

Chapter 9

Retained Surgical Items

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“Any man may err! Only a fool persists in his error.”

Marcus Tullius Cicero

Introduction

A retained surgical item (RSI) refers to surgical materiel used during a procedure that is *inadvertently* left in any part of a patient. RSI rather than retained foreign object (RFO) or retained foreign body (RFB) is the preferred term in the current surgical safety vernacular because RFO and RFB may be used to refer to swallowed or inserted objects, irretrievable shrapnel, bullets, and broken miscellaneous parts of toys and weapons [1]. The presence of these objects may require operative intervention and they often can't be removed and therefore are retained but these are not the instruments and tools that healthcare providers have used to heal patients. It is important to realize that an RSI is a surgical patient safety problem.

There are four classes of surgical items: cotton soft goods (sponges and towels), small miscellaneous items (SMIs), sharps, and instruments. In most reports the most frequently retained items have been cotton soft goods, particularly sponges [2]. The RSIs are usually discovered after the development of clinical symptoms such as

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pain or the presence of a mass. X-ray examination, especially computerized tomography (CT) scans have been most informative in establishing a diagnosis. The true incidence of RSI is unknown but public data systems from states such as California, Pennsylvania, and New York and regulatory agencies such as The Joint Commission continue to report yearly cases [3]. If this problem is to become a “never event” it is not so important to know how many cases there have been, it is only important to know that the number of cases is still greater than zero.

One obstacle in case reporting has been the difficulty in agreeing on a simple and unequivocal definition of when a surgical item is considered to be retained. The National Quality Forum has defined a list of serious reportable events (SRE) which they term “never events” [4]. Unintended retention of a foreign object in a patient *after surgery* or other invasive procedure is an SRE. The area of conflict in this definition is “after surgery.” Many have opined that surgery is over with the closure of the surgical wound which is akin to having a “wheels down” interpretation of when an airplane has landed [5]. Many would argue that an operation or procedure isn’t over when the incision is closed. The differences in opinion about what “after surgery” means has led to disagreement and probably over-reporting of RSI events. In 2011, the NQF reviewed the definitions of all the SREs and reexamined the question of when it is “after surgery.” The new definition states that surgery ends after all incisions have been closed in their entirety, devices have been removed, final surgical counts have concluded, and the patient has been taken from the operating or procedure room [4]. Just changing the definition will undoubtedly lead to a reduction in the number of reported cases. Other obstacles to case reporting include legal liability and medical and hospital staff reputation concerns.

Efforts to discern risk factors for retention based on patient characteristics such as patient size or operative characteristics such as the type of procedure or operative circumstance have been undertaken in the past [6, 7]. It turns out that there isn’t any predictable relationship between the likelihood of retention and the type of item, the number of items used, the size of a wound or cavity, or the type of case or medical specialty [8]. Retention of surgical items has occurred in all types of procedures. Retained sponges have occurred when only ten sponges were used in an elective operation; yet hundreds of instruments can be used during a case and whole instrument retention remains very uncommon. Operating room (OR) policies that stipulate that a surgical item count only needs to be performed in cases where there is a risk of retention are difficult to enforce because it leaves open for judgment just when that risk of retention would exist. It is more insightful to look at OR personnel characteristics and the OR environmental conditions under which people work rather than patient characteristics. Changing the focus from the patient to the providers and environment has revealed failed OR practices and poor communication as the key elements that lead to patient injury and harm from RSIs. This is further evidence for the usefulness of thinking of an RSI as a surgical patient safety problem rather than just another perioperative complication.

RSIs occur because of problems in the OR practices and communication strategies of multiple OR stakeholders [9]. The OR practices are not just the counting processes of the nurses and surgical technologists. Surgeon performance of a wound sweep instead of a methodical wound exam, cursory reading of X-ray images by radiologists,

and poor quality radiographic images taken by radiology technologists also contribute to errors which lead to RSI. Anesthesiologists may confound surgical item management by mixing their sponges and instruments with those that are counted and risk managers and administrators may be overly concerned with institutional protection to the exclusion of transparency needed for effective learning. An RSI is reflective of system problems and therefore require systemic solutions. Admonishing circulating nurses to just “count” harder will not address the complex nature of this problem.

Case Studies

To further illustrate the root causes and preventive strategies for RSI, we describe three retained sponge cases presenting three different perspectives. The fact that these are all cardiothoracic cases is of no particular significance because all types of surgical cases have had retained sponges. It is not important what type of case, where the sponges were lost, what kind of sponge was involved or when the sponge was found as much as it is important to try to understand why and how the sponges were retained and where the failures in the OR practices and communication strategies occurred. It has been difficult to see that there is any pattern or obvious corrective action to take when looking at an individual retained sponge case and since most hospitals have very few of these events, root cause analyses and focused reviews have been unable to uncover real systemic improvements for prevention. We present an alternative analysis.

We have characterized all cases of retention as belonging to one of three essential type of case based upon the status of the surgical counts as recorded at the end of the operation. The three types of cases are no count retention case (NCRC), correct count retention case (CCRC), and an incorrect count retention case (ICRC) [10]. We use the nomenclature of surgical counts but it is equally useful to use this term—surgical count—as a surrogate for some form of sponge management without being specific as to the actual action of counting sponges.

Clinical Summary

Case 1: No Count Retention Case

The patient had third-degree heart block and was undergoing placement of a pacemaker in the cardiac catheterization suite which was adjacent to the main operating rooms. All monitors were placed correctly, the patient had oxygen on, and a site on his right chest was prepped and sterilely draped. There were ten 4 × 4 raytex sponges (a neologism for a surgical sponge that contain a radiopaque marker woven into the gauze interstices of the sponge to enable X-ray detection) on the procedure table. An incision was made, a subcutaneous pocket was fashioned, and the pacemaker inserted. There was commotion in the room next door and the physician looked up and could see that the patient was in trouble. The pacemaker patient was completely

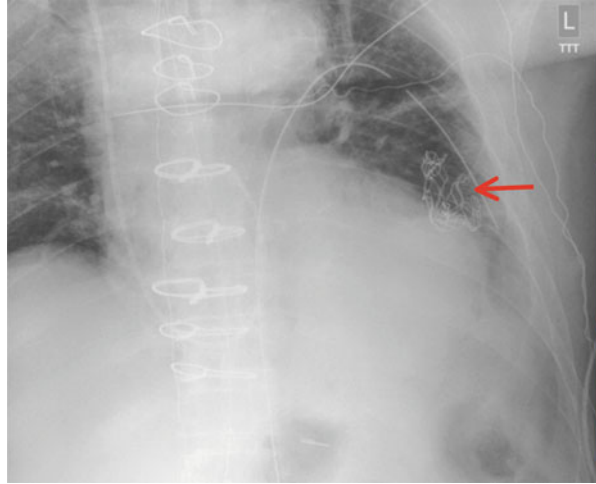
stable so the physician took a raytex and stuffed it in the newly created pocket and went to the suite next door to assist. About 15 min transpired before the physician came back to complete the pacemaker insertion. The patient was still completely stable. The skin incision was closed and a fluoroscopic image was taken to check the pacemaker position. This looked good and the pacemaker was functioning well. A sterile dressing 4 × 4 sponge was put over the wound and the patient was discharged home.

Over the next 2 months the patient developed redness, tenderness, and edema around and over the area where the pacemaker was. There were no electrocardiographic abnormalities and fluoroscopic imaging of the site showed an intact pacemaker. The patient received a course of antibiotics which initially helped the redness but recurred once the antibiotics were stopped. The physicians decided that the patient had developed an allergic reaction to the metal of the pacemaker and decided to remove it and replace it with another brand. Upon opening the incision and removing the pacemaker, an infected raytex sponge was encountered. The unsuspecting physician was amazed to find the retained sponge because it had not been seen on any of the fluoroscopic images but the patient had not had a formal chest X-ray series (AP and lateral). The sponge was removed and the infection in the incision was treated. The pacemaker was placed on the other side and the patient subsequently did well.

Case 2: Correct Count Retention Case

The patient had severe coronary artery disease and aortic stenosis and underwent a coronary artery bypass graft (CABG) and aortic valve replacement. The cardiac surgery team had worked together before and all were experienced clinicians. It was a long case that started in the morning and went through lunch into the early afternoon. The scrub technologist and the circulating nurse had both been given a morning break and lunch relief by two different relief nurses. Lap pads and 4 × 4 raytex sponges were used during the case. The raytex were only used as the grafts were being sewn in as a surgeon preference because of a belief that the gauze interstices of the raytex absorbed blood better. The CABG went well and there were no untoward problems. During the aortic valve replacement there was some bleeding, but this was eventually controlled. Lap pads were used during this portion of the case. The patient came off bypass well and there were no problems. As the sternum was closed the nurse informed the surgeon that the closing sponge counts were correct. The chest was then completely closed and the operation concluded. The nurses told the surgeon the final counts were correct and the patient was taken to the ICU. On the first postoperative day after the morning ICU chest X-ray had been taken, a radiologist called the surgeon to inform him that there were radiopaque markers consistent with a raytex sponge in the patient's left chest (Fig. 9.1). The surgeon was completely surprised because he had been told that the final sponge counts had been called correct. The patient was taken back to the OR for removal of the sponge and subsequently did well.

Fig. 9.1 Chest X-ray showing a retained raytex 4×4 sponge



Case 3: Incorrect Count Retention Case

The patient had repair of a thoracic aneurysm through a left thoracoabdominal incision. This was a long operation that involved a large volume blood loss and multiple changes of nursing staff giving breaks and lunch relief to each other. At the end of the operation as the abdominal wound was being closed, the nurses informed the surgeon that there was a missing lap pad. The surgeon looked in the abdomen and explored it and said he didn't see anything and continued to close the wound. The nurses explained to the surgeon that it was hospital policy that an intraoperative X-ray had to be obtained when there was an incorrect count so the surgeon agreed and a radiology technologist came to take a film. The surgeon told the technologist they just needed an X-ray of the chest because he had explored the abdomen and there wasn't a lap pad in the abdomen so the technologist just took an AP view of the chest. The image was sent back to the OR and the surgeon looked at it and told the staff he didn't see anything on the film. The nurses continued to look for the lap pad in the trash and receptacles in the room and entered in the OR record "miscount of lap pad, X-ray negative." The missing lap pad was never found. The patient went to the ICU and had a daily chest X-ray as was the usual practice for care after this type of operation. For the first 3 days, the morning chest X-ray was read by the same radiologist. There were no unusual findings reported. On the morning of the fourth day a different radiologist was assigned to read the morning ICU chest X-rays. On that morning the new radiologist called the surgeon to ask him if he knew about the lap pad in the patient's left chest and was wondering why it hadn't been removed. The surgeon shook his head in dismay and said "oh so that's where that missing lap pad was." The patient was taken back to the OR for removal of the lap pad and subsequently did well.

Analysis of Case Studies

Case 1 is an example of a no count retention case (NCRC). There was an RSI but no counts or methodology was employed by any surgical care personnel during the procedure to track, manage, or account for the sponges that were being used. These types of cases are common in non-OR environments such as cardiac catheterization labs, procedure rooms, and labor and delivery birthing rooms. Surgical items are being used in these areas but it has not been common practice or a matter of policy to have in place some management process for tracking the items to make sure none are left in the patient. The use of a fluoroscopic image which had only an AP projection falsely reassured the clinician that there was no problem with the pacemaker but the presence of the pacemaker obscured the view of the retained raytex because the sponge was behind the radiopaque device.

Case 2 is an example of a correct count retention case (CCRC), i.e., at the end of the operation the nurses called the surgical sponge count correct yet there was a retained sponge. These cases are always a surprise because everyone thinks things are just fine until the surgical item is discovered hours, days, months, or even years later inside the patient. The item is discovered either because the patient develops symptoms – usually pain related to an infection, or the presence of a mass or an X-ray has been obtained for some other reason which incidentally shows the presence of the surgical item. In CCRC the OR practices that have been used by the nurses and surgeons to track, manage, and account for the surgical item during the case have failed. The practices were employed, the nurses counted, the surgeons did a sweep but neither identified that an item was still in the patient and that the count was in fact wrong. While the counting was underway, no one identified an error and in retrospective analysis frequently no one can determine when the mistake in the counting practice occurred. Often they attribute the cause of the error to distractions or inexperience yet rarely look at the details of the counting practice itself. The surgeon may have performed a “sweep” around the wound but didn’t look and feel with intention for surgical items in order to remove them. This is designated as a CCRC based on the count as recorded in the medical record; not that in a post hoc analysis the count was truly incorrect. CCRC demonstrate problems with OR practices.

Case 3 is an example of an incorrect count retention case (ICRC). At the end of the operation, in spite of everyone knowing there was an incorrect count and that an item was missing, no one was able to find it and the patient left the OR with the sponge still inside. All stakeholders acknowledged that the count was incorrect, yet no further actions were taken to find the sponge or prove that it was not still inside the patient. In these cases, the surgical item management practices were working because the team members correctly identified that something was missing, but then other elements failed. The radiology technologist took a poor quality X-ray and the surgeon lacked the knowledge to direct the technologist to obtain additional views and then incorrectly interpreted the film. There was no hospital requirement that radiologists, who are the content experts in radiographic interpretation, review in

real-time OR films obtained when looking for missing surgical items (MSI). When the radiologist was looking at the post-procedure films, it wasn't known that there was a missing lap pad since there was no further communication from nursing to surgeons or surgeons to radiologists. Therefore, the radiopaque marker of the lap pad was attributed to other expected surgical material. It was not until a "new set of eyes" looked at the films and identified the persistent radiographic abnormality and questioned what it was. These ICRC usually are problems with communication and involve errors in the exchange of information and knowledge between multiple stakeholders.

It turns out from review of case series from around the country about 80 % of RSI cases are CCRC and 20 % are ICRC which is why nursing personnel so frequently are called to task to review the "counting" practices [10]. But the problems in these CCRC cases aren't that the staff didn't count, they have counted and in many cases they have counted many times, yet somewhere in the process of the counting, an error or errors have been made. Because they don't know with certainty when the error occurred, external cofounders are implicated as causal to the problem with the counting practice that led to the mistaken count. Most common explanations are that there was a distraction or noise or they were hurried or there were breaks and relief changes. Very few to no reports outline exactly what practice is being employed when performing a surgical count. That is, an exact process composed of individual steps that everyone follows that makes up the counting practice in that OR. This is one of the true roots of the problems with counting. There usually isn't one practice of counting but as many practices in place as there are people doing it. It often turns out at the end of the case that the surgical items have indeed been counted but they have not been accounted for. Similarly, surgeons often perform a wound "sweep" which just by the nature of the action may not uncover sponges packed behind pacemakers, stuck between loops of bowel, or lodged in parts of the chest. They do not have specified practices for the performance of a methodical wound examination that is done solely with the intent to find and remove surgical items that are not intended to remain in the patient [9]. It is not the failure of one surgical stakeholder that leads to an RSI but the concatenation of failed practices by multiple stakeholders.

In the 20 % of retention cases that are ICRC, as is illustrated in the case example, the initial practices that were employed by the nurses and surgeons to count and look for the items worked. The nurses told the surgeon they were missing a lap pad and the surgeon looked carefully in the abdomen and didn't find anything. The team then moved to bring in the secondary defender against RSI—the radiology team—and it was here that lack of knowledge and errors in communication set them up to fail. The radiology technologist took only an AP view of the chest rather than an AP and an oblique or a lateral view and the image that was obtained was read only by the surgeon rather than by a radiologist who is the true content expert in radiographic interpretation. The surgeon didn't do a manual exploration of the chest because he assumed the X-ray would provide the necessary information. The nurses never found the sponge and didn't move the missing sponge up the chain of command to notify the nurse manager or risk managers that there was a problem in this

case and that the patient still remained at risk. After the patient left the OR, no actions were taken to further confirm that indeed the intraoperative X-rays had been complete (which they weren't) and whether the image was indeed truly "negative." The radiologist reading the postoperative films missed the retained lap primarily because the radiologist wasn't looking for one but also because "everything on the film" wasn't seen which is a radiologists' nightmare [11, 12]. If the radiologist had been told that a lap pad was missing in the case and was never found, it might have been discovered sooner. As it turned out, the lap pad was on all of the postoperative films but it took a "new set of eyes" to see that something was there that shouldn't be there. Usual remedies after a RSI case include policy changes and additional steps to perform in an already overburdened and variable process. Understanding aspects of human fallibility and putting into place stronger communication linkages are different approaches to solve this problem.

We can take this analysis to the development of action plans for systemic remediation. If a hospital has a NCRC or a CCRC, the problem is with the OR practices and all surgical personnel need to change their practices [13]. There are only two real choices here. Either improve the existing practice or get a whole new practice. If it's decided that improvement is the route that is going to be taken, the first step is to look at the practice that is being employed and break down the process steps that make up the practice. There are two primary ways to improve a process—decrease the number of steps in the process or increase the reliability of any individual steps.

Strategies to Prevent RSIs

Soft Goods (Sponges and Towels)

Examination of the practices of counting sponges through observational audits and focused reviews led to the development of the Sponge ACCOUNTing system (SAS) by the NoThing Left Behind® project. The SAS is a standardized manual sponge management system that is an improvement practice which simplifies and increases the reliability of the process of accounting for surgical sponges [14].

The SAS requires OR personnel to use a wall-mounted dry erase board to record the sponge counts and requires surgeons to perform a methodical wound exam at the closing count in every case. Nurses and surgical technologists must ensure that all sponges in a case are used only in multiples of ten and at the end of the case, all the sponges are placed in blue-backed hanging plastic sponge holders, each of which has ten pockets. There should be no empty pockets visible at the final count if all the sponges have been accounted for. There are safety practice rules for surgeons and nurses to follow which standardize the practice, reduce individual variation, and are expected to prevent CCRC (Table 9.1). Embodied in the SAS are also communication tools (wall mounted checklist) for nurses, surgeons, and radiology stakeholders to use at point of service so an ICRC can be prevented (Fig. 9.2). Table 9.2 describes the guidelines for planning optimal image quality for suspected RSIs.

Table 9.1 Sponge ACCOUNTing actions

Surgeons	Nurses
IN COUNT	IN COUNT
Only use X-ray detectable sponges	Work only in multiples of 10
Don't cut or alter them	Discover the number of sponges in a pack
Avoid use of small sponges in large cavities	See, separate, and say
	Document count on dry erase board
CLOSING COUNT	CLOSING COUNT
Take a "Pause for the Gauze"	Take a "Pause for the Gauze"
Perform a Methodical Wound Exam (not just a sweep) before asking for closing suture	Remind surgeon to perform a Methodical Wound Exam
Get the sponges out so the nurses can count them	Count sponges in field and in holders
	Check back to surgeon the status of the count
FINAL COUNT	FINAL COUNT
Before leaving the OR look at the sponge holders and see that there are NO EMPTY POCKETS	ALL sponges (used and unused) MUST be in the sponge holders before the patient leaves the OR
Verification "Show Me" step	NO EMPTY POCKETS
Dictate actions in the operative report	Show the surgeon all the sponges have been ACCOUNTED for
	Document count in intra-operative record

If it's decided that a whole new practice is needed for sponge management rather than an improvement like the SAS, then there are technological adjuncts that use 2D matrix computer-assisted technology which counts sponges or electronic article surveillance technology which can detect the presence of a sponge with a compatible radiofrequency (RF) tag, or radiofrequency identification (RFID) technology which can count and detect sponges that contain an RFID chip.

The computer-assisted technology consists of sponges that have two-dimensional matrix labels annealed to them and a handheld or table-mounted scanning device that can read the labels [15]. Each sponge has a unique identifier that enables the scanner to count different types of sponges. The sponges are counted maintaining "line of sight" for each sponge and the sponges must be removed from the patient and individually passed under the scanner. The scanner has no capacity to "read-through" the patient to detect the presence of a matrix-labeled sponge. In the event of a missing sponge, an X-ray is used to determine if it is in the patient.

The electronic article surveillance system consists of sponges that have a small passive RF tag sewn into a pocket on each sponge and a handheld wand or mat which contains the antennae and detection system [16]. The tag is detected when the handheld wand or mat is activated and a visual and audible signal is registered on a console that a sponge has been detected. The system does not distinguish between sponge types or number of sponges. The signal readout will be the same intensity if there are one or five sponges. In the event of a missing sponge, the mat can be activated to determine if the sponge is in the patient or the wand can be used to wand the patient or scan the trash to find the sponge. This system does not count sponges.

YIELD

AND TAKE TIME TO RECONCILE AN INCORRECT COUNT

@ CLOSING COUNT TAKE A



SURGEONS

- STOP CLOSING THE WOUND!**
Remove fascial sutures and place retractor
- Repeat the methodical wound examination
- Actively look and feel for missing sponge

NURSES

- Tell surgeon what type of sponge is missing
- Ask surgeon to repeat methodical wound exam
- Repeat count
- Check holders to make sure only one sponge per pocket
- Search trash, linens

ADDITIONAL HELP

- Consider getting "another set of hands" to feel
- Cover the wound with towel or plastic drape

- Call for personnel to search, call nurse manager
- Scrubperson search field and drapes

XRAY

- Call for Xrays, get an AP and oblique view
- Tell radiologist what type of sponge is missing
- A radiologist should review the film before it is called negative especially if sponge not found

- Call for Xrays, include call back info on requisition
- Check sponge "departure" opportunities (e.g. went with newborn, around a specimen, anesthesia trash)
- Contact visitors who may have left the room

IF SPONGE NOT FOUND:

- RECORD COUNT AS INCORRECT
- REPORT TO ADMINISTRATION
- DISCLOSE TO THE PATIENT

SPONGE ACCOUNTING 



Fig. 9.2 Multi-stakeholder incorrect count checklist

Table 9.2 Guideline for obtaining X-rays for suspected retained surgical items (RSI)

Exam	Views	Region of interest (ROI)	Comments
MSI cranium	AP and lateral	Top of skull to below the mandible and bilateral skin borders	Include face and neck if ENT surgery
MSI chest	AP and oblique/lateral	Apices to costophrenic angles (CPA) and bilateral skin borders	This may require more than one film for the AP projection. The oblique may be a single 14 × 17 of the ROI
MSI abdomen/pelvis	AP and oblique/lateral	Diaphragm to pubis and bilateral skin borders	This may require more than one film for the AP projection. The Oblique may be a single 14 × 17 of the ROI
MSI vagina	AP and inlet	Inferior gluteus to above crest and bilateral skin borders. Inlet must show the pelvic ring	Inlet: place 14 × 17 vertical with 25° caudal angulation. Special attention needed to avoid grid cut-off
MSI spine	AP/PA and lateral	C-spine: neck; T-spine: chest; L-spine: abdomen	C-spine: 11 × 14 T-spine: 14 × 17 L-spine: 14 × 17
MSI extremity	AP and lateral	Include above and below ROI and bilateral skin borders	Use large films

The RFID system has a unique radiofrequency identification chip sewn into each type of sponge and a separate computer console with a scanning bucket or an attached wand into which used sponges are placed [17]. Each sponge has a specific identifying chip and thus sponges of different types pooled together can be distinguished and counted. Used sponges can be put directly into the bucket or into plastic bag-lined kick buckets and the entire plastic bag full of sponges then placed into the scanning bucket. The sponges will all be individually counted. If there is a missing sponge it can be detected with a wand that is attached to the bucket by a long cord. This device offers a complete sponge counting and detection system.

Small Miscellaneous Items and Unretrieved Device Fragments

SIMs used during procedures includes vessel loops, bovie scratch pads, trocars, parts of instruments or tools like screws, bolts, drill bits and guidewires, sheaths, and tubes. These items have become the second most commonly reported RSI [18]. The metal items are radiopaque while others are non-radiopaque and some are a combination of both in that surgical items composed of multiple parts may have one part that contains a radiopaque marker while another part does not. Many of these non-radiopaque SIMs are made of plastic and are disposable. Rather than try to

classify cases by the type of item, we have analyzed cases by the location of the procedural event. This segregates cases into OR cases and non-OR cases.

OR Cases

If we assume that the devices and SMIs are being used correctly, that is there is not a direct breakage of the device because of the way in which it was used, then there are three essential causes for parts or pieces of surgical items to be retained [19]. The first is because of manufacturer defects present in the tools or instruments when they are made. These defects may not be apparent until the actual device is deployed or used. The more common problem associated with retained SMI and unretrieved device fragment (UDF) is using worn or used equipment that is not recognized at the time of the case or is only recognized when the used equipment breaks or a piece breaks off. The last and probably most frequent problem with retained SMI is related to the plethora of new equipment, devices, and tools that are now used during operations. Many of these devices are unfamiliar and are composed of multiple separable parts. It is difficult for the surgeon at the time of the operation to recognize that there is something missing and the circulating nurse is often too far away from the site to identify a problem which means that the surgical technologist or person in the scrub position must become the content expert in this domain of surgical equipment.

SMI's are usually retained because of failed item management and error detection practices. The scrub person is in the closest position to check the condition of all items passed to and returned from the field [13]. Optimal performance will require knowledge about the tools that are used. The scrub position requires more than just passing instruments back and forth. OR managers will have to adopt standardized practices beyond just counting items, such as having standardized back tables where there is "a place for everything, and everything in its place" so the items and their constituent parts can be properly accounted for. If something is found to be amiss it is most important that if the scrub person "sees something, they will say something" so a concerted search can be undertaken to find the missing parts.

UDF are frequently so small that it is difficult to find them and they will not lead to any apparent harm if left behind. Larger UDFs can cause irritation, infection, obstruction or embolization. It is a matter of clinical judgment on the part of the surgeon to determine whether to try to remove the material or leave it alone. If it is decided to leave the material in the patient, it is important that the patient be informed and a disclosure discussion held between the patient and the surgeon.

Non-OR Cases

The primary non-OR cases of retained SMI involve procedural areas in the hospital including cardiology suites, radiology areas, and the ICU. Items left in patients from these areas usually include guidewires, sheaths, catheters, introducers, and various tubes. The objects can be either intravascular or in interstitial spaces. These items are usually retained because of problems with provider practices of insertion, usage

or removal techniques. If the wires or catheters are left intravascular, interventional radiology has a very good chance of retrieving the items. This should be done as soon as possible after discovery because left in the heart or vessels for too long they become embedded in the intimal surface and can't be removed.

Sharps

Needles are a frequent source of miscounts and their retention primarily involves practice problems even though these cases are usually ICRC. A small needle is known to be missing but the surgeon makes a clinical decision to intentionally not remove it. Suggestions for practice improvement involve accounting for needles by size and building a needle management policy around the ability to detect and find needles [1]. Needles should be passed back to the scrub person on an instrument and the use of a "safety zone" is highly recommended [13]. Best practices involve safe management of the needles on the back table. If a small needle is lost, it is often not possible to retrieve it. Small needles <15 mm are frequently difficult to see on X-ray, difficult to find in situ, and have not been reported to cause problems in large cavity spaces if lost. If a patient has a retained small needle it is unlikely to cause a problem for future MRIs. They are unlikely to wobble or cause injury and won't heat because they do not form complete loops. We know of patients who have very small needles left in the mediastinum and broken needles left in the pelvis because they have been incidentally noted on CT scans. The most important action in the event of a miscount for a missing needle is to disclose to the patient that there is a possibility that there could be a retained needle and consider obtaining a CT scan which has the necessary resolution to see needles of all sizes. This may or may not change the decision about whether or not it can or should be removed. The best strategy is to focus on strong needle management practices to prevent loss in the first place.

Instruments

Retention of whole instruments is very rare and is the result of incorrect practices of surgeons and nurses. These cases are uniformly CCRC. Interestingly enough the most commonly retained type of instrument is a retractor and the long, thin mal-leable retractor is the most common item [14]. This particular instrument is used after performance of the wound exam during fascial closure, so prevention of its retention is highly dependent on instrument accounting practices used by surgical technologists and nurses. If there are mistakes in "the count," there are no further opportunities for identification of the error until the retractor is discovered. X-rays have high specificity and sensitivity to show instruments since most are made of metal. The use of mandatory postoperative X-rays for abdominal and chest cases was an early recommendation [7]; however, this practice has been abandoned in many facilities because most X-rays are negative and the time, X-ray exposure, and

cost of obtaining them has not been rewarded with a significant yield. There are special circumstances when mandatory X-rays in lieu of performing instrument counts are useful. These cases include orthopedic and neuro-spine cases where X-rays are performed at the conclusion of the case to check the alignment and positioning of the surgical constructs. In these circumstances the images can be used to also look for the presence of any surgical instruments, but the X-rays must be obtained while the patient is still in the OR and cannot substitute for sponge, sharp or SMI counts. Short of this practice, most hospitals still use various counting protocols to determine that all instruments have been accounted for.

Conclusion

An RSI is a surgical patient safety problem. These are system problems and can be prevented by multi-stakeholder use of reliable OR practices and effective communication techniques. The operative words here are “reliable” and “effective.” These are human undertakings and as such are subject to human error but understanding why people fall into the error traps and learn how to avoid them, makes these events preventable. Much has been written about team-based training programs such as crew resource management as applied to medical units. In the operating theater, nurses and surgeons have a long tradition of working together but not always as a functional team [20]. Enhanced communication strategies and rule-based practice actions can be successful in transforming a rare event into a true never event. In order for the practices to work, they must be employed in every case, every time, and not only in cases where there is a perception of a risk of retention. Enforcing this undertaking alone is the greatest challenge. No matter which route is taken, multiple stakeholders will have to become engaged, work together, and change behavior to develop a safer OR. Engaging surgeons and radiologists, anesthesia personnel, and OR nursing staff in addition to physicians and technological staff throughout the hospital to rethink and change some of their behaviors and practices seem daunting. Not doing otherwise to prevent harm to patients is unacceptable. At the end of every procedure, together we must make sure there is NoThing Left Behind.

Key Lessons Learned

- Analyze an RSI case to identify practice or communication problems (or both).
- Reduce variation and customization in OR practices and make sure all stakeholders are employing the same standardized practices.
- A policy should be reflective of the actual practice and should be a multi-stakeholder policy since the effort to prevent RSI requires multidisciplinary actions.

- The use of strong communication tools specific to the OR or procedural environment are necessary.
- Leadership rule and policy enforcement has to include medical staff as well as hospital staff.
- Prevention of RSI requires practice change which takes longer than most people expect.
- Consistency yields excellence.

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