



## Diaphragmatic hernia following oesophagectomy for oesophageal cancer – Are we too radical?



F. Argenti, A. Luhmann, R. Dolan<sup>\*</sup>, M. Wilson, M. Podda, P. Patil, S. Shimi, A. Alijani

Department of Surgery, Ninewells Hospital, Dundee, DD1 9SY, United Kingdom

### HIGHLIGHTS

- Shows the potential for intra-thoracic herniation following oesophageal resection.
- Raise debate about the extent of resection needed for oncological safe margins while reducing postoperative complications.
- Shows the potential for severe morbidity and mortality after such an extensive resection.

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### ABSTRACT

**Background:** Diaphragmatic herniation (DH) of abdominal contents into the thorax after oesophageal resection is a recognised and serious complication of surgery. While differences in pressure between the abdominal and thoracic cavities are important, the size of the hiatal defect is something that can be influenced surgically. As with all oncological surgery, safe resection margins are essential without adversely affecting necessary anatomical structure and function. However very little has been published looking at the extent of the hiatal resection. We aim to present a case series of patients who developed DH herniation post operatively in order to raise discussion about the ideal extent of surgical resection required.

**Methods:** We present a series of cases of two male and one female who had oesophagectomies for moderately and poorly differentiated adenocarcinomas of the lower oesophagus who developed post-operative DH. We then conducted a detailed literature review using Medline, Pubmed and Google Scholar to identify existing guidance to avoid this complication with particular emphasis on the extent of hiatal resection.

**Discussion:** Extended incision and partial resection of the diaphragm are associated with an increased risk of postoperative DH formation. However, these more extensive excisions can ensure clear surgical margins. Post-operative herniation can be an early or late complication of surgery and despite the clear importance of hiatal resection only one paper has been published on this subject which recommends a more limited resection than was carried out in our cases.

**Conclusion:** This case series investigated the recommended extent of hiatal dissection in oesophageal surgery. Currently there is no clear guidance available on this subject and further studies are needed to ascertain the optimum resection margin that results in the best balance of oncological parameters vs. post operative morbidity.

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### 1. Introduction

Oesophageal cancer is the 13th most common cancer in adults; affecting 450 000 patients worldwide and its rate is increasing

rapidly [1]. Squamous-cell carcinoma is the predominant form of oesophageal carcinoma worldwide. A shift in epidemiology has been seen in Australia, the UK, the USA, and some western European countries (eg, Finland, France, and the Netherlands), where the incidence of adenocarcinoma now exceeds that of squamous-cell types [1]. In the United Kingdom there are around 8300 new cases diagnosed each year [2,3].

<sup>\*</sup> Corresponding author. Department of Surgery, Ninewells Hospital, Dundee, DD1 9SY, United Kingdom.

E-mail address: [rdolan@nhs.net](mailto:rdolan@nhs.net) (R. Dolan).

Oesophageal cancer is about twice as common in men as in women [3]. As is the case for most forms of cancer, oesophageal malignancy is more common in older patients [3]. More than 80% occur in people over the age of 60 [3,4]. Further, there are genetic factors increasing the likelihood of developing oesophageal cancer. In the so-called Asian belt, an area which includes Turkey, Iran, Kazakhstan, and Northern and central China there is a much higher rate of oesophageal squamous cell cancer with more than 100 cases per 100 000 annually [1,3].

Most oesophageal cancer cases in the UK can be linked to lifestyle and environmental factors [3]. Smoking and excessive alcohol consumption are direct lifestyle factors relating to the development of oesophageal cancer [3]. Low socioeconomic status as well as poor oral hygiene and nutritional deficiencies are associated with an increased risk of squamous cell cancers [1,3]. Recurrent gastro-oesophageal reflux and the development of Barrett's oesophagus as well as obesity increases the risk of developing adenocarcinoma [1].

Oesophageal cancer is aggressive with a poor prognosis. Surgery offers the only chance of potential cure [4]. Despite ongoing advances in cancer treatments oesophageal cancer remains stubbornly resistant to improved survival rates [5]. Indeed in recent population based studies post-operative 5-year survival rates remain low at just 15–31% [3,6,7]. Only 25% of all patients diagnosed with oesophageal cancer are estimated to be suitable for surgical resections [6]. Surgery for oesophageal cancer is associated with considerable morbidity and mortality. This is not unexpected given the extent of intraabdominal and intrathoracic dissection required [7,8].

Diaphragmatic herniation following oesophagectomy for oesophageal cancer is widely described in the literature with a reported incidence of 0.4%–15% [9–11]. Given the limited long-term survival and high disease recurrence rates in oesophageal cancer patients it is entirely possible that much higher rates of DH occur. These may not be reported due to a more palliative rather than surgical approach, which is often adopted if herniation occurs in the presence of disease progression [9]. The type of surgical technique applied also seems to have an effect on post operative herniation rates with minimally invasive oesophagectomy appearing to have higher rates of postoperative herniation when compared to traditional, open oesophagectomies [9].

The cause of DH is a combination of negative pressure in the chest and positive pressure in the abdomen together with the enlargement of the diaphragmatic hiatus. However, the hiatal defect is the one variable that can be influenced by surgical technique. Its size results from the judgement of preservation of anatomy versus radical oncological resection.

Surprisingly, while the *en block* resection for oesophageal cancer appears to be accepted as standard of care, very little is published about the recommended extent of the hiatal dissection and resection. We reviewed the literature to ascertain if there are published guidelines referring to the optimal extent of hiatal resection in lower oesophageal cancer surgery. We report these three cases with the aim to arouse interest among the surgical community and open the discussion on this topic.

## 2. Methods

We present a series of three patients with giant diaphragmatic hernias (DH) following oesophagectomy for oesophageal cancer, in order to stimulate discussion on how best to find the balance between oncological resection and avoidance of postoperative morbidity.

We conducted a literature search for publications describing technique and recommended extent of crural resection using

Medline, Pubmed and Google Scholar. The key words initially used were diaphragmatic hernia, oesophagectomy, cancer, post-operative, and hiatal dissection. All texts were accessed using the access rights of the university of Dundee and were saved on the secure university server.

## 3. Case reports

We present three cases of giant DH post oesophagectomy for cancer of the lower oesophagus all of which presented over a one month period in January 2015, all of which were classified as junctional tumours. All patients underwent initial upper gastro intestinal (GI) endoscopy with biopsies for diagnosis and subsequent computed tomography scan (CT scan) of chest/abdomen/pelvis, positron emission tomography (PET) and endoscopic ultrasound scan (EUS) for staging. Following multi disciplinary team (MDT) discussion all patients underwent neoadjuvant chemotherapy with two cycles of 5-FU and Cisplatin followed by open Ivor-Lewis oesophagectomy (ILO) (see Table 1). No patients had previous hiatal hernias prior to surgery and full crural sling dissections were carried out in all cases.

### 3.1. Case 1

The first patient was a 73 year old woman with a long history of gastroesophageal reflux disease. She presented to gastroenterology for investigation of anaemia. Visualisation of the upper GI tract showed an ulcerated lesion in the lower oesophagus at 35 cm. Biopsies confirmed a moderately differentiated adenocarcinoma. Staging was T3N1M0. Following two cycles of neoadjuvant chemotherapy she underwent open ILO five months after her initial diagnosis. Pathological staging was pT3 pN0 with negative resection margins. (Proximal and distal margin showed no involvement, distance of carcinoma from the nearest circumferential margin (CRM) was 25 mm). On day 7 post surgery she developed respiratory distress, with increasing oxygen requirements, shortness of breath, hypertension and tachycardia. An urgent CT scan revealed extensive herniation of abdominal content through a large hiatal defect immediately to the left of the midline, with a consequent complete collapse of the left lower pulmonary lobe and displacement of cardio-mediastinum (see Fig. 1). Emergency laparotomy was performed with reduction of the diaphragmatic hernia and primary closure of the hiatal defect with interrupted number 1 Nylon (see Fig. 2). Subsequent recovery was slow and she was discharged two months after admission. After 11 months of follow up she remains well and free of disease.

### 3.2. Case 2

A 68 year old man with a past medical history of hypertension, hyperlipidaemia and impaired fasting glycaemia but no significant personal or family history of cancer underwent an endoscopy for dysphagia. This showed a stricturing lesion of the lower oesophagus at 37 cm. Following biopsies and staging investigations he was diagnosed with a T3 N1 M0 poorly differentiated adenocarcinoma. He underwent two cycles of neoadjuvant chemotherapy followed by open ILO five months after initial diagnosis. He recovered without major problems and was discharged on day 9 post surgery. Pathological staging was pT3 pN2. (Proximal, distal and circumferential margins were all clear, with a distance of carcinoma to nearest circumferential margin of 2 mm).

The patient underwent routine outpatient follow up (1, 3, 6 months post operatively). At 6 months he developed disease recurrence with mediastinal lymph nodes and liver metastases and was started on palliative chemotherapy. Two months later (eight

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