The Effects of Surgical Hand Scrubbing Protocols on Skin Integrity and Surgical Site Infection Rates: A Systematic Review

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ABSTRACT

This systematic review aimed to critically appraise and synthesize updated evidence regarding the effect of surgical-scrub techniques on skin integrity and the incidence of surgical site infections. Databases searched include the Cumulative Index to Nursing and Allied Health Literature, MEDLINE, Embase, and Cochrane Central. Our review was limited to eight peer-reviewed, randomized controlled trials and two nonrandomized controlled trials published in English from 1990 to 2015. Comparison models included traditional hand scrubbing with chlorhexidine gluconate or povidone-iodine against alcohol-based hand rubbing, scrubbing with a brush versus without a brush, and detergent-based antiseptics alone versus antiseptics incorporating alcohol solutions. Evidence showed that hand rubbing techniques are as effective as traditional scrubbing and seem to be better tolerated. Hand rubbing appears to cause less skin damage than traditional scrub protocols, and scrub personnel tolerated brushless techniques better than scrubbing using a brush. *AORN J* 103 *(May 2016) 468-482. © AORN, Inc, 2016. http://dx.doi.org/10.1016/j.aorn.2016.03.003*

Key words: *surgical hand scrubbing, hand rubbing, skin, irritation, surgical site infection.*

Surgical site infections (SSIs) are a major issue in health care worldwide, accounting for approximately 16% of all health care–associated infections in England[1] and an estimated 24% in the United States.[2] Patients who have SSIs are subject to longer hospital stays, delayed incision site healing, and the use of antibiotics, which add additional psychological and financial burdens. Additionally, a severe SSI can be fatal.[3,4] The treatment of SSIs represents a significant cost burden to health care services. In the United Kingdom, the annual cost of SSIs to the National Health Service is approximately £700 million (approximately $1 billion).[5] In the United States, the estimated annual cost of SSIs is even higher—approximately $3.3 billion.[6] Although many factors lead to SSI occurrences, hygiene of the surgical-team members' hands has been documented as one of the important factors.[7,8]

Hand hygiene has been associated with reducing infections since the nineteenth century.[9,10] In 1847, Dr Ignaz Semmelweis observed that postdelivery mortality in women whose babies were delivered by physicians and medical students was much higher (13% to 18%) than in women whose

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babies were delivered by midwives (2%). Semmelweis believed that this was because the physicians performed autopsies on cadavers before performing clinical procedures. He asked his medical staff members to wash their hands with a chlorinated lime solution before performing clinical procedures, and found that patients' mortality was reduced to approximately 2%.[9] Two decades later, a Scottish surgeon named Joseph Lister began using carbolic acid as an antiseptic in his clinical work, a compound used by engineers to treat sewage. He reported that dressings containing carbolic acid dramatically reduced patients' mortality caused by incision site infection.[10] Since the twentieth century, a number of antiseptic formulas have been introduced for routine hand scrubbing before surgery; as a result, to prevent SSIs, surgical hand hygiene has been part of the standard care provided before any surgical procedure. To limit the risk of SSIs, several national and international organizations, such as the World Health Organization (WHO), AORN, and the National Institute for Health and Care Excellence (NICE) recommend protocols for surgical scrubbing in ORs.[1,11,12] Despite the implementation of guidelines, the length of time taken to scrub and the type of scrub solution used varies across health care settings, hospitals, and countries.

Traditionally, 7.5% povidone-iodine or 4% chlorhexidine gluconate solutions have been used in the United States and worldwide; the use of 4% chlorhexidine, 1% triclosan, or some alcohol preparations has been more common in Europe.[8,13] Some studies suggest that adherence to guidelines is generally poor.[14,15] Skin irritation is considered to contribute to poor adherence to the required guidelines. Asensio and de Gregorio[16] conducted a survey of 70 surgeons and perioperative nurses in Spain to evaluate the performance of surgical hand scrubbing and perceptions concerning the use of alcohol hand rubbing or antiseptic hand scrubbing. They found that 85% of survey participants agreed that alcohol hand rubbing improved hand hygiene compliance. Participants who used alcohol-rubbing methods reported better skin outcomes more frequently than those who used antiseptic scrubbing.[16]

Hand washing has been shown to remove dermal fatty acids and may result in dry skin.[17] Excessive scrubbing can also cause dermatologic problems such as skin irritation and skin dryness.[18] More importantly, skin damage can lead to disruptions in the normal bacterial hand flora and may cause more organisms to be shed, which could increase the risk of staff members transferring infections to patients.[19] A study conducted by Boyce et al[14] compared the effect of two hand hygiene regimens on the epidermal water content of the dorsal surface of nurses' hands. They found that the epidermal water content was significantly lower in nurses who washed their hands with soap and water than in those who used an alcohol hand rub. The target population in this study was nurses who worked in hospital wards rather than ORs. Understanding the available evidence on the effect of hand scrubbing on surgical-team members' skin is necessary to appropriately inform hand hygiene practices.

PURPOSE OF THE LITERATURE REVIEW

We conducted this systematic review to critically appraise and synthesize the evidence regarding the effects of various surgical-scrub protocols on skin integrity and their effectiveness in preventing SSIs. This review sought to address three specific questions.

- What is the effect of various scrub protocols on skin integrity?
- How has skin damage associated with scrubbing been measured, and which measurement tools were used?
- How has the effectiveness of surgical scrubbing protocols on preventing SSIs been measured, and what differences exist between scrubbing protocols?

RESEARCH METHODS

We developed a systematic review protocol for the identification, retrieval, and appraisal of the evidence. We registered our review in the PROSPERO database[20] in November 2014. We searched all relevant literature published from 1990 through January 2015 in four databases, without any language restrictions. We used free-text, key word, and Medical Subject Headings (MeSH) terms for each of the following databases: MEDLINE, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Embase, and the Cochrane Central Register of Controlled Trials. We entered subject subheadings and word truncations according to database requirements to map all possible key word terms. Search terms included

- hand, hands, or hand wash;
- hand disinfection;
- surgical scrub;
- surgical NEAR infection;
- surgical NEAR wound;
- post-operative or postoperative;
- NEAR (wound NEXT infection);
- perioperative care;
- preoperative or pre-operative;
- skin integrity, skin damage, and skin irritation;
- dermal tolerant; and
- skin redness, skin roughness, and skin condition.

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