# Surgical Oncology: An Overview

11

Aseem Mishra and Vivekanand Sharma

**Abstract**

This chapter aims to share with the readers a glimpse of the evolution of the role of surgery in oncological practice, and provide them with an understanding of what role does surgery play in management of cancer from diagnosis, treatment, and prevention of cancer as per tumor biology and stage of the disease.

**Keywords**

Surgery · Screening · Diagnosis · Staging

## 11.1 Introduction

The treatment of cancer is complex and is governed by multitude of factors. This requires an integrated multidisciplinary team approach of various specialities like surgical oncologist, medical oncologist, and radiation oncologist working together for treatment planning and administration. With the advent of personalized care in modern oncology practice, the role of allied subspecialities, for example, pathology, diagnostic and interventional radiology, and rehabilitation, has widened considerably.

The aim of this chapter is to share with the reader a glimpse of the evolution of role of surgery in oncological practice and to provide them with an understanding of

A. Mishra (✉)
Department of Head and Neck Surgical Oncology, Homi Bhabha Cancer Hospital, Varanasi, India

V. Sharma
Department of Surgical Oncology, Homi Bhabha Cancer Hospital, Varanasi, India



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what role does surgery plays in management of cancer from diagnosis, treatment, and prevention of cancer as per tumor biology and stage.

## 11.2 Evolution of Role of Surgery in Oncology

Historically, surgery was the sole method used for treating cancer and there are numerous texts documenting the same since thousands of years back. Leonidas of Alexandria is widely quoted as the first person to have devised an oncologically correct surgery in the first century AD for breast cancer (Retief and Cilliers 2011). However, in those days with the lack of understanding of antisepsis, anesthesia, blood transfusion, and disease biology, the outcome was usually poor and mortality with or without treatment remained high.

With advances in science and technology, a greater understanding for perioperative physiology, disease pathology, and treatment modalities, there has been a paradigm shift and many major cancer surgeries today are associated with less than 5% mortality rate (Ghaferi et al. 2009). This along with similar advances in sister specialities in medical and radiation oncology has allowed cancer to be treated as curable, when detected early.

## 11.3 Role of Surgical Oncologist

The roles of a surgical oncologist include cancer screening, diagnosis, and staging, which are discussed in this section.

### 11.3.1 Cancer Screening

As understanding of the development of cancer increased, some cancer types were recognized which could be identified early with simple diagnostic tests and if timely treated led to improved patient survival. Cancers of breast, colorectal, cervix, lung, and prostate are hence being increasingly identified in early stages, and the surgical oncologists are playing a key role in this process (Sankaranarayanan et al. 2005; White et al. 2020).

### 11.3.2 Diagnosis and Staging

Accurate diagnosis of cancer type is essential, since it not only dictates initiating any therapy, but also has implications in patient counseling and medico-legal issues as well. Identification of cancer is usually made by sampling a part of the suspected tissue, followed by pathological analysis. The method employed to obtain the tissue, called biopsy, may change depending upon the site of disease, presentation type, and individual patient.

1. Lesions over any accessible surface like on the skin or mucosa (e.g., in oral cavity, vagina, cervix, rectum, and anal canal) can be biopsied easily via an incisional or punch biopsy (Griffiths et al. 1964).
2. Lesions involving the mucosal surfaces in the gastrointestinal tract (GIT), hypopharynx, urinary bladder, etc., are usually biopsied with an aid of endoscopic access (colonoscopy/laryngoscopy/cystoscopy). The endoscopic vision helps in locating the lesion and targeting the appropriate lesion for biopsy. Certain scopy can be performed on out-patient basis which does not require any hospital admission or major preparation (Zalvan et al. 2013).
3. *Fine needle aspiration (FNA):* This can be performed in palpable but deeply located lesions or in nonpalpable lesions as in the case of breast lesion, lymph nodes, and thyroid and salivary gland malignancy (Lin et al. 1997; Zagorianakou et al. 2005). FNA is usually guided with an imaging modality like an ultrasonography, mammography, or a computed tomography scan. Rapid OnSite Evaluation (ROSE) permits the aspirate from the needle to be assessed immediately under microscope for adequacy and ensures successful result (O'Leary et al. 2012; Schmidt et al. 2013). FNA has a central role in diagnosing thyroid nodule, parotid gland, metastatic nodes, and borderline resectable pancreatic tumors. With recent advances and experience in immunohistochemistry markers, even cytological aspirate can be used in many diseases for an accurate diagnosis. The cytological examination is helpful in establishing a diagnosis, but it provides limited information regarding tumor architecture and hence biopsy still remains the gold standard for tissue diagnosis.
4. *Core needle biopsy (CNB):* Akin to FNA, core biopsy can be performed in out-patient setting with added advantage of providing additional information about the tumor architecture. CNB provides adequate tissue to make an appropriate diagnosis in most of the patients. It provides adequate tissue for pathologist to make a diagnosis and perform immunohistochemistry evaluation, whenever necessary. CNB is the cornerstone of diagnosis in all solid malignancy where the lesion is not accessible endoscopically or other less invasive techniques. CNB is superior as it is less invasive and can be performed quickly without any external scar and is less painful (Verkooijen et al. 2000; Yao et al. 2012).
5. *Open incisional biopsy:* Open biopsy is the gold standard for histopathological diagnosis in all cases where there is a diagnostic dilemma, but it should be reserved for those in which less-invasive procedures are inconclusive. It provides accurate diagnosis as the sampling error is minimized. However, care should be taken while planning an excisional biopsy so as to not compromise future treatment. Incision for biopsy must be planned in a way that the scar can be incorporated in the future excision, if needed. Improper incision placement leads to compromised surgical resection in future or may cause an unnecessary larger normal tissue resection with resultant loss of form or function or both.
6. *Open excisional biopsy:* Excisional biopsy involves excision of entire tumor with a margin of normal tissue. It offers the advantage of providing adequate tissue for diagnosis. However, selecting patient for excisional biopsy is of utmost importance. It should be reserved for small malignant or premalignant lesions where it

may be the definitive treatment. Similar to incisional biopsy planning, the final treatment and the future surgical plan should always be kept in mind before planning any excisional biopsy (Estourgie et al. 2007; Ghaem-Maghami et al. 2007).

In certain solid tumors of the pancreas, ovarian tumors, testicular cancer, and certain benign nasal mass like angiofibroma, routine biopsy is not recommended. Definitive treatment is planned in these cases without tissue diagnosis. Thus, clinical knowledge of tumor biology and characteristics is essential. The present era of technology has provided several lesser invasive investigations, which can be utilized to avoid a biopsy.

While the role of surgical oncologist remains central in most methods of biopsy, there is an increase in the role of endoscopist and interventional radiologists in an effort to explore less-invasive methods in challenging presentations.

## 11.4 Staging

Treatment of any cancer starts with accurate staging and is the most important component in the cancer treatment planning. The clinical history, physical examination, imaging, and biopsy are useful tools in clinical staging. These are essential component of clinical TNM staging. The pathological TNM staging is derived from the histopathological evaluation of the tissue from the resection of the primary tumor and regional lymph nodes. The Union for International Cancer Control (UICC) provides the staging system based on the clinical data and a similar staging system is also provided by American Joint Committee on the cancer AJCC - Cancer Staging Manual (2017).

Surgeries were a common method of staging in earlier times. With improved imaging methods like multi-detector computed tomography (MDCT), PET-CECT (PET-contrast enhanced computed tomography), and high-resolution magnetic resonance imaging (MRI), the need for invasive methods like open surgery for tumors of spleen and liver or pancreas has become obsolete. There is a paradigm shift in the last decade, and newer diagnostic methods are being used intraoperatively for diagnosing lymph node metastasis. One such technology is sentinel node biopsy (SNB) (Morton et al. 2006; Veronesi et al. 2003). This technique involves assessing the first echelon nodal station draining the primary tumor using a radiotracer dye. Primary tumor is injected with radiotracer dye (technetium labeled colloid sulfur or isosulfan blue), and a gamma camera is used to analyze radioactive uptake at the first echelon nodes. This helps in determining the possibility of lymphnodal metastasis at a very early stage and helps in surgical planning for the nodal clearance. Multiple scientific trials have proven this method to be effective in cancers of penis, breast, vulva, melanoma, and squamous head and neck cancers. However, en-bloc nodal dissection is almost certain in tumors like head and neck cancer and in en-bloc gastrectomy with extended lymph nodal dissection gastrointestinal cancer. The

newer improved technology and diagnostic modalities have played a significant role in adequate treatment planning.

## 11.5 Surgery: From More, to Less, to None

Principle of oncological resection involves complete removal of tumor with tumor-free margins, and the whole specimen must come out en-bloc. In the earlier centuries, cancer surgeries entailed major, often mutilating surgeries. Advances in multimodality therapy have led to the development of conservative approaches toward cancer, with better preservation of organ and function without compromising oncological outcomes. Notable examples in this context are cancers of the anal canal, hypopharynx, larynx, and upper esophagus, where traditional mutilating surgeries have been replaced with chemoradiation for the majority of patients. In cancers of breast, similar advances led to better cosmetic outcomes with breast conservation and oncoplasty.

With the advent of adjuvant therapy, surgery for the primary tumor has become less extensive. Following the NSABP B-06 trial, breast cancer patients now undergo breast conservation surgery and postoperative irradiation. Following the onset of VA trial in laryngeal and hypopharyngeal cancer, the organ preservation protocol became the need of the day (Wolf et al. 1991). Previously, the patients of laryngeal cancer underwent total laryngectomy. This led to loss of organ and subsequent loss of voice. After the successful completion of the Veteran Affairs trial, the organ conservation protocol came forward in a very big way. Subsequent to this, organ preservation became the treatment of choice. Induction chemotherapy followed by radiotherapy became treatment of choice to avoid a laryngectomy. A better understanding of early disease treatment and modalities has also expanded treatment options for early mucosal cancers in larynx, esophagus, stomach, and rectum where endoscopic options like endoscopic mucosal resection and dissection allow organ preservation. In recent years, even wait and watch policies are being attempted in cancers of the rectum and esophagus.

## 11.6 Plastic and Reconstructive Surgery

The development of *plastic surgery* has led to a remarkable improvement of surgical oncology. Extensive resections which were earlier deemed unresectable due to associated morbidity and lack of reconstructive option can now be resected and reconstructed with a good cosmetic and functional outcome (Munhoz et al. 2013). Advances including oncoplastic surgery are associated with improved cosmetic outcomes with less morbid measures in breast cancer, better aesthetic and functional outcome in cancers of the head, neck, and skull base region, and greater and earlier restoration of function in musculoskeletal cancers. These outcomes encourage more patients to lead a good quality of life after surgery.

The extensive resections of the tumors of the oral cavity can now be reconstructed using a microvascular free flap like a free anterolateral thigh flap and free fibula osteocutaneous flap. These flaps have offered significant improvement in quality of life of hitherto inoperable patients.

## 11.7 Minimally Invasive Surgery (MIS)

Minimally invasive surgery involves providing a lesser traumatic access to a disease site or organ. This provides good visualization and exposure, and this makes the resection easy. The development of MIS is an important development in recent surgical developments. Surgeries which were hitherto deferred due to the morbidity associated with the access and large incisions can now be performed with lesser complications. This reduces the trauma associated with creating the exposure for surgery. After initial dilemma over the oncological safety of MIS over open approach, oncological efficacy is now recognized in colorectal, endometrial, renal cancers, anterior skull base, and paranasal sinus tumors with encouraging results in esophageal, lung, gastric, and even thyroid and pancreatic cancers in carefully selected patients (Gemmill and McCulloch 2007; Nagpal et al. 2010).

## 11.8 Role of Robotic Surgery

Robotic-assisted surgical procedures are performed with the use of robotic system. Robotic surgery avoids several limitations associated with MIS. It provides superior image resolution and enhances the dexterity of surgeon due to robotic arms. The operating surgeon controls the console of the robot, and the main robotic system with the arms is utilized to deliver instruments at the operating site. The surgeon performs the surgery by sitting on console. It provides the advantage of better optical visualization, camera stability, three-dimensional view, and filters the tremors. Robotic assistance offers enhanced degree of freedom in a limited space, making robotic system useful in urological and gynecological surgery.

Robot-assisted surgery offers shorter length of stay of a patient, fewer readmissions, and reduced intraoperative morbidity. Robotic surgery in head and neck is performed through transoral access and is popularly known as transoral robotic surgery (TORS). TORS offers the advantage of excellent approach to tumors of the oropharynx and hypopharynx (Genden et al. 2009; Weinstein et al. 2012). It is particularly useful for salvage surgery of the oropharyngeal tumors like a recurrent disease of the base of the tongue and tonsillar fossa. Other indications in head and neck have also been developed, and robotic arms have been used to perform surgeries like thyroidectomy and neck dissection. The approach to these areas is via a postauricular incision and sublingual access through midline (Benhidjeb et al. 2009; Dionigi et al. 2017).

The application of robotic surgery in oncology has broadened in the recent times with the use of robot-assisted surgery in almost all specialities like urology, gynecology, thoracic, gastrointestinal, and head and neck oncology. However, it is essential to have a careful case selection as in minimal access surgery. The indication of surgery has to be analyzed carefully. The option of converting to an open procedure should be discussed with the patient beforehand. Another important aspect which has to be highlighted is not to popularize the robot-assisted surgery as stigma or superior against open procedure. As a common myth, the patient perceives robotic surgery being performed by robot which needs to be dissuaded. Judicious use of this technology is essential, and it depends on the patient selection and should not be popularized as patients' choice.

A patient undergoing surgery for prostate cancer is concerned about the urinary and sexual function. Robotic surgery is now being performed in several centers in India for oncological and nononcological indications. While robotic surgeries have found acceptance in cancers of multiple sites, one must also be cognizant of its cost-effectiveness as against other modalities.

## 11.9 Impact of Emerging Technology in Surgical Oncology

Integration of augmented reality, artificial intelligence, and technological advances has found place in guided surgical systems, which have a role in not only safer surgeries but also structured surgical training- and distance-based learning. The use of image guided navigation system has reformed the learning and practice of complicated surgeries like endoscopic surgeries of the anterior skull base. The CECT images of the patient are reformatted and utilized for anatomical guidance during surgery. This avoids several complications as the major vessels and nerves can be visualized through the system and the surgeon is alarmed well before dissecting these key structures.

## 11.10 Expanding Indications of Treatment and Indian Context

With increased survival of cancer patients, the surgical oncologist is playing a greater role even in metastatic cancers, which were earlier deemed beyond the purview of cure. Excision of metastatic sites in liver, lung, and even disseminated abdominal disease can now be operated with procedures like metastatectomy, peritonectomy, and hyperthermic intraperitoneal and intra-thoracic chemotherapy. With emerging technologies, several recurrent tumors and extensive resections are now being performed. The branch of surgical oncology has developed immensely in the Indian subcontinent. The improvisation of surgical oncology is now progressing toward subspecializations within surgical oncology. The surgical oncology training is offered as a superspecialization course through a three-year training (MCh Surgical Oncology). Other than that, various subspecialities like superspeciality training in head and neck oncology, gynecological oncology, and breast surgical oncology

have also developed. The various surgical specialities like gastrointestinal surgery, neurosurgery, and urology have also played an immense role in development of these cancer subspecialities. However, in majority of tier-II and tier III cities in the third world countries, the oncology treatment is still delivered by general surgeons, otolaryngologists, gynecologists, etc. The development of the training programs in India has led to significant improvement in the quality of care delivered to the patients. This has improved the survival outcome of these cancers and offered an excellent quality of life to cancer patients. With extensive training programs being structured, and formation of the national cancer grid, several institutes have been upgraded to provide adequate clinical care in oncology. The extension of the central institutes like Tata Memorial Hospital under the department of atomic energy to various towns like Sangrur, Varanasi, Mullanpur, Vizag, and others has also made affordable cancer available in these areas. The opening up of various institutes like All India Institute of Medical Sciences in various cities has helped in decentralizing not only cancer care but also has made available superspecialist clinical care available in various cities. These projects are going to change the phase of healthcare in India in the near future.

## 11.11 Conclusion

Surgery in oncology has developed rapidly in the last century. Surgery is curative in early solid malignancy and has superior survival outcome in head neck, breast, gastrointestinal, and gynecological cancers. While surgery remains the most effective single treatment modality, multidisciplinary team approach is essential for a better clinical outcome. While many tools are becoming available for surgery, their careful usage and patient selection are more important aspects of patient care.

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