BMJ Case Reports

Unusual association of diseases/symptoms

Plastic bag clip discovered in partial colectomy accompanying proposal for phylogenic plastic bag clip classification

Larisa M Lehmer,[1] Bruce D Ragsdale,[1] John Daniel,[2] Edwin Hayashi,[3] Robert Kvalstad[4]

[1]Western Dermatopathology Department, Central Coast Pathology, San Luis Obispo, California, USA;
[2]HotHouse Productions, Berkeley, California, USA;
[3]Associated Surgeons, San Luis Obispo, California, USA;
[4]Arroyo Grande Community Hospital, Arroyo Grande, California, USA

Correspondence to Dr. Bruce D Ragsdale, bragsdale@ccpathology.com

Summary

A plastic bag clip was incidentally found anchored in the mucosa of a partial colectomy specimen 2.6 cm proximal to a ruptured diverticulum for which the patient, a mentally retarded, diabetic, 58-year-old man, underwent surgery. Over 20 cases of accidental ingestion of plastic bag clips have been published. Known complications include small bowel perforation, obstruction, dysphagia, gastrointestinal bleeding and colonic impaction. Preoperative diagnosis of plastic clips lodged in the gastrointestinal tract is frustrated due to radiographic translucency. This occult threat could likely be prevented by the design of gastrointestinally safe, plastic-bag-sealing devices. Presented here is a morphologically based classification of bag clips as a possible guide for determining the most hazardous varieties and to aid further discussions of their impact on health.

BACKGROUND

Plastic bag clips, also known as *bread ties*, were developed by Floyd G Paxton, founder of Kwik Lok, in 1952. Originally mass produced for Pacific Fruit as a replacement for rubber bands in apple packing, plastic bag clips are currently used to secure a number of bagged food stuffs.[1] The first mention of gastrointestinal pathology due to plastic clips was in 1975, and over 20 cases of plastic clips adherent to the intestinal mucosa have been reported since.[2 3] The clips' tooth-like 'claws' enable gripping of various widths of intestinal wall leading to perforation or stricture if the full thickness of the wall is trapped. Entrapment of mucosa has resulted in necrosis whereas the free edge of the clip has been known to erode away the opposite intestinal wall.[4] The clip may release and travel back into the lumen of the intestine only to reattach, thereby creating multiple mucosal ulcerations.[5] The majority of cases reported have been located in the small bowel although plastic bag clips have also been found in the oesophagus[6] and large bowel.[4] To date, three postoperative deaths have occurred in association with resection related to a plastic bag clip in the gastrointestinal tract.[7 8] Some plastic bag clips have been merely found at autopsy.[3 6 9]

CASE PRESENTATION

A 58-year-old white male with a history of mental retardation, diabetes, kidney stones and hyperlipidemia entered

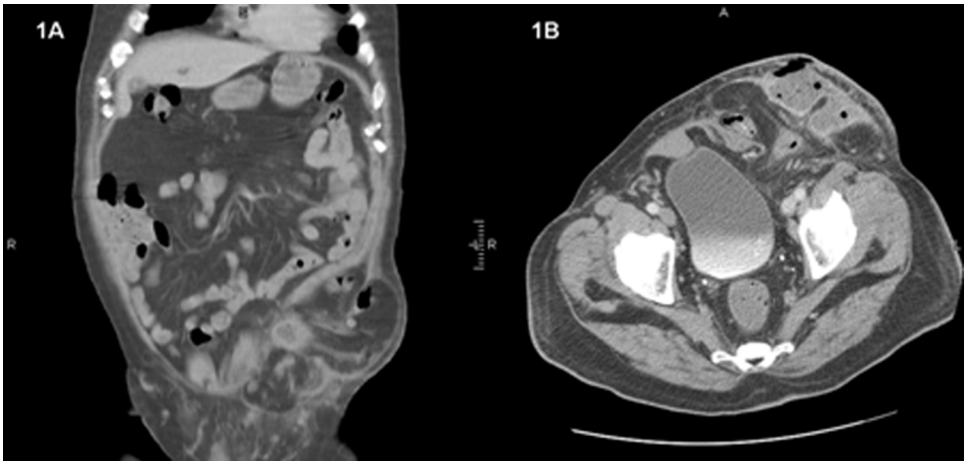

Figure 1 CT panels. (A) A non-strangulating and non-obstructing, chronic incarcerated ventral abdominal hernia projects as a dome from the left lower quadrant. (B) Five days after (A) inflammatory changes of adjacent subcutaneous tissues include gas in a colocutaneous fistula. No bread tie is apparent in either study.

Figure 2 *Toxodenta*, found incidentally 3 cm proximal to the perforated diverticulum responsible for the colocutaneous fistula.

the emergency room with complaints of fever, dizziness, vomiting, chills and increased difficulty in breathing. The patient did not complain of constipation or symptoms of obstruction. Mild sepsis accompanied pneumonia as determined by chest x-ray. Erythema, warmth and discomfort in the left abdominal wall motivated administration of Zosyn out of concern for an abscess. A CT scan of the abdomen did not show an abscess but revealed a ventral abdominal hernia (figure 1A). It was determined in consultation that the patient had a chronic incarcerated ventral hernia, non-strangulating and non-obstructing. He was discharged from the hospital 4 days after admission to see a gastroenterologist on an outpatient basis.

The patient returned to the hospital 2 days later with feculent drainage from the left lower abdominal wall and positive bowel sounds. His white count was 12 200, and urinalysis was negative. A CT scan of the pelvis taken on a General Electric Light Speed four-detector helical scanner revealed the presence of a ventral hernia measuring approximately 9 × 4 cm with extension of the bowel towards the left accompanied by an abnormal collection of fluid and air extending through a defect in the abdominal wall. No foreign body was visible on CT. Inflammatory changes of the adjacent subcutaneous tissues were apparent (figure 1B). As orally administered gastrointestinal contrast was not in the region for distinction, a diagnosis of a local abscess or abnormal herniated bowel could not be definitively made.

An exploratory laparotomy accomplished reduction and repair of a chronically incarcerated left lower quadrant incisional hernia, left partial colectomy and the mobilisation of splenic flexure. The sigmoid colon was incarcerated in the hernia, without obstruction. Dense inflammatory adherence of the sigmoid colon to the

Table 1 *Archignatha*: first tooth, *Haplognatha*: one tooth, *Acutignatha*: sharp tooth, *Tridenta*: three teeth, *Toxodenta*: curved teeth, *Corrugata*: corrugated

Occlupanidae: known orders		
		Distinguishing characteristics
	Archignatha	Lack dentition in the oral groove. They range in size from 22 mm to over 43 mm. They are most commonly found in bulk food stores in unbagged clusters. Some possess lateral palps.
	Acutignatha	Identified by a single sharp dental process in the oral groove. There are relatively few species.
	Toxodenta	They are identified by having curved processes on the sides of the oral groove, but note in the center. Most species have lateral palps, giving them a wavy, uneven appearance.
	Haplognatha	Identified by the single squared-off dental process in the middle of the oral groove. This order contains a vast amount of species.
	Tridenta	Identified by the three dental processes within the oral groove. There are few variations of species.
	Corrugata	Identified by the tightly constricted and lobed oral groove. Few specimens recorded.

BMJ Case Reports 2011; doi:10.1136/bcr.02.2011.3869

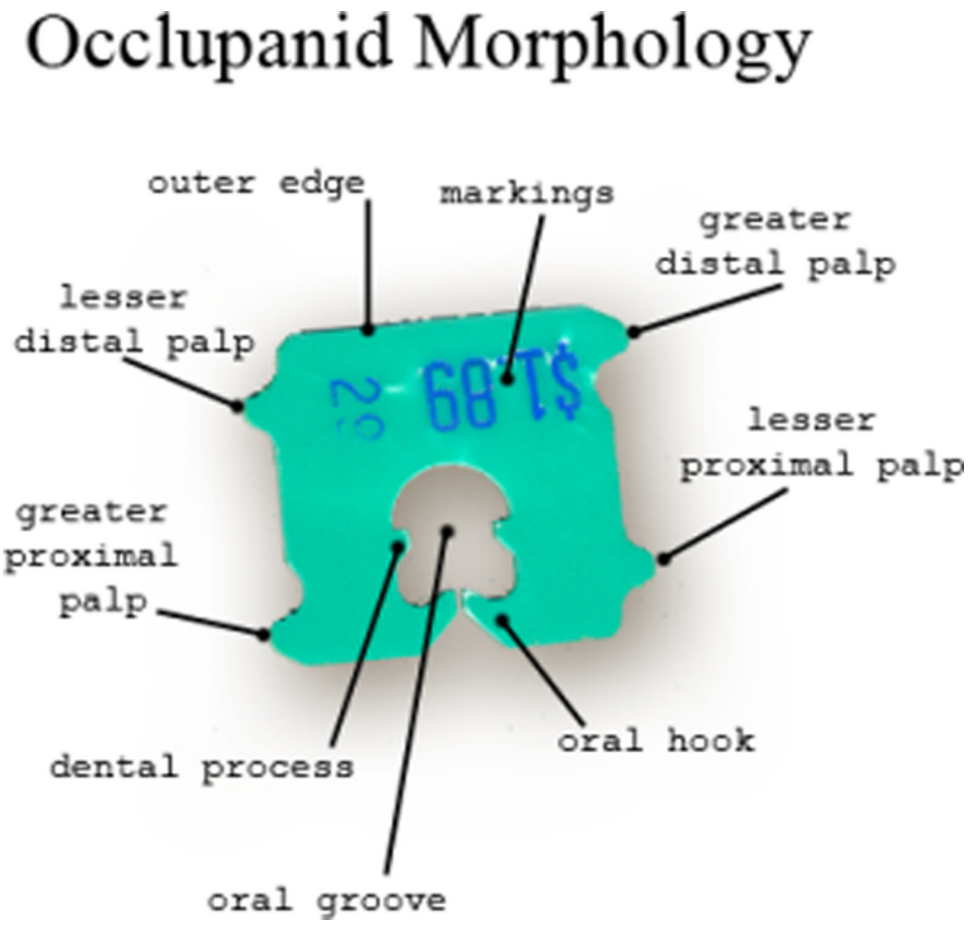

Figure 3 Markings may be worn off or absent from bread clips found in situ, making it more difficult to assess the time of ingestion. Palps, hooks and processes enable the occlupanid to adhere to the walls of the gastrointestinal tract (http://www.horg.com/horg/intro.html).

left lower quadrant abdominal wall mimicked malignancy. After resecting this segment, and in the absence of adjacent adhesions, a primary anastomosis rather than a colostomy was elected. The left lower quadrant abdominal wall was repaired with retention sutures. The resected left colon and products of debridement of the hernia cavity were sent to pathology.

Pathologic examination of the colon demonstrated that a ruptured diverticulum was the origin of a dissecting sinus tract that extended longitudinally in the plane between the outer muscularis and paracolic fat as described by Ferruci *et al*.[10] The cryptitis, crypt abscesses, dense chronic inflammation, granulomas and architectural changes of inflammatory bowel disease were not represented.

The colonic luminal diameter at the fistula was narrowed to 2 cm. The fistulous tract extended from the mucosa to the bowel's external surface. A 2 × 2 cm plastic clip was merely an incidental finding within the colon lumen anchored in mucosa 3 cm proximal to a ruptured diverticulum measuring approximately 2.6 cm in length (figure 2). It was apparent the clip had been in the colon long enough for its surface markings to have been eroded away.

OUTCOME AND FOLLOW-UP

The patient's recovery was uneventful, and he was discharged 11 days after surgery. Two months later, he was deemed fully recovered.

DISCUSSION

Accidentally ingested plastic bag clips represent a potentially fatal health hazard. They have been identified as a cause of local perforation[11] or obstruction at several sites in the gastrointestinal tract as well as surprise incidental findings in the distal small intestine at autopsy.[12] In three cases, the ingestion of a plastic bag clip proved fatal.[7 8] The initial report of such a gastrointestinal foreign body was in 1975 at Toronto Western Hospital.[2] The next report was a series of three plastic bag clips attached to small bowel mucosa discovered incidentally when other disease processes prompted surgery.[13]

A series of five cases was published by Newell *et al*. Three presented as small bowel perforation, in the fourth the clip was found incidentally in the small bowel at laparotomy during vascular surgery and in the fifth case the clip was found incidentally in the small bowel at autopsy.[3] None of the cases in the study produced conventional or CT radiographic evidence of a foreign body in the gastrointestinal tract. The radiologist co-author of the present case report (RK) experimented by placing three different plastic clips in the CT scanner in order to determine whether they would give a signal; nothing showed up on the scan. However, Guindi *et al* assert that in two out of three cases where radiographs were taken, an accumulation of calcium, phosphate and oxalate bile salts on the plastic ties caused them to show up as 'opaque densities' in which

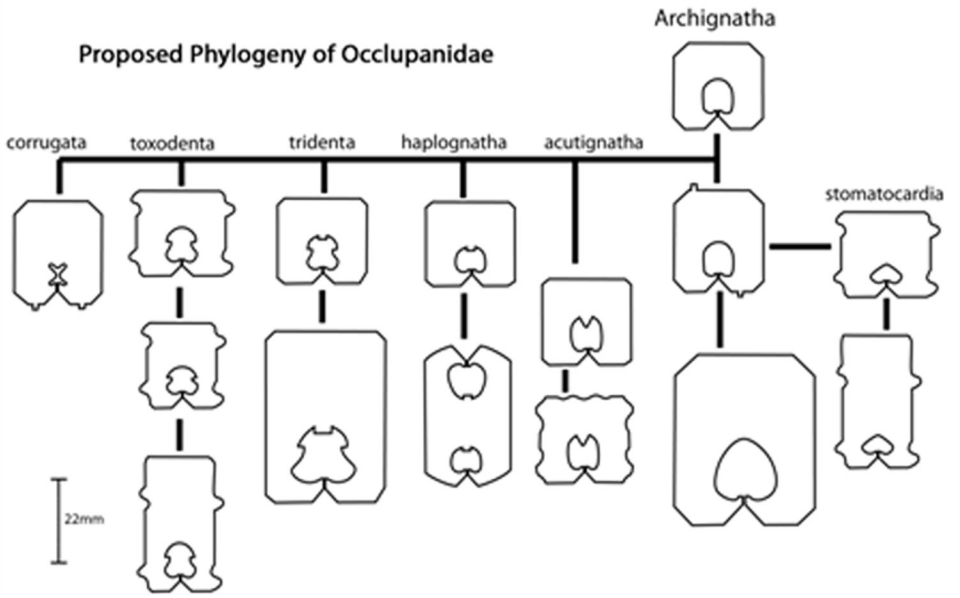

Figure 4 Phylogeny of known species of occlupanids.

the tie's characteristic configuration was identifiable on close inspection.[13] Tang *et al* assert that while conventional radiographs and CT scans revealed small bowel obstruction, the cause could not be identified through either method.[14] It is possible that in the two cases where plastic bag clips were faintly visible, the clips had been in the intestine longer in order to accumulate sufficient bile salts for radiographic detection. However, since the individuals never recall when the clips were swallowed, this hypothesis cannot be proven. We were unable to find any instance of gastroscopic removal of these devices. In each instance of plastic bag clip discovery in living persons reported, in the English medical literature, the procedure was surgical removal.

People older than 60 years of age who have either partial or full dentures seem to be at particular risk for the accidental ingestion of these devices. In five cases, the patient was known to be edentulous. As the population ages, small bowel perforation secondary to ingestion of such clips may occur with increasing frequency. The call has been made for elimination or redesign of the clips[3 11] to prevent their ingestion, make them less likely to hook into the mucosa (possibly by employing a spherical design), have them made out of digestible material, or simply incorporate radio-opaque compounds in the plastic to enable their identification in the gastrointestinal tract by conventional radiography. The path of eradication has already been taken in the UK where plastic clips have been replaced by tape for safety reasons.[7] To the aim of increasing radiographic identification, the addition of barium sulfate (a radio-opaque substance already commonly used as a stabiliser in the plastics manufacturing process) could easily be employed.[15] Barium sulfate and other radio-opaque compounds are widely employed in the healthcare field in a variety of applications. The ingestion of a small amount of barium aids in the radiographic visualisation of a gastrointestinal obstruction,[16] denture acrylics are now visible on x-ray to aid in the recovery of lost fragments from patients,[10] and radio-opaque strips are sewn into surgical pads to aid detection in case one is accidentally left in a patient's abdominal cavity.

Phylogenic classification

It may be a worthy enterprise to determine which designs are most often found in a pathologic context – *Toxodenta* in this case report (table 1). None of the clips have markings indicating their company of origin. While most come from the Kwik Lok company based in Yakima, Washington, USA, there are other manufacturers. Kwik Lok sells the machines that print on, or emboss, the plastic so that retailers can use whatever markings they wish. The dates printed on the tags are most often 'purchase by' dates reflective of the age of the product rather than the date of manufacture. This results in no effective identification by typography. So to take this subject to the next level, we herein present a morphologically based classification system (table 1).

The term *occlupanid* consists of the Latin *occlu-* (to close) and *-pan* (bread), referring to the item's ability to tightly close plastic-bagged bread packaging, though they are found on other bagged products from time to time. The principal feature of an occlupanid is its 'mouth', an invagination in what appears to be the anterior region of the body. Two inward-curving hooks of plastic surround a small area within, sometimes lined with smaller notches or tabs (figure 3). All dissection attempts have so far indicated that the body is uniformly composed of a stiff yet flexible plastic. Now worldwide in distribution, the comparative study of phenotypes of occlupanidae reveals a common ancestry from one *Archignatha*, from which all orders of the family stem (figure 4). Each order has retained the common, identifying structural characteristics of a rectangular, tab-shaped body and two pinching teeth, but diverge from one another in morphologic complexity. Occlupanidae range from 2 to 5 cm in size and are dorsoventrally flattened for ease of moving between the folds of the plastic on which they reside. For an indepth discussion on the origin and idiosyncrasies of all known occlupanid species,

BMJ Case Reports 2011; doi:10.1136/bcr.02.2011.3869

please refer to the Holotypic Occlupanid Research Group's website: http://www.horg.com/horg/intro.html[17] created by co-author JD. The use of the occlupanid naming system in all future reports of the discovery of this class of objects in the gastrointestinal tract will help determine if certain orders present a higher health risk than others so that even if these bag-closing devices cannot be completely eliminated, perhaps at least the most dangerous forms could be taken off the market.

Learning points

- The ingestion of plastic bag clips may cause serious health complications.
- Bag clip ingestion is difficult to diagnose due to radiotransparency.
- Treatment for plastic bag clip ingestion is surgical removal.
- A scientific naming system is provided for the identification of plastic clips in the hope of learning which clips are more of a threat to humans.

Competing interests None.

Patient consent Obtained.

REFERENCES

1. Kwik Lok Corporation. http://www.kwiklok.com/home.html (accessed on July 12, 2011).
2. **Medline A,** Shin D. Unusual cause of small bowel obstruction (letter). *SMAJ* 1975;**113**:608.
3. **Newell KJ,** Taylor B, Walton JC, *et al*. Plastic bread-bag clips in the gastrointestinal tract: report of 5 cases and review of the literature. *CMAJ* 2000;**162**:527–9 (Review).
4. **Rivron RP,** Jones DRB. A hazard of modern life. *Lancet* 1983;**2**:334.
5. **Bundred NJ,** Blackie RAS, Kingsnorth AN, *et al*. Hidden dangers of sliced bread. *Br Med J* 1984;**288**:1723–4.
6. **Horan TA**. Esophageal emergencies. *Schein's Common Sense Emergency Abdominal Surgery*. Berlin: Springer Publishing, 2009:121–31.
7. **Beer TW**. Fatalities from bread tag ingestion. *Med J Aust* 2002;**176**:506.
8. **Sutton G**. Hidden dangers of sliced bread (letter). *BMJ* 1984;**288**:1995.
9. **Cook DS**. Dietary dangers: ingestion of a bread bag clip. *J Clin Pathol* 2001;**54**:79.
10. **Davy KWM,** Causton BE. Radio-opaque denture base: a new acrylic co-polymer. *J Dentistry* 1982;**10**:254–64.
11. **Tang AP,** Kong AB, Walsh D, *et al*. Small bowel perforation due to a plastic bread bag clip: the case for clip redesign. *ANZ J Surg* 2005;**75**:360–2.
12. **Cala AD,** Sugo E. An unusual foreign body in the distal small intestine: case report. *Am J Forensic Med Pathol* 2000;**21**:53–5.
13. **Guidini MM,** Troster MM, Walley VM. Three cases of unusual foreign body in small bowel. *Gastrointest Radiol* 1987;**12**:240–2.
14. **Ferrucci JT,** Ragsdale BD, Barrett PJ, *et al*. Double tracking in the sigmoid colon. *Diagn Radiol* 1976;**120**:307–12.
15. **Molinter RP**. Method of manufacturing articles from vinyl resins. Patent No. 2629134. United States Patent Office, February 1953. http://www.google.com/patents?id=2WdxAAAAEBAJ&zoom=4&dq=introduction%20of%20barium%20to%20children's%20toys&pg=PA2#v=onepage&q=barium&f=false (accessed on July 12, 2011).
16. **Brooks JW**. Foreign bodies in the air and food passages. *Ann Surg* 1972;**175**:720–32.
17. **Daniel J**. Holotypic Occlupanid Research Group: Taxonomic Data of the Breadties of the World. http://www.horg.com/horg/intro.html (last accessed May 2011).