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Pictorial Review

Expected and unexpected imaging features after oesophageal cancer treatment

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Oesophageal cancer is a leading cause of cancer-related mortality worldwide. Various surgical procedures are performed for oesophageal malignancies. The advancement in surgical technique as well as post-surgical care has significantly reduced the complication rate. However, various complications may still occur either immediately (infection, aspiration, anastomotic leak, ischaemic necrosis, fistulae, chylothorax) or late after surgery (strictures, tumour recurrence, fistulae, delayed emptying). The palliative treatment options of radiotherapy and stent placement may also be accompanied by complications, such as radiation necrosis, stricture, and stent ingrowth by the tumour. This review presents the expected post-surgical appearance as well as various complications after surgical and non-surgical treatments of oesophageal cancer.

Introduction

Oesophageal cancer is the third most common gastrointestinal tract malignancy and has an overall poor prognosis.[1] The American Cancer Society estimates 18,170 new cases and 15,450 deaths attributed to oesophageal cancer in 2014.[2] From 1975–1977 the relative survival rate was a dismal 5%. The relative survival rate has been steadily increasing since then, but was still a mere 17–19% from 2001–2007. As with any other malignancy, the survival rate is strongly affected by the stage at the initial diagnosis. Surgical resection offers the best treatment option for early-stage disease without distant metastasis or locally advanced tumour. In the United States, the 5-year survival rates for localized and regional oesophageal cancers are 37% and 19%, respectively.[3]

An integrative imaging approach with computed tomography (CT), positron-emission tomography using 2-[^{18}F]-fluoro-2-deoxy-D-glucose (FDG), and endoscopic ultrasound (EUS) is advocated for staging and making decisions regarding surgical or non-surgical treatment options. Oesophageal resection with reconstructive surgery is offered for the initial stages that results in marked alteration in the anatomy and can develop potential complications. Non-surgical candidates are offered chemotherapy, radiation, and stent placement to relieve dysphagia.

In this article, we will focus on identification of complications after surgical and non-surgical treatments for oesophageal cancer utilizing imaging with emphasis on CT.

Surgical techniques of oesophageal resections

Various surgical approaches for the resection of oesophageal carcinoma are (1) transthoracic oesophagectomy: Ivor Lewis procedure, McKeown procedure, left thoracoabdominal approach; (2) trans-hiatal oesophagectomy; or (c) bypass surgery, whereby the stomach, colon, jejunum

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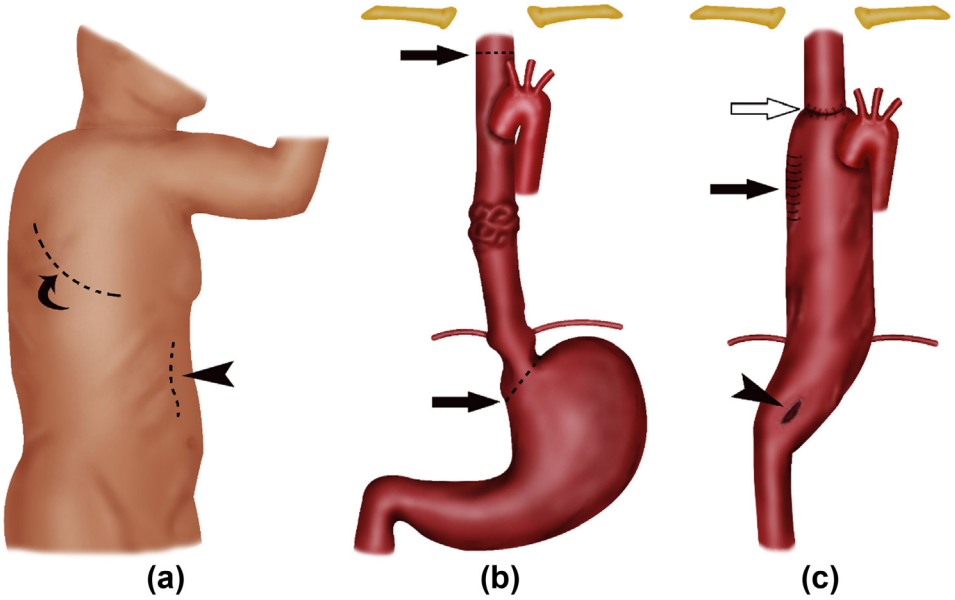

Figure 1 Diagrammatic illustration of Ivor Lewis oesophagectomy. (a) Upper abdominal (arrowhead) and right lateral thoracotomy (curved arrow) incision sites are shown. (b) *En bloc* dissection of oesophagus, adjacent lymph nodes, and other structures are performed with black arrows showing resection lines. (c) Oesophageal–gastric anastomosis (white arrow) and pyloromyotomy (arrowhead) are performed. The black arrow shows original gastro-oesophageal junction.

may be used in a substernal, subcutaneous, posterior mediastinal route.

The mainstay of treatment for curable oesophageal malignancies is *en bloc* resection of tumour and associated lymph nodes. There is no significant survival benefit of one method of oesophagectomy over the others.[4] For the purpose of the present article, we will describe Ivor Lewis oesophagectomy as a prototype procedure.

Ivor lewis oesophagectomy (Fig 1)

This is the most used surgical technique in the world for treatment of carcinoma of the middle and lower third of the oesophagus.[5] It begins with laparotomy for mobilization of the stomach to create a conduit that will replace the resected oesophagus followed by local lymph node dissection. Pyloromyotomy and pyloroplasty is performed to prevent post-vagotomy gastric outlet obstruction. After laparotomy closure, the patient is turned in the left lateral decubitus position and a right posterolateral thoracotomy is performed near the fifth intercostal space. The oesophagus, with adjacent structures, is dissected *en bloc* from vertebral body to the pericardium and meticulous local lymph node dissection is performed in the posterior and middle mediastinum. The gastric conduit is pulled into the chest and anastomoses are performed as high as possible to achieve adequate margins. The gastric conduit lies in the prevertebral or right paravertebral space.[6]

Over the last decade, minimally invasive oesophagectomy by laparoscopy and thoracoscopy has been prevalent compared to open surgery. Operative blood loss and complications are reported to be less with the minimally invasive surgery compared to the traditional open approach.[7]

Expected postoperative changes after Ivor Lewis oesophagectomy on plain radiograph and contrast upper gastrointestinal study (UGI) are depicted in Figs 2 and 3. **TP1** [The technique of gastro-oesophageal anastomosis leaves a variable-sized, blind-ending side pouch that should not be confused with an anastomotic leak] (Fig 3a).

Post-surgical complications

Oesophagectomy is a high-risk procedure with a complication rate of around 60%.[8] Marked improvements in

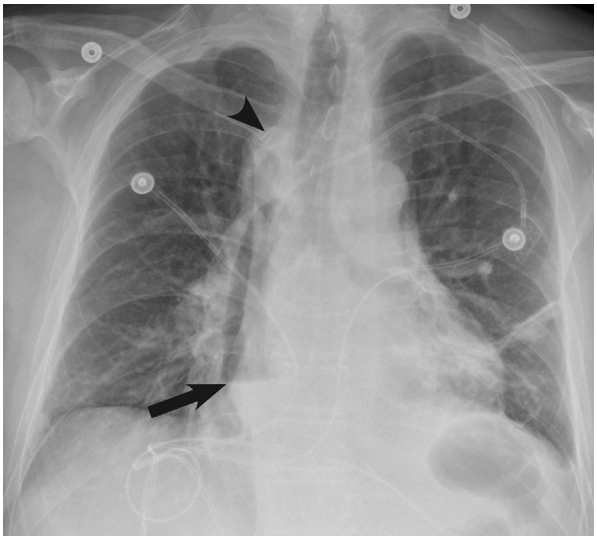

Figure 2 Normal post-Ivor Lewis oesophagectomy appearance: 7 days postoperation posteroanterior chest radiograph in a 49-year-old man. Note the surgical clips at the oesophageal–gastric anastomosis (arrowhead), air column with fluid level in the right mediastinum (black arrow) with small lingular atelectasis.