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# Interactive CardioVascular and Thoracic Surgery

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## Institutional report - Esophagus

## A surgeon's case volume of oesophagectomy for cancer does not influence patient outcome in a high volume hospital

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## Abstract

The aim of this study is to assess if individual case volume of oesophageal resections influences the operative mortality rate in a high volume hospital. Between June 1994 and June 2006, 252 total thoracic oesophageal resections (75% male, mean age 63 years) were performed by five surgeons in tertiary referral centre. Operative approach was standardised in all cases and consisted of left thoracotomy, resection of all intrathoracic and abdominal oesophagus and left cervical incision for anastomosis. Operative mortality, defined as in-hospital death irrespective of length of stay, was compared among consultants and also trainees. A total of 207 operations were performed by five consultants with nine deaths (4.3%) compared to two deaths after 45 operations by 17 trainees (4.4%) [Fisher's exact test,  $P=0.61$  (CI=0.84–1.26)]. Individual case volume for consultants ranged from 5 to 10.5 cases/years [ $\chi^2$ -test,  $P=0.34$  (CI=0.89–1.29)] with 0–5.4% mortality rate [ $\chi^2$ -test,  $P=0.24$  (CI=0.96–1.19)]. Overall hospital volume ranged from 17 to 57 cases/years. This study confirms that surgeons with appropriate training in oesophageal resection may get good results despite lower individual case volumes when a standardised approach is taken in an institution with a high case volume.

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Keywords: Oesophagectomy; Mortality; Hospital volume; Survival

## 1. Introduction

Oesophageal resection for cancer is a challenging operation associated with a significant operative mortality and morbidity rate while the prognosis remains poor. Despite substantial advances in preoperative staging, selection of patients, improved anaesthetic and surgical techniques, and more so postoperative care, operative mortality can be as high as 12% with even a higher rate of major postoperative complications [1].

Recent studies have suggested that the surgeon is to be considered an important variable that can influence outcome, and that a patient with oesophageal cancer in need of an oesophagectomy may benefit referral to a high volume surgeon [2]. Matthews et al. were the first to publish a relationship between a surgeon's experience and operative mortality after oesophagectomy in 1986 [3]. They defined a high volume surgeon as doing >6 oesophagectomies a year. However, Begg et al. demonstrated that when complex surgical oncological procedures are performed in high volume hospitals with speciality expertise, operative mortality is lower [4]. This was especially true for oesopha-

geal cancer for which the operative mortality rose to 17.3% in low volume hospitals compared with 3.4% in high volume hospitals adjusting for case mix [4].

The aim of our study is to determine if a surgeon's case volume has an influence on operative mortality and long-term survival in patients with operable oesophageal cancer when performed in high volume hospitals with speciality expertise.

## 2. Materials and methods

The study population consisted of patients diagnosed with oesophageal cancer who were surgically treated with a curative intent at a tertiary referral centre (Royal Victoria Hospital, Belfast) between June 1994 and June 2006. Data were obtained retrospectively from prospectively entered data from the in-house Thoracic Database.

Only data from patients undergoing a total thoracic oesophagectomy (TTO) were included in this study, as this is the operation performed in 70% of all oesophageal resections in our unit. This consists of a thoracotomy incision, resection of all thoracic and abdominal oesophagus, mobilisation of the stomach on the right gastroepiploic arcade creating a neo-oesophagus that is then anastomosed in the neck via a left oblique cervical incision.

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Major complications included respiratory (minitracheostomy, re-intubation), cardiac (commencement of inotropes for low cardiac output and or renal impairment) and surgical (wound dehiscence or anastomotic leak) that led to a delay in hospital discharge. Operative mortality is defined as in-hospital death irrespective of length of stay. Follow-up data were obtained from the Northern Ireland Cancer Registry.

### 3. Statistical analysis

All data were analysed using SPSS version 15.  $\chi^2$ -Test of association and Fisher's exact test were used to assess if there were significant differences in in-hospital operative mortality rates between the two groups of operators (Consultants and Trainees). Confidence intervals were also calculated for the main differences in order to assess if the clinically relevant differences could be excluded. Observed survival analysis was performed using the Kaplan–Meier technique and the log-rank test statistic was used. This test compares the survival times of two or more groups that involve calculating the observed and expected frequencies of failures (deaths) in separate time intervals. The actual test statistic is a comparison of the observed number of deaths occurring at each particular time-point with the number to be expected if the survival experience of the two groups is the same.

### 4. Results

Two hundred and fifty-two patients underwent TTO from June 1994 to June 2006, with a mean age of 63 years (range 30–84) (Table 1). Seventy-five percent were male patients. The operations were performed by five consultant surgeons, with a total hospital volume for all types of oesophageal resections being 17–57 cases/years with a mean TTO rate of 21 cases/years. The mean case volume for the individual surgeons ranged from 5 to 10.5 cases/years. The overall in-hospital mortality rate was 4.36% and that for the individual surgeons ranged from 0 to 5.4%. The case volume per surgeon did not have any significant influence on operative mortality [Pearson's  $\chi^2$ -test  $P=0.24$  (CI=0.96–1.19)].

The overall 1-year and 5-year observed survival was 69% and 28.8%, respectively. There was no significant difference in survival for patients amongst surgeons when adjusted for pathological staging (log-rank  $P=0.17$ ) (Fig. 1) irrespective of case volume (16% of patients did not have adequate information in order for a pathological stage to

be assigned and in some cases notes of deceased patients had already been destroyed). There was also no significant difference in survival for patients when adjusted for major complications (log-rank  $P=0.89$ ) (Fig. 2).

Nearly a quarter of oesophageal resections were performed by the trainees with consultant supervision. There was no difference in in-hospital mortality between consultants (4.3%) and trainees (4.4%) [Fisher's exact test  $P=0.61$  (CI=0.84–1.26)].

### 5. Discussion

Once considered an uncommon malignancy, the incidence of oesophageal cancer has increased steadily over the last few decades and it now is the ninth most common cancer in the United Kingdom and accounts for up to 5% of cancer cases diagnosed in the United States [5, 6]. Despite advances in multimodality therapy, the prognosis for those with this tumour remains poor.

Recent attention in the media regarding patient outcome has fuelled the idea that the surgeon is a prognostic factor. Though this is true, the surgeon is only one of many variables that can influence outcome. Socioeconomic status of the local population; prevalence of co-morbidities; threshold of referral from the general practitioner/physician; standards of anaesthesia, surgery and intensive care; attitude to training; interpersonal relationships between staff; and the geographic layout of the unit are other variables that can also influence patient outcome [7]. On reviewing the literature, there is conflicting evidence suggesting that the surgeon's volume as opposed to the hospital volume influences patient outcome. What many papers fail to demonstrate is not only the reduction in operative mortality, more so the in-hospital mortality, but the disease-free interval and long-term survival in this population of patients that should be measured as it is a better indicator of quality performance.

However, there is growing body of evidence to suggest improved patient outcome in high volume hospitals with speciality expertise irrespective of individual case volume. This was demonstrated by Sosa and colleagues in pancreatic cancer resection in which they demonstrated no difference in outcome between low and high volume surgeons in high volume hospitals as opposed to low volume hospitals which had a poorer outcome [8]. Not only were we able to demonstrate no significant difference in operative mortality for oesophageal cancer resections amongst the surgeons irrespective of case volume, but we were also able to

Table 1  
Summary of results

	Consultant 1	Consultant 2	Consultant 3	Consultant 4	Consultant 5	Total
Operation years	1995–1998	2000–2006	1998–1999	1994–2006	1994–2006	1994–2006
Total cases <i>n</i> (%)	38 (15%)	36 (14%)	16 (6%)	74 (29%)	88 (35%)	252
Mean age (years)	59	64	63	64	63	63
Males <i>n</i> (%)	30 (16%)	26 (14%)	15 (8%)	59 (31%)	61 (32%)	191
Stage 1 and 2 <i>n</i> (%)	16 (13%)	22 (18%)	4 (3%)	37 (31%)	40 (34%)	119
Stage 3 and 4 <i>n</i> (%)	12 (13%)	11 (12%)	11 (12%)	26 (28%)	33 (35%)	93
Major complications <i>n</i> (%)	9 (3.6%)	8 (3.2%)	8 (3.2%)	14 (5.6%)	18 (7.1%)	57 (22.6%)
In-hospital mortality <i>n</i> (%)	2 (5.2%)	1 (2.7%)	0	4 (5.4%)	4 (4.5%)	11 (4.4%)
Mean survival (months)	40	31	22	30	31	

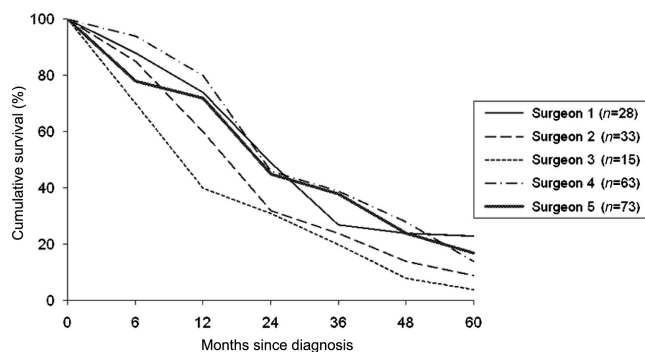


Fig. 1. Cumulative 5 years survivals for patients with stages 1-4 by consultants (log rank  $P=0.17$ ).

demonstrate no significant difference in the long-term outcomes when taking into account of the major complication rate as well as the cancer stage amongst the patients. There was, however, a slightly increased rate of complications as well as mortality amongst the more experienced surgeons (Consultants No. 4 and 5) which were attributed to the fact that they were not only taking on higher risk patients but also played an active role in training. More importantly, this overall lack of difference amongst the individual surgeons irrespective of their case volume was attributed to the fact that all these patients were managed not only by a collective surgical team but by all disciplines involved in cancer management that are available in a high volume hospital.

The knowledge, skill and experience of every member of the multidisciplinary team plays a pivotal role in management of these complex cases. For example, Stephens and colleagues clearly demonstrated that not only had the accuracy of staging improved, but there was a significant reduction in open and closed cases, a reduction in operative mortality and an improvement in the long-term survival of patients who were treated in high volume hospitals with a multidisciplinary team [9]. Another important variable in terms of outcomes is the complication rate, especially with regards to oesophageal resections which carries significant mortality and morbidity. Dimick and colleagues were able to show despite the complication rates being similar between high and low volume hospitals, the outcome was significantly better in the high volume hospital [10]. The

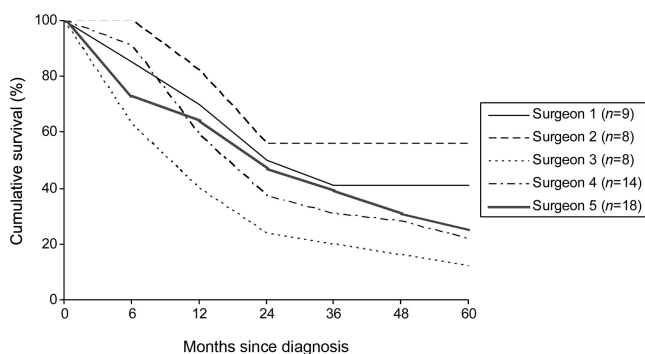


Fig. 2. Five-year survival for patients with major complications at surgery by consultants (log-rank  $P=0.89$ ).

author concluded that the management of such complications was decidedly better in higher case volume hospitals based on better experience and, therefore, the complications were recognised earlier and treated more effectively. Other significant benefits with regards to patient care in high volume hospitals was a decrease in length of intensive care and hospital stay, and that patients were more likely to be discharged home compared with a secondary care facility in low volume hospitals [11].

Therefore, is there still a need to establish a clear frequency cut-off that can define a high volume hospital that can feel justified to offer proper surgical treatment for oesophageal cancer? Metzger and colleagues tried to answer this question by performing a detailed analysis of the literature published regarding outcome related to hospital volume for oesophageal cancer [12]. Their recommendation for this type of oncological-surgery is that it should be performed only by specialists with multidisciplinary team input who operate in high volume hospitals with a minimum of 20 cases/years to ensure a decrease in operative mortality with better long-term outcomes and survival.

Our conclusion is in line with the United Kingdom National Health Service Guidance on Improving Outcome published in 2001 recommending centralisation of oesophageal resections [13]. This saw a drop in the number of low volume hospitals from 117 in 1997 to 45 in 2003 but also the improved outcomes in high volume hospitals [13]. Centralisation and multidisciplinary team expertise harness the diverse talents from an array of specialists with a common interest in upper gastro-intestinal surgical oncology, so that the management plans are patient tailored and stage directed to optimise outcome from the time of diagnosis to patient discharge.

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