Journal of Pediatric Surgery Case Reports 61 (2020) 101584

Contents lists available at ScienceDirect

Journal of Pediatric Surgery Case Reports

journal homepage: http://www.elsevier.com/locate/epsc

Multi-stage treatment of esophago-tracheal injury after button battery ingestion

Piotr Skrzypczak [a,*], Piotr Nogal [a], Patrycja Sosnowska [b], Jarosław Szydłowski [c], Przemysław Mańkowski [b]

[a] Student's Scientific Club: Pediatric Surgery, Poznan University of Medical Sciences, Poznań, Poland
[b] Department of Pediatric Surgery, Traumatology and Urology, Poznan University of Medical Sciences, Poznań, Poland
[c] Department of Pediatric Otolaryngology, Poznan University of Medical Sciences, Poznań, Poland

ARTICLE INFO

Keywords:
Battery
Ingestion
Reconstruction

ABSTRACT

The aspiration of the foreign body is a common problem in any pediatric specialization. We present a case of a 3-year-old boy admitted to the hospital after the button battery ingestion. In diagnostic imaging, a bronchoesophageal fistula was found. Gastrostomy and ileostomy were obtained. Due to increasing respiratory failure, the tracheotomy was made and the patient was intubated with the bilateral bronchopulmonary tube. On the 25th day, an attempt to reconstruct the esophagus and trachea was taken. During the operation, the surgery team took the cartilage lobe of the left ear, then switched to the extracorporeal circulation and finally made the esophagus end to end anastomosis and reconstruction of the tracheal loss with cartilage.

On the 45th day, the communication between the esophagus and the trachea was found. A esophagostomy was made, and salivary glands were injected with botulinum toxin. The tightness of the anastomosis was confirmed. The patient in the favorable general condition left the ward on the 103rd day of stay. In cases of the trachea, bronchus, or esophagus damages, the prognosis is very serious. The therapeutic success depends on the cooperation of many specialists, both the non-surgical and operational specializations.

The aspiration of the foreign body is a common everyday problem for any pediatric specialization. The most common ingested objects are coins and button batteries [1]. The button battery is a single, disc-shaped object frequently used to power hearing aids, toys, watches, hand calculators or TV remote controls. Most of the swallowed batteries pass down through the gastrointestinal tract safely without any disturbance. The other part could lodge in the esophagus and due to its composition, it can cause loads of serious complications that could be a problem for the treating team [1].

1. Case report

The 3-year-old boy was admitted to the Pediatric Surgery Department of Poznań University of Medical Sciences after the aspiration of the button battery. The diagnostic procedures were carried out and the laryngo-tracheoscopy was performed. A fistula just above the tracheal carina, including the main and intermediate right bronchus and the main left bronchus, was found. The fistula was communicating the trachea with the esophagus and mediastinal tissues. Besides, current active necrotic processes were noticed on the wound edges and in the esophageal mucosa. In the following days, gastrostomy (4th day) was performed to decompress gastric contents, as well as ileostomy, which was obtained. Because of the increasing ventilation insufficiency and severe general condition, the tracheostomy was performed on the 9th day. It was obtained in order to ensure the best possible ventilation and oxygenation. It also helped stabilize the patient and perform further reconstructive operation.

On the 12th day, the presence of the esophageal mucosa and soft tissues through the damaged posterior wall to the left main bronchus was observed in the fiberoscopy.

Due to increasing respiratory failure caused by airway leaks on the 24th day, bilateral bronchopulmonary intubation was started without improving the general condition. (see Fig. 1)

On the 25th day, an attempt to reconstruct the esophagus and trachea was taken.(see Fig. 2)

* Corresponding author. Department of Pediatric Surgery, Traumatology and Urology, Poznan University of Medical Sciences, Poland.
E-mail address: piotr.j.skrzypczak@gmail.com (P. Skrzypczak).

https://doi.org/10.1016/j.epsc.2020.101584
Received 16 June 2020; Received in revised form 15 July 2020; Accepted 21 July 2020
Available online 19 August 2020

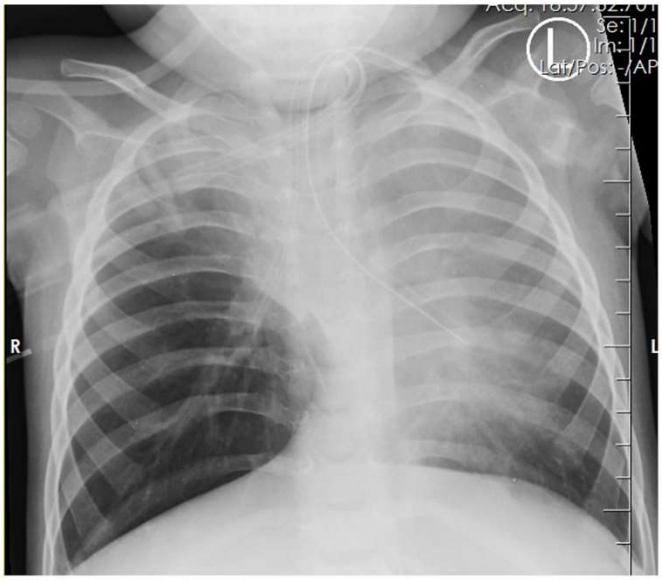

Fig. 1. The intubation tubes placement in the bronchi.

Fig. 2. The surgical field: esophagus (*), trachea (**).

The laryngological-surgical-cardiac surgery team performed the reconstruction divided into four stages:

1. Obtaining of the left ear cartilage lobe (chondro-perichondrial flap).
2. Thymectomy performed to access the posterior mediastinum, preparation of the esophagus and tracheal divergence.
3. Switching to the extracorporeal circulation to obtain proper blood oxygenation and cardiopulmonary efficiency after the airway opening.
4. Esophagus end-to-end anastomosis and reconstruction of the tracheal loss with the use of cartilage flap from the external ear tissues.

Two weeks after the operation, the cartilage graft closed the distal part of the trachea and covered itself with fibrin. On the 45th day, right-sided separation of the anastomosis at the level of the distal trachea and the right main bronchus was detected. Moreover, the communication between the esophagus and trachea was found. It was closed using a linear stapler. On the 46th day, a cervical esophagostomy was made and salivary glands were injected with botulinum toxin. It helped reduce the exposure of the anastomosis to the damaging effects of digestive juices and saliva. In the contrast examination, the gastric tightness and the tightness of the esophagus closure were confirmed. There was no evidence of esophageal stricture. Then it was followed by a gentian violet solution application. The leak to the respiratory tract was excluded. The patient was discharged from the hospital on the 103rd day of stay due to well-being. The esophagostomy was decided to be maintained. Currently, the patient is waiting for reconstruction of the gastrointestinal tract with the use of the large intestine.

2. Discussion

In 80% of cases, button batteries are swollen by small children between 6 months of age and 3 years with the domination of male patients [1–3]. Most ingestions of batteries have a favorable prognosis; almost 90% pass the digestive tract without serious complications [2]. It could take from 2 to 6 days to even 4 weeks for the battery to be disclosed in the stool [4].

There are several risk factors that can lead to severe complications and are connected with the higher morbidity and mortality: battery diameter >20 mm [2], patient age <4, the amount of ingested batteries, unwitnessed ingestion moment or delayed removal intervention [5]. The delayed elimination also increases the risk of tracheoesophageal fistula formation [5], which we observed in our patient's case. Also, the possible risk factor could be the fact of the battery's lifetime, which could cause more damage than the discharged one, which is less toxic and less possible to leak [1–3].

There are lots of controversies connected with the proper explanation of the possible damage mechanism. The most important are: leakage of the alkaline and caustic burn generated electrolyte circuit and electrical burn direct pressure and finally, relatively rare intoxication of mercury and lithium [1–5].

The patient, who swallowed the battery, could be firstly asymptomatic with some nonspecific complaints like cough, dysphagia, dyspnoea, odynophagia and relatively rare pneumonia [1]. The most severe complications are esophagus stricture, aortic perforation, tracheoesophageal fistula, mediastinitis or vocal cord paralysis [1,3].

Our patient swallowed the alkali battery and presented the image of the liquefaction necrosis of the esophageal wall. Alkali button batteries contain zinc anode and a cathode (manganese, silver or mercury oxide) separated by an alkali disc. The alkali solution leakage can cause necrosis [2].

X-ray imaging in early diagnostic is frequently used. The image of the ingested button battery is quite characteristic because of its double halo ring [3].

Most foreign bodies should be removed from the gastrointestinal tract only if they cause clinical symptoms or have not left the gastrointestinal tract after the appropriate time. Exceptions are batteries and sharp objects, that should always be removed endoscopically within 24 hours [6].

However, the battery location is crucial [1]. Some authors highlight the endoscopic intervention when the battery is in the esophagus, contrary to those asymptomatic, in which case the battery is in the stomach and it should be treated conservatively [4].

The management of tracheoesophageal fistula is usually unclear and becomes controversial, especially in children [1–3]. It is possible to cure the patient conservatively, expecting the spontaneous closure of the fistula [4]. The crucial issue is the decision about further surgical treatment if conservative treatment fails. It is crucial to make a decision when the patient can attempt the operation.

Another important thing is choosing the right operating technique. It is recommended to obtain the gastrostomy and jejunostomy for the gastrointestinal tract decompression, nutrition improvement, and the stomach contents drainage [6]. After the dissection of the fistula, it

can be supplied in many ways, using muscle, pleura, pericardial flap or fibrin glue [2,7].

Variety of different surgical techniques for the repair was described in the literature: segmental resection of the trachea and anastomosis with direct esophageal closure, the use of soft tissue flaps and also the cases of the multi-stage approach [7,8].

In our case, we decided to use the non-standard solution. Supplying the area of the fistula with the cartilage grafted from the ear resulted in a favorable final effect. It also lets the patient avoid the possible postoperative complications such as graft rejection or the occurrence of ischemia. The patient was in very bad general condition, circulatory and ventilatory insufficient, which is why the surgery was possible thanks to the extracorporeal circulation. This solution is also rarely found in the literature. In our opinion, the final good effect would not be impossible if the esophagostomy combined with the injection of the botulinum toxin had not been performed. It was the procedure that finally excluded the esophagus from the further contamination of the anastomosis and improved the healing process.

3. Conclusion

The removal of a foreign body from the airways or esophagus is very often identical to healing [6]. More attention should be paid to the aspiration of batteries or sharp objects. In cases of the trachea, bronchus or esophagus damages, the prognosis is very serious. The treatment of the chemical burns in the esophagus and airways is a challenge for the medical team. The therapeutic success depends on the cooperation of many specialists, both the non-surgical and operational specializations.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Patient consent

“Consent to publish the case report was not obtained. This report does not contain any personal information that could lead to the identification of the patient."

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

The authors would like to thank Małgorzata Peplińska for language support during the preparation of this manuscript.

References

[1] Marom T, Goldfarb A, Russo E, Roth Y. Battery ingestion in children. Int J Pediatr Otorhinolaryngol 2010;74(8):849–54.
[2] Sindi E, Bahadur A, AlRajhi H, Yousef Y. Disc battery ingestion; a single event with different outcomes. Int. J. Pediatr. Adolesc. Med. 2017;4(2):87–90.
[3] Şencan A, Genişol I, Hoşgör M. Esophageal button battery ingestion in children. Ulus. Travma Ve Acil Cerrahi Derg. Turk. J. Trauma Emerg. Surg. TJTES 2017;23(4):306–10.
[4] Wallace B, Landman MP, Prager J, Friedlander J, Kulungowski AM. Button battery ingestion complications. J. Pediatr. Surg. Case Rep 2017;19:1–3.
[5] Bhangu JS, Bajwa SJS, Anand S, Kalsi K. Button battery ingestion: a therapeutic dilemma and clinical issues in management. J. Sci. Soc 2016;43(1):30.
[6] Asge Standards of Practice Committee, et al. Management of ingested foreign bodies and food impactions. Gastrointest Endosc 2011;73(6):1085–91.
[7] Shen KR, Allen MS, Cassivi SD, et al. Surgical management of acquired nonmalignant tracheoesophageal and bronchoesophageal fistulae. Ann Thorac Surg 2010;90(3):914–8.
[8] Wein RO, Popat SR, Watson T, Orlando G. Management of an acquired tracheoesophageal fistula with a fascial free flap. Head Neck 2002;24(6):609–13.