

Review on Surgical Management of Esophageal Rupture

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Abstract:

Esophageal rupture presents a significant interprofessional challenge to the entire therapeutic team. It can occur in three different anatomical compartments and thus presents with a variety of symptoms; the majority of which are highly non-specific, which can significantly delay the time between perforation and final diagnosis. An esophageal rupture can be caused by a variety of pathophysiological factors. Instruments such as endoscope causes an elevation in the wall tension, particularly iatrogenic interventions, or a massive rise in intraluminal pressure caused by throwing up, chest injury, or abdominal injuries are the main stressors. The choice of the management plan and its outcome depends mainly on the site of the rupture. Although the perforation can occur at any site of the esophagus, there is a tendency to main areas that correspond to natural points of narrowing of the lumen.

Introduction:

The first occurrence of esophageal rupture in a patient brought to the Dutch Navy Admiral Hospital was described by Hermann Boerhaave in 1723. After multiple instances of vomiting, the patient's esophagus ruptured spontaneously. The first surgical attempts to repair esophageal perforation, on the other hand, were made in the 1940s. The prevalence of esophageal perforation has risen dramatically since the introduction of diagnostic endoscopy. [1-3] Esophageal rupture is a rare condition with a significant death and morbidity rate .Iatrogenic endoscopic operations are the most common cause of this fatal condition [4-7].

There isn't a lot of agreement on how to handle this life-threatening disease. When therapy is started within 24 hours of rupture, the reported mortality from treated esophageal perforation is 10% to 25%, and when treatment is postponed, the estimated mortality increases from 40% up to 60%. The distinctive anatomical structure and position of the esophagus, which provides bacteria and digestive enzymes an easy access to the mediastinum, leading to severe mediastinitis, sepsis, and numerous organ failure syndromes, is the cause of this massive rise in death rates. The exaggerated mortality is also due to non- specific presentations of the case that leads to delay in the diagnosis and treatment in more than 50 percent of the cases. [8-14]

An esophageal rupture can be caused by a variety of pathophysiological factors. Instruments such as endoscope causes an elevation in the wall tension, particularly iatrogenic interventions, or a massive rise in intraluminal pressure caused by throwing up, chest injury, or abdominal

injuries are the main stressors. All the previously mentioned causes lead to loss of the connective tissue integrity, so it loses its ability to defend the destroyed mucosal barrier following esophageal injury, so it becomes unable to protect infection from spreading to nearby important organs.[15]

The choice of the management plan and its outcome depends mainly on the site of the rupture. Although the perforation can occur at any site of the esophagus, there is a tendency to main areas that correspond to natural points of narrowing of the lumen. The cervical esophagus at the cricopharyngeus is known to be the place of the most incidence of rupture; it is located in the proximal site. In the middle of the esophagus, the narrowing occurs at the carina and aortic arch where perforation by foreign bodies mostly occurs. The last site is the gastroesophageal junction; it is the site of the rupture due to barotrauma causes.

Primary tear repair is reported to be the best option when esophageal rupture is diagnosed early (within 24 hours of rupture), while the best management for the rupture if its diagnosis was delayed for more than 24 hours is still under debate. Different surgical interventions can prevent the inflammatory deterioration caused by esophageal injury from becoming out of control [16-21]. Such as reinforced repair, primary repair, debridement and drainage and esophageal resection and stage reconstruction. However, several recent studies suggest that, regardless of the time between diagnosis and treatment, primary repair should be performed whenever possible. The outcomes and consequences of these various surgical methods have been documented to vary greatly, with mortality rates ranging from 3% to more than 50%. [22-27]

The location of the ruptures, etiological variables, and presentation time all influence the presenting characteristics. Pain is observed in around 80 percent of patients, and it is used mostly to indicate the site of rupture. Nausea and Vomiting, dysphagia, cough, hematemesis and fever are other symptoms which are present in the esophageal rupture. Extreme vomiting is the most common symptom of esophageal rupture, followed by sudden, intense pain located in the chest. Following esophageal instrumentation, pain noticed in the neck, chest, or belly, difficulty in swallowing, or dyspnea, and high temperature should raise alarms for esophageal rupture. If the patient reported a history of ingesting foreign body or caustic agents, it should be considered esophageal rupture until otherwise is proven. Other systemic symptoms such as tachycardia, hypotension and high temperature are also noticed in many cases. Up to 60% of the cases have reported development of subcutaneous emphysema, which took at least one hour to develop after the injury. In nearly half of all cases of esophageal rupture, the characteristic Mackler triad of vomiting, chest discomfort, subcutaneous emphysema, neck pain and stiffness. In cases of cervical perforation, surgical emphysema is also common. The symptoms of thoracic perforation include severe chest discomfort and mediastinitis. These symptoms differ depending on the etiology and the time of onset. Patients may be gravely unwell and present with sepsis and numerous organ failure syndromes if they present late. [28-35].

Epidemiology and Causes:

The age-standard incidence of esophageal rupture was 3.1 per 1 000 000 per year in recent population-based research in Iceland. Nonetheless, the real global prevalence of esophageal rupture is unknown. The majority of patients are in their sixties, and males are somewhat more likely than females to suffer from esophageal rupture. [36-38]

The most common cause of esophageal ruptures is iatrogenic interventions. Around 70% of esophageal perforations are due to iatrogenic causes, where endoscopic operations account for most of the cases. causes of the perforation could be classified into, endoscopic ones such as Diagnostic endoscopy, Endoscopic biopsy, Endoscopic dilatations and Endoscopic Stent Placement, Infective causes mainly Candida, Herpes and Syphilis, Trauma mainly by Blunt, Penetrating or Sword swallowing, Caustic agents either an Acid or alkali Malignancy of esophagus and Lung, or ingestion of foreign bodies.

The risk of esophagogastroduodenoscopy used for diagnosis has been reported to be 0.03 percent. When therapeutic managements are done during endoscopy, the risk of perforation elevates. Perforation is reported to be 0.5 percent in esophageal dilation, 1.7 percent in esophageal dilation for achalasia, , 5% in endoscopic laser therapy, 4.6 percent in photodynamic therapy, and 5-25 percent in esophageal stent placement . The cervical esophagus near the cricopharynx is the most common affected site during endoscopy. [39-45]

The superficially located cervical esophagus as well as the thoracic section of the esophagus can be damaged by penetrating sharp lesions, i.e., external trauma. Although uncommon, bullet wounds can result in tissue injury that is readily overlooked during an examination. As a result, anytime there are penetrating injuries in this area, a high index of suspicion of esophageal perforation is required.[46] Accidental intake of caustic substances is the most common cause of esophageal injury in children. Adults who consume caustic liquids, on the other hand, are more likely to have suicide thoughts. Cleaners, battery fluid, and solutions used in industrial processes are the most common caustic agents the cause esophageal rupture. While acids, which have a disagreeable taste, generate agglutination at the affected tissue with a limited probability of spreading, alkalis are more acceptable and promote liquefactive tissue necrosis that spreads quickly. The volume, thickness, and intensity of the caustic chemical, beside the time of contact between the agent and the esophagus mucosa, all affect the damage and clinical outcomes of ingestion of caustic compounds. [47-49]

Straining and vomiting cause Boerhaave's syndrome. The ability to resist vomiting is common, but it has also been recorded after weight lifting, and childbirth. Ruptures are more common in males and frequently occur in the left posterior part of the lower esophagus. In this situation, a delay in identification and treatment is linked to a lower chance of survival. Trauma to the chest

and upper abdomen can cause esophageal ruptures. A gunshot or stab wound can cause a penetrating injury. Esophageal rupture can also be caused by blunt trauma. Blunt esophageal perforations are common in motor vehicle accidents, with 82 percent of them occurring in the cervical and upper thoracic esophagus, possibly because it is immediately distal to where the esophagus is located. [28-30, 50,51]

Assessment and Evaluation:

The diagnosis of esophageal rupture relies mainly on having high suspicion in this case. the history of the patient is the first thing to be asked for , as ingestion of foreign bodies, chemicals or trauma of any type could help in fast detection and rapid management of the case Any patient who arrives with discomfort or fever after strong vomiting, esophageal instrumentation, or chest trauma should be assessed thoroughly to exclude esophageal perforation. Early esophageal perforations might have mild clinical symptoms that can be confusing. A lateral neck X-ray may reveal air in the facial planes if cervical esophageal rupture is suspected. Posterior and lateral chest radiographs, as well as an upright abdominal series, should be taken in cases with thoracic or intra-abdominal esophageal perforation. A chest x-ray may reveal subcutaneous emphysema, and mediastinal widening. [52-54]

Violation of the mediastinal pleura caused Pneumothorax in about 77% of the cases. mostly it is on the left (70%), to a less extent to the right (20%), and 10% bilaterally.

In individuals with distal third esophageal perforations, hydropneumothorax on the left is common [53]. A contrasting esophagogram must be conducted as soon as the chest X-ray revealed the possibility of esophageal rupture. Because of its intermediate sensitivity (60-70%), the use of a water-soluble contrast agent (Gastrografin) is controversial. Because of the quick passage of the thin contrast medium in the cervical oesophagus, a negative scan does not automatically exclude perforation. [52,54,55]

If the primary test is negative, contrast esophagography with a water-soluble substance is performed first, followed by a barium examination. It is the most reliable test for determining whether or not a perforation exists and where it is located. The primary location of rupture may be shown by a dilute barium study, which indicates if the perforation is restricted to the mediastinum or connects with the pleural or peritoneal cavities, which has a substantial impact on the future care. A strong inflammatory reaction in tissues, most mediastinitis, is a cause of worry. If obtaining a contrast esophagogram is difficult, or if a negative study is obtained despite significant clinical examination, or to exclude alternative diagnoses, a contrast-enhanced CT scan of the chest should be undertaken. Mediastinal air, periesophageal fluid collection or pleural effusions, may all be signs of perforation. [56,57]

If a perforation is mistakenly thought during an endoscopic process, a careful examination of the oesophagus without air inhalation is recommended before removing the endoscope; however, this is not recommended as a primary diagnostic procedure because inhaled air can end up causing further rupture MRI is another diagnostic tool that can be utilized to exclude aortic dissection. To exclude pulmonary embolism, a ventilation perfusion (V/Q) scan and a CT scan of the lungs are used Myocardial infarction and other cardiac abnormalities can be ruled out by an ECG. [54, 57, 58].

Management:

The treatment option is dictated by the etiology, site of rupture, patient's overall physical state, and the level of contamination as assessed by radiography. Perforation in a normal oesophagus and perforation with a previous intrinsic esophageal illness causing distal blockage require distinct treatments. When esophageal perforation is discovered late, non-operative therapy is appropriate. The cornerstone of treatment is surgery, but there has recently been a movement more toward non-operative treatments. Intravenous fluids, broad spectrum antibiotics, analgesics, parenteral nutrition, and a decision about surgical closure versus non-operative control should all be started as soon as feasible. [59-63]

Non-surgical Management:

Cameron et al first outlined the guidelines for non-operative management in 1979, and Altorjay revised them in 1997. Early or postponed diagnosis with contained leak, perforation not in the abdomen, contained perforation in the mediastinum, composition of the rupture discharging back to the oesophagus, lack of sepsis, existence of thoracic surgeon, and contrast imaging in the hospital are some of these. The majority of recent iatrogenic perforations or late post-emetic esophageal perforations can be treated without surgery.[64]

In an intensive care situation, non-operative treatment involves good IV access, supplementary oxygen, cardiovascular and pulmonary observation. A nasogastric tube must be inserted to remove gastric contents and prevent additional contamination; also mouth feeding is not allowed in this case. Broad-spectrum antibiotics should be started as soon as feasible and continued for at least 7–10 days, it should be administered using intravenous methods. To reduce pain and distress, enough analgesia, particularly narcotic analgesics, should be supplied, but it should be used with caution in patients with hypotension. Total parenteral nutrition should be considered when the course of treatment is assumed to be long. [65-69]

During non-operative therapy, consultation and involvement of a skilled esophageal surgeon is essential. If these facilities are not accessible at the initial clinic, the patient may need to be transferred to a tertiary care center. During non-operative care, all signs and symptoms of sepsis

require rapid surgical treatment. Surgical surgery is also indicated for respiratory problems such as pneumothorax, and respiratory failure. Non-operative therapy of esophageal ruptures has a fatality rate of 20 up to 38 percent. [61-62]

Surgical Management:

If esophageal rupture requires surgery, patients should be transported to the operating room as soon as feasible. Minor delays in surgical therapy can lead to higher rates of morbidity and fatality. Patients handled within 24 hours of rupture have a mortality rate of less than 10%, contrasted to 30% after 24 hours. A less invasive surgical operational approach to repair esophageal rupture must be considered. Reports are hard to come by; therefore, this method should definitely be limited to places with highly specialized competence. Good exposure, removal of non-viable cells, application of buttress to support esophageal sutures, and sufficient tube evacuation are the general concepts of esophageal perforation therapy. The surgical procedure should be adapted to the esophageal rupture location. [70-72]

Cervical esophageal rupture:

Direct repair of the esophageal defect should be undertaken whenever possible for esophageal rupture in the neck. If bilateral cervical exploration is required, the oesophagus is reached through a left neck incision along the anterior edge of the sternocleidomastoid muscle or a collar incision. Esophageal displacement to aid repair, cleaning of the perforated site, tension-free rupture closure, strengthening of the repair with vascularized tissue, and sufficient drainage are all surgical treatments. The use of a feeding tube during surgery allows for early nutritional supplementation and promotes recovery. External drainage is recommended if direct repair is not possible. To reduce contamination of the surrounding regions, a lateral or end esophageal stoma should be explored. [73-75]

Abdominal esophageal rupture:

For individuals with a free perforation of the abdominal oesophagus, surgical repair is the treatment of choice. A midline laparotomy must be used to treat abdominal esophageal rupture. After removal of necrotic cells, the wound should be closed using a single- or double-layer closure that is tension- free. Inserting a nasogastric tube, create a feeding pathway, and execute external drainage.[75]

Thoracic esophageal rupture:

The therapy of choice for esophageal rupture with free penetration of the thoracic oesophagus is the primary repair. The treatment of a thoracic esophageal perforation entails stopping mediastinal and pleural infection as soon as possible, excision of the perforation to healthy tissue, tension-free primary repair, and appropriate external evacuation.[76]

It's tough to be prescriptive about the actual operative steps in these circumstances because they require an individualized approach. A thoracotomy will almost always be required, and the degree of apparent wall defect on CT may help to choose which side to make the incision. In order to construct a feeding a nasogastric tube or a bundle of tubes can be used to allow decompression and feeding. A diversionary cervical esophagostomy (for saliva) is not suggested in most cases. A technique via a midline laparotomy may be employed in select patients with adequate body habitus.

Esophageal exclusion, diversion, or resection should be undertaken if direct repair of thoracic EP is not possible due to hemodynamic instability, delayed surgery, significant esophageal injury). To generate a regulated esophago-cutaneous fistula and reduce mediastinal and pleural contamination, repair over a big T-tube can be employed. When there is a substantial esophageal disturbance, complete esophageal diversion or thoracic esophageal resection is required. When there is pre-existing esophageal pathology, resection is the best approach. [77,78]

Conclusion:

Esophageal rupture is a serious condition with high mortality and morbidity rates. The rapid diagnosis and management is critically important as the efficacy of the treatment becomes less after 24 hours of the onset of the rupture. Causes are different but could be classified into four main categories which are; endoscopy, foreign bodies, caustic agents and trauma. History and clinical presentation are the first diagnostic approach followed by X-ray and contrasting imaging. The management could be done either by non- surgical methods which are done mainly within the first 24 hours in mild cases, or surgical intervention in case of severe cases, where the management depends mainly on the site of rupture.

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