Principles of Surgical Oncology

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Summary and Key Points

1. Oncology surgery includes operations to diagnose malignancy (biopsies), to remove known cancer of the primary tumor and metastases, and for palliation.
2. A fifth category of oncology surgery, reconstructive surgery, is not strictly speaking, cancer surgery, but practically all cancer operations involve some reconstruction. Frequently, plastic or vascular surgeons assist with this phase of the procedure.
3. Tumor resection with a margin of normal tissue (R0 resection) is the aim of radical cancer operations.
4. Surgical Oncology is a disease based discipline; surgical oncology fellowships prepare surgeons in the multi-disciplinary approach to the prevention, diagnosis, treatment, and rehabilitation of cancer patients.
5. Fellowships also prepare members of surgical subspecialties to interact with other oncologic disciplines and to provide leadership in the surgical, medical, and public health community in oncologic related matters.

Introduction

Surgery is a branch of medicine that developed primarily around the management of wounds, infections, and bladder stones. Along the way, it also became the primary treatment modality for malignant solid tumors. For many cancers surgical resection remains the foundation of curative treatment. This chapter aims to introduce the history of cancer surgery, to answer the question of "What is a surgical oncologist?", and to discuss the different categories of cancer surgery.

Surgical treatment for malignant disease has been employed with varying degrees of success since ancient times. Celsus, a physician during the Roman Empire once wrote, "After excision, even when a scar has formed, none the less the disease has returned." It was a long held belief that cancer was an incurable malady and often the treatments were more harmful than the cancer itself.

The foundation of modern surgical oncology practice was developed over a relatively short historical period (1840-1940), often referred to as "the century of the surgeon". The discovery and introduction of general anesthesia (1840s) allowed for slower more complex surgical interventions. In addition, the development of antiseptic surgery (1860s) improved surgical morbidity and mortality. Finally, technical advances in tissue microscopy hastened the discovery of unmediated cell growth that lies at the center of cancer biology that we now know to be the result of genetic mutations. Three surgeons are credited with the founding of "cancer operations" including Dr. Christian Albert Theodor Billroth of Germany, Dr. W. Sampson Handley of London, and Dr. William Stewart Halsted of Baltimore. Prospective surgeons will be interested in the history of the development of cancer surgery.

What is Surgical Oncology?

Broadly defined, surgical oncology refers to that discipline of surgery which concerns itself with the management of cancer. Since this is such a broad field, there are different kinds of surgical oncologists, many defined based on their organ (colorectal surgeons, urologists, gynecologic oncologists, ear nose and throat surgeons, orthopedic surgeons) or body cavity of interest (thoracic surgeons and neurosurgeons). Most of these aforementioned specialties manage both benign and malignant disorders. These disciplines are not to be confused with the surgical specialty which is almost exclusively devoted to oncology and is disease-based rather than organ- or cavity-based and is called surgical oncology. Fellowship-trained surgical oncologists are recruited from General Surgery residency and receive additional multidisciplinary experience in the treatment of malignancies of the head

and neck region (although not in the brain), breast, abdominal cavity, and skin and soft tissue (including melanoma and sarcoma) in two- or three-year programs accredited by the Society of Surgical Oncology (SSO) and the Accreditation Council for Graduate Medical Educations (ACGME). As a result, they are often experienced in a number of complex cases requiring intensive, multidisciplinary treatment. These fellowships prepare individuals to interact with other oncologic disciplines and to provide leadership in the surgical, medical, and public health community in oncologic related matters. The special skills provided by surgical oncology fellowships has now been recognized on the national level with the creation of a certificate in complex general surgical oncology provided by the American Board of Medical Specialties (ABMS) since March 2013. Recently, the SSO has begun accrediting more focused training programs such as breast surgical oncology.

Other surgical subspecialties have developed increasing expertise in operations for cancer:

- Thoracic surgeons, who belong to a specialty that evolved to manage the complications of tuberculosis in the pre-antibiotic era, are frequently the specialists operating on patients with lung cancer.
- Gynecologic, genitourinary, central nervous system (CNS), and skeleton malignancies have also almost always been claimed by their respective subspecialty disciplines outside surgical oncology.

Although a surgical oncologist certainly has the ability and training to perform complex surgeries for cancer expertly, a significant amount of the added value of subspecialty training is intellectual rather than technical. Surgical oncology programs include rotations in medical oncology, radiation oncology, and pathology in order to build a significant fund of knowledge in the biology of cancer and the other therapies needed in conjunction with surgery to cure or palliate cancer patients. This global perspective on treatment options allows for a more tailored plan of care.

Selecting the patient for a complex operation, at the optimal time in the patient's overall treatment plan can be complicated due to the local and systemic effects of chemotherapy or radiation. By extending the experience to nonsurgical disciplines, the surgical oncologist can understand the likely pitfalls of operating on patients who have had or will have multidisciplinary treatment. Finally, surgical oncologists frequently have experience with rare tumors and unusual situations. The discipline has a deeply engrained cultural expectation that its practitioners will make a significant attempt to improve the care of the cancer patient through research and teaching.

Types of Cancer Surgery

There are four categories of cancer surgery:

1. Operations performed for lumps, bumps, spots and ulcers because they might be malignant.
2. Operations performed to extirpate (completely remove) a known cancer with anatomic reconstruction to optimize function when appropriate.
3. Operations performed to extirpate metastatic disease.
4. Operations performed to improve quality of life and relieve symptoms related to cancer (palliative surgery).

A fifth category of surgery, reconstructive surgery, is not strictly speaking cancer surgery, but practically all cancer operations involve some reconstruction.

Each category has principles and challenges, and is best appreciated within the context of a particular tumor type or situation. This will be addressed in greater depth in the organ-specific chapters. Nevertheless, there are general observations that can be made about each of them.

1. Operations done to diagnose cancer for a lump, spot (on the skin or on a CT scan), or ulcer are called biopsies and should take into account what comes next if the diagnosis of malignancy is confirmed. Biopsies can be categorized as 'excision' or 'incision', with the latter being the removal of only a portion of the suspected malignancy. If on confirmation of cancer a larger or wider resection follows, the operative incision should be planned to avoid unnecessarily contaminating normal tissues and so that it can be encompassed easily in the subsequent resection specimen without having to sacrifice more normal tissue than necessary. If the operation required to establish a diagnosis is sufficiently "large" so that going back to resection more tissue seems unnecessarily invasive, then the original operation should be conducted as if the specimen in question really did have a cancer in it, effectively

performing an excision biopsy and a potentially curative cancer resection at the same time. An example of this is a segmental colectomy for a large villous adenoma with atypia in the endoscopic biopsy specimens. It is more efficacious to remove that section of colon with the lymph nodes in the mesentery attached (fairly easily accomplished without much extra operating or morbidity) as you would in a cancer operation, rather than simply taking out a small piece of colon and then re-operating on the patient's abdomen through the previous scar tissue for a wider resection of colon and lymph nodes when the villous adenoma turns out to be a cancer. This type of approach to lumps, spots and ulcers needs to be balanced by a realistic appreciation of the extra and unnecessary morbidity that might accompany radical resection of a benign condition. Fortunately, less invasive needle biopsies, core biopsies, and incisional biopsies often remove uncertainty in this area of cancer surgery.

2. Operations done to extirpate a known primary malignant tumor should be done without cutting across the tumor or any of its extensions. The operation is often done best without actually seeing the primary tumor. If the tumor extends into an adjacent structure or organ, the surgeon should resect that structure rather than separating the tumor from it. Of course, if that structure cannot really be sacrificed without threatening the patient's life (e.g. you can't really resect the blood supply to the liver), or function (e.g. if you sacrifice all the nerves to the leg so that it is insensate and paralyzed, preserving the leg becomes pointless), or cosmesis (e.g. taking the eyelids), then one may compromise on the margin if reconstruction is not a viable choice. How wide that margin of normal tissue around a malignant tumor needs to be is a source of endless fascination and controversy. It suffices to say that it is different for different tumors and other modalities such as radiation can help narrow that width. The resection is only as good as the closest margin. It makes little sense to sacrifice an important functional organ on one side of a tumor to achieve a nice wide margin there if the surgeon plans to shave the tumor off another structure on the other side.

   The extent of tumor before treatment significantly affects the chance of successful resection, and may suggest preoperative) neoadjuvant) treatment is indicated to improve the chance of complete removal of the tumor (Figure 1).

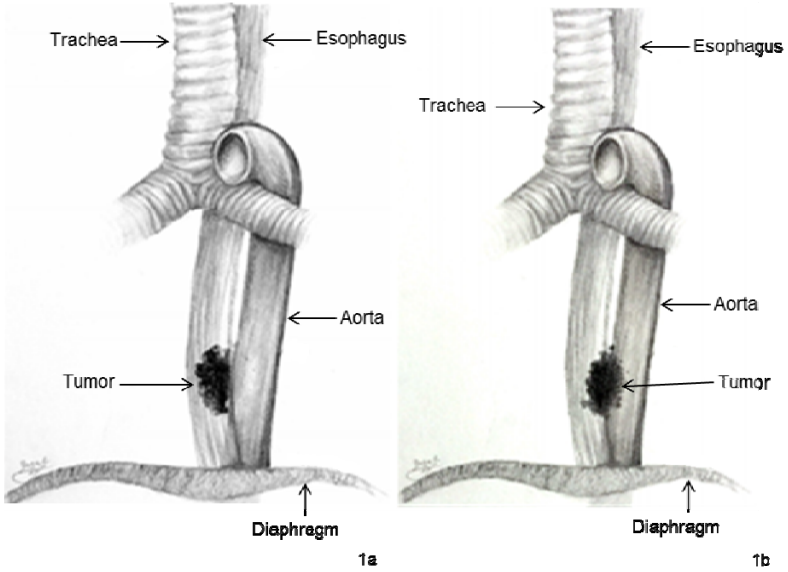

Figure 1. Preoperative images of esophageal cancer in distal esophagus **1a**. Tumor has extended to edge of esophagus, and not touched aorta. R0 resection is likely. **1b.** Tumor has extended beyond esophagus and touched or invaded aorta. This situation may be discovered by preoperative endoscopic ultrasound or CT. Image drawn by Sarah Alyssa Uy.

Resections where the surgeon cuts across grossly appreciable tumor are called R2 resections (Figure 2). Resections with grossly clear margins, but microscopically positive, are termed R1 resections (Figure 3). If the margins are both grossly and microscopically clear, it is termed an R0 resection. R0 resections are the aim of cancer operations (Figure 4). Fortunately, modern imaging allows surgeons to judge the likelihood of R2 resections before actually operating on the patient (Figures 5a & b and 6a & b). This is important because R2 resections rarely have a favorable impact on the natural history of the cancer and can be quite morbid for the patient. Debulking surgery, also called cytoreductive surgery, is a first cousin of R2 resections and by itself is almost always unhelpful, except for some specific situations such as surgery for carcinomatosis in ovarian cancer, pseudomyxoma peritonei, or palliation for neuroendocrine tumors. The decision to take a patient for debulking surgery should

be made in the context of a multidisciplinary tumor board. The conceptual difference between R2 and debulking surgery is the intention– R2 resections generally do not intend to leave gross tumor, whereas debulking surgery is undertaken with the expectation that some tumor will be left behind. R1 resections do not necessarily guarantee a local recurrence of the tumor. In fact, while R1 resections are associated with significantly worse overall survival and higher rates of local recurrence than R0 resections, rates of local recurrence are still often significantly less than 30%. The effects of R1 resections can many times be mitigated by the use of adjuvant radiation.

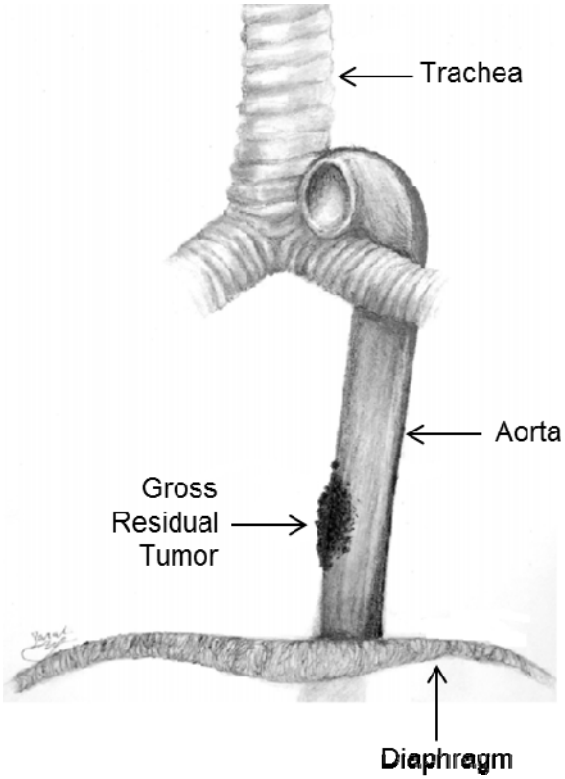

Figure 2. R2 Resection. Esophageal cancer after cut-through resection with gross tumor remaining in patient. Image drawn by Sarah Alyssa Uy.

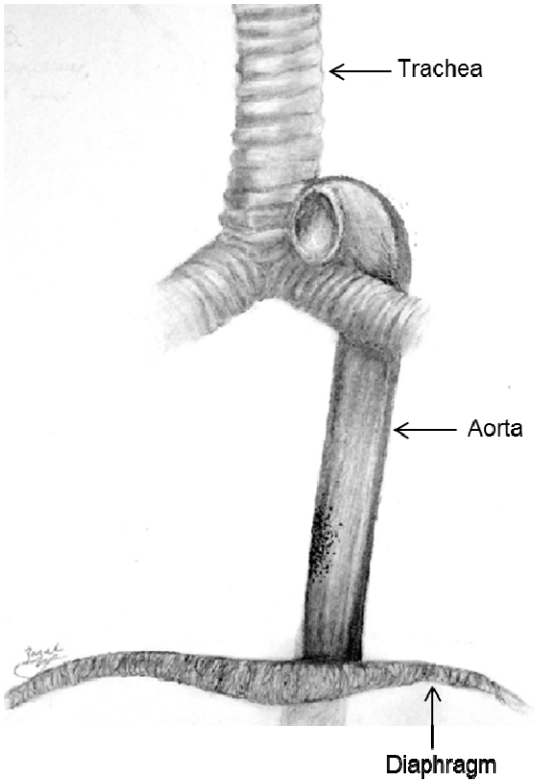

Figure 3. R1 Resection. Black dots on aorta represent microscopic cancer cells left behind. These may be suspected because the surgeon had to shave the tumor off an adjacent structure she does not wish to resect, or because the pathologist identifies tumor on the cut margin of the specimen (positive margin) or because the patient was injected with a radioactive labeled antibody to the tumor, which is found .with a tiny handheld radiation detector. Image drawn by Sarah Alyssa Uy.

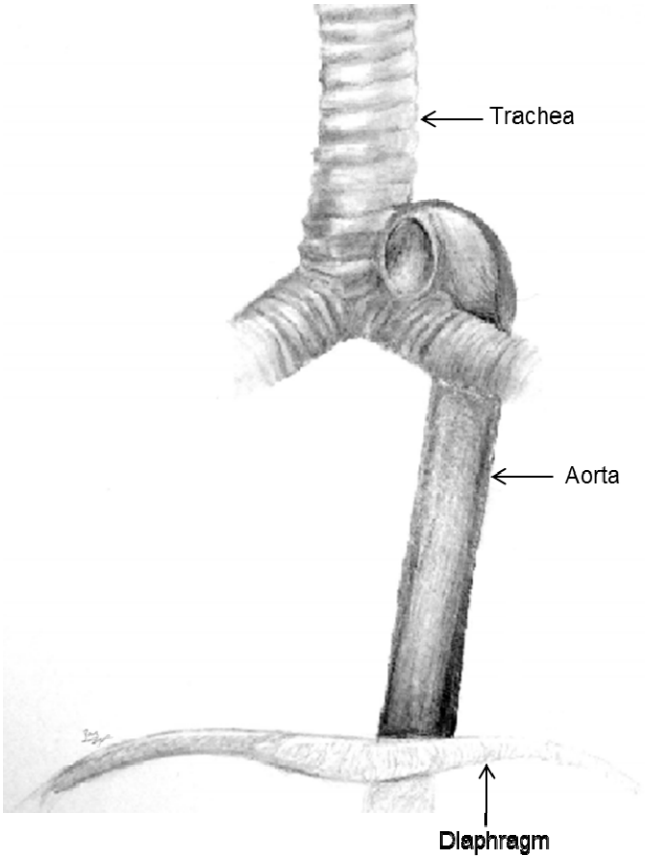

Figure 4. R0 Resection. No tumor is left on aorta, pathologic specimen margin is negative. Image drawn by Sarah Alyssa Uy.

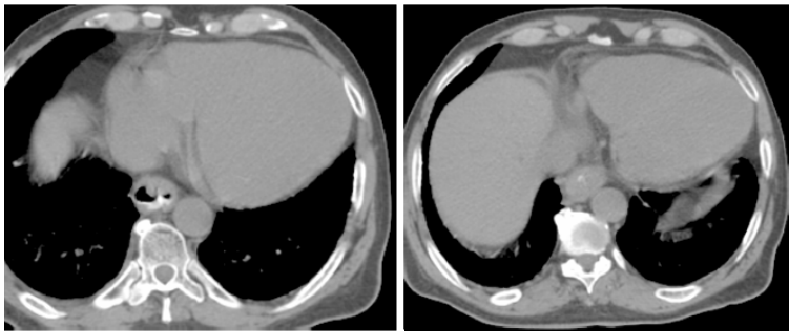

Figure 5. Non-contrast enhanced CT of esophageal cancer patient's chest. Image on left shows some oral contrast; image on right, which is caudad, demonstrates that the esophageal canal is almost completely occluded, with just a dot of contrast in the esophageal canal. Note fat plane between aorta and enlarged esophagus, which suggests this patient's tumor will be resectable with clean margins (R0). Images courtesy of the University of Massachusetts Medical School, Department of Radiation Oncology.

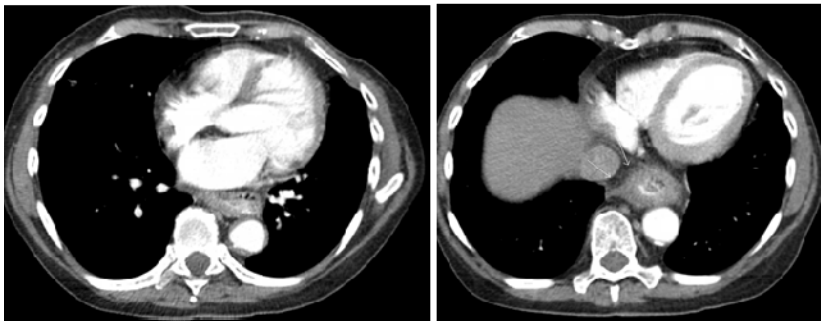

Figure 6. Two axial IV and oral contrast enhanced CT slices of esophageal cancer patient. Image on left is cephalad, and esophageal wall looks normal; a bit of contrast is visible in canal. Image on right shows thickened esophageal wall, but canal is still widely patent. Small arrows point at area of suspected infiltration into fat, but there appears to be clear fat between this infiltration and vena cava. In this direction, a clear margin is likely despite extra-esophageal extension. There does not appear to be a fat plane between esophageal tumor and anterior wall of aorta, suggesting that an attempt to resect tumor (without neoadjuvant treatment) may leave tumor cells on the aorta (R1). Images courtesy of the University of Massachusetts Medical School, Department of Radiology.

Tumors may spread or metastasize through lymphatics, blood flow, or local extension. For tumor types which spread to lymph nodes, removal of the local/regional lymph nodes is an important component of the resection for that cancer. Sarcomas- malignancies derived from tissues of mesenchymal embryonic origin (soft tissue and bone) are an example of a tumor type which typically does not metastasize to the local and regional lymph nodes. Therefore, these lymph nodes are not typically sampled or removed in sarcoma resections. For most malignancies derived from epithelial tissues- carcinomas- the lymph nodes are removed because these tumors do metastasize to them.

Removal of lymph nodes containing tumor may be diagnostic for staging, curative, or both. Conventional modern opinion is that involvement of local/regional lymph nodes simply predicts the biology of the cancer and most often implies a poor prognosis. An older conventional wisdom held that local regional lymph nodes were barriers to the spread of a cancer that cancer cells needed to colonize first before they spread to distant organs. Although it is clear that this older view of the metastatic process is inaccurate, it still animates the rationale for many cancer operations.

As is the case for margins, the extent, timing, and value of lymph node removal has been a source of enduring discourse and continues to evolve over time. There is vast literature on this topic because lymph node resections potentially come with major morbidity to patients, for example, lymphedema. There are two technical types of lymph node resection: sentinel lymph node biopsy (where only the first 1-3 lymph nodes that directly drain the tumor are removed and evaluated) and complete lymphadenectomy (where all of the lymph nodes in the draining basin are removed). Complete lymphadenectomy carries a much higher morbidity than sentinel lymph node biopsy.

Several general points have survived controversy by the weight of accumulated evidence. It is clear that determining whether the local and regional lymph nodes are involved by a cancer usually provides critical prognostic information that may guide treatment options for the patient. For several cancers (e.g. breast and melanoma), information may be acquired from a clinically negative lymph node basin (i.e. no palpable lymph nodes on examination) using sentinel lymph node biopsy. It is accepted that removing clinically involved lymph nodes along with the primary tumor improves outcomes for many cancers. However, if evaluation of an entire lymph node basin does not prove to carry prognostic or survival advantages, it may be unnecessary to submit the patient to these procedures. Evidence for the benefit of lymph node dissection has evolved over time, often due to advances in systemic therapy. For example, a current study, the American College of Surgeons Oncology Group Z0011 trial (ACOSOGZ11) showed lymph node sampling alone (sentinel node biopsy) was non-inferior to removal of all the lymph nodes in the axilla for certain women with invasive breast cancer and known lymph node metastasis.[1]

3. Operations performed to extirpate metastatic disease are a relatively new facet of cancer surgery. Previously, the presence of metastatic disease was considered to be a relative contraindication for any surgery aimed at cure. The presence of metastases was evidence of systemic disease and as a consequence it was determined that only a systemic therapy such as chemotherapy would be of benefit in controlling disease progression and improving outcomes.

   The success of local therapy (i.e. operations) for systemic disease is real and is based on the so called “seed and soil” hypothesis used to describe the process of metastasis. The idea is that cancer cells (the seeds) must find the right soil (target organ) in which to germinate. While the distribution of the seeds might be random (via the wind or the blood stream) the subsequent growth of colonies will be targeted. In circumstances where the pattern of metastases is relatively predictable (e.g. sarcoma metastases to lung or colon metastases to liver), and/or limited (i.e. one or two metastases is best), a local therapy such as complete surgical extirpation of the metastases can cure some patients. The key to success with this approach is careful patient selection. Generally, good selection leads to approximately 20% long-term survival rates across a remarkable variety of tumor types and target organ sites. Tighter selection policies lead to somewhat better cure rates and looser selection policies lead to worse outcomes. Combining metastasectomy with an effective chemotherapeutic regimen appears to improve long- term outcomes in most circumstances.

The four principal components of appropriate patient selection for metastasectomy include:

I. The primary tumor must be already controlled or be controllable.

II. The metastases should be limited to one target organ and that should be the expected target organ for metastases from that tumor type.

III. The metastases should be limited in number – the fewer the better. At the very least, the surgeon should be able to remove all metastases completely without significant mortality due to precipitating physiologic failure of the target organ in which the metastases are found (e.g. lung or liver failure); removing metastases partially does not improve cancer-related survival.

IV. There should be no other better single therapeutic options such as an effective chemotherapy for that tumor. Resection of locally recurrent malignancies and cytoreductive surgery with intra-abdominal chemotherapy for peritoneal metastases from tumors such as ovarian cancer and appendiceal cancer is another type of cancer surgery which is somewhat related to operations for metastatic disease. It derives much of its rationale from the seed and soil hypothesis, much of its success from very similar patient selection principles, and achieves fairly similar outcomes in appropriately selected patients.

4. Operations performed to palliate malignant tumors are a very important part of surgical oncology and all the surgical disciplines that operate on cancer patients. These are operations which are undertaken to relieve obstruction (of the bowel, ureters, bile duct, etc.), control bleeding or acute perforations, manage fistulas, and manage tumors that are breaking down, fungating, ulcerating or causing significant suffering in terms of quality of life. Sometimes these operations are performed to relieve pain. The important principle is that these procedures are undertaken to relieve a symptom, not to try to cure the patient of their cancer.

   The term palliative surgery is frequently misused; it is often used to describe an operation that a surgeon undertook to cure a patient of their tumor, which in retrospect has not succeeded (e.g. an R2 resection, or a failed metastasectomy). It is worth noting in this regard that many patients with primary tumors, and most patients who are candidates for metastasectomy, are either asymptomatic or minimally symptomatic. Sometimes palliative surgery is inappropriately used to describe operations to extirpate tumors in which there is simply a very low rate of long term survival (e.g. for cancers of the esophagus or pancreas) even though the operation is potentially curative.

   Finally, the term palliative surgery can be confused with the notion of prophylactic palliation; an operation done to prevent the appearance of unmanageable symptoms later. An example of this operation would be a distal gastrectomy performed for a cancer that was discovered as the result of a work up for guaiac positive stools (no other symptoms), and at operation is discovered to have small peritoneal implants. The rationale for proceeding with the gastrectomy in this instance is to prevent future problems with obstruction and bleeding, it is not to try to cure the patient. Prophylactic palliation is a traditional rationale for cancer resections, although for the most part there is no evidence to support its practice. These semantic issues are important because they prevent clarity of thought and purpose around what a surgeon or a care team is actually going to be able to accomplish for a patient with a difficult tumor, and thus can contribute to poor decision making and unnecessary suffering.

   When considering a palliative operation, it is helpful to keep in mind that you cannot make a symptom better if the patient is asymptomatic. Many operative procedures will have their own set of side effects, and it typically takes otherwise well patients about two months to recover completely from open abdominal or thoracic surgery. Patients who require palliative surgery usually are not that healthy, frequently have higher operative complication rates, and typically have a limited life expectancy – often measured in months. So, the decision making concerning palliative operations is not straightforward. Fortunately, there are an increasing number of less invasive tools that can be used to palliate many conditions.

   For example, obstructions of the biliary tree are routinely handled by stents that can be placed percutaneously through the liver or endoscopically. Endoscopically placed stents are also used for esophageal, gastroduodenal, and even colorectal and tracheal

obstructions. Radiation is often an effective way to handle raw tumor surfaces that are bleeding. Thoracoscopic and laparoscopic procedures when possible can minimize the morbidity of operations in the chest and abdomen. Repeated nerve blocks can be accomplished percutaneously to control pain. It is important to consider all of these issues as well as a variety of alternative approaches when contemplating a palliative operation. There is an old surgical saying that, “No problem is so bad that the wrong operation can’t make it worse”. Nevertheless, frequently a clearly conceived and well thought out operation can relieve suffering and prolong life, even if it does not cure the cancer.

Reconstructive surgery is a type of surgery that is not strictly speaking cancer surgery. However, practically all cancer operations involve some degree of reconstruction (Figure 7). Often this reconstruction is handled by the primary oncologic surgeon; especially when the reconstruction is relatively straightforward (e.g. creation of anastomosis), or when the need for flaps is so common that the oncologic surgeon develops a basic repertoire of simple flaps (e.g. head and neck surgeons and melanoma surgeons). However, some reconstructions are more complex. For example, major vascular resections may require facility with vascular grafts and patch reconstruction. Many cancer surgeons rely on colleagues in vascular surgery in these circumstances. Even more commonly, the primary oncologic surgeon may require the assistance of a colleague in plastic surgery to rotate tissue flaps or perform free tissue transfers to cover radiated fields, large defects that would not heal primarily, or simply to achieve a socially acceptable cosmetic result. Indeed, modern advanced cancer surgery probably cannot be practiced optimally without capable and gifted plastic surgeons on the team. This reemphasizes the point that, whatever the training background of the primary cancer surgeon is, surgical care of a modern cancer patient is best approach in a multidisciplinary manner.

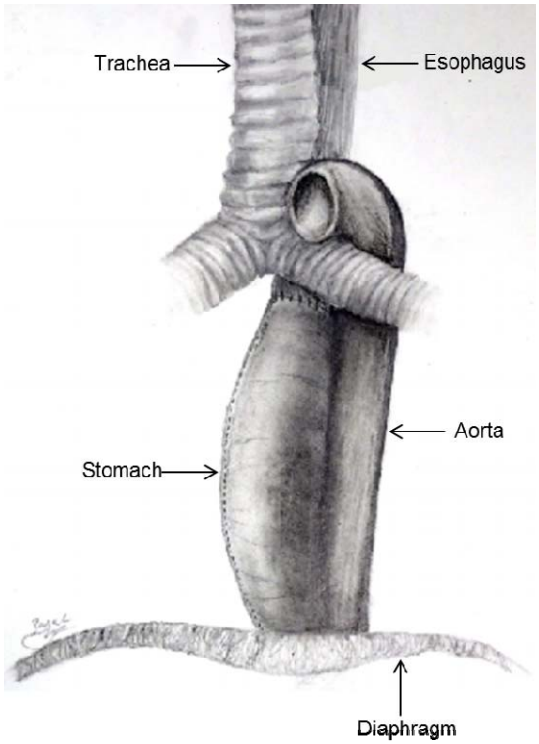

Figure 7. Reconstruction of the gastrointestinal tract. Stomach has been mobilized and pulled up into the chest, then anastomosed to the proximal stump of the esophagus. Image drawn by Sarah Alyssa Uy.

Conclusion

Surgery remains a very important part of cancer care. The surgical oncologist is an integral member of a multidisciplinary cancer team. Surgical oncologists are called on to obtain tissue for the diagnosis of cancer and to extirpate cancer with the goal of curing the patient of the malignancy. Surgery may also be used in selected patients to remove metastatic tumors. Finally, operations can be an important tool to relieve suffering resulting from cancer, even if cure is not possible.

Thought Questions

1. In 2001 two studies were published that showed that patients with metastatic kidney cancer lived longer if they underwent removal of the cancerous kidney (radical nephrectomy) followed by treatment with alfa-interferon than if they simply received alfa-interferon without surgery. How does this kind of surgery, that intentionally leaves known metastatic disease in place, fit into the four general categories of oncologic surgery discussed in the chapter? Can you explain how removing a primary tumor while leaving distant metastatic disease behind could possibly result in an improvement in survival?2, 3 References: NEJM. 2001;345(23):1655-9 and Lancet. 2001;358(9286):966-70.

   Your answer:

Expert Answer

2. A R0 resection of a tumor is the goal of any curative cancer surgery. Yet relapse after R0 resections can be very common, depending on the type and stage of cancer that is resected. Why should a cancer ever relapse if a surgeon is able to "get it all"?

   Your answer:

Expert Answer

Glossary

Endoscopic- Performed by means of an endoscope

Fistulas/ fistulae – An abnormal passage that leads from one organ to another organ or to the body surface

Heal primarily- (primary intention)- Surgical closure of a wound to facilitate healing as opposed to secondary intention (wound is left open and healing occurs as the wound edges contract and granulation tissue forms)

Laparoscopic- An abdominal operation done via a laparoscope– a usually rigid endoscope that is passed through a small incision in the abdominal wall into the peritoneal cavity

Percutaneous- Performed through the skin

Sentinel lymph node biopsy- Removal of a lymph node identified as the first node draining a tumor

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PubMed

History

Cancer surgical advancement really opens with the first successful gastrectomy done in 1881 by Theodor Billroth at his internationally famous clinic in Vienna - to which much of the western world travelled for surgical instruction.

> A 40 year old woman, a patient who was dying from a gastric outlet obstruction, agreed to the experimental procedure and succumbed to liver and peritoneal metastases four months later. Billroth also performed the first laryngectomy and esophagectomy.

Other examples of cancer surgery advances include:

- Development of the modern radical resection of rectal cancer (abdominoperineal resection) by Ernest Miles at the Gordon Hospital for Diseases of the Rectum in London in 1908.
- Development of the field of Neurosurgery by one of the great American surgical innovators, Harvey Cushing. Dr. Cushing developed the use of electrocautery in surgery with the help of an electrical engineer named William Bovie and as a medical student he established the practice of frequent vital sign checks during anesthesia.
- The first single staged pancreaticotoduodenectomy for cancer was done by Allen O. Whipple in 1940 at Columbia.
- The first pneumonectomy for lung cancer was done by Evarts Graham at the Barnes Hospital in St Louis in 1933.

The radical mastectomy was devised and performed by William Stewart Halsted in 1882. This procedure is the hallmark of modern cancer surgery. Mastectomy for breast cancer was not a new operation and had been performed in a quick amputative fashion for centuries. The longstanding problem was that most breast tumors presented in advanced stage (T4 tumors) and recurred locally in the chest wall and glands under the arm. Microscopic tissue studies of the women who had died of their disease demonstrated cancer cells at some distance from the primary tumor, in lymph nodes, bones, liver, chest wall and lungs. Informed scientific opinion at the time, was that the seeds of cancer spread along fascial planes (to the muscles of the chest, ribs and vertebrae) and along the lymphatic channels to the nodes. Once those barriers were breached, the cancerous cells were able to travel in the bloodstream and establish colonies in liver, lung and brain. Based on this understanding of how cancer spread, Halsted's operation was designed to control the disease by removing those dissemination conduits and contaminated tissue. Although he was not the first to arrive at these conclusions about what was needed for a successful operation, he employed a meticulous dissection technique for which he subsequently became well known and succeeded beyond what been accomplished to that point. His operation (the radical mastectomy) removed the breast and overlying skin widely, the pectoralis major and minor muscles and all the lymph node containing tissue from the apex of the axilla all the way to the latissmus dorsi muscle (which was also partly taken to encompass any spread down to the vertebrae where the tendon inserts). The bare chest wall was then skin grafted. The clinical results of his new operation were spectacular and paradigm changing: whereas practically everyone had recurred and died within two years, 80% of his patients were alive in that time frame. Halsted then made the observation that the extent of the primary tumor and the amount of nodal involvement by tumor cells determined the prognosis. This was the beginning of a cancer staging system. Halsted was a giant figure in the history of medicine and he made many fundamental contributions to the art and science of surgery in many areas which are still relevant today. The Halsted operation and its subsequent variations became the gold standard for breast cancer treatment until the 1980s when it was supplanted by operative approaches based on a different understanding of how cancer spreads and were designed for much smaller tumors. Despite the vast expansion of biomedical knowledge about cancer and control of cellular behavior in the century since Halsted described and reported his radical mastectomy; margins and lymph nodes remain an abiding focus for Surgical Oncologists today.

Surgical oncology was originally the unintentional creation of a pathologist named James Ewing. Dr. Ewing was the founder and director of the Memorial Hospital in New York and believed that advances would come from surgeons (all general surgeons at that time) concentrating on the care of patients with cancer (there was no chemotherapy or medical oncologists at that point) and that these surgeons should become experts in the use of a new tool with anticancer properties. This tool was radium, which had also recently been discovered by Madam Curie in 1898. Dr. Ewing was a tireless advocate for better care of cancer patients and overcoming the social stigma associated with the diagnosis. At that time, the diagnosis of "cancer" was not mentioned for the similar

type of fear it engendered. Time magazine honored Dr. Ewing for his work with its cover in 1931 titled “Cancer Man Ewing.” He inspired enormous affection and admiration in the students and young surgeons he gathered under his wing. This group ultimately formed an alumni association at Memorial Hospital; the acme of cancer care in the world. In 1940, they named themselves the James Ewing Society and in 1975 this society became the Society of Surgical Oncology (SSO) which is the governing body for the Surgical Oncology specialty.

The presence of metastases was evidence of systemic disease and as a consequence it was determined that only a systemic therapy such as chemotherapy could be employed. In fact, cancer surgery of metastatic disease was for many years considered vaguely disreputable; something only done by surgeons who were either ignorant or charlatans. That belief began to change in the 1960s when lung metastases from extremity osteosarcomas in young patients were being resected as part of aggressive treatment protocols (which included chemotherapy) developed at Memorial Sloan Kettering Cancer Center. It became apparent that some of these patients were cured. Around the same time in the 1970s, other cancer surgeons such as Martin Adson at the Mayo Clinic, James Foster at the University of Connecticut and Joseph Fortner at Memorial Sloan Kettering began resecting isolated solitary colorectal liver metastases and achieved some cures. This was unheard of, and the field began to change. Today, these kinds of operations are done frequently and for an expanding set of histologic types of cancer and indications.

Return to page 1