KEYWORDS: SURGICAL ATTIRE, SURGICAL SITE INFECTION, PATIENT SAFETY, EVIDENCE-BASED PRACTICE.

SURGICAL ATTIRE – A MATTER OF PREFERENCE OR EVIDENCE?

Author: *Lisa Spruce, DNP, RN, CNS-CP, CNOR, ACNS, ACNP, FAAN presented on this topic at the 2015 ORNAC National Conference in Edmonton, AB.*

Dr. Spruce is the Director of Evidence-based Perioperative Practice for the Association of periOperative Registered Nurses (AORN). She is responsible for the overall leadership, development, evaluation and maintenance of the products, services, and standards of practice developed by AORN's Nursing Practice Team. She is also the author of AORN Journal's highly popular Back to Basics series.

Dr. Spruce received her Masters of Nursing as well as her Doctorate of Nursing Practice from the University of South Alabama and is certified as an Acute Care Nurse Practitioner, an Adult Clinical Nurse Specialist, and a Perioperative Registered Nurse.

ABSTRACT:

Surgical attire can be an emotional and controversial topic among health care providers. The reality, however, is that exposing perioperative patients to the skin and hair of the perioperative team members may be putting patients at risk for a surgical site infection.

INTRODUCTION:

Surgical site infection (SSI) continues to be a major problem in the health care setting. The Centers for Disease Control and Prevention (CDC) healthcare-associated infection (HAI) prevalence survey found that there were an estimated 157,500 surgical site infections associated with inpatient surgeries in 2011 in the United States.[1] There have been vast improvements in infection control practices, over the years, including improvements in surgical skin antisepsis, sterilization of instruments, antimicrobial prophylaxis, and others, and yet SSI continues to be a cause of significant morbidity, mortality, and prolonged hospitalization. SSI is associated with a mortality rate of 3% with 75% of SSI associated deaths directly attributable to the SSI.[1]

Surgical attire can be an emotional and controversial topic among health care providers

The major source of microbial contamination and transmission in the surgical environment comes from the human body and inanimate surfaces.[2] Reducing the patient's exposure to microorganisms from the perioperative team, their attire, and their personal items, can reduce the risk of SSI. Proper use of surgical attire also protects the hospital personnel.

Patient safety is the primary responsibility of perioperative personnel and proper surgical attire is each team member's personal responsibility. There are very few studies that link surgical attire directly to SSI and it is, of course, ethically unsound to perform such clinical studies on humans. For this reason most studies are done in a non-experimental setting and give empirical data that can be used in clinical practice. Surgical attire has been a challenge, in many facilities, from both an implementation and a compliance perspective. Many health care providers put personal preference over evidence-based practice. Because of these challenges the Association of periOperative Registered Nurses (AORN) updated, in 2015, its national guideline on surgical attire.[3] This update brought some changes to surgical attire

recommendations and also introduced some new evidence to ground the recommendations.

The update began with a systematic literature search conducted using the MEDLINE®, CINAHL®, and Scopus® databases and the Cochrane Database of Systematic Reviews. The literature search included meta-analyses, randomized and non-randomized trials and studies, systematic and non-systematic reviews, and opinion documents and letters, in order to identify articles related to the topic. The search was conducted by a medical librarian and limited to literature published in English from January 2008 through June 2013.

Inclusion criteria were research and non-research literature in English, complete publications, and relevance to the key questions. Excluded were non-peer-reviewed publications; literature that examined the use of sterile gowns, drapes, and masks worn for maintaining sterile technique; low-quality evidence when higher quality evidence was available; and literature outside the time restriction when literature within the time restriction was not available. In total, 885 research and non-research sources of evidence were identified for possible inclusion and, of these, 123 were cited in the guidance document.

The evidence was appraised for level and quality using the AORN Research and Non-Research appraisal tools. The complete table of evidence is available at https://www.aorn.org/evidencetables/.

This article will discuss the changes in the AORN guideline document, as compared to previous editions, and will highlight some critical and challenging concepts perioperative professionals face in every day practice.

Scrub Attire Fabric

Several studies supported that all fabrics worn in the perioperative environment should be tightly woven, low linting, stain resistant, and durable. There was no clearly defined, or universally accepted, definition of 'tightly woven'. One study described tightly woven as 50% cotton/50% polyester woven with 560 × 395 threads/10 cm.[4] There is not a recommendation in the updated guideline regarding fleece fabrics. There was no specific evidence surrounding fleece fabrics in the perioperative setting but all fabrics should meet the requirements stated above.

An emerging new technology for scrub attire is antimicrobial scrubs and these types of scrubs may help protect the patient from SSI, however the research is emerging and further research is warranted. One quasi experimental study by Mariscal et al5 evaluated the action of a commercially available antimicrobial fabric (80% polyester / 20% cotton containing silver [180 parts per million]) on 33 strains of bacteria. The researchers found that the antimicrobial fabric significantly reduced the numbers of four reference microorganisms compared with

the numbers of reference microorganisms on the control fabric (80% polyester / 20% cotton without silver). This type of scrub attire may be the trend of the future and perioperative professionals should be aware of this technology when the purchase of scrub attire is being considered.

Covering the Arms

Another recommendation that changed with this update was the covering of the arms. The collective evidence supported covering the arms in the restricted area, while performing the surgical prep, and while preparing and packaging items in the clean assembly section of the sterile processing area. A literature review by Noble found 11 studies demonstrating that the skin is a source of multiple organisms and more than 10 million particles are shed from skin every day. Just the act of walking releases 1,000 skin scales per minute.[6] In a literature review Ibrahimi et al found that the bacterial transfer of organisms during surgery included respiratory droplets, skin scales carried on air currents, direct contact with the perioperative team member's skin, and contaminated fomites (e.g., clothing, identification badges, pens). The authors concluded that actions to decrease the bacterial load at the surgical site were prudent to reduce the risk of SSI. These actions included reducing the patient's exposure to the perioperative team members' skin.[7]

There were no studies that looked at arm covering in the semi-restricted area so bare arms are allowed in this area providing jewelry and watches are not worn. This aligns with the Society of Healthcare Epidemiology of America's guideline on attire for non-operating room settings. This guideline states that facilities may adopt a bare below the elbows concept for infection prevention. Bare below the elbows means wearing short sleeves but no wristwatch, jewellery, or ties during clinical practice.[6]

Jewellery

Jewellery should either not be worn or should be contained within the surgical attire. Wearing earrings, watches, and rings was found to increase bacterial counts on skin surfaces both when the jewelry is in place and after its removal. The collective evidence supports the removal of rings, the removal or containment of watches, and the complete covering of ear and nose piercings with a surgical mask or head covering in the surgical setting.[3]

Going Outside

If perioperative team members go outside, for any reason, they should change their scrub attire upon re-entering the perioperative environment. Even though there were no studies that have been conducted on the effects of the outside environment on attire, there have been studies on the adherence of bacteria, viruses, and fungi on all types of fabrics. A quasi-experimental study by Neeley and Maley[9] and a non-experimental study by Neeley and Orloff[10] both found that microorganisms, such as enterococci and fungi, can survive on fabrics and plastics for at least one day and many can survive for as long as 90 days. These studies demonstrate that potentially pathogenic organisms can survive on many objects and fabrics and therefore may contaminate surgical attire when it is worn outside of the facility. When this contaminated attire is subsequently worn inside the facility it could potentially increase the risk of SSIs via the transfer of microorganisms from the contaminated attire to patients and surfaces within the perioperative environment. Surgical attire may then become contaminated by contact with the external environment. Changing into clean surgical attire before entering the semi-restricted area(s) decreases the possibility of contamination with microorganisms present in the external environment.[3]

In addition, pathogenic microorganisms can be carried on contaminated surgical attire and transferred to a variety of external environments (eg, home, car, community) so changing out of surgical attire before leaving the hospital is also recommended.

Cover Apparel

Perioperative team members do, on occasion, wear cover apparel, such as lab coats, over their attire. There was no evidence that showed cover apparel was effective at protecting scrubs from contamination with microorganisms. Studies did demonstrate that cover apparel is highly contaminated and should be laundered daily or be single use. Reusable cover apparel should be laundered in a health care-accredited laundry facility after each daily use and when visibly contaminated.[3]

Personal Items

Perioperative providers often need to bring briefcases, backpacks, or other items that relate to patient care into the operating room. These types of items should be made of material that can be cleaned with a low level disinfectant and should not be placed on the floor. Cleaning these items may help to decrease the transmission of potentially pathogenic microorganisms from these external surfaces to perioperative surfaces and vice versa. Floors in the OR or procedure room are considered contaminated and items placed on the floor could become vehicles for transferring microorganisms from the floor to other perioperative or external surfaces.[3]

There are, additionally, many perioperative team members who bring cell phones, tablets, or other personal devices into the operating room. These devices are highly contaminated and should be cleaned with a low level disinfectant according to manufacturer's instructions both before and after use in the OR.[3]

One study, by Datta et al, conducted a randomized controlled trial to investigate the rate of bacterial contamination on the mobile phones of health care workers employed in a tertiary health care teaching hospital and compared the contamination rate with that of a group of individuals not working in a health care environment. Of the 200 health care workers' mobile phones sampled, 144 (72%) were contaminated with bacteria, and 18% of those bacteria were MRSA.

One area of surgical attire that can be a compliance challenge is the head covering.

Of the 50 non-health care workers' mobile phones sampled, only five (10%) were contaminated with bacteria (ie, coagulase-negative staphylococci). The researchers concluded that simple measures such as regular cleaning of cell phones and other hand-held electronic devices and improving hand hygiene might help to decrease the risk of HAIs from bacteria carried on personal mobile devices.[12]

Head covering

One area of surgical attire that can be a compliance challenge is the head covering. Perioperative team members should wear a clean surgical head cover or hood that confines all hair and completely covers the ears, scalp skin, sideburns, and nape of the neck.[3] There were several studies that demonstrated the contamination of hair and ears. A study by Mastro et al investigated a prolonged outbreak of 20 postoperative surgical site infections caused by group A Streptococcus. Two case control studies, and a review of records conducted by the researchers, failed to identify the carrier. The researchers used bacterial settling plates to sample the air in the OR and identified the source of the outbreak as a surgical technologist who carried the identical type of group A Streptococcus on the scalp.[13] Owers et al conducted a non-experimental study in which 20 OR team members had their foreheads, eyebrows, and ears cultured. The researchers found there was significantly more bacteria isolated from the ears than from the foreheads and eyebrows of the surgical team members. The researchers concluded that the ears should be covered by surgical head covers during surgery.[14]

Laundering

Surgical attire does pose a risk to patients and healthcare workers alike if guidelines are not followed. Often times, healthcare workers are taking their scrub attire home to be laundered in their home washing machines.[3] A case study by

It is important to remember that surgical masks are not only for the patient's protection but also provide protection for the wearer from exposure to blood, body fluids, or other potentially infectious materials.[3]

Wright et al has demonstrated a causal relationship between scrub attire and the spreading of disease. Wright reported three cases of postoperative Gordonia bronchialis sternal infections after coronary artery bypass grafting surgery. G bronchialis was isolated from the scrub attire, axilla, hands, and purse of a nurse anaesthetist and was implicated as the cause of the SSIs. Cultures taken from her roommate, who was also a nurse, showed the same microorganism. After notification of the culture results, the nurse anesthetist discarded her front-loading washing machine. During the next year, the nurse anesthetist and her roommate's scrub attire, hands, nares, and scalp tested negative for G bronchialis. The authors concluded that the home washing machine was the likely bacterial reservoir. Home laundering may not reliably kill all pathogens, and the pathogens may survive in the form of biofilms within the washing machine. Biofilms have been implicated in the malodour of washing machines. The authors recommended that hospital-laundered scrub attire be implemented to reduce patients' risk of developing an SSI.[15]

Masks for Unscrubbed Personnel

There has been some question as to whether unscrubbed personnel need to wear masks in the operating room. It is important to remember that surgical masks are not only for the patient's protection but also provide protection for the wearer from exposure to blood, body fluids, or other potentially infectious materials.[3] An observational, descriptive, non-experimental study, conducted by White et al,11 involving 8,500 surgical procedures showed that 26% of exposures to blood were to the heads and necks of scrubbed personnel and 17% of blood exposures were to circulating personnel outside the sterile field. Unscrubbed personnel should protect themselves from potential exposure by wearing masks while in the operating room.

CONCLUSION:

This article has highlighted the important updates to the AORN Guideline for Surgical Attire. Following the recommendations that have been presented in this article will help to decrease patient exposure to microorganisms from the perioperative team, their attire, and their personal items, can reduce the risk of SSI. Proper use of surgical attire also protects the hospital personnel.

Attire is a personal, and sometimes emotional, issue and perioperative team members must put their personal preferences aside and prioritize what is best for patients. All team members including surgeons, nurses, anaesthesia providers, and surgical technicians should be involved in the planning and implementation of a healthcare facility's surgical attire guidelines. They should understand the evidence for practice and know that attire must be about protecting patients and not about personal preference.

Patients trust that they are going to come out of surgery better than they went in. They do not expect to get an SSI and it is up to all perioperative professionals to adhere to evidence-based practice in order to provide the highest quality, and safest, care. Patient safety is the utmost responsibility for all people practicing in the perioperative profession.

ORNAC Standards pertaining to this article can be found in the Operating Room Nurses Association of Canada (ORNAC) (October 2015) *Standards for Perioperative Registered Nursing Practice* (12th edition). Section 2, pages 121 - 125, Standards 2.7 - 2.9.

The full version of these Standards has been reprinted in this Journal (see pages 20-23) for the reader's information.

REFERENCES:

1. Centers for Disease Control and Prevention. Surgical Site Infection Event. [Internet]. 2012 [cited 30 March 2015]. Available from: http://www.cdc.gov/nhsn/PDFs/pscManual/9pscSSIcurrent.

2. Noble W, Habbema J, Van Furth R, Smith I, De Raay C. Quantitative studies on the dispersal of skin bacteria into the air. Journal of Medical Microbiology. 1976;9(1):53-61.

3. Spruce L, Van Wicklin S, Conner R. Guideline for surgical attire. Guidelines for perioperative practice. Denver, CO: Association of perioperative Registered Nurses; 2015.

4. Tammelin A, Domicel P, Hambraus A, Stayhle E. Dispersal of methicillin-resistant Staphylococcus epidermidis by staff in an operating suite for thoracic and cardiovascular surgery: relation to skin carriage and clothing. Journal of Hospital Infection. 2000;44(2):119-126.

5. Mariscal A, Lopez-Gigosos R, Carnero-Varo M, Fernandez-Crehuet J. Antimicrobial effect of medical textiles containing bioactive fibres. Eur J Clin Microbiol Infect Dis. 2010;30(2):227-232.

6. Noble W. Dispersal of skin microorganisms*. Br J Dermatol. 1975;93(4):477-485.

7. Ibrahimi O, Sharon V, Eisen D. Surgical-Site Infections and Routes of Bacterial Transfer: Which Ones Are Most Plausible?. Dermatologic Surgery. 2011;37(12):1709-1720.

8. Bearman G, Bryant K, Leekha S, Mayer J, Munoz-Price L, Murthy R et al. Healthcare Personnel Attire in Non-Operating-Room Settings. Infection Control and Hospital Epidemiology. 2014;35(2):107-121.

9. Neeley A, Maley M. Survival of enterococci and staphylococci on hospital fabrics and plastic. J Clin Microbiol. 2000;38(2):724-726.

10. Neely A, Orloff M. Survival of Some Medically Important Fungi on Hospital Fabrics and Plastics. Journal of Clinical Microbiology. 2001;39(9):3360-3361.

11. White M, Lynch P. Blood contact and exposures among operating room personnel: A multicenter study. American Journal of Infection Control. 1993;21(5):243-248.

12. Datta P, Rani H, Chander J, Gupta V. Bacterial contamination of mobile phones of health care workers. Indian J Med Microbiol. 2009;27(3):279.

13. Mastro T, Farley T, Elliott J, Facklam R, Perks J, Hadler J et al. An Outbreak of Surgical-Wound Infections Due to Group A Streptococcus Carried on the Scalp. New England Journal of Medicine. 1990;323(14):968-972.

14. Owers K, James E, Bannister G. Source of bacterial shedding in laminar flow theatres. Journal of Hospital Infection. 2004;58(3):230-232.

15. Wright S, Gerry J, Busowski M, Klochko A, McNulty S, Brown S et al. Gordonia bronchialis Sternal Wound Infection in 3 Patients following Open Heart Surgery: Intraoperative Transmission from a Healthcare Worker. Infection Control and Hospital Epidemiology. 2012;33(12):1238-1241.