

An analysis of foreign body ingestion treatment below the pylorus in children

Wei Wu, MD, Zhibao Lv, MD*, Weijue Xu, MD, Jiangbin Liu, MD, Qingfeng Sheng, MD

Abstract

We retrospectively studied records of patients who received conservative therapy or surgical operation for ingested foreign body (FB) located below the pylorus, and aimed to analyze the different treatment methods including prevention or operation of foreign bodies (FBs) when we found them in children of different age.

The records of 16 patients (11 men and 5 women) who were hospitalized for FB ingestion between 2011 June and 2014 June were evaluated retrospectively. Mean age of the patients was 5.5 years (65.9 ± 61.0 mo). Nine patients underwent operations and 7 patients received conservative therapy. Approximately, 75% of the patients or their families recorded a positive FB swallow history. According to the results of plain radiographs, 81% patients had positive FB findings. Five patients experienced intestinal perforation. The mean duration of hospitalization was 9.13 ± 6.29 days.

Intestinal perforation due to FBs is uncommon but needs to be taken into consideration especially when the FB is a magnet. It is not appropriate to give whole nuts to children (age < 2 years). Radiographs should be taken 6 to 12 hours apart, and vital signs should be observed when observing a child who has ingested a sharp FB. Lastly, our society should pay more attention to psychotherapeutic needs in prepubertal children.

Abbreviations: FB = foreign body, FBs = foreign bodies.

Keywords: conservative therapy, foreign body ingestion, magnet, perforation, surgical operation

1. Introduction

It has been reported that 80% to 90% of ingested FBs can be simply passed via the alimentary tract spontaneously. However, 10% to 20% of ingested FBs require endoscopic removal, and 1% or less ultimately require surgery.^[1,2,3]

Patients and their families are rarely aware of ingested FBs, which could cause complete intestinal obstruction or even intestinal perforation.^[4,5,6] The aim of the present study was to report our experience with surgical and conservative management of ingested FBs with specific emphasis on risk groups, including children between 6 months and 3 years of age, adolescents with psychological disorders, object type, site of perforation, and attention to the lower or upper gastrointestinal system.

2. Materials and methods

This study was approved by Shanghai Children's Hospital, affiliated with Shanghai Jiao Tong University. All procedures

performed involving human participants were in accordance with ethical standards and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study.

The medical records of 16 patients (11 men and 5 women) who were hospitalized for FB ingestion between June 2011 and June 2014 were evaluated retrospectively in our hospital.

3. Result:

Nine patients underwent operation and 7 patients received conservative therapy. Mean age of the patients was 5.5 years (range, 10 months–13 years). Mean duration of hospitalization was 9.13 days (3–28 days). The commonly presented symptoms were vomiting in 8 of 16 patients (50%) and abdominal pain in 8 of 16 patients (50%); 12 of 16 patients or families (75%) provided a positive FB swallowing history. A positive finding on physical examination was noted in 83% patients (the most common manifestation was abdominal tenderness). Moreover, 14 of 16 patients (87%) showed had positive findings on plain radiographs (mixed density shadow or incomplete intestinal obstruction), 5 of 16 patients (31%) revealed intestinal perforation at a similar bowel site—the terminal ileum. The summary of the type of ingested FBs for 16 patients is provided in Tables 1 and 2. The type of ingested FBs varied widely, including gastrolith, needles, magnets, and nuts.

4. Clinical manifestations

The duration of ingestion ranged from 1 day to 6 months. The most common presenting symptom was recurrent vomiting (8/16). A positive finding on physical examination was obtained in 50% of patients (the most common manifestation was abdominal tenderness), and in the other 50% of patients, an abdominal radiograph revealed upper or lower gastrointestinal obstructions (8/16). The radiograph also provided information on the location

Editor: Johannes Mayr.

The authors report no conflicts of interest.

Department of General Surgery, Shanghai Children's Hospital, Affiliated to Shanghai Jiao Tong University, Shanghai, China.

* Correspondence: Zhibao Lv, Department of General Surgery, Shanghai Children's Hospital, Affiliated to Shanghai Jiao Tong University, Shanghai 200040, China (e-mail: lvzhibao@sohu.com).

Copyright © 2017 the Author(s). Published by Wolters Kluwer Health, Inc. This is an open access article distributed under the terms of the Creative Commons Attribution-Non Commercial-No Derivatives License 4.0 (CCBY-NC-ND), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.

Medicine (2017) 96:38(e8095)

Received: 4 June 2017 / Received in final form: 12 August 2017 / Accepted: 15 August 2017

<http://dx.doi.org/10.1097/MD.0000000000008095>

Table 1**Summary of surgical operation group.**

Reference no.	Age	Sex	Duration of foreign body ingestion	Clinical symptoms	Physical examination	The site of obstruction (* perforation)	Preoperative diagnosis
1	13y	Male	13d	Constipation 13 days	(-)	Junction of sigmoid colon and rectum	Distal intestinal obstruction, anorectal injury
2 [†]	9y	Female	11d	Hypogastric pain Vomiting	Abdominal tenderness (+)	Descending part of duodenum	Incomplete intestinal obstruction FB stomach
3 [‡] (Fig. 6)	8y	Male	3d	Abdominal pain Recurrent vomiting	Dehydration Abdominal tenderness (+)	40 and 65 cm distal to the ligament of Treitz, respectively, and ileum*	Acute abdominal pain FB ingestion
4 (Fig. 3)	10m	Male	1d	Right inguinal Irreducible mass Recurrent vomiting	Right inguinal mass	Terminal ileum*	Right inguinal incarcerated hernia
5 [§] (Fig. 5)	6y	Female	6m	FB in stomach Vomiting	(-)	Pylorus	Gastroilethiasis
6 (Fig. 4)	1y	Male	7d	Abdominal distension Vomiting	Abdominal tenderness (+)	Terminal ileum*	Abdominal distension
7	1y	Male	5d	Abdominal pain Vomiting	Abdominal tenderness (+)	40 and 25 cm distal to the ligament of Treitz, respectively, and ileum*	Acute abdominal pain FB ingestion
8	8y	Female	3m	Vomiting	Upper abdominal mass	Descending part of duodenum	Intestinal obstruction
9	4y	Male	1d	FBs	(-)	Terminal ileum	FB ingestion

FB = foreign body; FBs = foreign bodies.

*The site of perforations.

[†]The patient ate hair and cotton line since 3 years old.

[‡]Emergency hospitalization (PICU).

[§]The patient suffered from psychiatric disorder and frequently ingested foreign bodies.

Table 2**Postoperative information of patients.**

Reference no.	Plain abdominal film	Objects	Treatments	Hospital stay (d)
1	Distal intestinal obstruction	Melon seed shells 200 g	Rectal foreign body removal surgery	6
2	Gastric foreign body shadow	Hair	Laparotomy + upper gastrointestinal foreign body removal	11
3	Intestinal foreign body shadow Incomplete intestinal obstruction	Two bucks of magnets	Laparoscopy + intestinal resection and anastomosis	28
4	(-)	Melon seed shells	Surgical treatment of bowel obstruction and intestinal repair + intestinal repair	13
5	High-density mass in stomach	Trichobezoar (hair 500 g)	Endoscopic-assisted gastric foreign body removal surgery	9
6	Air-fluid level Incomplete intestinal obstruction	Seeds of red dates	Adhesiolysis Intestinal resection and anastomosis	15
7	Intestinal foreign body shadow Incomplete intestinal	Four bucks of magnets	Laparoscopy + intestinal resection and anastomosis	10
8	Gastric foreign body shadow	Trichobezoar	Endoscopic-assisted gastric foreign body removal surgery	10
9	Intestine foreign body shadow	Needle	Laparoscopy + intestinal repair	11

of the object in 10 of 16 patients (62.5%) and whether the object had a high density, such as magnets. However, 2 patients showed a negative result in the abdominal radiograph.

We observed a correlation between perforated hole size/number and the type of objects. For instance, an 8-year-old boy with abdominal pain and recurrent vomiting for 3 days was admitted to our pediatric intensive care unit. Physical examination revealed that his abdomen was distended and tender, and his bowel sound was increased; his leukocyte count was 12,000/

mm.^[5] Moreover, a plain abdominal radiograph showed increased air-fluid levels in the small intestine and 2FBs arranged in a line. Thus, we diagnosed this case as intestinal obstruction caused by FB ingestion. After preoperative preparation and emergency exploratory laparotomy were performed, 2 bucks of magnets were found to be located in the jejunum a colon, attracting each other through the intestinal wall and clamping the ileum, thereby forming a sandwich-like structure where the ileum wall was perforated. Another 10-month-old boy was brought to

Table 3**Summary of conservative therapy group.**

Reference no.	Age	Sex	Duration lodgment	Clinical symptoms	Objects	Treatments	Hospital stay (d)
10 (Fig. 2)	21m	Female	6h	FBs	Needle	Fasting	4
11	17y	Male	4d	FBs	Needle	Fasting	4
12	2y	Female	3d	Vomiting	Needle	Fasting	3
13	13m	Male	4d	Repeated intussusception	Cap of pen	Air enema	4
14	10y	Male	4d	(-)	Blade of a knife	Fasting	4
15	4y	Male	4d	Abdominal pain	Mercury from broken thermometer	Fasting and enema	10
16	4m	Male	4d	(-)	Mercury from broken thermometer	Fasting and enema	4

FB = foreign body; FBs = foreign bodies.

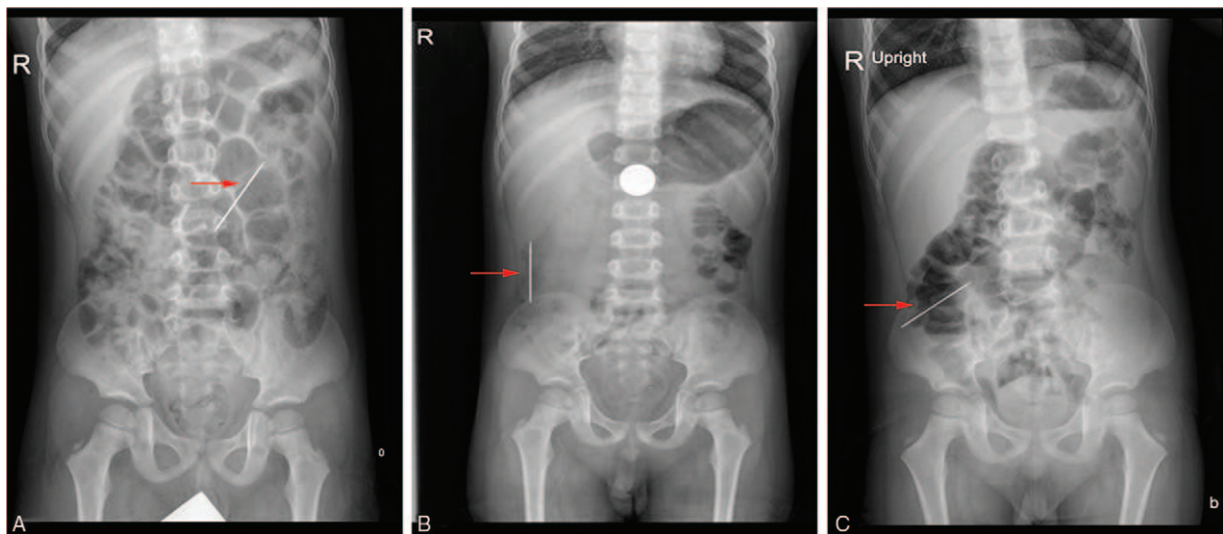


Figure 1. (NO9) A 4-year-old boy visited in the outpatient service because of swallowing FBs and conservative therapy failed, plain abdominal film showed perforation of a needle. FBs=foreign bodies.

our hospital owing to a right inguinal irreducible mass and recurrent vomiting for 1 day. Upon admission, no abdominal distension or signs of peritoneal irritation were discovered, and his vital signs were within the normal limit. The leukocyte count was 7600/mm,^[5] whereas the other laboratory findings were nonspecific. The finding of the abdominal radiograph was also negative. Surprisingly, when the surgeon opened the hernia sac, muddy peritoneal exudate was mixed with manure. The doctors reconsidered potential peritonitis, and the surgeon performed a laparotomy. The child was finally diagnosed with perforation of the ileum and secondary inguinal hernia because of melon seeds that caused the intestinal perforation.

Nine patients underwent an emergency exploratory operation after observation. A 13-year-old boy with constipation for 13 days was operated under anesthesia for rectal FB removal that was cleared at the junction of the rectum sigmoid; congestion and edema were discovered in the anorectal wall. A 6-year-old girl suffering from psychosocial alteration presented with a trichobezoar. In an endoscopically assisted laparotomy we removed a

trichobezoar weighing 500 g. The 16 patients had an uneventful postoperative recovery, without any significant complications.

5. Discussion

In the conservative group (Table 3), the most common FB is a coin.^[7–10] However, needles and blades were included in this group owing to their specific characteristics. A 4-year-old boy visited the outpatient clinic because he had swallowed a needle. Conservative therapy failed, and a plain abdominal radiograph showed perforation owing to the sharp needle. This patient required intestinal repair by laparoscopy (Fig. 1). Fortunately, the other patients who ingested needles or blades were successfully treated with conservative therapy (Fig. 2). For this group, we aimed to emphasize that abdominal radiography at a 6 to 8 hours interval, along with monitoring vital signs, is necessary.^[11,12]

In the operation group, FB ingestion does not follow a specific and accurate definition. The types of ingested FBs differ among countries according to feeding habits and cultural features.

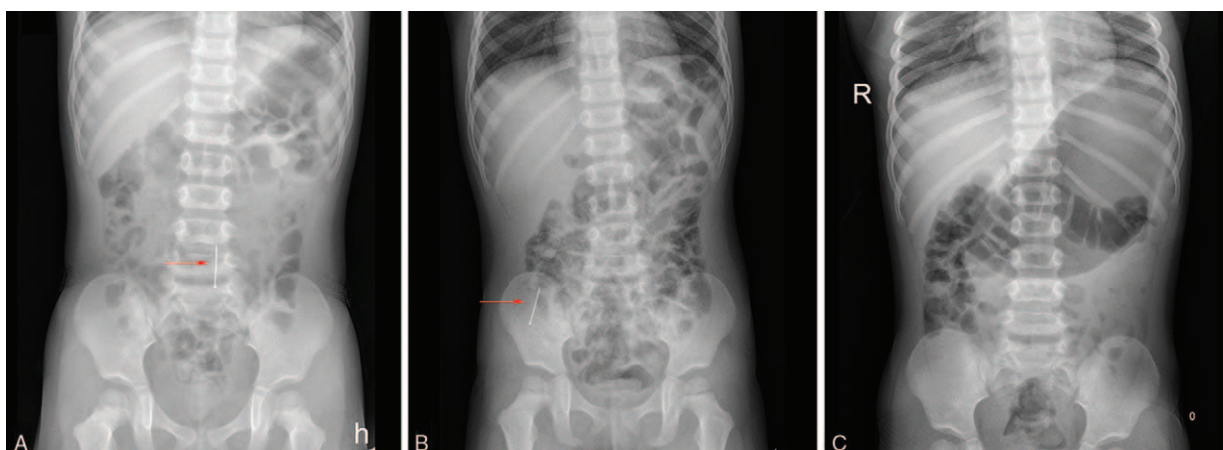


Figure 2. (NO12) A 2-year-old boy ingested a needle 3 days before admission. Conservative therapy was successfully applied.



Figure 3. (NO1) A 10-month-old boy with the right inguinal irreducible mass and recurrent vomiting for 1 day. Intraoperative photograph shows perforation of the terminal ileum owing to melon seeds (A, arrow).

Grandparents in China have to and love to raise their grandchildren, as the parents are working. Conventional families prefer to eat melon seeds, nuts, and red dates. As a result, such families and some young, inexperienced parents who do not have an accurate definition of FB for children, may give some of the seeds to their babies to lick and swallow, which results in ingestion of FBs (Figs. 3 and 4). This group of patients exhibits a psychological problem. A retrospective discussion of the medical history of case no. 2, 5, and 8 necessitates psychotherapy rather than operative treatment. The age of the patients varied from a broad range, 10 months to 13 years, which is in contrast to the basic sense. Therefore, children of all age groups may possibly ingest FBs, but may not provide a positive history. Moreover, a negative history does not exclude the possibility of FB ingestion, and the surgeon should raise suspicion in order to avoid overlooking an ingested FB. Furthermore, we describe some salient points for the surgical treatment of gastrointestinal FBs. First the endoscopic-assisted operation is a better treatment method when it is necessary to remove an FB in the stomach through open surgery. Endoscopy could support convincing visualization in upper gastrointestinal trace exploration and aid in making a small incision (Fig. 5). Second, in infants, for example, cases no. 4 and 6 exhibited unexplained incomplete/complete intestinal obstruction or acute peritonitis. Finally, a special emphasis was required for case no. 3. This 8-year-old boy showed the most severe clinical symptoms and had to be admitted to the pediatric intensive care unit directly (Fig. 6). If a child

swallows only one magnet, it may not be a serious problem. However, if several magnets are ingested, and are divided into several groups owing to the limited space in the pylorus, they can attract to each other through the intestinal wall. This continually exerts pressure and brings about a fistula formation or perforation and may even be fatal. In summary, magnets must be detected and treated at the earliest symptom.^[13–16]

More emphasis to FB ingestion should be given in some patients with unexplained incomplete or complete intestinal obstruction or acute peritonitis. Some families are ignorant about FBs (such as different nuts) in infants, leading to tragedies. By contrast, they tend to swallow hazardous materials (such as hair and blades) to receive family attention. Therefore, in patients with unexplained acute peritonitis who ultimately require operative treatment, routine examination of the sigmoid colon, rectum, or distal ileum is essential. Laparotomy and colostomy were not found to be necessary for any patient.

6. Conclusions

Intestinal perforation from FBs is uncommon, but needs to be taken into consideration especially when the FB is magnets. It is not appropriate to give whole nuts to infants (age <2 year). Radiographs should be taken 6 to 12 hours apart, and vital signs should be monitored when a child is observed with a history of FB ingestion. Lastly, our society should pay more attention to psychotherapeutic needs in prepubertal children.



Figure 4. (NO6) A 1-year-old boy was admitted to the outpatient service because of abdominal distension and vomiting for 7 days. Intraoperative photograph shows perforation of the terminal ileum owing to red dates seed (B, arrow).

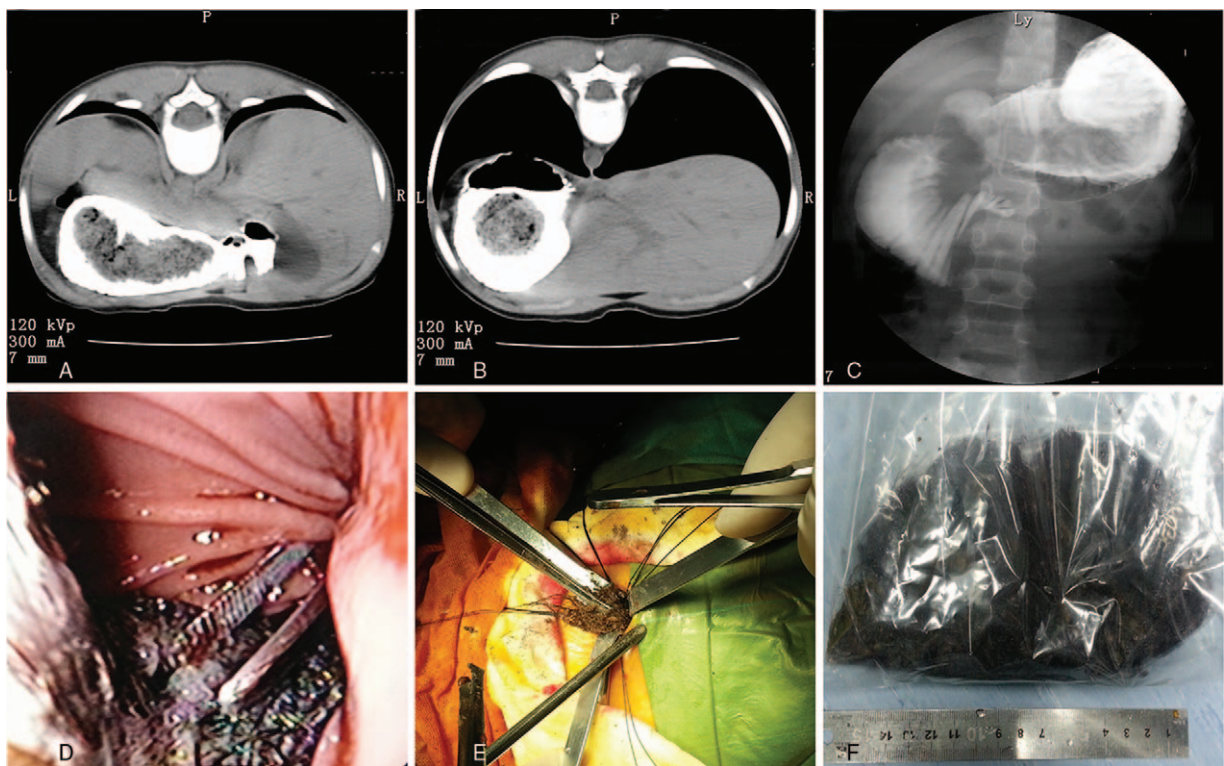


Figure 5. (NO5) A 6-year-old girl suffering from psychological alteration developed a trichobezoar. Her parents were unaware of her habit to eat hair. A trichobezoar weighing 500 g was removed by endoscopic-assisted gastric foreign body removal surgery.

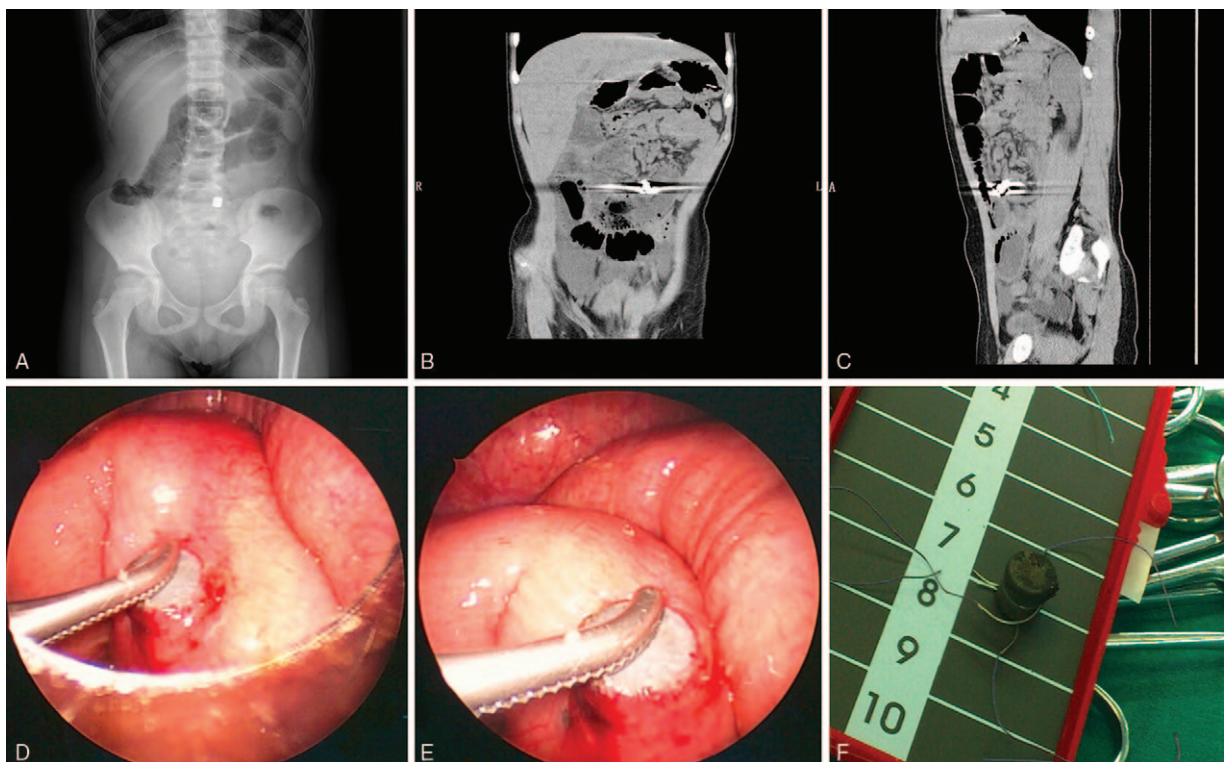


Figure 6. (NO7) A 8-year-old boy suffered from abdominal pain for 3 days. Plain abdominal x-ray images showed gastrointestinal perforation and a FB of high density in the abdomen. FB=foreign body.

References

- [1] Panieri E, Bass DH. The management of ingested foreign bodies in children—a review of 663 cases. *Eur J Emerg Med* 1995;2:83–7.
- [2] Dutta S, Barzin A. Multiple magnet ingestion as a source of severe gastrointestinal complications requiring surgical intervention. *Arch Pediatr Adolesc Med* 2008;162:123–5.
- [3] Velitchkov NG, Grigorov GI, Losanoff JE, et al. Ingested foreign bodies of the gastrointestinal tract: retrospective analysis of 542 cases. *World J Surg* 1996;20:1001–5.
- [4] Arana A, Hauser B, Hachimi-Idrissi S, et al. Management of ingested foreign bodies in childhood and review of the literature. *Eur J Pediatr* 2001;160:468–72.
- [5] Yalçın S, Karnak I, Ciftci AO, et al. Foreign body ingestion in children: an analysis of pediatric surgical practice. *Pediatr Surg Int* 2007;23:755–61.
- [6] Wahbeh G, Wyllie R, Kay M. Foreign body ingestion in infants and children: location, location, location. *Clin Pediatr (Phila)* 2002;41:633–40.
- [7] Cheng W, Tam PK. Foreign-body ingestion in children: experience with 1,265 cases. *J Pediatr Surg* 1999;34:1472–6.
- [8] Chung JH, Kim JS, Song YT. Small bowel complication caused by magnetic foreign body ingestion of children: two case reports. *J Pediatr Surg* 2003;38:1548–50.
- [9] Berg DA, Tynan MG, Grewal H. Magnets in the stomach. *J Pediatr Surg* 2006;41:1037–9.
- [10] Jayachandra S, Eslick GD. A systematic review of paediatric foreign body ingestion: presentation, complications, and management. *Int J Pediatr Otorhinolaryngol* 2013;77:311–7.
- [11] Lai AT, Chow TL, Lee DT, et al. Risk factors predicting the development of complications after foreign body ingestion. *Br J Surg* 2003;90:1531–5.
- [12] Hesham AH. Foreign body ingestion: children like to put objects in their mouth. *World J Pediatr* 2010;6:301–10.
- [13] Strickland M, Rosenfield D, Fecteau A. Magnetic foreign body injuries: a large pediatric hospital experience. *J Pediatr* 2014;165:332–5.
- [14] Klein K, Pegoli W, Lee YH. Transluminal migration of ingested foreign body without peritonitis. *J Pediatr Surg* 2012;47:788–91.
- [15] Lee JH, Kim HC, Yang DM, et al. What is the role of plain radiography in patients with foreign bodies in the gastrointestinal tract? *Clin Imaging* 2012;36:447–54.
- [16] Ozkan Z, Kement M, Kargı AB, et al. An interesting journey of an ingested needle: a case report and review of the literature on extra-abdominal migration of ingested foreign bodies. *J Cardiothorac Surg* 2011;6:77.