Learning objectives

- To present CT findings of patients with gossypibomas after chest or abdominal surgeries.
- To illustrate complications related to retained surgical sponge including bowel or visceral perforation, bowel obstruction, transmural migration, fistula formation, adhesions and development of abscess.
Background

Gossypiboma is the term used to describe a mass of cotton matrix that causes a foreign-body reaction inside the body. It occurs when inadvertently non-absorbable surgical materials as cotton, surgical sponge or gauze are left inside the human body following a surgical procedure. Gossypibomas may present at any time, from immediately postoperatively to several decades after initial surgery.

In the medical literature there are several synonyms for gossypibomas: retained surgical sponge, textiloma, cottonoid, cottonballoma, muslinomas, gauzeoma, retained surgical mop, pad forgotten in situ, and cotton - based foreign body.

Forgotten or missed cotton foreign bodies after chest and abdominal surgical procedures are considered a misadventure and are associated with legal problems. First malpractice plaint about gossypibomas was reported in 1933. Retained sponges may cause no adverse effects on patients and may remain undiscovered for decades. However, gossypibomas may lead to serious complications, including sepsis, intestinal obstruction, fistulization and perforation, and this problems may lead to death with a death incidence ranging from 15 to 22%.

Gossypibomas are most frequently observed in patients with obesity, during emergency operations, and after laparoscopic interventions.

Literature reports that the mean time between surgery and foreign body retention symptoms occur from 11 days to 23 years. The longest period reported is 43 years after a thoracotomy. The clinical presentation is variable and depends on the location of the sponge and the type of reaction. The symptoms are usually nonspecific and some patients remain asymptomatic and are never discovered. Pain / irritation (42%), palpable mass (27%), and fever (12%) were the leading signs and symptoms Wan et al., found in their systematic literature review, and only 6% of cases were asymptomatic. Delays in diagnosis could increase mortality and morbidity.

Foreign Body Reactions

Foreign body reactions develop secondary to two subsequent process, the first one to occur is the exudative, which leads to abscess formation with or without concomitant infection, bowel obstruction and fistula formation. The second in order is an aseptic fibrinous response that forms foreign body granulomas by encapsulation and adhesions of the retained material; this response is asymptomatic and can suffer decomposition.
Gossypibomas have a great capacity to form adhesions, encapsulate, and create granulomatous response, thus leading to complications such as bowel obstruction, fistulization and transparietal migration to other hollow viscus as stomach and bowel with possible extrusion through rectum, bladder or vagina. Retained material can also become infected and facilitate complications, specially development of abscess and fistulas.

Fistula or sinus tract formation occurs when the retained foreign body erodes adjacent structures and is extruded into a hollow viscus or externally. This process can lead to obstruction or conversely to expulsion per rectum or even urethra.

Acute complications are usually secondary to infection with abscess formation and posterior bowel obstruction, gastrointestinal bleeding and fistulization in some cases.
Findings and procedure details

The diagnosis of gossypibomas may be extremely challenging because of their variable presentation and absence of suspicion. CT is the technique of choice for evaluating a possible gossypiboma, as it has a great value on identifying symptomatic and asymptomatic patients. CT can detect material labeled with radiodense markers as non-labeled material.

CT properly characterizes the internal structure of the retained material, its location, size, extent and relation / involvement of adjacent structures. CT is an useful tool in identifying complications related to gossypibomas. It also helps differentiating from tumors, feces and abscess.

Technique

All CT examinations were performed with a 64-detector row CT scanner (GE Lightspeed), and all images were obtained in a craniocaudal direction. The following parameters were used: reconstruction thickness, 1.25 mm; 120 kVp; pitch factor, 0.98; and gantry rotation time, 0.4 second.

Iodinated contrast agent was injected through an 18-gauge catheter placed in an antecubital vein. We administered 80 mL of iopamidol (Iopamiron [300 mg of iodine per milliliter]); at a rate of 4 mL/sec by using a power injector.

In all cases, multiplanar reformations in coronal and sagittal planes were provided. Additional three-dimensional (3D) reconstructions with volume renderings are performed by attending radiologists at independent workstations.

CT Appearance of Gossypibomas

Gossypibomas are usually a diagnostic dilemma because of their diversity of radiologic appearance and serious complications. It is important for radiologist to know their variable presentation.
In the systematic literature review performed by Wan et al., about retained sponges, gossypibomas were most frequently found in the abdomen (56%), pelvis (18%), and thorax (11%). The most common detection method was computed tomography (61%).

Key points to recognize a gossypiboma

1. **Radioopaque markers**

Surgical sponges usually have radioopaque marker seen as a thin metallic density in the mass (Fig. 1 and 2). Occasionally the marker may be distorted by folding, twisting or disintegration over a period of time. Surgical sponges without such markers are still commonly used.

2. **Well circumscribed soft-tissue density mass**

The mass may be low density, or complex with both low density and wavy, striped or spotted high density areas that represent the sponge itself (Fig 3).

3. **Morphologic appearance of the wall**

Gossypiboma may appear as a mass with a thick wall, with or without gas, calcification or an external high-density wall that is further highlighted on contrast-enhanced imaging (Fig. 4).

4. **Internal structure**

Internal structure of the mass may show whirl-like or a spongiform pattern due to the presence of gas bubbles trapped in the mesh of sponges. The spongiform pattern is the most characteristic CT sign for gossypibomas (Fig. 5).

5. **Other features**
Cystic masses with infolded densities have been described in few cases of gossypibomas (Fig 6).

**Complications Related to Gossypibomas**

The most frequent complications include adhesion (31%), abscess (24%), and fistula (20%).

1. **Abscess formation**

Abscess results from an exudative body reaction, usually in the early postoperative period. In some cases may be associated with secondary bacterial invasion. The abscess formation may lead to fistulization to the skin, the intestine, or the urinary tract, with subsequent clinical signs.

CT findings reveal a fluid collection into the gossypiboma or in the surrounding tissues. Radiologist should inspect if a fistulas tract is associated (Fig. 7, 8 and 9).

In long standing cases, CT findings of gossypiboma may be indistinguishable from intraabdominal abscess, since air bubbles and calcification of the cavity wall as well as contrast enhancement of the rim may be seen in both conditions.

2. **Transmural migration and fistulas**

Transmural migration of gossypibomas is less common than other complications. The inflammatory process evolves to tissular necrosis, and results in fistula formation and transmural migration of retained surgical material with endoluminal transit or visceral perforation (Fig 10). Necrotic area closes after complete migration of the surgical sponge.

3. **Bowel or visceral perforation**

This complication occurs due to the inflammatory process and foreign body reaction that progresses to tissular necrosis. The most commonly compromised area is the gastrointestinal tract, especially the small intestine due to its thin wall and large outer
surface (Fig. 11), but it can also occur in bladder, vagina and diaphragm. Visceral perforation may be further complicate and evolve to development of fistulous tracts, abscesses and obstruction.

Visceral perforation both in chest and abdomen generally follows a late presentation from months to years after surgery. It is well known that the longer the retention time, the bigger the risk of perforation.

4. Adhesions and intestinal obstruction

Gossypiboma can induce adhesions that may cause postoperative adhesive intestinal obstruction (Fig. 12). However, transmural migration can also lead to intestinal obstruction, especially if incomplete migration of gossypiboma occurs. The sponge advances into the small bowel because of peristaltic activity, but usually impacts at the terminal ileum, resulting in obstruction.

Differential Diagnosis

CT appearance of gossypiboma may be indistinguishable from other entities. Radiologic findings, although specific, are not pathognomonic, hence the possible confusion of gossypibomas with other lesions. The main differential diagnoses that should be considered by radiologist are abscesses and hematomas.

Other less common entities in the differential diagnosis are hydatid cysts, mycetomas and neoplasms.
Fig. 1: Coronal (A) and axial (B) CT images show the radiopaque marker strip (arrows) in the gossypiboma.

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Fig. 2: Axial and coronal CT images demonstrate a surgical sponge on the left pleural cavity. Note the internal structure of the mass with infolded densities that represent the sponge itself. Radiopaque markers are also depicted.

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**Fig. 3:** Coronal contrast-enhanced CT demonstrates a complex mass (yellow arrow) with both low density and high density areas located next to the stomach, in a patient with history of distal pancreatic resection. A gossypiboma was confirmed on surgery.

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Fig. 4: Axial contrast-enhanced CT image show the typical appearance of the gossypiboma. The mass contains trapped gas bubbles and is surrounded by an enhanced peripheral capsule.

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**Fig. 5:** Axial (A) and coronal (B) CT images demonstrate a mass in the lower portion of the left hemithorax consistent with a gossypiboma. Note mottled small air densities superimposed on this mass.

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**Fig. 6:** Patient with history of surgical aneurysm repair six months back, refers to emergency department with abdominal pain. Axial (A) and coronal (B) contrast-enhanced CT show a cystic masses with infolded densities. A gossypiboma was confirmed on surgery.

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Fig. 7: A 52-year-old woman with history of nephrectomy 10 years ago, presented with lumbar pain. Axial contrast-enhanced CT shows a mass with thick wall, containing air bubbles and calcifications. Direct communication (yellow arrow) between the gossypiboma and the left colon (white arrow) is seen. Retained surgical sponge complicated with a fistula was diagnosed radiologically and confirmed with operation.

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Fig. 8: Same patient as Fig 7. The severe fibrous reaction limited the complete surgical remotion of the gossypiboma. A follow-up CT performed 10 months later demonstrated a fluid collection along of soft tissues in the left lumbar region (arrow) that extends to the retroperitoneal residual inflammatory mass. An abscess was diagnosed and treated successfully with percutaneous drainage.

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**Fig. 9:** Coronal (A, B) and axial (C) CT images demonstrate a gossypiboma (yellow arrow) complicated with a fistula formation (red arrow in B) that ends in a small abscess in the umbilical region (white arrows).

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**Fig. 10:** 72-year-old woman with history of chronic cough. Axial (A) and coronal (B) contrast-enhanced CT show an intraluminal mass of soft-tissue attenuation within the distal trachea with extension through its wall. A primary tracheal malignancy was suspected. Surgery revealed an encapsulated sponge surrounded by fibrous tissue, and the gossypiboma was removed. In her previous history was a thyroid surgery two years back. The gossypiboma led to necrosis of the soft tissues of the neck and the sponge eroded and migrated into the lumen of the trachea.

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Fig. 11: Axial (A,B, C) and coronal (D,E,F) reformatted contrast-enhanced CT show a retained surgical sponge within loops of the jejunum (yellow arrows). Small bowel perforation has occurred and the gossypiboma is migrating to the sigmoid, penetrating its wall and occupying its lumen (red arrows). The findings were confirmed at surgery.
Fig. 12: Axial contrast-enhanced CT shows a gossypiboma (white arrow) associated to a small peritoneal air fluid collection (yellow arrow). Dilated bowel loops are noted and bowel obstruction is diagnosed as a complication from the gossypiboma.

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Fig. 13: Axial (A) and sagittal (B) contrast-enhanced CT show a mass containing gas bubbles and soft tissue density, and surrounded by an enhanced peripheral capsule. This lesion can mimic a gossypiboma. The definite diagnosis was an abscess.

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Conclusion

A surgical sponge retained in the abdominal or thoracic cavity following surgery is a serious and medicolegal problem. Gossypibomas are usually a diagnostic dilemma because of their variety of radiologic appearance and serious complications. It is important for radiologist to know their different presentation and how to suspect its complications.
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