

CASE REPORT

Oropharyngeal Foreign Body: Upper Airway Management Strategies in Paediatric Population

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ABSTRAK

Kemasukan benda asing ke dalam badan di kalangan kanak-kanak merupakan aduan yang paling kerap diterima oleh Jabatan Kecemasan. Di antaranya, kemasukan benda asing ke bahagian orofarinks adalah yang terendah iaitu 5-10%. Walaupun begitu, ia boleh menyebabkan kematian dan komplikasi yang teruk akibat daripadanya. Salah satu komplikasi yang boleh terhasil akibat kemasukan benda asing ialah halangan kepada saluran pernafasan. Oleh kerana terdapat perbezaan fisiologi dan anatomi yang besar di antara kanak-kanak dan orang dewasa, menangani masalah saluran pernafasan yang terhalang boleh menjadi lebih sukar dan mencabar. Ia memerlukan kepakaran dan kemahiran yang teliti untuk mengelak sebarang komplikasi yang boleh membawa maut. Penilaian tepat mengenai masalah tersebut amat penting sebelum meneruskan sebarang prosedur intubasi endotrakeal. Pembedahan saluran udara hanya diperlukan untuk kes 'Cannot Ventilate Cannot Intubate' sahaja dan ia perlu dilakukan oleh pakar kerana ia membawa risiko kecederaan struktur penting yang tidak diingini.

Kata kunci: benda asing, kanak-kanak, orofarinks, pengurusan salur udara

ABSTRACT

Foreign body (FB) ingestion among children is one of the most common presenting complaint to Emergency Department. Oropharyngeal foreign body are the least common, 5-10% in all FB ingestion. However, it carries significant mortality and morbidity following complications which may arise from it. Airway obstruction is one of the complications which may present after FB ingestion. Due to the significant differences in airway anatomy and physiology of children, management

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of an obstructed pediatric airway is challenging. It requires proper skill and experience to prevent further fatal complications. Proper assessment and airway evaluation are crucial before proceeding with endotracheal intubation. Surgical airway is only reserved in 'Cannot Ventilate Cannot Intubate' situation where it should be done by a skilled person, as it carries risk of injury to underlying vital structures.

Keywords: airway management, foreign body, oropharyngeal, pediatric

INTRODUCTION

Foreign body (FB) ingestion is one of the most common presenting complaint for Emergency Department (ED) visits among children. The ingestion can either be intentional while playing or accidental during feeding. The peak age varies from 6 to 36 months, and boys are more affected than girls (Brinegar & Jolly 2005). Coins are the most common ingested object in 70% of cases and the others are pins, needles, toy parts, fish bones, chicken bones and food boluses. Most of the FB are found lodged in stomach (60%), oesophagus (20%), distal part of stomach/ small intestine (10%) and oropharyngeal region (5-10%) (Brinegar & Jolly 2005). Fish bone FB is the commonest cause of FB ingestion among Asian population, especially in Chinese. Cervical esophagus is the commonest site, with three important constriction within the esophagus which related to fish bone FB. These constriction are at cricopharyngeal muscle, level of aortic arch or left main stem bronchus and at gastroesophageal junction (Ng & Ahmad 2018)

Oropharyngeal trauma is rare and accounts for 1-2% of all paediatric

trauma. Only in 2% of cases, the child is brought to hospital with the FB still in situ, with the commonest location of injury being the soft palate (90%). At least 1000 cases were admitted in hospital due to pharyngeal FB. FB in oropharyngeal are high likely to dislodge. This is because the children are prone to cry and vomit which increase the elimination of FBs (Huang et al. 2017). The majority of cases presenting to ED, did not involve active bleeding (Ryan et al. 2006). However, complications of airway compromise may arise due to oedema and swelling caused by airway obstruction (Chauhan et al. 2006). Besides that, presence of FB stuck in the oral cavity may obscure and cause limitation to visualise the vocal cord during intubation.

This was a case of a child who presented to ED with a FB in his oropharynx. The strategies in managing potential upper airway obstruction are discussed.

CASE REPORT

A 3-year-old boy presented to Emergency Department (ED) with a S-shaped metal hook stuck in his oral cavity (Figure 1). The ingestion

was intentional while playing with his sister. There was bleeding from his mouth and nose with the metal hook projecting out from his mouth.

Upon assessment, the child was agitated and crying with normal voice. There were blood clots present in his nostrils but there was no active bleeding from his mouth or nose. There was no peripheral or central cyanosis, no hoarseness of voice, no respiratory distress, and no stridor. The end part of S-shaped metal hook was protruding out from the oral cavity with the other end curved superiorly into the nasopharynx. There was no palpable neck swelling. Examination of chest was unremarkable. The initial blood pressure was 129/80mmHg, pulse rate 125bpm and oxygen saturation were 100% without supplemental oxygen. Intravenous Morphine 0.1mg/kg was administered for analgesia. The child was referred to Otorhinolaryngology team for emergency removal of metal hook in view of potential airway

obstruction.

The child was kept fasted and pushed to the emergency operation theatre (OT) for examination under anaesthesia and removal of FB by Otorhinolaryngology team. Airway assessment was done under direct laryngoscopy showed Cormack Lehane grade I. Intubation was successfully performed in emergency OT using a video-assisted laryngeal scope after rapid induction with IV Propofol 50mg and paralytic agent IV suxamethonium 15mg, while the metal hook was still in situ.

Intra-operatively, the S-shaped metal hook upper end was lodged in the right nasopharynx and it was mobile and not penetrating into the mucosa. There was no active bleeding, no mucosal laceration or oedema was seen. Nasal cavity and mucosa was normal. Intra-oral endoscopy showed no ulcer or laceration visualised on the tongue, oropharynx, palates and posterior pharyngeal wall. The metal



Figure 1: (A) The child with metal hook in situ when presented to the emergency department. (B) The metal hook that was successfully removed.

hook was successfully removed by manual manipulation. The operative time was within 60 seconds and the child was consequently extubated post-operatively. He was observed in the general ward and was discharged 24 hours, post removal of FB without complications.

DISCUSSION

A child is not a small adult and should not be treated as one. The physical and physiological systems are still in development. A child aged less than 2 years has the biggest anatomical

and physiological differences, while children aged 2-8 years are in transition and children more than 8 years are nearly similar to an adult (Choi et al. 2012). This difference gives an implication in choosing the appropriate methods of airway management during resuscitation (Table 1). The lung physiological changes in adult and paediatric cases were tabulated (Table 2). Oropharyngeal trauma in paediatric population is rare, accounting for 1-2% of all paediatric trauma. The majority of cases heal spontaneously and rarely cause severe sequelae. However, few can have life-threatening complications

Table 1: Comparison between adult and paediatric airway anatomical differences.

	Paediatric	Adult	Significant
Airway anatomy	Head is larger relative to its body with prominent occiput Short neck Large tongue	Flat occiput Small tongue	Prone for airway obstruction in lying position. Thus, positioning is important. To open up airway, child should be in neutral position. To achieve it, towel to be placed under the shoulder.
	Small mandible Prominent adenoid and tonsils	Small adenoid and tonsils	Loss of upper airway space which leads to difficult mask ventilation, obstruction during ventilation and difficulty during laryngoscopy
	Hypopharynx relatively shorter in height and narrower in width. larynx is relatively higher in the neck C2-C3	Airway more elliptical Larynx at C4-C6	Implication in placement of supraglottic placement
	Cricoid ring is located approximately at the level of the C4 vertebrae at birth, C5 at age 6, and C6 as adult	Cricoid ring at C6	It causes the placement of endotracheal tube difficult and traumatic as the tube tends to collide with or become obstruct onto the anterior commissure of the vocal cord
	Vocal cord angled in an anterior inferior to posterior superior fashion	Right angled to trachea (90degree)	Use of semi-curved/straight blade is preferable to directly lift up the floppy epiglottis. This affect the seal of cuffed or uncuffed ETT and guide the selection of ETT
	Epiglottis U shaped and floppy Airway funnel shaped with narrowest part in cricoid	Flat and flexible Airway cylindrical with narrowest is glottis	

Table 2: Lung physiological changes differences between adult and paediatric

	Paediatric	Adult	Significant
Physiology	Oxygen consumption is greater 6 ml/kg/min	Oxygen consumption is 3 ml/kg/min	Rapid desaturation during RSI despite best efforts of pre-oxygenation.
	Functional residual capacity lower	Higher FRC	Higher respiratory rate to achieve higher minute ventilation to expel CO ₂
	Higher CO ₂ production -100-150 ml/kg/min	CO ₂ production of 60 ml/kg/min	Significant trauma to airway/significant disease which causes narrowing of airway and causes higher resistance of flow.
	Narrow airway	Bigger airway	

such as injuries to the carotid artery with neurological deficits and deep neck soft tissue infection (Francis et al. 2014). Thorough assessment of the wound is crucial to exclude possible complications.

This child was brought by parents with a FB lodged inside his mouth and bleeding was present from mouth and nose. There was no stridor and no signs of respiratory distress. Recognition of children in respiratory distress is essential in order to properly plan for airway management before the child progresses into respiratory failure. Respiratory distress can be difficult to detect in infants and non-verbalizing children. Most often, they may present with agitation, tachypnoea with compensatory signs of respiratory distress which includes head bobbing, nasal flaring, substernal and intercostal recessions. Various respiratory sounds can give clues to the assessor in managing the child with respiratory distress. Upper airway obstruction often presents with stridor in which the obstruction is usually above or near the vocal cord. Subglottic pathology such as in asthma and bronchiolitis, present

with wheezes (Charles Stewart et al. 2006). These signs can be subtle but should not be missed as unrecognized and untreated respiratory distress may lead to respiratory failure. Paediatric assessment triangle (PAT) are used as an evaluation tool to detect the seriously ill child during triaging (Horeczko et al. 2013). It was introduced and published by the American Academy of Paediatrics in 2000 and the use of PAT in ED are supported by the American College of Emergency Physicians and American Academy of Paediatrics in the Advance Paediatric Life Support Course (Horeczko et al. 2013). The components of PAT consist of work of breathing, appearance and circulation to skin. Abnormality in any arm suggests an unstable child requiring prompt clinical intervention.

The child was appropriately triaged to the Resuscitation Zone and rapid assessment revealed a potential airway obstruction. In this child, a thorough assessment of the wound in ED was challenging due to agitation and uncooperative behaviour prior to sedation. The FB obscured the oral cavity causing difficulties in further

assessment of the airway. Otherwise, no syndromic facies was observed in this child to suggest a difficult airway. Therefore, it was best to examine the injury under anaesthesia to avoid underestimation of the severity. The child was taken to emergency OT for further assessment and removal of FB under controlled environment with Otorhinolaryngology team on field for possibility of cannot ventilate cannot intubate (CVCI) situation. Assessment of a difficult airway starts from the history itself. History of AMPLE (allergies, medications, past medical history, last meal, events leading to the need for intubation) should be obtained from the caretaker prior to endotracheal intubation (Charles Stewart et al. 2006). Mallampati scoring system was found to be inaccurate in predicting the view of glottis in a child during direct laryngoscopy. The standard value of thyro-mental and horizontal mandibular length, which is usually applied in adults is unsuitable for the paediatric age group due to anatomical differences. Difficult airway in paediatrics can be classified into i) unexpected difficult normal paediatric airway such as in anatomical or functional airway obstruction; ii) impaired normal paediatric airway in allergy, inflammation, FB and trauma; iii) actual difficult paediatric airway such as in congenital anomalies which is usually associated with dysmorphism or tumour that prevents manoeuvres for optimal visualization of the airway (Engelhardt et al. 2012). Computed tomography (CT) is recommended in unstable and uncooperative patients or if there is suspicion of vascular injury

with neurological deficit (Zonfrillo et al. 2008). Computed tomography angiography (CTA) is the goal standard investigation to detect any vascular injury. There was no indication for CT or CTA for this child.

Intubation was performed under controlled environment in the emergency OT using a video-assisted laryngoscopy with rapid sequence intubation (RSI) after assessment of airway. Intubation was successful upon first attempt without any complications. Achieving a high rate of first pass success in endotracheal tube (ETT) placement is important, as paediatric patients are prone to rapid desaturation due to higher rate of oxygen consumption and low oxygen reserve. It was reported that 23.0% of emergency paediatric intubation were via rapid sequence intubation, 38.5% were intubated without medication and 38.5% with sedation only intubation (Choi et al. 2012). Choi et al. also reported that the rate of first pass success was 74.4% among emergency medical doctors with the highest first pass success among senior residents and specialist. In another study of video-assisted intubation using RSI method in children, the authors reported 52.0% first pass success, 22.0% success in second attempt and 26.0% required three or more attempts (Kerrey et al. 2012). The median time taken for intubation were longer resulting in 25.0% of patients predisposed to apnoea and no ventilation for more than 60 seconds during placement of endotracheal tube (Kerrey et al. 2012). This predisposes paediatric patients to hypoxia and cardiac arrest while

attempting endotracheal intubation.

This child had no evidence of upper airway obstruction during presentation. Therefore, it was considered safe to proceed with RSI in a controlled environment. Rapid sequence intubation is defined as simultaneous administration of potent induction agent followed by paralytic agent prior to endotracheal intubation. It offers greater opportunity for successful intubation as it facilitates direct laryngoscopy by preventing resistance, promoting rapid induction and reducing risk of aspiration. Based on a study done in 9 centres in the United States of America, RSI had become the primary method with low adverse events and higher rate of success (Sagarin et al. 2002). RSI gives higher rate of success with fewer attempts and lower risk of complications compared to intubation without neuromuscular blocking agents (Gnauck et al. 1994). The Paediatric Emergency Medicine Committee of the American College of Emergency Physicians advocates RSI for emergency intubation in a child with intact upper airway reflexes (Sagarin et al. 2002). However, there are few contraindications for RSI. These includes spontaneous breathing with adequate ventilation, operator concern that both intubation and mask ventilation may not be successful, major laryngeal trauma, upper airway obstruction and distorted facial or airway anatomy (Charles Stewart et al. 2006). If intubation fails, an emergency surgical airway may become the choice of emergency airway management due to the obstruction by FB.

Emergency surgical airway can be

difficult and is reserved for cases of cannot ventilate, cannot oxygenate and cannot intubate. A neonate cricothyroid membrane has a mean length of 2.6 mm and width of 3 mm with a different orientation to adults. The cricoid cartilage and hyoid bone are more prominent than thyroid cartilage making the identification of cricothyroid membrane more difficult and thus, cricothyrotomy almost impossible and prone to laryngeal injury with significant fatalities, if performed by inexperienced hands (CotÉ et al. 2009). Based on the recommendation by the American Heart Association, percutaneous needle cricothyrotomy in children carries less risk of injury to vital structures. Transtracheal cannula insertion or an emergency surgical tracheotomy are the other alternatives to a CVCI situation (Johansen et al. 2010). The benefits of surgical tracheotomy is that it is a definitive airway which can be used to ventilate while transtracheal cannula is only a temporary measure prior to placement of definite airway. However, these methods require further study to establish the success and risk in attempting the procedure (Johansen et al. 2010). Therefore, according to the Difficult Airway Society, the rescue technique for CVCI situation is needle cricothyroidotomy for children 8 years and older, and surgical cricothyroidotomy in less than 8 years (Johansen et al. 2010).

CONCLUSION

Oropharyngeal injury by FB is uncommon but carries potential complications that may lead to the

difficult paediatric airway. It is therefore vital to decide on the most appropriate method for securing the airway. Rapid sequence intubation is the best and recommended practice for paediatric emergency intubation as it gives high rate of first pass success and favourable outcome. Percutaneous cricothyroidotomy should be considered for CVCI situation and in a controlled environment by well-trained hand.

REFERENCES

- Brinegar, A.P., Jolly, S.K. 2005. Location, Location, Location. National contextual factors and public support for European integration. *Eur Union Polit* 6(2): 155-80.
- Chauhan, N., Guillemaud, J., El-Hakim, H. 2006. Two patterns of impalement injury to the oral cavity: Report of four cases and review of literature. *Int J Pediatr Otorhinolaryngol* 70(8): 1479-83.
- Charles Stewart, G.Q. 2006. Managing the pediatric airway in the ED. *Pediatr Emerg Med Pract* 1(3).
- Choi, H.J., Je, S.M., Kim, J.H., Kim, E. 2012. The factors associated with successful paediatric endotracheal intubation on the first attempt in emergency departments: A 13-emergency-department registry study. *Resuscitation* 83(11): 1363-8.
- CotÉ, C.J., Hartnick, C.J. 2009. Pediatric transtracheal and cricothyrotomy airway devices for emergency use: Which are appropriate for infants and children? *Paediatr Anaesth* 19(Suppl 1): 66-76.
- Engelhardt, T., Weiss, M. 2012. A child with a difficult airway: What do i do next? *Curr Opin Anaesthesiol* 25(3): 326-32.
- Francis, E.C., Browne, K.M., Eadie, P.A. 2014. The tin whistle: a rare and serious cause of penetrating oropharyngeal trauma in children. *Case Rep Emerg Med* 2014: 562418.
- Gnauck, K., Lungo, J.B., Scalzo, A., Peter, J., Nakanishi, A. 1994. Emergency intubation of the pediatric medical patient: use of anesthetic agents in the Emergency Department. *Ann Emerg Med* 23(6): 1242-7.
- Horeczko, T., Enriquez, B., McGrath, N.E., Gausche-Hill, M., Lewis, R.J. 2013. The pediatric assessment triangle: accuracy of its application by nurses in the triage of children. *J Emerg Nurs* 39(2): 182-9.
- Huang, Z., Li, P., Xie, L., Zhou, H., Li, Q. 2017. Related factors of outcomes of pharyngeal foreign bodies in children. *SAGE Open Med* 5: 2050312117724057
- Johansen, K., Holm-Knudsen, R.J., Charabi, B., Kristensen, M.S., Rasmussen, L.S. 2010. Cannot ventilate-cannot intubate an infant: Surgical tracheotomy or transtracheal cannula? *Paediatr Anaesth* 20(11): 987-93.
- Kerrey, B.T., Rinderknecht, A.S., Geis, G.L., Nigrovic, L.E., Mittiga, M.R. 2012. Rapid sequence intubation for pediatric emergency patients: Higher frequency of failed attempts and adverse effects found by video review. *Ann Emerg Med* 60(3): 251-9.
- Ng, V.H., Ahmad, K.I. 2018. Fish bone foreign body disease: a case with dramatic complication. *Med & Health* 13(1): 264-71.
- Sagarin, M.J., Chiang, V., Sakles, J.C., Barton, E.D., Wolfe, R.E., Vissers, R.J., Walls, R.M., National Emergency Airway Registry (NEAR) investigators. 2002. Rapid sequence intubation for pediatric emergency airway management. *Pediatr Emerg Care* 18(6): 417-23.
- Ryan, J., Soose, M., Jeffrey P., Simons, M., David L., Mandell, M.O. 2006. Evaluation and management of pediatric oropharyngeal trauma. *Arch Otolaryngol Head Neck Surg* 132: 446-51.
- Zonfrillo, M.R., Roy, A.D., Walsh, S.A. 2008. Management of pediatric penetrating oropharyngeal trauma. *Pediatr Emerg Care*, 24(3): 172-5.

Received: 5 May 2018

Accepted: 25 Sep 2019