Adherence to surgical hand rubbing directives in a hospital district of Southwest Finland*

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ABSTRACT

Background: The primary objective was to measure the compliance with alcohol-based surgical hand rubbing (SHR) among operation room personnel. The secondary objective was to evaluate the effect of feedback sessions on compliance. Methods: This was a prospective observational before-after intervention study. Between October 2010 and June 2012 the hygiene nurses observed SHR among operation room personnel in the hospital district of Southwest Finland. After feedback sessions a second observation round was conducted in the main operation room of Turku University Hospital. The first observation round comprised 477 observations: 259 (54%) were doctors, 190 (40%) nurses and 28 (5%) other personnel. In the second observation round a total of 210 observations were made. Results: During the first round in 42% of observations the 3 min SHR time recommended by WHO was used. Median times for SHR were 1 min 50 s (range 0 min to 5 min 44 s) for doctors and 3 min 25 s (range 1 min 1 s to 8 min 15 s) for nurses, respectively (p < 0.0001). In 40% of observations hands were not properly dried after a wash before applying SHR and in 45% hands were not allowed to dry properly after SHR before donning surgical gloves. After feedback, time for SHR did not significantly improve but technique did. Conclusions: SHR was performed incorrectly in most observations even after feedback. The results stress the importance of more effective education, helping techniques and positive role models for operation room personnel to promote SHR.

Introduction

Surgical site infections (SSIs) are a great burden to modern healthcare. It has been estimated that SSIs cause a 4.3% independent rise in mortality and may even triple healthcare costs [1,2]. The hands of operative personnel are one source of microbes causing SSIs. Therefore routine hand antiseptic measures are aimed at preventing contamination of the surgical site. Sterile gloves form a physical barrier between the hands of the operating personnel and the surgical site, thus contributing to prevention of SSIs and also protecting personnel from a patient’s microbes. However, it has been estimated that sterile gloves get punctured in 8–50% of operations [3–9] and that these punctures go unnoticed in more than 80% of cases [10]. Increased risk of SSIs has been demonstrated in operations where sterile gloves have been punctured when antimicrobial prophylaxis has not been used [11]. Surgical hand antiseptics are widely regarded as a vital part of measures aimed at preventing SSIs. Due to ethical difficulties, the effectiveness of these antiseptic measures cannot be demonstrated in a randomized controlled trial. However, a large body of indirect evidence suggests their effectiveness in preventing the contamination of surgical sites by microbes from the hands of operating personnel [12–15].

Two distinctive methods used for surgical hand antiseptics (SHAs) are surgical hand rubbing (SHR) and surgical hand scrubbing (SHS). In SHR hands are treated with alcohol-based hand rub (AHR) whereas in SHS hands are washed with antimicrobial soap. No difference in SSI rates was found between SHR and SHS in a randomized trial [16], but AHRs do have as good as or better in vitro antimicrobial efficacy [17,18], and better dermal tolerance than traditional antimicrobial soaps [16,19–21]. Therefore SHR is commonly preferred. The World Health Organization (WHO) recommends SHR for surgical hand antiseptics at least if the quality of water is not assured [22].

It has been well documented that the introduction of hand disinfection with AHR in hospital wards increases compliance with hand hygiene guidelines due to better availability and shorter duration compared with hand washing [23–25]. It has been thought that a similar rise in compliance could be seen when replacing SHS with SHR in surgical hand antiseptics. However, there are only a few studies on surgical hand disinfection compliance. Furthermore, the sample sizes are small and study methods are variable [16,26–29]. In a recent study by Umit et al. SHS practices of surgical personnel were observed preoperatively and the results showed significant
shortcomings in adherence to hand hygiene protocols [30]. To our knowledge the present study is the largest study to comprehensively examine the fulfilment of SHR and its areas of shortcomings in operation rooms.

Material and Methods

Hospital setting and study design

The aim of the study was to survey the fulfilment of WHO guidelines on SHA among operation room personnel and to evaluate points of shortcomings. The secondary objective was to evaluate the effectiveness of feedback sessions in enhancing compliance.

This study was conducted in operation rooms of Turku University Hospital, and in three secondary care hospitals in the hospital district of Southwest Finland. A total of 11 surgical settings were included in the study. Observations were conducted between autumn 2010 and summer 2012. SHR has been preferred for SHA in the hospital district for years, and the guidelines for SHR were reviewed to match the WHO guidelines for surgical hand disinfection in the summer of 2010 [22]. All operating personnel were informed of the revisions.

We conducted an observational study, where the operating room personnel were observed at operation room hand disinfection points. We used a structured observation form that was based on the WHO guidelines for surgical hand disinfection [22] (the observation form is available as supplementary online material). Direct observations were carried out by hygiene nurses from the Department of Hospital Hygiene and Infection Control of Turku University Hospital, who were not part of the operating team. Observations were carried out mostly in the morning before the first operations of the day. Observations begun when operating personnel arrived at the disinfection point and ended with the donning of sterile gloves.

Observations included personnel from all operative specialties except the ear, nose and throat specialty. No identification of the observed persons could be made afterwards.

Intervention

The first round of observations ended in summer 2012. Feedback sessions were used as intervention to improve compliance with surgical hand disinfection directives. Sessions were given to both doctors and nurses from surgical departments. These sessions included presentations of the results of the first observation round and information on the surgical hand disinfection directives. To evaluate the effectiveness of these feedback sessions a second round of observations was conducted in the main surgical setting of Turku University Central Hospital.

Study population

In the first observation round a total of 477 observations were made. Of these, 266 (56%) involved women and 211 (44%) involved men. Of these observed persons, 259 (54%) were doctors, 190 (40%) nurses and 28 (5%) other personnel. Other personnel included, for example, nursing and medical students. In the second observation round a total of 210 observations were made. Of the observed persons, 111 (53%) were women and 99 (47%) men; 108 (51%) were doctors, 73 (35%) nurses and 27 (14%) other personnel. The surgical specialty of the observed operation was not initially recorded during the observations. While analysing the collected data we retrieved the surgical specialties of each observation for the first observation round from the hospital database using the collected time and place of each observation. Operations from 10 different surgical specialties were observed in the present study. Of observed specialties in the first observation round, 42 (9%) were neurosurgery, 36 (8%) gynecology, 30 (7%) pediatric surgery, 35 (8%) ophthalmic surgery, 125 (28%) orthopaedics, 29 (6%) plastic surgery, 11 (2%) endocrine surgery, 14 (3%) urology, 79 (18%) gastrointestinal surgery and 45 (10%) cardiothoracic surgery. We were unable to retrieve the surgical specialty for 31 observations.

Statistical analysis

The Shapiro-Wilk W test was used to evaluate the normality of the distributions. The Mann–Whitney U test was used to analyse the significance of statistical differences between subsamples. Pearson’s chi-squared test was used to compare categorical variables.

Results

In 58% of observations in the first observation round the surgical personnel did not use the 3 min SHR time recommended by the WHO (Figure 1). The median disinfection time was 2 min 38 s (range 0 min to 8 min 15 s). Among the staff observed, 42% of women and 79% of men did not use the recommended 3 min disinfection time. The median time was 3 min 10 s (11 s to 8 min 15 s) in women and 1 min 50 s (0 min to 5 min 51 s, \( p < 0.0001 \)) in men, respectively.

Median times for SHR were 1 min 50 s (0 min to 5 min 44 s) for doctors and 3 min 25 s (1 min 1 s to 8 min 15 s) for nurses, respectively (\( p < 0.0001 \)). The median SHR time for female doctors (\( n = 80 \)) was 2 min 17 s (11 s to 5 min 22 s) and for female nurses (\( n = 176 \)) 3 min 29 s (1 min 1 s to 8 min 15 s, \( p < 0.0001 \)) (Figure 2). The median SHR time for male doctors (\( n = 179 \)) was 1 min 39 s (0 min to 5 min 44 s) and for male nurses (\( n = 108 \)) was 2 min 17 s (11 s to 5 min 22 s) for doctors and 3 min 25 s (1 min 1 s to 8 min 15 s) for nurses, respectively (\( p < 0.0001 \)) (Figure 2).
nurses (n = 14) 3 min 2 s (1 min 48 s to 5 min 51 s, p = 0.0003) (Figure 3). The difference in SHR time between female and male doctors was statistically significant (p = 0.0008).

In surgical specialties, only in neurosurgical operations was the median time for SHR by doctors above 3 min (median 3 min 32 s, range 31 s to 5 min 8 s). In 4 of 10 operative specialties over 25% of the doctors used the recommended time for disinfection. These specialties were neurosurgery, gynaecology, paediatric surgery and ophthalmic surgery (Figure 4, Table I).

Obstacles to fulfilment of SHR were detected in 16 of 477 observations (3.4%). The obstacles included persons’ negative attitude towards the SHR in eight cases, long fingernails in five cases, hand eczema in one case, nail polish in one case and a wound in a finger in one case.

Shortcomings of the performance of SHR were observed as follows: in 40% of observations hands were not properly dried after a wash with soap and water before applying AHR. Hands were not properly dried by 33.5% of women and 47.4% of men (p = 0.0039), 49.8% of doctors and 28.4% of nurses (p < 0.0001). The WHO recommends that AHR is applied up to the elbows twice during SHR. In 67.5% of observations AHR was applied up to the elbows at least once and in 35% twice. AHR was applied up to the elbows twice by 48.3% of women and 18.5% of men (p < 0.0001), and by 17% of doctors and 59.8% of nurses (p < 0.0001). In 45% of observations hands were not allowed to dry properly after AHR before donning surgical gloves. Hands were not allowed to dry properly after AHR by 34.3% of women and 58.8% of men (p < 0.0001), and by 62.9% of doctors and 24.9% of nurses (p < 0.0001).

After the feedback, a second observation round was carried out in the main surgical unit of Turku University Central Hospital. All comparisons below are made between the results
of this surgical unit in the first and second observation round. The median time used for SHR in that surgical unit was 2 min 18 s (range 11 s to 6 min 31 s) in the first and 2 min 16 s (15 s to 7 min 6 s) in the second round \( p = 0.6689 \).

AHR was applied on dry hands in 60.5% of observations in the first observation round and in 72.4% in the second round \( p = 0.0103 \). This improvement was due to change in behaviour of female doctors (42.3% in the first observation round, 75.8% in the second, \( p = 0.0089 \)). There were no statistically significant improvements in the behaviour of male doctors and female nurses. Rubbing of hands until they were dry from AHR was done in 60.5% of observations in the first observation round and in 76.2% of observations in the second round \( p < 0.0001 \). This improvement was due to change in behaviour of female doctors (34.6% in the first observation round, 69.7% in the second, \( p = 0.0072 \)) and by male doctors (35.6% in the first observation round, 58.7% in the second, \( p = 0.0030 \)).

There was no statistically significant improvement in the behaviour of female nurses. All male nurses applied AHR on dry hands and let their hands dry properly in the second observation round; however, these improvements were not statistically significant due to small sample sizes. When looking only at the results from the second observation round in the main surgical unit, there was still a statistically significant difference regarding letting hands dry from AHR between female doctors and female nurses (69.7% of female doctors, 92.3% of female nurses, \( p = 0.0033 \)), but no statistically significant difference regarding applying AHR on dry hands (75.8% of female doctors, 86.7% of female nurses, \( p = 0.1990 \)).

Direct observation of hand hygiene practices is regarded as the gold standard in measuring compliance with hand hygiene directives. The limitations of this method have been discussed thoroughly elsewhere [31]. We attempted to minimize the bias arising from the use of direct observations, i.e. to minimize the change in the observed personnel’s behaviour due to awareness about being observed: the observed operating room personnel were aware that a study regarding perioperative antiseptic methods was performed, but they were not aware of the details of the observations. All observations were carried out by trained personnel of the Department of Hospital Hygiene and Infection Control to minimize variations in the results due to differences in observer practices.

The limitation of the present study was that no information about the cleanliness of the operation was collected. At a subjective level, this may be an important factor affecting the thoroughness of preoperative antiseptic methods; for example, surgical personnel preparing for a sterile hernia operation may be more motivated as regards SHR than for perianal operations. Some of the shortest SHR times in our observations may be due to low overall cleanliness of the following operations.

Discussion

To our knowledge, this is the largest study on the compliance of operating personnel with SHR guidelines. Remarkable shortcomings in the fulfilment of SHR were detected, especially in terms of time of SHR and of technique. Umit et al. found similar results regarding the time used for SHS [30]. Our results are in line with the current understanding that doctor status and male sex are risk factors for poor adherence to recommended hand hygiene practices. A positive result was the small number of obstacles for proper disinfection, indicating that education on harmful effects of rings and long fingernails has been effective in our hospitals. It must be stressed that all surgical personnel utilized surgical hand antiseptics, at least with medicated soap wash if not with SHR.

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We found significant differences in compliance between surgical specialties. However, in the scope of the present study it is not possible to determine whether these differences are due to differences in the proportions of different cleanliness level operations in these specialties. SHR should, however, be carried out in a routine way despite the differences in the cleanliness of operations.

It must be noted that evaluation of the performed SHR technique is always subjective and therefore there could be some inter-observer differences in these results.

Due to complete anonymity of the observed personnel in the present study, it is possible that the same person was observed occasionally more than once.

This study was concluded in one hospital district in Finland. A larger multicentre study is needed to determine whether the results of the present study represent a general trend in surgical units. We recommend that the cleanliness level of the observed operation should be added to the observation form in future studies.

No clear improvement in the time used for SHR was found after presenting the results of the first observation round to the surgical personnel, but some improvements were found in the technique for performing SHR. We believe that pointing out the shortcomings in an individual’s behaviour is not effective if that individual does not believe that the difference between

Table I. Non-parametric comparisons for each pair using the Wilcoxon method (only \( p \) values < 0.05 are shown).

|                  | Urology | Plastic surgery | Endocrine surgery | Gastrointestinal surgery | Ophthalmic surgery | Cardiothoracic surgery | Paediatric surgery | Gynaecology | Neurosurgery | Orthopaedics |
|------------------|---------|-----------------|-------------------|--------------------------|--------------------|-----------------------|-------------------|-------------|--------------|--------------|
| Urology          | –       | –               | –                 | –                        | 0.0061             | 0.0437                | 0.0012            | 0.0004      | <0.0001      | 0.0147       |
| Plastic surgery  | –       | –               | –                 | –                        | 0.0310             | –                     | 0.0030            | 0.0011      | <0.0001      | –            |
| Endocrine surgery| –       | –               | –                 | 0.0265                   | –                  | 0.0170                | 0.0065            | 0.0016      | –            | –            |
| Gastrointestinal surgery | 0.0061 | 0.0310 | 0.0265            | –                        | –                  | –                     | 0.0025            | 0.0003      | <0.0001      | –            |
| Ophthalmic surgery | 0.0437 | –               | –                 | –                        | –                  | 0.0333                | 0.0062            | 0.0003      | –            | –            |
| Paediatric surgery | 0.0012 | 0.0030          | 0.0170            | 0.0025                   | –                  | –                     | –                 | 0.0148      | 0.0078       | –            |
| Gynaecology      | 0.0004  | 0.0011          | 0.0065            | 0.0003                   | –                  | –                     | –                 | –           | 0.0014       | –            |
| Neurosurgery     | <0.0001 | <0.0001         | 0.0016            | <0.0001                  | 0.0001             | 0.0003                | 0.0148            | –           | <0.0001      | –            |
| Orthopaedics     | 0.0147  | –               | –                 | –                        | –                  | –                     | 0.0078            | 0.0014      | <0.0001      | –            |
expected and observed behaviour is of any importance. The demonstration of the effect of properly performed SHA on the outcome of surgical patients would undoubtedly clarify the perceived importance of SHA among personnel. This would, however, require large multicentre studies and controlling of multiple factors that can affect patient outcome. However, as Misteli et al. have proven with their study concerning glove perforations and surgical site infections, they are conceivable [11].

Because of resources-related issues the second observation round was carried out in only one surgical setting. The main surgical setting of Turku University Hospital was chosen because of the large surgical capacity and the large number of different surgical specialties using this surgical setting. We compared the results from the second observation round to the results of this same surgical setting in the first observation round. A limitation of our intervention was that only one follow-up observation round and feedback session could be arranged and that no personal feedback could be given.

Hand hygiene practice is a part of continuous education in Southwest Finland Hospital District. We have easily readable reminders and instructions regarding surgical hand antiseptics in all of our surgical settings. The institutional safety climate, and hand hygiene practices as an essential part of it, is an important background in improving patient safety. In addition to education, correctly performed SHA should also be made an important part of the surgical process. This could be achieved by adding it to the surgical checklist, which has been proven to be effective in improving the patient outcome [32]. Adding timers to wash basins would enable surgical personnel to more clearly follow the SHR directives. We do not believe that changing AHRs to faster acting preparations would work in the long run: AHRs have been proven to have good antimicrobial efficacy and superior dermal tolerance compared with other disinfection products. Most importantly, we believe that teachers, senior doctors and senior nurses are the key players in improving hygiene behaviour as they serve as role models and also opinion leaders in this field.

Acknowledgments

This study was concluded as part of a general quality control done by the Department of Hospital Hygiene and Infection Control in Turku University Hospital. No financial support was received. The authors thank Dr Harri Marttila MD, and Hygiene Nurses Kirsu Terho, Tiina Kurvinen, Merja Laaksonen, Anu Harttio-Nohteri and Elisa Yli-Takku, and department secretary Minna Koskimäki for data collection.

Declaration of interest

This study was concluded as part of a general quality control done by the Hospital Hygiene and Infection Control Unit of Turku University Hospital. No outside financial support was received. The authors report no conflicts of interest.

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