4 Principles of Surgical Therapy in Oncology

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History of Surgical Oncology

The role of surgery in the treatment of cancer has seen a dramatic change over the past century, from that of the only chance for cure to becoming one weapon in an armamentarium of oncologic therapies. As the role of surgery changes, so has the role of the surgeon, evolving from *cancer surgeon* to *surgical oncologist*. This role continues to evolve, as the management of cancer is altered by increased knowledge of genetics, molecular biology, and tumor immunology. Although surgery has historically been the first line of defense against a tumor, the escalating use of neoadjuvant therapies often shifts surgery to the second or third line. The role of surgery has expanded from that of purely therapeutic to include both palliation and prophylaxis. Inasmuch as surgeons are the ones with direct access to tumors, they have cemented their role as physician-scientists, investigating novel molecular and immunologic therapies. As new discoveries continue to transform our approach to cancer, the field of surgical oncology will continue to evolve (Table 4.1).

The surgical treatment of superficial cancers is clearly not a new concept. Some of the oldest medical records in existence, Egyptian papyri dating back to 1700 B.C., describe the cautery destruction of the breast.[1] Celsus and Galen, Roman physicians of the first and second centuries A.D., wrote about breast cancer operations, and the Greek physician Lenoidas described a mastectomy for breast cancer, including the use of cautery for hemostasis, in the 5th century A.D. Surgery was obviously limited to superficial tumors, and even that approach was halted throughout the dark ages of medicine. Ultimately the humoral theories of disease (blood, phlegm, white bile, and black bile) were replaced by scientific experimentation, and the principles of modern medicine began to take shape.

The principles of surgical oncology, along with several other fields, found their start with John Hunter (1728–1793), often referred to as the father of surgery. He first described many of the concepts of surgical oncology, including the idea that cancer could be a localized process that was potentially amenable to surgical cure. He stressed the need for total removal of the cancer along with the potential areas of lymphatic spread a century before Halsted's theory. These theories would not realize themselves, however, until the surgery itself became more feasible through a better understanding of anatomy and pathology through autopsies, the introduction of general anesthesia in 1842, and the principles of antisepsis, first described by Lister in 1867. This knowledge allowed surgical oncology to expand beyond superficial tumors, such as breast cancer, to the treatment of intraabdominal malignancies.

The next few decades would see the description of several major operations for cancer, including many by Theodore Billroth of Vienna, who could probably be considered the first surgical oncologist. He is most well known for the first successful partial gastrectomy for cancer (1881), but he also described the first total laryngectomy (1873), the first hemipelvectomy (1891), and the first suprapubic removal of a bladder tumor.[2] Other notable milestones include the resection of colon cancer (Weir, 1885),[3] the radical mastectomy (Halsted, 1891),[4] the radical hysterectomy for cancer (Kelly, 1895),[5] the first radical neck dissection (Crile, 1906),[6] and the first abdominoperineal resection for rectal cancer (Miles, 1908).[7]

Throughout the first half of the 20th century, surgery remained the mainstay of cancer treatment. Although these major operations were not without significant mortality and morbidity, the risks of surgery were still outweighed by the potential for cure or palliation of symptoms. It is during this time that the phrase *cancer surgeon* was popularized, as the only major advances in cancer care were surgical. Cancer surgeons were in abundance at the major medical centers and were the clinical leaders at the few dedicated cancer centers.

The mid-20th century saw advances in cancer therapies outside the realm of surgery. Roentgen's discovery of X-rays in 1896 ultimately led to radiation treatments for surface cancers such as those of the cervix, head and neck, or breast. Chemotherapy entered the scene with the discovery of the alkylating agent nitrogen mustard in WWII,[8] the folic acid antagonists reported by Farber in 1948,[9] and the concept of hormonal alteration proposed by Nobel laureate Charles Huggins in 1941.[10] It soon became apparent that cancer could be treated using more than one modality. It was at this time that the field of oncology began to mature, with clinical chemotherapists becoming known as oncologists. James Ewing, a pathologist who had experimented with immunotherapy, chemotherapy, and radium, established the multidisciplinary approach to the treatment of cancer with his book entitled *Neoplastic Diseases*.

In the mid-1960s, the term *surgical oncology* first arose; however, this phrase served to differentiate not between

TABLE 4.1. Important milestones in surgical oncology.

1600–1700 B.C.	Egyptians use cautery to destroy breast cancer.
400 B.C.	Hippocrates describes the clinical symptoms of cancer and coins the terms "carcinoma" and "sarcoma."
1st and 2nd century A.D.	Roman physicians use surgery to treat breast cancer.
5th century A.D.	The Greek physician Lenoidas first describes a mastectomy as a treatment of breast cancer.
1760s	John Hunter, the "Father of Scientific Surgery," describes principles of surgical oncology including cancer as local disease and lymphatic spread.
1775	Percival Pott describes scrotal cancer in chimney sweeps, first identifying a specific etiology of cancer.
1809	The first modern elective surgery for an abdominal cancer is performed: the removal of a 22-lb ovarian tumor by Ephraim MacDowell.
1829	Joseph Recamier first describes the principles of tumor metastasis.
1846	The first major cancer operation is performed under general anesthesia: the excision of the submaxillary gland and part of the tongue by John Collins Warren.
1867	Lister describes the principles of antisepsis and introduces carbolic acid, greatly reducing the morbidity of surgery.
1873	First total laryngectomy for laryngeal cancer by Theodore Billroth.
1881	First partial gastrectomy for cancer by Theodore Billroth.
1885	First colectomy for colon cancer by Robert Weir.
1887	New York Cancer Hospital becomes the first hospital in the United States specifically for cancer treatment.
1891	First hemipelvectomy by Theodore Billroth; first radical mastectomy for breast cancer by William Halsted.
1896	Roentgen discovers X-rays, ultimately leading to radiation oncology; G.T. Beason performs the first oophorectomy as hormonal treatment for breast cancer.
1906	First abdominoperineal resection for rectal cancer by W. Ernest Miles.
1909	Theodore Kocher first describes thyroid surgery.
1913	Both the American Association for the Advancement of Cancer (which would become the American Cancer Society) and the American College of Surgeons are established.
1919	James Ewing publishes *Neoplastic Diseases*, promoting the concept of the multidisciplinary treatment of cancer.
1927	First resection of pulmonary metastases by George Divis.
1935	First pancreaticoduodenectomy for pancreatic cancer by Allen O. Whipple.
1940	The James Ewing Society is established to "further our knowledge of cancer."
1940s	Chemotherapy begins with the discovery of nitrogen mustards and folic acid antagonists.
1957	The initiation of the National Surgical Adjuvant Breast Project (NSABP).
1960s	Dr. Walter Lawrence establishes a division of surgical oncology at the Medical College of Virginia.
1975	The Society of Surgical Oncology (SSO) is established.
1978	The term *surgical oncologist* is defined by the SSO and NCI, and the SSO formulates guidelines for postresidency surgical oncology training.
1998	The American Board of Surgery establishes the Advisory Council for Surgical Oncology. The American College of Surgeons Oncology Group (ACOSOG) is established.

cancer surgeons and general surgeons but rather between surgeons and oncologists. Although the fields of medical oncology and radiation oncology were quickly acknowledged as legitimate subspecialties, the field of surgical oncology had difficulty separating from general surgery. Most well-trained general surgeons felt capable of performing the majority of cancer operations, and so subspecialization was limited to university hospitals that allowed such a focus. In the mid-1960s, the Medical College of Virginia was the first university department of surgery to establish a formal division of surgical oncology under the auspices of Dr. Walter Lawrence. By 1986, 38% of university surgery departments had done the same.[11] Despite the territorial conflicts between general surgeons, whose workload continues to be devoted in large part to cancer, and the surgical oncologist, the field continued to emerge as a surgical subspecialty. In 1975, the Society of Surgical Oncology (SSO) was established from the James Ewing Society, a group of alumni who had trained at the Memorial Sloan-Kettering Cancer Center and gathered in New York for both scientific and social purposes. Although not a purely surgical society, it was dominated by surgeons and was established with the premise that its members would continue to be true to the inspiration of Dr. Ewing and his multidisciplinary approach to cancer. In conjunction with the National Cancer Institute (NCI), the SSO defined a surgical oncologist as an individual who is a fully qualified general surgeon who has had additional training and experience in all aspects of oncology, is capable of collaborating well with other oncology disciplines, has a full-time commitment to oncology, and serves the important role of leader of his fellow general surgeons in the care of the cancer patient.

Goals of Cancer Surgery

With the expansion of the multidisciplinary approach to cancer, the role of the surgeon has changed significantly. In addition to the well-established curative role, surgeons are

often asked to obtain tissue for diagnosis and staging, debulk tumors as part of multimodality therapy, palliate incurable patients, or prevent cancer by the surgical removal of nonessential organs. As the management of cancer is altered by new discoveries in genetics, molecular biology, immunology, and improved therapeutics, so too will the functions of the surgical oncologist change. With our increased understanding of the genetic predisposition to cancer, the surgeon is increasingly being asked to remove healthy organs to prevent malignancy. However, as other effective methods of prevention are developed, such as chemoprevention or gene therapy, this role will certainly diminish. Improving imaging technologies may have diminished the need for surgical intervention for staging (such as in Hodgkin's lymphoma), but the expanded use of neoadjuvant therapies often requires interventions to accurately assess response to therapy. In addition, harvesting tumors may become increasingly important for molecular staging as well as identifying molecular targets for specific therapies. It is therefore imperative for surgical oncologists to remain up-to-date on the newest approaches to cancer therapy, both multidisciplinary and experimental, and be prepared to adapt to the changing requirements for surgery.

Curative Surgery

Surgery for Primary Cancers

The major objective for surgery of the primary cancer is to achieve optimal *local control* of the lesion. Local control is defined as the elimination of the neoplastic process and establishing a milieu in which local tumor recurrence is minimized. Historically, this was achieved with radical extirpative surgeries that shaped the surgical oncologists' major objective, namely, avoiding a local recurrence. Before William Halsted's description of the radical mastectomy, surgical treatment of breast cancer resulted in a dismal local control rate of less than 30%. The reason why Halsted's procedure was adopted as a standard approach was because he achieved greater than 90% local control, despite the fact that the overall survival of his patients was not improved.[4] The latter was due to the locally advanced stage of the patients who were treated in those days. This consideration ushered in the concept of en bloc removal of adjacent tissue when removing a primary cancer. Halsted's mastectomy involved the removal of adjacent skin (often necessitating a skin graft), underlying pectoral muscles, and axillary lymph nodes (Figure 4.1).

One of the major principles of surgical therapy of the primary tumor is to obtain adequate *negative margins* around the primary tumor, which could mean different operative approaches depending on the tumor type and its local involvement with adjacent structures. For example, the removal of a primary colon cancer that involves an adjacent loop of small bowel or bladder requires the en bloc resection of the primary tumor along with removal of the involved segment of small bowel and bladder wall. This approach avoids violation of the primary tumor margins that could lead to tumor spillage and possible implantation of malignant cells in the surrounding normal tissues. Aside from biopsies of the primary tumor, the lesion should not be entered during a definitive resection. In fact, any biopsy tract or incision that was performed before the tumor resection should be included in the procedure to reduce the risk of local recurrence (Figure 4.2).

The risk of local recurrence for all solid malignancies is clearly increased if negative margins are not achieved. The adequacy of the negative margin has been defined for most tumor types either from retrospective clinical experience or prospective clinical trials. For example, a 5-cm margin is an adequate bowel margin for primary colon cancers that has been established from clinical experience. Likewise, it is accepted that a 2-cm distal margin for rectal cancers results

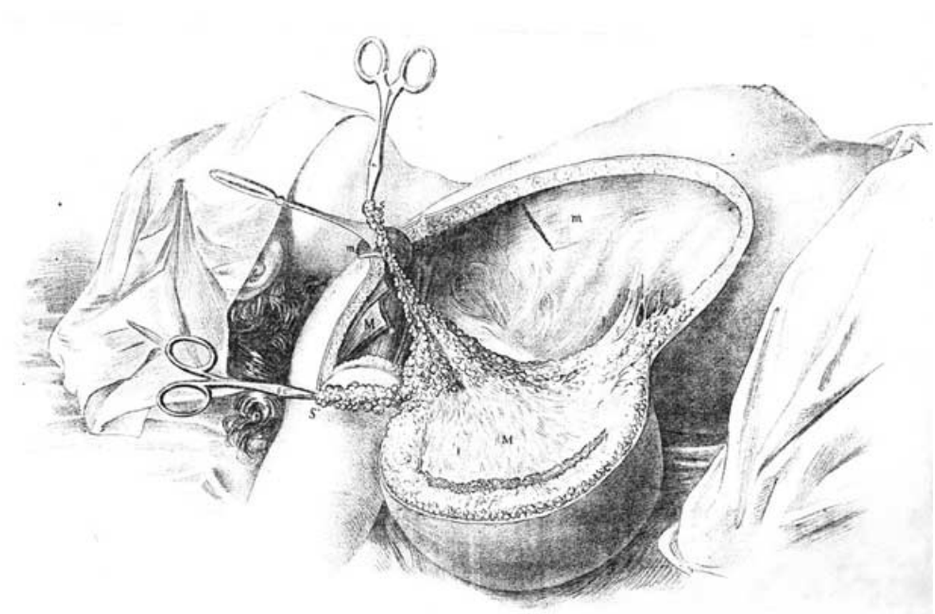

FIGURE 4.1. Original drawing of the radical mastectomy reported by William S. Halsted in 1894. Introduction of this operation led to improved local control in the treatment of breast cancer. (From Halsted,[4] by permission of *Annals of Surgery*.)

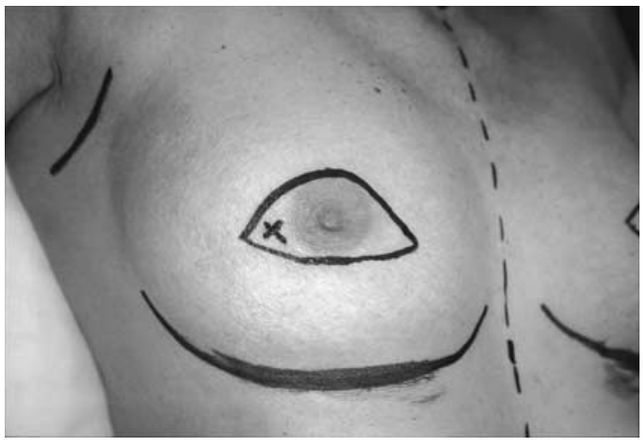

FIGURE 4.2. Location of core-needle biopsy site (*x*) in a patient undergoing a skin-sparing mastectomy for breast cancer. The biopsy site is incorporated in the elliptical skin incision to be removed en bloc with the specimen.

in adequate local control. Through several prospective, randomized clinical trials, the margins of excision for primary cutaneous melanomas differ according to the thickness of the primary (see Chapter 60). It was a commonly held notion that the development of a local recurrence would in itself result in metastatic disease with decreased overall survival. However, this has not been borne out in the context of prospective trials as described here.

The emergence of multimodal therapy has dramatically affected the surgical approach to many primary cancers, especially when surgical resection of the tumor is combined with radiotherapy. Local control is significantly improved after surgical resection of breast, rectal, sarcoma, head and neck, and pancreatic primary cancers. In fact, the addition of radiation therapy as an adjunctive therapy has allowed for less-radical procedures to be performed with an improvement in the quality of life of patients. A prime example of this is in breast cancer. Several clinical trials have demonstrated that the overall survival of patients with invasive breast cancer was comparable if treated by mastectomy versus lumpectomy plus adjuvant radiotherapy (see Chapter 55). This realization has resulted in better cosmesis and quality of life. In the National Surgical Adjuvant Breast and Bowel Project protocol, B-06, local recurrence in breast cancer patients did not affect overall survival.[12] In this seminal study, women with stage I or II breast cancer were randomized to total mastectomy with axillary node dissection, lumpectomy, and axillary node dissection followed by breast irradiation, or lumpectomy and axillary node dissection without irradiation. There was a significantly greater local relapse of tumor in women who underwent lumpectomy who did not receive breast irradiation versus those who received it (10% versus 39%, respectively, *P* less than 0.001). However, there was no difference in overall survival between any of the randomized groups. This study demonstrated the improved local control achieved with irradiation combined with lumpectomy.

Another example of how irradiation has altered surgical management of cancers is with extremity sarcomas. Before the 1970s, amputation was the standard surgical therapy of extremity soft tissue sarcomas because of the excessive local relapse rate with wide excisions. In a landmark trial conducted at the National Cancer Institute, subjects with high-grade soft tissue sarcomas were randomized to receive amputation versus limb-sparing surgery plus radiotherapy.[13] All subjects received postoperative chemotherapy. Despite a higher local recurrence rate in the limb salvage group, there were no significant differences in overall survival between the randomized groups. This study paved the way for offering limb salvage procedures for patients with soft tissue sarcomas.

As the field of multimodality therapy has developed, the role of surgery as primary therapy for certain solid malignancies has changed. The concept of neoadjuvant therapy where chemotherapy and/or radiation therapy is administered before surgical resection has become standard care for some tumors. A prime example of this is the treatment of anal squamous cell cancers. Before the 1970s, the primary therapy for this cancer was an abdominoperineal resection, which involves removal of the rectum and creation of a permanent colostomy. The discovery of effective chemoradiation therapy for this tumor has resulted in a high percentage of complete responses in many patients who then require having only excisional biopsies of residual scar.[14,15] This change has spared patients from having an abdominoperineal resection, which is now reserved for those who fail to completely respond to chemoradiation or who subsequently relapse. Another example is the treatment of childhood rhabdomyosarcomas. In breast cancer, the use of neoadjuvant chemotherapy has been able to render many more women to be candidates for breast-sparing surgery who may not have been initially because of large tumor size.[16,17] Postoperative adjuvant therapies involving chemotherapy and/or radiation therapy have also become standard approaches in many solid tumors, resulting in improved local control and overall survival.

Surgical Resection of Regional Lymph Nodes

The regional lymph nodes represent the most prevalent site of metastasis for solid tumors. Because of this, the involvement of the regional lymph nodes represents an important prognostic factor in the staging of the cancer patient. For this reason, the removal of the regional lymph nodes is often performed at the time of resection of the primary cancer. Besides staging information, a regional lymphadenectomy provides *regional control* of the cancer. Examples of this are patients with melanoma who have tumor metastatic to lymph nodes. It is well documented that the removal of these regional lymph nodes can result in long-term survival benefit in approximately 20% to 40% of individuals depending upon the extent of nodal involvement. Hence, the removal of regional lymph nodes can be therapeutic.

The controversies regarding regional lymphadenectomy for solid malignancies have related to the timing of the procedure as well as the extent of the procedure. For some visceral solid tumors such as gastric and pancreatic cancers, the extent of lymphadenectomy at the time of primary tumor resection has been hypothesized to be important in optimizing local and regional control and has an impact on improving overall survival. This concept has not been borne out in prospective randomized trials of gastric cancer in which the extent of lymphadenectomy has been examined (see Chapter

42). Based on these trials, the more-extended lymphadenectomy appears to result in more accurate staging of patients at a cost of increased morbidity. For nonvisceral solid tumors such as melanoma, breast cancers, and head and neck squamous cancers, the *elective* removal of regional lymph nodes at the time of primary tumor resection has been postulated to result in better survival outcomes compared to taking the wait-and-watch approach. The latter involves performing a lymphadenectomy only when the patient relapses in a nodal basin that would then necessitate a therapeutic lymph node dissection. In prospective randomized clinical studies evaluating elective versus therapeutic lymph node dissection in various tumor types, there was no survival advantage for performing elective lymph node dissections (Table 4.2).[18–25] It is apparent from these controversies that the initial removal of regional lymph nodes is most important for its staging impact, rather than its therapeutic effect. The introduction of *selective lymphadenectomy* based upon the concept of the *sentinel lymph node* has dramatically improved our ability to stage the regional lymph nodes of certain cancers. This is reviewed in more detail in the Diagnosis and Staging section of this chapter.

Surgical Resection of Metastatic Disease

The resection of *isolated* metastases in patients with solid malignancies should always be a consideration when technically feasible. The term *isolated* metastasis implies that there are no other sites of metastatic disease present as assessed by clinical and imaging modalities. Hence, the selection of candidate patients for surgical resection requires a thorough evaluation of the individual's disease status, preoperative medical status, and assessment of the feasibility of resecting the metastatic site with a negative margin. This process ends up identifying a small subset of patients who would be surgical candidates. Although there are no prospective randomized

TABLE 4.2. Randomized trials evaluating elective versus therapeutic lymphadenectomy (Level 1 evidence).

Author	*Reference*	*Cancer*	*Year*	*No. of patients*	*Randomized groups*	*F/U period*	*Results*
Fisher et al.	18, 19	Breast (clinical T1, T2, NO)	1977	1,079	Total mastectomy vs. total mastectomy and RT[a] vs. radical mastectomy	21 years	No significant differences between groups in overall or disease-free survival
Vandenbrouck et al.	20	Squamous cell cancer of oral cavity (clinical T1-3, NO)	1980	75	Elective neck dissection vs. therapeutic neck dissection	5 years	No significant differences between groups in overall or disease-free survival
Veronesi et al.	21, 22	Extremity melanoma (clinical NO)	1977	553	Elective lymphadenectomy vs. therapeutic lymphadenectomy	5 years	No significant differences between groups in overall or disease-free survival
Sim et al.	23	Melanoma (clinical NO)	1986	171	No lymphadenectomy vs. elective lymphadenectomy vs. delayed lymphadenectomy	4.5 years	No significant differences between groups in overall or disease-free survival
Balch et al.	24	Melanoma (intermediate thickness; clinical NO)	1996	740	Elective lymphadenectomy vs. therapeutic lymphadenectomy	7.4 years	No significant differences between groups in overall or disease-free survival
Cascinelli et al.	25	Truncal melanoma (>1.5 mm thickness; clinical NO)	1998	240	Elective lymphadenectomy vs. therapeutic lymphadenectomy	11 years	No significant differences between groups in overall or disease-free survival

F/U, follow-up.

[a]RT, radiation therapy to chest wall, internal mammary, axillary, and supraclavicular lymph nodes.

clinical studies documenting the survival benefit of surgical resection of isolated metastases, there is a significant body of retrospective evidence indicating that this approach can result in significant long-term benefit in patients with either lung or liver metastases. Aside from the regional lymph nodes, both lung and liver represent the next most common sites to which solid tumors metastasize.

The resection of metastases to the lung in patients with osteogenic or soft tissue sarcomas has been established from numerous retrospective reports. Both osteogenic and soft tissue sarcomas have a propensity to metastasize to the lung as the only site. Computed tomography studies of the lung are capable of identifying lesions that are a few millimeters in size. Multiple wedge excisions can be performed utilizing stapling devices without compromise of pulmonary function. Pulmonary metastasectomies for bone and soft tissue sarcoma can result in 5-year overall survival rates of approximately 35% if all disease is resected.[26,27] The resection of metastases for adenocarcinomas is not so well documented. Primary adenocarcinomas often metastasize to multiple sites and do not result in isolated lung metastases. When they are confined to the lung, the metastases are often too numerous to consider wedge resections. There are retrospective reports indicating that, in select patients with metastatic adenocarcinomas to the lung (i.e., colorectal primaries), resection can result in long-term survival benefit.[28,29]

A large body of retrospective evidence documents the benefit of resecting isolated liver metastases; this is especially the case for colorectal primary cancers. These cancers appear to have a pattern of spread that involves the liver as the initial site of metastasis. Resection of solitary or multiple colorectal liver metastases has resulted in a 25% to 40% overall 5-year survival rate, depending on the extent of liver involvement. Factors that have been associated with better survival are node-negative primary cancers, prolonged disease-free interval from time of primary resection to diagnosis of liver metastases, negative margins of hepatic resection, and fewer numbers of hepatic metastases (see Chapter 95). Current trials are under way to determine if adjuvant therapies given after hepatic metastasectomies further improve survival in this patient group. Besides colorectal liver metastases, the resection of noncolorectal liver metastases also can be therapeutic or palliative for selected individuals. For example, the resection of functional neuroendocrine metastases to the liver can result in palliation and prolonged survival of patients.[30] These tumors tend to be indolent in their growth rate; however, the symptoms associated with the metastatic lesion can often be detrimental to the quality of life of the patient. For other nonneuroendocrine, noncolorectal liver metastases, resection can result in survival benefit as well. Patients with isolated genitourinary or gynecologic primary malignancies with a prolonged disease-free interval have been reported to benefit from aggressive resection of hepatic metastases.[31]

Both liver and lung represent the majority of the evidence that resection of visceral metastases can result in long-term survival. These results have been observed usually in the absence of adjuvant systemic therapies. Our current concept that solid malignancies are systemic at their onset (i.e., breast cancer) would have us surmise that, with the presence of bulky visceral metastases, there must also be micrometastatic disease present at the time the bulky disease is resected. Nevertheless, approximately 20% to 25% of individuals remain disease free for many years. This finding begs the notion that perhaps an immune mechanism is involved in preventing disease relapse in a subset of these patients. Besides liver and lung sites, there are clearly anecdotes and published series indicating that the resection of isolated metastases to skin, bowel, adrenal glands, pancreas, and other sites can result in survival benefit. One of the roles of the surgical oncologist is to know when it is appropriate to offer surgical resection of metastatic disease as a palliative or therapeutic option.

Diagnosis and Staging

In addition to operating for curative purposes, the surgical oncologist will often operate for the purpose of obtaining tissue for diagnosis or staging or for monitoring response to therapy. Biopsies for diagnosis can be done with fine-needle aspiration, core-needle biopsy, or incisional or excisional biopsy.

Fine-Needle Aspiration

Fine-needle aspirations obtain cell suspensions suitable for cytology or flow cytometry. This technique can be helpful in aspirating a thyroid nodule, sometimes a breast lump, or a lymph node whenever lymphoma is not primary in the differential diagnosis. The advantages to fine-needle aspiration include the lack of a scar, lack of need for anesthetic, good patient tolerance of the procedure, and the relatively fast turnover of cytology in obtaining a diagnosis. Cell-surface receptors cannot be evaluated, and cytology cannot distinguish between invasive and noninvasive cancers. A fine-needle aspiration should be done only when the determination of atypical or malignant cells will help in diagnosis or treatment, such as proceeding with a thyroid lobectomy or documenting whether a lesion is recurrent cancer in a patient with a known history of the disease. Although a determination of cell abnormality and malignancy can be done, it is usually not sufficient for determining the definitive diagnosis of a primary neoplasm, with the possible exception of abnormal cytology on brushings from an endoscopic examination in a patient with a pancreatic head mass or bile duct stricture. Because of the possibility of false-positive results, cytology is not considered sufficient for proceeding with a major surgical resection such as a mastectomy. In such instances, a method of biopsy that yields definitive histology should be obtained.

Core-Needle Biopsy

Core-needle biopsies can be done percutaneously by palpating a mass or lymph node or by radiologic guidance. Core biopsy material yields tissue architecture, including the diagnosis of malignancy, the tissue of origin of the primary tumor, whether a tumor is noninvasive or invasive, and cell-surface receptors. Advantages include the ability to do the biopsy under local anesthesia, minimal scarring, and improved patient tolerance of the procedure. Care should be taken to keep the entry point for the needle in a location that can be incorporated in a definitive resection of the mass in the event the result shows a malignancy (Figure 4.2). A core-needle

biopsy when diagnostic can allow planning for either neoadjuvant or adjuvant therapies or for surgical resection. For example, a core-needle biopsy of a large breast mass can allow neoadjuvant chemotherapy of a breast malignancy and possibly downstage the patient to being a breast conservation candidate, particularly when an excisional biopsy would be cosmetically unacceptable and obligate a mastectomy. Thus, it is usually the procedure of choice for making a pathologic diagnosis in many areas of oncology. For large soft tissue tumors or bone lesions, core biopsies should be the first method to consider to obtain a diagnosis.[32,33] However, core needle biopsies often do not yield sufficient tissue for making a diagnosis of primary lymphoma, which often requires incisional or excisional biopsies.

Incisional Biopsy

Incisional biopsies are usually done when a needle biopsy is nondiagnostic or technically not feasible. Common examples include a pancreatic mass in which attempts at obtaining cytology by endoscopic brushings or fine-needle aspiration via endoscopic ultrasound have been nondiagnostic, or for a retroperitoneal mass that is potentially a lymphoma. For these intraabdominal tumors, the minimally invasive laparoscopic approach offers advantages of obtaining adequate tissue material as well as staging information that might not be appreciated by imaging modalities. For tumors outside the abdomen, care should be taken in planning an incisional biopsy to keep the biopsy within the area of the definitive operation. Biopsies of the extremity should be done along the line of the long axis of the extremity (Figure 4.3). An improperly placed transverse incision on the extremity can lead to an unnecessarily morbid procedure because the definitive resection must achieve negative margins around the area of previous dissection (Figure 4.4). Impeccable hemostasis should be obtained during incisional biopsy procedures because the complication of a postoperative hematoma can lead to the dissemination of tumor cells into tissue planes well beyond the area that would be resected for definitive surgical therapy. For large cutaneous lesions, a *punch biopsy* represents a form of incisional biopsy that will sample all layers of the skin including the subcutaneous fat (Figure 4.5A). This procedure can be performed under local anesthesia in the outpatient setting using disposable punch biopsy tools (Figure 4.5B).

Excisional Biopsy

Smaller tumors are often more amenable to excisional biopsy. Excisional biopsy implies the removal of the entire skin lesion or lump. Small, particularly superficial, mobile tumors can be difficult to obtain with an adequate needle biopsy. Small masses or skin lesions on the extremity or trunk that are potentially malignant are often best approached with an excisional biopsy, as it allows definitive diagnosis without risking violation of tissue planes. Disadvantages include the resultant scar, the need for anesthetic, and the potential need for reexcision for margins. It is important to orientate excisional biopsy specimens in three dimensions for the pathologist to determine margins if surgical reexcision is needed. The precautions regarding orientation of incisions, not violating tissue planes, and hemostasis are the same as mentioned in the previous section on incisional biopsies.

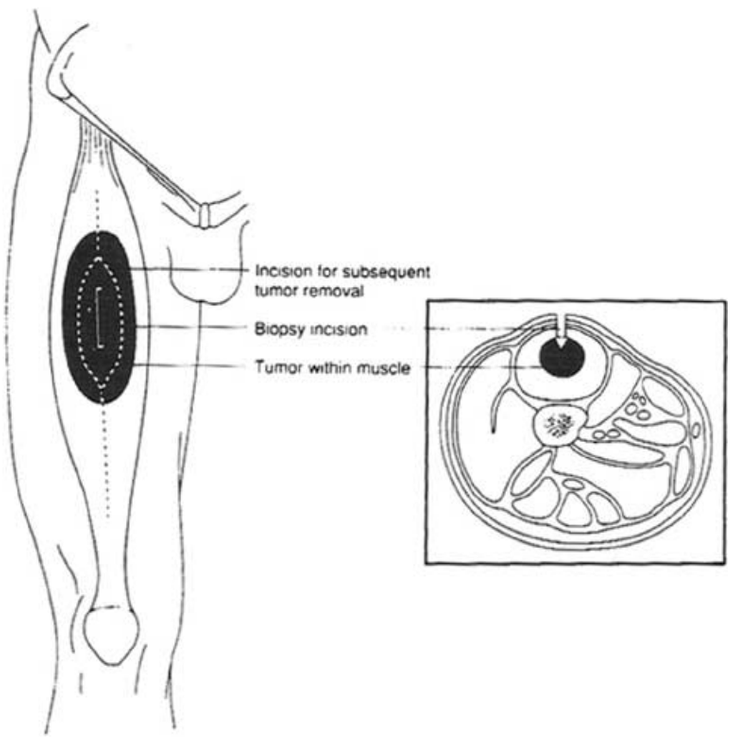

FIGURE 4.3. Placement of an incisional biopsy incision in a patient with an extremity soft tissue tumor. These incisions should be placed parallel to the long axis of the extremity. [By permission of Sondak VK. In: Greenfield LJ, et al. (eds). *Surgery Scientific Principles and Practice*. Philadelphia: Lippincott: Williams & Wilkins, 1993.]

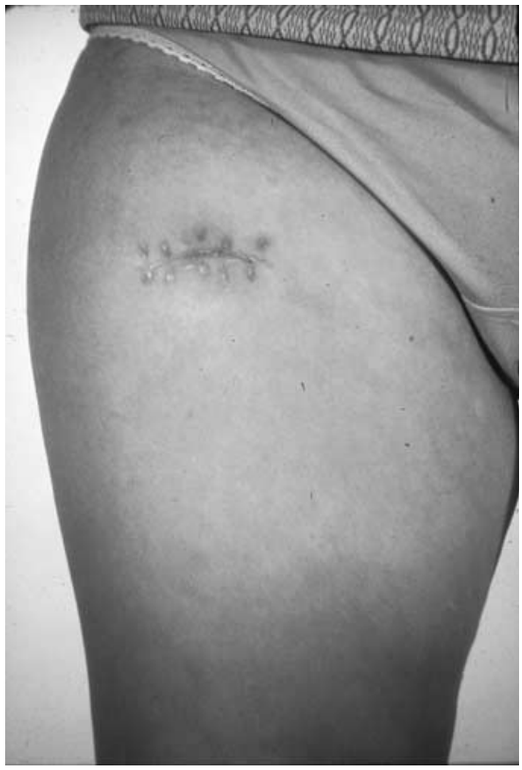

FIGURE 4.4. Improperly placed transverse incision of a large soft tissue tumor. The tumor proved to be a high-grade sarcoma, with the subsequent wide excision being compromised because of the initial procedure.

Care should be taken, when biopsying more then one lesion of the same patient, to use separate instrument setups between biopsies in the event that not all the lesions are malignant to avoid cross-contamination of malignant cells between surgical sites. In this setting, precise labeling of each biopsy specimen is needed in the event that only one of the biopsied lesions is malignant to correctly identify the area to be further treated. It is also important to ensure proper handling of specimens. For example, lymph node tissue obtained for the potential diagnosis of lymphoma should go to pathology fresh to procure part of the specimen for flow cytometry.

In addition to obtaining biopsies to make a diagnosis, the surgical oncologist is increasingly called on to do a biopsy to assess response to adjuvant therapy because routine imaging studies do not always reflect what is happening at the tissue level. For example, necrotic tumor may still show as a mass on CT or mammography. In some protocols, serial biopsies are obtained to access response to therapy; this is most often done as a core-needle biopsy.

Sentinel Lymph Node Biopsy

Increasingly, attempts at a more minimal approach to lymph node staging are being done with selective lymphadenectomy, also known as sentinel lymph node mapping or biopsy. The principle underlying this approach assumes that a cancer will metastasize to one or more *sentinel nodes* in the regional lymph node basin(s) as defined by the anatomic distribution of lymphatic vessels present within and adjacent to the tumor (Figure 4.6).[34] One can determine whether the lymph node basin is involved with tumor by removing the sentinel lymph nodes and performing careful histologic examination of the nodes. Negative sentinel nodes predict fairly accurately that the remaining nodes within that basin will also be uninvolved with tumor, thereby avoiding the need for a regional lymphadenectomy and its attendant complications. This method has become the standard of care for staging patients with invasive breast cancer or melanoma (greater than 1 mm thickness) and is increasingly being evaluated in other malignancies such as head and neck, lung, gynecologic (i.e., cervical cancer), and gastrointestinal malignancies (i.e., colorectal and gastric cancers). The sixth edition of the American Joint Commission on Cancer staging guidelines has been revised to reflect the identification of micrometastasis to lymph nodes in melanoma and breast cancer (see Chapters 55 and 60).

Complete lymph node dissections of the affected lymph node basin should be performed for positive sentinel lymph nodes. Continued questions remain regarding the incorporation of sentinel lymph node biopsy into melanoma treatment, including whether this method of staging and treating lymph node basins affects overall or disease-free survival (as is being evaluated in the Multicenter Selective Lymphadenectomy Trial), the natural history of microscopic sentinel node metastasis, and whether survival is affected by lymphadenectomy or treatments with interferon alpha-2b in these patients (as is being evaluated in the Sunbelt Melanoma Trial).[35] Sentinel lymph node biopsy has been accepted as accurately staging the clinically negative axilla in early-stage breast cancer patients with accuracy rates of 97% or greater. Currently, all patients with histologically proven metastasis to the sentinel node undergo completion axillary lymph node dissection.

Cancer Prevention

With the exponential increase in our understanding of inherited genetic mutations and the identification of patients who are predisposed to malignant transformation, surgical therapy has expanded beyond the therapy of established tumors and into the prevention of cancer. Prophylaxis is not a new concept in surgical oncology. Patients with chronic inflammatory diseases are known to be at high risk of subsequent malignant transformation. This realization typically prompts close surveillance and surgical resection at the first identification of premalignant changes. However, with the ability to perform genetic screening for relevant mutations, cancer prevention can be implemented before the onset of symptoms or histologic changes. With the decoding of the entire human genome, it is likely that more genes responsible for specific cancers will be identified, and the potential role for prevention will expand. Although many interventions may ultimately be nonsurgical (such as tamoxifen for the chemoprevention of breast cancer), the role of surgical therapy remains a primary option in the prevention of cancer. It is for this reason that all surgical oncologists must be aware of those high-risk situations that require surgery to prevent subsequent malignant disease (Table 4.3).

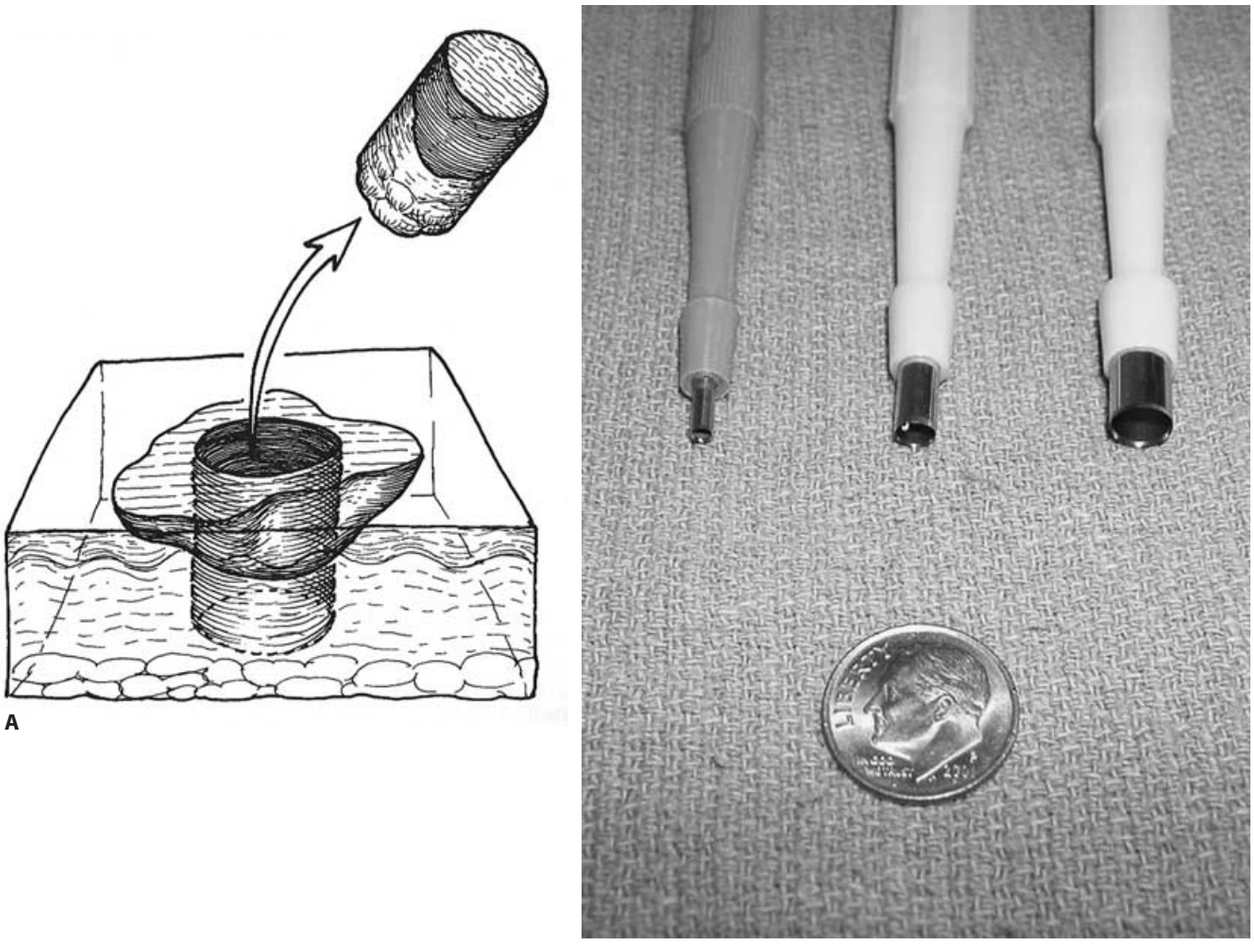

FIGURE 4.5. Punch biopsy of large cutaneous lesions. (A) Schematic view demonstrating that all layers of the skin can be sampled using this technique. (B) Different size punch biopsy tools that can be used. (A: From Arca MJ, Biermann JS, Johnson TM, et al.,[32] by permission of *Surgical Oncology Clinics of North America*.)

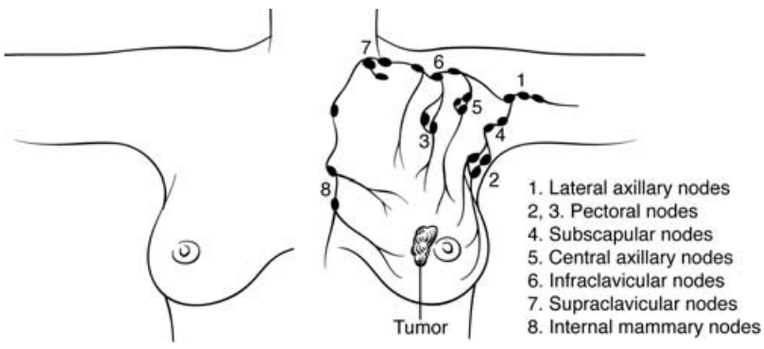

FIGURE 4.6. Schematic diagram illustrating the lymphatic drainage of the breast and sentinel lymph nodes.

TABLE 4.3. Potential indications for prophylactic organ removal.

Prophylactic surgery	*Potential indications*
Bilateral mastectomy (patients with no history of cancer)	BRCA1 or BRCA2 mutation Atypical hyperplasia or lobular carcinoma in situ (LCIS) Familial breast cancer
Bilateral mastectomy (patients with unilateral breast cancer)	BRCA1 or BRCA2 mutation Familial breast cancer or age of diagnosis less than 40 years History of atypical hyperplasia or LCIS followed by unilateral breast CA Difficult to evaluate contralateral breast
Bilateral oophorectomy in patients with no history of cancer	BRCA1 mutation Familial ovarian cancer Hereditary nonpolyposis colorectal cancer
Bilateral oophorectomy in addition to other abdominal cancer surgeries (postmenopausal women)	Hysterectomy for endometrial cancer Colon resection for colon cancer
Thyroidectomy	RET proto-oncogene mutation Multiple endocrine neoplasia type 2A (MEN 2A) Multiple endocrine neoplasia type 2B (MEN 2B) Familial non-MEN medullary thyroid carcinoma (FMTC)
Total proctocolectomy	Familial adenomatous polyposis (FAP) or APC mutation Ulcerative colitis Hereditary nonpolyposis colorectal carcinoma (HNPCC) germ-line mutation

Colorectal Cancer

One of the earliest examples of surgical prophylaxis is the recommendation for total proctocolectomy for subsets of patients with chronic ulcerative colitis. Patients with pancolitis, onset of disease at a young age, and a long duration of colitis are at high risk of developing colorectal cancer.[36] Other clinical diseases of the large intestine also illustrate the role of proctocolectomy in cancer prevention. Familial adenomatous polyposis coli (FAP) syndrome, defined by the diffuse involvement of the colon and rectum with adenomatous polyps often in the second or third decade of life, almost always predisposes to colorectal cancer if the large intestine is left in place. However, the role of screening and prophylactic proctocolectomy changed dramatically with the identification of the gene responsible for FAP, the adenomatous polyposis coli (APC) gene, located on the long arm of chromosome 5 (5q21).[37] Now, children of families in which an APC mutation has been identified can have genetic testing before polyps become evident. Carriers can have screening and surgical resection once polyps appear, usually in the late teens or early twenties. Although not ideal, the palatability of proctocolectomy in this population was furthered with the description of the total abdominal colectomy, mucosal proctectomy, and ileoanal pouch anastomosis.[38]

As we identify additional syndromes and genes that carry an increased risk of colorectal cancer, the potential role of screening and prophylactic surgery also expands. Hereditary nonpolyposis colorectal carcinoma (HNPCC), or Lynch syndrome, is an autosomal dominant disorder that is estimated to be responsible for 5% to 10% of all colorectal cancers. Although the carcinomas arise from benign adenomas, HNPCC is not characterized by a large number of polyps. Two Lynch syndromes have been described. Lynch syndrome I features an early age onset of cancer, often metachronous. Lynch syndrome II involves cancers not only of the small and large intestine but also endometrial, ovarian, renal, gastric, and hepatobiliary. Although the genes responsible for HNPCC have been identified, namely hMSH1, hMLH1, hPMS1, and hPMS2, these mutations do not have a 100% penetrance; thus, cancer will not develop in all carriers. Prophylactic surgery is recommended for some but not all carriers, but aggressive screening should be implemented and a subtotal colectomy should be performed if a cancer develops.[39,40]

Breast Cancer

Another example of prophylactic surgery is the bilateral mastectomy for women at high risk of developing breast cancer. Before the identification of the BRCA genes, prophylactic mastectomies were typically reserved as an option for women with lobular carcinoma in situ (LCIS). However, with the identification of BRCA1 and BRCA2, the role of prophylactic mastectomies has been greatly expanded. For women with BRCA1 or BRCA2 mutations, the lifetime probability of breast cancer is between 40% and 85%.[41–43] Because mastectomy cannot remove all breast tissue, women can expect a 90% to 94% risk reduction with prophylactic surgery.[44] Schrag et al. calculated the estimated gain in life expectancy after prophylactic surgery versus no operation in women with either a BRCA1 or BRCA2 mutation and found a 30-year-old woman would be expected to gain 2.9 to 5.3 years of life, depending on her family history.[45] However, potential benefits of prophylactic mastectomy must be weighed against quality of life issues and the morbidity of the surgery.[46] In addition, other methods for prophylaxis, such as tamoxifen chemoprevention or bilateral oophorectomy, must be considered. Along with the increased risk of breast cancer with BRCA1/2 mutations, the risk of ovarian cancer is also increased. Bilateral oophorectomy after childbearing is complete not only reduces the risk of ovarian cancer[47] but may also decrease the risk of breast cancer.[48] A detailed discussion must be held with each patient considering bilateral mastectomies regarding the risks and benefits, the knowns and unknowns. It is becoming increasingly important that today's surgical oncologist have a clear understanding of genetics and inherited risk.

Medullary Thyroid Cancer

Increased genetic knowledge has also changed our approach to thyroid cancer. Medullary thyroid cancer (MTC) is a well-established component of multiple endocrine neoplasia syndrome type 2a (MEN 2a) or type 2b (MEN 2b). Previously, family members at risk for MEN 2 underwent annual screening for elevated calcitonin levels; however, this only detected MTC after it developed. In 1993 it was identified that mutations in the RET proto-oncogene were present in almost all cases of MEN 2a and 2b. Now family members of MEN patients can be screened for the presence of a RET mutation. Those without the mutation need not undergo additional screening, whereas those with the mutation should undergo total thyroidectomy at a young age (6 years for MEN 2a, infancy for MEN 2b).[49]

Palliation

Surgical intervention is sometimes required in the patient with unresectable advanced cancer for palliative indications. The common indications for palliation in this setting are pain, bleeding, obstruction, malnutrition, or infection. The surgeon needs to consider several factors regarding each situation as to whether the surgical intervention will add significantly to the quality of life of the patient. These factors include the expected survival of the individual, the potential morbidity of the procedure, the likelihood that the procedure will palliate the patient, and whether there are alternative nonsurgical methods of palliation.

The acute onset of pain, bleeding, or obstruction represents a potential oncologic emergency. This topic is covered in more detail in Chapter 74 (Surgical Emergencies). Probably the most common oncologic emergency that the surgeon confronts is the obstruction of a hollow viscus, which can give rise to an acute abdomen, perforation of the viscus, and possibly bleeding. The hollow viscus could be the bowel, biliary tree, endobronchial tree, ureters, or bladder. There are surgical interventions that can be employed to address these problems, and in certain instances, nonsurgical approaches with stents that are effective.

Malnutrition is a common problem in the cancer patient, especially one with advanced, unresectable disease. Nutrition can be supplemented or replaced by intravenous hyperalimentation or enteral feedings via a gastrostomy or jejunostomy tube. Commonly, the surgeon is involved in placement of vascular access for hyperalimentation. If the gastrointestinal tract is functional, the surgeon may be called upon to place a feeding tube for enteral nutrition. The nutritional support of the cancer patient as well as aspects of vascular access are reviewed in more detail in Chapters 82 and 85.

Occasionally, the surgeon is involved in palliating pain caused by a metastatic lesion compressing an organ or adjacent nerves. Examples include cutaneous or subcutaneous melanoma metastases, a large ulcerating breast cancer, or a recurrent intraabdominal sarcoma mass. As indicated previously, the surgeon needs to assess the relative risk-to-benefit ratio in resecting a symptomatic mass, knowing that it will not affect the overall survival of the patient. If the quality of life of the individual can be improved at an acceptable operative risk, then the surgical intervention is warranted.

Surgical Considerations in the Cancer Patient

There are special considerations when planning operative procedures on cancer patients beyond the normal planning done for the same operation on a nononcologic patient (Table 4.4).

TABLE 4.4. Special considerations in the cancer patient.

Oncologic factors	*Potential associated problems*
Tumor-specific factors:	
Gastrointestinal	Obstruction and aspiration risk; gastrointestinal bleeding; bowel perforation
Head and neck/mediastinal	Reduced oral intake; superior vena cava obstruction; airway compromise; difficulty with ventilation or intubation
Cerebral tumors/brain metastasis	Decreased mental status; syndrome of inappropriate secretion of antidiuretic hormone; increased intracerebral pressures
Paraneoplastic syndromes	Syndrome of inappropriate secretion of antidiuretic hormone; hypercalcemia
Cancer factors:	
Cachexia/malnutrion	Increased infection; fluid and electrolyte management; wound healing
Hypercoagulability	Venous thrombosis; superior vena cava syndrome; pulmonary embolism
Bone metastasis	Hypercalcemia; increased fracture risk; potential for cord compression; potential for difficulty with intubation
Treatment-specific factors:	
Steroids	Gastritis and gastrointestinal bleeding; diabetes; adrenal insufficiency; difficulties with wound healing
Chemotherapy	Neutropenia and anemia; pulmonary fibrosis; cardiac dysfunction; stomatitis; alteration in mucosal integrity of the gastrointestinal tract; constipation; bowel perforation; nausea; vomiting; diarrhea; hypercoagulability
Radiation therapy	Pulmonary fibrosis; difficulty with wound healing
Tamoxifen	Hypercoagulability

These considerations include cancer syndromes affecting nutrition, debilitated performance status, hypercoagulability, paraneoplastic syndromes, tumor-specific effects, and effects of chemotherapy or radiation therapy.

Tumor-Specific Effects

Alteration of physiologic function or distortion of normal anatomy may occur due to specific tumor effects. For example, tumors of the mediastinum or neck may cause venous congestion, superior vena cava obstruction, airway compression, or tracheal deviation that may make establishment of an airway or ventilatory management difficult. Gastrointestinal tumors may cause obstruction, causing an aspiration risk. Cerebral tumors or brain metastases can cause changes in mental status, syndrome of inappropriate secretion of antidiuretic hormone making perioperative fluid management difficult, or may cause an increased intercerebral pressure that affects anesthesia management of the patient.

Paraneoplastic Syndromes

Paraneoplastic syndromes such as hyponatremia due to inappropriate secretion of antidiuretic hormone such as seen in small cell lung cancers, prostate, pancreas, and other cancers, or hypercalcemia such as seen in squamous cell carcinomas of the lung, breast, or kidney, will alter nutritional and fluid and electrolyte management. Although mild hyponatremia can be associated with mild symptoms such as nausea and headaches, severe, acute hyponatremia can lead to more severe symptoms, even seizures or coma. Hypercalcemia is most often associated with bone metastasis, but it may be related to a paraneoplastic syndrome and can lead to neuromuscular symptoms such as weakness and fatigue and gastrointestinal symptoms such as nausea, ileus, and abdominal pain. Severe hypercalcemia can disturb cardiac conductivity. Given the tendency to malnutrition and low serum albumin in cancer patients, serum calcium levels are often best determined by measuring ionized calcium.

Malnutrition

A hallmark warning sign of cancer is unexplained weight loss. Malnutrition has long been recognized in surgery as being related to an increased risk of infection, with difficulties in perioperative electrolyte and fluid management, and with difficulties in wound healing postoperatively. A large National Veterans Affairs Surgical Risk Study identified the preoperative serum albumin level as the single most important predictor of 30-day mortality.[50] Cancer cachexia is a syndrome of malnutrition with muscle wasting, protein malnutrition with myopathy, incomplete nutrient utilization, glucose intolerance, and anemia with decreased nutrient absorption. Its causes are multifactorial. Cancer, or its treatment, can cause alterations in taste, stomatitis, dysphagia, anorexia, nausea and vomiting, alterations in intestinal tract absorptive surface area, gastroparesis, constipation, pancreatic insufficiency, or pain, fatigue, and depression, which in turn can lead to impaired oral intake. Gastrointestinal tumor with associated obstruction or head and neck tumors can interfere with, or prohibit, oral intake. In addition, tumor- or treatment-associated diarrhea, fistulas, or nephrotic syndrome can lead to increased nutrient loss. An assessment of nutritional status can be done by assessing for a recent weight loss of 10% or more from prediagnosis weight, current caloric intake, or by measuring albumin, prealbumin serum transferrin, or cutaneous testing for anergy.

Hypercoagulability

Cancer is associated with hypercoagulability and an increased risk of venous thrombosis or pulmonary embolism. This susceptibility can be compounded by decreased mobility resulting from fatigue and diminished functional status, or by pain related to the operative procedure. Operations particularly of risk include operations of the abdomen, pelvis, hip, or leg. Surgery that is of long duration, which uses laparoscopy, or has a degree of postoperative immobilization adds additional risk. Cancer patients have twice the risk of postoperative venous thrombosis, and three times the risk of fatal pulmonary embolism, as noncancer patients undergoing the same procedure.[51] Patients at a higher risk are those with a history of previous myeloproliferative disorders such as polycythemia vera and primary thrombocytosis, or a history of obesity, varicose veins, cardiac dysfunction, indwelling central venous catheters, inflammatory bowel disease, nephrotic syndrome, pregnancy, or estrogen use, or treatment with tamoxifen or chemotherapy. Treatment with tamoxifen induces hypercoagulability with an associated two- to threefold greater risk of venous thrombosis. This risk is increased even more in women undergoing treatment with both chemotherapy and tamoxifen.[52,53] Chemotherapy has been shown to increase the risk of thromboembolism up to 7% in early-stage breast cancer patients.[52,54]

A history of hypercoagulable abnormalities should be ascertained, such as activated protein C resistance (factor V, Leiden); prothrombin variant 20210A; antiphospholipid antibodies (lupus anticoagulant and anticardiolipin antibody); deficiency or dysfunction of antithrombin, protein C, protein S, or heparin cofactor II; dysfibrinogenemia; decreased levels of plasminogen and plasminogen activators; heparin-induced thrombocytopenia; or hyperhomocystinemia.[55]

Cancer patients older than 40 years undergoing major surgery without prophylaxis have a risk of deep venous thrombosis of 10% to 20% and a risk of fatal pulmonary embolism of 0.2% to 5.0%.[10] Although most clinical trials show pneumatic compression devices to be similar in effectiveness to prophylactic doses of subcutaneous heparin, their effectiveness is directly dependent on compliance with their use, and most clinicians recognize that, in practice, pneumatic compression devices are only on the patient a portion of the time they are nonambulatory and therefore they are not as effective.[56] The sixth American College of Chest Physicians consensus conference in 2000 recommended the following: (1) oncology patients more than 40 years old undergoing major surgery, or nonmajor surgery in patients more than 60 years old, with no other risk factors, receive pneumatic compression devices or low molecular weight heparin; (2) oncology patients more than 40 years old undergoing major surgery and additional risk factors receive pneumatic compression devices and prophylactic low molecular weight heparin; and (3) low-dose coumadin for patients with central venous catheters. They did not recommend routine continuation of anticoagulation after discharge for surgical patients;

however, many clinical studies are under way regarding the efficacy of continued prolonged anticoagulation after discharge from a surgical procedure.

Chemotherapy Considerations

Agents such as adriamycin can affect cardiac function, and an assessment of functional status, a review of systems looking for decreased exercise tolerance, dyspnea, edema, orthopnea, etc., should be elicited. On physical examination, particular attention should be paid to signs of edema, tachycardia, or arrhythmias. At minimum, a 12-lead EKG should be done on any patient who has received adriamycin before undergoing a surgical procedure to look for conduction changes. An echocardiogram for an evaluation of function should be done for any symptomatic patients before any major surgical procedure in patients who have received an adriamycin-based chemotherapy. An evaluation of respiratory symptoms should be elicited in patients who have undergone radiation to the thorax or treatment with bleomycin-based chemotherapy to evaluate for pulmonary fibrosis. Treatment with corticosteroids can lead to diabetes or adrenal insufficiency requiring monitoring of glucose levels postoperatively and potential treatment with stress dose steroids and the implications for glucose control perioperatively. Treatment with steroids can also lead to gastritis and gastrointestinal bleeding or mask symptoms of peritonitis, making evaluation of abdominal pain difficult. Chemotherapy can also affect the gastrointestinal tract, with bowel perforation having been reported in patients undergoing treatment with cytosine arabinoside, taxol, and interleukin 2. In addition it should be remembered that oncology patients will still succumb to and need to be treated for the same illnesses as nononcologic patients such as cholecystitis and appendicitis; however, treatment with steroids, or immunosuppressive agents such as seen in patients after bone marrow transplantation, and the potential for neutropenic colitis in those undergoing chemotherapy can make evaluation of these more common diseases more difficult.[57]

Elderly Patient

In addition, the readers are reminded that older or elderly patients will increasingly make up the population of patients with cancer. Currently 60% of all malignancies, and 70% of all cancer deaths, occur in people over the age of 65.[58] In addition to the previously mentioned considerations, assessment of the older patient should include evaluation of activities of daily living, depression, cognitive function, current medications and potential medication interactions, and available social support.[59–62]

Clinical Trials: Role of the Surgical Oncologist

At the very heart of evidence-based medicine, and nowhere is this truer than in oncology, are clinical trials. Although the early trials initiated by the National Cancer Institute (NCI) in the mid-1970s primarily considered nonsurgical issues (leukemia, lymphoma, stage IV disease), surgeons quickly became involved in significant roles in clinical oncology trials, such as the National Surgical Adjuvant Breast Project (NSABP), which has answered, and continues to answer, many important questions regarding the optimal surgical and adjuvant therapy of breast and colon cancer. Today, most cooperative groups include surgery committees to address ongoing questions regarding the surgical management of a variety of malignancies. The prominent role of surgery in the design and implementation of clinical oncology trials is best exemplified by the establishment of the American College of Surgeons Oncology Group (ACOSOG) to evaluate the surgical management of patients with malignant solid tumors. Created in May 1998 under the leadership of Dr. Samuel Wells, the ACOSOG is 1 of 10 cooperative groups funded by the NCI to develop and coordinate multiinstitutional clinical trials.

As surgical oncologists, our obligation is not only to the patient who is sitting before us in the office, but to the progression of patients who will follow. The improved success and decreased morbidity of the treatments that we offer today are only possible because of the involvement of surgeons and their patients in clinical trials of the past. As the newest discoveries in all fields of oncology will have a direct impact on the surgical therapy, it is imperative that surgeons continue to play prominent roles as both leaders and participants in multidisciplinary cooperative group trials. All surgical oncologists should not only incorporate clinical trials into their practice but strongly encourage the participation of the general surgical community.

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