A single surgeon’s series of transthoracic oesophageal resections

WD Beasley¹, MT Jefferies², J Gilmour³, JMcK Manson¹

¹Abertawe Bro Morgannwg University Health Board, UK
²Cardiff and Vale University Health Board, UK
³University Hospitals Coventry and Warwickshire NHS Trust, UK

ABSTRACT
INTRODUCTION Significant controversy persists over the optimum surgical management of oesophageal carcinoma. The authors report on a consecutive personal series of open transthoracic oesophageal resections.

METHODS Data relating to resections performed between mid-1993 and the end of 2010 were analysed. Patient and tumour assessment evolved over this period. Preoperative chemotherapy in appropriate cases was introduced in 2002. A laparotomy and right lateral thoracotomy approach (Ivor–Lewis) was used. In all cases the pylorus was not interfered with, no attempt was made to perform a radical lymphadenectomy but surgical strategy was focused on producing an R0 resection and a hand sewn anastomosis was fashioned.

RESULTS A total of 165 resections were performed; 130 patients (80%) were male. The median age was 66 years (range: 31–82 years). Eighty per cent had an adenocarcinoma. Sixty-four per cent of the tumours were T3/T4 and sixty-two per cent node positive. Forty patients (24%) had an involved circumferential resection margin (CRM). Five patients (3.0%) had no resection and a quarter (26%) developed morbidity of some form. There was one clinical anastomotic leak (0.6%) and three benign strictures requiring dilation (1.8%). In-hospital mortality was 3.0% (5 patients). Disease specific survival at one, two and five years was 77%, 42% and 36% respectively. Neither CRM involvement nor preoperative chemotherapy influenced survival significantly. No patient required intervention to disrupt the pylorus.

CONCLUSIONS Excellent outcomes are achievable following open transthoracic oesophagectomy without radical lymphadenectomy using a hand sewn gastro-oesophageal anastomosis and without disrupting the pylorus.

KEYWORDS
Oesophagectomy – Ivor–Lewis – Oesophageal cancer – Gastro-oesophageal anastomosis – Pyloroplasty – Lymphadenectomy

Accepted 1 November 2013

CORRESPONDENCE TO
James Manson, Consultant Surgeon, Department of Oesophagogastric Surgery, Singleton Hospital, Sketty Road, Sketty, Swansea SA2 8QA, UK
E: james.manson@wales.nhs.uk

The incidence of oesophageal cancer is increasing, especially for men. Nearly 8,500 people are diagnosed each year in the UK and of these, only around 15% will survive 5 years.¹ Over the past few decades, improvements in preoperative staging, perioperative care, multidisciplinary and multimodal approaches, and high volume centres have led to better patient selection, reduced operative morbidity and mortality, and prolonged postoperative survival.²,³

There is no consensus regarding the optimal surgical approach, be it transthoracic (Ivor–Lewis), transhiatal, thoracoabdominal or minimally invasive. Similarly, there is ongoing debate in relation to the appropriate extent of a lymphadenectomy and the gastro-oesophageal anastomosis, both regarding the technique (stapled or hand sewn) and the position (intrathoracic or cervical).

In the light of these uncertainties surrounding oesophagectomy for cancer and the increasing interest in minimally invasive oesophagectomy, we report a consecutive series of 165 transthoracic oesophageal resections performed by a single surgeon (JM). The aim of this paper is to demonstrate that the approach and technique used in the operative management of oesophageal cancer is safe, reliable and effective.

Methods Between 1995 and the end of 2010, consecutive transthoracic oesophageal resections were registered prospectively and the recorded information was supplemented by case note review, contacting general practitioners and from the Welsh cancer registry. Essentially this represents the consultant experience of the senior author.
Patient assessment and selection

From 2002 all patients with oesophageal cancer were discussed at the upper gastrointestinal multidisciplinary team meeting. The decision pathway for these patients is summarised in Figure 1. All patients had contrast enhanced computed tomography (CT) and, since 1995, endoscopic ultrasonography. Starting in 2008, positron emission tomography (PET) CT was employed in cases where there was uncertainty about the presence of metastatic disease and, from the beginning of 2010, every patient had PET CT in all cases. Only patients with junctional tumours and a significant gastric component had staging laparoscopy.

All patients had clinical assessment by an experienced consultant anaesthetist, including echocardiography and pulmonary function tests. From 2007 to 2010 inclusive selected patients also underwent cardiopulmonary exercise testing. No minimum value of ejection fraction, forced expiratory volume in one second (FEV1), the ratio of FEV1 to forced vital capacity ratio, anaerobic threshold or any other parameter was applied. All the available information, together with the clinical impression of the surgeon and anaesthetist, was considered in the decision whether to offer surgery. The views of the patient and, in some cases, the stage of the tumour were also considered. No upper age limit was applied.

Since 2002 patients staged as more advanced than T2 N0 received two cycles of neoadjuvant chemotherapy with fluorouracil and cisplatin. Three patients in this cohort were given preoperative chemoradiotherapy as part of a pilot study that was terminated owing to unacceptable morbidity and mortality. Patients with upper third/postcricoid tumours were offered radiotherapy as primary treatment and were not included in our study. Patients with significant dysphagia compromising nutritional intake, especially those undergoing preoperative chemotherapy, had an oesophageal stent placed preoperatively.

Operative strategy

All operations were carried out by the senior author or by a senior upper gastrointestinal trainee under his direct supervision. All patients had thoracic epidural analgesia. All but four patients, who underwent resection via a left thoracotomy, were operated on using a modified Ivor–Lewis approach via a laparotomy and right lateral thoracotomy. In all cases, except one, the stomach was employed as the intrathoracic conduit, preserving the right gastric and right gastroepiploic vessels. The left gastric artery was ligated and divided as close to the coeliac axis as possible but no attempt was made to perform a radical intra-abdominal lymphadenectomy. The pylorus was not interfered with in any way. If necessary, in particular in junctional tumours, a diaphragmatic cuff was taken en bloc with the tumour. This is the only situation in which patients staged with a T4 tumour were subjected to surgical intervention. Since 2000 a feeding jejunostomy has been placed.

The right chest was opened usually through the bed of the sixth rib. The oesophagus was dissected with its surrounding areolar tissue, leaving a denuded aorta on one aspect and pericardium on the other to achieve an R0 resection whenever possible. The azygos vein was divided in every case. Radical intrathoracic lymphadenectomy was performed in five cases. However, this practice was abandoned after the development of a bronchial fistula in one of those cases. Following three chyle leaks requiring operative intervention, the thoracic duct was subsequently ligated and divided as close to the coeliac axis as possible but no attempt was made to perform a radical intra-abdominal lymphadenectomy. The pylorus was not interfered with in any way. If necessary, in particular in junctional tumours, a diaphragmatic cuff was taken en bloc with the tumour. This is the only situation in which patients staged with a T4 tumour were subjected to surgical intervention. Since 2000 a feeding jejunostomy has been placed.

Epidural analgesia was maintained for four to five days. Jejunostomy feeds were started on the first postoperative day. Patients were kept nil by mouth with a nasogastric tube for six days. Subsequently, oral intake was commenced together with erythromycin syrup 250mg four times daily following a contrast study. The nasogastric tube was usually removed the following day and normal diet was established over the next three or four days. The chest drain was removed when the drainage had subsided, usually at day four or five.

Outcomes

Outcomes studied include resection margin involvement as well as pathological stage, morbidity, in-hospital mortality and long-term survival. Circumferential resection margin...
(CRM) involvement is defined as microscopically visible tumour within 1mm of the marked circumferential margin after formalin fixation. Only postoperative complications that delayed the patient’s discharge or were of prognostic significance (eg myocardial infarction) have been reported.

Statistical analysis
A database was created using Excel® 2005 (Microsoft, Redmond, WA, US) and all statistical analyses were performed using SPSS® version 14.0 (SPSS, Chicago, IL, US). The two-tailed Mann–Whitney U test was used to determine the significance of differences in non-parametric continuous data. Overall survival was analysed using the Kaplan–Meier method and comparisons of curves were made with the logrank test. The chi-squared test was used to analyse categorical data. A p-value of <0.05 was considered statistically significant.

Results
A total of 165 oesophageal resections were performed: 130 in men and 35 in women (male-to-female ratio 3.7:1). The median age was 66 years (range: 31–82 years).

Preoperative interventions
Seven patients with significant dysphagia had a stent placed to maintain their preoperative nutrition. There were no complications of stent placement. Sixteen patients who had tumours with a significant gastric component had staging laparoscopies, none of which altered management. Sixty-three patients had preoperative chemotherapy and five had preoperative chemoradiotherapy.

Surgical outcomes
Five patients underwent surgical intervention but no resection. One patient had a tumour inseparable from the aorta (prior to the use of endoscopic ultrasonography), one had small liver metastases undetected on CT, two patients had unresectable junctional tumours (one entirely unsuspected) and the final patient developed ventricular fibrillation during gastric mobilisation. He was resuscitated and survived but the operation was abandoned.

Three patients could not be extubated on the operating table at the end of the procedure but were extubated within 24 hours.

The median postoperative length of stay was 15 days (range: 10–165 days). The median critical care stay was 7 days (range: 1–105 days). In the absence of specific changes in management, the median inpatient stay over the previous 2 years reduced to 15 days (p<0.001).

Two patients suffered postoperative jaundice, which settled spontaneously and was presumed to be drug related. One patient developed a temporary vocal cord palsy, the cause of which was not determined. Six patients suffered cardiovascular complications (2 myocardial infarction, 2 deep venous thrombosis, 1 pulmonary embolus, 1 cerebral vascular accident) but these were not severe and no patient experienced long-term disability.

There were two anastomotic leaks. One patient had a normal contrast study at six days but two days later developed signs of sepsis. A further contrast study showed an anastomotic leak and a track leading to a collection in the pleural space just deep to the chest wall. This collection was drained percutaneously and the patient recovered with no further intervention. A second patient, who was asymptomatic, had a small leak demonstrated by contrast swallow at six days. This patient went home after 11 days still nil by mouth (nutrition was maintained with jejunostomy feeds) and a contrast study 10 days later in his local hospital showed no abnormality. Oral nutrition was established without difficulty. Three patients (1.8%) required dilation for benign anastomotic stenosis.

Eight patients required reoperation. One patient, who developed a dehiscence of the thoracotomy wound, had received preoperative chemoradiotherapy. One patient, who underwent a radical thoracic lymphadenectomy, developed a bronchial leak at day 10, later complicated by a fistula between the bronchus and the gastric suture line. This patient required three further operations, gastrointestinal continuity being re-established four months later by means of a retrosternal colonic conduit. Three patients required intervention for a chyle leak greater than 10ml/kg/day. No further chyle leaks occurred after introduction of a policy of deliberate thoracic duct control during the thoracotomy.

Five patients (3.0%) died in hospital. One man, who had undergone preoperative chemoradiotherapy, developed ventilatory failure on the first postoperative day requiring reintubation and died on day 16 of adult respiratory distress syndrome. Two elderly patients died from cardiorespiratory complications; the cardiorespiratory reserve in both cases was insufficient to withstand an oesophagectomy. One patient developed respiratory failure on the third day, culminating in a respiratory arrest, from which he could not be resuscitated. One patient died as a consequence of gastric dilation. He had pulled out his nasogastric tube on day 1 and it was not replaced until day 5 when he suffered a sudden deterioration. A nasogastric tube was passed and four litres of gastric content were drained. Five days later his condition worsened again. At reoperation, there were four or five large serosal tears on the surface of the gastric conduit, one of which had perforated. The reconstruction was taken down, the stomach returned to the abdomen and a cervical oesophagostomy fashioned but the patient died of intrathoracic sepsis.

These five deaths all occurred in the period 1998–2002. Since then, there have been no in-hospital deaths.

Tumour characteristics
The majority of the tumours resected were lower third oesophageal or junctional tumours and the most common histological type was adenocarcinoma (Siewert type I or II) (Table 1). The median nodal harvest was 12. Forty patients (24.2%) had an involved CRM, of which thirty-nine had T3 or T4 disease. The introduction of neoadjuvant chemotherapy did not reduce the CRM involvement rate in T3/T4
tumours ($p=0.19$, chi-squared test). One patient (0.6%) had an involved distal resection margin. Adjuvant chemoradiotherapy was not routinely offered to patients with an involved resection margin.

Survival
Overall five-year survival was 28%. Disease specific survival at one, three and five years was 77%, 42% and 36% respectively. Cancer stage and nodal involvement significantly influenced survival (Figs 2 and 3). CRM involvement did not influence survival after resection of T3/T4 tumours (logrank statistic = 0.167; df=1, $p=0.683$). Patients with tumours staged as T2 N1 or more advanced who had neo-adjuvant chemotherapy had a similar median survival to patients with the same distribution of tumour stage who had no preoperative treatment (logrank statistic = 0.592; df=1, $p=0.442$).

Discussion
Using the approach outlined above, we were able to achieve low postoperative morbidity (20.6%), a low reoperation rate (4.9%), low in-hospital mortality (3%) and low 90-day mortality (5.5%). The long-term results (77% 1-year and 56% 5-year survival) were entirely acceptable, when one considers the advanced disease in this patient cohort, for the surgical management of oesophageal cancer.

Owing to the large geographical scatter of our patients and the number of small hospitals from which the patient population was drawn, it is difficult to be certain about the proportion of patients to whom we offer surgery. Our best assessment is that about a third of patients who suffer from this pathology undergo surgical resection. The advent of PET CT almost certainly means that this proportion is falling. This is consistent with data from other specialist units in the UK.

There are a number of ways of maintaining nutrition in patients with significant dysphagia being assessed for possible surgical intervention or undergoing preoperative chemotherapy. We chose to stent our patients, which was required in only seven patients. Surgical resection of the specimen including the stent has not posed any problems. In future, we would consider employing removable stents.

In common with the majority of series published from the Western world, $11$ 64% of our patients had T3 disease and 62% were node positive. This reflects the fact that even the relatively small proportion of patients subjected to surgical intervention have advanced disease.
Long-term survival was influenced by node positivity and cancer stage but, perhaps surprisingly, not by the introduction of neoadjuvant chemotherapy when compared with historical controls. In light of the findings of the Medical Research Council OE02 study, we are unable to explain this finding. We are aware that our approach to postoperative oral intake is conservative. There are surgeons who allow oral intake even as early as the first postoperative day. The significant recent fall in the median postoperative length of stay was, we believe, due to a change in attitude precipitated by the introduction of an enhanced recovery programme for colorectal patients managed on the same ward although there were no specific changes in our approach.

Our failure to resect rate of 5.0% and our reoperation rate of 4.8% compare well with other published series. Five patients (3.0%) died before leaving hospital. This mortality rate also compares well with other published data, particularly when one considers that the series goes back to 1993. The operative mortality rate following oesophagectomy quoted in the 2010 National Oesophago-Gastric Cancer Audit is 4.5%. In retrospect, the outcome in the last two deaths in our series, from a respiratory arrest and massive gastric distension/necrosis, could possibly have been avoided.

Conclusions

This series and other similar series clearly demonstrate that ‘traditional’ transthoracic oesophageal resection can be carried out with low morbidity and mortality rates. This approach should not be abandoned in favour of apparently less invasive alternatives in the absence of robust and high quality evidence supporting such a change.

Acknowledgements

Surgical management of oesophageal cancer is a team effort. So many people have contributed to the care of this cohort of patients that it is not possible to name them all but their contribution is gratefully recognised. It is appropriate to acknowledge the role of J Stuart Davies, the anaesthetist who has taken the vast majority of these patients through their surgery. Finally, we would like to thank Professor S Michael Griffin and Professor Derek Alderson for their advice and help with difficult problems.
6. Romijn MG, van Overhagen H, Spillenaar Bilgen EJ et al. Laparoscopy and laparoscopic ultrasonography in staging of oesophageal and cardial carcinoma. Br J Surg 1998; 85: 1,010–1,012.

7. Surgical resection with or without preoperative chemotherapy in oesophageal cancer: a randomised controlled trial. Lancet 2002; 359: 1,727–1,733.

8. Mukherjee S, Abraham J, Brewster A et al. Pilot study of preoperative combined modality treatment for locally advanced operable oesophageal carcinoma: toxicities and long-term outcome. Clin Oncol 2006; 18: 338–344.

9. Al Sarra AA, David G, Willmott S et al. Oesophagectomy practice and outcomes in England. Br J Surg 2007; 94: 585–591.

10. Singhvi R, Abbasakoor F, Manson JM. Insertion of self-expanding metal stents for malignant dysphagia: assessment of a simple endoscopic method. Ann R Coll Surg Engl 2003; 85: 243–248.

11. Peyre CG, Hagen JA, DeMeester SR et al. Predicting systemic disease in patients with oesophageal cancer after esophagectomy: a multinational study on the significance of the number of involved lymph nodes. Ann Surg 2008; 248: 979–985.

12. Siewert JR, Stein HJ, Feith M et al. Histologic tumor type is an independent prognostic parameter in esophageal cancer: lessons from more than 1,000 consecutive resections at a single center in the Western world. Ann Surg 2001; 234: 360–367.

13. Khan OA, Fitzgerald JJ, Soomro I et al. Prognostic significance of circumferential resection margin involvement following oesophagectomy for cancer. Br J Cancer 2003; 88: 1,549–1,552.

14. Sagar PM, Johnston D, McMahon MJ et al. Significance of circumferential resection margin involvement after esophagectomy for cancer. Br J Surg 1993; 80: 1,386–1,388.

15. Sujendran V, Wheeler J, Baron R et al. Effect of neoadjuvant chemotherapy on circumferential margin positivity and its impact on prognosis in patients with resectable oesophageal cancer. Br J Surg 2008; 95: 191–194.

16. Lassen K, Kjaeve J, Febeit T et al. Allowing normal food at will after major upper gastrointestinal surgery does not increase morbidity: a randomized multicenter trial. Ann Surg 2008; 247: 721–729.

17. Berresford RG, Wajed SA, Sanders D, Rucklidge MW. Short-term outcomes following total minimally invasive oesophagectomy. Br J Surg 2008; 95: 602–610.

18. National Oesophago-Gastric Cancer Audit 2010. Leeds: NHS Information Centre; 2010.

19. Griffin SM, Shaw IH, Dresner SM. Early complications after Ivor Lewis subtotal esophagectomy with two-field lymphadenectomy: risk factors and management. J Am Coll Surg 2002; 194: 285–297.