

Unplanned splenectomy during oesophagectomy does not affect survival

Edward Black^{*}, Jason Niamat, Srikanth Boddu, Antonio Martin-Ucar,
John P. Duffy, William Ellis Morgan, Francis David Beggs

Department of Thoracic Surgery, Nottingham City Hospital, Hucknall Road,
Nottingham NG5 1PB, United Kingdom

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Abstract

Objective: There are limited and conflicting data available concerning the incidence of inadvertent splenectomy and its impact on the outcome in patients who have undergone oesophagectomy. The aim of this study is to identify the factors associated with a likelihood of inadvertent splenectomy and its influence on early and long-term outcome in patients having oesophagectomy for oesophageal carcinoma. **Methods:** A consecutive series of 738 oesophagectomies performed between 1991 and 2004 was analysed. In our practice, the spleen was removed only if damaged intraoperatively. Routine chemo- and immunoprophylaxis would subsequently be used. Multivariate analysis with logistic and Cox models determined significant variables. **Results:** Of the 738 oesophagectomies, 48 (6.5%) had splenectomy. Neoadjuvant chemotherapy was administered to a minority of patients; none subsequently had splenectomy. There were significant differences between types of operation (Ivor–Lewis 18 (9.0%), left thoracotomy 14 (9.9%) and left thoracophrenotomy 15 (3.9%), $p = 0.01$). Splenectomy was more common with advanced N stage disease (OR = 0.44 [0.20–0.95]; $p = 0.04$). Splenectomy resulted in more blood transfusions (median, 2 units vs 0 units; $p = 0.03$) more anastomotic leaks (7 [14.6%] vs 42 [6.1%]; $p = 0.02$) but not an increase in pulmonary complications ($p = 0.64$) or in-hospital mortality (1 [4.6%] vs 37 [5.4%]; $p = 0.30$). Splenectomy did not significantly affect median survival (551 [332–770] days vs 627 [554–700] days; $p = 0.63$). **Conclusion:** Although inadvertent splenectomy increased the morbidity of oesophagectomy, it did not impair survival. Type of operation and advanced N stage are important risks for splenectomy. Though best avoided, most of the consequences of splenectomy can be managed. An unexpected relationship between splenectomy and anastomotic leaks needs further investigation.

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Keywords: Oesophageal cancer; Oesophageal surgery; Splenectomy

1. Introduction

The incidence of oesophageal carcinoma is increasing. Surgery is the principal treatment for local disease but it is a major operation associated with several significant risks. Little has been recorded about the specific risk from inadvertent splenectomy resulting from iatrogenic trauma. It has been recognised for some time that splenectomy predisposes to infection [1–4]. It is also quite probable that the immune functions of the spleen have some impact on a various systems and a patient's subsequent health [2]. We identified only one paper addressing the impact of splenectomy on outcomes after oesophagectomy [5]. However, this was a relatively small study and so we reviewed our relatively large series of oesophagectomies to determine if splenectomy affected outcome.

2. Methods

Data from patients who had an oesophagectomy performed between 1991 and 2004 have been collected prospectively in our department and cross-referenced at regular intervals by audit specialists. All patients were assessed for suitability for resection by preoperative investigations that include endoscopy, an assessment of cardio-respiratory fitness, CT scan and contrast swallow chest X-ray. Neoadjuvant chemotherapy was not offered until late in our series.

Operations were performed through a left-sided approach for mid-lower third tumours and a right-sided two-stage approach for the rest. Occasionally, a cervical anastomosis was performed, otherwise a stapled intra-thoracic anastomosis was preferred. If the spleen was injured during an operation, packing for several minutes was usually the first manoeuvre. If this did not stop the bleeding, splenectomy rather than splenic preservation, by several of the available techniques, was carried out. Postoperative care was standardised for all patients which included nursing them on a high-dependency ward and keeping them nil by mouth

^{*} Corresponding author. Tel.: +44 7834600435.
E-mail address: edblackis@hotmail.com (E. Black).

until water-soluble contrast swallow on the seventh post-operative day. Rigorous attempts were made to prevent atelectasis with twice-daily physiotherapy, regular nebulised medication and judicious use of mini-tracheostomies.

In the event of splenectomy, a standardised regime of prophylaxis was used as described in the protocol from our Department of Microbiology. Our regime was pneumococcal vaccine (Pneumovax[®] II) repeated every 3–5 years.

When it became available, a one-off *Haemophilus influenzae* type b (Hib) and meningococcal Group C conjugate vaccine was given to all who had not been previously immunised. A recommendation was sent to all primary care doctors to administer yearly vaccination with meningococcal polysaccharide A+C vaccine.

2.1. Prophylactic antibiotics

After finishing intravenous antibiotics with benzyl penicillin all patients received antibiotic prophylaxis for at least 2 years following splenectomy with Penicillin V 250 mg bd (or erythromycin 250 mg bd).

To help with compliance problems, patients were educated and followed up. In the event of infection their primary care physicians were recommended to administer amoxicillin or erythromycin.

Variables examined as possible risk factors for splenectomy were age, sex, neoadjuvant chemotherapy, body mass index, resection margins, tumour length, surgical approach, site of tumour, type of tumour and pathological stage. Outcome variables examined were postoperative blood use, pulmonary complications, cardiac complications, anastomotic leaks, hospital deaths, survival and wound

infections. Variables were analysed to determine the association with inadvertent splenectomy and their likely impact on in-hospital mortality and long-term survival. Continuous variables were analysed by Student's *t*-test or Mann–Whitney and categorical variables by chi-squared analysis. Those variables that had a *p* value of less than or equal to 0.1 were put into a logistic regression model to determine significance. Long-term survival was assessed by Kaplan–Meier method, with log-rank test for differences and Cox model to assess the impact of variables that approached significance.

2.2. Definitions

In-hospital death was defined as death within the same hospital admission or within 30 days.

Pulmonary complications were evidence of either segmental collapse/infection/effusion/requirement for ventilatory assistance.

Leaks were defined as clinical or radiological evidence of mediastinal leak.

Wound infection was defined as a wound requiring intravenous antibiotics and/or debridement.

3. Results

A total of 738 consecutive oesophagectomies were performed between 1991 and 2003; 48 (6.5%) had splenectomy. Preoperative variables are presented in Table 1. The incidence of splenectomy varied with the different operations (see Table 1). There were 15 (3.9%) patients with left

Table 1
Pre- and perioperative variables

	No splenectomy, <i>n</i> = 690 (93.5%)	Splenectomy, <i>n</i> = 48 (6.5%)	<i>p</i>	Odds ratio (95% CI)
Age (years) (mean ± SD)	66.3 ± 10.2	67.2 ± 10.2	0.98	1.01 (0.44–2.32)
Female patients, <i>n</i> (%)	185 (27)	19 (40)	0.06	1.85 (0.98–3.49)
Body mass index (mean ± SD)	24.9 ± 4.5	24.5 ± 4.1	0.85	1.13 (0.32–4.00)
Left thoracophrenotomy, <i>n</i> (%)	368 (96.1)	15 (3.9)		
Left thoracolaparotomy, <i>n</i> (%)	128 (90.1)	14 (9.9)	0.01	0.37 (0.18–0.79)
Ivor–Lewis, <i>n</i> (%)	181 (91.0)	18 (9.0)	0.01	0.41 (0.20–0.83)
Adenocarcinoma cell type, <i>n</i> (%)	460 (67.1)	30 (62.5)	0.09	0.08 (0.004–1.46)
Pathological T stage ≥ 3, <i>n</i> (%)	523 (77.6)	38 (82.6)	0.43	0.81 (0.34–1.90)
Pathological N stage >1, <i>n</i> (%)	70 (10.3)	9 (19.1)	0.06	0.44 (0.20–0.95)

Table 2
Postoperative outcomes

	No splenectomy, <i>n</i> = 690 (93.5%)	Splenectomy, <i>n</i> = 48 (6.5%)	<i>p</i>	Odds ratio (95% CI)
Pulmonary complications ^a , <i>n</i> (%)	124 (18.2)	10 (20.8)	0.64	0.84 (0.41–1.73)
SVT, <i>n</i> (%)	105 (15.2)	5 (10.4)	0.37	1.57 (0.61–4.06)
Leaks ^b , <i>n</i> (%)	42 (6.1)	7 (14.6)	0.02	0.41 (0.14–1.21)
Wound infection ^c , <i>n</i> (%)	30 (4.3)	2 (4.2)	0.95	1.08 (0.25–4.69)
Length of stay > 14 days, <i>n</i> (%)	181 (26.3)	21 (43.8)	0.03	0.41 (0.18–0.92)
Postoperative blood transfusion, <i>n</i> (%)	232 (46.2)	21 (65.6)	0.09	0.51 (0.24–1.11)
Median survival (days) (95% CI)	627 (554–700)	551(332–770)	0.42	0.93 (0.64–1.35)

^a Pulmonary complications defined as evidence of ≥segmental collapse/infection/effusion/requirement for ventilatory assistance.

^b Leaks defined as clinically or radiologically diagnosed leaks.

^c Wound infection defined as a wound requiring intravenous antibiotics and/or debridement.

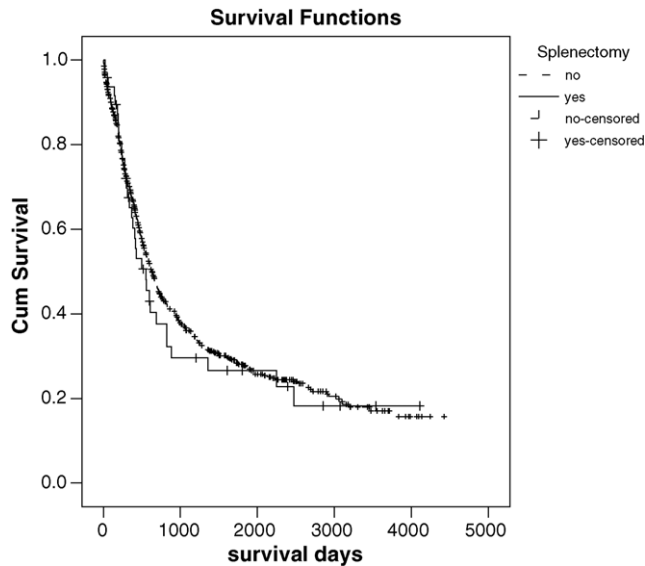


Fig. 1. Survival post-oesophagectomy with or without splenectomy.

thoracophrenotomy operations and 14 (9.9%) with left thoracolaparotomy operations ($p = 0.008$). For the Ivor–Lewis operation, there were 18 (9.0%) patients ($p = 0.009$). There was an increased propensity for women in the splenectomy group. Adenocarcinoma was the most common cell type in both splenectomy and no-splenectomy groups. Comparison of early and late tumours ($pT > 2$ or $pN > 1$) showed that there was an increased incidence of splenectomy with N2 disease (OR = 0.44 [0.20–0.95]; $p = 0.06$).

Splenectomy was not associated with increased pulmonary complications, SVT or wound infections. There were, however, significantly more leaks after splenectomy ($p = 0.02$, see Table 2). More blood needed to be transfused following splenic injury and removal (mean, 1.1 ± 1.5 units vs 1.8 ± 2.0 units, $p = 0.05$).

Lengths of stay increased from a mean \pm SD of 15.7 ± 13.6 to 19.9 ± 19.2 , $p = 0.02$. In-hospital mortality was 37 (5.4%) without and 1 (2.1%) with splenectomy ($p = 0.32$). Splenectomy had no significant effect on median survival (see Table 2 and Fig. 1).

4. Conclusions

Oesophagectomy is the principal curative treatment for oesophageal cancer. It remains an operation with high perioperative risks for complications and mortality. Operative mortality rates between 4 and 12% and complication rates of 30% are representative of those reported in the literature [6–8]. There is very little in the literature on the impact of splenectomy on short- or long-term outcomes after oesophagectomy for primary cancer. Our series of 738 patients represents a large series of consecutive oesophagectomies from one institution with standardised management. Inadvertent splenectomy occurred in 48 (6.5%) cases. The spleen was removed if it was injured at time of surgery (usually traction injuries secondary to adhesions). Attempts to preserve the spleen were limited to per-operative packing

if this failed to control the bleeding or haematoma, removal of the spleen was performed at the end of the (abdominal phase) operation. We analysed pre- and perioperative variables that might be associated with iatrogenic injury to the spleen. We had expected that more advanced tumours, bulky nodal masses and awkward tissue manipulation would be more likely to result in accidental splenic injury.

It has been previously reported that the cause of iatrogenic trauma to the spleen is most often traction on splenic ligaments or adhesions [9,10]. We had a very significant difference in incidence of splenectomy between the different types of operations used at our institution (Table 1). We believe that the reasons for this are multiple but might include the direct access to the spleen and protection from traction pressure from retractors in the thoracophrenotomy operation. During thoracolaparotomy, the retractor tends to press on the spleen. The Ivor–Lewis operation has the worst access to the spleen. In an obese patient, particularly when combined with short stature, access to the fundus and greater curve of the stomach is difficult. The peritoneal–splenic adhesions can also be missed. In our hands, the thoracophrenotomy approach was the least likely to be associated with splenic injury. Also, we found more female patients who underwent splenectomy (40% vs 27%; $p = 0.06$). This may have been also because of worse access to the fundus from their body habitus and shorter short gastrics.

There were no differences in tumour cell type but there was an increase in the incidence of splenectomy in the higher N stage disease. It is also usual that once committed to resection, upon encountering bulky N2 area nodal disease, we tend to continue with resection rather than abandon at this stage. We were a little surprised to find no association with the advanced T stages. It has also been our experience that in patients who have more intra-abdominal fat, or during an Ivor–Lewis oesophagectomy, it can be difficult to get access to the vasa brevia. This area is easy to access during the left-sided approaches, which centre over the fundus and splenic hilum. We think that this accounts for the almost significant increase in splenectomy in women and Ivor–Lewis approaches (Table 1).

Data have been available for a long time about the association between splenectomy and an increased risk of infections, both in paediatric and adult populations [1,3]. There might also be an increased risk of non-infective complications post-splenectomy [2]. Furthermore, patients with underlying diseases, such as cancer, may be at a greater risk than patients who had a splenectomy from trauma [3]. It seems that patients who have inadvertent splenectomy during surgery for intra-abdominal malignancy have a worse outcome than those who have splenectomy for trauma [4].

Sepsis following splenectomy is rare [4]. However, we know that following D2 gastrectomy, mortality is increased significantly by the additional insult of splenectomy [10,11]. Following oesophagectomy specifically, Kyriazanos et al. [5] found a significant increase in many infective complications. We had a more varied picture. Whilst we had no increase in pulmonary complications or wound infections we had a significant increase in leaks (Table 2). We could not identify a cause for this; for example, there was not a difference in

cervical anastomotic rate. Perhaps this difference was due to a generally more difficult case, for example, resulting in non-specific trauma to both conduit and spleen during access.

There is no consensus about how to manage the patient who has an inadvertent splenectomy, in part, due to studies highlighting the relatively low incidence of infective complications [4]. We treat our patients aggressively as guided by consultation with our microbiologists. They also provide a protocol for the management of all patients who have splenectomy. It consists of antibiotic, immunological and educational prophylaxis as detailed earlier in the text. We are not aware of any complications from this regime. Adverse reactions to the vaccines were not seen. Not surprisingly, the patients who had splenectomy had greater need for blood transfusions postoperatively ($p = 0.03$) (Table 2). The mean number of units transfused was still only less than 2 units.

In the absence of other data on infective complications, we assessed pulmonary complications, wound infections and SVT. There were no significant differences between the groups. Similar to the findings of Kyriazanos et al. [5], we had more leaks in the splenectomy group, though the rate was still only 14.7% in the splenectomy group ($p = 0.02$). Our microbiologists recommend post-splenectomy immunoprophylaxis against pneumococcus, meningococcus and *H. influenzae*, chemoprophylaxis, intensive postoperative care and patient education to protect patients. Perhaps our routine use of these strategies helped to control infections. A prospective trial would be required to know for sure.

We examined the early (30-day) complications as well as studied the late survival. Perioperative mortality was not increased by splenectomy, despite the increase in the number of leaks. Kyriazanos et al. [5] reported increased hospital mortality from 8 to 36% ($p < 0.01$). The cause seemed to be a significant increase by more than 25% in the incidence of pulmonary complications ($p < 0.01$). In the light of the increased mortality attributable to splenectomy in patients randomised to D2 gastrectomies, our findings are encouraging [10,11]. That our mortality rate remains quite low in both groups may be due in part to the fact that our unit is a high volume centre for oesophagectomies and experience is thus translated into better outcomes [12].

Median survival was not significantly different either at 627 (554–700) or 551 (332–770) days for no-splenectomy and splenectomy groups, respectively ($p = 0.63$). Most of our patients had stage pT3N1 adenocarcinoma. Davis et al. [13] found a reduced 5-year survival in patients undergoing colectomy for cancer if they also had a splenectomy. While there was no difference in 30-day mortality, the 5-year survival was 44% with splenectomy compared to 62% without splenectomy ($p < 0.03$). Conversely, the impact of splenectomy in D2 gastrectomy has been reported not to affect 5-year survival [11].

In conclusion, splenic injury during oesophagectomy is an infrequent occurrence with little available literature on the significance of its impact on outcome. In our series, which represents a large single institutional series, splenectomy was least likely with those with the left thoracophrenotomy approach and early N stage and possibly with males. It seems to be associated with a greater tendency for leaks. In our institution, we have an aggressive and standardised approach to infection control. Perhaps this is an important reason that we did not experience greater infections in this group.

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