

CASES

The lost sponge: patient safety in the operating room

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A 43-year-old woman presented to the emergency department with acute nausea and vomiting. She was admitted by the general surgery team with a suspected obstruction of the small bowel. Examination and imaging revealed an enlarged uterus (18 × 9 × 16 cm) with fibroids. Nine years earlier, she had undergone a uterine myomectomy by means of midline laparotomy, after which postoperative pancreatitis and bleeding had occurred followed by repeat laparotomy.

The next morning (midweek), a laparotomy was performed to identify and treat the source of the obstruction. An incision from the base of the sternum to the symphysis pubis was made, followed by dissection of some minor adhesions next to the terminal ileum. No discrete bands were identified that could explain the obstruction. The gynecology service was then consulted to manage the fibroid uterus.

Upon arrival, the staff gynecologist was informed by the senior surgery resident that no cause of the obstruction was found. The resident then left the operating room. The gynecology team completed a subtotal hysterectomy, after which the sponge count was incorrect. The abdomen and pelvis were explored, but no sponges were found. A radiograph of the abdomen showed no signs of a retained sponge (Figure 1). The abdomen was closed and the patient transferred to the recovery room.

The circulating nurse remained concerned about the incorrect sponge count and followed up with the gynecologist the next day. The gynecologist requested a computed tomography (CT) scan, and the patient was informed of the incorrect sponge count. At the time, the institution's policy did not require a routine follow-up CT scan if the count was incorrect. The CT scan showed a radiopaque marker indicating a sponge in the lesser sac below the greater curvature of the stomach (Figure 2).

The gynecology team performed an exploratory laparotomy. A packing sponge was found and removed from the lesser sac. No other con-

cerns or complications arose, and all sponge counts were correct. The patient made an uneventful recovery.

Discussion

Surgical care is complex and is prone to errors and subsequent adverse events.¹ The retention of foreign objects such as sponges, needles and instruments after surgery (also known as gossypiboma) is an example of a preventable medical error. The case we have described prompted an analysis of the root cause of the surgical and communication failures that led to this occurrence.

When a foreign object is left behind after surgery, a local and systemic inflammatory response may occur. The resulting clinical manifestation can include signs and symptoms of local infection, adhesions, fistulas, obstruction and sepsis.¹ A fatality rate of 2% has been reported.² The most common indication of a retained foreign object is pain, tenderness and infection (in 42% of patients).³ Ultimately, the patient's risk of complications is increased when there is a retained foreign object.

Incidence and risk factors

The incidence of retained foreign objects after surgery has varied in the literature. Cima and colleagues undertook a four-year review at a tertiary care centre and reported an incidence of

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KEY POINTS

- Communication between surgical teams is critical during combined operations.
- Each operating room should have a policy for counting surgical sponges and instruments that is consistent with national recommendations.
- A count should be considered before a changeover of surgical teams during operations at high risk of errors.
- A radiograph obtained because of an incorrect count should be reviewed by a radiologist to ensure adequate anatomic coverage.
- If the radiograph is negative, a follow-up computed tomography scan should be considered.

about 1 in 5500 operations.² After reviewing claims and incident reports of retained objects in 54 surgical patients in four hospitals, Gawande and colleagues reported that the incidence varied from 1 in 18 760 to 1 in 8800 inpatient operations.⁴ In both studies, sponges were the most common object left behind (in about 68% of patients).

Gawande and colleagues identified possible risk factors associated with the retention of foreign objects after surgery.⁴ These factors included the operation being performed on an emergency basis (risk ratio [RR] 8.8, 95% confidence interval [CI] 2.5–31.9), unexpected change in operation (RR 4.1, 95% CI 1.4–12.4) and body mass index (per 1-unit increment) (RR 1.1, 95% CI 1.0–1.2). Evidence suggests that the most frequent contributor is poor communication.⁵ Wan and colleagues reported that, in the event of a retained foreign object, team hierarchy and lack of cooperation inhibit the signaling and subsequent reconciliation of the error.³ Some examples of poor communication include disagreements among team members regarding incorrect surgical counts and poor exchange of information during perioperative personnel changes.

Unfortunately, these communication problems are not uncommon in the operating room, occurring in about 30% of exchanges between team members.⁶ Lingard and colleagues found that communication failures were associated with factors such as delayed communication, incomplete and inaccurate content, exclusion of

key individuals and issues left unresolved until the point of urgency.⁶ One-third of the communication failures resulted in immediate effects, including inefficiency, team tension and procedural error.

Risk reduction

Efforts to improve surgical care include the introduction of the World Health Organization (WHO) Surgical Safety Checklist,⁷ and local and national policies relating to the provision of surgical care.

Although the WHO Surgical Safety Checklist has shown benefits,⁸ specific policies to prevent the retention of foreign objects are also crucial. Most operating rooms have preventive procedures and policies; however, no standardized practices have been established. Each hospital formulates policies and procedures based on the recommendations of various hospital organizations and professional associations. These include the Operating Room Nurses Association of Canada (www.ornac.ca) and, in the United States, the Association of Perioperative Registered Nurses (www.aorn.org). Both agencies provide guidelines to members on performing surgical counts and protocols to reduce incorrect counts.

Policies and protocols for surgical counts are only one part of a prevention strategy. Although they are essential verification methods, they are fallible. In a multivariable analysis, Gawande and colleagues found that failure to perform a sponge count was not a significant risk factor for retention



Figure 1: Radiograph obtained after laparotomy for suspected small-bowel obstruction to help locate a retained surgical sponge. Because of the limited imaging area, localization of the sponge was not possible.

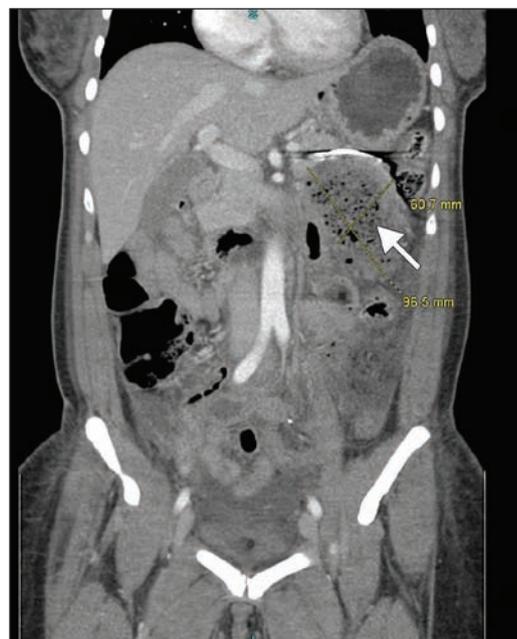


Figure 2: Follow-up investigation with computed tomography. Scan shows radiopaque sponge in the lesser sac below the greater curvature of the stomach (arrow).

of a foreign object (RR 0.6, 95% CI 0.03–13.9).⁴ Cima and colleagues reported that, in 62% of patients from whom a sponge or other object was recovered, the instrument count had been correct.² Additional measures should be considered to ensure patient safety.

Current protocols for preventing the retention of foreign objects after surgery are summarized in Table 1.^{2-4,9-12} In operations with a high risk of error, it has been suggested that universal radiographic screening be done regardless of the surgical count.² Given the frequency of false-positive counts and the possibility of litigation in such circumstances, the cost-effectiveness of this protocol could be substantial.¹³ Other options for prevention include the use of bar-coded and radiofrequency-tagged sponges. A recent cost-effectiveness review highlighted the use of bar-coded sponges as the most reliable protocol.⁹

Risk factors and incidence rates of retained foreign objects are well documented. However, few studies have systematically examined the relative merits of alternative prevention protocols. Cima and colleagues undertook a unique measure to reduce the frequency of retained foreign objects. Their three-phase systematic approach included (a) a review of policies and circumstances facilitating these events; (b) an education campaign to increase awareness and communication in the operating room; and (c) a monitoring and control phase. Consistent with previously cited studies, communication failure among team members in the operating room was the leading contributor to these events. An education campaign centred on open discourse between all team members and allied health staff yielded a reduction in the incidence of retained foreign objects from 0.52 to 0.11 per 1000 surgeries.¹⁴

Efforts such as the initiative studied by Cima and colleagues, analysis of the root cause of errors in the operating room, and strategies to improve prevention policies are examples of how health care facilities can reduce risks in the operating room and improve the quality of patient care. Realistically, most institutions choose a suitable prevention strategy based on cost, ease of use and prevention priority.⁹

Analysis of the case

In the case we have described, multiple risk factors for retention of a foreign object after surgery were present. It was an emergency surgery. When the general surgery team found no obstruction of the small bowel during the initial laparotomy, the gynecology service was urgently called. The unexpected change in operative plans meant that more than one surgical procedure was performed, and more than one team and surgical site were

involved. In addition, the sponge was found in the lesser sac, a location not familiar to most gynecologic surgeons; the location suggests that the sponge was likely used by the previous team. The sponge was not detected in the radiograph because the full length of the abdomen (from diaphragm to pubis) was not imaged.

Collectively, the key factors in this case — limited communication between the surgical teams, no surgical count when the teams and procedure changed, and incomplete radiographic evaluation — highlight the need for increased communication in the operating room and specific preventive measures during such high-risk surgeries.

Changes in practice

Increased communication between the surgical teams and more stringent policies in the operating room might have prevented retention of the sponge in our patient. A full description of the procedure by each team and a follow-up by both teams at the time of the final count might have also helped. In addition, having nursing personnel perform a surgical count at the changeover of the surgical teams would have allowed both

Table 1: Protocols for preventing the retention of a foreign object after surgery

Manual counting of surgical items

Perioperative nurses (circulating and scrub nurses) manually and audibly count and document all surgical sponges and instruments at the beginning and end of the surgery

- Sensitivity 62%–88%⁹
- Many occurrences of retained foreign objects have had correct counts^{3,4}

Perioperative radiographic screening

Radiograph is obtained during abdominal surgery to identify radiopaque sponges and instruments

- Less costly and more effective than traditional counting of surgical items
- May be routine or restricted to high-risk operations
- Detection rate 85.8% for selective and 95.5% for universal application of protocol⁹

CT scanning

Most often used as a follow-up investigative tool

- Detection rate 61%²

Use of bar-coded sponges

Sponges with a bar code are scanned with a hand-held device at the beginning and end of the surgery

- Detection rate 97.5%⁹
- Increased time in operating room and new technical difficulties introduced¹⁰

Use of radiofrequency-tagged sponges

Sponges with an embedded electronic chip are detected with a hand-held device that is scanned over the patient's body

- Sensitivity and specificity 100%
- Susceptible to electronic interference, mechanical failure and user error^{11,12}

Note: CT = computed tomography.

teams to be present and might have aided in finding the sponge.

The analysis of this case has had several outcomes in our institution. These include:

- recognition of the need for increased communication among surgical teams in the operating room
- development of standard protocols during operations with a high risk of error
- highlighting the need for consistent guidelines and count policies.

To prevent such events from occurring, a critical incident review was undertaken with the perioperative committee to amend the hospital's policy on surgical counts. A comprehensive radiograph from the pubis to the diaphragm is now required for all abdominal surgeries with an incorrect count. The radiograph must be reviewed by the on-call radiologist to ensure quality and adequate coverage before the patient is transferred from the operating room. If the radiograph is inconclusive, further imaging is strongly encouraged but remains at the discretion of the most responsible surgeon.

Any event involving a retained foreign object has strict reporting guidelines. The incident is reviewed by the perioperative committee with all members of the surgical team to identify the root causes and opportunities for improvement.

Conclusion

Protocols are a safety net to prevent medical errors such as retained sponges. Although each institution is free to build its own policies, several key tools and procedures may be useful. For instance, the WHO Surgical Safety Checklist encourages open communication among operating room personnel. This team approach helps to ensure that circulating nurses are comfortable following up with the surgeon about incorrect counts and requesting further investigation. The WHO checklist (or a local adaptation) is now provincially mandated in all operating rooms in Ontario, Alberta, Saskatchewan and Manitoba. In Quebec, implementation of the checklist is a requirement for hospital accreditation. Although the checklist may not be formally mandated by other provinces, local, provincial and national initiatives are promoting its use.

Health care is an evolving system, with strategies for improving patient safety continually being researched. Safety is always a surgical team's top priority, and collectively, surgical teams can improve it.

References

1. Leape LL, Brennan TA, Laird N, et al. The nature of adverse events in hospitalized patients. Results of the Harvard Medical Practice Study II. *N Engl J Med* 1991;324:377-84.
2. Cima RR, Kollengode A, Garnatz J, et al. Incidence and characteristics of potential and actual retained foreign object events in surgical patients. *J Am Coll Surg* 2008;207:80-7.
3. Wan W, Le T, Riskin L, et al. Improving safety in the operating room: a systemic literature review of retained surgical sponges. *Curr Opin Anaesthesiol* 2009;22:207-14.
4. Gawande AA, Studdert DM, Orav EJ, et al. Risk factors for retained instruments and sponges after surgery. *N Engl J Med* 2003;348:229-35.
5. Gibbs VC. Patient safety practices in the operating room; correct-site surgery and nothing left behind. *Surg Clin North Am* 2005;85:1307-19.
6. Lingard L, Espin S, Whyte S, et al. Communication failures in the operating room: an observational classification of recurrent types of effects. *Qual Saf Health Care* 2004;13:330-4.
7. World Alliance for Patient Safety. *WHO surgical safety checklist and implementation manual*. Geneva: World Health Organization; 2008 [updated 2011]. Available: www.who.int/patientsafety/safesurgery/ss_checklist/en/index.html (accessed 2011 Nov. 6).
8. Haynes AB, Weiser TG, Berry WR, et al.; for the Safe Surgery Saves Lives Study Group. A surgical safety checklist to reduce morbidity and mortality in a global population *N Engl J Med* 2009;360:491-9.
9. Regenbogen SE, Greenberg CC, Resch SC, et al. Prevention of retained surgical sponges: a decision-analytic model predicting relative cost-effectiveness. *Surgery* 2009;145:527-35.
10. Greenberg CC, Diaz-Flores R, Lipsitz SR, et al. Bar-coding sponges to improve safety: a randomized controlled trial. *Ann Surg* 2008;247:612-6.
11. Fabian CE. Electronic tagging of surgical sponges to prevent their accidental retention. *Surgery* 2005;137:298-301.
12. Macario A, Morris D, Morris S. Initial clinical evaluation of a handheld device for detecting surgical gauze sponges using radiofrequency identification technology. *Arch Surg* 2006;141:659-62.
13. Dossett LA, Dittus RS, Speroff T, et al. Cost-effectiveness of routine radiographs after emergent open cavity operations. *Surgery* 2008;144:317-21.
14. Cima RR, Kollengode A, Storsveen A, et al. A multidisciplinary team approach to retained foreign objects. *Jt Comm J Qual Patient Saf* 2009;35:123-32.
15. Gawande A. *The checklist manifesto: how to get things right*. New York (NY): Metropolitan Books; 2009.

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Resources

- WHO Safe Surgery Saves Lives (www.who.int/patientsafety/safesurgery)
- *The Checklist Manifesto* by Atul Gawande¹⁵
- Safer Healthcare Now! (www.saferhealthcarenow.ca)
- Operating Room Nurses Association of Canada (www.ornac.ca) and Association of Perioperative Registered Nurses (United States) (www.aorn.org)
- Canadian Patient Safety Institute (www.safesurgerysaveslives.ca)