Original Article

A Retrospective Review of the Management of Impacted Coin Ingested in Children

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Abstract

Introduction: Accidental coin ingestion is a common presentation amongst paediatric patients in emergency departments (ED) worldwide, necessitating prompt management to prevent complications. **Objectives:** This study aimed to describe the clinical features of paediatric patients with impacted oesophageal coins at Dr. George Mukhari Academic Hospital ED and compare outcomes between the balloon catheter and oesophagoscopic techniques for coin extraction. **Methods:** This was a retrospective review of the medical records of patients aged ≤12 years over 5 years. Data were collected from the hospital records and analysed using SAS® (SAS Institute Inc, Cary, NC), Release 9.3, running under Microsoft Windows. **Results:** The analysis included 95 patients (51 females, 44 males) with a median age of 3 years, ranging from 0.70 to 10 years. Coins were predominantly located in the upper oesophagus (71.6%). Thirty-five (36%) children presented 8 h after the ingestion of the coin. At presentation, 82 (86.3%) patients were asymptomatic. The most observed symptoms were hypersalivation in 17 (17.9%) patients and vomiting in eight (8.4%) patients. Of the 62 patients for whom the balloon catheter was solely used, it was successful in 77.4% of the cases. Rigid oesophagoscopy was used in 33 patients as the first procedure (34.7%), and its overall success rate was 100% (44 patients). **Conclusions:** This study contributes valuable insights into the management of oesophageal coin ingestion in a resource-constrained setting, emphasising the safety and efficacy of the balloon catheter and the role of rigid oesophagoscopy in cases of failure or delayed presentation.

Keywords: Balloon catheter, coin extraction, coin ingestion, oesophagoscopic coin extraction, foreign-body ingestion

Introduction

Foreign-body ingestion is a surgical emergency that requires urgent attention as it can be life-threatening. Oesophageal ingestion of foreign bodies occurs most frequently in children.[1] Literature also shows that children, more often than adults, ingest coins, which are often lodged in the cricopharynx.

Several studies have reported many complications following coin ingestion, from mucosal ulceration to acute respiratory distress syndrome, including certain acute complications (oesophageal obstruction, perforation and pneumomediastinum), as well as subacute or chronic complications (infections and fistulas) and death, especially if the child was not attended to on time, and the condition was not managed appropriately.[1-5]

The above facts on ingestion outcomes justify why patients with oesophageal coin ingestion require prompt diagnosis and therapy. The clinical history is a key element for early medical attention and assessment, given that the lack of reporting by parents has been associated with a high complication rate.[4] Notwithstanding the absence of parental reports, physicians usually find these lodged foreign bodies while investigating other chest problems. Despite the frequency and seriousness of coin ingestion with oesophageal lodgement, there is no consensus in the literature on the appropriate management of such patients.[1,3]

Methods

Study design and setting

This study was a retrospective cross-sectional descriptive study reviewing the medical records of paediatric patients

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who were treated at Dr. George Mukhari Academic Hospital (DGMAH) for coin ingestion with oesophageal impaction for 5 years (January 1, 2009–December 31, 2013), in the Department of Paediatric Surgery.

Ethical considerations

Permission to access patient information was sought from hospital executive management, and ethics approval was obtained from the Sefako Makgatho University Research Ethics Committee before commencing with data collection. Ward admission records and theatre lists were used to identify potential participants, and their hospital records were accessed and reviewed. Patients' information was kept confidential, and no consent was required.

Study population

All patients aged 12 years or less who presented with a diagnosis of oesophageal coin ingestion and underwent an attempted extraction of the foreign body were included in the study. All other foreign bodies or coins that were beyond the oesophagus were excluded from the study.

Data collection and analysis

The data collected included sociodemographic variables (age, sex and home circumstances), the time elapsed since ingestion of the coin, history and related symptoms, physical signs as noted by the clinician, associated comorbidity, clinical variables (location of the coin or anatomic site and type of coin), complications before and after removal of the coin and eventual outcomes. These data were captured on the data collection sheet and transcribed on the Microsoft Excel spreadsheet for analysis. Descriptive statistics were performed on SAS® (SAS Institute Inc, Cary, NC), Release 9.3, running under Microsoft® Windows® for a personal computer. The normal approximation of the *Z*-test was used for significance testing involving percentages. $P \leq 0.05$ was considered statistically significant.

Results

Sociodemographic characteristics

Ninety-five patients constituted the study sample. The age of the patients ranged from a minimum of 7 months to a maximum of 10 years, with a mean and median age of 3.5 and 3.0 (5-2) years, respectively. Most of the patients (n = 69; 73%) were younger than 5 years compared to those who were 5 years and older (n = 26; 27%). The peak age in this study was 3 years. There were more females (n = 51; 54%) than males (n = 44; 46%). Most of the patients (n = 77; 81%) resided in informal settlements (squatters), whereas 18 (19%) patients lived in formal middle-class residential areas [Table 1].

Clinical signs and symptoms on examination

The majority (n = 82; 86.3%) of the presenting patients were asymptomatic, whereas 13 (13.7%) presented with vomiting, chest pain, refusing to eat and dysphagia [Table 2]. In 66 (69.5%) patients, no clinical signs were observed on examination, and they were comfortable. The most observed symptoms of oesophageal coin lodgement were hypersalivation (n = 17; 17.9%) and vomiting (n = 8; 8.4%) as presented in Table 3. Ninety-one patients were stable (95.6%), whereas 4 (4.4%) patients were unstable with airway compromise [Table 4].

Elapsed time since ingestion of coin

Thirty-five (36%) patients presented 8 h after the ingestion of the coin had elapsed, whereas 47 (49%) presented eight or more hours after the coin was ingested. In the remaining 13 patients,

Table 1: Summary of sociodemographic characteristics

Sociodemographic characteristics	*n* (%)	*p* value
n	95	
Age (years)		
<5	69 (73)	*P*=0.000
≥5	26 (27)	
Mean±SD	3.5±2.14	
Median (IQR)	3 (2–5)	
Minimum–maximum	0.70–10	
Gender		
Male	44 (46)	*P*=0.263
Female	51 (54)	
Residence		
Informal settlements	77 (81)	*P*=0.000
Formal middle-class areas	18 (19)	

SD: Standard deviation, IQR: Interquarti e range

Table 2: Presenting symptoms

	n (%)
None	82 (86.3)
Symptoms reported	
Vomiting	4 (4.2)
Chest pain	3 (3.2)
Stomach ache	3 (3.2)
Refuse to eat	2 (2.1)
Dizziness	1 (1.0)
Total	95 (100)

Table 3: Patients' clinical signs on examination

	n (%)
None	66 (69.5)
Signs on examination	
Hypersalivation	17 (17.9)
Vomiting	8 (8.4)
Symptoms of stridor	3 (3.2)
Agitated patient	1 (1.0)
Total	95 (100)

Table 4: Stable condition observed on examination

	n (%)
Yes	91 (95.6)
No (respiratory distress)	4 (4.4)
Total	95 (100)

Table 5: Summary of elapsed time since ingestion of coin

Time since ingestion of coin	*n* (%)	*p* value
n	95	
Time since ingestion (h)		
<8	35 (36)	*P*=0.039
≥8	47 (49)	
Indeterminate	13 (13)	
Mean±SD	14.9±21.10	
Median (IQR)	8 (5–15)	
Minimum–maximum	1–120	

SD: Standard deviation, IQR: Interquartile rage

Table 6: Site and size of coin

	n (%)
n	95
Site of coin	
Upper oesophagus	68 (71.6)
Middle oesophagus	19 (20.0)
Lower oesophagus	8 (8.4)
Size of coin	
Five cent (21 mm)	24 (25.2)
Ten cent	6 (6.3)
Twenty cent	3 (3.2)
Fifty cent (22 mm)	26 (27.4)
One rand	8 (8.4)
Two rand (23 mm)	19 (20.0)
Five rand	9 (9.5)

Table 7: Balloon catheter outcome

Outcome of catheter technique	Number of patients (%)
Successful	48 (77.4)
Not successful	14 (22.6)
Total	62 (100)

Table 8: Upper airway obstruction

Condition	Before coin removal, *n* (%)	After coin removal, *n* (%)
No complication	91 (95.6)	89 (100)
Partial upper airway obstruction	4 (4.4)	-
Total	91 (100)	89 (100)

Table 9: Length of hospital stay

Length of hospital stay	Number of patients (%)
<24 h	20 (21.1)
1 day	37 (39.0)
2 days	25 (26.3)
3 days	8 (8.4)
4 days	2 (2.1)
5 days	1 (1.0)
6 days	2 (2.1)
Total	95 (100)

the time of ingestion was not recorded. The mean and median time were 14.9 and 8 h, respectively, with the minimum time of 1 h and the maximum time of 120 h [Table 5].

Site and size of the coin

Coins lodged in the oesophagus were mostly located in the upper oesophagus (71.6% of cases), with 20%, and 8.4% presented with coins lodged in the middle and lower oesophagus, respectively. The most impacted coin was a 22-mm coin (50c), which occurred in 23 (27.4%) patients, followed by a 21-mm coin (5c) in 21 (25%) patients and a 23-mm coin (R^2) in 17 (20.2%) patients [Table 6].

Extraction methods and outcome

The balloon catheter was solely used in 62 (65%) patients as a primary method with success in 48 (77.4%) patients and unsuccessful in 14 (22.6%) patients. The unsuccessful patients were then taken for endoscopy. Rigid oesophagoscopy was applied to 47 patients in total. It was used as a primary method in 33 (34.7%) patients and secondary in 14 (22.3%) patients. It was successful in all 44 (100%) patients. Coins were retrieved in all except in three patients who had the coins in the stomach during endoscopy [Table 7].

Amongst the 91 patients (95.6%), no complications were observed before removal. Four (4.4%) patients experienced discomfort owing to airway obstruction before removal, which was resolved after the removal of the coin. There were no major complications, such as perforation, airway impaction or bleeding [Table 8].

After coin removal, 37 (39%) patients were hospitalised for one night for further observation. The length of stay beyond 24 h was due to administrative issues, like waiting for parents or ambulance to referring hospitals [Table 9].

Discussion

Sociodemographics

Foreign-body ingestion is a surgical emergency that requires urgent attention as it can be life-threatening. Oesophageal ingestion of foreign bodies occurs most frequently in children.[1] These findings were also similar to those reported in the American Poison Control Center Annual Report, where 119,323 cases of foreign-body ingestion were recorded.[2] Children represent approximately 75%–80% of the total number of patients. Children ingest all kinds of foreign bodies, such as food, non-food and toys. Amongst these, coins are reported as the most ingested foreign bodies.[1]

In this study, coin ingestion was more common in patients between 0 and 5 years of age in a range from 7 months to 10 years. The mean age was 3.5 years, which was comparable to the mean age reported in a study conducted at the Red Cross War Memorial Hospital in Cape Town.[5] The results of the present study were also comparable to those of the study conducted by Baral *et al*. on the removal of coins from the upper oesophageal tract in children with Magill's forceps under propofol sedation.[1]

The study conducted by Lin *et al*. on the endoscopic removal of foreign bodies in children reported similar findings with a range of 6 months–13 years and a mean age of 3.4 years.[6]

The age distribution found in this study is consistent with a worldwide trend, and preventive measures should thus include children of all ages from 7 months up to at least 10 years. It was reported in the literature that 22% of children with oesophageal foreign bodies and older than 5 years had anatomical abnormalities.[7] In the present study, anatomical abnormalities were unspecified in the patients' records, and it cannot be confirmed that there was any previous oesophageal pathology in any patient that could have constituted a real risk factor for the impaction of a foreign body.

In the present study, 51 (53.7%) female children and 44 (46.3%) male children were seen. This slight female predominance could just reflect the community gender distribution. Research conducted at the Red Cross War Memorial Children's Hospital of the University of Cape Town showed that both sexes were equally affected (boys 49%).[5]

Al-alawneh *et al*. at Taibah University in Pakistan reported 34 cases of foreign-body ingestion between December 2012 and May 2013, with 52.9% of females and 47.1% of males.[8] These findings are in line with the findings of this present study. Pokharel *et al*., in retrospective research, reported a male predominance of 67%, but no explanation for the high incidence of a foreign body in male children was given.[9] From the findings of this study, it seems that age rather than gender predisposes the child to ingestion. As a result, prevention should target the age of a child and not only gender.

The present study showed that 77 (81.1%) patients originated from informal settlements, also known as squatter camps in South Africa, which comprise the lowest socioeconomic class; 18 patients were in the middle class (18, 9%). The high incidence amongst the lowest socioeconomic patients may be explained by the lack of toys that prompt children to play with coins.[5,8] It was observed that it appears that children in a rural environment have minimal access to toys in comparison with their counterparts in urban areas.[5] The findings of Al-alawneh *et al*. also concur with the results of our study, where most of their cases were from the lower socioeconomic strata of society because of the catchment area of the institution and perhaps because of less awareness of the consequences.[8] The DGMAH hospital has a large catchment area, covering urban, peri-urban and rural areas with relatively low-to-middle income. Although it seems that foreign-body lodgement is more common in patients from the lower socioeconomic conditions when one considers the location of the hospital and patients included in this study, the results could be distorted.

Clinical signs and symptoms on examination

Most patients (86.3%) were asymptomatic on presentation in this study. Symptoms generally found in the literature may vary from vomiting or refractory wheezing to generalised irritability in swallowing or even breathing.[7] Predominant symptoms found were vomiting (4.2%), followed by chest pain (3.2%) without respiratory distress, as well as abdominal pain (3.2%) in the present study. Uyemura in Salt Lake City in the USA reported only 50% of asymptomatic patients.[10] The low incidence of symptoms reported in the present study can be attributed to a few factors, such as poor record-keeping, language barriers, time constraints and early presentation.

In this study, only a third of the patients (36%) arrived within 8 h after the ingestion of the coin. The median time of arrival was 8 h. This delay could be explained by low socioeconomic problems such as absent child supervision, waiting for parents or ambulance and proximity to the health facilities.

Most patients (69.5%) presented with no signs on physical examination. The most observed signs of oesophageal coin lodgement in the present study were hypersalivation in 17 (17.9%) patients and vomiting in 8 (8.4%) patients. This was in contrast with respiratory signs (dyspnoea, stridor, asthma and cough) and digestive signs (hypersalivation, regurgitation and dysphagia), also reported by Triadafilopoulos *et al*.[11] and Even *et al*.[4] No signs were observed in 66 (69.5%) patients, and they were comfortable. Four patients were uncomfortable and unstable with airway compromise. There were no respiratory discomfort or distress syndrome signs recorded in the files. Even with a delay of more than 8 h, there were a high number of asymptomatic patients. As for the physical signs, the drooling of saliva was the most frequent sign in 17 (17.9%) patients.

Almost all the study patients (95.6%) were stable on presentation. A stable condition in this study refers to patients without airway compromise. The absence of signs in at least 50% of patients with an impacted oesophageal foreign body is not uncommon. A study from Lariboisiere Hospital in Paris on the management and endoscopic techniques for a digestive foreign body and food impaction has also reported the same finding (up to 50% in paediatric series).[12]

Coins were more often lodged in the upper oesophagus (71.6%) at the cricopharyngeus muscle, which is consistent with the literature,[1-9,11-22] including the study by Waltzman *et al*.[13] on the anatomical configuration of the tracheo-oesophageal tree at the Children's Hospital at Harvard Medical School in Boston. This is the narrowest segment compared to the remaining oesophagus.[1,4-25] In contrast, Chinski *et al*., in their study, found that the middle part of the oesophagus was the most frequent area of impaction.[26] The most common impacted coins found were 21 mm (5c) and 22 mm (50c); 23 mm (R2) coin, which is middle-sized coins compared to the 16 mm (10c) and 19 mm (2c), passed without difficulty through the gut. These coin values and sizes are different in different countries and the size is probably only the determinant of impaction. Chen *et al*. reported that infants and children have poor oral control capability and narrower airways, and it may be difficult for them to shift a coin like a quarter to the back of their oral cavity and subsequently ingest it.[24] However, such an incident might prove to be fatal if it lodges in the airways.

Extraction methods and outcomes

Studies by Waltzman and Khan found that in the asymptomatic group, careful medical observation for at least 12 h is recommended for the spontaneous passage of a coin into the stomach.[13,20] In the present study, the paediatric surgical team did not take the same approach in any radiographically confirmed case of an ingested impacted oesophageal coin. Instead, the coin was removed promptly without observing for the spontaneous passage into the stomach. The DGMAH surgical team believes that the duration that a foreign body is retained in the oesophagus is an unreliable variable because the time of ingestion is frequently unknown or inaccurate in their population.

The balloon catheter was solely used for more than half of the patients (65%). The indication was stable presentation within 24 h after ingestion of the coin (as per unit protocol) because delay decreases the likelihood of successful removal and increases the risk of complications, including the risk of perforation.[14] The procedure did not require anaesthesia. The balloon catheter was used in 62 patients and with success in 48 (77.4%) patients with a failure rate of 22% for reasons not recorded in the patient's files. Nonetheless, this failure rate is not too high compared to results by Little *et al*. who reported a 25% failure rate.[15] Van As *et al*. in Cape Town attributed their failure rate to the late presentation by patients which caused oesophageal oedema secondary to impaction.[5]

Harned *et al*. reported that the Foley balloon catheter used for coin extraction under fluoroscopy was successful in 322 (96%) of 337 patients.[14] In their opinion, the Foley catheter method of oesophageal coin extraction is safe and effective. In our opinion, the failure rate of 22% in this record review of 95 patients could be attributed to factors like the inexperience of the registrar who first attended to the patients in this study. The experience of the specific registrar performing the procedure was never evaluated in the study. The other reason for the relatively high failure rate could be that rapid airway oedema developed, as reported in other studies,[5,14] although no reason for the failure was recorded in any of the patient's files. No complications were experienced after this procedure was performed on any of the 62 patients. Consequently, we still consider that even with a failure rate of 22%, the procedure is safe and possibly cost-effective and avoids general anaesthesia for oesophagoscopy. We opt to always consider it first if the patient is stable because in DGMAH, we share the emergency theatre with all adult surgical specialities and invariably there is always a long waiting time for theatre space. These authors recognise that it is generally not recommended to use the Foley balloon catheter for impacted coins for later than 24 h after ingestion as well as the presence of oesophageal abnormality or history of oesophageal surgery. Manning *et al*. showed in their series that the delay did not have a negative impact on the outcome.[25]

The rigid oesophagoscope was used in this study in case of failure with Foley catheter extraction and as the first procedure. It is also recommended when a patient presents at the emergency room more than 24 h after the ingestion of a coin. In the present study, rigid oesophagoscopy was used in 33 patients as a first method (34.7%) and in 14 (14.8%) patients who failed balloon extraction. The coin was successfully removed in all 44 (100%) patients. In three cases, the coin had passed spontaneously into the stomach; therefore, there was no need for coin retrieval. The results in this record review in DGMAH correlate well with the one retrospective study by Lin *et al*. who reported a 100% success rate for removing the coin from the oesophagus by endoscopy at the China Medical University Hospital, Taiwan.[6] The 100% success rate observed in this study indicates that the method is safe and effective with no reported complications. The limitation was the need for general anaesthesia and waiting time on the emergency theatre list that we share with all adult surgical specialities.

In the present study, most of the patients (90%) had no complications. There were no major complications such as perforation, airway impaction or bleeding before or after a procedure. Most of our patients were late presenters, and we still did not have major complications. This is similar to less than one percent reported by Uyemura.[10]

The prolonged hospitalisation in 39% of the patients was a result of either waiting for theatre endoscopy, parents to collect after discharge or waiting for ambulance back to referring hospital. In a retrospective review study by Arms, the length of stay was determined by the management option and was longer for the endoscopic option.[23]

Conclusions

This retrospective cross-sectional descriptive study on paediatric patients with coin ingestion in a South African setting sheds light on the demographics, clinical presentations and management outcomes of such cases. The study underscores the prevalence of coin ingestion in children aged 0–5 years, with a significant proportion hailing from low-socioeconomic backgrounds. The majority of patients were asymptomatic on presentation, emphasising the challenges in early detection. The study's approach to utilising the Foley balloon catheter in the emergency room as a primary extraction method appears to be a safe and effective alternative, particularly in a resource-constrained environment without a readily available theatre. This technique could be applied in two-third of our children without complications. The study recommends that a balloon catheter be used as the first method to extricate an impacted coin in the oesophagus unless contraindicated. Oesophagoscopy is an effective second alternative if the balloon catheter fails. While the findings contribute valuable insights into the local context, the study suggests that with further training and refined patient selection, the success rate of non-surgical interventions for coin extrication could potentially be enhanced.

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Conflicts of interest
There are no conflicts of interest.

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