Learning Objectives:

1. Understand the fundamental physiologic issues of managing the post-operative esophagectomy patient.
2. Develop an approach to the medical management of the major complications of the esophageal surgical patient.

Outcomes

Mortality for post-esophagectomy in esophageal cancer patients has gradually improved since the 1970’s largely as a result of improvements in surgical technique, use of neoadjuvant chemoradiation therapy, and advances in intraoperative and post-operative care. Nonetheless, the post-esophagectomy in-hospital mortality still ranges from 3% to 10% (ave. 8%). Many variables can impact the success of the operation including the experience of the surgeon and institution, meticulous surgical technique, development of anastomotic or conduit leaks or fistulas, infection, patient co-morbidities, and nutritional state. Overall there is probably little difference in the in-hospital mortality between the transthiatal (Orringer-UM) versus the transthoracic (Ivor-Lewis) approach (about 9%).

Post-operative 30-day mortality reported by many analyses is 10% with a 5-year relative cancer survival rate of approximately 17% (American Cancer Society statistics).

Post-operative Care of the Esophagectomy Patient

Initial post-operative care of the esophagectomy patient adheres to the basic tenets of intensive care tailored to this procedure. Intensive monitoring and aggressive approaches to maintenance and rehabilitation of the respiratory system, hemodynamic stability, renal function maintenance, nutrition, and physical therapy are all necessary (Table 1). Specifically, the patient is allowed nothing per os since the gastric conduit anastomosis is fragile (worse at 48 hours) and GI atony is present. Maintenance of a clear nasogastric tube and continuous low-pressure suction is essential to avoiding distension of the gastric conduit by supplemental oxygen, reflex swallowing, and reflux of lower GI contents. In our institution most patients arrive in the ICU extubated. However if there is significant pulmonary disease or obstructive sleep apnea then extended mechanical ventilator support until the immediate effects of the surgery and general anesthesia have dissipated may be indicated. Mechanical ventilation should be performed with an “open lung protective strategy” using small tidal volumes, adequate positive end-expiratory pressure, and limiting peak airway pressures to < 35 cm H₂O. Aspiration precautions and supplemental oxygen without positive-pressure delivery devices can limit interventions after extubation. Early mobilization, good pain control, and incentive spirometry are sufficient interventions for the majority of extubated patients. Hemodynamic stability remains the greatest focus and all patients should be monitored. Adequate perfusion pressure and oxygen delivery must be assured to promote gastric conduit integrity and adequate renal function. Beta-blockers may be administered to prevent post-operative atrial fibrillation.

Controversy exists regarding the use of vasoactive drugs to maintain blood pressure in the face of a tenuous conduit vasculature. As a result the usual approach to maintaining an “ideal” mean arterial pressure above 70 mm Hg, is by infusing significant volumes of...
crystalloid and colloid. As described in the intraoperative management of esophagectomy, this approach can be guided with some success by using some measure of hypovolemia, e.g. arterial pulse pressure or stroke volume variation using available commercial devices. This approach has proponents citing the notion that an esophagectomy is primarily an abdominal surgery. Post-operative continuation of a maintenance intravenous fluid, lactated Ringer’s or normal saline with dextrose, is common and often requires supplementation with colloid boluses, 5% albumin (if pre-operative serum albumin levels are low) or hydroxyethyl starches. If not monitored closely, significant pulmonary edema can develop after either surgical approach and the accumulation of interstitial fluid within the conduit can impair wound healing and oxygen delivery. The use of thoracic epidural analgesia may actually improve gastric conduit blood flow.

Table 1  Primary Focus in Routine Post-operative Care

Pulmonary
- Supplemental oxygen
- Pulmonary toilet (non-invasive) & incentive spirometry
- Thoracostomy tube management
- Aspiration precautions (elevated head of bed; ±GI prophylaxis)
- Early mobilization

Cardiovascular
- Maintain mean blood pressure ≥ 70 mm Hg and adequate oxygen delivery
- Monitor for myocardial ischemia
- Cardiac arrhythmia prophylaxis

Renal
- Maintenance of GFR (foley for 24-48 hours only)
- Maintenance intravenous fluid for 48 hours (until tube feeds started)
- Electrolyte replacement

Gastrointestinal
- Strict NPO status
- Bridled NGT to low constant wall suction with frequent small water flushes
- Jejunostomy tube for all nutrition & medications per os
- Barium swallow study prior to anything per os (usually post-op day 5)

Hematologic
- Monitor complete blood count
- Hemoglobin >8 g/dL
- DVT prophylaxis (high risk)

ID
- Monitor for signs & symptoms of infection (especially conduit dehiscence)
- Prophylactic antibiotics for 24 hours

Pain Control
- Thoracic epidural analgesia
- Combination of PCA and lidocaine-impregnated patches

Nutrition
- Usually start trophic J-tube feeds on post-op day 2 (support for several weeks)
- Monitor nutritional state

Experimental and clinical studies have estimated the risk of gastrointestinal anastomosis dehiscence after prolonged use of vasopressors to be several-fold (odds ratio
However the use of vaspressors at low doses to counter the vasodilation and hypotensive effects of thoracic epidural analgesia is less conclusive. Conflicting results suggest that epidural analgesia actually improves conduit blood flow with the caveat that blood pressure is maintained. While a small study suggested that epinephrine infusion actually improved conduit blood flow by increasing cardiac output and systemic blood pressure, the bulk of the evidence is to the contrary. Nitroglycerine infusions to improve venous drainage from the gastric conduit have had mixed results.

**Post-operative Esophagectomy Complications**

Complications or medical issues after esophagogastrectomy can be grouped into two groups, an immediate perioperative period and a long-term period. Table 2 lists the multitude of potential complications but our discussion will only address the anastomotic dehiscence.

**Table 2. Post-operative Esophagogastrectomy Issues**

<table>
<thead>
<tr>
<th>Immediate Perioperative</th>
<th>Long-term Post-operative</th>
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<td>Anastomotic leaks or gastric necrosis</td>
<td>Anastomotic stricture</td>
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<tr>
<td>Empyema</td>
<td>Dysphagia</td>
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<tr>
<td>Aspiration pneumonia/pneumonitis</td>
<td>Chronic aspiration</td>
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<tr>
<td>Malnutrition</td>
<td>Tracheo-oesophageal fistula</td>
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<td>Recurrent laryngeal nerve injury</td>
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<td>Atrial fibrillation</td>
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<td>Chyllothorax</td>
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<td>Pain management</td>
<td>Physical rehabilitation</td>
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<td>DVT / PE</td>
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**Anastomotic Leaks**

Esophagogastrostomy anastomotic or conduit leaks are a major source of postoperative morbidity and mortality with historical estimates of mortality as high as 60% for intrathoracic anastomosis dehiscence. More recent analyses estimate that cervical esophagogastric anastomoses have a leak rate of 8-14% but a stricture rate of 25%. Intrathoracic anastomoses leak less (3.5-7%) with a stricture rate of about 14% but have more serious repercussions (35% mortality with a leak versus 9% mortality if no leak).

Paramount to its avoidance is the maintenance of adequate conduit perfusion and oxygenation to promote healing. Surgical disruption of microcirculatory blood flow at the level of the conduit anastomosis is clearly a major contributing factor. “En bloc” resections can result in ligation of the left gastric artery & vein, the inferior phrenic artery, ascending lumbar veins at the level of the diaphragmatic hiatus, several intercostal arteries & veins, and the azygos vein. The right gastroepiploic artery is preserved to perfuse the gastric conduit. On entering the wall of the esophagus, the arteries assume a T-shaped division to form longitudinal anastomoses, giving rise to an intramuscular vascular network in the muscular and submucosal layers. As a consequence, the esophagus can be mobilized from the stomach to the level of the aortic arch without total devascularization. However caution must be exercised as to the extent of esophageal mobilization in patients who have had a
previous thyroidectomy and ligation of the inferior thyroid arteries proximal to the origin of
the esophageal branches, since this artery is important for proximal esophagus perfusion.

In the intact esophagus, blood from the capillaries drains into a submucosal venous
plexus and then into a periesophageal venous plexus from which the esophageal veins
originate. In the cervical region, the esophageal veins empty into the inferior thyroid veins;
in the thoracic region, the esophageal veins drain into the bronchial, azygos, or hemi-azygos
veins; and in the abdominal region, the drainage is into the left gastric vein (coronary vein).
After esophagogastrectomy, many of these pathways are disrupted and venous congestion
has been implicated as a cause of inadequate conduit perfusion.\textsuperscript{15}

Animal models have demonstrated that the microcirculation within the anastomotic
region of the gastric fundus decreases at two intervals during esophagectomy and the
creation of the esophagogastric conduit.\textsuperscript{19} The first period occurs during the formation
of the gastric tube when the left gastric and short gastric arteries are dissected and ligated.
The second occurs during the gastric pull-up phase. This procedure lengthens the right
gastroepiploic artery along the greater curvature of the stomach. The increased stretch and
associated tension may impair venous drainage. In studies of human esophagectomy,
conduit ischemia may occur in 10\% of patients to a degree that risks dehiscence (odds ratio
5.5; 95\% CI 2.5-12.1).\textsuperscript{20} Schroder, et al measured gastric conduit pCO\textsubscript{2} following
uncomplicated esophagectomy and found evidence of anaerobic metabolism that peaked 24
hours after surgery and required 4 days to recover.\textsuperscript{21} They estimated that microvascular
recovery of the anastomosis region probably required up to 96 hours. This is supported by
the clinical experience of discovering leaks within 2 to 7 days after operation.

Several surgical techniques have been proposed to mitigate this problem, especially
in colonic or jejunal free flap interposition. Supercharging or microvascular augmentation
and ischemic pre-conditioning have been tried with some success.\textsuperscript{22,23} Post-operative
prevention though, must rely on maintenance of perfusion and oxygen delivery in
conjunction with nutrition using more traditional means.

Diagnosis and management of anastomotic leaks can be difficult and delayed
especially intrathoracic leaks.\textsuperscript{24,25} Intra-thoracic anastomosis leaks present as empyema or
mediastinitis with high fevers, leukocytosis. Must maintain a high index of suspicion.
Ipilateral or bilateral pleural effusions (frequently loculated) can develop and
thoracostomy tube drainage with gram stain and culture of fluid will be diagnostic.
Modified barium swallow may show a fistulous tract or small leak but often are non-
diagnostic and confirmation with endoscopy is suggested. Intra-abdominal free air with
peritonitis is present if dehiscence of any sub-diaphragmatic gastric remnant occurs.

Anastomotic leaks when small, can be treated conservatively with drains and broad-
spectrum prophylactic antibiotics (in particular, gram negative, oral anaerobes and fungal).
More significant leaks have been treated with esophageal stents placed endoscopically.\textsuperscript{27}
The major problem with esophageal stents is their propensity to migrate distally. Alternate
approaches include the endoscopic placement of vacuum-assisted sponge-tipped NGTs.\textsuperscript{28} If
severe dehiscence is apparent with empyema, then immediate thoracic re-exploration with
excision of the primary anastomosis and construction of a new one may be required. This
approach can be successful if pleural infection is not well established and sufficient conduit
length remains to avoid tension. Alternatively, thoracic re-exploration with excision of the
primary anastomosis, exteriorization of the esophageal stump (cervical esophagostomy),
closure of the gastric stoma and reduction of the stomach back into the abdomen with a
gastrostomy for drainage and jejunostomy tube for nourishment may be performed. A
colon or jejunal interposition may be performed later to re-establish alimentary continuity. Attention to adequate nutrition to promote healing cannot be over stated. If all goes well spontaneous healing can take 1.5 to 3 months.

Summary

The basic issues surrounding the post-operative care of the esophagectomy patient have been presented with an emphasis on some of the more controversial areas of tissue perfusion maintenance and avoidance of pulmonary complications. An overview of both surgical and critical care management of the more devastating of the post-esophagectomy complications is presented with an emphasis on detection and aggressive therapy.

References:


