Esophageal Perforation in Children: A Review of one Pediatric Surgery Institution's Experience (16 Years)

Perfuração Esofágica na Criança: Casuística de um Serviço de Cirurgia Pediátrica (16 Anos)

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ABSTRACT

Introduction: The objective of the study was to evaluate the experience of our service in the treatment of esophageal perforations.
Materials and Methods: Retrospective chart review of the nine cases occurred between January 1, 1996 and December 31, 2011. Seven occurred after accidental ingestion of foreign bodies and in two patients were iatrogenic lesions after esophagoscopy with dilation: a peptic stricture in one case and in the other stenosis of the esophageal anastomosis in a child operated for esophageal atresia.
Results: In 78% of cases the initial approach was medical, with healing of the perforation confirmed on average after 20 days, 22% of patients (2 cases) underwent surgery without success, one of them healed without sequelae having nothing by mouth and medical therapy, in the other case there was a need for further colon esophagoplasty. There was no mortality.
Discussion: Esophageal perforation is one of the most serious injuries of the alimentary tract, continues to be devastating, and difficult to diagnosis and treatment. The recognition of this complication is critical for a successful treatment.
Conclusions: The delay of the diagnosis is associated with a mortality which can oscillate between 20 and 40%.

Keywords: Esophageal Perforation; Foreign Bodies; Child

RESUMO

Introdução: O estudo teve por objetivo avaliar a experiência do nosso Serviço no tratamento das perfurações esofágicas.
Material e Métodos: Análise retrospetiva de nove casos ocorridos entre 1 de Janeiro de 1996 e 31 de Dezembro de 2011. Destes casos, sete ocorreram após ingestão acidental de corpos estranhos e em dois tratou-se de lesões iatrogénicas após dilatação esofágica: por estenose péptica num caso e no outro por estenose da anastomose esofágica término-terminal de uma criança operada por atrésia do esófago.
Resultados: Em 78% dos casos a abordagem inicial foi médica, com encerramento comprovado da perfuração em média ao fim de 20 dias; 22% dos doentes (dois casos) foram submetidos a cirurgia sem sucesso, acabando um deles por curar sem sequelas com pausa alimentar e terapêutica médica; no outro caso verificou-se necessidade de realizar posteriormente uma esofagocoloplastia. Na nossa série não se registou mortalidade.
Discussão: A perfuração esofágica é uma das lesões mais graves do trato alimentar, continuando a ser devastadora, e, de difícil diagnóstico e tratamento. O reconhecimento desta complicação é fundamental para o seu tratamento com sucesso.
Conclusões: O atraso do diagnóstico está associado a uma mortalidade que pode oscilar entre os 20 e 40%.

Palavras-Chave: Corpos Estranhos; Criança; Perfuração Esofágica

INTRODUCTION

Foreign body ingestion is a frequent accident in children, accounting for 70% of all cases of oesophageal perforation. Children usually swallow objects while they play. More than two thirds of these accidents involve coins.[1-3] Other objects frequently found include toys, batteries, paper clips, earrings, pen caps and bottle caps, among others. Most of these objects get through the gastrointestinal tract without any damage, although in a small percentage (10 to 20%) they may block the lumen and perforate through the wall. As the oesophagus is the narrowest portion of the gastrointestinal tract (except for the appendix), it is at this level where most of the foreign bodies are found. Sharp or pointy objects, although infrequently found, are the ones that present a higher complications risk. The severity range is variable from a mild perforation with a small pneumomediastinum to a huge disruption involving a free leakage of the oesophageal content to the pleural cavity with subsequent mediastinitis. In children, foreign body ingestion is frequently accidental with an increase of intentional ingestion incidence in adolescence.

Anatomically, the upper portion of the oesophagus is the narrowest of the child´s upper gastrointestinal tract and for that reason the most frequent location of the impaction. A past history of oesophageal disease may be found in up to 17% of these patients.[2] The presence of airway obstruction or battery ingestion require emergency management.

After foreign body ingestion, 20% of the patients remain asymptomatic, 46% present with gastrointestinal complaints (dysphagia, sialorrhea, refusing to eat and vomiting) and 33% present with respiratory symptoms (mainly cough and stridor). The latter are more common in long-term impactions, lasting more than 24 hours.

Treatment of foreign body ingestion depends on the ingested object, its location, as well as on the age and height of the child. It must be prompt due to its potential to cause respiratory complications, oesophageal erosions or, in more severe cases, an aortoesophageal fistula.[2-7]

Management of these patients may include an

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observation period of time, between 8 and 16 hours, assuming the child is asymptomatic, in the case of recent ingestion and when there is no subsequent oesophageal or tracheal disorder - 25 to 30% of the ingested coins get through the oesophagus without any complications. Spontaneous passage through the stomach is more likely in older boys and when the foreign body was located in the distal one third of the oesophagus.[3]

The options for its extraction include rigid oesophagoscopy, flexible oesophagoscopy, baloon extraction and *bougienage*.[1,2,4]

We assessed every diagnosis occurred in the last 16 years, in order to evaluate the oesophageal perforation treatment experience of our department.

MATERIAL AND METHODS

We carried out a retrospective analysis of the nine patients with oesophageal perforation that presented to the Department of Paediatric Surgery at Santa Maria Hospital, from the 1st of January 1996 to 31st December 2011.

We assessed the age, gender, perforation cause, diagnosis, symptoms, therapy, disease progress, complications and outcomes (Table 1).

In eight of the nine patients, after the perforation was confirmed,, medical therapy was carried out, including intravenous broad-spectrum antibiotics and parenteral nutrition followed by enteral nutrition through a nasogastric tube or a gastrostomy. Only one patient was submitted to surgical correction without success, requiring cervical oesophagostomy and gastrostomy. One patient was operated in another hospital and was subsequently transferred to our Department due to a perforation relapse, undernourishment and sepsis. Medical therapy was adopted with enteral infraesophageal nutrition and intravenous antibiotics.

RESULTS

In this series, the age of the patients varied between six weeks and seven years (median of 19 months) with a female predominance (five patients).

Oesophageal perforation was caused by foreign body ingestion in seven patients and after oesophageal dilation of strictures in the other two. These strictures occurred post-surgical correction of oesophageal atresia on one patient and in another due to a severe gastroesophageal disorder. In perforations without mediastinitis, patients presented mainly with dysphagia and sialorrhea while in the remaining patients, the clinical presentation consisted of respiratory distress requiring a ventilatory support and sepsis.

Four patients were admitted to the Accident and Emergency Department due to suspected foreign body ingestion (patients 3, 4, 5 and 6) that has been radiologically confirmed. In all these patients, removal using rigid oesophagoscopy has been successful. The diagnosis of perforation was based on direct visualisation of the oesophageal lesion (using endoscopy), by the presence of a pneumomediastinum in the control X-ray after removal of the ingested object, in one patient through a simultaneous tonsil laceration identified in the CT-scan and in another patient with a doubtful oesophageal perforation

Table 1 – Description of patients with an oesophageal perforation

Nº	Gender	Age	Aetiology	Treatment	Outcome
1	F	1M	Dilation (operated oesophageal atresia)	Perforation with a severe mediastinitis – ATB, PNT	Closure – 3 weeks
2	M	2Y10M	Dilation due to peptic stricture	Perforation with left haemothorax, right pneumothorax and haemopericardium – Primary closure →jejunostomy→oesophagoga strostomy	Oesophagostotmy + gastrostomy
3	M	7Y4M	Foreign body (pin)	ATB + enteral nutrition through duodenal tube	Closure – 2 weeks
4	F	2Y4M	Foreign body (rigid plastic)	ATB + PNT → enteral nutrition in continuous feeding through NGT	Closure – 18 days
5	F	9M	Foreign body (Christmas decoration)	Perforation with mediastinitis – ATB + PNT	Closure – 23 days
6	F	20M	Foreign body (coin)	Operated and recurrent oesophageal-pleural fistula – ATB + enteral nutrition (gastrostomy)	Closure – 2 months
7	F	19M	Foreign body (coin)	Perforation of medial 1/3 of the oesophagus – ATB + PNT	Closure – 23 days
8	M	11M	Foreign body (coin)	Minimal perforation – ATB + PNT	Closure – 7 days
9	M	13M	Foreign body (battery)	Perforation with tissue necrosis – ATB + PNT	Closure – 38 days

F – female; M – male; Y – years; M – months; ATB – antibiotic therapy; PNT – parenteral nutrition; NGT – nasogastric tube

also confirmed by the CT-scan. All patients started broad-spectrum intravenous antibiotic therapy and total parenteral nutrition, followed in some by enteral nutrition through a nasogastric tube until perforation closure was confirmed radiologically (for an average duration of 20 days) (Fig. 1).

Patient number 6, a post-foreign body ingestion perforation (Fig. 2) was transferred to our Department after a surgical correction attempt requiring right pleural empyema thoracic drainage was performed one and a half months before admission. At admission, the patient still presented a perforation (Fig. 3) and was severely malnourished and septic. Treatment consisted of a Stamm gastrostomy allowing for enteral nutrition in addition to broad-spectrum intravenous antibiotic therapy and daily chest physiotherapy. Radiological (Fig. 4) and endoscopic confirmation of the perforation closure was obtained two months later, with resolution of the infectious process and improvement of respiratory function as well as nutritious condition.

As regards those with post-oesophageal dilation perforations, one of the patients presenting with a VACTERL association developed severe mediastinitis after the first dilation of a termino-terminal oesophageal anastomosis stricture (postoperative oesophageal atresia). He was admitted to the ICU, requiring ventilatory support. After stabilisation, patient's nutrition was started through gastrostomy and upon radiological confirmation of perforation closure (after three weeks) oral feeding was started. The other patient was a two-year and ten-month old boy, the only child submitted to surgery in our Department. Upon oesophageal dilation (patient 2), he presented bilateral haemothorax and a pericardial effusion. Thoracic drainage and pericardiocentesis were performed and two days later the child has been submitted to surgical suture of the oesophageal laceration. Two weeks later the postoperative barium oesophagram revealed a persistent oesophageal-pleural fistula requiring surgical intervention followed by a right thoracic drainage due to a pneumothorax. Jejunostomy was required to allow for enteral nutrition and cervical oesophagostomy and subsequent oesophago-coloplasty.

Figure 1 - Radiological confirmation of the perforation closure after medical therapy (patient 3).

Figure 2 – Presence of a foreign body (coin) in the proximal one--third of the oesophagus (patient 6).

DISCUSSION

Esophageal perforations are the most severe lesions of the gastrointestinal tract and can still be devastating, presenting diagnostic and treatment difficulties. The incidence of iatrogenic perforations in children is increasing due to a wider use of endoscopy as a diagnostic and therapeutic tool. This iatrogenic origin is more prevalent in this age group, although other causes such as bleach burns, direct or indirect trauma, foreign body impaction, surgical procedures in this region and more rarely idiopathic rupture, should also be considered.[6,8-10]

Perforations occur more frequently at anatomical narrow regions or in pathological strictures such as in the pharingeal-oesophageal junction where the cricopharyngeus muscle acts as a lumen *squeezer*, as well as in operated oesophageal atresia situations.

The mortality rate in oesophageal perforations may reach 20% and a longer than 24 hours delay in treatment may double this value.[6,9] The reason for this increase in mortality relies on the unique anatomical configuration and location of the oesophagus, surrounded by lax connective tissue that is therefore unable to efficiently prevent the spread of infection and inflammation, allowing digestive bacteria and enzimes easy access to the mediastinum or to the subphrenic space, as well as the development of a severe mediastinitis, empyema, sepsis and sometimes multiorgan failure and death.[6,9] Without treatment, the prognosis is usually fatal.[6]

The cause, location and size of the lesion, as well as the time interval between perforation and diagnosis determine the clinical presentation.

A cervical perforation is generally less severe and

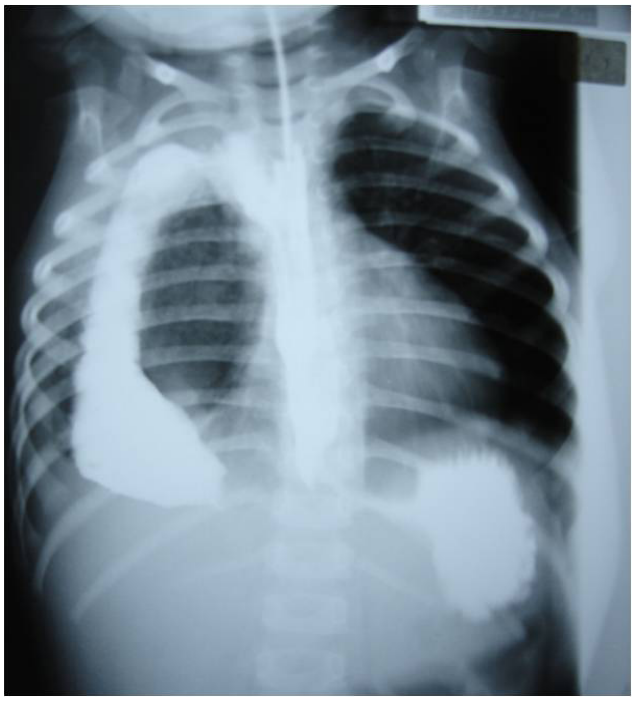

Figure 3 – Oesophageal-pleural fistula relapse after surgery in the Hospital of origin (patient 6).

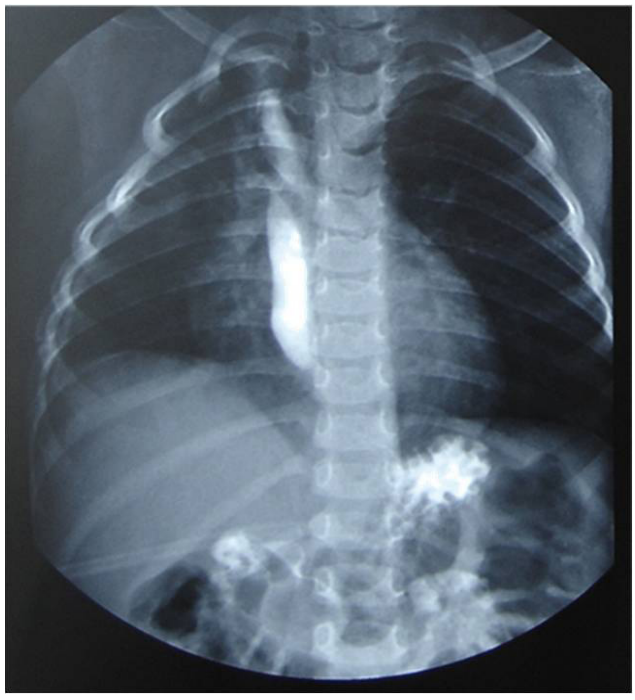

Figure 4 – Radiological confirmation of the perforation closure upon medical therapy (patient 6).

more easily treated than when located in the intrathoracic or intra-abdominal oesophagus. Possible mediastinal contamination through the retroesophagic"' space is slow to develop and the oesophageal ligaments linked to the prevertebral fascia in this region limit the lateral spread of oesophageal flora. There may be complaints of local pain and dysphagia, dysphonia or bloody regurgitation. Characteristically, subcutaneous emphysema is present.[6]

In contrast, intra-thoracic perforations rapidly spread to the mediastinum, presenting with thoracic pain, tachycardia, tachypnea, fever and leucocytosis, sepsis and shock developing in a few hours. Anatomically, the left pleura is closely related to the oesophagus in the upper mediastinum, while on the right is in close contact with the distal two thirds of the oesophagus, except where it is crossed by the azygos vein. As such, proximal thoracic perforations present with left-sided pneumothorax or pleural effusion while distal perforations present with signs on the right.[5-7]

In general, the following may be considered as initial symptoms of oesophageal perforation: thoracic pain (76.9%); dyspnea (69.2%); vomiting (46.1%); fever (46.1%) and epigastric pain (7.6%). In more advanced disease already presenting with mediastinitis (in the presence or absence of an abscess), tachycardia, fever, thoracic pain and odynophagia become manifest and dyspnea increases. At this stage cervical subcutaneous crepitations may become palpable, a reduction of vesicular breath sounds due to a pneumothorax or to an effusion may develop as well as tracheal deviation, possible cyanosis, fever and/or clinical signs of sepsis or shock.[1,2,6]

A perforation may also be complicated by an oesophageal-pulmonary or oesophageal-vascular fistula, extraluminal migration and a false oesophageal diverticulum. A longstanding impaction causes a true oesophageal diverticulum.

As regards diagnostic tests, chest and cervical antero-posterior and lateral X-rays allow the visualisation of pneumomediastinum, pleural effusion, subcutaneous emphysema, extraluminal location of a foreign body or an atypical location of a nasogastric tube. The oesophageal X-ray usually shows oesophageal leakage and/or a paraesophageal swelling but is not always diagnostic. The CT-scan complemented by the administration of an oral hidrosoluble contrast allows for the definition of an oesophageal leak, showing the presence of mediastinal air or swelling. Gastroscopy might by indicated when there is clinical suspicion of a possible perforation in the absence of a radiological diagnosis. Thoracocentesis may clinch the diagnosis in the cases of pleural effusion with oesophageal content leakage, even when the presence of a perforation is not suspected .[6,8-10]

Early diagnosis and adequate treatment are essential for the successful management of these patients.[8] However, the rarity of this condition and its non-specific presentation leads to a diagnosis and treatment delay in more than half of the patients and may result in severe sepsis, mediastinal abscess, widespread mediastinitis and oesophageal friability.[6]

Although oesophageal perforation is a potentially deadly event, the advances in antibiotic therapy, imaging techniques, parenteral nutrition and intensive care have allowed a considerable reduction of its morbidity and mortality.

In contrast to adults, in whom surgical closure of this

defect is frequently preferred, a conservative management has been the preferred approach with better results in child oesophageal perforation.[7,9,10] In our experience, this attitude was successfully followed in 89% of our group of patients and we emphasize that one patient was admitted to our Unit after having been unsuccessfully operated in another hospital.

CONCLUSION

It is thought that healing capacity in a child is better than in adult, explaining why paediatric oesophageal perforations may usuallly be safely treated with an aggressive and prompt conservative management attitude, including nasopharyngeal aspiration, broad-spectrum antibiotic therapy, nil-by-mouth, parenteral or enteral infraesophageal nutrition. Immediate pleural effusion or mediastinal abscess drainage is mandatory. Surgical procedures (such as primary closure of the defect, resection and anastomosis with oesophagostomy) should be reserved for big oesophageal disruptions, intra-abdominal perforations and for cases refractory to conservative measures.

Immediate and aggressive non-surgical treatment of a paediatric oesophageal perforation allows survival with organ preservation in most cases and is still the first therapeutic choice in this age group.

A direct oesophageal approach is only justified when conservative therapeutic fails, keeping in mind that this attitude may lead to organ loss.

CONFLICT OF INTERESTS

The authors declare that there is not any conflict of interests regarding the writing of this manuscript.

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