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SPECIAL REPORT

SSI Prevention: Evidence-Based Practices Replace Lingering 'Sacred Cows' in the OR

Although evidence-based practice has eclipsed so-called "sacred cows," there are some questionable practices that may linger in operating rooms. These sacred cows — an idiom for something immune from question or criticism — are practices that lack scientific evidence and impede clinical progress. One such lingering sacred cow has been the issue of using razors in the operating room. The medical literature points to an association between surgical site infections (SSIs) and hair removal around the surgical site, and experts advise using surgical clippers or depilatories to lower the risk of infection.

By Kelly M. Pyrek

Table of Contents

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By Kelly M. Pyrek

When Thomas Paine noted in 1776 that, "A long habit of not thinking a thing wrong, gives it a superficial appearance of being right," he could not have imagined that he was describing a current tug-of-war that still exists in some operating rooms today. Although evidence-based practice has eclipsed so-called "sacred cows," there are some questionable practices that may linger in operating rooms. These sacred cows — an idiom for something immune from question or criticism — are practices that lack scientific evidence and impede clinical progress. Kavran (undated) notes, "As with other specialties, gone are the days that perioperative nurses do things because 'This is the way we have always done it.' ...Past perioperative sacred cows include perioperative staff members walking into the operating room suite and then stepping in disinfectant solutions poured on a drape on the floor to decrease the risk of infections at the surgical site, removing hair from the surgical site with a razor prior to skin preparation, and believing that gowning and gloving oneself from the back table was acceptable. But sacred cows are still among us, according to a survey of 50 U.S. hospitals that reported all participants believed sacred cows existed in their facility. (Ryon, 2004) These outdated practices included timed surgical hand scrubs, the use of cover gowns over scrubs outside the perioperative setting, and wearing shoe covers. They are just a few examples of current practices in some perioperative settings that do not have a scientific basis on which to base one's nursing practice."

Mellinger and McCanless (2010) summarize the sacred cow problem: "Sacred cows are found throughout nursing practice and are often the subject of emotionally charged conversations. Ryon describes sacred cows as "Common practices . . . revered by nurses regardless of their contribution to quality healthcare or patient outcomes." Muller-Smith states that sacred cows are "behavioral patterns that we continue to use even though they may no longer be effective. Their continued use tramples creativity, reduces innovative thought, limits the ability to respond quickly to change, and ultimately becomes costly to individuals

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and organizations . . . they must be rounded up and dealt with." Sacred cows can impede the introduction of best practice in the patient care environment because they are often practices based on tradition, not science."

As Cynthia Spry, RN, RA, MS, CNOR, an independent clinical consultant, explains, "I think the biggest sacred cow exists when staff members perform tasks because 'that's the way we have always done it.' There is a growing recognition that we must practice within the framework of evidence-based. For the most part I think leadership 'gets it' and where appropriate, drives practice changes. An empowered staff is also more likely to be tuned into evidence-based initiatives. When everyone is on board we should see lingering sacred cows put to pasture."

Mellinger and McCanless (2010) say that professional organizations such as the Association of periOperative Registered Nurses (AORN) have developed evidence-based recommended practices that replace previously common practices not supported by research: "For example, according to AORN's "Recommended practices for surgical attire," OR shoe covers and cover gowns worn over scrub attire are not generally considered infection prevention measures. AORN's Recommended practices for maintaining a sterile field states that healthcare professionals should practice 'event-related sterility' and no longer practice 'expiration dating' of reprocessed sterile items and that healthcare professionals should not completely cover and then remove sterile sheets from sterile setups because they risk contaminating the entire set-up. Routine culturing of environmental surfaces before the first surgical procedure every day or every week is no longer practiced; instead, healthcare professionals should practice good environmental cleaning practices, standard precautions, and ongoing infection prevention surveillance. A surgical clipper, not a razor, is the preferred preoperative hair removal method when hair removal is necessary."

As Kavran (undated) explains further, "Sacred cows become part of common practice simply because they have been performed for so long without being questioned. So, the first step in getting rid of a sacred cow is to identify it. When a practice or action is commonplace in the perioperative setting, the perioperative nurse should ask two questions: 'Why are we carrying out this practice?' and 'Is there current research to support this action?' If a nurse can't answer these basic questions, it's time to formulate a question to guide an investigation to determine if evidence supports the practice in question. For example, a nurse might ask, 'Does performing a timed surgical scrub reduce the risk of surgical infections?'

The Importance of Evidence-based Practice

Over the last few years there has been a significant shift toward translational research to encourage practitioners to implement research into practice. A key component of that is embracing evidence-based practice. Sigma Theta Tau International's Evidence-Based Nursing Position Statement explains that, "Evidence-based practice has become a prominent issue in international healthcare. Rising health costs, the management principle of doing things right and the desire for quality improvement have created a climate for the evolution of evidence-based healthcare. The end results are policy imperatives around clinical guideline development, research agendas focusing on intervention and problem based learning curricula. As nursing became involved in this movement, the quest to define best practices began, often resulting in complex challenges that have no easy solutions. What is clear is the responsibility of nurses to deliver care based on evidence, for nurses to be able to access, evaluate, integrate and use the best available evidence in order to improve practice and patient outcomes. The imperative is to reduce the gap between knowledge development and knowledge use to improve the health of people."

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In its support of evidence-based nursing (EBN), Sigma Theta Tau International states further, "The society defines EBN as an integration of the best evidence available, nursing expertise, and the values and preferences of the individuals, families and communities who are served. This assumes that optimal nursing care is provided when nurses and healthcare decision-makers have access to a synthesis of the latest research, a consensus of expert opinion, and are thus able to exercise their judgment as they plan and provide care that takes into account cultural and personal values and preferences. This approach to nursing care bridges the gap between the best evidence available and the most appropriate nursing care of individuals, groups and populations with varied needs."

Mellinger and McCanless (2010) point to Sackett's definition of evidence-based practice (EBP) as the "conscientious use of current best evidence in making decisions about patient care." (Sackett, et al. 2000) and note, "It is a problem-solving approach to practice that incorporates a systematic search for and critical appraisal of the most relevant evidence to answer a clinical question.

According to Melnyk, et al. (2005), components of EBP include:

- evidence from research/evidence-based theories and opinion/expert panels
- evidence from assessment of the patient's history and physical examination
- availability of healthcare resources, clinical expertise, and information about patient preferences and values

Makic, et al. (2011) point to the Institute of Medicine (IOM)'s definition of evidence-based practice as "The integration of best research, clinical expertise, and patient values in making decisions about the care of individualized patients." (Greiner and Knebel, 2003) They add further, "One would hope that clinicians would strive for this goal in all practice decisions. Unfortunately, philosophical goals and clinical realities are not always congruent. Many practice decisions that were originally based on intuition and tradition have not changed despite compelling evidence that change is warranted."

In terms of evidence-based practice in the OR, Spry says that "Hospitals are definitely making progress in terms of evidence-based practice. Just knowing how many patients have been injured (IOM reports) because of mistakes in care has had a tremendous impact. Evidence demonstrating that a change in practice can save lives and reduce patient injuries, coupled with Joint Commission focus on patient safety, has had a huge and positive impact. There is much more to be done especially with regard to research. There are huge gaps in 'evidence.' With more evidence will come more changes in practice and better patient outcomes."

Spry encourages nurses to ensure their practices are aligned with the science. "Two years ago AORN began the process of writing all recommended practices within an evidence based framework," Spry says. "Recommendations are rated according to the strength of the evidence. Using the AORN Evidence Rating Model ratings are 'limited evidence,' 'moderate evidence,' 'strong evidence' and 'benefits balanced with harm.' This process points out areas where research is needed but it also provided the evidence that supports practice. Revision of the AORN Recommended Practices is an ongoing process. This ensures that as evidence becomes available it is incorporated into practice recommendations. Knowing what the recommendations for practice are and adhering to them along with reading appropriate journals to remain current should ensure that practice is aligned with science. "

Preoperative Hair Removal

One lingering sacred cow has been the issue of using razors in the operating room. The medical literature points to an association between surgical site infections (SSIs) and hair removal around the surgical site, and experts advise using surgical clippers or depilatories to lower the risk of infection. It is important to remember the pathophysiology of shaving, in that using a razor to remove hair can compromise skin integrity by causing microscopic exudative rashes and skin abrasions that can provide a portal of entry for pathogenic microorganisms and potentially infect the surgical incision site. Powered surgical clippers can trim the hair close to the skin, thus avoiding the skin trauma caused by a razor's blade. Reviews of other randomized controlled trials have confirmed this finding. When hair needs to be removed, it should be clipped instead of shaved. Another acceptable method, using depilatories may generate a sensitivity reaction at the surgical site and may be more costly.

Spry emphasizes the necessity of banning razors in the OR. "Shaving with a razor sets

up an environment for bacteria to grow," she says. "The evidence for not shaving with a razor has been in existence since the 1960s. However it wasn't until the SCIP measures and resulting accountability came to be that the use of razors dropped dramatically. There are probably still some facilities that are using a razor but I have not seen this in a number of years and so I would say for the most part this is a non-issue. With increasing mandates to report infections and with consumer access to hospital score cards preventing infection and practices that have been shown to promote infection is a top priority and leadership directives have been very successful in changing from razors to clippers or from unnecessary shaving to no shaving."

The Surgical Care Improvement Project (SCIP), a national quality partnership of organizations focused on improving surgical care by significantly reducing surgical complications, has developed recommendations for hair removal methods that can help reduce the occurrence of SSIs:

- Do not remove hair unless it interferes with the operating site
- Perform hair removal immediately prior to surgery
- Use clippers or depilatories—not razors
- Remove all razors from the operating room
- Implement a hair-removal protocol

As rationale, SCIP measure SCIP-Inf-6 explains, "Studies show that shaving causes multiple skin abrasions that later may become infected. In a randomized study of 1,980 adult patients undergoing cardiopulmonary bypass surgeries, Ko, et al. (1992), reported a significantly higher rate of infection among patients who were shaved with a razor than those who had hair removal by electric clippers before skin incision. In another randomized trial of 200 patients undergoing elective inguinal herniorraphy, Balthazar, et al. (1982), concluded that hair removal with electric clippers immediately prior to the procedures "did not increase the risk of postoperative wound infection" (p. 799). In a systematic literature review by Kjonniksen, et al. (2002), there was no strong evidence to contraindicate preoperative hair removal; however, there was strong evidence against hair removal with a razor. This review recommended depilatory or electric clippers immediately prior to surgery when hair removal was required. Alexander, et al. (1983), reported that clippers, used on the morning of surgery, resulted in reduced surgical site infections and healthcare expenditures.

Regarding SCIP-Inf-6 measure analysis, it is advised that, "In the course of quality improvement efforts, hospitals may find it useful to drill down to the responses for the data element Preoperative Hair Removal. It may be instructive to tally frequency with which each allowable value occurs. Possible quality improvement initiatives may include: instructing patients against performing their own hair removal, and instructing staff as to the appropriate methods and timing of hair removal."

The Institute for Healthcare Improvement makes the following recommendations for preoperative hair removal:

- Avoid hair removal unless necessary for the procedure
- When necessary, remove hair with clippers right before surgery, but not in the operating room itself
- Remove all razors from operating room and supply area
- Establish protocol for when and how to remove hair in affected areas
- Provide patient education and materials on appropriate hair removal techniques to prevent shaving at home
- Avoid shaving heart surgery patients for EKG conducted shortly before surgery

Proper hair removal is just one of several other interventions that decrease the number of SSIs. Current performance measures for surgical site infection prevention include:

- Appropriate timing, selection, and duration of prophylactic antibiotics
- Glucose management
- Maintenance of normothermia

Consulting the Guidelines

The CDC/HICPAC's Guideline for Prevention of Surgical Site Infection, 1999 outlines what has been accepted as proper SSI prevention protocols. For preoperative hair removal, the guideline authors (Mangram, et al. 1999) advise: "Preoperative shaving of the surgical site the night before an operation is associated with a significantly higher SSI risk than either the use of depilatory agents or no hair removal. [Cruse, et al. (1980); Mishriki, et al. (1990); Seropian, et al. (1971); Hamilton, et al. (1977); Olson, et al. (1986); Mehta, et al. (1988] In one study, SSI rates were 5.6 percent in patients who had hair removed by razor shave compared to a 0.6 percent rate among those who had hair removed by depilatory or who had no hair removed. [Seropian, et al. (1971)] The increased SSI risk associated with shaving has been attributed to microscopic cuts in the skin that later serve as foci for bacterial multiplication. Shaving immediately before the operation compared to shaving within 24 hours preoperatively was associated with decreased SSI rates (3.1 percent versus 7.1 percent); if shaving was performed more than 24 hours prior to operation, the SSI rate exceeded 20 percent. [Seropian, et al. (1971)] Clipping hair immediately before an operation also has been associated with a lower risk of SSI than shaving or clipping the night before an operation (SSI rates immediately before = 1.8 percent versus night before = 4.0 percent). [Alexander, et al. (1983); Masterson, et al. (1984); Sellick, et al. (1991); Ko, et al. (1992)] Although the use of depilatories has been associated with a lower SSI risk than shaving or clipping, [Seropian, et al. (1971); Hamilton, et al. 1977)] depilatories sometimes produce hypersensitivity reactions. [Seropian, et al. (1971)] Other studies showed that preoperative hair removal by any means was associated

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with increased SSI rates and suggested that no hair be removed. [Mishriki, et al. (1990)]

Because the CDC's SSI guideline is aging, more up-to-date instruction can be found in the Association for periOperative Registered Nurses (AORN)'s Recommendation IV of the Recommended Practices for Preoperative Patient Skin Antisepsis. The RP makes the following suggestions:

- Hair at the surgical site should be left in place (i.e., not removed) whenever possible.

Research studies have found that preoperative shaving of the surgical site increases the risk of surgical site infection and results in higher surgical site infection rates than using a depilatory cream or clipping. Hair has successfully been left in place for neurosurgery without increasing the risk of surgical site infection.

- The patient should be instructed not to shave or use a depilatory on the surgical site before surgery.

Removing hair at the surgical site abrades the skin surface and enhances microbial growth. Shaving has been found to increase the risk of surgical site infection. Depilatory creams may cause skin reactions in some individuals, which could result in cancellation of surgery.

- Hair at the surgical site should not be removed with a razor. Shaving increases the risk of surgical site infection.

Alternatives to hair removal for head and neck surgery include braiding hair instead of shaving and using a nonflammable gel to keep the hair away from the incision. If the presence of hair will interfere with the surgical procedure and removal is in the best interest of the patient, the following precautions should be taken:

- Hair removal should be performed the day of surgery, in a location outside of the operating or procedure room.
- Only hair interfering with the surgical procedure should be removed.
- Hair should be clipped using a single-use electric or battery-operated clipper, or a clipper with a reusable head that can be disinfected between patients.

Clipping hair the morning of surgery has resulted in fewer surgical site infections than shaving or clipping the day before surgery.45 Limiting the amount of clipping minimizes the risk of microscopic nicks. Clipping the hair outside of the operating room minimizes the dispersal of loose hair and the potential for contamination of the sterile field and surgical wound. During use, the clipper handle is contaminated with the patient's skin flora. The clipper head may become contaminated with microscopic blood or body fluids; therefore, decontamination for bloodborne pathogens is necessary to prevent transmission.

- Depilatories may be used for hair removal if skin testing has been performed without tissue irritation.

Depilatories may be used when hair is to be removed from the operative site. The use of depilatories, however, does increase the risk of hypersensitivity reactions. The written manufacturers' instructions regarding skin testing and the use of chemical depilatories should be followed.

Consulting the Literature

Let's take a look at what some of the literature says regarding preoperative hair removal.

Adisa, et al. (2011) aimed to evaluate the relationship of two methods of preoperative hair removal to postoperative wound infection in a developing country where razor shaving is very popular. Consecutive consenting patients scheduled to have such operations were randomized into two groups. One group had hair removal by shaving with a razor blade while the other had hair removed by depilatory cream. Adequacy of hair removal and presence of skin injuries and/or reactions were noted preoperatively. Details of the procedures were recorded and patients were then assessed for postoperative wound infection. A total of 165 patients were studied. Of the 79 patients who had hair removal by depilatory cream, hair was completely removed in 70 (88.6 percent) compared to 53 (61.6 percent) of the 86 patients who had razor hair shaving ($p < 0.0001$). Skin injuries were noted in 24 (27.9 percent) of the razor group and 3 (3.8 percent) of patients who had depilatory cream, ($p = 0.001$). Thirteen patients (7.9 percent) had postoperative wound infection including 2 (2.5 percent) in the depilatory cream group and 11 (12.8 percent) of the razor group. A significant association was found between preoperative skin injuries and postoperative wound infections. The researchers concluded that preoperative hair removal with razor shaving predisposes to skin injuries which in turn significantly influence postoperative wound infection rates. Such injuries and resultant wound infection are fewer when depilatory cream is used for hair removal.

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Diana, et al. (2011) sought to evaluate surgeons' strategies and adherence to preventive measures against surgical site infections. All surgeons participating in a prospective Swiss multi-centric surveillance program for SSIs received a questionnaire developed from the 2008 National (United Kingdom) Institute for Health and Clinical Excellence (NICE) clinical guidelines on prevention and treatment of SSIs. The researchers focused on perioperative management and surgical technique in hernia surgery, cholecystectomy, appendectomy, and colon surgery (COL). Forty-five of 50 surgeons contacted (90 percent) responded. Smoking cessation and nutritional screening are regularly propagated by one-third and one-half of surgeons, respectively. Thirty-eight percent practice bowel preparation before COL. Preoperative hair removal is routinely (90 percent) performed in the operating room with electric clippers. About 50 percent administer antibiotic prophylaxis within 30 minutes before incision. Intra-abdominal drains are common after COL (43 percent). Two thirds of respondents apply non-occlusive wound dressings that are manipulated after hand disinfection (87 percent). Dressings are usually changed on postoperative day (POD) 2

(75 percent), and wounds remain undressed on POD 2-3 or 4-5 (36 percent each). The researchers concluded that surgeons' strategies to prevent SSIs still differ widely. The adherence to the current NICE guidelines is low for many procedures regardless of the available level of evidence. Further research should provide convincing data in order to justify standardization of perioperative management.

One of the most prominent reviews was conducted by Tanner et al. (2006) who found:

- No difference in SSI in those that have had hair removed prior to surgery versus those who have not.
- If hair removal is necessary then clipping and depilatory creams result in fewer SSIs than shaving with a razor
- There is no difference in SSI if hair is removed one day prior or on the day of surgery

Tanner, et al. (2007) conducted a review to determine if routine preoperative hair removal results in fewer SSIs than not removing hair. Eleven randomized controlled trials were included in this review. The researchers said there was insufficient evidence to state whether removing hair impacts on surgical site infection or when is the best time to remove hair. However, if it is necessary to remove hair then both clipping and depilatory creams results in fewer SSIs than shaving using a razor.

In an updated review by Tanner, et al. (2011) researchers sought to determine if routine pre-operative hair removal (compared with no removal) and the timing or method of hair removal influence rates of SSI. For this second update the researchers searched the Cochrane Wounds Group Specialized Register; The Cochrane Central Register of Controlled Trials (The Cochrane Library 2011, Issue 3); Ovid MEDLINE (1950 to August Week 1 2011); Ovid MEDLINE (In-Process & Other Non-Indexed Citations Aug. 11, 2010); Ovid EMBASE (1980 to 2011 Week 31) and EBSCO CINAHL (1982 to Aug. 11, 2011). The researchers were looking for randomized controlled trials (RCTs) or quasi-randomized trials (QRCTs) that compared: hair removal with no hair removal; different methods of hair removal; hair removal at different times before surgery; and hair removal in different settings (e.g. ward, anesthetic room). The researchers independently assessed relevance and quality of each trial; data were extracted independently by two authors and cross-checked.

Tanner, et al. (2011) included 14 trials (17 comparisons) in the review; three trials involved multiple comparisons. Six trials, two of which had three comparison arms, (972 participants) compared hair removal (shaving, clipping, or depilatory cream) with no hair removal and found no statistically significant difference in SSI rates however the comparison is underpowered. Three trials (1,343 participants) that compared shaving with clipping showed significantly more SSIs associated with shaving (RR 2.09, 95% CI 1.15 to 3.80). Seven trials (1,213 participants) found no significant difference in SSI rates when hair removal by shaving was compared with depilatory cream (RR 1.53, 95% CI 0.73 to 3.21), however this comparison is also underpowered. One trial compared two groups that shaved or clipped hair on the day of surgery compared with the day before surgery;

there was no statistically significant difference in the number of SSIs between groups however this comparison was also underpowered. The researchers identified no trials that compared clipping with depilatory cream; or investigated application of depilatory cream at different pre-operative time points, or hair removal in different settings (e.g. ward, anesthetic room).

As Tanner, et al. (2011) note, "While this review found no statistically significant effect on SSI rates of hair removal insufficient numbers of people have been involved in this research to allow confidence in a conclusion. When it is necessary to remove hair, the existing evidence suggests that clippers are associated with fewer SSIs than razors. There was no significant difference in SSI rates between depilatory creams and shaving, or between shaving or clipping the day before surgery or on the day of surgery however studies were small and more research is needed.

Large randomized, controlled trials are needed to determine the optimal policy for preoperative hair removal.

Niël-Weise, et al. (2005) sought to determine whether certain hair removal policies are better than others to prevent surgical-site infections in patients undergoing clean surgery. Publications were retrieved by a systematic search of Medline, the Cochrane Library, and EMBASE up to February 2005. Additionally, the reference lists of all identified trials were examined. All randomized trials, quasi-randomized trials, and systematic reviews or meta-analyses of randomized or quasi-randomized trials comparing hair removal policies in clean surgery were selected. Trials involving patients undergoing cranial neurosurgery were excluded. Two reviewers independently assessed trial quality and extracted data. Disagreements were resolved by discussion with a third reviewer. Data from the original publications were used to calculate the relative risk or risk difference of surgical-site infection. Data for similar outcomes were combined in the analysis, where appropriate, with the use of a random effects model. Four trials were included in the review. No eligible systematic review or meta-analysis of randomized or quasi-randomized trials was found. The quality of the trials and how they were reported were generally unsatisfactory. Evidence regarding whether preoperative hair removal has any effect was inconclusive. When hair removal was considered necessary, evidence about the best time for removal was inconclusive. There was some evidence that hair removal by clipper is superior to removal by razor. The researchers concluded that because of insufficient evidence as a basis for recommendations, the practical consequences for ward management were essential when the Dutch Working Party on Infection Prevention formulated its recommendations for hair removal policies. Large randomized, controlled trials are needed to determine the optimal policy for preoperative hair removal.

Kjønniksen, et al. (2002) described a systematic literature review on whether, how, and when to perform preoperative hair removal. By searching electronic databases and reference lists of relevant articles, team members identified 20 clinical studies that deal

with preoperative hair removal. No strong evidence was found to advocate against preoperative hair removal. Furthermore, there was strong evidence to recommend that when hair removal is considered necessary, shaving should not be performed. Instead a depilatory or electric clipping, preferably immediately before surgery, should be used.

Bekar, et al. (2001) sought to assess the rate of postoperative infection in cranial surgery patients, comparing a group of patients whose heads were shaved pre-operatively to a group whose hair was not shaved prior to cranial surgery. The latter patients had their hair washed with shampoo and 4 percent chlorhexidine within 24 hours of their operation. In the operating room, the surgical site was scrubbed for 8 to 10 minutes with 4 percent chlorhexidine diluted with water, and then cleansed with 10 percent povidone-iodine solution. Prophylactic antibiotics were administered for three days. The researchers report that 1,038 cranial procedures were performed without hair removal. The procedures included craniotomy for tumor, trauma, aneurysm, other vascular lesions and intra-cerebral hemorrhage (n = 847), stereotactic biopsy (n = 90), stereotactic craniotomy (n = 34), ventriculoperitoneal shunt placement (n = 27), surgical treatment of infection with aspiration of brain abscess or resection of infected tissue (n = 14), microvascular decompression for trigeminal neuralgia or hemifacial spasm (n = 11), and other miscellaneous procedures (n = 15). The researchers observed 13 postoperative wound infections (1.25 percent), including nine deep (0.87 percent) and four superficial infections (0.39 percent). There was no significant difference between the rate of infection in patients whose heads were shaven (12/980) and the rate in those whose hair was spared (13/1038) ($p > 0.05$). In addition. there were no other problems related to the surgical preparation technique in the latter group. The researchers concluded that cranial surgery without hair removal is safe and does not increase the risk of surgical wound infection and note, "Patients naturally prefer to keep their full head of hair. We believe that preoperative hair removal is not necessary in preparation for any type of cranial neurosurgery."

The objective of an investigation by Kretschmer, et al. (2000) was to prevent the stigmatizing effect of a totally or partially shaved head with openly visible signs of a head operation, easing the reintegration of the patient into his daily life. After extended surface cleaning with a colorless, regular skin disinfection liquid (undyed isopropanol/dibrom/propylenglycol solution) the hair was combed apart from the incision line before draping. Wound closure was performed as usual, taking care to remove meticulously hair from the wound. To aid closure the researchers used a 20 percent chlorhexidine jelly that holds the hair away from the incision. A neomycin ointment served for sealing the wound surface, no further dressing being used. After 215 cranial neurosurgical operations, among them 63 for tumors, 33 stereotactic procedures 18 shunt, 55 for torticollis and 46 other operations performed without shaving the hair, the researchers saw one wound infection (0.5 percent). This percentage corresponds very well to the general infection rate of 0.6 percent.

Moro, et al. (1996) sought to investigate potential risk factors for surgical wound infections in clean surgery in a multi-center prospective study in eight general surgical wards and one thoracic surgical ward. All patients undergoing clean operations in the nine wards were included in the study. The following data were collected for each study participant: demographic characteristics, underlying disease, predisposing factors, type of surgery, length of operation, preoperative shaving, type and duration of surgical drains, and length of hospital stay. After surgery, patients were visited daily by an intern surgeon in order to detect infections. Infections occurring after discharge were not actively surveyed. A multiple logistic regression was performed to obtain an adjusted estimate of the odds ratios and to identify which factors were independently associated with surgical infection. The researchers found that 2,262 patients were included in the study: eighty three patients (3.7 percent) developed a surgical infection. The highest infection rates were observed following vascular surgery, thoracic surgery and herniorraphy. Seven factors appeared to be significantly and independently associated with an increased risk of SWIs in a logistic regression model; age greater than 85 years, obesity, patients undergoing high risk operations or more than one operation during stay, length of operation greater than 120, preoperative shaving, open surgical drains lasting more than three days. The researchers concluded that the high incidence of infection observed in our study population indicates potential problems in quality of care. In order to prevent SWIs in patients undergoing clean operations, more efforts should be placed on the prevention of the risk associated with two modifiable risk factors, that is preoperative shaving and use of open surgical drains.

In order to prevent SWIs in patients undergoing clean operations, more efforts should be placed on the prevention of the risk associated with two modifiable risk factors, that is preoperative shaving and use of open surgical drains.

Mishriki, et al. (1990) conducted a prospective study of postoperative wounds to determine the incidence of infection, describe the time distribution of presentation before and after discharge from hospital and identify possible contributory factors. There were 702 consecutive patients admitted to the study (600 inpatients and 102 day cases). Fifty one became infected (47 inpatients and four day cases), corresponding to an overall infection rate of 7.3 percent. More than 50 percent of infections presented during the first week after operation, and almost 90 percent were diagnosed within two weeks of surgery Twenty-eight (55 percent) wounds that became infected presented after hospital discharge. Of 23 specific etiological variables studied, four (age, preoperative stay, shaving and the surgeon) were shown to have a statistically significant association with the development of wound infection. The researchers concluded that a strong association between the individual surgeon and the development of a wound infection was demonstrated and this supports the need for routine surgical audit.

Olson, et al. (1986) reported that for a one-year period, hair was removed from the operative site with clippers rather than by shaving with a razor or by application of depilatories. The study involved comparison of clean (Class I) wound infection rates in 2,580 patients

after clipping was instituted compared with 17,424 patients studied in seven preceding years. There was no significant change in the wound infection rate (1 percent) when compared with the three years immediately preceding. There was no change in the identified distribution of the infecting organism. Failure to show a clear reduction in wound infection rate was probably related to the low historic base line rate. There were definite benefits achieved by avoiding cancellation of elective operations, by using operating room personnel more efficiently and by expediating the surgical schedule.

Alexander, et al. (1983) studied the influence of preoperative shaving versus clipping on wound infection rate was studied in 1,013 patients undergoing elective operations at a single hospital. Patients were prospectively randomized to be either shaved or clipped the night before or the morning of operation. The AM clipper method was associated with significantly fewer infections than were the other methods, both at discharge and at 30-day follow-up. The greatest benefit was in the group with clean wounds. For each 1,000 patients treated, a savings of approximately $270,000 could be realized if the AM clipper method replaced shaving for preoperative hair removal. The researchers concluded that preoperative shaving is deleterious, and the practice should be abandoned.

For each 1,000 patients treated, a savings of approximately $270,000 could be realized if the AM clipper method replaced shaving for preoperative hair removal.

Balthazar, et al. (1982) reported the results of a random, prospective study of electrical clipping versus routine razor shaving in the removal of hair immediately before operation. Two hundred patients having elective inguinal herniorrhaphy according to strict protocol were included in this study. Unsatisfactory skin preparation, as evidenced by gross cuts made in the skin during hair removal, was noted in 7 percent of those shaved and 4 percent of those clipped. Two subcutaneous wound infections occurred in the shaved group (2 percent) and one in the clipped group (1 percent). This study indicates that preoperative clipping of hair with electric barber's clippers immediately before operation is a safe, well tolerated procedure that does not increase the risk of postoperative wound infection.

Conclusion

Makic, et al. (2011) remind us that "It is important as nurses that we challenge tradition and habits in our nursing practice. As we continue to perfect the art of nursing, we must also remember the science of nursing. Science is dynamic and ever changing. Clinical practices should be based on evidence whenever possible. The challenge is in getting the evidence in the right hands and encouraging and empowering the clinicians at the bedside to make clinical changes, moving nursing practice away from habits of tradition. Practicing by best evidence improves patients' outcomes and nurses are instrumental to the process of examining and implementing the evidence in practice, putting sacred cows out to pasture."

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