be carefully inspected and then selectively sampled from those areas where it is most closely approached by the tumor.

A shave section is one taken parallel to the edge of the specimen. Because the entire shave section spans the margin, a relatively large surface area at the margin can be evaluated with a single section. A shave section is ideal for obtaining complete cross sections of small luminal or cylindrical structures. Unlike the perpendicular section, the shave section does not effectively demonstrate the relationship between the margin and the edge of the tumor. Its major drawback is that it cannot be used to distinguish between a lesion that truly extends to the margin and one that very closely approaches but does not actually involve the margin. For this reason, shave sections should be reserved for those instances when the margin appears widely free of tumor or when dealing with small luminal or cylindrical structures that are not easily sampled using perpendicular sections.

To help the pathologist interpret the histologic findings, the slide index portion of the gross description should clearly document how the margin was sampled. The presence of tumor in a margin section may have entirely different implications, depending on whether the margin was sampled using a perpendicular or parallel section.

Sampling Lymph Nodes

A specimen dissection is not complete until the lymph nodes, when present, have been found and sampled. Sampling of lymph nodes is especially important for resections of neoplasms where critical staging information may depend on the number and location of lymph nodes involved by metastatic tumor.

Although the lymph node status is clearly important in staging neoplasms, finding these lymph nodes can be a tedious and frustrating job. They may be small, inconspicuous, and entirely overshadowed by the fibroadipose tissues in which they are embedded. Skill at finding lymph nodes develops over time, but a few guidelines may enhance the efficiency of your search. First, it is generally best to orient the specimen, designate the various regional lymph node levels, and submit margins of the soft tissues before a lymph node dissection is undertaken. Keep in mind that lymph node dissections require significant distortion and manipulation of the soft tissues such that the specimen may not be easily reconstructed following a thorough search for lymph nodes. Second, many prefer to look for lymph nodes in the fresh specimen. Lymph nodes are often best appreciated by touch, and smaller lymph nodes may elude detection when the surrounding soft tissues have been hardened by fixation.

Lymph nodes larger than 5 mm should be serially sectioned at 2- to 3-mm intervals. A common error is to submit multiple slices from more than one lymph node in the same tissue cassette for histologic evaluation. This may cause considerable confusion regarding the number of involved lymph nodes if more than one tissue fragment contains metastatic tumor. To avoid this confusion, a given cassette should contain slices from only one lymph node. A more detailed description of the processing of lymph nodes for the evaluation of metastatic disease is provided in Chapter 5.

Sampling Normal Tissues

Even tissues that do not appear to be involved by a pathologic process should be sampled for histologic evaluation. Histologic evaluation can uncover diseases that may not have been appreciated on gross inspection. These microscopic alterations may be entirely unrelated to the primary lesion, or they may be closely associated findings that provide important insight into the origin of the primary lesion. It is also important to sample normal tissues to document the structures that were surgically removed. For example, a section taken from the adrenal gland in a radical nephrectomy specimen clearly documents that this organ was removed, identified, and examined.

The Surgical Pathology Report

The surgical pathology report is a comprehensive statement that integrates the macroscopic and microscopic findings. It represents the summation of efforts on the part of the prosector, the histotechnologist, and the pathologist. Forms are now available that have standardized the reporting of the pathologic findings in a comprehensive way. For the prosector facing a complex and intimidating specimen, the time to contemplate the content of the surgical pathology report is not after the dissection is completed but before the first cut is even made. With this in mind, this manual describes the dissections of various specimens, including a tabulation of important issues to address in the surgical pathology report. These lists are provided so relevant clinical issues can be kept in mind as specimens are dissected, described, and sampled.

Appendix 1-A. Information to Be Included in the Specimen Requisition Form

Patient Identification	Type of Specimen	Clinical History	Additional Notations
Full name	Date of specimen collection	Pertinent clinical history	Special requests
Identifying number	Site of specimen	Differential diagnosis	Biohazard alerts
Date of birth	Type of procedure	Operative findings	Name/phone number of physicians to contact

Appendix 1-B. Example: Slide Index for a Modified Radical Mastectomy

Designation	Meaning	No. of Pieces of Tissue
FSC	Frozen section control	1
TA	Tumor—(A = first tissue block)	1
TB	Tumor—(B = second tissue block)	1
UIA	Upper inner quadrant	1
UIB		1
UOA	Upper outer quadrant	1
UOB		1
LIA	Lower inner quadrant	1
LIB		1
LOA	Lower outer quadrant	1
LOB		1
N	Nipple	2
S	Skin	1
LNIA	Level I lymph nodes	3
LNIB		2
LNIIA	Level II lymph nodes	2
LNIIB		4
LNIIIA	Level III lymph nodes	3
LNIIIB		4
Total blocks: 19		Total pieces of tissue: 32

Appendix 1-C. Selective Specimen Sampling

Tumor Sampling

- Sections from the periphery of a tumor are usually more informative than are sections from the center of a tumor.
- For heterogeneous tumors, sample all components of the tumor.
- For cystic lesions, sample areas of the cyst wall that are thickened or lined by a complex surface.
- If there is concern about a hidden focus ofmalignant transformation within a benign neoplasm or premalignant process (e.g., infiltrating carcinoma arising in a pre-existing villous adenoma), the lesion should be extensively, or even entirely, sampled for histologic evaluation.

Margin Sampling

- Always sample the specimen margins, even from lesions that are clinically thought to be benign (e.g., gastric ulcers).
- Perpendicular sections show the relationship of the lesion to the margin. Perpendicular sections are usually preferred to parallel sections, especially when the margin is closely approached by the tumor.
- Shave (i.e., parallel) sections are sometimes best when the margin appears widely free of tumor or for samples of a cylindrical or tubular structure (e.g., optic nerve or ureter margins).

Lymph Node Sampling for Tumor Staging

- Orient the specimen, submit soft tissue margins, and designate regional lymph node levels before dissecting the soft tissues for lymph nodes.
- Lymph nodes are easiest to find in unfixed tissues where they can be more readily appreciated by palpation.
- Lymph nodes larger than 5 mm should be sectioned to facilitate tissue fixation.
- Never submit multiple sections from more than one lymph node in a single tissue cassette.

Normal Tissue Sampling

- At least one representative section should be taken from each grossly normal structural component of the specimen.