

■Article-analysis

Effectiveness and Problem of alcohol-based hand rub on hand hygiene

Jiro Tukuda*, Hiroyoshi Kobayashi*

Introduction

Hand hygiene is the most effective precaution for the prevention of healthcare associated infection. However, the compliance of hand hygiene by healthcare workers is still insufficient. The hand hygiene guideline of Centers for Disease Control and Prevention (CDC), United States by the Healthcare Infection Control Practices Advisory Committee (HIPAC) was published on October 25, 2002. CDC recommended that alcoholic hand rub be the primary choice for hand hygiene in clinical settings instead of hand washing with soap and tap water in order to improve the compliance of hand hygiene and to decrease skin damage¹⁾. Alcoholic hand rub has become widespread all over the world since then. However the compliance, the educational intervention, suitability and others for hand rubbing still exist. This study aims to investigate the published papers on the efficacy and problem of alcoholic handrubbing.

1. Suitability and acceptability

In a study on the efficacy and suitability of alcohol-based hand gel for surgical hand disinfection, it was evaluated that the gel type preparation was more suitable for surgical hand hygiene rather than liquid antiseptic agent, because the former showed better skin feeling after use, good smell and easier donning of the surgical gloves²⁾. Also, in a study on the healthcare worker's acceptability, it was reported that most users

assessed that the hand gel to be better than liquid preparation used up to now³⁾. In other studies, introduction of an alcohol-based hand gel improved the compliance of hand hygiene because the hands dry quickly without wiping comparing to the handwash with soap and water^{4,5,6)}. Additionally, the gel preparation has less probability of spilling onto the floor than the liquid preparation.

On the other hand, in a study on the comparison of alcohol hand gel and liquid formulation, it was reported that the degree of stimulation and the dryness of the skin was according to the difference of the antiseptic agent, and that there was some liquid preparation evaluated to be better than the gel⁷⁾. Additionally, the hand damage has to be considered with various factors like the season, the individual differences, and kinds of antiseptic agents used. These factors for skin damages seem to be the causes of lowering the compliance of hand hygiene in clinical settings. Therefore, the hand hygiene preparation less damage to skin is required strongly.

Generally, alcohol-based hand gels do not alter the transepidermal water loss (TEWL) and cause slight irritation. Additionally, it was reported that gel product with glycerin content hydrated the skin. Higher ethanol concentrations resulted in increased scaliness, and influence for skin revealed more with isopropanol. Finally, this study concluded that hand gel containing an elevated glycerine concentration and 70vol % ethanol was preferred⁸⁾.

As problems of the alcohol-based hand rub with the water-soluble high molecular compound such as carboxyvinyl polymer, it has pointed out that there left

* Division of Infection Prevention and Control, Tokyo Healthcare University of Postgraduate School, Tokyo, Japan.

grime-like film of the polymer extraction on the skin after use and feeling uncomfortable⁹⁾. To prevent the grime-like film on the skin, the quick drying of the gel preparation is necessary with compatibility of carboxyvinyl polymer, cellulose compound and other antiseptic agent with alcohol-based antiseptic. In the case of this gel antiseptic, there was the case that produced slime and stickiness by the water. When gel preparation is used before the wearing gloves for surgical operations, stickiness or the slime production in gloves have been pointed out. The slime in surgical gloves disturbs the fine surgical procedure which is said to be one of the reasons why surgeon does not use gel type hand antiseptics. In addition, when gloves are exchanged during surgery, the gloves exchange is not smoothly done.

2. Antimicrobial efficacy in health care settings

Some studies indicated that the introduction of an alcoholic hand gel decreased infection rates. In a study on evaluation of infection rates, since the alcohol gel hand sanitizer was employed 10-month ago, 36.1% of infection rates decrease was revealed¹⁰⁾. Furthermore, in another study on comparison of the infection rates, 30.4% decrease in infection rates for the 34-month period in the same units was demonstrated¹¹⁾. Additionally, it is also reported that the introduction of the hand gel and feedback the compliance of hand hygiene resulted in decreasing a number of patients newly affected by methicillin-resistant *Staphylococcus aureus* (MRSA). These studies indicated that use of an alcohol gel could decrease infection rates and provide an additional tool for an effective infection control program in clinical settings.

In a study on acquiring MRSA, vancomycin-resistant *Enterococcus* (VRE), *Clostridium difficile* in six years, 21% decrease of nosocomially acquired MRSA and 41% decrease of VRE were revealed, but the incidence of nosocomial acquisition of *C. difficile* was unchanged¹³⁾.

The alcoholic handrub recommended by the guideline in 2002 is effective for the improvement of the compliance of hand hygiene and reduction of the nosocomial MRSA prevalence rate. However, in the case of *C. difficile* and

norovirus, the healthcare worker need to wash with antimicrobial soap and water because alcohol is not sufficiently effective for them. The selection of antiseptics on the hand hygiene is necessary for special microorganisms.

3. Analysis of cost performance

In a study on comparison of the efficacy of surgical hand rubbing with surgical hand scrubbing, and to determine the costs of both techniques for surgical hand antiseptics, it was reported that the hand rubbing had immediate efficacy that was similar to that of the hand scrubbing, but the hand rubbing had a more lasting effect and reduced costs by 67%, and concluded that the hand rubbing was a cost-effective alternative to the hand scrubbing¹⁴⁾. In a previous study on comparison of the costs of the two techniques, the report has shown that a relative cost of 203 Euros per week in the method of hand scrubbing and 25 Euros in the hand rubbing¹⁵⁾. Additionally, other report has shown that it was necessary to set up a new paradigm for hand hygiene in the dental setting because alcoholic handrub protocol was less costly and less time consuming compared to traditional hand washing¹⁶⁾. Though it was an indirect result, a report has evaluated that hand rubbing method resulted in reduction of nosocomial MRSA infection rates and antibiotic use and subsidiary led to reduce a medical cost¹²⁾. It is considered that alcoholic hand rub contributes not only remarkable improvement of compliance but also economical benefit.

4. Verification in side effects

In a study on investigation of cutaneous adverse reactions (CARs) to alcoholic handrub, it was reported that CARs were infrequent among exposed healthcare worker and were not influenced by the duration or intensity of alcohol-based handrub use, but cases associated with the presence of irritant contact dermatitis were also reported¹⁷⁾. This report concluded that it was important for healthcare workers to be educated enough about the recognition and management of irritant contact dermatitis¹⁷⁾. Also in this

report, a remarkable side effect with alcoholic hand rub was not caused frequently, but the accumulated longtime skin disorder was reported. Particularly, it is considered that the nurse with water and soap washing and occlusive exposure by using gloves for a long term causes frequently irritant contact dermatitis. If the nurses will use alcohol-based hand rub, such dermatitis will become seldom because of the emollient in alcoholic hand rub.

In other studies, the prevention of occupational skin damages in two additional measures for reducing exposure to skin irritants has been postulated.

- 1) Use of alcoholic hand rub instead of soap and water in hand hygiene when the hands are not visibly dirty.
- 2) Use of gloves in wet activities such as patient washing to prevent the hands from becoming wet and visibly dirty.

In addition, the study investigated the change in transepidermal water loss (TEWL) on the back of the hands was measured after 3 weeks of exposure to those wet-work simulations. Consequently, the study reported that skin disorder was effectively prevented by using alcoholic hand rub in hand hygiene when the hands were not visibly dirty and when gloves are used for wet activities and reduction of the opportunity to exposure to skin irritants among nurses¹⁸). According to this study, hand hygiene with conventional antimicrobial soap and water causes more frequent. Therefore, it is considered that the hand hygiene with alcoholic hand rub have to control the skin damages.

5. Intervention for the higher compliance

Although hand hygiene is one of the most efficient preventive measures, compliance with this single action remains low. The alcoholic hand rub must be introduced more widely to obtain more effective infection control measure. In a study on the investigation of overall compliance with hand hygiene practices among nurses, physicians, nursing assistants, and other health care workers, it was demonstrated that the easy access to hand rub improved the compliance (35.3% versus 50.6%,) and that the gel antiseptic introduction resulted in the

significantly higher compliance than the liquid formulation based on self-assessment, observer assessment, and the measurement of epidermal water content¹⁹). Finally, the study concluded that facilitated access to an alcoholic hand gel led to improve the compliance of hand hygiene and better skin condition among healthcare workers. Alcoholic hand rub was the strongest predictor of compliance, and the hand gel was acceptable very friendly in medical facilities where many urgent health cares exist¹⁹).

In a study on assessment in the effect of an intervention consisted of a hospital promotional campaign, including observation and performance feedback, posters display, and distribution of individual bottles of alcohol-based hand rub in intensive care units, it was reported that overall compliance increased from 38.4% to 54.5% and hand rubbing method increased from 5.4% at baseline to 21.7%²⁰). In this study, hand washing compliance decreased, on average, by 4.7% for an increase of 10 opportunities for hand hygiene per hour of patient care, whereas no such association existed for hand rubbing. Therefore, the study concluded that the intervention induced a marked and sustained increase in compliance with hand hygiene, less time-consuming hand rubbing might replace standard hand washing and overcome the barrier of the time constraints²⁰). Being interested in this report, the compliance was remarkably decreased in a past hand scrubbing method though increasing the frequency of healthcare worker practice one hour around was seen. On the other hand, the compliance of hand hygiene with alcoholic hand rub wasn't completely changed. It is considered that hand hygiene with an effective and prompt alcoholic hand rub is the best method because an intense duty is digested.

In a study of a self-report questionnaire to measure beliefs and perceptions among 163 physicians on investigation of individual observation of their hand hygiene practices during routine patient care, it has reported that the compliance averaged 57% and varied markedly across medical specialties. In addition, a multivariate analysis, it has reported that the compliance was obviously associated with the awareness of being observed²¹). On the other hand, it reported that exhaustive workload, activities

associated with a high risk for cross-transmission, and certain technical medical specialties (surgery, anesthesiology, emergency medicine, and intensive care unit) were risk factors for low compliance. In addition, the study has indicated that physician's compliance to hand hygiene was associated with work and system constraints, as well as knowledge and cognitive factors, and at the individual level, strengthening a positive attitude toward hand hygiene and reinforcing the conviction that each individual could influence the group behavior might improve compliance among physicians. At the same time, physicians who work in technical specialties should also be targeted for the improvement²¹⁾. It is notable that the compliance of hand hygiene improved by being observed. Additionally, it is a very interesting phenomenon that recognition in the action of the group as the standard also improves compliance. Analyzing it from psychological aspect gives a fresh impression, as a result, the importance researched from various aspects can be recognized again. However, in a study on comparison of actual behaviors with self-report, as well as intentions and attitudes towards hand hygiene by using the questionnaires that the participant filled in 1,284 times at the opportunities of the hand hygiene, it has reported that observed practice showed very poor rates of adherence to guidelines and indicated that staff failed to take account of risk, even with patients colonized with meticillin-resistant *Staphylococcus aureus*. Furthermore, it was reported that observed practice was unrelated to intentions in healthcare and self-reported behavior. Consequently, this study concluded that hand hygiene interventions to target changes in attitudes, intentions or self-reported practice were likely to fail in terms of changing behavior, and consideration was given to how this could be remedied²²⁾. Therefore, it is considered that the intervention to the hand hygiene to correct the action on which it self-reports doesn't necessarily immediately demonstrate a high effect, and lead to the improvement of compliance by executing the intervention of the hand hygiene for the long term.

In the prospective study analyzed from a different aspect of preference of parental and healthcare worker for hand hygiene practices of emergency physicians, the study

reported that families and healthcare worker obviously preferred use of the hand rub to the antimicrobial soap for hand hygiene; additionally, both groups preferred hand hygiene before and after the examination and wanted to observe the physician perform this procedure. Therefore, this study concludes that families and healthcare worker preferences for hand hygiene were not in keeping with recommendations published by the CDC and educational interventions were needed to disseminate the CDC's guidelines and to promote compliance with evidence-based recommendations for hand hygiene²³⁾. The hand rubbing method with the alcoholic hand rub is becoming a major method in the hand hygiene now. However, the rubbing method has not been known very much for the non-healthcare worker who included a general patient under the present conditions. Furthermore, a negative possibility is guessed to be high to non-healthcare workers who observed the rubbing method with healthcare worker made of the hand rub on an actual medical treatment site for the first time. As for the rubbing method, not only healthcare worker but also general people are expected to lead to a wide spread of hand rubbing method by positively advertising the concept and the effect.

6. Strategy for hand hygiene

Health care workers have a higher tendency of skin irritation than seen in the general population because of the necessity for the frequent hand hygiene during patient care. Therefore, there is a risk of causing the patient infection due to small abscess on the skin. Therefore, it is important to select a type of hand hygiene with less irritating antiseptic agent, with effective skin moisturizers, and to avoid unnecessary hand washing

In a study on investigation of knowledge of infection control policy and procedures at the University of Birmingham Medical School, it has shown that 58% of the students did not know the correct indications for using alcoholic hand gel, 35% did not know the correct use of gloves, and 50% did not the exclusion period after an episode of diarrhea and vomiting²⁴⁾. Furthermore, the study has demonstrated that 64% of the students were educated

formal curriculum on hand hygiene, 12% informal, 19% both types and 5% not entirely at all²⁴). Interestingly, the study showed that 49% of the students thought the education of infection control insufficiently educated in their curriculum. These results indicate the lack of the fundamental knowledge of medical student for the infection control. Universities are currently reviewing the need for a more structured model for the teaching and assessment of infection control. The report has shown that the compliance of doctor's hand hygiene was poor among the healthcare workers; herefore, the education of hand hygiene for the medical students is very important. In addition, the study has shown a shortage of the infection control education for the medical student definitely.

In a previous study, it has shown that healthcare workers are overestimated on their knowledge and skills, and that compliance of hand hygiene was influenced by risk perception²⁶). Also, the report indicated that healthcare workers encountered the problems with comprehension, acceptability and applicability of protocols, especially post-exposure precautions. Recently, there is still lack of hand hygiene support system to improve compliance for most health care workers in medical facilities. Therefore, this study suggests that it is important to consider informing and training on risk management and individual responsibilities regarding the safety of coworkers and patients, participation of healthcare workers in protocol development, and support of management to avoid reversion to previous habitual behaviors.

It is essential for healthcare worker to improve hand hygiene with the introduction of alcoholic handrub. Therefore, the execution of the training and development concerning the approach to the infection control measures including hand hygiene technology and the antiseptic method is necessary for healthcare workers with the cooperation such as well informed specialists in hand hygiene and reliable antiseptic manufacturers. In conclusion, it is important to consider various tie-ups including the technical guidance between each medical facility and further development in the infection control strategies.

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