Transabdominal mass ligation of the thoracic duct for the prevention of chylothorax following en bloc oesophagectomy

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Abstract

The occurrence of a postoperative chylothorax after en bloc oesophagectomy for cancer is a severe and potentially life-threatening complication. In this study, we describe the technique of transabdominal mass ligation of the thoracic duct as an elective, simple and safe method for the prevention of postoperative chylothorax.

Keywords: Oesophagectomy • Chylothorax • Oesophageal cancer

INTRODUCTION

Chylothorax after transthoracic en bloc oesophagectomy for cancer is a potentially life-threatening postoperative complication. Selective ligation of the thoracic duct at the level of the thoracic cavity does not sufficiently eliminate the risk of chylothorax due to possible trauma of the very vulnerable thoracic duct wall at the level of ligation, or incomplete ligation in the case of anatomical variations. It has been reported that mass ligation of the thoracic duct at the level of the diaphragm is an effective technique in treating the complication of postoperative chylothorax after en bloc oesophagectomy [1]. To avoid the occurrence of postoperative chylothorax, we have refined the technique of transabdominal mass ligation of the thoracic duct and added it to our operative standard protocol for en bloc oesophagectomy for cancer.

ANATOMY OF THE THORACIC DUCT

The thoracic duct transports approximately 4 l of lymphatic fluids a day from the intestinal organs in the abdominal cavity and the lower extremities up to the left brachiocephalic vein. The duct itself has a diameter of 2-5 mm [2], a very thin layer of smooth muscle in its wall and internal valves that inhibit the flow of the lymphatic fluid downwards. The thoracic duct originates from the cisterna chyli, which is located anterior to vertebral bodies L1 and L2. It crosses the diaphragm in the right retrocrural space with the thoracic splanchnic nerves and the azygos vein on the anterolateral front of the vertebral column and posterior to the descending aorta through the aortic hiatus into the right thoracic cavity (Fig. 1).

TECHNIQUE OF TRANSABDOMINAL MASS LIGATION OF THE THORACIC DUCT

In our practice, oesophagectomy for cancer is usually carried out by a transthoracic approach through the right chest and includes mediastinal lymphadenectomy with en bloc resection of the thoracic duct and preservation of the azygos vein. To access both the right thoracic and the abdominal cavities, the patient’s abdomen and pelvis are placed supine with only a slight rotation, and the thorax rotated to a left lateral decubitus position. During the transthoracic part of the procedure with en bloc oesophagectomy, no extra efforts are made for the ligation of the remaining upper and lower end of the thoracic duct. After completion of the transthoracic oesophagectomy, abdominal D2 lymphadenectomy, en bloc resection and extraction of the oesophagogastric specimen and the construction of the gastric conduit are achieved transabdominally through an upper midline incision. Before the transthiatal pull-up of the gastric conduit is performed, the right diaphragmatic crus is dissected down to the level of inferior vena cava to obtain sufficient access to the retrocrural space, which contains the thoracic duct at the level of the diaphragm. Subsequently, the paraverterbral pleura at the right edge of the aorta is incised, and a large curved forceps (e.g. Rummel, Overholt) is guided along the right and posterior aortic circumference to the anterior surface of the vertebral column. The forceps is turned right and led along the anterior and right surface of the spine until the paravertebral pleura is reached at the right edge of the vertebral body (Supplementary Video 1). Now, the complete large portion of fatty fibrous tissue is circumnavigated with the forceps (Fig. 2). This portion of tissue contains the thoracic duct, the right thoracic splanchnic nerve and the azygos vein. It is double ligated with a non-resorbable 0 polyester ligature (Mersilene 0). Then, the gastric conduit is pulled up through the oesophageal hiatus, without reconstruction of the right...
DISCUSSION

The occurrence of a postoperative chylothorax after oesophagectomy can lead to significant morbidity and mortality. The current literature reports chylothorax rates of 2.5–4.0% after radical oesophagectomy for cancer [3–5]. Major complications like pneumonia, sepsis and re-intubation are significantly increased, and mortality rates of 17% have been reported in a large series for postoperative chylothorax after oesophagectomy [4]. But even in cases without severe morbidity or mortality, the treatment of postoperative chylothorax usually prolongs hospitalization and increases the cost of treatment. For this reason, specific efforts should be made to avoid the occurrence of postoperative chylothorax after oesophagectomy for cancer. Different techniques of transthoracic ligation and methods for the improvement in visualization of the thoracic duct have been described for this purpose [6–8]. In our institution, prophylactic transabdominal mass ligation of the thoracic duct has been introduced and proved to be safe and effective in avoiding postoperative chylothorax. The described technique has been applied in more than 100 oesophagectomies since 2009 without causing any specific complications, and the method was able to completely avoid the occurrence of postoperative chylothorax.

In contrast to previous studies [6, 7] that described preventive mass ligation of the thoracic duct by a transthoracic approach, we prefer transabdominal ligation because it allows us to safely ligate the thoracic duct on the diaphragmatic level and excludes pre-existing injury of the duct by preparation for en bloc oesophagectomy below the level of ligation. As anatomical variations with duplication or even multiplication of the thoracic duct at the hiatal level are common [2] and the wall of the thoracic duct is very thin and vulnerable, we ligate the complete paravertebral portion of fatty tissue to obtain sufficient and safe closure of the thoracic duct. The described technique is also applicable not only for prevention, but also for therapy of previously failed transthoracic thoracic duct ligation with postoperative chylothorax. In our practice, we applied the described technique initially only in these cases. With this operation, we were able to treat postoperative chylothorax after oesophagectomy in all patients successfully. For this reason, we added the transabdominal mass ligation to our standard protocol for en bloc oesophagectomy as a part of the primary procedure.

Moreover, as visualization of the oesophageal hiatus usually is very good from the laparoscopic approach, the described technique should be applicable not only via laparotomy but also as a part of minimally invasive approaches for en bloc oesophagectomy. Summing up, in our practice, prophylactic transabdominal mass ligation of the thoracic duct is a simple, effective and safe technique that can be easily applied during radical oesophagectomy for cancer to minimize the risk of postoperative chylothorax.

SUPPLEMENTARY MATERIAL

Supplementary material (Video 1) is available at EJCTS online

Video 1: Mass ligation of the thoracic duct after incision of the right diaphragmatic crus.

Conflict of interest: none declared.

REFERENCES


