

Conservative Management of Instrumental Esophageal Perforation in Children; A Review of One surgeon's Experience

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Abstract: Instrumentation of the esophagus to dilate stricture can very occasionally result in many complications, esophageal perforation may be the most serious one. The main corner stone in the management of which is urgent exploration to define the extent of the lesion and drain the area. To avoid this aggressive, approach to our patients, we choosed to apply conservative management. We reviewed retrospectively records of all the five patients of instrumental esophageal perforations done or referred to pediatric surgery unit in King Abdulaziz University Hospital, Jeddah, Saudi Arabia who were treated by the author conservatively in the period from 1997 to 2011 in our institution. The aim of this study was to review our experience in the conservative management of esophageal perforation in pediatric population, thus to add to the growing evidence with this modality of treatment. The results of successful non operative management of all the cases supports our conclusion that conservative management guided by the clinical response is a safe and effective modality of treatment for esophageal perforation in pediatric population.

[Osama M Rayes, FRCSI. **Conservative Management of Instrumental Esophageal Perforation in Children; A Review of One surgeon's Experience.** *Life Sci J* 2013;10(1):1941-1944] (ISSN:1097-8135). <http://www.lifesciencesite.com>. 278

Keywords: esophageal, perforation, conservative management, instrumental, pediatric.

1. Introduction

Esophageal perforation is a rare, but potentially life threatening injury that can quickly lead to the development of mediastinitis, sepsis and multi-organ failure in the absence of prompt recognition and treatment^[1]. Controversy persists concerning appropriate treatment of this condition^[2]. Reports began to surface showing success of conservative management in children, and the contemporary management of esophageal perforation has seemingly shifted to a conservative (non-operative) approach for the majority of cases^[3-5]. The overall goal of conservative management is to promote healing with control of infection and nutritional support. However, the consensus of what constitutes conservative management is still unclear, with various therapies and protocols have been described.

The aim of this study was to review our experience in the conservative management of esophageal perforation in pediatric population, thus to add to the growing evidence with this modality of treatment.

2. Material and Methods:

We reviewed retrospectively records of cases of instrumental esophageal perforations who were treated non-surgically in the period from 1997 to 2011, by the author in King Abdulaziz University Hospital, Jeddah, Saudi Arabia. Intercostal drain and gastrostomy tube insertions weren't considered as

exclusion criteria. Data collected included patient demographics, etiology, diagnosis, treatment, complications and outcome.

3. Results:

Five patients were identified who met inclusion criteria (kindly describe inclusion criteria). The average age at diagnosis of esophageal perforation was 4.6 years (range 1-12 years). In all cases the cause of perforation was instrumental esophageal dilatation; three of them were post balloon dilatation with direct endoscopic visualization while the remaining two were post balloon dilation with fluoroscopic control. The three endoscopic cases were referred from the pediatric gastroenterology unit while the fluoroscopy cases were done by the senior author. The three referred cases were diagnosed by plain chest radiograph showing pneumothorax, pneumomediastinum and subcutaneous emphysema. Our two cases, however, were diagnosed by visualizing the guide wire in the left pleural Cavity during the procedure in one case and by CT chest with oral contrast in the other case.

Our protocol of non operative treatment plan in cases of esophageal perforation consists of three main pillars; pillar of *flow* where we aim at decreasing the proximal flow and maintaining the distal flow using NPO status and Replogle` tube proximally on continuous suctioning to achieve the first aim and through a stent tube to achieve the second aim. The

second pillar is the pillar of minimizing *contamination* through IV antibiotics and chest drainage when necessary. Finally, the pillar of *nutrition* which should be provided through TPN. Throughout the journey of treatment patients should be observed vigilantly for any signs of sepsis and/or unresponsiveness to treatment.

Four patients needed PICU admission with an average length of stay of 8.8 days (range 2-19 d). Chest tube insertion was needed in three cases out of five. Gastrostomy tube insertion wasn't done except in one patient. Esophagogram was done –on average– on the 10th day post perforation (range 7th-17th d). There was no mortality. All perforations healed, with an average length of hospital stay of 31.2 days (range 10-64d).

CASE I (referred from pediatric gastroenterology)

A boy with a history of ingestion of an alkaline corrosive at age of two years old. He developed a mid esophageal stricture of around 4 cm length. He underwent 3 dilatations before his esophagus perforated during balloon dilatation with direct endoscopic visualization at age of 3 years. He presented with respiratory distress and left sided pneumothorax. He was admitted to PICU for 2 days, Intercostal tube was inserted and left for 8 days. Patient was kept NPO on TPN for 12 days and IV antibiotic coverage. NGT was inserted under fluoroscopy guidance. Contrast esophagogram was done in the 7th post perforation day and showed no leakage so patient started feeding on the 9th day and was discharged in good condition.

Following the perforation he underwent eight further dilatations for the preexisting stricture he has.

CASE II (referred from pediatric gastroenterology)

A boy with a history of ingestion of an alkaline corrosive at age of 1 year which caused two esophageal strictures; at mid and lower esophagus. The patient had esophageal perforation during balloon esophageal dilatation under direct endoscopic visualization. He presented with respiratory distress, subcutaneous emphysema in the neck and the chest and right sided pneumothorax. He was admitted to PICU for 19 days, intercostal tube was inserted and left for 7 days. Patient was kept NPO on TPN for 31 days and on IV antibiotic coverage. NGT was inserted under endoscopy guidance during the dilatation procedure. Replogle tube was kept in the upper esophagus for 30 days. Contrast esophagogram was done on the 16th post perforation day and showed no leakage and/or definite stricture in the esophagus. Feeding was started through the NGT on the 17th day.

CASE III (referred from gastroenterology)

A girl with a history of ingestion of an alkaline corrosive at age of 4 years. She developed long stricture involving mid to lower esophagus. She had esophageal dilatation on the first dilatation under direct endoscopy visualization. She presented with subcutaneous emphysema. She was admitted to PICU for 19 days. Chest drainage was done through right sided intercostal tube. Patient was kept NPO on TPN for 12 days. Gastrostomy tube was inserted and feeding was started through it on the 7th day post perforation. NGT, Replogle tube were inserted.

CASE IV (a case perforated during a balloon dilation done in our unit)

A twelve years old girl who is a known case of esophageal atresia repaired outside our hospital after birth. Two months post repair she developed dysphagia and repeated attacks of choking and cyanosis. Gastrostomy was fashioned and was used for feeding for three years. Trials of esophageal dilations failed during this period. The girl was referred to us at this stage; retrograde balloon esophageal dilation was done through the gastrostomy tube and over a period of two years the patient underwent 25 esophageal dilations however, symptoms recurred persistently. We proceeded with resection and anastomosis of the area of esophageal stricture. Postoperatively, the patient underwent 5 esophageal dilations on yearly basis. She had perforation during the last balloon dilation. She presented with respiratory distress, tachycardia, tachypnea and desaturation. She was admitted to PICU for 7 days to start the conservative management after we confirmed the diagnosis with a CT chest with contrast which showed a contained contrast leak through a perforation in the lower esophagus with no pleural effusion. Patient was kept NPO on TPN for 10 days. Dye swallow was done after 10 days and showed no further leakage so oral feeding was resumed and patient was discharged on the 15th post operative day.

CASE V (a case perforated during a balloon dilation done in our unit)

A 3 years old girl; known case of esophageal atresia with radial anomalies. Esophageal atresia repair was done outside our hospital and was referred to our hospital with severe esophageal stricture and was depending entirely on the gastrostomy tube. Gastroenterology team failed to dilate her through balloon under direct endoscopic visualization. The patient was referred to us and retrograde esophageal dilatation was done successfully but during the procedure the guidewire was seen passing into the left pleural cavity during one of the trials. Patient was admitted in PICU for 5 days postoperatively for

observation. During that period the patient was diagnosed with hypothyroidism which manifested itself with bradycardia spells. Other than those spells which were at first attributed to the perforation, there was no other symptom and/or sign. No dye esophagogram was done to confirm the diagnosis. Patient was kept NPO for seven days with an NGT in place, then an esophagogram was done on seventh day post-perforation to delineate the esophagus and to rule out leakage. Patient started orally after the esophagogram and was discharged with the

gastrostomy to follow a program of esophageal dilatations (on the tenth day post perforation). Later, she was dilated three times and gastrostomy was closed. After around ten months from the last dilatation the patient came almost obstructed and dilatation failed, thus gastrostomy was refashioned. Another trial of dilatation failed and finally the patient underwent thoracotomy with resection of the strictured area with reanastomosis. Patient is still on postoperative follow-up.

Table (1): Summary of studied cases of esophageal perforation

Patient	Case I	Case II	Case III	Case IV	Case V
Age at perforation	4 years old	1 year	4 years	12years old	3 years
Cause of perforation	Balloon Esophageal Dilatation under direct endoscopic visualization			Balloon Dilatation under fluoroscopic guidance (retrograde)	Esophageal (antegrade)
Symptoms	Respiratory distress				Almost Nil
CXR findings	Lt pneumothorax, pneumo-mediastinum & S.C. emphysema	Rt pneumothorax, pneumo-mediastinum & S.C. emphysema	Rt pneumothorax, pneumo-mediastinum & S.C. emphysema	—	—
Retrograde dilation	Not done	Not done	Done	Not done	Done
ICT insertion	Done	Done	Done	Not done	Not done
Gastrostomy	Not done	Not done	Done	Done	Done
Contrast esophagogram	On 7 th day post perforation	On 17 th day post perforation	Not done	On 10 th day	On 7 th day
Feeding	On 9 th day	On 17 th day	On 7 th day (thru gastrostomy)	On 10 th day	On 7 th day
PICU stay					
Hospital stay	16 days	64 days	51 days	15 days	10 days

4. Discussion

Oesophageal perforation is an abnormal communication of the esophagus into the pleural cavity or mediastinum. It is produced by introduction of an object into the esophageal lumen. These lesions are traumatic and, in many cases, result from diagnostic or therapeutic manipulation. Iatrogenic trauma by nasogastric tube has been reported in very premature infants^[6].

Dilatation of an existing stricture is the most commonly reported cause of iatrogenic perforation in children^[7]. Garey *et al.*, in his review stated that being aware of this risk, they currently obtain an on-table esophagogram after dilatation in patients who have an existing stricture^[1]. The early diagnosis of esophageal perforation is indicated by clinical findings and confirmed by radiological procedures^[8]. Pain, fever, dyspnea, and tachycardia are early symptoms of esophageal perforation after dilation for an esophageal stricture. Radiological findings include pneumomediastinum, pleural effusion, subcutaneous emphysema, and pneumothorax. Proximal thoracic

perforations lead to signs in the left thoracic cavity, whereas distal perforation usually show findings on the right side. Complications include mediastinitis, septicemia, empyema, and death^[9].

The current management of esophageal perforation in children has shifted towards conservative management, with operative intervention reserved for those who clinically worsen with conservative management. Hemodynamically stable patients with a contained perforation may be managed medically. Exploration of the chest for attempted direct repair of the injury is now only rarely indicated. Mortality rates have been reported between 20 and 28% with delays in diagnosis and treatment appearing to be most strongly correlated with poor outcome^[10].

Conservative management is based on the tenant that spontaneous healing will occur if proximal flow is minimized, contamination is controlled, downstream patency is maintained, and the patient's overall clinical and nutritional status is optimized^[1]. Engrum *et al.*, in 1996, studied retrospectively 24 cases of esophageal perforation and reported that one

third of the series were successfully treated non-operatively^[11]. Martinez *et al.*, however, in 2003 employed what he described as aggressive conservative management in 19 patients of esophageal perforation. In this series the authors advocated aggressive drainage of the perforation near the site of leakage. One patient of those 19 cases required subsequent surgical intervention though^[5]. In china, in 2006, a series reported eight patients with esophageal perforation who were treated conservatively with thoracoscopic insertion of an intercostal tube^[12].

In all those series we have noticed the importance of drainage as part of the conservative approach to esophageal perforation. Although our report has the drawbacks of a small, heterogeneous sample of patients, it supports the notion that conservative management guided by the clinical response is a safe and effective modality of treatment for esophageal perforation in pediatric population.

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1/20/2013