Chapter 10
Wrong-Site Surgery

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> *"What are man's truths ultimately? Merely his irrefutable errors."*

> Frederich Nietzsche

Case Studies

Case 1: Wrong Limb Amputation

Clinical Summary

Mr. Jones is 51-year-old diabetic male with a history of chronic ulcerations involving both lower extremities. After 2 days of increasing fatigue, fever, and foul smelling drainage from his right foot he presented to Dr. Michaels' surgery office for evaluation.

Dr. Michaels diagnosed wet gangrene of the right foot extending above the ankle. The left foot had a deep, chronic ulcer on the lateral plantar aspect but was pink with minimal exudate and felt to be viable. Dr. Michaels had an extensive discussion with the patient regarding the need for amputation to control his infection. Mr. Jones reluctantly agreed to the procedure and signed consent for a below knee amputation of the right lower extremity. The surgeon's office assistant booked the operative procedure as an emergency in the local hospital.

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Six hours later Mr. Jones arrived in the holding area of the operating suite, while the nursing team set up the room and equipment for the amputation. The surgeon arrived shortly after and, while he was changing into his scrubs, the anesthesiologist and circulating nurse brought the patient into the operating room, induced anesthesia, and proceeded to prep and drape the patient.

Dr. Michaels entered the operating room, thanked his colleagues for their efficiency, and proceeded with the amputation. After Dr. Michaels cut through all the soft tissues and ligated the major blood vessels, the circulating nurse became anxious and called out to the team. While organizing her paperwork she noted that the surgical consent was for a right below knee amputation but the team was operating on the left leg. There was immediate silence followed by a prolonged period of distress by the members of the operating team. Unfortunately, the procedure had progressed to a point where they were committed to amputation and Dr. Michaels had no choice but to complete the amputation of the left leg. The following morning Mr. Jones underwent a right below knee amputation to treat his gangrenous extremity by another surgeon.

Analysis of Errors

Analysis of this case reveals a series of errors and system failures leading to the wrong limb amputation and subsequent bilateral leg amputations, despite the fact that the surgeon had obtained the correct consent (See Table 10.1).

The first error was performed by Dr. Michael's office assistant who inadvertently booked the case as a "left" below knee amputation rather than a "right" amputation. The office assistant routinely booked the surgeon's cases via phone. This error could have been prevented if she had been required to review the consent form at the time of the booking. Similarly, if the individual who received the call and put the case on the OR schedule had had a faxed copy of the signed consent form to review at the time the case was entered, the discrepancy could have been identified and rectified at the time of booking.

Once the patient arrived in the holding area of the operating suite there was no attempt made to confirm the correct procedure by any member of the OR team. At that time, there was no requirement in place for the team to confirm the planned procedure with the patient and the consent form.

In an effort to be efficient, the anesthesiologist and scrub team brought the patient into the operating room while the surgeon was still changing into scrubs. This was a common practice in that OR to minimize turnover time. In addition, there were several other emergency cases still waiting to be done and the team was pressured to move the case along. Once in the room, the team proceeded to prep and drape the wrong extremity according to the OR schedule.

When Dr. Michaels arrived in the OR, he proceeded with the left leg amputation without taking the time to review the consent, confirm the surgical site, or discuss the planned procedure with the other members of the team. The fact that the left leg was already prepped and draped introduced the risk of a perception error and/or confirmation bias, increasing the chances that he would not recognize that the wrong leg was prepped. The fact that Mr. Jones had skin ulcerations involving both lower

Table 10.1 Case 1: Timeline of events/risks and solutions

Risks and failures during the process	Solutions
The surgeon determines need for right below-knee amputation and obtains appropriate informed consent	Standardize booking process for all operative procedures
Office assistant books case as "left" below knee amputation instead of "right"	Require that provider/clerk cross-check procedure against a written consent or medical record at time of booking
Wrong procedure placed on OR schedule	Have electronic booking form or, fax the consent or a written booking form to the OR if off-site booking
OR team failed to verify the planned procedure with the patient and medical record prior to the patient entering the OR	Block entry into the OR unless a verification process has been performed with both the patient and consent form by all members of the surgical team
The operative site was not marked by the surgeon and confirmed prior to entering the OR	Assure that the surgeon physically marks the intended operative site and have it confirmed by other members of the team before entering the OR
The opportunity to identify the booking error before entering the OR was missed	
The left leg was already prepped and draped at the time of the surgeon's arrival increasing the chances of a perception error or confirmation bias on the part of the surgeon	Assure that the correct operative site is marked and visible before the patient is prepped and draped
Another opportunity to identify the error in laterality was missed	
There was no team discussion performed prior to the start of the operation to reconfirm the planned procedure with the patient and the consent form	Do not allow any incision until a "time-out" process is performed by all member of the operative team
The team proceeded to amputate the wrong leg	The process must reconfirm the correct patient, the correct procedure, and the correct side/site and agreed on by all

extremities was another factor that contributed to the sequence of events. Since both legs were already bandaged upon arrival to the holding area, there was less of an opportunity for a member of the team to identify the discrepancy between the diseased limb and the one booked for amputation.

Case 2: Death from Wrong-Patient Procedure

Clinical Summary

Mrs. Smith was a 68-year-old female with a history of prior left pneumonectomy for lung cancer. She was admitted to the MICU for COPD exacerbation and required endotracheal intubation for respiratory failure. Mr. Wong was the patient in the bed adjacent to Mrs. Smith and was also in respiratory failure requiring mechanical ventilation. During afternoon rounds, the medical team decided to place a central venous catheter in Mr. Wong.

The team had difficulty reaching Mr. Wong's wife for consent. Due to the delay, the day resident signed out the procedure to the night-float resident. Shortly thereafter, the night resident gathered the required supplies and began placing a central line via Mrs. Smith's right subclavian vein. During the procedure, the nurse came to the bedside to inquire what the night resident was doing as she was not aware of any planned procedure for her patient. The resident replied that an informed consent for central venous catheter insertion was in the patient's chart and proceeded with the insertion. While the nurse was confirming the consent, the resident called frantically for her to come back because the patient was arresting. A code was called but resuscitation efforts were unsuccessful. The resident realized that she had placed the central line in the wrong patient. A postmortem examination determined that the cause of death was a right-sided tension pneumothorax.

The resident was suspended for the remainder of her second year because she failed to adhere to the "Universal Protocol" policy. The nurse was reprimanded for not being more observant and ensuring the safety of her patient. While the resident had excellent medical knowledge and clinical skills, she decided that the stress caused by her mistake was too overwhelming and she decided to pursue a career in the pharmaceutical industry.

Analysis of Errors

Similar to Case 1, a series of errors and contributing factors led to the death of Mrs. Smith. These errors could have been interrupted at several points during the process, had appropriate policy and procedure been followed (See Table 10.2). As in Case 1, an informed consent was properly obtained for the correct procedure on the correct patient. Unlike in Case 1, the institution did have a policy in place (the "Universal Protocol") that mandated a "verification" and "time-out" process to identify the correct patient, the correct procedure, and the correct side/site prior to initiating any invasive procedure. However, the policy was not followed.

In her haste to get started, the resident failed to notify the nurse that the procedure was being performed. She failed to verify the patient's identity against the consent obtained earlier by the prior team. Had this been done, the resident would have immediately recognized that the procedure was planned for Mr. Wong.

When Mrs. Smith's nurse was puzzled at seeing a procedure being performed without having prior knowledge, she should have immediately voiced her concern and insisted that the resident stop the procedure until she could verify the correct patient and procedure in concordance with the consent. Once the nurse questioned the procedure the resident should have been cued into recognizing that this was a potential safety issue and subsequently stopped on her own accord until these issues were clarified. Had this been done, the procedure would have been aborted before causing harm to Mrs. Smith.

Other factors that increased the risk for error in this case include the fact that the procedure was planned by the day team but executed by the night team. Shift work and handoffs are occurring with increasing frequency in medicine today. All practitioners need to recognize the increased risk for miscommunication and misinterpretation of

Table 10.2 Case 2: Timeline of events/risks and solutions

Risks and failures during the process	Solutions
Patient Wong was unable to sign own consent leading to delay in procedure Delay required procedure to be "signed-out" to the night float resident Combination of "hand off" and a sedated patient imposed increased risks for patient misidentification	Standardize the process for hand offs Assure accurate transfer of information with special attention to follow up procedures and tasks Need increased provider vigilance when performing high risk procedures in high risk environments
Resident initiated the procedure without confirming the correct patient and consent Resident failed to involve the patient's nurse in the process Procedure initiated on the wrong patient	Implement the Universal Protocol for all bedside procedures Protocol requires a verification and time-out process be performed with a second team member prior to the initiation of any invasive procedure in order to assure the correct procedure is performed on the correct patient
Patient's nurse raised concern at the initiation of the procedure but failed to insist the procedure be stopped until plan confirmed Opportunity to halt procedure before patient harm missed	Foster an environment where open communication is respected and valued among all members of the healthcare team Empower any member of the team to stop a procedure immediately if there are any patient safety concerns
Resident proceeded with procedure on the wrong patient despite nurse's concern causing pneumothorax in a patient with a prior pneumonectomy causing the patient's death	Promote individual accountability for patient safety. Educate providers to stop all procedures immediately if any team member raises a safety concern until the issue is resolved or corrected

information transmitted during handoff procedures. The transfer of information during handoffs must be structured and complete and all parties must be extra diligent during the process. Time pressures and increased workloads often lead to employees "cutting corners" and by-passing policies to get the work done.

Discussion

Case 1 has many similarities to the real-life case of Mr. Willie King that occurred at University Community Hospital in Tampa Florida on February 20, 1995. Like the patient in the scenario, Mr. King was left with unnecessary bilateral below knee amputations because the planned surgical procedure was erroneously booked as a left below knee amputation rather than a right below knee amputation. Policies and procedures were not in place to pick up the error before the wrong amputation was performed [1]. The case of Willie King was heavily publicized at the time and although the circumstances of his case are not unique, it is historic in that the notoriety from the King case brought wrong-site surgery (WSS) to the forefront of

patient safety initiatives. As a result of its publicity, the Joint Commission initiated its Sentinel Event policy as a method to identify and track the leading causes of medical errors within the USA. This initiative mandated that accredited hospitals analyze and report any unexpected occurrence that resulted in death or serious physical or psychological injury to a patient [2]. In 2002, the National Quality Forum (NQF) followed the Joint Commission's lead and developed its own list of 27 Serious Reportable Events [3].

Definition

"Wrong-site surgery (WSS)" is most often associated with surgical procedures performed on the wrong side (laterality) of the correct patient. However, the term WSS actually encompasses a broader definition of surgical errors and includes any procedure that is performed on a wrong patient, a wrong procedure performed on the correct patient, and all procedures performed on the correct patient but at the wrong level or the wrong site such as the wrong vertebral level or the wrong finger. The definition of WSS also includes the placement of incorrect implants and prostheses such as when a prosthesis for a left hip is inserted into the right hip or a left corneal implant is placed into the right eye.

Incidence

The true incidence of WSS is somewhat difficult to determine. It depends on how one defines WSS, how the data is collected, and whether or not mandatory reporting by institutions is required. For instance, Kwann and coauthors evaluated all wrong-site surgeries reported to a single, large, medical malpractice insurer in Massachusetts between 1985 and 2004. Among the 2,826,367 operations performed at the hospitals within that system, there were only 25 wrong-site operations identified from the malpractice claims. This produced an incidence of 1 in 112,994 operations [4]. Based on these results, the authors concluded that WSS is an exceedingly rare event. However, using single payer malpractice claims to determine the rate of wrong-site procedures underestimates its true incidence. For one thing it fails to identify cases in which malpractice claims were never filed. It should be pointed out that Kwann's analysis excluded spine-related procedures. Since spine surgery is one of the specialties at highest risk for WSS, one has to interpret Kwann's results cautiously.

In contrast to Kwann's study, the Physician's Insurance Association of America (PIAA) evaluated claims from 22 malpractice carriers insuring 110,000 physicians from 1985 to 1995. The PIAA study revealed 331 WSS cases and 1,000 closed malpractice claims involving WSS. Their study identified a significantly higher number of cases occurring over a shorter period of time when compared to Kwann's analysis [5].

After the Joint Commission initiated its mandatory reporting in 1995, there were 531 sentinel events involving wrong-site surgeries reported between 1995 and 2006. Similar results were seen in several states that also require mandatory reporting of these events. The State of Minnesota reported 26 wrong-site surgeries during their first year of public reporting and another 31 during their second year [6]. In Virginia, a WSS was reported in 1 of every 30,000 surgeries equating to about 1 case per month and in New York, a WSS was reported in 1 out of every 15,000 surgeries [7]. Thus, wrong-site surgeries are not rare events. Wrong-site surgical procedures ranked the highest among all 4,074 sentinel events reported to the Joint Commission between January 1995 and December 2006 [8].

WSS affects all surgical specialties. Of 126 Joint Commission sentinel cases of WSS reported between 1998 and 2001, 41 % involved orthopedic or podiatric surgery, 20 % general surgery, 14 % neurosurgery, 11 % urologic surgery. The remaining cases included cardiothoracic, ear–nose–throat, and ophthalmologic surgeries [9]. Wrong-site surgical and invasive procedures occur throughout all surgical and nonsurgical settings. Of the 126 cases of WSS reported to the Joint Commission, 50 % of the WSS cases occurred in either a hospital-based ambulatory surgery unit or freestanding ambulatory setting. Twenty-nine percent occurred in the in-patient operating room and 13 % in other in-patient areas such as the Emergency Department or the ICU [8, 10]. Similar results were found by Neily and colleagues in a review of the Veterans Health Administration (VHA) National Center for Patient Safety database. Of 342 reports of surgical events in Neily's study, there were 212 actual adverse events (62 %) and 130 close calls (38 %). One hundred and eight (50.9 %) of the adverse events occurred in the operating room (OR) and 104 (49.1 %) occurred elsewhere [11]. Similar results were reported by the same group in a 2011 follow-up study (See Fig. 10.1) [12]. As with the Joint Commission data, wrong-side surgery procedures in Neily's study were the most common errors performed within the OR while wrong-patient procedures were the most frequent in the non-OR setting. Although intraoperative errors tend to get more publicity, errors performed outside the OR are no less harmful.

Impact

Cases of WSS that result in significant harm are not only devastating to the patient but also to the families, the caregivers, and the institutions involved. Intense media attention often leads to a loss of public trust in the healthcare system and its providers. Defending these types of errors is nearly impossible and those involved usually pay a significant emotional, professional, and financial price for the event. In Case 2 the young resident had such difficulty dealing with the consequences of her error that she gave up a promising career in medicine (see Chap. 23 on "Second Victim" phenomena). In the case of Willie King, the Florida authorities suspended the surgeon's license for 6 months and fined him $10,000. The Tampa hospital paid Mr. King $900,000 and the surgeon paid an additional $250,000 directly to Mr. King [13].
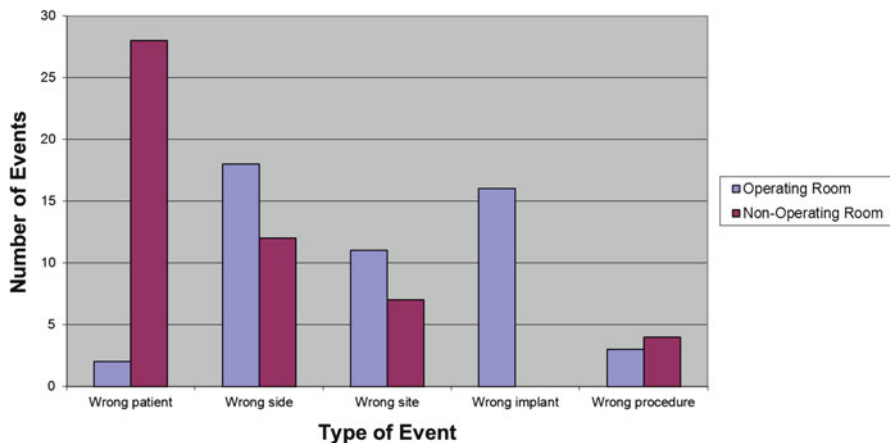
Fig. 10.1 Comparison of wrong-site procedures performed inside and outside of the operating room based on the Veterans Health Administration patient safety database between July 2006 and December 2009. Of note, wrong-patient procedures outside the operating room outnumbered all other events in either location reprinted with permission from Elsevier

Preventive Strategies

As previously stated, increased attention has been focused on WSS since 1995 when the Joint Commission initiated its mandatory reporting. Interestingly, however, the problem of WSS was recognized earlier by several medical associations and efforts were actually made to educate practitioners about strategies to reduce these errors. Between 1988 and 2001 several professional and orthopedic societies throughout the UK, Canada, and the USA recognized the seriousness of WSS procedures and initiated several safety campaigns in an effort to reduce their occurrence [14, 15]. Although these efforts were genuine, they had only a moderate impact on reducing the incidence of WSS possibly because they relied on voluntary participation.

The Universal Protocol was implemented on July 1, 2004 and applied to all Joint Commission accredited organizations including ambulatory care facilities and office-based surgery programs [2, 7]. The protocol was also to include special procedure units such as Endoscopy and Interventional Radiology. In 2009, the WHO extended this mandate to require that the "Universal Protocol" be performed for all procedures done outside of the operating room as well [16].

The Universal Protocol consists of three steps: verification, site-marking, and "time out." It requires multiple people to confirm that the correct procedure is being performed on the correct location of the correct patient. Table 10.3 describes the intended process for each of these three steps. If there is a discrepancy in the information provided or a team member has concerns regarding the elements of the case

Table 10.3 The three steps of the universal protocol for preventing wrong site surgery [17]

Conduct a preprocedure verification process
Address missing information or discrepancies before starting the procedure
 • Verify the procedure, the patient, and the site
 • Involve the patient in the verification process
 • Identify the items that must be available for the procedure
Mark the procedure site
  At a minimum, mark the site when there is more than one possible location for the procedure
   and when performing the procedure in a different location could harm the patient
 • Mark the site before the procedure is performed
 • Involve the patient in the site marking process
 • The site is marked by a licensed independent practitioner who is ultimately accountable for
   the procedure and will be present when the procedure is performed
Perform a time-out
  The procedure is not started until all questions or concerns are resolved
 • Conduct a time-out immediately before starting the procedure or making the incision
 • All relevant members of the procedure team actively communicate during the time-out
 • The team members must agree, at a minimum, on the correct patient, the correct site, and
   the correct procedure to be done

at any point during these three processes, the procedure should not proceed until the discrepancy is reconciled. It is believed that performing the Universal Protocol will significantly reduce the rates of WSS [16].

Root Causes and Potential Solutions

Unfortunately, even after the initiation of mandatory reporting and implementation of the Universal Protocol, the problem of WSS still exits. At first glance it seems hard to understand why these events occur with such frequency and why they have been so hard to eliminate. It is not a surprise that wrong-site and wrong-side surgeries occur more commonly in the orthopedic, podiatric, neurosurgical, and urological specialties since most of the procedures performed by these specialties involve laterality. However, if laterality was the only risk factor for WSS, then the initiation of "site-marking" would essentially eliminate the problem. Like many other errors in medicine today the causes of WWS are complex and many factors contribute to their occurrence. The most common of these are listed in Table 10.4 [9, 18]. Awareness of these root causes allows institutions and practitioners to become more vigilant during high risk situations and may even prompt the institution or practitioner to create additional preventive measures.

For example, it has been shown that wrong-patient procedures are more prone to occur in fast-moving environments. Eye operations are particularly vulnerable to wrong-patient, wrong-site, and wrong-implant errors because they are short procedures with rapid turnover times. There are usually several patients waiting

Table 10.4 Common risk factors for wrong-site surgery [9, 18]

Patient-related factors
• Morbid Obesity
• Physical deformity
• Comorbid conditions
• Presence of bilateral disease
Procedure-related factors
• Emergency case or procedure
• Need for unusual equipment or set-up
• Multiple procedures performed
• Multiple surgeons/physicians involved
• Change in personnel
• Room changes
Environmental factors
• Incomplete or inaccurate communication
• Poor booking practices
• Failure to engage patient or family in the processes
• Unusual time pressures

simultaneously at the center for similar procedures involving one or the other eye. The knowledge that such situations increase the risk for error should prompt the team to be more vigilant during their verification and time-out process [7, 19]. Such knowledge may also prompt prevention measures such as scheduling only right- or left-sided procedures on a particular day.

Poor communication and incomplete patient assessment are the two factors that have been shown to contribute most to inadequate patient or site verification. Of 455 wrong-site surgeries reviewed, inadequate communication was deemed to be the root cause in almost 80 % of the cases [7]. Types of communication errors include miscommunication, misinformation, information not shared, and information not understood. These communication errors are often perpetuated by incomplete or inadequate preoperative assessments, such as what occurred in case 1. However, having a process in place by itself will not be effective if the involved individuals do not complete the process appropriately and diligently every time.

Good communication is an active process. It must engage the patient and/or family members in the informed consent and again during the surgical site verification process. A collaborative team approach, with each team member taking individual responsibility to assure the correct patient and site, is the best way to prevent an error due to inaccurate or incomplete information and will serve to catch a "miss" by other members of the team.

There is no doubt that the initiation of the Universal Protocol with a quality "verification" and "time-out" process prevents WSS errors. However, as previously stated, the Universal Protocol, by itself, does not prevent all WSS errors. In a review of 13 cases of WSS from a liability insurance company database, nine of the errors actually originated prior to the patient arriving in the perioperative area. These sources of error included an incorrectly printed MRI (11 %), a referral to a surgeon

that specified the incorrect laterality of pathology (11 %), multiple pathologies that were not identified, clarified, or documented during the clinic visit (33 %), and incorrect OR scheduling (44 %). A tenth error originated in the holding area where the surgeon discussed a change in the laterality of a procedure for a patient with bilateral pathology. The patient did not recall consenting to the contralateral procedure because the patient did so after receiving sedation [18].

Another overlooked cause of WSS includes perception errors due to a person's inability to discriminate right from left. A study of Irish medical students in 2008 showed significant variability in the students' ability to distinguish the right hand from the left hand using stick figure illustrations. The errors in discrimination occurred most frequently when the figures were varied between views of the front and back. This emulates the situation in the operating room where patients are often positioned in different orientations. The study also showed that the ability to perform right–left discrimination was significantly worse when figures were viewed from the front than when they were viewed from the back. This is an important finding since most patients are supine on the operating table and thus viewed from the front by the surgeon [20].

There are also risk factors unique to certain subspecialties. Wrong-site procedures have been reported by anesthesiologists in association with increased use of regional anesthesia. Reasons include the fact that nerve blocks are performed prior to the surgical time-out. Since the site for the nerve block is usually away from the operative site, marking of the operative site may not be enough to assure that the anesthesiologist injects the correct site. Edmonds reported two cases of wrong-site peripheral nerve blocks and suggested the creation of a policy that mandates that the anesthetic consent specify the laterality of the surgery and that a separate anesthetic time-out be performed to include participation of the nurse and patient prior to the start of regional anesthesia. Of note, marking of the injection site for regional anesthesia by the anesthesiologist was not advised because a second marking could be a source of later confusion at the time of incision [21].

Dental procedures pose several risks for wrong-site (tooth) surgery. There are currently three major systems that can be used for numbering teeth for identification (1) The Universal/National System, (2) The Federation Dentaire International System, and (3) The Palmer Notation Method. Each of these systems number teeth differently. Thus, a written notation identifying a specific tooth using one system by one practitioner will refer to a different tooth if a different system is used to interpret that notation by another practitioner. Misidentification also occurs in patients in whom teeth are already missing. Correct identification of the remaining teeth is more difficult because the roots or sockets of the missing teeth are often obscured leading to a miscount of the remaining teeth. To avoid these errors, Lee recommends a standardized referral form for oral procedures that includes a diagram of the mouth for marking the desired pathologic tooth. Since there is no practical way to mark teeth at the time of surgery, it is essential that the correct site be marked on a dental diagram or X-ray [22].

Foot surgery is prone to a similar set of errors because patients use a variety of terms to refer to their toes. One study asked 100 patients to label the toes on each

Table 10.5 The percent of operating room (OR) caregivers who rated their collaboration with other members of the OR team as "high" or "very high"

Caregiver Position Performing Rating	Caregiver position being rated			
	Surgeon (%)	Anesthesiologist (%)	Nurse (%)	CRNA (%)
Surgeon	85	84	88	87
Anesthesiologist	70	96	89	92
Nurse	48	63	81	68
CRNA	58	75	76	93

Source: Borrowed with permission from [24]
Surgeons and Anesthesiologist consistently rated teamwork and collaboration among members of the operating room team higher than their nurse colleagues
CRNA certified registered nurse anesthetists

foot choosing to use either name or number according to their preference. The patients had an overall error rate of 11.6 %. Other factors that increase the risk for errors in foot surgery include the fact that patients frequently have disease that affects multiple toes, such as gangrene or rheumatoid arthritis, and the fact that foot pathology is common among diabetics who may not be able to see or feel their feet due to retinopathy and neuropathy [23].

Good teamwork, communication, and redundant systems are the only way to reduce these types of errors. However, as more WSS cases are analyzed it is increasingly clear that "good teamwork" may need to be fostered.

Poor interpersonal dynamics hamper effective teamwork. Too rigid a hierarchy and too steep authority gradients between team members often results in the withholding of critical information and safety concerns. Healthcare organizations are characterized by large authority gradients with physicians generally positioned above the rest of the workforce. This is particularly true within the OR environment.

In 2000, Sexton and colleagues surveyed OR personnel on teamwork climate within the OR. The survey included perceptions about difficulty speaking up, conflict resolution, physician–nurse collaboration, feeling supported by others, asking questions, and the heeding of nurse input [24, 25]. Across all institutions surveyed, surgeons and anesthesiologists perceived that physician–nurse collaboration was much better than nurses did. Among the 60 institutions, more than 80 % of all surgeons rated the quality of communication and collaboration within the OR as high, whereas only 48 % of their nursing colleagues felt the collaboration between nurses and surgeons was high. Similar results were found between nurses and anesthesiologists (see Table 10.5). Nurses and other staff were also less positive about speaking up when having safety concerns. Transforming this "culture" is extremely challenging but there are a number of communication and teamwork strategies that the healthcare industry can adapt from the aviation industry.

The first step is to dampen authority gradients. Methods include techniques such as having the team leader introduce himself, learn the names of other team members, and to explicitly welcome input from all members of the team. To improve communication and information exchanges within groups a number of other tools

have been designed to ensure that important information and safety concerns are both heard and acted upon. Two examples are the use of SBAR and CUS words.

SBAR stands for "**S**ituation, **B**ackground, **A**ssessment, and **R**ecommendation." It provides a format for nurses and other team members to structure their communication with physicians in such a way as to capture the latter's attention and to generate an appropriate action. The need for SBAR training grew from the recognition that nurses have been schooled and socialized to report in story format, while physicians have been trained to think and process information in bullet points [26].

The use of CUS words is a tool used to escalate levels of concern by anyone lower on the hierarchy to get the attention of someone higher up. The CUS words are used in escalating order as needed and begin with "I am Concerned about…" then "I am Uncomfortable…." and finally, "This is a Safety issue!" The key to success is to teach those who are in a position to receive such messages to appreciate the significance of such statements and the need to respond appropriately. Appropriate use of CUS words between the nurse and resident in scenario 12–2 may have prevented the death from the central line placement. Other team training techniques that have been used successfully include the use of checklists, briefings, and debriefings [24, 25, 27].

Institutions that have promoted medical team training programs and the use of checklists, briefings, and debriefings have not only reduced the incidence of surgical errors such as WSS but have also shown a significant reduction in overall surgical mortality as well. Haynes et al. reported a decrease in mortality after initiating a surgery safety checklist involving eight hospitals [28]. Neily and her colleagues demonstrated a dose–response relationship between OR team training and surgical mortality within the Veterans Healthcare Administration System. For each quarter period of team training at a single institution, the risk adjusted mortality rate within that institution decreased 0.5 per 1,000 procedures. Data analysis also showed an almost 50 % greater reduction in mortality rates in the trained VHA institutions when compared to those that had not yet received training [27].

Conclusion

In Summary, WSS errors are not rare events. Wrong-patient, wrong-side, and wrong-site procedures occur with equal frequency within and outside of the operating room and with the same risk of harm. The Joint Commission created the Universal Protocol as a mandatory safety standard in order to eliminate wrong procedures through the implementation of a preprocedure verification, site marking, and "time-out" process in order to confirm the correct patient, the correct procedure, and the correct side/site prior to the start of any invasive procedure. Up to 70 % of wrong-site procedures can be prevented if the verification and time-out process are performed correctly. In order for the Universal Protocol to be successful there must be 100 % compliance and it must involve the patient and/or family in the process and include active communication between all members of the clinical team.

The remaining 30 % of wrong procedure errors are more difficult to address. Avoidance of these errors requires redundant systems, teamwork, and equal accountability between all members of the operating team. Aggressive education of all employees, both clinical and nonclinical, in the prevention of WSS is essential for a successful prevention program. It must include the education of staff in the risk factors and common errors known to occur at each step along the process. But above all, there must be constant vigilance by all practitioners who participate in invasive procedures both inside and outside the operating room.

Key Lessons Learned

- There must be a policy and procedure in place at every institution to assure correct patient, correct procedure, and correct site prior to the performing any surgery or invasive procedures.
- Errors in information and communication can occur at multiple steps along the process.
- There must be a verification checklist that ensures that all sources of information have been checked before starting any procedure.
- Ensure that all pertinent radiologic studies and pathology specimens have been reviewed and are consistent with the planned procedure, the medical record, and the patient diagnosis.
- Assure effective communication between all members of the operative or clinical team. Special care should be given when information is transferred during hand-off procedures.
- Include the patient and/or family member in the process at every feasible point.
- Ensure accurate site markings to include right versus left, multiple structures (finger/toes), or levels of the spine. Use the assistance of radiographs, photographs, diagrams, and forms when marking the actual operative site is not feasible.
- Do not allow time pressures to short-cut completion of the verification and time-out process.
- Train the team so that each member feels empowered to raise concerns. Other members must never belittle or dismiss another's inquiry and should halt all procedures until concerns are reconciled.

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