

Discussion and study of surgical hand disinfection timeliness and hand colony rule in medical personnel

Song YUAN, Xincheng MA*

*The Seventh Affiliated Hospital, Sun Yat-sen University, Shenzhen, China *the corresponding author,*

Email: maxincheng@sysush.com <https://orcid.org/0000-0001-6082-9898>

Abstract

Objective: To monitor and evaluate the timeliness of surgical hand disinfection and the regularity of hand colonies. **Method:** A total of 74 surgical medical workers were randomly selected to monitor and evaluate the effect of hand disinfection at 1 hour, 2 hours, 4 hours, and 6 hours after surgical hand disinfection. The occurrence of bacterial colonies at different times and the patterns between the left and right hands were observed and compared. **Results:** Significant differences were found in the occurrence of bacterial colonies at 1 hour, 2 hours, 4 hours, and 6 hours after surgical hand disinfection ($F=3.542$, $p=0.015$). Additionally, there were significant differences in the occurrence of colonies between the left and right hands ($p < 0.05$).

Keywords surgical hand disinfection; monitoring; bacterial colonies

1 Introduction

With the continuous development of the medical industry, more and more attention has been paid to infection control management. The hospital has popularized infection control work to all levels, including hospital cleaning staff, patients, escorts, and security personnel. Surgical site infection (SSI) is a top priority for hospitals. In recent years, with the development of aseptic technology and the standard use of antimicrobial drugs, the incidence of SSI has decreased. However, the control of SSI is still challenging due to factors such as variations in infectious sources, bacterial resistance, and the increased complexity of surgeries. Proper surgical hand disinfection is an effective measure to prevent surgical site infections.

In order to further improve the quality of surgical hand disinfection, this study discusses the timeliness of surgical hand disinfection by medical staff and the pattern of hand colony counts.

Under the guidance of our infection management department, the operating room staff established a surgical hand disinfection monitoring team. The effect of surgical hand disinfection was monitored, and the findings are reported as follows.

2 Materials and Methods

From May 2019 to March 2021, 74 surgical medical staff (43 doctors and 31 nurses) were randomly selected as the study subjects. Operators included 34 males and 9 females, aged 28–59 years, with an average age of 39.0 years. They were from various departments: digestive surgery, thoracic surgery, urology, neurosurgery, general surgery, obstetrics, gynecology, orthopedics, and otolaryngology. Operating room nurses included 14 males and 17 females, aged 23–35 years, with an average age of 27.5 years, all holding a bachelor's degree. All personnel used the same hand sanitizer and brand of sterile surgical gloves.

Under the guidance of the hospital infection management department, the surgical hand disinfection monitoring team, composed of operating room personnel, was responsible for the specific work. Before implementation, the hospital infection management department trained the team members and prepared the Dynamic Monitoring Record Form of Hand Hygiene Disinfection Effect (hereinafter referred to as the record form). Unified training was provided on filling out the record form and performing data statistical analysis.

During the study phase, the team members sampled and monitored the number of hand colonies recorded by the surgeon and the device nurse after surgical hand disinfection once a week. The number of monitoring times depended on the length of the operation. The surgeon, the first assistant doctor, and the instrument nurse were selected as the hand hygiene monitoring subjects, with samples collected from both the left and right hands. Basic data of the monitoring subjects, including left and right hands and specific sampling times, were recorded on the record form.

2.1 Sampling Period and Monitoring Method

Hand hygiene monitoring was divided into two periods:

Post-surgical Hand Disinfection: The surgeon performs surgical hand disinfection and enters the operating room for normal operation.

Postoperative: After the operation, the subject removes the sterile surgical gloves for sampling. The sampling times were divided into 1 hour, 2 hours, 4 hours, and 6 hours post-surgical hand disinfection, with any sampling time less than 1 hour considered as 1 hour.

For detection and sampling methods, refer to the standard set in Appendix B of the Hand Hygiene Code for Medical Personnel, with improvements to the collection site. The collection process was as follows: using a cotton swab soaked with the corresponding neutralization agent, the five fingers were wiped on one hand surface, covering an area of about 30 cm². The cotton swab was rotated during the wiping process, then the part of the cotton swab touching the operator was cut and placed into a 10 ml sterile detergent test tube with the corresponding neu-

tralizing agent. The same method was used for the other hand. Samples were timely submitted for inspection, culture, and result recording. If subjects monitored hand colonies after surgical hand disinfection, they were not included in the study subjects.

3 Statistical Analysis

Using SPSS 20.0 software for data analysis, the mean \pm standard deviation was used for measurement data, the number of cases or percentage was used for count data, and the χ^2 test was used for significance testing.

Colonies were monitored at different times after surgical hand disinfection. All samples at different times showed significant differences ($F=3.542$, $p=0.015$). With the extension of operation time, the emergence of hand colonies showed an increasing trend, especially the increase of bacterial colonies monitored 6 hours after surgical hand disinfection. The proportion of bacterial colonies reached 9.09%, indicating that the growth of hand colonies accelerated from 4 hours after surgical hand disinfection. See Table 1.

Table 1 Comparison of colony results in different periods after surgical hand disinfection

<i>Results of ANOVA</i>						
Monitoring time	sample capacity	The number of colonies	average value	standard deviation	<i>F</i>	<i>p</i>
For 1 hour after disinfection of the surgical hands	146	3	1.02	0.14	3.542	0.015
For 2 hours after disinfection of the surgical hands	94	4	1.04	0.2		
For 4 hour after disinfection of the surgical hands	66	3	1.05	0.21		
For 6 hour after disinfection of the surgical hands	44	6	1.14	0.32		
grand total	350		1.05	0.21		

<i>Results of the t-test analysis</i>									
region	Number of hand samples	The number of colony cases	average value	standard deviation	Mean difference	Difference value of 95% CI	<i>t</i>	<i>df</i>	<i>p</i>
Left hand	175	4	1.02	0.15					
Right hand	175	12	1.07	0.25	-0.05	-0.090 ~ -0.002	-2.054	282.433	0.041
grand total	350	16	1.05	0.21					

Colonies occurred in the left and right hands after surgical hand disinfection. The left and right hands showed significant differences in colony occurrence ($t=-2.054$, $p=0.041$). Specifically, the mean number of colonies on the left hand (1.0 ± 1.02) was significantly lower than the mean number of colonies on the right hand (2.0 ± 1.07). In summary, there were significant differences between the left and right hand samples in terms of colony occurrence.

Results

The occurrence of surgical site infection (SSI) is multifactorial. According to the relevant literature [5], the occurrence of SSI in China may be closely related to inadequate disinfection of the surgical environment and poor hand hygiene. Currently, the hospital infection control department strictly manages sterile items, ensuring they are used within specific time frames after opening. For example, sterile plates are effective within 4 hours of opening, sterile solvents within 24 hours, and disinfectants within 7 or 30 days. However, there is still a lack of relevant data and theoretical support for the timeliness of surgical hand disinfection, whether to resume surgical hand disinfection, and how to prevent the growth of hand colonies. In hospitals, the hands of medical staff are a primary source of hospital infections. Surgical personnel can lead to the spread of pathogenic bacteria and SSIs. Further standardization of surgical hand disinfection can effectively block the transmission of diseases and reduce the incidence of SSIs [3].

The multi-period monitoring and analysis of surgical hand disinfection by medical personnel align with the WHO's hand hygiene multimodal promotion strategy launched in 2019 [6], which has achieved good results. Data show that after surgical hand disinfection, hand colonies increased with operation time. At 1 hour, 2 hours, and 4 hours after surgical hand disinfection, the number of hand colonies increased significantly. After 4 hours, hand colonies began to grow rapidly, and hand sanitizer was no longer effective in inhibiting their growth. Relevant measures are needed to reduce or prevent the emergence of surgical colonies. Therefore, it is recommended that within 4 hours after performing surgical hand disinfection, medical personnel should resume surgical hand disinfection or apply hand sanitizer to prevent SSIs due to the presence of hand microorganisms.

According to the monitoring data, after surgical hand disinfection, the number of bacterial colonies on the right hand was significantly higher than on the left hand, likely due to operational reasons. As the dominant hand, the right hand experiences higher labor intensity than the left hand, leading to an increase in bacterial colonies. Therefore, it is recommended to strengthen the disinfection of the right hand during surgical hand disinfection to reduce SSIs and improve surgical safety. In conclusion, after surgical hand disinfection, the number of hand colonies increased with operation time, and the findings of this study warrant further investigation.

Article History

Received: March 26, 2024 **Accepted:** March 29, 2024 **Published:** June 30, 2024.

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To Cite This Article Song YUAN,et al. (2024). Discussion and study of surgical hand disinfection timeliness and hand colony rule in medical personnel. *Medical Research*, 6(2), 49-53. <https://doi.org/10.6913/mrhk.060205>

Medical Research, ISSN 2664-0333 (print), ISSN 2664-0341 (online), DOI 10.6913/mrhk, a bimonthly, founded on 2018, Indexed by CNKI, Google Scholar, AIRITI, Scilit, CrossRef, Elsevier PlumX, etc., published by Creative Publishing Co., Limited. Email: wtocom@gmail.com, <https://mrhk.cc>, <https://cpcl.hk>.