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• REVIEW •

Oesophageal surgery

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INTRODUCTION

The origins of oesophageal surgery, like most surgical treatments, are based in the treatment of traumatic injury. The *Smith Surgical* Papyrus describes the examination, diagnosis and treatment of "a gaping wound of throat, penetrating the gullet"[1]. This article focuses on the important conditions facing the oesophageal surgeon today, with an emphasis on those where there have been significant changes in our understanding of disease or approaches to treatment.

BENIGN OESOPHAGEAL DISEASE: SURGICAL PRINCIPLES AND PRACTICE

Oesophageal motility disorders: Achalasia

Pathogenesis While the exact cause remains obscure, achalasia is clinically characterized by a triad of findings: oesophageal aperistalsis usually with atony, varying degrees of oesophageal dilatation, and failure of normal lower oesophageal sphin cter (LOS) relaxation in response to deglutition. It has been recognized recently that symptoms (particularly pain) can occur when the oesophagus remains undil ated and still exhibits contractions which are frequently of high amplitude, although it should be stressed, non-peristaltic. This is called vigorous achalasia. Most theories surround the concept of a neurogenic origin for achalasia, due to a loss of ganglion cells in Auerbach's plexus[2]. The cause remains obscure. Recent evidence suggests that achalasia may be part of a spectrum of oesophageal motility disorders with potentially common or similar aetiologies including diffuse oesophageal spasm (DOS) and nutcracker oesophagus[3].

Diagnosis The onset of symptoms is typically insidious and diagnosis is commonly made months to years later. Dysphagia is the most common presenting symptom, occurring in over 80% of patients. As the disease progresses, oesophageal dilatation occurs, which may lead to regurgitation and aspiration, resulting in pulmonary complications.

A clear diagnosis of achalasia can rarely be made on clinical grounds alone, and this usually relies on a combination of contrast radiography, motility studies, and endoscopy. Contrast oesophagography characteristically demonstrates a dila ted, possibly tortuous oesophagus, with smoothly tapered "birds beak" narrowing at the OGJ. Endoscopy may be indicated to ensure that no mucosal lesion is present and rule out the presence of a neoplasm in the lower oesophagus which can lead to a manometric pattern indistinguishable from achalasia (pseudoachalasia[4]). Manometry demonstrates absent relaxation of the LOS during wet and dry swallows, as well as usually simultaneous, low amplitude contractions in the body of the oesophagus. Although multiple medications have been tried for achalasia, including calcium channel blockers, nitrates, anticholinergics, prostaglandins, aminophylline and beta-agonists, none provide long-term symptomatic improvement. The intramuscular injection of botulinum toxin into the LOS was popularized in 1994. The toxin directly inhibits the release of acetylcholine from nerve terminals, causing the sphincter fibers to relax. Long term results have been disappointing. Of 28 patients enrolled in one study[5], only 20 experienced a remission lasting longer than 3 months, with most requiring additional treatments. Various strategies to improve results have not led to sustained relief of symptoms. Botulinum toxin injection is probably best regarded as an alternative to pneumatic dilatation in those who are not candidates for surgery.

The use of rigid mechanical dilators has given way to hydrostatic and pneumatic balloon dilators. Sanderson reported improved results in a cohort of 457 patients when successive dilatations were used[6]. Perforation occurs in 1%-5%, leading to a mortality rate of about 0.3%[7]. Balloon dilatation has compared favorably to oesophagomyotomy in some reviews[8], although in the only prospective, randomized trial to date, conducted by Csendes *et al*, oesophagomyotomy achieved 98% good to excellent results compared to just 68% good to excellent results after balloon dilatation[9]. Many authors have, however, considered that this was optimal surgery versus sub-optimal endoscopic therapy due to the nature of the "bag" used for dilatation. Since Heller described oesophagomyotomy, surgery has remained the standard against which all other methods are compared. The myotomy extends for approximately 5 cm to 6 cm above the oesophagogastric junction. It does not need to extend for any great length on to the stomach[10,11]. Intraoperative oesophagoscopy is helpful in assessing the proper proximal and distal extent of the myotomy, allowing the surgeon to accurately visualize the level of the squamocolumnar junction, and test the myotomy by air insufflation.

When performed through the abdomen, there seems to be a higher incidence of pathological gastroesophageal reflux than seen after a thoracic approach. DeMeester and colleagues reported an approximately 12% incidence of pathologic reflux after successful myotomy, reduced to 4% with the addition of fundoplication[12]. Surgeons who advocate the use of a Toupet fundoplication, argue that as it lies posterior and is sewn to the leading edges of the myotomy it allows the mucosa to bulge, keeping the myotomy pulled open so that it is less likely to scar. While reasonable arguments exist for the application of the Dor, Toupet, or Belsey partial fundoplications, none has been shown to have a clear advantage over the others. With the advent of minimally invasive surgery, thoracoscopic and laparoscopic approaches have become popular. Advocates of a thoracoscopic approach have propos ed that the chest offers a better view of the oesophagus in order to achieve a long myotomy[13], although difficulties extending the myotomy onto the anterior wall of the stomach may leave the muscular sling at the gastric cardia intact resulting in an ineffective myotomy and a higher incidence of post operative dysphagia[14]. Most early advocates of the thoracoscopic

approach have converted to laparoscopy.

In any event, the limited surgical morbidity afforded with a minimally invasive approach to oesophagomyotomy and the excellent results achieved have led to a change in the clinical decision making regarding the management of the patient with achalasia. Patients and physicians who once shunned the morbidity and time of recovery from open surgical treatment may consider a laparoscopic procedure to avoid the long term complications of achalasia.

Diffuse oesophageal spasm (DOS) The hallmarks of DOS are intermittent and unpredictable chest pain and non -progressive dysphagia. Dysphagia may be associated with chest pain, which is spontaneous, reproducible, retrosternal in location and may radiate to the left arm or neck. The dysphagia and chest pain may be triggered by certain hot or cold foods, carbonated beverages, or stress. Before the development of manometry, contrast oesophagography was the meth od of choice in making the diagnosis of DOS. A barium swallow may demonstrate s imultaneous, nonperistaltic contractions, with segmentation of the barium column, giving the characteristic "corkscrew" appearance to the oesophageal body, but is unreliable as these abnormalities exist in only a minority of patients[15]. While manometry remains the preferred method of establishing the diagnosis of DOS, disagreement exists over a precise definition. The most widely accepted manometric definition of DOS is two or more swallows resulting in simultaneous contractions in a series of ten wet swallows (the rest being peristaltic). Neither amplitudes, nor duration considered [16]. Recent authors have advocated the use of 24 hr ambulatory manometry, as DOS commonly produces intermittent symptoms that can be correlated with abnormal motility findings during a 24 hour study. An alternative and perhaps more acceptable definition of DOS is "the presence of multi-peaked contractions over at least 10cm of the oesophageal body lasting longer than 15 seconds and with maximum amplitudes of greater than 200 mmHg. Some of these spasm contractions should produce symptoms of ches t pain and/or dysphagia"[17]. Management of DOS is directed at symptom relief. Medical management has included the use of sublingual or oral long acting nitrates, calcium channel blo ckers, and hydralazine, all of which can provide some symptomatic and manometric improvement. Balloon dilatation has been shown to significantly relieve the severity of DOS symptoms in 70% of patients in whom initial medical management proved unsuccessful[18]. The surgical management of DOS is based on oesophagomyotomy, its length being de termined by the extent of manometric abnormalities. Most authors recommend carrying the myotomy through the LOS onto the gastric cardia. In carefully selected patients, the results have been excellent, with significant improvements (P<0.01) in symptoms, and a 93% effective palliation of dysphagia[19]. With the advent of minimally invasive surgery in the last several years, more surgeons are approaching DOS with a thoracoscopic long oesophageal myotomy, although there are no long-term results as yet.

Nutcracker oesophagus High amplitude peristaltic contractions were first described by Brand and collea gues in patients with noncardiac chest pain and dysphagia, and were confirmed by Benjamin and associates in 1979, who coined the term "nutcracker esophagus"[20], on the assumption that these contractions were the cause of symptoms. The manometric definition states that average peristaltic pressures are at least two standard deviations above the normal value, usually defined as 180mmHg[18]. The aetiology of nutcracker oesophagus is unclear. A psychological component has been implicated, and it has been reported to evolve eventually into diffuse oesophageal spasm or achalasia. It is the most common motor disorder diagnosed in patients with noncardiac chest pain.

Management focuses on symptom relief, and like DOS, many patients obtain relief with nitrates and calcium channel blockers, although dilatation seems ineffective. A few case reports have shown positive results after myotomy whose symptoms were not relieved with medical management, although there are no long-term results.

Gastroesophageal reflux disease and hiatus hernia

Gastroesophageal reflux disease (GORD) has become the most prevalent upper gastrointestinal disorder in the west. In 1946, Allison coined the term "ref lux oesophagitis" after identifying the fundamental pathophysiologic process resulting in the inflammation found at the gastroesophageal junction[21]. Since then, it has become clear that injury due to reflux may extend beyond the oesophagus to the larynx and lungs, and heartburn can occur without the changes in the oesophageal mucosa that define reflux oesophagitis. Thus, the broader term GORD was coined to describe any symptomatic condition or pathologic alterat ion that occurred as a result of reflux[22]. Although GORD is thought to account for approximately 75% of oesophageal disease in clinical practice, the epidemiology is not well defined, as no precise definition exists, nor is there a gold standard diagnostic procedure. Heartburn is experienced by approximately 20% to 40% of the western population[23], although the true prevalence is almost certainly higher than reported, as many sufferers treat themselves. Incidence increases with age in both sexes. Many foods exacerbate symptoms including coffee, chocolate, peppermint, and dairy products. Tobacco use and obesity are also related to increased incidence of GORD[24].

Symptoms are not reliable predictors of the presence of GORD. Only 60% of patients with "heartburn" have abnormal 24 hr pH and manometry testing, while chronic heartburn and regurgitation can be present without evidence of mucosal damage on upper endoscopy[25]. Complications develop in approximately 50% of patients with abnormal gastroesophageal reflux by pH testing including oesophagitis, oesophageal stricture, Barrett's metaplasia, and pulmonary disease[26].

Pathogenesis The anatomic and physiologic barriers to the development of GORD involve a lower oesophageal high pressure zone/sphincter (LOS), a gastroesophageal junction that is located intrabdominally, an anatomically intact gastroesophageal flap valve, an intact esophageal clearance mechanism that efficiently evacuates refluxed gastric contents from the oesophageal lumen, and a stomach that empties properly. The role of hiatus hernia in GORD has been controversial, although it clearly alters the anatomic relationship between the OGJ and diaphragmatic crura, and may contribute to LOS incompetence. Patients with large hiatus herni as have been demonstrated to have lower LOS pressures, be exposed to more reflux than patients with no or smaller hiatus hernias, and have prolonged acid exposure in t he oesophageal lumen, which may be secondary to impaired oesophageal clearance, rather than an increased number of reflux episodes[27]. Impaired oesophageal clearance has been demonstrated to correlate with inc reasing severity of inflammation[28]. As oesophageal clearance becomes increasingly impaired, even effective acid suppression may not be enough to reverse the mucosal injury in some patients, and for this reason it has been argued that surgical correction of a dysfunctional LOS should be considered before peristaltic function becomes impaired[29].

Diagnosis and treatment Oesophagoscopy provides the opportunity for the diagnosis of complications of GORD, including the identification of the presence of Barrett's metaplasia. Further

evaluation may involve 24 hour pH and manometry testing, to confirm the diagnosis of GORD and identify motility abnormalities.

The indications for surgery vary, but most recommend antireflux surgery in patients with symptoms refractory to medical management, and when complications exist such as stricture formation, bleeding, or pulmonary manifestations due to regurgitation and aspiration. It is important to recognize that most of the conditio ns which complicate gastroesophageal reflux disease are of a benign nature.

Many operations have been devised to treat GORD. While no single technique can guarantee excellent results under all circumstances, all involve reduction of any hiatus hernia and crural repair. The Nissen fundoplication is undoubtedly the most commonly employee and widely known antireflux procedure in the world. Multiple modifications to the original operation have been made since its original description by Nissen in 1956[30].

The Nissen-Rosetti operation incorporates a 360° fundic wrap without ligation of the short gastric vessels for simplicity and ease of dissection. The Rosett imodification proved quite effective, although postoperative morbidity with regard to dysphagia, gas bloat, and inability to belch are higher (8%) than the later "floppy" Nissen (3%), potentially reflecting the difference when a lower part of the fundus/ greater curve must be used in the wrap and the short gastric vessels not divided[31]. When performed correctly and for the right indications, long term outcomes with the "floppy" Nissen fundoplication have been excellent, with the alleviation of reflux and its symptoms in approximately 85%-90% of patients at 10 years, with morbidity including dysphagia, gas bloat, and inability to belch in the range of 3%-10%[32].

A variety of incomplete (<360°) wraps have been described (Toupet, Lind, Wats on). Historically, the most widely used was the 240° vertical fundoplication developed by Belsey and performed via a left thoracotomy. All produce excellent results in the hands of experienced surgeons with similar results to total fundiplication[33-35]. Hill championed the importance of the gastroesophageal flap valve as one of the chief natural barriers to reflux. He described a musculomucosal valve created by the angle of His, acting to prevent reflux by closing against the lesser curve with increased gastric pressure. The original Hill repair reconstructed the oe sophagogastric junction by posteriorly fixing it to the median arcuate ligament and accentuating the angle of His, thereby reestablishing the gastroesophageal flap valve apparatus[36].

The Hill operation has not enjoyed the popularity of the Nissen, probably as a result of the perceived difficulty in defining the median arcuate ligament. Vansant simplified the dissection in 1976[37], while further modifications have adopted the use of the preaortic fascia and condensation of the crus as the anchor for the repair. Long-term results with the modern Hill antireflux operation have been excellent, in one of the longest postoperative follow-up studies in antireflux surgery, after 15 to 20 years, 88% of patients had good to excellent outcomes[38].

With the development of minimally invasive techniques, it became possible to perform antireflux operations laparoscopically. Isolauri and associates demonstra ted that ten years worth of a proton pump inhibitor will cost 10 times more than a laparoscopic Nissen fundoplication, including the preoperative evaluation and postoperative care[39]. An initial report by Dallemagne[40] led to the rapid popularization of laparoscopic Nissen fundoplication throughout the world. Hinder reported on 198 patients who underwent laparoscopic Nissen fundoplication from 1991 to 1994, the main indication for surgery being symptom s refractory to medical management. The outcome for most patients was excellent , although nearly a third had problems with postoperative dysphagia or gas bloat[41]. Watson reported on 230 laparoscopic Nissen fundoplications, with a median follow-up of 16 months with symptom relief in 88%[42]. Whether the long term results of laparoscopic fundoplication will match those of open surgery remain to be seen, but initial results appear favourable when the surgery is performed at high volume centres.

Although laparoscopic antireflux surgery has proved successful for patients with small hiatus hernias, larger hiatus and paraesophageal hernias pose additional problems. The technical imperatives, as outlined by Horgan for open surgical technique, apply equally well to laparoscopic repair and include transhiatal oesophageal mobilization with reduction of the oesophagogastric junction into the abdomen, complete reduction of the hernia sac, effective crural closure, attention to the geometry of the fundoplication, and an anchored repair[43].

Although most series have demonstrated good to excellent results[44-46] they have been criticized for their short follow-up periods and lack of objectivity. Hashemi and associates demonstrated a concerningly high recurrence rate in patients who underwent laparoscopic repair of paraesophageal hernias. Routine postoperative contrast oesophagography demonstrated a 43% recurrence rate, compared to 15% following open surgery at 5 years[47], prompting many surgeons to discontinue the laparoscopic approach to large hiatus and paraesophageal hernias. While the presence of a large hiatus or paraesopha geal hernia is not a contraindication to laparoscopic repair, the high recurrence rate reported in the recent literat ure should prompt responsible surgeons to follow patients objectively while more data are obtained, preferably through prospective trials.

OESOPHAGEAL CANCER

The German-born surgeon, Dr. Franz Torek, working in New York in 1913, performe d the first successful transthoracic resection of the oesophagus for carcinoma[48]. In 1933 Grey Turner successfully resected an intra-thoracic oesophageal tumor by the trans-hiatal route, and in the same year Ohsa wa reported success in eight patients undergoing transthoracic oesophageal resec tion with intrathoracic oesophagogastrostomy for carcinoma of the lower oesophagus[49]. While refinements in techniques reduced morbidity and improved outcomes in the latter part of the 20th century, surgical treatment continues to be viewed unfavorably, mostly due to high operative mortality and poor survival statistics as documented by Earlam[50] and Muller[51]. Recent advances in perioperative care, more accurate staging techniques, better patient selection and the addition of chemo-radiotherapy have led to decreased perioperative mortality and improved survival rates, which has challenged the pessimistic attitudes toward oesophageal resection.

Pathogenesis Oesophageal carcinoma has a unique and changing epidemiologic pattern. Ge ographic variation is remarkable with 5 cases per 100 000 population in the United States, 7-10 cases per 100 000 in the United Kingdom, to over 500 cases per 100 000 population in parts of Iran, China, and Russia, leading most to believe that environmental causes play a large role in the development of oesophageal carcinoma[52]. Factors associated with an increased risk of oesophageal cancer include age, gender, race, excessive tobacco and alcohol use, diet and a variety of nutritional deficiencies including retinoic and ascorbic acids, riboflavin, and zinc. In areas where oesophageal carcinoma is endemic, diets appear to be low in fruit, vegetables, minerals, and vitamins A, C, and riboflavin[53].

Another remarkable feature of oesophageal cancer is the recent change in histologic pattern. While 20 years ago adenocarcinoma made up just 10% of oesophageal cancers, it now represents approximately 50% to 70% in the western world, virtually all due to a marked increase in the incidence of adenocarcinoma. While the exact reason for this is unknown, it has something to do with the rising incidence of Barrett's metaplasia, a condition which occurs as a response of the lower oesophageal epithelium to chronic

gastroesophageal reflux. The associ ation of specialized Barrett's oesophagus with an increased risk of developing oesophageal adenocarcinoma is well documented. Further understanding of the biology of oesophageal cancer, coupled with the identification of significant risk factors, such as Barrett's oesophagus, have permitted the surveillance of high-risk patients and the identification of early stage disease. The impact of this on future survival remains to be seen.

Diagnosis and staging The decision to consider a patient for curative therapy is essentially influence d by fitness to withstand treatment aimed at cure and accurate staging. At presentation, a careful history and physical exam may immediately reveal that the disease is beyond cure. Severe weight loss, spinal pain, recurrent laryngeal nerve palsy, or lymphadenopathy all indicate advanced disease. A chest x-ray may demonstrate mediastinal enlargement, tracheal deviation, a dilated fluid filled oesophagus, pleural effusions, or nodular lung involvement; all indicating advanced disease. Flexible endoscopic examination permits tumour visualization and biopsy. Contrast oesophagography can be used to confirm tumour location and length, and may be particularly useful in the detection of fistula formation or in clarifying anatomy in patients who have undergone previous gastric surgery.

Although computed tomography is not useful in staging early carcinomas of the oe sophagus[54], it can define the extent of more locally advanced disease as well as identify distant metastases. Patients with haematogenous metastases are incurable. With the advent of endoscopic ultrasound, the ability to more accurately define the locoregional extent of oesophageal carcinoma has improved significantly. Endoscopic ultrasound provides an accurate assessment of oesophageal wall p enetration (T-stage), as well as peri-tumoral and regional lymph node status (N-stage). Nodal positivity is the single factor which correlates most with the chance for cure[55], and the detection of contiguous organ invasion has made "open and close" or by-pass surgery virtually obsolete. Multiple reports have demonstrated an overall accuracy of approximately 90% for T-staging and approximately 80% to 85% accuracy for N-staging[56-58]. In addition, thoracoscopic and laparoscopic techniques are being more widely used to exclude pleural or peritoneal metastases again with accuracy approaching 90%[59].

Surgical treatment and results Exactly what constitutes an adequate resection margin or extent of lymph node dissection is widely debated, but it is evident that prolonged survival in oesopha geal carcinoma depends principally on the completeness of surgical resection as well as the pathologic stage of disease. Most surgeons recommend removing at least a 5 cm margin of normal oesophagus proximal to the lesion with surrounding pleura and fibro-areolar tissue along with the entire distal oesophagus and cardia. More proximal oesophageal tumors require a total thoracic oesophagecto my and cervical anastomosis for adequate resection margins, while more distal oesophagogastric junction tumors require removal of more stomach, especially along the lesser curve. A number of techniques have been developed for oesophageal resection, and while there does not appear to be a substantial difference in the overall mortality be tween procedures, the type and degree of morbidity does vary. The most popular approach in the west is the two-phase (abdomen, right chest) operation popularized by Lewis[60]. While devised principally for mid-oesophageal tumors, it is equally useful for distal tumors as well in providing adequate resection margins. A three-phase oesophagectomy combines a cervical incision for total thoracic oesophagectomy and cervical oesophagogastric anastomosis[61].

Transhiatal oesophagectomy involves the resection of the intrathoracic oesophagus through the oesophageal hiatus and the thoracic inlet with a cervical oesopha gogastric anastomosis. Most of the operation can be done under direct vision through the diaphragmatic hiatus, although the mid and upper thoracic dissection is done bluntly, with risk of tracheobronchial or great vessel injury. Many surgeons believe transhiatal oesophagectomy to be an appropriate choice only for distally located tumours due to the risk of radial margin positivity and the inability to perform an adequate intrathoracic lymph node dissection with mid-oesophageal tumours.

A left thoracoabdominal oesophagectomy is also widely used for lower oesophageal tumors. Anastomosis may be performed in the left chest or after further mobilization of the upper oesophagus a cervical oesophagogastric anastomosis can be fashioned. The incidence of symptomatic reflux is highest following 'low' anastomosis in the left chest and diminishes with higher anastomoses. There are relatively few series that have compared right and left thoracotomies for oesophageal resection, although Launois and associates demonstrated similar operative mortality and survival rates for both approaches[62]. The choice of conduit for reconstitution of gastrointestinal continuity is largely based on surgical preference, as there have been no controlled clinical trial s comparing techniques. Stomach, colon and jejunum have all been used successfully. The easily mobilized stomach has been found by many surgeons to be the best functional replacement for the resectedoesophagus. There is no standard for performance of the oesophagogastric anastomosis; the advent of circular stapling devices may have resulted in a decrease in anastomotic leak rates. Stricture rates of approximately 5% to 10% are seen with handsewn anastomotic techniques and medium sized stapling devices, although this can be as high as 30%-40% with smaller stapling anvils[63]. Stricturing occurs more commonly with cervical than intra-thoracic anastomoses irrespective of technique[64].

Emptying of the gastric conduit, occurs mainly as a gravity dependent mechanism with very little propulsive action in the gastric tube[65]. While there is continued debate regarding the need for a gastric emptying procedure, randomized studies do not support the use of pyloroplasty or pyloromyotomy to improve postoperative function. Gastric outlet obstruction after gastric pull-up may be due to axial rotation of the gastric tube and not pyloric function, thus, close attention should be paid intraoperatively to maintaining the correct anatomic orientation of the conduit. The extent of lymphadenectomy performed during oesophageal resection for carcinoma is highly variable. While no prospective trial has been performed in the was tern hemisphere demonstrating improved survival with more extended lymphadenecto my, the "three field" lymph node dissection has been claimed by Japanese autho rs to contribute to their improved survival statistics. Advocates of standard oesophagectomy argue that once an oesophageal carcinoma has penetrated the oesophageal wall and involved peritumoral lymph nodes, surgical cure is unlikely. Skinner, however, demonstrated that the removal of involved regional lymph nodes will improve survival rates[66], while Sasaki and colleagues showed that patients who underwent extended lymphadenectomy with oesophageal resection had significantly improved survival compared to patients who underwent more limited node dissection[67].

A standard lymphadenectomy in oesophageal cancer should include all paraesophageal, subcarinal, left gastric, common hepatic, proximal splenic, and crural nodes . A proper oncologic resection with adequate lymphadenectomy might improve survival, but it will certainly lead to more accurate staging and avoid the error of "improved" survival figures which reflect the stage migration inherent in a more accurate nodal assessment. Extended lymphadenectomy, however, does potenti ally increased morbidity, particularly when applied to nodes along the recurrent laryngeal nerve chains[68].

Postoperative mortality in oesophageal resection has decreased from approximatel y 25% to less than 8% in the past two decades. While complications have also decreased, a third of patients can be expected to have a major complication after surgery, including arrythmias, pulmonary embolus, pneumonia, or anastomotic leak . Most patients resume a normal diet within three to six months following surgery and maintain their weight at approximately 90% of normal. While surgery remains the mainstay of therapy for oesophageal carcinoma, there is considerable cur rent interest in combined modality approaches.

Loco-regional disease is a significant cause of morbidity and mortality, but even when this is controlled, most patients eventually die of metastatic disease. Combined modality therapy aims to improve local control, eliminate micrometas tatic disease and improve cure rates. Adjuvant systemic chemotherapy has not been shown to reduce the risk of metastases in randomized studies[69,70]. While some studies have shown a statistically significant reduction in loco -regional recurrence with the use of post-operative radiation, this also has not translated into a survival advantage[71].

Most enthusiasm now focuses on the use of neo-adjuvant multimodal therapy designed to reduce the size of the primary tumor to potentially improve the curative resection rate, and expose micrometastases to systemic chemotherapy at an early stage. Randomized trials comparing preoperative chemoradiation plus surgery to surgery alone vary considerably with regard to chemotherapy regimens, radiation doses, histologic type of cancer, and numbers of patients accrued making conclus ions difficult. Trials conducted by Walsh *et al*[72] and Forastiere *et al*[73] have demonstrated either a statistically significant survival advantage or trend toward improved survival with preoperative chemoradiation, while others have not[74]. While it is clear that some oesophageal carcinomas respond dramatically to preoperative chemoradiation, further prospective randomized trials are needed to see if this will translate into a clear survival advantage.

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