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The Incidence of Retained Objects in Intraoperative X-rays for Missing Counts in Plastic Surgery: We Should Do Better

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Background: In the event of incorrect surgical counts, obtaining X-rays to rule out retained surgical items (RSI) is standard practice. However, these safeguards also carry risk. This study investigates the actual incidence of RSI in plastic reconstructive surgery (PRS) cases as measured on intraoperative X-rays and its associated modifiable risk factors.

Methods: X-rays with indication of "foreign body" in PRS procedures from 2012 to 2022 were obtained. Reports with "incorrect surgical counts" and associated perioperative records were retrospectively analyzed to determine the incidence of retained surgical items.

Results: Among 257 X-rays, 21.4% indicated incorrect counts during PRS operations. None were positive for RSIs. The average number of staff present was 12.01. This correlated to an average of 6.98 staff turnovers. The average case lasted 8.42 hours. X-rays prolonged the time under anesthesia by an average of 24.3 minutes. Free flap surgery had 49.1% prevalence of missing counts (lower extremity 25.5%, breast 20%, craniofacial 3.6%), followed by hand (14.5%), breast (10.9%), abdominal reconstruction (10.9%), craniofacial (9.1%), and cosmetic (5.4%).

Conclusions: Although X-rays for incorrect counts intend to prevent catastrophic sequela of inadvertent RSIs, our results suggest the true incidence of RSI in PRS is negligible. However, intraoperative X-rays have potentially detrimental and pervasive consequences for patients, including increased anesthesia time, radiation exposure, and higher overall cost. Addressing modifiable risk factors to minimize unnecessary intraoperative X-rays is imperative while also considering whether this modality is an effective and appropriate tool in PRS procedures with incorrect surgical counts. *(Plast Reconstr Surg Glob Open 2023; 11:e5419; doi: 10.1097/GOX.0000000000005419; Published online 16 November 2023.)*

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INTRODUCTION

Numerous safety measures, including the World Health Organization's surgical safety checklist, are implemented in operating rooms (ORs) to prevent retained surgical items (RSI) because of their potential deleterious effects in addition to medical, legal, and financial implications for patient, surgeon, and the hospital.[1,2] Hospital costs for one RSI event is estimated at $70,000.[3] To prevent these "never events," the surgical team regularly conducts manual counts of the material used throughout a procedure.[1,4] However, despite these standardized practices, incorrect surgical counts still occur with an estimated incidence of 1.32 RSI events per 10,000 procedures.[5,6] Although the overall reported prevalence of discrepant surgical counts is quite common, occurring in one in eight surgical procedures (12.5%), the overall reported prevalence of RSIs is one in 70 cases (1.42%) of incorrect counts.[6,7]

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As a result, universally, hospital protocols mandate X-rays to be performed if the surgical count is off to rule out RSI.[8,9] Radiographic evaluation is conducted intraoperatively while the patient is still under anesthesia. A negative X-ray must be confirmed by the attending radiologist and communicated to the attending surgeon, ideally before wound closure, but certainly before emergence from anesthesia and leaving the operating room.[10] Unfortunately, undergoing intraoperative X-rays is not without potential risks to the patient, including unplanned exposure to radiation, additional time under anesthesia, and thus, resultant direct and indirect costs.[2,8]

Risk factors, such as length and complexity of surgical procedures, for incorrect surgical counts have been identified in a variety of thoracic and abdominal surgery studies.[11,12] However, there is a paucity of data on RSI in plastic surgery, in which many core operations are complex, lengthy, or both. This study aims to investigate the true incidence of positive RSI identified on intraoperative X-ray during plastic and reconstructive surgical procedures at a large academic medical center and review the modifiable risk factors pertaining to plastic surgery that contribute to incorrect surgical counts.

Takeaways

Question: What is the actual incidence of retained surgical items (RSI) in plastic reconstructive surgery (PRS) cases as measured on intraoperative X-rays and their associated modifiable risk factors?

Findings: No X-rays were positive for RSIs. Case complexity, duration, and staff turnover are associated with incorrect counts. The use of intraoperative X-rays increases anesthesia time, radiation exposure, and overall costs.

Meaning: Our results suggest that the true incidence of RSI in PRS is negligible. It is necessary to address modifiable risk factors to minimize unnecessary intraoperative X-rays.

METHODS

The institutional review board approved this single-site, retrospective study. All X-ray reports from September 2012 to September 2022 ordered intraoperatively during PRS procedures with indication of "foreign body" were obtained. Reports with incorrect surgical counts were identified. Patient demographics, type of procedure, procedure length (in hours and minutes), number of instrument counts, number of staff present in the case (including all members of the surgical team, scrub technicians, and registered nurses), number of handoffs between nurses or scrub technicians (including shift changes and breaks), and number of handoffs between surgeons were assessed. Number of medical students was not recorded in the electronic medical record, and thus, it was not analyzed. Procedures were categorized as free flap (lower extremity, breast, or craniofacial), cosmetic (ie, lipo-abdominoplasty), hand, reconstructed craniofacial, breast, or abdominal reconstruction (ie, abdominal hernia repair). Procedures that were considered free flaps utilized microsurgery and anastomosis to transfer tissue from one area of the body to another. Multisurgical department case and bilateral or unilateral cases were also identified. The type and number of surgical items missing, as well as the amount of time (in minutes) added under anesthesia due to X-ray were also analyzed.

Analyses were performed using Microsoft Excel (version 16.73; Microsoft Corp, Redmond, Wash). Continuous variables were expressed as mean ± SD. Categorical variables were expressed as the number of cases or percentage of total.

All procedures followed University of Florida Shands hospital intraoperative protocol for instrument recounts, which details verbal confirmation of complete instrument, sponge and needle counts before the patient leaves the OR (Table 1). There was an instrument count after every nursing/surgical technician turn over. If the counts are incorrect, an intraoperative ray will be ordered.

RESULTS

A total of 257 intraoperative X-rays ordered during PRS procedures over a 10-year period were reviewed with a listed indication of "foreign body." Of these, 55 cases (21.4%) reported incorrect surgical counts. The other 202 X-rays (78.6%) were indicated for traumatic injuries, such as fractures, bullet wounds, and blasts injuries. Needles (n = 23), sponges (n = 5), lap pads (n = 4), blades (n = 3), clip appliers (n = 3), Bovie tip (n = 1), pen cap (n = 1), ruler (n = 1), suction tip (n = 1), and other unspecified objects (n = 16) were reported missing during these surgical cases (Table 2).

The average patient body mass index in cases that had intraoperative ray for missing counts was 30.12 (range = 19.5–48.3). The average patient age was 46.5 years.

Table 1. Intraoperative Count Protocol

Intraoperative Instrument Count Protocol	
1.	Any item that has the potential for being retained in a surgical wound must be recorded on the count communication when placed in the surgical wound.
2.	The RN and surgical tech should evaluate each case for items with the potential to be retained and use the count communication board to record any variable, high risk or miscellaneous counted item that needs special attention during the count process.
3.	The surgical count must be conducted by two staff members, one of whom must be an RN, who concurrently view each item as it is counted.
4.	All sponges must be bagged at the end of the case for better visualization during the final count.
5.	If the counts are not correct, an intraoperative X-ray is ordered.
6.	An intraoperative X-ray will be performed on all patients with a BMI of 50 or greater after fascia closing in abdominal procedures. Counts will still be performed on all of these cases even though an X-ray will be obtained.

Table 2. Missing Items

Missing Item	No. Cases
Needle	23
Sponge	5
Lap pad	4
Blade	3
Clip applier	3
Bovie	1
Pen cap	1
Ruler	1
Suction tip	1
Unspecified	16

Table 3. Types of Plastic and Reconstructive Procedures

Procedure Type	N (%)
Surgical category	
Free tissue transfer	27 (49.1%)
Lower extremity	14 (25.5%)
Breast	11 (20%)
Craniofacial	2 (3.6%)
Hand	8 (14.5%)
Breast	6 (10.9%)
Abdominal reconstruction	6 (10.9%)
Craniofacial	5 (9.1%)
Cosmetic	3 (5.4%)
Multisurgical department case	15 (27.3%)
Colorectal	2 (13.3%)
Oral/maxillofacial	2 (13.3%)
Breast surgery	4 (26.7%)
OB/GYN	1 (6.7%)
Trauma	2 (13.3%)
Orthopedics	1 (6.7%)
Urology and OB/GYN	1 (6.7%)
Pancreatobiliary	1 (6.7%)
Trauma and urology	1 (6.7%)
Bilateral	29 (52.7%)

N, number; OB/GYN, obstetrics and gynecology.

Free flap procedures were the most common procedures with indication for missing count (49.1%) (Table 3). More specifically, lower extremity free flap procedures had the highest prevalence of missing counts (25.5%), followed by breast free flap procedures (20%) and craniofacial free flap procedures (3.6%; Table 2). Less common procedures that had indications for missing counts were hand (14.5%), breast (10.9%), abdominal reconstruction (ie, abdominal hernia repair; 10.9%), craniofacial (9.1%), and cosmetic (5.4%) procedures (Table 3). Multidisciplinary cases made up 27.3% of the cases (Table 3). Of these multi-disciplinary cases with plastic surgery, 26.7% were with breast surgery, 13.3% with colorectal, 13.3% with oral/maxillofacial, 13.3% with trauma surgery, 6.7% with obstetrics and gynecology (OB/GYN), 6.7% with orthopedics, 6.7% with urology and OB/GYN, 6.7% with trauma and urology, and 6.7% with hepatobiliary (Table 3). The majority of the cases were bilateral (52.7%) (Table 3).

The average number of staff, including physicians, registered nurses, and surgical technicians, on a plastic surgery case was 12.01 with an SD of 3.57 (Table 4). The average number of registered nurses was 3.48 (SD = 1.51) and the average number of surgical technicians was 2.98 (SD = 1.39) (Table 4). There was an average of 6.98 (SD = 4.13) nurse and surgical technician turnovers (including shift changes, breaks, and so on; Table 4). The average number of surgeons was 3.56 (SD =1.60; Table 4). There was an average of 0.33 (SD = 0.55) surgeon turnovers (including shift changes) (Table 4). The average number of instrument counts was 4.45 (SD = 1.38; Table 4).

Table 4. Average Number of Staff Involved in Each Case

Variable	Mean (SD)
Total number of staff (less anesthesia)	12.01 (3.57)
No. nurses	3.48 (1.51)
No. surgical technicians	2.98 (1.39)
No. surgeons	3.56 (1.60)
Nurse and surgical tech turnover	6.98 (4.13)
Surgeon turnover	0.33 (0.55)
No. instrument counts	4.45 (1.38)
Case duration (min), mean (SD)	522.5 (265.22)
X-ray duration (min), mean (SD)	24.39 (28.68)

The average case duration was 522.5 minutes (SD = 265.22; Table 4). Intraoperative X-ray prolonged the time under anesthesia by 24.3 minutes (SD = 28.68; Table 4). Notably, no retained foreign objects were discovered in any of the 55 cases.

DISCUSSION

Surgical "never events" are defined as procedural errors that should never take place and are always avoidable. These include the wrong patient, procedure, and site, as well as RSI. Among them, RSI occurs most frequently with potential catastrophic physical, emotional, and financial consequences for patients, physicians, and healthcare systems.[13] More specifically, RSIs can result in the need for reoperation and increased patient morbidity and even mortality. Financial implications can be significant as well, including malpractice liability costs, legal fees, and other indirect costs. Due to these deleterious sequelae afflicted on the patients and heavy financial burden posed on the healthcare system by RSI, systematic surgical counts and X-rays are routinely implemented in the OR to minimize the occurrence of this never event.[1,4,11,13]

Among all PRS procedures, long and complex cases such as microsurgical procedures with free tissue transfer are the most vulnerable to incorrect counts and resultant radiographic confirmation. This is consistent with prior reports from other institutions.[2,14] Possible factors contributing to incorrect counts due to missing items in these procedures are the increased complexity, duration, and number of instruments used.[2,14] Stawicki et al further highlighted this in their multi-center matched cohort study that showed increase in case duration was associated with increased risk of RSI.[10] Lincourt et al also demonstrated an association between RSIs and several surgical procedures performed simultaneously on a patient.[11] Missing item size may also be a major factor contributing to incorrect counts, as the majority of the

instruments missing in our study were needles, which can be difficult to visualize if missing. Furthermore, more complex PRS procedures often include multiple, large surgical sites where wound closure requires numerous sutures and may include several surgical team members sewing, increasing the potential opportunities for a needle to be misplaced.

Similar to the current study, Reformat et al also found that needles were the most commonly miscounted instruments in PRS cases.[14] although retained sponges and lap pads are known to cause detrimental outcomes such as infection and resultant sepsis,[15,16] several studies question the benefits of addressing retained needles due the unlikelihood of them actually causing adverse clinical outcomes.[17,18]

OR chaos and disorder has also been suggested as a contributing factor to recounts and radiographic confirmation.[5,14] Similarly, our study found that high numbers of staff and turnover rate were associated with incorrect counts. Communication failure between staff is most likely a major factor underlying this association.[14,15] More specifically, two studies that performed root-cause analyses found that poor communication was a central factor to recounts and RSI.[19,20]

Other specialties have found similar risk factors to recounts and RSIs. In minimally invasive surgery, Gibbs showed in four case series that retained sponges were found due to a lack of a reliable system to verify and account for all sponges at the end of the cases.[21] Gibbs recommended that performing repeated sponge counts before and after each part of the minimally invasive surgery and utilizing large radiopaque sponges could prevent these issues.[21] In emergency surgery, Gawande et al found that the risk of an RSI significantly increases when there is increased disorder and chaos and in patients with higher body mass index.[22] Interestingly, among pediatric surgical admissions, Camp et al showed in a case-control study that RSIs were most likely to be found during gynecologic operations.[23]

To our knowledge, this is the first study to show that while X-rays for missing counts intend to prevent catastrophic sequela of inadvertent RSIs, the true incidence of RSI on intraoperative X-ray in PRS procedures measured over a 10-year period is actually nonexistent. Hempel et al similarly showed, in their systematic review, a low retained surgical item rate of 1.32 events per 10,000 procedures.[24] This necessitates a hard look at the adequacy of using intraoperative radiographs as a valid measure to rule out RSI, specifically in PRS, as this clearly indicates that while the surgical count remains off, the foreign body was not actually left in the patient.

Furthermore, we also found that, in addition to the time to spent trying to reconcile the counts and search for a missing item, count discrepancies require the plastic and reconstructive surgical teams in our institution an additional 24.3 minutes to perform intraoperative X-ray to rule out RSI. Yet, the additional time under anesthesia, exposure to completely unnecessary radiation, and direct and indirect costs are very real. For example, numerous studies have suggested a significantly increased risk for thyroid cancer is associated with radiation exposure.[25] Increased time under anesthesia for an extended amount of time is associated with cognitive effects and risks of infection, especially if the X-ray is obtained before wound closure.[2,8] Prolonged OR time and additional testing increase healthcare costs as well as prevent surgeons and anesthesiologists from tending to other patients.[2] Lastly, the numerous possible and not always foreseeable costs for treatment arising from these complications (eg, cancer from radiation exposure) should be considered.

It therefore goes without saying that these modifiable risk factors must be addressed to minimize intraoperative X-rays. Excellent communication during the procedure between surgeons, nurses, and surgical technicians is also vital. A laissez-faire attitude toward obtaining intraoperative radiographs for incorrect counts is not infrequent, especially in institutions where personnel work is shift-work rather than salaried. System-based methods, including staff training, should thus be implemented and embraced by all members of the team to decrease the need for intraoperative radiographs. Supplemental training and staff reward should be given to implement strategies for mitigating incorrect counts in the first place. As needles seem to be the most culpable item, innovative strategies to prevent missed counts should be considered. These might include more frequent counting than only during personnel change and/or counting and passing items—particularly needles—off the field in its counting box after a set item number (eg, after every 10 needles). Another idea that has been proposed is using a data-matrix-coded sponge counting system. Cima et al showed that the data-matrix-coded sponge counting system significantly eliminated sponge RSIs while causing no workflow disruption or increases in case duration.[26] Bar-coding surgical sponges has also showed promise in randomized controlled trial by Greenberg et al in reducing RSIs.[27]

This is specifically true for "emergency cases" where many institutional policies mandate intraoperative X-rays to prevent RSI regardless of the count. However, as most surgeons would agree, not all "emergencies" are created equal. Specifically, in PRS, even cases booked as emergencies exceedingly rarely involve true life and death situations in which normal counting practices must be suspended in favor of routine postoperative X-rays. Given the exceptionally low yield of utilizing X-rays to rule out RSI in PRS, plastic surgery procedures, even if deemed emergencies, should therefore be considered exempt from such institutional policies.

Lastly, although support team turnover clearly increases the risk of incorrect counts and subsequent X-rays, support staff familiarity with PRS procedures and sense of ownership in the case by necessity makes a difference. At many institutions, ours included, the relief staff unfortunately almost exclusively has limited to no familiarity with the specific PRS procedure or working with the attending surgeon, increasing the risks of errors. Given high stakes of microsurgical cases (ie, those most prone to incorrect counts), stress levels and demand on the nurse and surgical technician can be quite high. Placing unfamiliar individuals in this scenario for very short

time blocks (eg, the duration of a typical lunch relief) increases risks of mistakes.[28] Trained and dedicated specialty teams (including relief teams) have been shown to be imperative, especially for the higher risk procedures such as microsurgical cases to improve efficiency and overall outcomes.[29]

Limitations of this study include a restricted focus on plastic surgery cases that ordered an intraoperative X-ray with the indication for "foreign body." It is thus possible that not all cases with intraoperative X-rays for missing counts were accounted for. Another limitation is its retrospective nature and lack of control group. However, the objective was not to compare groups where counts were incorrect versus correct, but primarily to assess whether intraoperative X-rays were an effective tool in diagnosing RSI in PRS procedures. In addition, as none of the patients in this study had a body mass index of 50 or greater, we were unable to evaluate whether this particular delineation in the guidelines in mandatory intraoperative X-rays (Guideline 6 in Table 1) in all such patients has a clinical impact. Lastly, it is also possible that the study suffered from regional or institutional selection bias, as it was performed at a single academic center.

CONCLUSIONS

Our results suggest that as the true incidence of RSI in PRS is likely extremely low or nonexistent, it is necessary to address modifiable risk factors to minimize unnecessary intraoperative X-rays for missing counts and consider whether this modality is an effective and appropriate tool in PRS procedures with incorrect surgical counts.

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DISCLOSURE

Dr. Momeni is a consultant for AxoGen, Gore, RTI, and Sientra. The other authors do not have any disclosures.

REFERENCES

1. Freitas PS, Silveira RC, Clark AM, et al. Surgical count process for prevention of retained surgical items: an integrative review. *J Clin Nurs*. 2016;25:1835–1847.
2. Egorova NN, Moskowitz A, Gelijns A, et al. Managing the prevention of retained surgical instruments: what is the value of counting? *Ann Surg*. 2008;247:13–18.
3. Williams TL, Tung DK, Steelman VM, et al. Retained surgical sponges: findings from incident reports and a cost-benefit analysis of radiofrequency technology. *J Am Coll Surg*. 2014;219:354–364.
4. Moffatt-Bruce SD, Cook CH, Steinberg SM, et al. Risk factors for retained surgical items: a meta-analysis and proposed risk stratification system. *J Surg Res*. 2014;190:429–436.
5. Rowlands A. Risk factors associated with incorrect surgical counts. *AORN J*. 2012;96:272–284.
6. Yun G, Kazerooni EA, Lee EM, et al. Retained surgical items at chest imaging. *Radiographics*. 2021;41:E10–E11.
7. Greenberg CC, Regenbogen SE, Lipsitz SR, et al. The frequency and significance of discrepancies in the surgical count. *Ann Surg*. 2008;248:337–341.
8. Macilquham MD, Riley RG, Grossberg P. Identifying lost surgical needles using radiographic techniques. *AORN J*. 2003;78:73–78.
9. Lutgendorf MA, Schindler LL, Hill JB, et al. Implementation of a protocol to reduce occurrence of retained sponges after vaginal delivery. *Mil Med*. 2011;176:702–704.
10. Stawicki SP, Moffatt-Bruce SD, Ahmed HM, et al. Retained surgical items: a problem yet to be solved. *J Am Coll Surg*. 2013;216:15–22.
11. Lincourt AE, Harrell A, Cristiano J, et al. Retained foreign bodies after surgery. *J Surg Res*. 2007;138:170–174.
12. Weprin S, Crocerossa F, Meyer D, et al. Risk factors and preventive strategies for unintentionally retained surgical sharps: a systematic review. *Patient Saf Surg*. 2021;15:24.
13. Mehtsun WT, Ibrahim AM, Diener-West M, et al. Surgical never events in the United States. *Surgery*. 2013;153:465–472.
14. Reformat DD, David JA, Diaz-Siso JR, et al. How many people work in your operating room? An assessment of factors associated with instrument recounts within plastic surgery. *J Plast Reconstr Aesthet Surg*. 2017;70:1285–1291.
15. Thiels CA, Lal TM, Nienow JM, et al. Surgical never events and contributing human factors. *Surgery*. 2015;158:515–521.
16. Steelman VM, Shaw C, Shine L, et al. Retained surgical sponges: a descriptive study of 319 occurrences and contributing factors from 2012 to 2017. *Patient Saf Surg*. 2018;12:20.
17. Ruscher KA, Modeste KA, Staff I, et al. Retained needles in laparoscopic surgery: open or observe? *Conn Med*. 2014;78:197–202.
18. Hariharan D, Lobo DN. Retained surgical sponges, needles and instruments. *Ann R Coll Surg Engl*. 2013;95:87–92.
19. 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;207:80–87.
20. Whang G, Mogel GT, Tsai J, et al. Left behind: unintentionally retained surgically placed foreign bodies and how to reduce their incidence—pictorial review. *AJR Am J Roentgenol*. 2009;193(6 Suppl):S79–S89.
21. Gibbs VC. Retained surgical items and minimally invasive surgery. *World J Surg*. 2011;35:1532–1539.
22. Gawande AA, Studdert DM, Orav EJ, et al. Risk factors for retained instruments and sponges after surgery. *N Engl J Med*. 2003;348:229–235.
23. Camp M, Chang DC, Zhang Y, et al. Risk factors and outcomes for foreign body left during a procedure: analysis of 413 incidents after 1946831 operations in children. *Arch Surg*. 2010;145:1085–1090.
24. Hempel S, Maggard-Gibbons M, Nguyen DK, et al. Wrong-site surgery, retained surgical items, and surgical fires: a systematic review of surgical never events. *JAMA Surg*. 2015;150:796–805.
25. Han MA, Kim JH. Diagnostic X-ray exposure and thyroid cancer risk: systematic review and meta-analysis. *Thyroid*. 2018;28:220–228.
26. Cima RR, Kollengode A, Clark J, et al. Using a data-matrix-coded sponge counting system across a surgical practice: impact after 18 months. *Jt Comm J Qual Patient Saf*. 2011;37:51–58.
27. Greenberg CC, Diaz-Flores R, Lipsitz SR, et al. Bar-coding surgical sponges to improve safety: a randomized controlled trial. *Ann Surg*. 2008;247:612–616.
28. Bloom JP, Moonsamy P, Gartland RM, et al. Impact of staff turnover during cardiac surgical procedures. *J Thorac Cardiovasc Surg*. 2021;161:139–144.
29. Avery DM, III, Matullo KS. The efficiency of a dedicated staff on operating room turnover time in hand surgery. *J Hand Surg Am*. 2014;39:108–110.