Experimental study on disinfection effect of different dose of rapid hand disinfectant

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ABSTRACT

Purpose: To investigate the appropriate antiseptic handrubbing method.
Methods: Seventy-four clinical nurses were randomly divided into two groups based on the number of disinfectant presses used, with group 1 using one-press and group 2 using two-presses. Sterilizing effects as a function of presses were compared and analyzed between the two groups.
Results: Prior to hand disinfection, the hand sampling region resulted in 72 colony forming units for the 74 nurses. Following disinfection, only 2 colony forming units ($p < 0.001$) were found. The analysis of drying time effects on the disinfection rate between the two groups showed a significant difference ($p = 0.049$).
Conclusion: In an effort to reduce the incidence of nosocomial infection, the medical personnel should sufficiently dry hands following handrubbing with disinfectant in a strict accordance with the six part washing technique for antiseptic handrubbing.

1. Introduction

Approximately 20%–40% of nosocomial infections are caused by cross-transmission via the hands of medical workers, which affect the quality of health care and patients’ safety [1]. According to advanced research, hand hygiene is the most effective and convenient precaution against nosocomial infections. In most cases work overload leads to a reduction in time available for proper hand hygiene compliance [2]. The clinical antiseptic handrubbing method is easier and faster than hand washing alone. The World Health Organization, along with the Centers for Disease Control and Prevention (Atlanta, GA, USA), suggested antiseptic handrubbing as an appropriate method for hand hygiene. However, the appropriate dosage of the alcohol-based hand rub was not determined [3,4]. In this study we attempted to determine the most efficient antiseptic...
handrubbing method in an effort to promote hand hygiene compliance among nurses without affecting work efficiency.

2. Methods

2.1. Materials and participants

The most commonly used hand disinfectant in Chinese hospitals is Jifro hand antiseptic rinse free gel (Shanghai Likang Disinfectant Hi-Tech Co, Shanghai, China) with a one-press dosage of 1.8 mL, and a two-press dosage of 3.6 mL. Seventy-four clinical nurses were randomly separated into two groups based on the press dosage of Jifro used for hand disinfection with group one disinfecting hands with 1.8 mL of Jifro, and group two using 3.6 mL of disinfectant.

2.2. Data collection

All of the nurses involved in the study followed the guidelines for antiseptic handrubbing, which was published in the "Standard for hand hygiene for healthcare workers in healthcare settings” until their hands were completely dry [5]. Both the dry time and skin acceptability were observed and recorded. The bacterial samples from nurses’ hands were obtained prior to and following disinfectant treatment using the imprinted experimental method. The imprints were then incubated at 36 °C on agar plates. Following the 24 h incubation, colony forming units (CFU) were counted on each plate. Nurses were not allowed to touch other surfaces following antiseptic handrubbing in an effort to ensure accurate results.

2.3. Statistical analysis

Sterilization rate, dry time and hand acceptability were compared and analyzed between the two groups using the statistical software SPSS 16.0 (SPPS Inc., Chicago, IL, USA).

3. Results

The median of CFU for 74 nurses prior to antiseptic handrubbing was 72. Following antiseptic handrubbing, the average number of CFU for 74 nurses was 2. The Wilcoxon test analysis of the CFUs from the hands sampling region before and after antiseptic handrubbing resulted in a Z = –5.087 with a p < 0.001, indicating a statistically significant in recovered CFUs (Table 1).

Our data did not identify a statistical difference in CFUs between the two groups prior to the antiseptic handrubbing. The difference in both the sterilization rate and dry time between groups 1 and 2 was statistically significant (Table 2).

4. Discussion

4.1. Antiseptic handrubbing can efficiently reduce the CFU on nurses’ hand

The CFU results for the 74 nurses prior to antiseptic handrubbing (72) strongly suggest nurses’ hands are a critical vehicle for potential pathogens. Therefore, strict hand hygiene is of utmost importance for the prevention and control of nosocomial infections. However, studies have previously shown a lack of compliance by nurses in following good hand hygiene practices. Such is the case of medical staff in the United States where out of 270 medical staff investigated, only 63.3% complied with good hand washing methods [6]. The on-site observations of nurses conducted in different departments and at different positions in eight hospitals in Beijing, Shanghai, and Guangzhou, China, showed that hand hygiene rate after contact with a patient was only 53.8% [7]. A considerable number of nursing staff did not wash their hands or washed their hands infrequently [8]. Analysis of the possible explanations for the lack of compliance among nursing staff identified several culprits, and includes the following: large workload due to too many critically ill patients; ignorance of the good hand hygiene practices due to lack of knowledge; insufficient equipment cleanliness and skin irritation and damage due to frequent usage of disinfectant. Therefore, in an effort to promote good hand hygiene practices among nursing staff, an increase in awareness and compliance must be increased by regular trainings, continuous education and frequent monitoring of staff habits [9].

The standard of hand hygiene for healthcare workers requires that the total number of CFUs on medical workers’ hands should be <10 CFU/cm² [5]. The results of this study on 74 subjects showed 2 CFU on the hands of the nurses following disinfection. These results strongly suggest that Jifro, a commonly used disinfectant in healthcare, is highly efficient. Jifro is a non-ionic broad-spectrum fungicide. Its advantages are that it does not require hand washing, it contains vitamin B5, silicone oil and hyaluronic acid, and it has a moisture curing effect on

| Table 1 – CFU before and after antiseptic handrubbing. |
|-----------------|-----------------|-----------------|-----------------|
| Item            | CFU before antiseptic handrubbing (median) | CFU after antiseptic handrubbing (median) | Z        | p      |
| Group 1 (1 press) | 73              | 2               | –5.121          | <0.001 |
| Group 2 (2 presses) | 66              | 2               | –4.901          | <0.001 |
| Total           | 72              | 2               | –5.087          | <0.001 |

* CFU = colony forming unit.

| Table 2 – Sterilization rate and dry time comparison between two groups. |
|-----------------|-----------------|-----------------|-----------------|
| Item            | Sterilization rate, % | Dry time, sec* |
| Group 1 (1 press) | 92.2 ± 10.8     | 44.1 ± 12.4     |
| Group 2 (2 presses) | 96.1 ± 5.6     | 75.3 ± 20.6     |
| t                | –2.00           | –7.94           |
| p                | 0.049           | <0.001          |

* sec = seconds.
the skin. This is particularly important for the medical personnel, who are required to frequently wash their hands. Research has shown that quick drying hand disinfectant can improve the compliance of hand hygiene among medical staff, thereby reducing the rate of hospital acquired infections [10].

4.2. Antiseptic handrubbing with two-press (3.6 mL) disinfectant dosage is suggested

The World Health Organization and Centers for Disease Control and Prevention did not suggest the most effective hand disinfectant dosage for antiseptic handrubbing [4]. Research has shown that both quick hand disinfection and hand washing have the same desired effect; however, due to time constraints and workload, quick hand disinfection may be a preferred method [11]. The results of this study show that at a 1.8 mL dosage, the drying time was (44.1 ± 12.4) s with a sterilization rate of (92.2 ± 10.8)%. The double dosage of Jifro (3.6 mL) increased drying time to (75.3 ± 20.6) s, and sterilization rate to (96.1 ± 5.6)%. The difference in drying time and sterilization rate between the two dosage treatments was significant (Table 1). In an effort to save time, medical staff preferred the lower dose and shorter drying time, although the sterilization rate was significantly reduced compared to a double press.

In order to reduce the incidence of nosocomial infections, hospitals should maximize disinfection by utilizing the sufficient dry hand disinfectant dosage, while strictly following the six step hand washing method described in the "Standard for hand hygiene for healthcare workers in healthcare settings". The six step hand washing method requires one to use a mechanical kneading action of hands, palm, fingers and joints to completely clear temporary bacteria. It is the responsibility of hospital managers to follow the principles of continuous quality improvement, adhere to strict hygienic hand disinfection and mandate the appropriate dry hand disinfectant dosage. Regular monitoring of hand hygiene among medical staff to increase hand washing awareness and compliance could lead to a reduction in the incidence of nosocomial infections.

Conflicts of interest statement

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REFERENCES