

The Role of Thoracic Surgery in Palliative Care: A Review

Jacob A. Klapper and Betty C. Tong*

Department of Surgery / Cardiovascular and Thoracic, DUMC 3531 Durham, NC 27710, United States

Abstract

The goal of palliative surgery, like that of palliative care in general, is to relieve symptoms and suffering due to a disease state, rather than curing the disease itself. Perhaps more so than other palliative interventions, patients and providers considering palliative surgery must carefully weigh the risks of the intervention with the intended benefit. The purpose of this article is to describe the variety of palliative operations performed by Thoracic surgeons as well as the indications and outcomes for these procedures.

Keywords: Palliative surgery; Thoracic surgeons; Mortality

Introduction

Tantamount to the practice of medicine is the principle to “do no harm.” The application of surgery is inherently injurious to the human body and thus harmful. In ideal situations, the surgical patient is one whose overall well-being has been heavily scrutinized and deemed acceptable for operative intervention. In this way, the potential morbidity and mortality from the operative management of disease is limited and the patient achieves maximal benefit.

Achieving the above stated goal is particularly difficult in the setting of the patient with advanced, life-limiting disease. In treating this patient population, the clinician must be even more cognizant of the tenuous line between benefit and harm. Palliative surgery or interventions must thus be designed to achieve symptomatic relief, not cure. In addition to being relatively low risk, such procedures should be simple and expeditious to perform with the ultimate goal being the improvement in symptoms and overall quality of life.

The purpose of this article is to review the variety of palliative operative interventions for symptom relief in thoracic surgery, the goals of these interventions, and the indications for their application. In addition, the paper reviews the data on each and applies an evidence-based review of palliative thoracic surgery where available.

Unresectable esophageal cancer

Of the roughly 17,000 cases of newly diagnosed esophageal cancer each year in the United States, two-thirds of patients are not candidates for esophagogastrectomy due to advanced disease at the time of diagnosis. Historically, surgical intervention for incurable disease was attempted in selected individuals. These “bypass” procedures were primarily designed to relieve patients’ dysphagia. Not surprisingly, outcomes were poor with in-hospital mortality ranging 11% to 41.5% and median survival of only five months [1-3]. In comparison, combined chemotherapy and radiation regimens for inoperable cancer are well-tolerated and result in survival that is superior to those expected from these operations [4,5]. With the advent of modern endoscopic instrumentation, the tools available for palliation have expanded beyond surgical bypass, which is largely of historic interest in the current era.

Current palliative interventions are designed at addressing dysphagia, tracheoesophageal fistulas, and bleeding, amongst other things. Esophageal stenting is particularly beneficial in patients with significant dysphagia due to tumor bulk. Stent options include Self-Expanding Metal Stents (SEMS) and plastic stents (SEPS). Early studies of SEMS demonstrated the relief of dysphagia in an overwhelming majority of patients with the most common complication being in growth or overgrowth [6]. In a randomized controlled trial of

100 patients with unresectable esophageal cancer, Conio et al. [7] demonstrated an improvement in dysphagia symptoms using both SEMS and SEPS. In final analysis, dysphagia was improved by at least one grade in 100% of the SEPS group and 94% of the SEMS group. However, more complications, particularly late stent migration were seen in the SEPS group.

In certain situations, obstruction is secondary to endoluminal tumor. Stenting in these situations is a less effective modality for palliation and more popular techniques for overcoming obstruction include neodymium-doped yttrium aluminum garnet (Nd:YAG) laser debridement and photodynamic therapy (PDT). The former utilizes thermal ablation to destroy tumor and the latter employs a chemical sensitizer that accumulates in the tumor and is activated by light thereby destroying tumor via a photochemical effect. In a multicenter randomized trial of unresectable esophageal cancer, 236 patients were randomized to treatment of their obstruction with either PDT or Nd: YAG. In terms of dysphagia relief, the two modalities were equivalent, but the objective tumor response at one month was significantly greater in the PDT group. In terms of complications, significantly more patients in the PDT group experienced an adverse event. Of note, patients undergoing PDT therapy may experience skin hypersensitivity for one to two months after therapy and can develop sunburns if exposed to the sun for prolonged periods. Overall, the authors concluded that the adverse events associated with PDT were mild and that dysphagia relief was comparable to the use of Nd: YAG, while being easier to perform than laser debridement. [8]. The Nd: YAG laser and PDT are also effective options for managing bleeding from an unresectable esophageal tumor [9, 10].

In a large study designed to look at improvements in quality of life beyond simply dysphagia relief, Homs and colleagues randomized 209 patients with inoperable esophageal cancer to metal stent placement versus single dose brachy therapy. They then assessed each patient’s quality of life using a disease-specific and general questionnaire. The disease-specific questionnaire demonstrated that, while patients treated with a single dose of brachy therapy had deterioration in their

*Corresponding author: Dr. Betty Tong, Department of Surgery / Cardiovascular and Thoracic, DUMC 3531 Durham, NC 27710, United States of America, Tel: 919-613-4690; Fax: 919-684-8508; E-mail: betty.tong@duke.edu

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dysphagia relief and ability to eat over time, it was less so than in the stented cohort. In addition, results from the general questionnaire demonstrated that brachy therapy was superior in terms of improving patients' emotional, social, cognitive, and role functioning. Undoubtedly, future studies will continue to assess the various effects of these many different technologies on quality of life beyond simple improvements in dysphagia relief [11].

Chest wall tumors

Chest wall tumors can be primary lesions or metastatic in nature. Regardless of histology, these tumors can be particularly debilitating due to pain, bleeding, or ulceration and infection. For these reasons, radical surgical resection is applied in appropriately selected patients. Individuals should have their nutritional status optimized, should cease any smoking behaviors, and should have pulmonary function tests that demonstrate the necessary fitness to undergo such operations.

Ideally, not only are these procedures palliative, but in most cases they will render the patient free of disease. Accomplishing both of these goals often requires a wide excision with 2- 4 centimeters of grossly normal tissue circumferentially, followed by chest wall reconstruction. Free or advancement flaps for soft tissue coverage can be achieved with the involvement of a Plastic and Reconstructive surgeon. Obviously, such palliative operations require close evaluation of each candidate prior to proceeding. Preoperative PET/CT is useful for determining the presence of distant metastatic disease, the presence of which should prompt a discussion with the patient and other providers regarding the benefits of surgical resection versus palliative radiation for pain symptoms [12]. While beyond the scope of this chapter, palliative radiation therapy for chest wall lesions is another acceptable treatment option, especially for patients who are medically unfit for surgery or who have oligometastatic disease.

Hemoptysis

Hemoptysis can be secondary to a variety of etiologies with malignancy being one of the most common causes. Mild to moderate hemoptysis can be a nuisance and/or disconcerting to a patient and family members. Conversely, more severe hemoptysis can be life-threatening. In either clinical situation, bronchoscopy is central to confirming a pulmonary etiology (versus upper airway or gastrointestinal tract), identifying the source and potentially palliating symptoms. For instance, via the bronchoscope, one can administer topical vasoconstrictors and further direct therapies aimed at bleeding cessation [13,14].

In best case scenarios, bronchoscopy is sufficient to control hemorrhage and allow for the resuscitation of the patient and the planning of subsequent interventions. One such commonly applied intervention for persistent hemoptysis bronchial artery embolization. Swanson et al. reported this to be effective at controlling hemorrhage in 85% of patients at one month [15]. Unfortunately, bronchoscopy and bronchial artery embolization are occasionally not enough to treat persistent hemorrhage and surgical intervention, such as palliative lobectomy is required. In sum, these patients are often critically ill and are high risk thus underscoring the importance of skilled bronchoscopy and interventional radiology in helping to avoid emergent surgical exploration.

Pericardial effusion

Another common clinical scenario presented to the thoracic surgeon is the management of malignant pericardial effusions. While longstanding or chronic effusions may be relatively asymptomatic,

patients with symptomatic pericardial effusions often present with dyspnea, orthopnea, pain or tachycardia. For some patients, signs and symptoms of cardiac tamponade are present. In addition to clinical evaluation, echocardiography can be pivotal in determining the urgency in which the effusion should be addressed.

Therapies are primarily designed to relieve symptoms either emergently, in the case of tamponade, or electively in the case of constitutional symptoms such as fever dyspnea, cough or chest pain. While highly morbid techniques such as thoracotomy with pericardiectomy are definitive procedures, they are rarely indicated for the palliative purposes and have been replaced with other techniques. One traditional option for the treatment of tamponade is the subxiphoid pericardial window. Capable of being performed under local anesthesia, this procedure involves a small incision just inferior to the xiphoid process. The soft tissues under the xiphoid are then dissected bluntly until the pericardium is visualized. It is then grasped and incised relieving the effusion and allowing the placement of a small drain. Overall, the creation of a subxiphoid window is effective about 90% of the time.

With the popularity of Video-Assisted Thoracoscopy (VATS), more surgeons are electing to approach pericardial effusions in this manner. Superior long-term results have been achieved with the VATS technique, which also offers the opportunity for simultaneous drainage of pleural effusions. Finally, VATS has the added benefit of obtaining larger pieces of pericardium for biopsy and pathologic analysis. A comparative study from the University of Pennsylvania looked at thoracoscopy pericardial window versus subxiphoid drainage in a retrospective review of patients between 1992 and 2002.

While both procedures were well tolerated with minimal morbidity and no procedure related mortality, thoracoscopic pericardial window, on multivariate analysis, was an independent predictor of freedom from recurrence [16].

Tracheobronchial obstruction

A source of high anxiety to both physician and patient, the central tenet in the management of tracheobronchial obstruction is airway patency. Achieving this goal then allows for the palliation of symptoms and improvement in quality of life. In addition, post obstructive pneumonia can be treated more effectively in the setting of relieved obstruction.

One technique for addressing this problem includes rigid bronchoscopy with the mechanical debridement of obstructing airway masses. Mathisen et al. [17] studied the use of biopsy forceps for "coring-out" tumor in fifty-six patients. They reported success in the fifty-one patients with the most common complication being bleeding.

Similar to the treatment of obstructing esophageal cancers, PDT and Nd:YAG laser can also be employed for the destruction of obstructing tracheobronchial lesions. While there are no direct comparisons between these two treatment modalities versus mechanical methods, PDT and Nd:YAG laser are more expensive (i.e. instrument costs) and require more expertise than mechanical relief of obstruction. In addition, one must always consider when using PDT, the potential inconvenience that post-procedure skin hypersensitivity can be for patients.

Also similar to the management of obstructing esophageal malignancies, external compression with collapse of the airway is particularly responsive to stenting. Tracheobronchial stents have become an invaluable resource in the management of tracheobronchial

obstruction. A University of Washington study of 143 patients with obstructing tracheobronchial lesions noted an improvement in symptoms in 94% of patients with no stent-related mortalities. In addition, of the 53 patients in the study who had obstruction secondary to malignancy, 45 maintained airway patency for follow-up periods of one to thirteen months with only 28% requiring further bronchoscopic interventions [18].

Silicone stents are one option because they are both easy to remove and reposition as well as relatively inexpensive. In addition, they are solid, which limits tumor in growth and granulation. These stents are placed using either rigid or flexible bronchoscopy, sometimes with fluoroscopic guidance.

An alternative to the silicone stent is the expandable metal stent, which is also easy to deploy using flexible bronchoscopy and fluoroscopy. These stents rarely migrate and conform well to the airway. The drawbacks of these devices are that they can be very difficult, if not impossible, to remove and are susceptible to the inevitable in growth of granulation tissue and sometimes tumor.

Malignant pleural effusions

There is perhaps no other palliative clinical scenario that the thoracic surgeon is confronted with more than the management of malignant pleural effusions. Regardless of the intervention chosen, the ultimate goal is a reduction in dyspnea and pain, with the concomitant induction of scar to obliterate the pleural space. Ideally, all three of these goals are accomplished with minimal discomfort and in a cost-effective manner.

The spectrum of interventions for malignant effusions includes morbid procedures such as pleurectomy, which outside of the management of malignant pleural mesothelioma, is rarely indicated. Likewise, the application of pleuroperitoneal shunts is really of historic interest with the advent of the PleurX catheter [19].

The most common modality currently employed for the management of malignant effusions is chemical pleurodesis. Multiple agents have been used over the years including antibiotics such as doxycycline and tetracycline as well as the antineoplastic agents, bleomycin, doxorubicin, mitomycin, IFN, and IL-2. Despite these many options, talc is considered by many to be the best agent in terms of results and expense [20].

The best approach for talc pleurodesis was studied in a randomized fashion in the CALGB 9334 trial. This study compared the application of talc via thoracoscopy with Talc Insufflations (TTI) to thoracoscopy and Talc Slurry (TS). The primary objective of the study was 30-day freedom from radiographic pleural effusion recurrence among surviving patients whose lungs initially re-expanded 90%. Five hundred and one patients were randomized and there was no significant difference between study arms in terms of the primary endpoint (78% for TTI and 71% for TS). However, in subgroup analysis, the success for patients with primary breast and lung cancer was superior in those treated with TTI. While this was a subgroup analysis, these cohorts made up well over 50% of the patients in both arms, thus suggesting that one give strong consideration to TTI over TS in the management of effusions secondary to breast and lung cancer.

While generally well-tolerated, talc pleurodesis, regardless of the method of its application, can be associated with rare but significant side effects. In addition to pain and fever, more serious complications like ARDS can result in death. In the CALGB study, the combined incidence of pneumonia and respiratory failure in both groups were

12.9% and 12.1% respectively. Another sobering statistic was that postoperative death occurred in 14.5% of the study patients. In sum, the application of talc pleurodesis for the palliation of malignant effusions, while highly effective, should not be dismissed as routine as morbidity and mortality can be significant [21].

One increasingly attractive alternative to talc pleurodesis is the PleurX catheter (Denver Biomaterials Inc., Golden, CO). The use of this catheter was originally approved in 1999 by the FDA. It is essentially a 15.5 French silicone catheter with multiple side holes and a proximal polyester cuff that induces fibrosis under the skin thus securing it. On the proximal end of the catheter is a valved hub that opens when a dilator is applied to it thus draining fluid. These catheters can be applied at bedside and are best for patients with free-flowing effusions [22].

Enthusiasm for the PleurX catheter led to a randomized trial conducted by Putnam et al. [23] This multi institutional study randomized 144 patients to an indwelling PleurX catheter versus doxycycline pleurodesis. The authors hypothesized that the PleurX catheter would decrease hospital stay and result in an improved quality of life as compared to traditional chemical pleurodesis. As in the CALGB study, the majority of patients had breast and lung cancer as the primary diagnosis. In the final analysis the PleurX catheter group did indeed have a shorter median hospital stay (1.0 day vs. 6.5 days). In addition, only 13% of the patients in the Pleura group experienced recurrence of their effusion post discharge as occurred to those treated with doxycycline. In some cases, patients treated with the PleurX catheter are ultimately able to have their catheters removed due to resolution of their effusions.

With the variety of modalities and agents available for the management of malignant pleural effusions, as well as the frequency with which this problem is encountered, analysis of the cost-effectiveness of each is important. A recent cost-effectiveness study was conducted to examine four treatment options: repeated thoracentesis Tunneled Pleural Catheter (TPC), bedside pleurodesis and thoroscopic pleurodesis. Analysis was conducted assuming two different clinical scenarios, 3-month and 12-month survival. In the setting of 3-month survival, repeated thoracentesis was the least expensive treatment (\$4,946) with TPC second at \$6,450. However, in terms of cost-effectiveness with the short survival interval, TPC was superior to repeated thoracentesis due to its low complication rate and higher incidence of inducing pleural sclerosis (i.e. resolution of malignant effusion). Over the longer 12-month survival period, bedside pleurodesis was the least expensive treatment and was more effective than both repeated thoracentesis and TPC. Incidentally, thoroscopic pleurodesis was more effective in inducing pleural sclerosis but at a significantly higher cost than bedside pleurodesis (\$250,000 per quality adjusted life year). Thus the authors of this study concluded that, based on cost-effectiveness, patients with short survival estimates should have tunneled pleural catheter placement while those expected to live longer should undergo pleurodesis [24].

Summary

The options for the palliative management of thoracic disease have expanded greatly over the last twenty years. The popularity and wide application of both esophageal and tracheobronchial stents has provided significant symptomatic relief for many patients. Likewise, expertise with laser and photodynamic therapy has provided yet another option for the management of obstruction in both organ systems. Meanwhile, the results from randomized trials have provided evidence-based approaches for the management of malignant pleural effusions.

Regardless of these advances, it is still important that the thoracic surgeon always be cognizant of the sometimes tenuous clinical status of these patients. Applying the right modality to the palliation of symptoms should always start with considering patients preferences, as well as what the individual patient can tolerate. Secondly, in today's healthcare climate, one must consider what makes the most sense from a cost-effectiveness standpoint. In the ideal world, maximal benefit, limited morbidity, and economic sense meet and the patient are provided the most clinically and cost effective palliation.

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