European Journal of Surgical Oncology xxx (2018) 1–8

Contents lists available at ScienceDirect

European Journal of Surgical Oncology

journal homepage: www.ejso.com

Changes in volume, clinical practice and outcome after reorganisation of oesophago-gastric cancer care in England: A longitudinal observational study

M. Varagunam [a, *], R. Hardwick [b], S. Riley [c], G. Chadwick [a], D.A. Cromwell [a, d], O. Groene [d, e]

[a] Clinical Effectiveness Unit, Royal College of Surgeons of England, London, UK
[b] Cambridge Oesophago-Gastric Centre, Addenbrookes Hospital, Cambridge, UK
[c] Department of Gastroenterology, Northern General Hospital, Sheffield, UK
[d] Department of Health Services Research and Policy, London School of Hygiene and Tropical Medicine, London, UK
[e] OptiMedis AG, Burchardstraße 17, 20095, Hamburg, Germany

ARTICLE INFO

Article history:
Accepted 2 January 2018
Available online xxx

Keywords:
Oesophageal
Gastric
Cancer
Centralisation
Surgical outcomes

ABSTRACT

Aim: The centralisation of oesophago-gastric (O-G) cancer services in England was recommended in 2001, partly because of evidence for a volume-outcome effect for patients having surgery. This study investigated the changes in surgical services for O-G cancer and postoperative mortality since centralisation.

Methods: Patients with O-G cancer who had an oesophageal or gastric resection between April 2003 and March 2014 were identified in the national Hospital Episodes Statistics database. We derived information on the number of NHS trusts performing surgery, their surgical volume, and the number of consultants operating. Postoperative mortality was measured at 30 days, 90 days and 1 year. Logistic regression was used to examine how surgical outcomes were related to patient characteristics and organisational variables.

Results: During this period, 29 205 patients underwent an oesophagectomy or gastrectomy. The number of NHS trusts performing surgery decreased from 113 in 2003–04 to 43 in 2013–14, and the median annual surgical volume in NHS trusts rose from 21 to 55 patients. The annual 30 day, 90 day and 1 year mortality decreased from 7.4%, 11.3% and 29.7% in 2003–04 to 2.5%, 4.6% and 19.8% in 2013–14, respectively. There was no evidence that high-risk patients were not undergoing surgery. Changes in NHS trust volume explained only a small proportion of the observed fall in mortality.

Conclusion: Centralisation of surgical services for O-G cancer in England has resulted in lower post-operative mortality. This cannot be explained by increased volume alone.

Introduction

In 2001, the UK Department of Health published guidance on the commissioning of health care for patients with oesophago-gastric (O-G) cancer [1]. It contained a number of recommendations that would require a major restructuring of NHS services. First, it recommended that cancer networks should be established, with specialist hospitals within each network responsible for performing curative surgery and specialist diagnostic tests (cancer centres). Other hospitals in the Network would continue to provide routine diagnostic investigations and palliative services (cancer units). Second, it recommended that clinicians from different specialties (eg, upper gastrointestinal surgeon, gastroenterologist, oncologist, radiologist, pathologist and clinical nurse specialist) should work together in multi-disciplinary teams, in order to improve the coordination of clinical management. The National Cancer Peer Review Programme was established in 2004 to monitor implementation of these organisation changes [2]. The National Oesophago-Gastric Cancer Audit has complemented this by assessing whether O-G cancer services meet the relevant standards of care as measured against various process and outcomes indicators [3].

* Corresponding author. Clinical Effectiveness Unit, Royal College of Surgeons of England, 55-43 Lincoln's Inn Fields, London, WC2A 3PE, UK.
E-mail address: m.varagunam@rcseng.ac.uk (M. Varagunam).

https://doi.org/10.1016/j.ejso.2018.01.001
0748-7983/

One rationale for centralisation was the thought that expanding the volume and variety of cases treated in larger cancer centres would address apparent regional inequalities in life expectancy [1,4]. This was partly underpinned by an increasing number of international studies that showed a volume-outcome relationship in O-G cancer surgery [5–8]. Moreover, this relationship was observed across O-G cancer services in England between 2004 and 2008 by Coupland et al. [9]. They reported that increasing hospital volume was strongly associated with lower postoperative mortality at 30 days.

This study was designed to investigate the changes in surgical activity and outcomes that have occurred over the eleven year period from April 2003 to March 2014. The reorganisation of O-G cancer services was still ongoing during 2004 and 2008 [10] and it is unclear how this might have influenced the results describing the period between 2003 and 2013. In addition, since 2001, there have also been many improvements in areas of diagnosis, pre-operative staging, peri-operative care, and the introduction of neoadjuvant and adjuvant oncology [11]. In this study, we examined trends in (i) the numbers of NHS trusts performing curative surgery, (ii) the median patient volume of these trusts, (iii) the number of consultants performing surgery, and how these might be associated with changes in postoperative mortality after surgical resection at 30 days, 90 days and 1 year.

Methods

Data source

Data on the inpatient care received by patients with O-G cancer in English NHS trusts was obtained from Hospital Episodes Statistics (HES), a hospital administrative database that contains records on all same day and overnight admissions to English NHS acute trusts. Clinical information is captured using the International Classification of Disease (ICD-10) diagnostic codes and the Classification of Surgical Operations and Procedures (OPCS-4), but it lacks specific information about tumour characteristics (such as pathological stage) and cancer care (such as date of diagnosis). Records for the same individual are allocated the same anonymised identifier, which allows treatment pathways to be followed over time.

Patient cohort and characteristics

We identified all patients (aged 18 years and over) diagnosed with oesophageal or stomach cancer (ICD-10: C15 and C16) between 1 April 2003 and 31 March 2014, taking the first instance of these codes as the date of diagnosis. Variables were defined for patient age at diagnosis, sex, tumour type (oesophageal/stomach), and number of comorbidities. Comorbidities were identified using the RCS Charlson score [12], which covers 14 conditions known to be associated with the risk of postoperative mortality (the score includes categories for malignancy and metastatic tumours, and these were excluded when calculating the score in this study). Patients were labelled as having 0, 1, 2, and 3 or more comorbidities. A variable for socioeconomic deprivation was also defined using the 2004 Index of Multiple deprivation (IMD) [13]. We categorised the IMD score into ordered quintiles, with the first and fifth quintiles corresponding to the least and most deprived, respectively.

Services and treatments at NHS hospitals

Patients were flagged as having curative surgery if they underwent either oesophagectomy or gastrectomy (OPCS codes: G01, G02, G03-oseophageal resections; G27, G28-gastric resections). We flagged an NHS trust as performing curative surgery if it had performed more than five procedures in a financial year (April–March). Individual consultants were identified using the anonymised consultant code, and were counted as part of the O-G surgical team within an NHS trust if they had performed at least one operation in a year. The consultant codes were available from the 2005–06 financial year. Surgical volume at NHS trust and consultant level was defined as the total number of procedures performed in the financial year.

Over the study period, there was an increase in the combination of neoadjuvant chemotherapy and radiotherapy with surgery. As inpatient HES records do not capture information about the provision of chemo/radiotherapy reliably, we used the time from diagnosis to surgery as a proxy marker for a patient having neoadjuvant therapy (Appendix, Fig. A). If the time from diagnosis to surgery was greater than 100 days, a patient was flagged as having neoadjuvant therapy and surgery; otherwise, they were flagged as having surgery alone.

Outcome variables

The primary outcomes were postoperative mortality at 30 days, 90 days or 1 year and was calculated for each patient as the difference between the date of operation and date of death. The date of death was obtained from the Office for National Statistics Death Register, with patients identified using the same anonymised HESID used within the HES database. Dates of death were available until 16 October 2016, hence all patients had a minimum of 1 year follow up information. Length of postoperative hospital stay was defined as a secondary outcome and calculated as the difference between operation date and the discharge date.

Statistical analysis

For each financial year, we derived the number of NHS trusts undertaking curative surgery, the number of consultants per NHS trust performing surgery, the annual number of operations performed at a trust, and the number of patients having surgery. The financial years were labelled as the year in which they begin.

Patient characteristics were described using proportions, with continuous variables being categorised to show the skewness of the distributions. The analysis was undertaken using year of operation. We grouped the data into periods for presentation only. The association between year of operation and categorical variables were assessed using chi-squared tests, and the association between year of operation and continuous variables were assessed using linear regression where the year of operation was defined as a linear term.

Logistic regression models were used to examine the association between postoperative mortality (at 30 day, 90 day and 1 year), trust volume, and patient variables (age, sex, type of cancer, comorbidities, social deprivation, and whether or not a patient was flagged as having neoadjuvant therapy). Estimates were derived with robust standard errors to account for the clustering of patients within NHS trusts.

Adjusted mortality rates for each financial year were derived by dividing the observed deaths by the number expected multiplied by the mean rate over the study period. A predicted risk of death for each patient was derived from multivariable logistic regression models and summed up for each year to create the expected number [14]. All statistical tests were two-sided, with p-values of less than 0.05 indicating a significant result. The analyses were performed using STATA® version 14 (StataCorp, College Station, Texas, USA).

Please cite this article in press as: Varagunam M, et al., Changes in volume, clinical practice and outcome after reorganisation of oesophagogastric cancer care in England: A longitudinal observational study, European Journal of Surgical Oncology (2018), https://doi.org/10.1016/j.ejso.2018.01.001