Hand washing rituals in trauma theatre: clean or dirty?

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ABSTRACT

INTRODUCTION The aim of this study was to investigate the degree of contamination of a surgeon's hand following use of chlorhexidine gluconate or alcohol gel as disinfectants.

MATERIALS AND METHODS In this prospective, randomised trial, orthopaedic surgeons were allocated to one of two different hand-washing protocols using a randomisation table. The hand-washing protocol dictated that all surgeons should wash for 5 min with chlorhexidine for their first case. Thereafter, the surgeon was randomised to wash for 3 min with either alcohol gel or chlorhexidine. At the end of each procedure, the gloves of each surgeon were carefully removed and the fingertips from each hand were placed on an agar plate. The number of bacterial colonies present after 24 h and 48 h of incubation were recorded for each agar plate by a microbiologist blinded to the washing protocol used.

RESULTS Overall, 41 procedures and 82 episodes of hand washings were included in the study. Two episodes were discarded due to contamination at the time of glove removal. Four hands (8%) were contaminated in the chlorhexidine group compared to 19 (34%) in the alcohol group. Fisher's exact test confirmed a significantly higher risk of contamination using alcohol gel compared to chlorhexidine ($P = 0.002$). In addition, the average bacterial colony count was substantially higher in the alcohol group (20 colony forming units) compared to the chlorhexidine group (5 colony forming units). There was no relationship between the duration of surgery and the degree of contamination ($P = 1.12$).

CONCLUSIONS Alcohol gel disinfectant is not a suitable alternative to chlorhexidine when hand washing before surgery. This study has identified a higher risk of bacterial contamination of surgeons' hands washed with alcohol. This may lead to higher levels of postoperative infection in the event of glove perforation.

KEYWORDS

Hand washing – Chlorhexidine gluconate – Alcohol

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Deep infection condemns the patient to multiple operations, protracted immobilisation, reactive depression and a substandard joint when the process is complete. One of the factors affecting the infection risk during a procedure is the surgeon's method of hand washing prior to the surgery, as between 50–67% of gloves are perforated during joint replacement operations. Infection, in these cases, can be directly transmitted from the hands of the surgeon. Research has shown that as few as 10 organisms can produce an infected joint replacement.¹

The Hospital Infection Society Working Group on Infection Control recommends that, in operating theatres, hand washing should be performed for a set time using chlorhexidine gluconate.² It is postulated that alcohol gel or foam can be as effective as more conventional detergents if applied to clean hands. Repeated washing using chlorhexidine gluconate can lead to skin irritation, the development of abrasions and further colonisation with other organisms.

Therefore, the use of alcohol may form a suitable alternative.

The aim of this study was to investigate the degree of contamination of the surgeon's hand using these two different disinfectants in the trauma theatre setting.

Materials and Methods

In this prospective randomised trial, orthopaedic surgeons were allocated to one of two different hand-washing protocols using a randomisation table. The hand-washing protocol dictated that all surgeons should wash for 5 min with chlorhexidine for their first case with thorough cleaning under the fingernails. Thereafter, the surgeon was randomised to wash for 3 min with either chlorhexidine or alcohol gel. Alcohol was allowed to dry on the hands prior to double gloving. At the end of each procedure, the gloves of each surgeon were carefully removed and the fingertips from each hand were placed on a separate agar plate. All

agar plates were marked for the surgeon's grade, patients order on the list, date and hand side. The length of time was recorded from the time of gloving to the time of glove removal and was identified as operative time. At the end of each theatre list, all agar plates were transferred to the incubator at the microbiology department. The number of bacterial colonies present after 24 h and 48 h of incubation were recorded for each agar plate by a microbiologist blinded to the washing protocol used. Bacterial colonies present at finger print areas were considered as positive fingertip contamination. Bacterial colonies found in other areas were considered as environmental contamination. In this study, organisms were not individually identified.

Results

Overall, 41 procedures and 82 episodes of hand washings were included in the study. Two episodes were discarded due to contamination at the time of glove removal. There was no incidence of outer glove perforation during this study.

All procedures were performed under general anaesthetic and 34 (83%) procedures were performed on emergency admissions. Table 1 shows the differences between the three hand washing groups in relation to operation time.

There was no relationship between the duration of surgery and the degree of contamination ($P = 1.12$).

Twenty-nine (35%) primary hand washings (5 min hand washing with chlorhexidine) were recorded. In this group, 8 (14%) and 11 (19%) hands were found to be contaminated based on positive bacterial colonies found at 24 h and 48 h, respectively. Figure 1 indicates the frequency of contamination for each fingertip. In this group, the thumb and index finger showed higher degrees of contamination compared to the other fingertips.

Four hands (8%) were contaminated in the chlorhexidine group compared to 19 (34%) in the alcohol group based on positive bacterial colonies found after 48 h. Fisher's exact test confirmed a significantly higher risk of contamination using alcohol gel compared to chlorhexidine ($P = 0.002$). The contamination of the fingertips in these two groups are compared in Figure 2.

The average bacterial colony count was substantially higher in the alcohol group (16 colony forming units; CFUs) compared to the chlorhexidine group (2 CFUs).

The contamination of surgeons' fingertip in the three groups are compared in Figure 3. There is a significantly higher risk of contamination when alcohol is used for surgical scrub compared to the other two groups. There is an improvement in

Table 1 Operative time in the three categories of hand washing

Operative time (min)	Minimum	Mode	Maximum	Average
Primary hand washing (5 min chlorhexidine)	15	45	135	65
Secondary hand washing (3 min chlorhexidine)	20	30	100	55
Secondary hand washing (3 min alcohol gel)	20	60	128	57

Figure 1 Fingertip contamination in first theatre case hand wash with chlorhexidine.

Figure 2 Fingertip contamination in other theatre cases.

Figure 3 Fingertip contamination in all groups.

the contamination rate after repeated hand washing using chlorhexidine due to the persistent effect of chlorhexidine.^{5,4}

Conclusions

Alcohol gel disinfectant, although skin-friendly, is not a suitable alternative to chlorhexidine when hand washing before surgery in trauma or elective orthopaedic theatre. This study has identified a higher risk of bacterial contamination of surgeons' hands washed with alcohol. Although this could be due to a variation of hand-washing techniques among the surgeons, it may lead to higher levels of postoperative infection in event of glove perforation.

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