

# Use of Decellularized Human Skin to Repair Esophageal Anastomotic Leak in Humans

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## ABSTRACT

Multiple surgical techniques have been described for repair of esophageal leaks. None of the repairs are optimal, and the morbidity and mortality of an esophageal leak remains high. To our knowledge, this is the first case report of use of AlloDerm (Lifecell Corp, Brachburg, NJ) to successfully repair a thoracic anastomotic esophageal leak.

**Key Words:** AlloDerm, Esophageal leak, Decellularized human skin.

## INTRODUCTION

One of the most feared complications of esophageal resection is anastomotic leak. The incidence is reported to be from 4% to 13%.<sup>1-4</sup> An anastomotic leak can be a very difficult problem to treat in an inflamed, infected area, especially in a physically compromised patient. Methods of treatment have included primary repair, esophageal resection or diversion, or both, and various types of patches including pleural, mucomuscular, and Vicryl mesh. We report here the use of decellularized human skin for patch repair of an anastomotic esophageal leak.

## CASE REPORT

A 60-year-old male with symptomatic, biopsy proven, esophageal cancer underwent a laparoscopic-assisted distal esophagectomy with right thoracotomy (Ivor Lewis Esophagectomy). The patient presented from an outside hospital with a history of progressive solid and later liquid dysphagia. Esophagoscopy revealed an almost completely obstructing mass of the distal esophagus. Biopsy revealed poorly differentiated adenocarcinoma of the esophagus. A computed tomographic (CT) scan did not reveal any nodal or extraesophageal involvement.

The patient underwent a laparoscopic-assisted Ivor Lewis esophagectomy. The laparoscopic gastric mobilization was performed via a 10-mm umbilical port, two 10-mm ports in the right lateral abdomen, two 10-mm ports in the left lateral abdomen, and a 5-mm subxiphoid port for liver retraction. A pyloromyotomy was performed and the stomach was mobilized laparoscopically. The distal esophagus was also mobilized well into the mediastinum.

Through a right sixth intercostal minithoracotomy incision, the distal esophagus was mobilized. The proximal third of the stomach was transected laparoscopically by using a laparoscopic GIA stapler. The proximal stomach was pulled into the chest, and the esophagus was transected about 2 cm proximal to the gross tumor margin and passed to the pathology department for margin evaluation. Due to a microscopically positive proximal margin, 2 additional centimeters of the distal esophagus was excised. An anastomosis was created in an end-to-side fashion between the distal esophagus and the mobilized

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distal stomach. The anastomosis was fashioned in a single-layer technique using 3–0 interrupted full-thickness silk sutures. A nasogastric (NG) tube was left in the stomach; a feeding jejunostomy tube was placed laparoscopically in the proximal jejunum. The right chest was closed with a straight 28F and an angled 28F chest tube in place.

The patient's postoperative pathology was consistent with poorly differentiated adenocarcinoma. It had extensive involvement of the paraesophageal and perigastric soft tissue. On postoperative day #3 the NG tube was removed, and the patient was started on a clear liquid diet the following day. On POD #4, one chest tube was removed and due to minimal output the second chest tube was removed on POD #8. On POD #9, the patient was found to have a new pleural effusion that was drained. It showed no sign of particulate matter consistent with food. The following day, POD #10, the patient complained of acute onset of back pain. His white blood cell count was elevated to 22 000. A CT scan with oral contrast was performed and showed a leak into the right chest.

The patient was returned to the operating room immediately and underwent a right thoracotomy. The leak was not immediately apparent, and a gastroscope was passed into the proximal esophagus and used to evaluate the leak. The majority of the anastomosis appeared intact, with a small 2-mm dehiscence at the lateral anastomotic edge. Due to the friable nature of the surrounding tissue, it was felt that a primary repair was not possible. The chest cavity was irrigated and debrided. AlloDerm was used as a patch onlay over the site of the breakdown. A piece 2x3 cm with a thickness of 0.031 inches to 0.077 inches was fashioned. It was sewn into place with four 3–0 Prolene simple interrupted corner sutures, covering the point of leak. One more, simple interrupted suture was placed between the corner sutures to reinforce the patch. Two more 28F sized chest tubes were placed in the right chest.

The patient was extubated in the recovery room and admitted to the intensive care unit. On postoperative day (POD) #1, jejunal tube feeds were initiated. On POD #3, the chest tube output was down to 70cc total for 24 hours. Chest x-rays were obtained daily and showed no effusion.

On POD #6 after his second surgery, the patient underwent a Gastrografin swallow that showed no sign of leakage. On the same day, he was started on a liquid diet. On POD #7 and #8, the chest tubes were removed. Five days later, the patient was discharged to a rehabilitation hospital, tolerating a full liquid diet with nightly jejunal tube feeds.

One month after surgery, the patient was readmitted to the hospital due to nausea and vomiting. He underwent an esophagogastroduodenoscopy, which showed a small ulceration at the anastomosis site, but no sign of stenosis.

Currently, the patient is at home, tolerating an oral diet with supplemental tube feedings and receiving ongoing oncological treatment for his esophageal cancer.

## DISCUSSION

One of the most feared complications of esophageal reconstruction surgery is a leak at the anastomotic site. The morbidity and mortality of a leak is considerable. Alanezi et al<sup>3</sup> reported a 7.5% rate of esophageal anastomotic leak, with an associated 35% mortality. Junemann-Ramirez et al<sup>4</sup> noted an anastomotic leak rate of 5.1%, with 30-day mortality significantly higher in the leak group vs. nonleak group (35.7% vs 4.2%).

Repairs of these leaks are very difficult. The patients are typically nutritionally deficient and debilitated from their disease and surgery. The area of leak usually exhibits local inflammation and tissue necrosis. Treatment of esophageal leaks depends on time to diagnosis of the perforation and whether the perforation is walled-off or not. A walled-off perforation with minimal symptoms and no sepsis may be treated conservatively. This includes nothing-by-mouth status, antibiotics, and an alternative feeding source. If this fails, a primary repair that is reinforced is used. The reinforcement can be gastric fundus as a partial or total fundoplication, a pleural or muscle flap, or as we are suggesting AlloDerm mesh. If there is free perforation and early diagnosis, this primary repair and reinforcement is also recommended.<sup>5</sup> Studies<sup>6,7</sup> report that this technique may also be used for free perforation after a delay of 48 hours to 72 hours. Other techniques used when a diagnosis of perforation has been delayed include resection, cervical esophagostomy, gastrostomy, and jejunostomy.<sup>5</sup>

AlloDerm has been shown to be effective in multiple surgical applications. These include reconstruction of complicated abdominal wound defects, reconstruction of dural defects, pharyngeal reconstruction, vaginal repairs, and multiple plastics applications.<sup>8–11</sup>

Isch et al<sup>12</sup> successfully applied an AlloDerm patch repair in a canine cervical esophageal leak model. In their study, an AlloDerm onlay patch was used in 12 dogs with cervical esophageal leaks. No occurrence of wound infection, sepsis, or anastomotic leak was noted with the use of this material. Furthermore, on evaluation by barium

esophagram, no leak, stricture, or diverticulum formation was found.<sup>12</sup>

Our hypothesis is that AlloDerm provides the properties needed for a successful esophageal leak repair. AlloDerm provides an acellular matrix for regeneration and healing even in a contaminated field. Due to its properties, it allows revascularization and remodeling into native tissue. It is more effective in resisting infection. It also has been shown to minimize the inflammatory reaction associated with prosthetic graft repair. We have found AlloDerm easy to store and work with.

## CONCLUSION

We have successfully applied AlloDerm to patch an esophageal intrathoracic leak in a patient with esophageal carcinoma without any resulting leak or stenosis. To our knowledge, this is the first report of successful AlloDerm use in an esophageal anastomotic leak. We feel that AlloDerm is currently the optimal option in complicated esophageal repairs, adding to the surgeon's armamentarium of repair techniques.

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