

Minimally invasive management of chylous fistula after esophagectomy

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SUMMARY. Chyle leak is an unwelcome complication of esophagectomy that is associated with a high mortality. The diagnosis of this condition may be difficult or delayed and requires a high index of suspicion. Management varies from conservative treatment with drainage, intravenous nutrition, treatment and prevention of septic complications, to re-operation, either by thoracotomy or laparotomy to control the fistula. To reduce the mortality, early surgical intervention is advised and a minimally invasive approach has recently been reported in several cases. From June 2002 through August 2005 we have used video-assisted thoracoscopic surgery to diagnose and treat chyle fistulas from 6/129 (5%) patients who underwent esophagectomy for resectable carcinoma of the esophagus or high-grade dysplasia. The fistula was successfully controlled in 5/6 cases by direct thoracoscopic application of a suture, clips or fibrin glue. One patient required a laparotomy and ligation of the cysterna chyli after thoracoscopy failed to identify an intrathoracic source of the leak. An early minimally invasive approach can be safely and effectively applied to the diagnosis and management of post-esophagectomy chylous fistula in the majority of cases. Open surgery may be appropriate where minimally invasive approaches fail or where the availability of such skills is limited.

KEY WORDS: chylothorax, complications, esophagectomy, thoracic duct, thoracoscopic.

INTRODUCTION

Chylous fistula is a rare complication of esophagectomy that is reported to occur in 2–4% of cases.^{1–4} It can lead to hypovolemia, metabolic and nutritional depletion, risk of infection and a mortality in excess of 50%.⁵ Approximately half of all cases occur as a result of surgery.⁶ The optimal management is controversial, but conservative treatment with drainage, nutritional support and control of sepsis for a low-output fistula may be appropriate.⁷ Conservative treatment is of higher risk when the output is greater than 10 mL/kg/day, when re-operation may be advisable.⁷ Surgical management is often required to control a chylous fistula in the majority of cases following esophagectomy.⁸

Re-thoracotomy can be hazardous in this situation, particularly because of the risk of postoperative respiratory compromise and the potential need for mechanical ventilation. If re-operation is required

then aggressive early intervention rather than a delay after conservative treatment is suggested.^{1,9} There have been successful case reports of the use of a thoracoscopic approach to control chylothorax following cardiothoracic procedures,¹⁰ neck dissection¹¹ and esophagectomy.^{12–14} We have routinely utilized thoracoscopy as the primary intervention for re-operative management of post-esophagectomy chyle leakage and we report our experience with respect to a review of the current literature.

PATIENTS AND METHODS

The period under investigation was 1 June, 2002 through to 31 August, 2005. During this time, 129 patients underwent esophageal resection for high-grade dysplasia or potentially curable carcinoma of the lower third of the esophagus, gastro-esophageal junction or cardia (Siewert types I and II). A total of 110 patients had an Ivor-Lewis procedure. A transhiatal resection was performed in 10 cases and a further nine patients had a laparoscopic transhiatal esophagectomy. The two-stage procedure employed by all three surgeons was similar and involved a

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radical *en bloc* resection of the esophagus and surrounding tissue, two-field lymphadenectomy and reconstruction with a gastric tube based on the greater curvature of the stomach. The procedure differed between surgeons in some respects. Two out of the three surgeons excised the thoracic duct *en bloc* after ligation at the hiatus. They also routinely placed a feeding jejunostomy tube at the time of surgery. The third surgeon preserved the thoracic duct, with careful ligation of its tributaries, and did not routinely place an enteral feeding tube. Alimantation via jejunostomy at a rate of 30 mL/h of Fresubin (Fresenius Kabi, Bad Homburg, Germany) was routinely commenced after 48 h and increased as tolerated over several days.

A chyle leak was suspected if the chest drain output continued to exceed 1000 mL/day following surgery or if the quality of the drain output changed (to a 'milky' color) following commencement of the jejunostomy feed. In such cases, thoracoscopy was planned without delay. Enteral feeding via the jejunostomy tube was commenced at least 2 h prior to thoracoscopy to enable intraoperative visualization of the suspected chyle leak. A right-sided thoracoscopy was initially undertaken in all cases. The right lung was collapsed by use of a double-lumen orotracheal tube or a single-lumen tube with a right-bronchial occlusion balloon. A primary blunt 10 mm cannula was introduced through the intercostal drain site. Two 5 mm or 10 mm secondary ports were placed under direct vision. The territory of the thoracic duct was carefully inspected in an attempt to identify and control chyle leakage using a ligaclip, suture, fibrin glue or a combination of these. The procedure was concluded by placement of a large-bore chest drain and pulmonary decortication, if necessary.

RESULTS

Three men and three women, median age 58 years (range, 50–72) underwent post-esophagectomy intervention for chyle leakage. The primary tumors had been located in the lower third of the esophagus in all cases (adenocarcinoma, $n = 5$ patients; squamous cell carcinoma, $n = 1$). At final pathological staging, four patients had N1 disease (median number of lymph nodes examined of 31 (range, 11–62)).

The leak was identified as early as the second and as late as the 24th post-operative day (median of 5th day). Four patients had thoracic duct ligation and excision and two had preservation of the thoracic duct during esophagectomy. In five patients, the chyle leak was thoracoscopically identified in the right chest and controlled using a combination of titanium ligaclip or Hemolok clip (Weck Systems,

NC, USA), nonabsorbable suture combined with Tisseel fibrin glue (Baxter Healthcare, Deerfield, IL, USA). The leaks were located at the caudal thoracic duct stump ($n = 3$), in the mid-portion of the thoracic duct ($n = 1$) and from the point of suture ligation of a tributary of a preserved thoracic duct ($n = 1$). In three of the patients, the ligature previously placed around the thoracic duct at the hiatus during esophagectomy was seen to be *in situ*. In the patient where the fistula was not identified after the initial right thoracoscopy, a left thoracoscopy was immediately performed, and chyle was found emerging up through the hiatus. Laparotomy identified a leak from the cisterna chyli, which was controlled with a nonabsorbable suture. One patient who had their initial thoracoscopy on day 2 that failed to identify the fistula, required a repeat operation on day 11 for a persistent leak that eventually resolved with the application of a ligature and glue. One patient developed a persistent pneumonia following their thoracoscopy. The median length of hospital stay was 25 days (range, 15–79). There was no in-hospital mortality during this 39-month period.

DISCUSSION

The first indicator of a chyle leak after esophagectomy may be a high chest or abdominal drain output of greater than 500 mL/day.¹⁵ Straw-colored drain fluid may become opacified following commencement of enteral feeding or naso-gastric administration of cream. This complication may be more common after a trans-thoracic compared with a trans-hiatal esophagectomy,¹⁶ although some describe the opposite experience¹ and others have found no difference.⁴ Laboratory analysis of drain fluid should identify large numbers of lymphocytes and chylomicrons.¹⁷ Computed tomography, magnetic resonance imaging or lymphoscintiscan may assist with the diagnosis.^{18–20}

Conservative treatment consists of adequate drainage of chyle, nutritional support and the treatment and prevention of septic complications.⁵ The use of adjunctive treatments such as somatostatin analogs or sympathomimetic agents have had limited success.^{21–23} Table 1 summarizes the outcome of management of chyle leaks after esophagectomy performed by a variety of approaches. The overall mortality in the literature for 106 chyle leaks is 20 cases (18%). The overall mortality for conservative treatment is 23% (range, 0–57%) and for surgical intervention (by thoracotomy), 15% (range, 0–57%). An aggressive surgical strategy with early intervention is associated with better results.³ In contrast, a conservative approach produced poor outcomes from both medical and surgical treatment.¹ In the case of a low output fistula (< 10 mL/kg/day), an initial period of conservative treatment may be

Table 1 Outcome of chylous fistula management following esophagectomy

Reference	Cases	Type of resection	Conservative treatment		Surgical treatment	
			Number	Mortality	Number	Mortality
Orringer <i>et al.</i> 1988	11	Trans-hiatal	0	–	11	0
Bolger <i>et al.</i> 1991	11	Trans-hiatal, trans-thoracic	8	4 (50%)	3	1 (33%)
Dougenis <i>et al.</i> 1992	10	Thoraco-abdominal	1	0	9	1 (11%)
Alexiou <i>et al.</i> 1998	21	Ivor-Lewis	17	4 (24%)	4	1 (25%)
Merigliano <i>et al.</i> 2000	19	Ivor-Lewis, transhiatal	4	0	15	1 (7%)
Rao <i>et al.</i> 2004	14	Trans-hiatal, trans-thoracic	7	4 (57%)	7	4 (57%)
Lagarde <i>et al.</i> 2005	20	Trans-hiatal, trans-thoracic	16	0	4	0
Overall	106	Trans-hiatal, trans-thoracic, thoraco-abdominal, Ivor-Lewis	53	12 (23%)	53	8 (15%)

appropriate. However, patients whose drain output is > 10 mL/kg/day are less likely to resolve.⁷ Cerfolio *et al.* found that drainage of > 1000 mL/day for 7 days predicted the need for operative treatment.⁸ Others suggest that conservative attempts at management should be avoided if the drain output exceeds 1500–2000 mL/day.^{2,16,24}

There are case reports of thoroscopic management of chylous fistula from a variety of causes. These include spontaneous chylothorax, blunt trauma and after surgery such as coronary artery bypass, thoracic aortic aneurysm repair and resection of soft tissue tumors.^{10,11,25–27} A number of treatment methods have been used including pleurodesis, clip and fibrin glue application and main thoracic duct ligation. Thoroscopic control of a chylous leak following esophagectomy is an attractive proposition, especially in a patient who may have had a trans-hiatal resection. The thoroscopic technique has been described in several case reports (Table 2) with minimal morbidity.^{12–14} We report our experience with the minimally invasive approach to the diagnosis and management of chyle fistula over a 39-month period in the context of radical esophageal resection and have included our data in Table 2. This method was not difficult to perform and afforded good views of the preserved thoracic duct or of its ligated ends and allowed the easy application of a combination of clips, suture and glue. It also enabled decortication, pleural lavage and the accurate placement of an intercostal drain. This procedure was achieved in both the early and late stage of post-operative recovery. In cases where the duct had been excised intra-operatively, a leak may have occurred

due to a loose ligature, a ‘cheese-wire’ effect of a tight ligature or trauma to a nearby tributary. We have contributed to the published experience of this technique that now consists of 12 cases of post-esophagectomy chylothorax managed thoroscopically with no reported mortality.

Perhaps the most promising alternative to thoroscopic management of chyle fistula is percutaneous catheterization and embolization of the thoracic duct using microcoils, particles or glue.^{28–30} Needle disruption of the thoracic duct is possible if it cannot be cannulated.^{30,31} There is data now from 60 cases of chylothorax due to a variety of causes treated using this technology with a 65% success rate.³¹ However, surgical treatment may still be required for the failures. In nine patients who have developed chylothorax after esophagectomy, seven have been cured by this method.³⁰ However, this is a procedure for the interventional radiologist which may be available only in selected units.

It should be emphasized that there is as yet no level I evidence to recommend the best practice for managing chyle fistula after esophagectomy. There is a single Japanese randomized study that attempted to prevent lymph leakage after esophagectomy by randomly allocating the application of fibrin glue or no glue to the mediastinal dissection at the end of the operation.³² Surprisingly, the fibrin glue group had significantly more lymph leakage after resection than the controls and so this approach found little to commend it. Based on our experience with a small series of cases, we suggest a thoroscopic approach to the diagnosis and management of suspected chylous fistula following esophagectomy.

Table 2 Thoroscopic management of chylous fistula after esophagectomy

Reference	Cases	Type of operation	Thoroscopic intervention	Mortality
Crosthwaite <i>et al.</i> 1995	1	Attempted thoroscopic resection	Thoracic duct clip	0
Takemura <i>et al.</i> 2000	1	Thoroscopic esophagectomy	Thoracic duct ligation	0
Wurnig <i>et al.</i> 2000	1	Esophago-gastrectomy	Thoracic duct clip	0
Bonavina <i>et al.</i> 2001	2	Ivor-Lewis resection	Thoracic duct clip, suture, endoscopic stapler	0
Nadesan <i>et al.</i> 2005	1	Ivor-Lewis resection	Drainage, pleurodesis	0
Leeds experience	6	Ivor-Lewis resection	Drainage (6), clip (5), fibrin glue (4), suture (2)	0

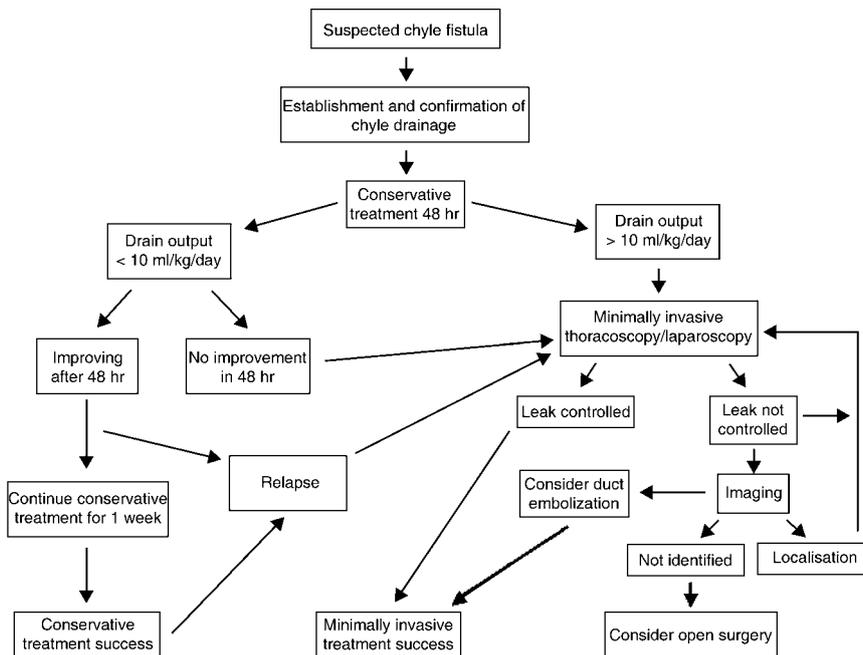


Fig. 1 Suggested algorithm for the management of chylous fistula after esophagectomy.

Even in cases where a chyle leak is diagnosed late, a thoracoscopy rather than a thoracotomy may be considered. Our treatment algorithm for the management of chyle fistula after esophagectomy is shown in Fig. 1.

CONCLUSION

Chylous fistula is an uncommon yet serious complication after esophagectomy. Early diagnosis and treatment is important to reduce morbidity and mortality. Conservative treatment may be employed for a duration of up to 48 h and continued if the fistula produces an output of < 10 mL/kg/day. If fistula output exceeds 10 mL/kg/day then intervention is recommended. This can be achieved using thoracoscopy, laparoscopy or interventional radiological techniques. Open surgery has a role if these approaches fail to identify or control the fistula or where minimally invasive skills are limited.

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