Role of Point-of-Care ultrasound as a Bridge Investigation for Management of Upper Oesophageal Coins in Children.

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Coins are commonly ingested foreign body (FB) in children, particularly the area just below the cricopharyngeus muscle, being the most common site of lodgement. The aim of the present study was to evaluate the effectiveness of point-of-care ultrasound (POCUS) of the upper airway as an investigation arm to guide and assist the clinical management of foreign body coin in children with expectant management for spontaneous passage. A total of 50 children with coin in upper oesophagus were chosen and POCUS was done in the preoperative area. Those in whom coin was visualised on POCUS were taken for retrieval under general anaesthesia and in whom coin was not visualised were taken for 2nd X-ray to confirm passage. In 50 children with a coin in upper oesophagus, point-of-care ultrasound (POCUS) showed the presence of coin in 44 children (confirmed on esophagoscopy) and spontaneous passage in 6 children (confirmed on 2nd X-ray), thus resulting in the reduction of approximately 88% of 2nd check X-ray to demonstrate the position of coin.

Key words: Foreign body (FB), esophagus, Point-of-care ultrasound (POCUS).

Introduction

Accidental ingestion of foreign bodies is one of the common problems in children. Although majority of the foreign bodies in gastrointestinal (GI) tract pass spontaneously without complications, 10%–20% need endoscopic retrieval, and 1% require open surgery secondary to complications.[1,2] In the GI tract the sites of foreign body (FB) lodgement involve the upper, middle and lower obstructions of the esophagus, pylorus, ileocecal valve and rectosigmoid colon.[3] Coins are a common type of FB ingested by children. Cervical oesophagus, particularly the area just below the cricopharyngeus muscle is the common site of lodgement.[4,5]

Although 25% to 30% of the oesophageal coins in children pass spontaneously without complications, age of the child, size of the coin and location in the oesophagus are the factors that affect their spontaneous passage.[6] When a child presents with a history of FB ingestion, a screening X-ray is done to confirm the presence of coin, its size, and location in the oesophagus and then observed for 12 -24 hours for the possibility of spontaneous passage. They can be followed up by serial X-rays to look for passage of the coin.

Ultrasonography has been found useful in identification of sonoanatomy of the upper airway structures, assessment and management of difficult airway, performing nerve blocks etc. Having the advantage of real time evaluation, portability, availability in emergency and perioperative area, point of care ultrasound (POCUS) is an extremely useful diagnostic adjunct in emergency patient management. It is been utilised in evaluation of FBs in skin and soft

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tissues, ocular, cardiac, pulmonary, gastrointestinal, and genitourinary systems. Most of these applications highlight that POCUS is a novel tool for emergency management.[7-9]

This study was devised to evaluate the effectiveness of POCUS as an investigation arm in confirming the presence and location of coins in the oesophagus before taking the patient for endoscopic retrieval.

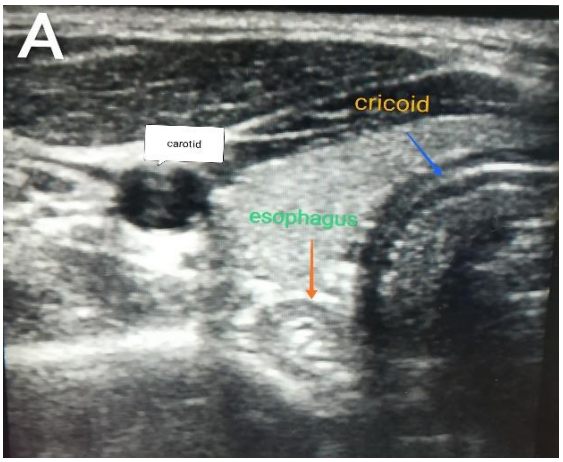
Methods

This study was carried out after the institutional ethics committee approval from January 2019 to December 2019. We studied a total of 50 patients up to the age of 18 years who presented to emergency department with the history of coin ingestion with a positive radiological visualization in the upper oesophagus. They were inquired about the time of ingestion of foreign body, the mode of ingestion, number of coins ingested and details about possibility of potentially high-risk objects like battery, pointed or sharp foreign body. Only the patients in whom the coin was in the upper oesophagus were included for ease of visualization with both plain radiograph and POCUS. Patients with a prior history of anatomical esophageal disease like stricture, fistula, previous surgery of the oesophagus or trachea, patients with signs of airway compromise, delayed presentation of more than 24 hours and ingestion of high-risk objects like battery, irritant or sharp foreign body were excluded.

All patients were then kept for conservative management for 12 hours if they were free from signs of obstruction such as stridor, respiratory distress or excessive secretions unable to manage. Then a POCUS was carried out to demonstrate the position of the coin in the upper oesophagus.

Each child was placed supine with head extended and a linear high frequency 12 MHz probe was placed transversely over the anterior midline of neck. The probe was moved caudally to localise the cricoid cartilage which is seen as a hump and the tracheal wall which is seen as a bright air-mucosal interface. (Figure 1). Normally, the oesophagus is not visualized, however, if a foreign body is present, it appears hyperechoic posterior to thyroid in the left paratracheal space. Patient can be encouraged to do active swallowing to visualise the oesophageal lumen.

Figure 1*. USG neck of a normal person showing structures in transverse plane with oesophagus, carotid and cricoid in Picture A.*



Patients in whom the coin in oesophagus was demonstrated on POCUS were shifted to operating room for endoscopic retrieval of the coin under general anaesthesia. The patients in whom the coin was not visualised on POCUS, underwent a 2nd X-ray to locate the coin.

Results

As shown in Table-1, age of study group ranged from 16 years to 1 year. Most frequent presentations were parental recognition and dysphagia. Out of 50 patients, 6 patients (12%) had spontaneous passage of the coin during the period of conservative management and in all of them it was a five rupees coin (as shown in Table-2). Five of these patients were more than 5 years old and one was 1 year old(as shown in picture-3 showing one year old child foreign body coin). Time of presentation to hospital was variable with maximum patients presenting in less than 6 hours of ingestion.Two patients had ingested 2 coins of same size (as shown in pic-2) showing overlapping coins over each other on X-ray. Different sizes of commonly ingested coins are shown in picture 4. 5-rupee coin is the smallest in size, 2.5cm in diameter.

12-hour POCUS showed the presence of the coin in upper oesophagus in 44 patients and all of them

had a coin evident by oesophagoscopy and the coin was retrieved. 6 patients did not have a positive POCUS evidence of a coin in 12 hours, and their 2nd X ray showed that the coin has spontaneously passed beyond the oesophagus.

The use of point-of-care ultrasound as a bridge investigation for management of upper oesophageal coins in children gave the real time visualisation of oesophageal foreign body coin resulting in the reduction of approximately 88 % of 2nd check X-ray to demonstrate its position.

Table -1 *Age distribution of FB coin presentation .*

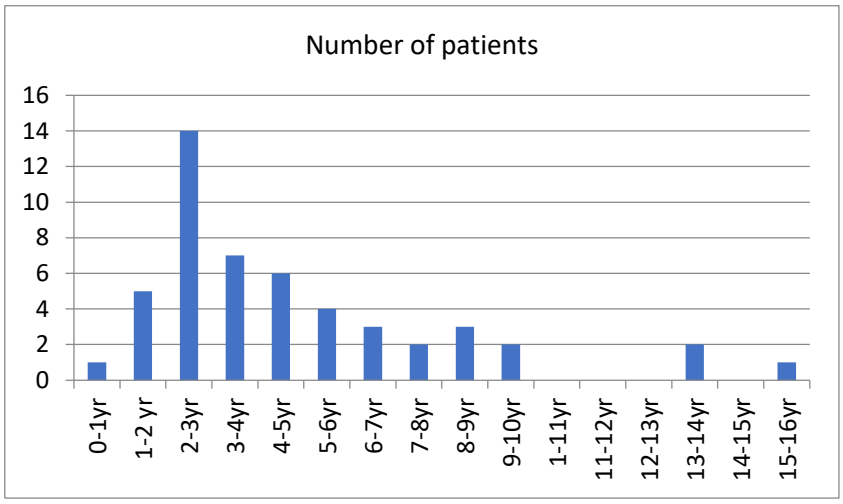


Table 2 *: Number and percent of FB coin not visualised on POCUS and spontaneous passage on X-ray. Number and percent of FB coin visualised on POCUS and retrieved on esophagoscopy.*

Description	Number of patients
POCUS ultrasound visualization of FB was positive	44 patients (88%)
POCUS ultrasound visualization was negative	6 patients (12%)
POCUS ultrasound was positive and coin was eventually extracted on esophagoscopy	44 patients (88%)
POCUS ultrasound was positive and did not show any coin on esophagoscopy	None
POCUS ultrasound was negative and showed passage of coin beyond upper oesophagus on 2nd radiography.	6 patients (100%)
POCUS ultrasound was negative and did not show passage of coin beyond upper oesophagus on 2nd radiography.	None

***Figure 2**: A: FB in the upper oesophagus as demonstrated by POCUS (red arrow) as hyperechoic shadow. B: AP and lateral X-ray of the neck showing upper oesophageal coin*

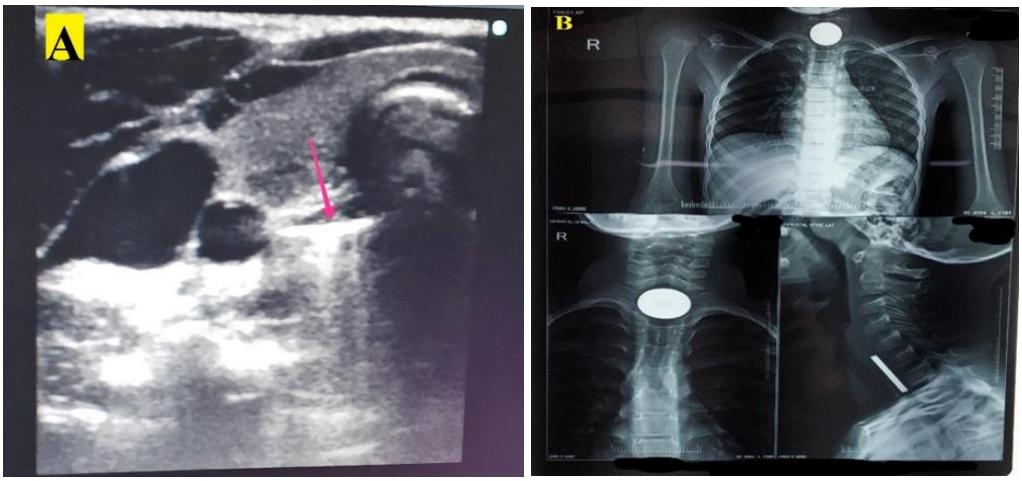


***Figure 3**. A: X-ray showing FB coin in upper oesophagus in a 1-year old child at presentation B:Its spontaneous descend into the stomach*

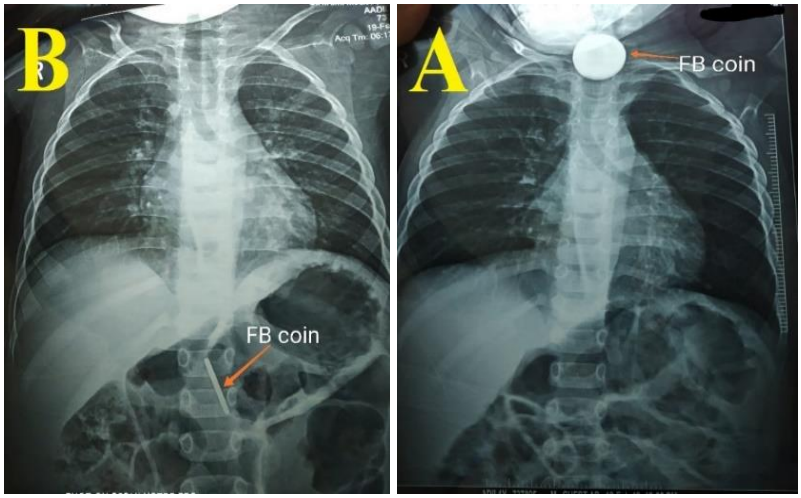


***Figure 4**. Different types of coins and their size.*

Discussion

Food seeking behaviour in infants and young children leads to hazards of foreign body ingestion. Although majority of the ingested foreign bodies pass down spontaneously, some get stuck in the gastrointestinal tract. Coins are the most frequently ingested FB by children hence accounts for majority of the esophageal foreign bodies.[4] In our study 33 out of 50 patients were less than 5 years of age (66%) with equal male and female preponderance. These results are similar to other studies wherein majority of children are toddlers.[5,6]

Three primary areas of physiologic narrowing of the oesophagus are the upper oesophageal sphincter that includes the cricopharyngeus muscle, the middle esophagus where esophagus crosses over the aortic arch, and the lower oesophageal sphincter. The presentation of FB in children is mostly from the history provided by parents or caretakers however it may also present with other associated complications.[10,11] The most common area of FB lodgement in children is the cervical esophagus, particularly the area just below cricopharyngeus muscle.[5,12]

Screening X-ray is done to confirm the presence of FB, to detect the location of FB and to identify the size and type of FB. A button battery would show the characteristic double halo sign on radiography. The presence of hazardous FB like button batteries mandates early removal to prevent the complications associated with its corrosive nature.[6,13] Because of the possibility of spontaneous passage of a FB, it is always advisable to do a second X-ray before taking the child for FB retrieval to reconfirm location of the FB there by to prevent any unnecessary retrieval procedures[14]. In this study we replaced 2nd check X-ray with POCUS utilising the advantages of its portability, repeatability and ease of operation in perioperative area. POCUS allows changes in the patient position during the examination and hence dynamic images can be obtained which are useful for evaluating the status of foreign bodies.

In our study a total of six patients had spontaneous descend of coin and five among them were more than 5 years of age. Older children tend to have more chance of spontaneous passage of coin. These reflect the findings of Waltzmann et al., who concluded that spontaneous passage of ingested coin tends to be more with age, higher in patients older than 5 years of age.[6]

After spontaneous passage beyond the oesophagus, further progression of FB coin is usually uneventful, however it may get delayed even in some uncomplicated cases. Follow up with serial X-ray every weekly can be done till the passage of coin from GI tract is confirmed. Sometimes the need of endoscopic retrieval arises if FB coin remains in stomach for more than 2-4 weeks.[14-16]

Shibasaki M et al utilised airway USG in calculation with subglottic airway diameter in children which correlated well of ETT size. Similarly Siddiqui N et al utilised the role of POCUS in difficult airway cases to reduce airway injuries while performing cricothrotomy[18,19] Ultrasonography has been utilised to confirm the endotracheal tube placement with high sensitivity and specificity.[20] Hence we extended its role and utilised POCUS as a bridge investigation in identification and management of FB coin which reduced the need of 2nd check X-ray. The use of point-of-care ultrasound not only gave the advantage of the real time visualisation of upper oesophageal coin but also resulted in the reduction of approximately 88 % of 2nd check X-ray. POCUS has the potential to be a novel bridging investigation as a screening tool in management of FB coins in the oesophagus.

Conclusion

The use of point of care ultrasound (POCUS) as an investigation arm to guide and assist the clinical management of foreign body ingestion has potential benefits for both provider as well as the patient providing the real time assessment to observer and significant reduction of 2nd check X-ray to patients.

Declarations

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Conflict of interest: none.

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