

A Tale of Three Foreign Bodies

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Abstract

It has been exactly 100 years since Sigmund Freud proposed Oedipal complex as explanation for the increased incidence of foreign bodies in pediatric population, though experts are still arguing about the validity of the argument. But it is an undeniable fact that foreign bodies are far too frequent in pediatric age group. It is also an accepted fact that in the best-case scenario these can be an unnecessary nuisance (e.g. plastic bead in nostril), but at times these can be lethal (e.g. airway foreign bodies). We report three varied cases of foreign bodies that presented to our hospital. Each one more interesting than the other.

CASE REPORTS

Case 1: A 3-year-old boy presented to the emergency department with abdominal pain and vomiting. Clinical examination indicated generalised rigidity of abdomen and signs of peritonitis. Radiological examination confirmed the presence of intestinal obstruction with free fluid in abdomen. Also, a string of beads (Fig. 1) was seen distinctly on x-ray of abdomen. Patient was taken to theatre after stabilization for emergency laparoscopic exploration. After rapid sequence induction and endotracheal intubation, laparoscopy begun. The string of beads seen on x-ray was found to be magnetic beads stuck to one another and doubled on itself by magnetic attraction. The magnetic beads were very difficult to extract since the laparoscopy instruments manipulation was frequently interrupted by beads within the loops of intestine, getting stuck to instruments. Hence converted to laparotomy. After successfully removing magnetic beads, total of nine perforations were identified and closed. Abdomen was closed and patient was transferred to ITU for postoperative care.

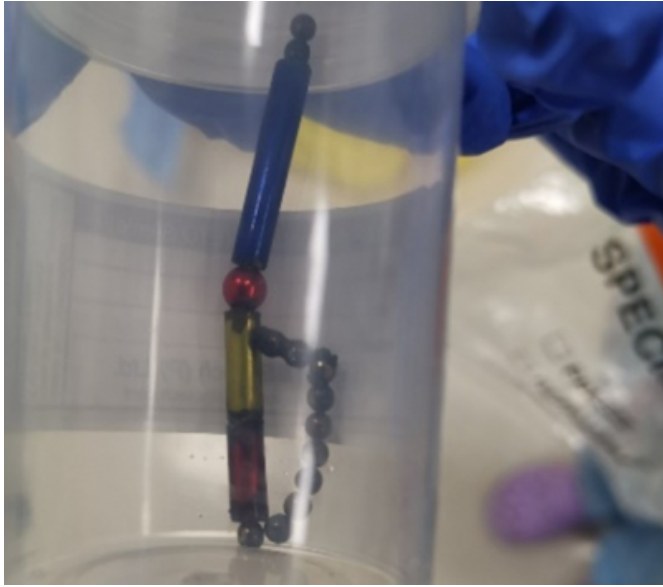
Figure 1a

Magnetic foreign body in duodenum



Figure 1b

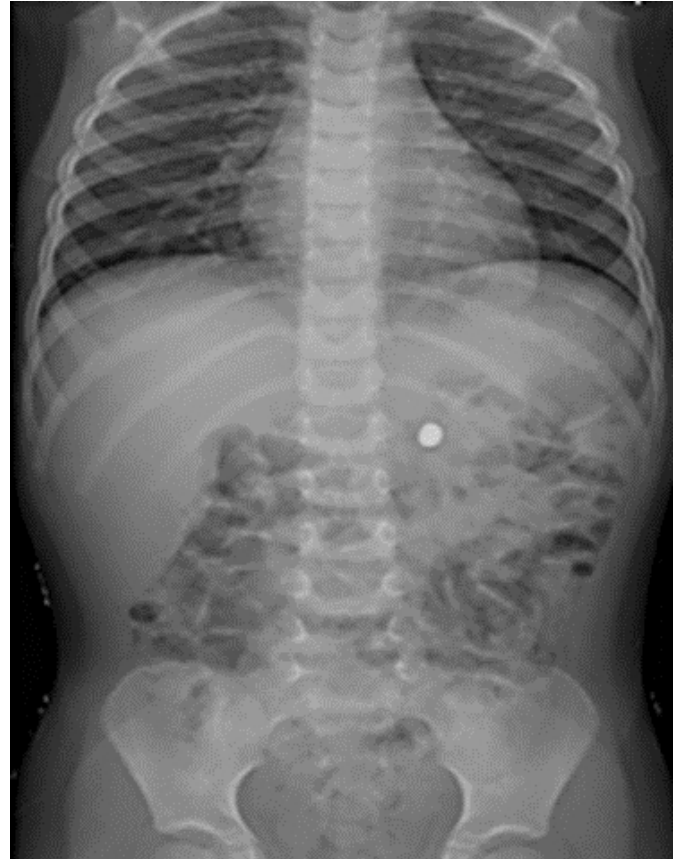
Magnetic foreign body in duodenum



Case 2: A 5-year-old presented to emergency department with severe abdominal pain, fever and vomiting. Clinical examination and blood works indicated peritonitis with early stages of septicemia. Radiological examination showed a button battery (Fig. 2) encapsulated by diffuse mass like lesion. Plenty of free fluid was also detected. After rapid sequence induction and endotracheal intubation, laparotomy commenced. The button battery ingested was found between third and fourth part of duodenum. It had caused severe necrosis of gut wall and the peritoneum adherent to it caused the mass like appearance on CT-scan. After extensive debridement, resection of affected segment and end to end anastomosis, abdomen was closed. Patient was transferred to ITU for postop recovery.

Figure 2

Button battery in duodenum



Case 3: A 10-year-old child presented to emergency, who during consumption of a meal of fish, started to cough and gag. He was in obvious distress due to pain on swallowing and was drooling copiously. After radiological confirmation of fish bone (Fig. 3) in upper esophagus, he was taken for endoscopic removal of foreign body. Anesthesia was induced with rapid sequence induction and endotracheal intubation. Despite extensive searching, for a long time all that could be visualized was edematous, erythematous mucosa. Finally, after nearly one-hour search, the tip of fish bone was seen and bone was extracted in toto. Patient was extubated uneventfully and sent to recovery ward.

Figure 3

Fishbone foreign body in esophagus



DISCUSSION

Nearly half of pediatric foreign body ingestion are unwitnessed, though nearly half of confirmed foreign body (FB) ingestions are asymptomatic. But button batteries, magnets, large objects (>6 cm length, >2 cm width) and sharp objects (including fish bone) are recognized as hazardous foreign bodies. Most hazardous foreign bodies are radio opaque, hence chest X-ray is often the initial investigation of choice, not only to diagnose foreign body, but also to refer to appropriate specialty.

Most smooth, small foreign bodies, once pass esophagus, usually are expelled naturally. In case of obstructed foreign bodies, most are radiopaque, but wooden, plastic, and glass objects, as well as fish and chicken bones, may not be seen on radiographs.¹

Because contrast studies pose a risk of aspiration and compromise subsequent endoscopy, an expert panel⁴ recommended endoscopy rather than barium study if radiographs are negative. Computed tomographic scans, ultrasonography, and magnetic resonance imaging also have been used to identify radiolucent foreign bodies.^{2,4}

If an object is in the esophagus, removal is considered mandatory. The airway should be protected with an

endotracheal tube during removal, particularly critical if the patient has been fasting for <8 hours. Timing of endoscopy is decided by clinical status of the patient, the time of the patient's last oral intake, type of foreign body, and location within the gastrointestinal (GI) tract. Generally speaking, timing can be divided into categories of emergent (<2 hours from presentation, regardless of fasting status), urgent (<24 hours, 6 hours fasting) and elective (24 hours from presentation, following usual NPO guidelines).

Button battery FB: The first case of a button battery ingestion (BBI) was reported in 1977 in a child swallowing camera battery lodged on the proximal esophagus.¹ Though it used to be 2% of all pediatric foreign bodies, recently the rate of significant complications and death resulting from BBI has increased almost 7-fold.² In the literature, four mechanisms of injury have been suggested: (1) leakage of the battery contents with direct corrosive damage, (2) direct electrical current effects on the mucosa and resultant mucosal burns, (3) pressure necrosis resulting from prolonged local pressure on the tissue, and (4) local toxic effect due to absorption of substances: this can be the case in mercuric oxide batteries.^{3,5-9} The primary mechanism of injury is the generation of electrolytic current that hydrolyzes tissue fluids and produces hydroxide ions at the battery's negative pole.⁴ This creates a highly alkaline environment that raises the local tissue pH up to 12 or 13, leading to liquefactive necrosis of adjacent tissues. They may also cause perforation and erosion into adjacent structures, including the airway, vasculature, mediastinal structures, or spinal cord. The development of an aorto-esophageal fistula is an ominous finding, as there are only four reported cases of survival in the literature.¹⁰⁻¹⁴

Button batteries that are lodged in the esophagus pose the greatest risk, requiring prompt removal. Endoscopic removal of esophageal batteries is essential to determine the extent of injury and anticipate complications. Once it has passed into stomach, serial x-rays determine the need for further intervention. Adjuvants like honey, dilute acetic acid have all been tried to limit the degree of mucosal damage, but the level of evidence is quite poor and large, randomised studies are needed to delineate the proper protocol.

Magnetic FB: In general, ingesting more than one magnet can potentially lead to severe gastrointestinal injury, such as mural pressure necrosis, bowel perforation, peritonitis, intra-abdominal sepsis, fistula formation, volvulus, intestinal obstruction, ischemia, and death.^{15,16,17-19} In our case, primary

injury was due to strong magnetic forces, which adhered two different loops of bowel together during peristalsis. This led to vicious cycle of Impaired peristalsis, kinking and twisting of bowel loop, ischemia, and necrosis of the gut, which resulted in multiple perforations and peritonitis.

Advancement in technology created neodymium-iron-boron magnets that are approximately 10-20 times more powerful than traditional ferrite magnets and are often sold in packs of multiple, colourful beads.²⁰ Though ingestion of single bead can be managed expectantly, multiple bead ingestion almost always needs either endoscopic or surgical intervention.

Many countries have passed legislative rules regarding toys containing button batteries, but no such legislative rule is available for magnetic toy beads. Probably this reflected by the age and circumstances of ingestion as well. Population that ingests BBs are usually younger and acquire BBs accidentally, usually due to parental oversight. But the population that ingests magnetic FBs are older children, even teens and the toys are purchased by the parents themselves. Play simulations like tongue piercing ornaments, when done with magnetic foreign bodies, the risk of accidental ingestion rises significantly.²¹ Lack of realisation of risks is undoubtedly a major reason for parental attitude towards these magnetic beads.

Fish bone FB (FB): Fish bone foreign body (FBFB) is the most frequent food-associated foreign body (FB) in adults, especially in Asia, though it is uncommon in pediatric population.²²⁻²⁴ When they do occur, esophageal sphincters are usually common sites of impaction. FBFB needs emergent treatment, preferably within 2 hours, and definitely within 6 hours. In FBFB, esophageal penetration or perforation reportedly occur in >50% of cases.²⁵ If long standing this can result in infection and adjacent organ damage. Most severe of which is aorto-esophageal fistula, necessitating thoracic surgery. Once FBFB crosses esophagus, almost always, stomach acid dissolves or softens bone, eliminating risk of perforation. As a diagnostic modality, CT is superior to plain radiography for localizing and identifying FB and is highly reliable for localizing FB in the esophagus.²⁵ Once identified, even retrieval of FBFB is a considerable risk since abrasions and perforations can happen during retrieval. Hence appropriate retrieval device should be selected according to need of case on individual basis.²⁵

CONCLUSION

Management of pediatric foreign bodies remains one of the most challenging endoscopic and surgical dilemmas faced by pediatric team. This is made more difficult by the lack of prospective, multicentre trials to provide a strong evidence base to develop guidelines. We feel this unfortunate situation can be best managed by primary prevention. But this needs strong legislative rules and extensive parental education regarding dangers of pediatric FBs. We also feel magnetic beads are so dangerous that its production as well as sale as toys should be banned.

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