

# Acute Mediastinitis in Children: A Nine-Year Experience

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Received: 26 November 2012

Accepted: 6 February 2013

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**Background:** Acute mediastinitis is a serious medical condition with a mortality rate of 30 to 40% or even higher. Early diagnosis with prompt and aggressive treatment is essential to prevent its rapid progression. We evaluated acute mediastinitis cases and analyzed the outcomes.

**Materials and Methods:** A retrospective chart review was conducted on patients diagnosed with acute mediastinitis who were admitted to Mofid Children's Hospital from January 2001 to January 2010.

**Results:** Seventeen patients aged 1 to 10 yrs. (mean =3.8 yrs) were evaluated including 12 (70%) boys and 5 (30%) girls. The most common symptoms were fever, dyspnea, cyanosis, tachycardia and tachypnea. The etiology of mediastinitis was iatrogenic esophageal perforation (EP), and related to manipulation in 13(77%), and leakage of esophageal anastomosis in 4 cases (33%). The underlying diseases were esophageal atresia in 2(12%), corrosive injury of the esophagus in 13(76%), congenital esophageal stenosis in one (6%), and gastroesophageal reflux esophagitis also in one (6%) patient. Patients with clinical symptoms were evaluated by immediate chest radiography, and gastrografin swallow. After early diagnosis, the patients received wide spectrum antibiotics and immediate mediastinal or thoracic drainage, followed by esophagostomy and gastrostomy. Only one case of endoscopic perforation was managed by NG tube. Fifteen patients (88%) survived successfully. We had 2(12%) cases of mortality in our study (one patient after esophageal substitution, mediastinal abscess and septicemia, and the other one developed esophageal perforation 6 months after early management and died of cardiac arrest during endoscopic dilation).

**Conclusion:** Prevention of acute mediastinitis is still a difficult challenge. As the prognosis is not good and patients have high mortality, rapid management is mandatory.

**Key words:** Acute mediastinitis, Esophageal perforation, Treatment, Survival, Children

## INTRODUCTION

Previously, the majority of acute mediastinitis cases were due to esophageal perforation and spread of infection from retropharyngeal or odontogenic infections. At present, with advancements in surgical procedures, most cases of mediastinitis are the complication of endoscopic surgeries and esophageal instrumentations (1-3). Mediastinitis, the inflammation of the mediastinal tissues, has a range of causes including foreign body-induced perforation, rupture or infection of the esophagus

or etc. (2-5) pulmonary infections disseminated to mediastinum, (3) and iatrogenic post-operative complications (6) especially after cardiac surgeries (7). Perforation and rupture of the esophagus is a rare condition with a well-known high risk of morbidity and mortality in children (4). It can potentially and quickly cause mediastinitis, sepsis and also multi-organ failure (4) directing children to weak prognosis like morbidities and even death (in 9-41% of cases) despite advanced supports in the intensive care unit (1, 5).

As indicated above, rupture and perforation of the esophagus due to the absence of serosa and having a loose areolar connective tissue (8) could result in spread of bacteria and digestive enzymes into the mediastinal and/or subphrenic spaces causing mediastinitis and more severe complications like empyema, abscess and sepsis (5, 8). This is globally accepted that a successful management of any medical situation such as mediastinitis should be achieved through accurate diagnosis and early treatment of cases (2). This is while the presentations and symptoms are ambiguous and often resemble that of other conditions delaying suitable diagnosis and treatment (2). Concerning the most common cause (77%) (8), iatrogenic etiologies of mediastinitis, esophagectomy and esophagogastrectomy cases often suffer from post-operative complications that are usually life-threatening (9). Anastomosis at the site of surgery is the most common location to leak directing the situation to mediastinitis. The leakage ranges from asymptomatic identified only in contrast x-ray studies to fulminant events with sepsis and multi-organ failure (9). Today, the most common etiology of esophageal perforation in children is iatrogenic (8). In 1961, the first case of iatrogenic esophageal perforation was reported in a neonate following placement of a stiff rubber catheter for respiratory suctioning. Nowadays, endoscopic instrumentation, endotracheal intubation, Bougie dilation, respiratory suction catheters and nasogastric tube insertion are the most frequent causes in this regard (8). Despite being rare (0.6%), iatrogenic esophageal perforations lead to death in 28% of children as reported in 1987 (8). Nasogastric tube insertion, intubation or nasotracheal suctioning are the most frequent causes of esophageal perforation in premature and low birth weight infants who weigh less than 1500 grams (8,10,11).

Thoracic esophagus is a common site of perforation in children due to iatrogenic causes and a case series reports a higher rate of perforation in the upper third of the organ (8). The most common location of perforation is likely to be the pharyngoesophageal junction in neonates firstly because the site is the narrowest point of the esophagus in

which muscular constriction following instrumentation could result in a perforation during intubation attempts in neonates. Secondly, compressed posterior esophageal wall against the cervical vertebrae in neck hyperextension during attempts to intubate children may lead to this condition (8, 12). The site of perforation is important due to its effects and clinical presentations of the patient such as signs of respiratory distress like tachycardia and tachypnea. Use of accessory muscles is often seen in the case of thoracic perforation. It is usually accompanied by other signs like chest pain and subcutaneous emphysema. In neonates with hypersalivation, coughing or cyanosis on feeding who have suffered a difficult endotracheal intubation or nasogastric tube insertion, esophageal perforation is on the top of the differential diagnosis list (13).

The aim of this study was to evaluate and analyze our cases with acute mediastinitis, and report the outcomes.

## MATERIAL AND METHODS

A retrospective chart review was conducted on patients diagnosed with acute mediastinitis who were admitted to Mofid Children's Hospital from January 2001 to January 2010. The diagnosis of acute mediastinitis was made based on history, clinical symptoms, underlying diseases, etiologic factors and results of imaging studies. The clinical data reviewed included age, gender, clinical manifestation, underlying disease, etiologic factors, imaging findings, endoscopic results, treatment and mortality.

## RESULTS

Seventeen patients aged 1 to 10 years old (mean =3.8 yrs) were reviewed including 12 (70%) boys and 5 (30%) girls. The most common symptoms were fever, dyspnea, cyanosis, tachycardia and tachypnea. The etiology of mediastinitis was iatrogenic esophageal perforation (EP), and related to manipulation in 13 cases (77%), and leakage of esophageal anastomosis in 4 (33%). Table 1 shows patients' characteristics. The underlying diseases were esophageal atresia in 2 (12%), corrosive injury of the

esophagus in 13 (76%), congenital esophageal stenosis in one (6%), and gastroesophageal reflux esophagitis also in one (6%) patient. Patients with clinical symptoms were evaluated by immediate chest radiography, and gastrografin swallow. After early diagnosis, the patients received wide spectrum antibiotics and immediate mediastinal or thoracic drainage, followed by esophagostomy and gastrostomy. Only one case of endoscopic perforation was managed by NG tube. Fifteen patients (88%) survived successfully. We had 2(12%) cases of mortality in our study (one patient after esophageal substitution, mediastinal abscess and septicemia, and the other one developed esophageal perforation 6 months after early management and died of cardiac arrest during endoscopic dilation).

**Table 1.** Patients' characteristics

Patients	17
Male	12
Female	5
Mean age (years)	3.8
Most common symptoms	Fever, Dyspnea, Cyanosis
Esophageal perforation	13 patients
Surgical intervention	16 patients
Conservative intervention	one patient
Survival	15 patients
Mortality	2 patients

## DISCUSSION

With a higher occurrence in iatrogenic cases, esophageal perforation is a rare but life threatening injury which can quickly direct patients, especially children to dangerous outcomes like mediastinitis, sepsis, multi-organ failure and consequent death without alarming. The serious injury of gastrointestinal tract is not common in children and may result from trauma, foreign body or nasogastric tube insertion or even a simple airway intubation (4). Surprisingly, researchers showed a 60% rate of injury through endoscopy among 559 patients with esophageal perforation (14); whereas, the current study showed that iatrogenic manipulation was the most

common cause in 77% of patients enrolled during nine years followed by esophageal anastomotic leakage in 33%. Our findings are similar to those of previous reports (5, 8, 15). There are reports that blame dilation of an existing stricture as the most common cause of iatrogenic esophageal perforation in children (14). This is not rare in neonates at all, following nasogastric tube insertion, airway intubation and suction at the site (10). It seems that Killian's triangle is likely to be the most frequent place of perforation in cervical esophagus when there is no morbidity or problem in the organ (14).

In terms of full thickness injuries, erosion due to foreign body ingestion or the extraction procedures are the ordinary causes in esophagus (4,16,17). Any procedure on the organ or nearby organs is likely to lead to an injury. In anastomotic site leakage following repair of esophageal atresia, draining the liquids out of the site by placing drains near the location is an intra-operative solution.

Any relevant symptom after esophageal manipulation should be alarming for the patient and physician in terms of esophageal perforation since iatrogenic etiology is the most common cause for this condition. Delay in diagnosis or treatment could direct patients to a poor prognosis (4,7, 18,19).

Despite the low diagnostic value of simple chest x-ray, this para-clinical tool may be used for initial investigation, especially with a prompt water-soluble contrast study. Plain chest radiography is normal in 12-33% of esophageal perforation cases (4). Except for clinically worsening cases, the most common treatment for children with esophageal perforation is currently conservative management. Progressive symptoms and worse clinical manifestations often necessitate surgical operation considering the case.

The location of the injury, most of the time, is a valuable index to select the type of surgery followed by its size, viability of the esophageal wall, the degree of local sepsis as well as the presence of underlying pathology (20).

The time interval between the perforation and access to proper treatment is a good prognostic factor. Delay for

more than 24 hours could predict an increased risk of mortality, although the injured portion of the organ is important as well. For instance, cervical perforation remains confined in a closed space and has a lower risk to life, compared to the involvement of superior mediastinum. Severe thoracic perforation leads to extensive mediastinitis (4, 14, 21, 22). A mortality rate of 16% has been recently reported despite the previous rates of 10-40% indicating an acceptable improvement in diagnosis, access to medical centers and proper treatment (1).

## CONCLUSION

Esophageal perforations are fatal in one out of five cases. Early diagnosis and appropriate management can improve the dismal prognosis, and treatment of underlying causes remains the mainstay of treatment. However, nonsurgical treatment associating medical treatment and radiological drainage can be proposed in select patients. When major esophageal damage is found or when conservative treatment fails, esophagectomy must not be delayed because patient's survival may be jeopardized.

## Acknowledgment

This study was financially supported by the Mofid Children's Hospital, Clinical Research Development Center (CRDC).

## REFERENCES

1. Muir AD, White J, McGuigan JA, McManus KG, Graham AN. Treatment and outcomes of oesophageal perforation in a tertiary referral centre. *Eur J Cardiothorac Surg* 2003; 23 (5): 799- 804; discussion 804.
2. Brinster CJ, Singhal S, Lee L, Marshall MB, Kaiser LR, Kucharczuk JC. Evolving options in the management of esophageal perforation. *Ann Thorac Surg* 2004; 77 (4): 1475- 83.
3. Cekovska Z, Kaftandzieva A, Petrovska M, Panovski N, Spirovski Z, Abdulahi H. Mediastinitis due to actinomycetes naeslundii. *Maced J Med Sci* 2010; 3(2): 1-5
4. Garey CL, Laituri CA, Kaye AJ, Ostlie DJ, Snyder CL, Holcomb GW 3rd, et al. Esophageal perforation in children: a review of one institution's experience. *J Surg Res* 2010; 164 (1): 13- 7.
5. Martinez L, Rivas S, Hernández F, Avila LF, Lassaletta L, Murcia J, et al. Aggressive conservative treatment of esophageal perforations in children. *J Pediatr Surg* 2003; 38 (5): 685- 9.
6. Tuebergen D, Rijcken E, Mennigen R, Hopkins AM, Senninger N, Bruewer M. Treatment of thoracic esophageal anastomotic leaks and esophageal perforations with endoluminal stents: efficacy and current limitations. *J Gastrointest Surg* 2008; 12 (7): 1168- 76.
7. Durandy Y. Mediastinitis in pediatric cardiac surgery: Prevention, diagnosis and treatment. *World J Cardiol* 2010; 2 (11): 391- 8.
8. Gander JW, Berdon WE, Cowles RA. Iatrogenic esophageal perforation in children. *Pediatr Surg Int* 2009; 25 (5): 395- 401.
9. Alanezi K, Urschel JD. Mortality secondary to esophageal anastomotic leak. *Ann Thorac Cardiovasc Surg* 2004; 10 (2): 71- 5.
10. Sapin E, Gumpert L, Bonnard A, Carricaburu E, Sava E, Contencin P, et al. Iatrogenic pharyngoesophageal perforation in premature infants. *Eur J Pediatr Surg* 2000; 10 (2): 83-7.
11. Soong WJ. Endoscopic diagnosis and management of iatrogenic cervical esophageal perforation in extremely premature infants. *J Chin Med Assoc* 2007; 70 (4): 171- 5.
12. Mollitt DL, Schullinger JN, Santulli TV. Selective management of iatrogenic esophageal perforation in the newborn. *J Pediatr Surg* 1981; 16 (6): 989- 93.
13. Panieri E, Millar AJ, Rode H, Brown RA, Cywes S. Iatrogenic esophageal perforation in children: patterns of injury, presentation, management, and outcome. *J Pediatr Surg* 1996; 31 (7): 890- 5.

14. Eroglu A, Turkyilmaz A, Aydin Y, Yekeler E, Karaoglanoglu N. Current management of esophageal perforation: 20 years experience. *Dis Esophagus* 2009; 22 (4): 374- 80.
15. Peng L, Quan X, Zongzheng J, Ya G, Xiansheng Z, Yitao D, et al. Videothoracoscopic drainage for esophageal perforation with mediastinitis in children. *J Pediatr Surg* 2006; 41 (3): 514- 7.
16. Parolia A, Kamath M, Kundubala M, Manuel TS, Mohan M. Management of foreign body aspiration or ingestion in dentistry. *Kathmandu Univ Med J (KUMJ)* 2009; 7 (26): 165- 71.
17. Griffiths EA, Yap N, Poulter J, Hendrickse MT, Khurshid M. Thirty-four cases of esophageal perforation: the experience of a district general hospital in the UK. *Dis Esophagus* 2009; 22 (7): 616- 25.
18. Dai Y, Chopra SS, Kneif S, Hünerbein M. Management of esophageal anastomotic leaks, perforations, and fistulae with self-expanding plastic stents. *J Thorac Cardiovasc Surg* 2011; 141 (5): 1213- 7.
19. Vallböhmer D, Hölscher AH, Hölscher M, Bludau M, Gutschow C, Stippel D, et al. Options in the management of esophageal perforation: analysis over a 12-year period. *Dis Esophagus* 2010; 23 (3): 185- 90.
20. Chirica M, Champault A, Dray X, Sulpice L, Munoz-Bongrand N, Sarfati E, et al. Esophageal perforations. *J Visc Surg* 2010; 147 (3): e117- 28.
21. Yang MC, Lee SW, Huang YG, Yeh AR. Acute mediastinitis resulting from an unsuspected fish bone--case report. *Int J Clin Pract Suppl* 2005; (147): 45- 7.
22. Keeling WB, Miller DL, Lam GT, Kilgo P, Miller JI, Mansour KA, et al. Low mortality after treatment for esophageal perforation: a single-center experience. *Ann Thorac Surg* 2010; 90 (5): 1669- 73; discussion 1673.