

Diagnosis and Management of Retained Foreign Objects

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ABSTRACT

Retained surgical foreign objects (RFO) include surgical sponges, instruments, tools or devices that are left behind following a surgical procedure unintentionally. It can cause serious morbidity as well as even mortality. It is frequently misdiagnosed. It should be considered in the differential diagnosis of any postoperative case with unresolved or unusual problems. Risk factors for RFOs include emergency procedures, unplanned change in operation, and body mass index and are clarified as being more frequent approximately 1 in 700 emergent cases. Although human errors cannot be completely prevented, medical training and consistency to rules seem to reduce the incidence to a minimum. It is a legal issue and potentially dangerous medical error. The definition, types, incidence, risk factors, complications and prevention strategies from RFOs are reviewed, from the comprehensive series until the year 2014.

Key Words: Retained surgical foreign objects. Gossypiboma. Prevention. Management.

INTRODUCTION

The first recognition of the danger of retained surgical instruments was published by Wilson in 1884.¹ Retained surgical foreign objects (RFOs) are surgical sponges, instruments, tools or devices that are left behind with the patients who underwent surgery.² The true incidence of RFOs after intra-abdominal operations in the United States is unknown because of legal and medical issues connected with this problem. Risk factors for RFOs include emergency procedures, unplanned change in operation, and body mass index.² Here, the definition, types, incidence, risk factors, complications and prevention strategies is reviewed from the English literature, through comprehensive series until the year 2014.

Gossypiboma: This word is derived from “gossypium” (Latin for cotton) and boma (Swahili for place of concealment). Synonyms, textiloma and cottonoid, are still commonly used.²⁻⁴ The most common type of retained foreign body is gauze sponges, which can be referred to as gossypiboma, textiloma, gauzoma, or muslinoma.^{2,5,6} Surgical instruments, needles, and other items can be left in the patient after closure of the wound.⁷

Incidence: Gawande *et al.* reported the incidence of retained foreign bodies as one per 8801-18, 760 inpatient operations.² The location where the RFO occurs is most commonly the thoracic and abdominal cavity and

may be as high as 1 of every 1000 to 1500 in these locations.^{2,8,9} In review from a level I trauma center it is clarified as being more frequent approximately 1 in 700 emergent cases.¹⁰ The reported rates of RFO after appendectomy, cholecystectomy, and gynecologic surgery are strikingly high. In contrast to other interventions in the lesser pelvis, such as procedures on the recto sigmoid, the portion of urologic and vascular interventions is less substantial (10% each).^{3,11}

Risk factors: Although many studies have attempted to identify potential factors associated with RFOs, the results have not been consistent in the literature. Factors include emergency surgical procedures, increased Body Mass Index (BMI), damage control surgery, unexpected change in the course of the surgical procedure, multiple operative teams, high blood loss.^{2,9,12} Gawande *et al.* identified those emergency procedures, unplanned changes in procedure, and high body mass index as risk factors.² Furthermore, problems in communication and information flow of the chief surgeon with the deputy team like nurses, assistants and anesthesiologists, play an important role in RFOs.¹³ Disabling attention because of interruptions, noise, conversations, and chaos in the operating room should be minimized. All details about the situation of the operation about the surgical field and its contents should be communicated if personnel or team changes.

Prevention strategies: Prevention should be considered a priority to treatment. There are several suggestions as to how RFOs can be avoided. All sponges and instruments should be counted. Sponges are counted before the beginning of the operation and before the closure of a body cavity and wound closure, then a final time at skin closure or at the end of operation by a scrub nurse.^{4,14} Also, small sponges should not be used during laparotomy and only sponges with a radiopaque indicator should be used. Prior to closure, the surgeon should explore the abdomen to ensure that

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all laparotomy sponges have been removed, and no sponges should be used to facilitate closure.^{4,8} Sponges and compresses should be used only inside the peritoneal space when appropriately tagged, or when a special note has been made of its usage. Finally, in doubtful cases or in operations that have been completed without proper sponge counts, the surgeon should check the surgical sites where dissection and operative approaches are performed carefully, and abdominal X-ray should be done before closure.¹² The film should be interpreted by a staff radiologist informing about the purpose of the film to rule out RFOs.

Count discrepancies and radiographic screening: In the literature, it is reported that 88% of RFO were associated with a correct count.² Gawende *et al.* informed the inadequacy of the counts. Although, the counts are enounced as complete, especially for high risk patients, screening should be considered. The first approach is the method by radiographic screening performed before the patient leaves the operating theatre. The current use of radiographic screening varies due to the policy of the institutions. Some institutions perform when there is an incorrect count while some in every patient with an abdominal surgery. Also, some appear to have no policy regarding radiography at all.¹⁵

However, if there is a discrepancy between the initial and final sponge counts, there is a 100-fold increase in the odds of a RFO.^{2,16} This suggests that interventions to improve the accuracy of the counting protocol would decrease the rate of RFOs.¹⁶

Cost-effectiveness of screening radiography: Dossett *et al.* declared a cost-effectiveness analysis of routine radiographs after emergent operations. They claimed that intraoperative radiography was both less costly and more effective than counting when the institutional costs and legal fees associated with retained surgical sponges were estimated. In this study, routine intra-operative radiography was preferential as long as the sensitivity of surgical counts was less than 98% and the legal fees were more than \$44,000 per case of retained surgical sponges. Macilquham *et al.* informed that the radiographic technique of choice for optimum detection of lost surgical needles was imaging with a mobile image intensifier. Also, Egorova *et al.* persisted on high-resolution radiography, because of 18 out of 34 RFO patients who had radiography with a portable machine. They made a point of excessive cost of routine high-resolution radiographs.¹⁷⁻¹⁹

Counting devices: Counting devices are another approach to materials management that involves tagging items used in cavitary surgery with bar codes or radiofrequency chips. Instead of radiographs, these newer technologies reliably identify retained surgical foreign bodies more reliably. Bar-code system, which

accounts for sponges is based on affixed, two-dimensional matrix labels.

In a study by Greenberg *et al.* bar-coding system was performed scanning the sponges, as they were added to the sterile field, and again as they were removed. The bar-code system was more sensitive to observe discrepancies than the traditional counting. In this study, the bar-code system detected a discrepancy in twice as many operations (24 vs. 12 operations, $p = 0.049$) with a sensitivity 98%. Compared with the traditionally counted sponges, increased cost were the drawback and the amount of time required to resolve discrepancies and the need for a radiograph to resolve a discrepancy was almost equable.²⁰

Electronic article surveillance (EAS) system based on magneto mechanical technology, and radiofrequency identification (RFID) microchips, which receive signals sent by a wand-like handheld scanner, are the other modified technologies. Although, EAS and RFID systems have 100% sensitivity and specificity on cadaver and live advertisements,^{21,22} these systems have disadvantages like operator dependent errors, electronic interferences, and mechanical failures.²³ Regenbogen *et al.* performed a decision-analytic model simulation to show the predicted incidence of retained sponge and the incremental costs associated with various prevention strategies and as the medical and liability costs of > \$200,000 per incident were estimated, novel technologies can substantially reduce the incidence of RFOs at an acceptable cost.²⁴ Table I shows a flow chart of studies associated with gossypiboma as literature search.

Clinical presentation: Surgical sponges are made of cotton, an inert material that does not stimulate but causing adhesion and granuloma formation.^{25,26} These patients may remain asymptomatic for a long time. The possible types of body responses are aseptic fibrinous or exudative responses Fibrinous response is characterized with adhesions, encapsulation, and eventually, granuloma formation (Figure 1). This is a long and silent clinical course. However, exudative response occurs early in the postoperative period and may involve secondary bacterial contamination.^{11,27,28} The human body attempts to extrude the foreign material either externally or into a hollow viscus, causing migration, and creating various fistulae into the stomach, bladder, intestine and some other viscus (Figures 2a and b).^{3,4,8,29}

The most common findings and symptoms of RFO are pain, palpable mass, vomiting, weight loss, diarrhea, abdominal distension, ileus, tenesmus, abscess and fistula formation, and protrusion through the surgical wound, rectum, or bladder.^{3,8,26-29}

The main complications of RFO are obstruction, peritonitis, adhesion, abscess development, erosion of

Table 1: Flow chart of studies associated with gossypiboma as literature search.

Authors <i>et al.</i>	Type of the article	Number of subjects	Main outcomes and conclusions
Gawande AA, <i>et al.</i>	Case- control study on surgical patients for identifying the risk factors.	54 patients	Emergencies, un-planned changes in the procedure, high body-mass index increases the risk of retention of foreign body after surgery.
Kaiser CW, <i>et al.</i>	Review	-	Both for vaginal and any incisional procedures are at risk for retaining sponge. Also, surgeon should perform a brief and routine post-procedure wound cavity exploration before closure.
Christian CK, <i>et al.</i>	Prospective observational study.	10 complex general surgery cases.	Communication break-down and information loss, as well as increased workload and competing tasks cause negation on patient safety.
Egorova NN, <i>et al.</i>	Retrospective study with data from Medical Event Reporting System (MERS-TH).	153,263 operations with 1062 count discrepancies	Count discrepancies increased with surgery duration, late time procedures and number of nursing teams. Alternative strategies of prevention should be measured.
Greenberg CC, <i>et al.</i>	Randomised controlled trial for evaluating a computer-assisted method for counting sponges using a bar-code system.	300 patients	Detection of miscounted and misplaced sponges is improved with a bar-code system and surgical staff members tolerated this automated counting.



Figure 1: Removed sponge material and encapsulation. The patient has admitted with left flank pain two years after nephrolithotomy.



Figure 2 (a,b): Pre-operatively endoscopic(a) and specimen(b) photograph of intragastric retained surgical foreign object.

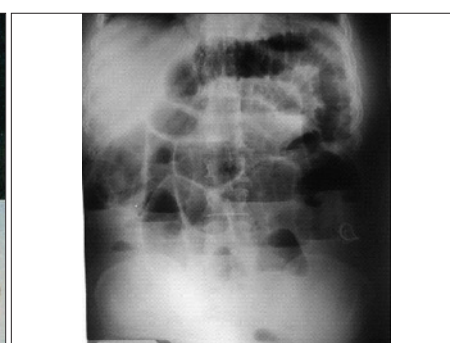


Figure 3: Plain radiographs shows radiopaque marker of retained surgical foreign object on left lower quadrant of the patient who had abdominal hysterectomy two days ago

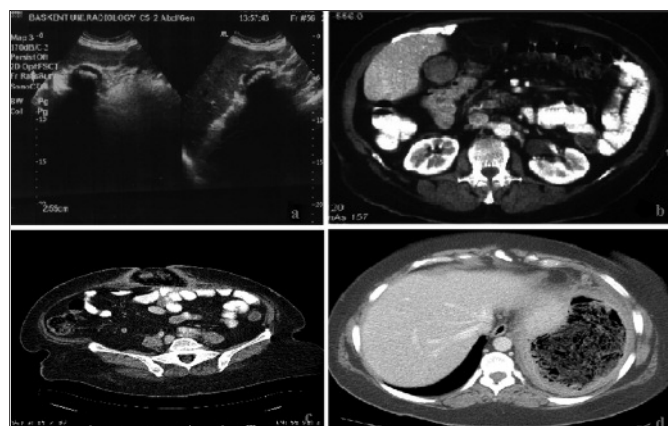


Figure 4: (a) Ultrasonographic images of gossypiboma developing after laparoscopic cholecystectomy. (b) Axial CT image shows hypodense well-defined mass in the gall-bladder fossa. (c) 57-year-old woman who had history of incisional hernia operation, axial CT image shows gas contained mass on the anterior abdominal wall. (d) 40-year-old woman who had history of hiatal hernia operation, axial CT image shows heterogeneously gas contained mass between spleen and diaphragm.

urinary or gastrointestinal tissues, and migration of the sponge into the lumens of these systems.^{2,4,26,28} Mortality due to RFOs is 11 - 35% of patients with RFO while morbidity rate is close to 50%, with most illness linked to intra-abdominal sepsis.^{3,30} When an RFO is diagnosed and removed in the early postoperative

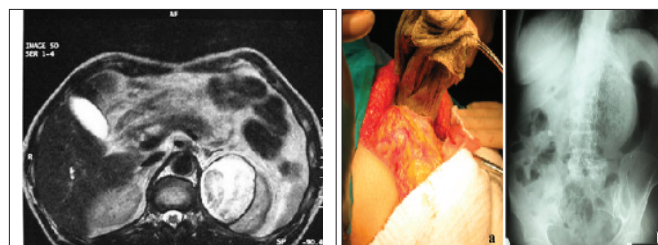


Figure 5: Axial T2 weighted MRI images shows encapsulated renal mass due to retained surgical foreign object on left kidney that has history of nephrolithotomy 2 years earlier.

Figure 6: (a) Plain radiograph shows a mass lesion contained multiple air densities on left upper quadrant. (b) Photograph of foreign material that fistulized to stomach.

period, morbidity and mortality are low; however, if there is a significant time delay, major surgical interventions are mandatory, and there is a higher risk of complications and mortality.³

Imaging: Although conventional abdominal radiographs should be able to detect gossypibomas due to their radiopaque indicators, the use of textiles provided with these markers is not a matter of routine (Figure 3). Also these indicators may be left out of account as they become distorted. On the other hand, surgical clips can mimic the pattern of these markers.³¹ Radiographs can also suggest the diagnosis through characteristic whorl

like pattern. Additionally radiographs can reveal a fine opacity and some mottled air densities superimposed on this area.³² When a sinus tract is present, fistulography with water-soluble contrast medium can reveal the gauze.²⁸ Ultrasound features are usually hypo-echoic or inhomogeneous mass containing highly echogenic foci and strong posterior acoustic shadowing. Acoustic shadowing is usually caused by retained material itself, calcifications or pockets of air.³² CT is the most commonly used and effective method for detecting gossypiboma and possible complications. The typical finding was a thin or thick-walled mass, with a whorl-like spongiform pattern and trapped gas bubbles.^{32,34} Round masses may contain a single, dense core but were also observed as multiple concentric masses of varying densities that changed over time (Figures 4 a-d).³⁵ Reports have mistakenly identified a gossypiboma as an echinococcal cyst or intracavitary fungus ball.^{36,37} In one case, the infolded densities of a gossypiboma found on CT yielded the interpretation of an atypical hydatid cyst with septations and multiple daughter cysts.³⁸ MRI was helpful in problematic cases such as in distinguishing a gossypiboma from a tumor. MR intensity of gossypiboma may vary according to histological composition, stage, and fluid content of lesion. A prototypical retained sponge presented as a soft-tissue mass with a thick, well defined capsule and whorled internal configuration on T2-weighted imaging (Figure 5).³⁹ A case which featured a surgical sponge retained for 5 years after knee surgery suggested that wavy, low-signal-intensity stripes, representing gauze fibers, are more characteristic of retained sponges than tumors.²⁷

Management: If a RFO is identified in a symptomatic patient, it should be removed.^{2,23,40} RFOs that present for a prolonged time can be removed with high complication rates.³ The procedures used to treat RSS include the removal of the material via US-guided, laparoscopic, or open surgical exploration of the abdomen and treatment of complications.^{26,41,42} In this situations after removal of the RFOs, primary repair, wedge or partial resection of the hollow viscus may be required (Figure 6 a,b).⁴³

In our review of 14 cases of RFOs at our institution over a six-year period, twelve of the cases had been referrals. Four of those patients required emergent surgery due to symptoms of intestinal obstruction or intra-abdominal sepsis. After the removal of RFOs, 5 of the 14 patients developed postoperative complications like surgical-site infection, and evisceration.²⁶

For asymptomatic patients, and selected cases, follow-up is a choice if removing of RFO has a probability of giving harm to the wronged individual.^{7,9} However, controlled trials should be set for these groups as there is no data revealing the long term follow-up.

CONCLUSION

Although human errors cannot be completely prevented, medical training and consistency to rules seem to reduce the incidence to a minimum.

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