

## Patient Safety Tip of the Week

October 27, 2020

### Conflicting Studies on Technology to Reduce RSI's

We've been discussing use of tracking technologies to avoid retained surgical items (RSI's) for many years now. But we continue to see conflicting reports on outcomes with use of these technologies.

There are 2 types of technologies. In one, data-matrix codes (barcodes) are embedded in the surgical sponges. In the other, radiofrequency (RF) chips are embedded. Each can be used to scan in the number of sponges introduced to a case and scan the number of sponges taken out at the end. The RF technologies may have the additional advantage of using of a handheld device or mat to scan the patient for the presence of a sponge if one is missing from the final count.

Gunnar and colleagues ([Gunnar 2020](#)) looked at retained surgical item (RSI) rates for 137 Veterans Health Administration surgery programs and compared rates between those with and without surgical count technology. Retained surgical item rates were calculated by the sum of events (sharp, soft good, instrument) divided by the total procedures performed. One hundred twenty-four RSI events occurred in 2,964,472 procedures for an overall RSI rate of 1/23,908 procedures. The RSI rates for 46 programs with surgical count technology were significantly higher in comparison with 91 programs without a surgical count technology system (1/18,221 versus 1/30,593). Moreover, RSI rates before and after acquiring the surgical count technology were not significantly different (1/17,508 versus 1/18,673). Root cause analyses for 42 soft good RSI events found that human factors (n = 24), failure of policy/procedure (n = 21), and communication (n = 19) accounted for 65% of the 98 root causes identified.

On the other hand, recent studies published in the AORN Journal found that such tracking technologies were successful in reducing RSI rates. Primiano et al. ([Primiano 2020](#)) did a retrospective evaluation of incident reports before and after implementing the use of an RF system for retained surgical sponges at one facility. They found that using RF technology was associated with fewer retained sponges and improved outcomes. Mortality rates before and after RF technology implementation were similar. They also estimated that the hospital's costs were reduced.

The potential benefits of such RF tracking systems have other potential benefits. Steelman et al. ([Steelman 2019a](#)) reported an observational study evaluating the effect of a radiofrequency (RF) surgical-sponge detection system on time spent searching for surgical sponges. The study included 27,637 procedures during nine months before and after implementing an RF surgical-sponge detection system. Though they had no RSI's in either the pre- or post-implementation period studies, after implementation the RF system detected eight missing sponges that were in patients and removed. After implementation of the system, time spent searching for sponges was reduced by 79.58%, the percentage of unreconciled counts was reduced by 71.28%, and time spent using radiography to rule out a retained sponge was reduced by 46.31%. This resulted in a reduction of costs. The estimated cost savings of x-rays and OR time obtaining the x-rays was \$38,218.40 for a hospital performing 15,000 procedures per year. The estimated total annual cost savings related to searching for sponges and using radiography to rule out the presence of a sponge to be \$6,350.93 per 1,000 procedures or \$95,263.95 for a hospital performing 15,000 procedures per year. So, there may well be benefits to surgical sponge-counting systems even if they did not reduce the actual rate of RSI's.

Statistics we've cited before are that the sensitivity of the surgical count is only 77.2% and that more than 80% of retained surgical sponges occur when the count has been recorded as "correct". Previous work by Steelman et al. ([Steelman 2012](#)) had shown 100% sensitivity of the RF wand and the 98.1% sensitivity of the RF mat, compared to only 67% sensitivity of intraoperative radiographs.

Back in 2011, Cima et al. ([Cima 2011](#)) first reported on use of a data-matrix-coded sponge counting system at the Mayo Clinic to reduce RSI's. In their pre-implementation period, the overall incidence of RSI's was 0.178 RSIs/1,000 operations, or approximately 1 RSI per 5,500 cases, 68% of which were retained sponges. After implementation of the data-matrix-coded sponge count system they had no RSI's after 18 months.

Stelman et al. ([Stelman 2018](#)) identified factors contributing to over 300 occurrences of retained surgical sponges (RSS's) that had been reported to the Joint Commission. 52.2% of the items were laparotomy sponges, which are radiopaque. The second most frequently identified RSS (34.0%) was a 4 in. by 4 in. or 4 in. by 8 in. sponge (81% of which were radiopaque). 6.9% were of the retained towels. 50.2% of items were left in the abdomen or pelvis, 23.9% in the vagina, and 8.5% in the chest or mediastinum. Other sites included the throat, breast, or the pocket made to insert an internal pacemaker/defibrillator.

A sponge count was performed in 77.4%, and when the count was performed, it was reported as being correct in 80.6% of cases. The latter is consistent with other reports on the percentage of RSI's that had correct counts. (Note: there were higher percentages of counts done and correct counts for general surgery cases than Ob/Gyn cases).

They found that, in some cases where RF technology was used, RF did identify the retained item. However, in one case where the RF did alarm for a likely RSS, the alarm

was ignored. In several other cases, RF technology was available but not used. In another case, RF did not identify kerlix, not surprising since kerlix does not contain an RF chip or radiopaque marker.

In the 319 cases, they identified 1430 contributing factors, clustered into 13 categories with 63 subcategories. You should go to the article itself for full details of these contributing factors. Some of the more frequent contributing factors were related to policies and procedures, communication, and human factors.

The had several recommendations:

- A methodologic wound exploration should be performed to retrieve all sponges prior to wound closure or completion of the procedure
- For procedures involving the vagina, a vaginal sweep should be performed
- Kerlix should not be used as a sponge
- Sponges should not be cut

Sponges identified and removed after the incision is closed/procedure completed, prior to transfer from the operating/procedure room, should be considered either a sentinel event, or a near miss. These events should be reported internally and investigated.

The authors go on to state “Because of the multitude of contributing factors that have led to a RSS, and the published accuracy and potential benefit of the RF sponge detection, we recommend that this technology be seriously considered in areas where surgery is performed and in Labor and Delivery.” They note that laparotomy, episiotomy, 4 X 4 s and towels should all include a RF chip, and that small sponges unavailable with a RF chip (cottonoids, peanuts, and kittners) should be counted.

Victoria Steelman, in a review of the evidence for preventing retained surgical items ([Steelman 2019b](#)), reiterated the recommendation of using RF surgical sponge identification systems since the collective evidence suggests that the sensitivity and specificity of manual counting and radiograph screening is insufficient to prevent RSI's.

She included a section on guidewires, another item often inadvertently left behind. She notes other researchers have recommended education and training with simulation and forced error, using checklists during insertion of guidewires, and having two people present during the insertion for verification purposes.

Weprin et al. ([Weprin 2020](#)) note that there has been a significant shift from retained soft surgical items to retained hard surgical items over the last decade. While reported retained soft items (primarily sponges, packs and towels) have indeed decreased, retained hard items have increased. The latter include things like needles, blades, instrument fragments, guidewires and an incredible variety of “hard” surgical items that we’ve described in several columns. Weprin et al. note that most retained “hard” items are radiopaque but radiographs are usually only ordered when there is an unreconciled count. Moreover, many of the items are very small and may be easily missed on radiographs.

While sponge accounting systems are at the top of everyone's list of tools to prevent RSI's because surgical sponges are far and away the most commonly retained surgical items, our previous columns warn you not to lose sight of the fact that all sorts of other RSI's have been appearing more and more. In our August 20, 2019 Patient Safety Tip of the Week "[Yet Another \(Not So\) Unusual RSI](#)" we noted the following items that have been retained: blue towels, Kerlix, cautery tips, Glassman viscera container, KOH cup, instrument labeling tape, Jackson Pratt drain bulbs, Rainey clips, and, yes, a cell phone, and others. Other unusual RSI's reported since our last column include a fetal scalp monitor ([Marchitelli 2019](#)) and the bulb from a Toomey bulb syringe ([CDPH 2016](#)). Even the newest radiofrequency identification and tracking systems would miss most of those items.

Victoria Steelman ([Steelman 2019b](#)) also notes a variety of "other URFO's" (unintentionally retained foreign objects), including instruments, catheters or drains, needles and blades, packing, implants, specimens, and a variety of other items. She notes that some of these were retained during minimally invasive surgery, previously felt by some to have had a low risk of RSI's.

Recommendations to avoid URFO's have included team training, managing disruptive behavior, conducting a proactive risk assessment, using a white board to communicate insertion of devices discussing packing during handovers, methodologically exploring the incision before closure, verbally acknowledging the removal of objects, and verifying the integrity of objects removed.

It's worth your reviewing the root cause analyses (RCA's) in our August 20, 2019 Patient Safety Tip of the Week "[Yet Another \(Not So\) Unusual RSI](#)" that identified factors contributing to many of these "other" RSI's. These included communications breakdowns, failure to maintain a "sterile cockpit", personnel changes, time of day, distractions and interruptions, unanticipated events, time pressures, and in some cases unfamiliarity with the particular device involved. In addition, cognitive biases such as "**seeing what we expect to see**" and the related cognitive bias "**inattentional blindness**" were contributory factors.

So, maybe studies aren't really contradictory after all. It's highly likely that technological solutions do reduce retained surgical sponges and "soft" products, but more and more "hard" and unusual items have been being reported and these are not detected by the newer technologies.

We agree with Steelman et al. that it makes sense to use RF technology as an adjunct to help avoid RSI's. But, don't just rely on high-tech solutions to help you avoid RSI's. Some simple things can also help reduce RSI's. Vaginal packing is often used to stop bleeding after Ob/Gyn procedures and sometimes those packs are inadvertently left in place. One hospital began using bright orange wristbands with the word "packing" printed on them to alert providers and patients that packing has been used ([McDonald 2020](#)). A single band is applied to the patient for each packing that's placed, and it remains in place until the packing is removed per physicians' orders. Since they

implemented this system they have had no instances of vaginal packing inadvertently left behind.

Yet another “low-tech” intervention is the “visualize and verify” process. One facility instituted this process after 2 cases of retained sponges that occurred after the final count was completed and was documented as correct, despite being incorrect ([Patel 2020](#)). After the final count is conducted at the incision closure, all sponges are removed from the surgical field, bagged, and laid out for the third verification process. The RN circulator and the surgeon then visualize and verify the sponge count together. This process is not initiated unless the final count is correct. The authors describe the initial barriers and challenges to implementation, including difficulties co-opting surgeons and other OR staff, but eventually convinced all of the usefulness of the process. Compliance with “visualize and verify” eventually rose to 75-80%.

Avoiding RSI’s requires good planning, good systems, good teamwork and communication, adherence to policies and protocols, technological solutions, and, most of all, a good culture of safety that appreciates the “sterile cockpit” concept and respects the voices of the whole OR team.

In addition to our many prior columns on RSI’s/RFO’s listed below, there are many good resources available to help prevent these. NoThing Left Behind® ([NoThing Left Behind®](#)) is the preeminent resource. Others include AORN ([AORN 2020](#)), the American College of Surgeons ([ACS 2016](#)), The Joint Commission ([TJC 2017](#), [TJC 2013](#)), Pennsylvania Patient Safety Authority ([Wallace 2017](#)). Verna Gibbs, founder and director of NoThing Left Behind®, also has provided some great tips for surgeons, nurses, and all OR staff for avoiding RSI’s ([Gibbs 2019](#)). And Victoria Steelman, author of so many publications on RSI’s, and her colleagues have also published recent articles on RSI’s ([Steelman 2018](#), [Steelman 2019a](#), [Steelman 2019b](#)). A recent webinar from the University of Michigan School of Nursing had a nice review on retained surgical items and described how one surgical sponge tracking system works ([University of Michigan 2020](#)).

### **Our prior columns on retained surgical items/retained foreign objects (RSI’s/RFO’s):**

- June 12, 2012 “[Lessons Learned from the CDPH: Retained Foreign Bodies](#)”
- November 2012 “[More on Retained Surgical Items](#)”
- January 8, 2013 “[More Lessons Learned on Retained Surgical Items](#)”
- November 5, 2013 “[Joint Commission Sentinel Event Alert: Unintended Retained Foreign Objects](#)”
- August 19, 2014 “[Some More Lessons Learned on Retained Surgical Items](#)”
- October 28, 2014 “[RF Systems for Retained Surgical Items](#)”
- February 2016 “[AORN Updates Guideline to Prevent Retained Surgical Items](#)”
- February 7, 2017 “[Maternal Safety Bundles](#)”
- August 20, 2019 “[Yet Another \(Not So\) Unusual RSI](#)”
- June 16, 2020 “[Tracking Technologies](#)”

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