

Factors Affecting Implementation and Pass Rates of Moistening Surgical Instruments

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Research Article

Keywords: Central sterile supply department, surgical instruments, moistening

Posted Date: January 15th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-144437/v1>

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Version of Record: A version of this preprint was published at BMC Infectious Diseases on August 4th, 2021. See the published version at <https://doi.org/10.1186/s12879-021-06471-3>.

Abstract

Background: Under influences of count, handover, transport and other procedures, surgical instruments might not be cleaned immediately after use, and they were not kept moist before cleaning, which allowed contaminants to dry on the instruments and become difficult to remove. Therefore, surgical instruments should be kept moist immediately after use. However, implementation and pass rates of moistening surgical instruments have been rarely studied. We aimed to investigate the factors affecting implementation and pass rates of moistening surgical instruments.

Methods: We carried out on-site investigations for keeping surgical instruments moist at the 22 clinical departments using reusable surgical instruments in August 2019 in the West China Second University Hospital, Sichuan University. During the investigations, the survey utilising an interviewer-administrated questionnaire was conducted among nurses and workers from the 22 clinical departments. Data about implementation and pass rates of moistening surgical instruments was analysed in SPSS20.0.

Results: Implementation and pass rates of moistening surgical instruments were 57.49% and 31.98%, respectively. Factor analysis showed that implementation rates of moistening were affected by instrument structure ($\chi^2 = 143.670$; $P = 0.001$), the number of instruments inside the pack ($\chi^2 = 140.135$; $P = 0.001$), and the person responsible for keeping surgical instruments moist ($\chi^2 = 8.052$; $P = 0.005$). Correlation analysis showed that instrument structure and the number of instruments inside the pack were negatively correlated with implementation rates of moistening. The more complex the structure and the greater the number of the instruments inside the pack, the lower implementation rates of moistening surgical instruments.

Conclusion: Implementation and pass rates of moistening surgical instruments were low, which meant that moistening failed to meet the applicable industrial standard for central sterile supply department and there was a potential risk of hospital-acquired infection. It was necessary to provide more training about keeping surgical instruments moist for nurses and workers of the clinical departments, and regulate the procedure of keeping surgical instruments moist.

Background

Thorough cleaning of surgical instruments is the key to success of disinfection and sterilization [1]. However, under the centralized management of the central sterile supply department, and due to the influences of count, handover, transport and other procedures, surgical instruments might not be cleaned immediately after use, and they were not kept moist before cleaning, which allowed contaminants to dry on the instruments and become difficult to remove. According to the Central sterile supply department (CSSD) - Part 2: Standard for operating procedure of cleaning, disinfection and sterilization (WS 310.2–2016) issued by the Ministry of Health of the People's Republic of China [2], the user shall timely remove visible contaminants from diagnostic and treatment instruments, apparatus and articles after use, and moisten them according to actual situations. To improve effect of moistening and provide references for

improving criteria for keeping surgical instruments moist, we investigated the factors affecting implementation and pass rates of moistening surgical instruments.

Methods

Study object

The survey about keeping surgical instruments moist was conducted on a total of 45,717 instruments from 22 clinical departments in August 2019 in the West China Second University Hospital, Sichuan University.

Survey tools

According to the Central sterile supply department (CSSD) - Part 2: Standard for operating procedure of cleaning, disinfection and sterilization (WS 310.2-2016), we designed an interviewer-administrated questionnaire for the survey about keeping surgical instruments moist. The questionnaire was used to gather information about description of surgical pack, the number of instruments inside the pack, end date and end time of surgery, time of moistening, whether instruments were kept moist in the department or not, place of moistening, the person responsible for keeping instruments moist, method of keeping instruments moist, effects of moistening of different instruments, reasons why moistening failed, reasons why instruments were not kept moist, etc.

The questionnaires were filled in by us, the CSSD staff members who had received the training about how to fill in questionnaires and how to carry out on-site investigations for keeping surgical instruments moist. We went to the 22 clinical departments to investigate whether surgical instruments were kept moist after use, type of moistening agent, place and time of moistening, method of keeping instruments moist, and effects of moistening of different instruments. We asked the nurses and workers why moistening failed, and why the instruments were not kept moist. We divided the reusable surgical instruments into three categories, namely common instruments, instruments with articulation joints or grooves, and cannulated instruments. We recorded information about effects of moistening of instruments in different surgical packs, and calculated pass rates of moistening for the three categories of instruments and those for surgical packs with the different number of instruments inside. We also recorded information about effects of moistening handled by different persons (nurses or workers). Moistening was determined pass when Conbizyme moisturizing gel was sprayed on the instruments immediately after use, the surface, articulation joints and grooves of the instruments were fully and evenly covered with moisturizing gel and were kept moist till delivery to CSSD for subsequent processing. When we had a doubt or question about something at the scene, we took photos or recorded videos about it for determination by the research team through further analysis and discussion.

All methods were carried out in accordance with the relevant guidelines and regulations. This study was conducted in accordance with the Declaration of Helsinki, and was approved by the Medical Ethics Committee of West China Second University Hospital, Sichuan University (No.: YXKY2020LSP(171)).

Informed consent to participate in this study was obtained from all nurses and workers who participated in this study. When we carried out the on-site investigations, we presented our employee's identity cards to nurses and workers of the 22 clinical departments, orally explained the purpose and significance of this study to them, and told them that they had the right to withdraw their consents and the right to refuse to answer any of our questions. Then, we asked them whether they consented to participate in this study or not. After obtaining their verbal consent to participate in this study, we started to orally present the questionnaire items, and then we recorded their responses to the questionnaire items. The whole interview process, including our oral presentation and obtaining participants' verbal consents, was witnessed by the head nurse of their respective department. The Medical Ethics Committee of West China Second University Hospital, Sichuan University reviewed and approved the research proposal and procedure of verbal consent of this study, and felt that we did not need to obtain written consent from the participants.

Statistical methods

We used Excel 2007 for data entry, and analysed data in SPSS20.0. The enumeration data was expressed as percentage, frequency and relative frequency. Comparison was conducted with chi-square test and rank sum test, and the correlation between variables was described with rank correlation. There was a statistically significant difference ($P < 0.05$).

Results

Implementation of moistening surgical instruments

Nurses and workers of only 3 of the 22 clinical departments moistened surgical instruments. A total of 45,717 reusable surgical instruments from the 22 clinical departments were investigated, among which 26,172 instruments were kept moist, with the implementation rate of 57.24%, and 8,369 instruments were moistened in compliance with the relevant standard, with the pass rate of 31.98%. The implementation and pass rates of moistening surgical instruments were low, as shown in Table 1.

Table 1
Implementation of keeping surgical instruments moist

Departments	Sample quantity	Quantity of instruments kept moist	Quantity of instruments moistened in compliance with relevant standard	Implementation rate of moistening	Pass rate of moistening
Inpatient operating rooms	27105	21506	6139	79.34%	28.55%
Delivery rooms	12611	0	-	0%	
Outpatient operating rooms	4097	4097	2152	100%	52.53%
In vitro fertilisation	818	0	-	0%	
Pediatric Cardiology	328	0	-	0%	
Radiology	569	569	78	100%	13.71%
Other clinical departments	189	0	-	0%	
Total	45717	26172		57.24%	

Reasons why surgical instruments were not kept moist

Pareto diagram was utilised to analyse the reasons why surgical instruments were not kept moist. Analysis showed that the main reasons included “do not know instruments shall be kept moist immediately after use”, “do not know the method of keeping instruments moist”, and “do not know the importance of keeping instruments moist”, as shown in Fig. 1.

Reasons why moistening failed

Pareto diagram was utilised to analyse the reasons why moistening failed. Analysis showed that improper time for moistening and no standard operating procedure for keeping instruments moist were the main reasons why moistening failed, as shown in Fig. 2.

Time of moistening (interval between end of using instrument and start of moistening)

Among the 3 clinical departments which moistened instruments, the interval between end of using instrument and start of moistening in the outpatient operating rooms lasted 4.04 minutes on mean, that

of the inpatient operating rooms lasted 4.88 minutes on mean, and that of radiology department lasted 172.5 minutes on mean.

Spraying method

Random spray covered 83.56%, evenly spray covered 12.33%, and targeted spray covered 4.11%.

Factors affecting keeping surgical instruments moist

Pass rates of moistening were calculated for instruments with different structures, surgical packs with the different number of instruments inside, and instruments moistened by different staff members. Single factor analysis was conducted by chi-square test. Analysis showed that instrument structure, the number of instruments inside the pack, and the person responsible for keeping instruments moist affected the pass rates of moistening, as shown in Table 2.

Table 2
Single factor analysis on factors affecting keeping surgical instruments moist

Item	Fail rate (%)	Pass rate (%)	χ^2	P value
Instrument structure			143.670	0.001
Common instruments	22.35	77.65		
Instruments with articulation joints or grooves	78.95	21.05		
Cannulated instruments	98.90	1.10		
The number of instruments inside the pack			140.135	0.001
< 10 pcs	16.76	83.24		
10 ~ 20 pcs	32.75	67.25		
21 ~ 30 pcs	56.64	43.36		
31 ~ 40 pcs	77.72	22.28		
> 40 pcs	86.80	13.20		
Person responsible for keeping instruments moist			8.052	0.005
Nurses	35.92	64.08		
Workers	56.38	43.62		

Correlation analysis was conducted for the factors affecting keeping surgical instrument moist. Analysis showed that the more complex the structure and the greater the number of the instruments inside the

pack, the lower implementation rates of moistening; and the pass rates of moistening handled by nurses was higher than that handled by workers, as shown in Table 3.

Table 3
Correlation analysis on factors affecting keeping surgical instruments moist

Item	Correlation coefficient	P value
Instrument structure	-0.525	0.001
The number of instruments inside the pack	-0.203	0.001
Person responsible for keeping instruments moist	0.194	0.001

Discussion

This study revealed that implementation rate of moistening surgical instruments in our hospital was only 57.24%. The main reasons were that many nurses and workers of the clinical departments did not know the necessity, method or importance of keeping surgical instruments moist. Therefore, nurses and workers should be provided more training about keeping surgical instruments moist so that they could understand importance and benefits of keeping instruments moist. Low pass rates were related to lack of standard operating procedure of keeping instruments moist, so it was necessary to create a standard operating procedure for keeping instruments moist. As reported in relevant references, contaminants should be removed from the reusable surgical instruments timely after use and sent to CSSD within 30 minutes to avoid affecting cleaning quality, otherwise, the instruments should be kept moist [3]. Numerous dried contaminants on the instruments will be difficult to remove and increase cost of cleaning, and even cause corrosion leading to damage to instrument function, shortening the service life of instruments, and increasing unit cost in using devices [4]. Therefore, surgical instruments should be kept moist immediately after use if they are unavailable for timely cleaning. Some studies showed that contaminants would dry within several minutes if not timely processed after use [5], bacteria would grow in 4–20 minutes on dried contaminants, and biofilm would form within 2 hours [6]. The earlier moistening is handled, the better effect of moistening is. It is recommended that surgical instruments shall be kept moist immediately after surgery ends [7].

According to correlation analysis, the main factors affecting keeping surgical instruments moist included instrument structure, the number of instruments inside the pack, and the person responsible for keeping instruments moist. The more complex the instrument structure, the worse effect of moistening. Special methods shall be used for instruments with special structure. Ultrasonic scalpel, connecting cable for argon beam coagulation, and other instruments with complex structure shall be kept moist through separate multienzyme soaking [8]. Meanwhile, correct spraying method shall be adopted to ensure effect of moistening, i.e. unlock instrument articulation joints upon spray, carry out targeted spray on articulation joints, grooves and cannulations of instruments [7], and place instruments in the recycling box for spraying when there are many instruments inside the pack. It is recommended that keeping

surgical instruments moist shall be handled by nurses, as they have more professional knowledge and higher sense of responsibility compared with workers.

Conclusion

Implementation and pass rates of moistening surgical instruments were low, which meant that moistening failed to meet the applicable industrial standard for CSSD and there was a potential risk of hospital-acquired infection. It was necessary to provide more training about keeping surgical instruments moist for nurses and workers of clinical departments, and regulate the procedures of keeping surgical instruments moist.

Abbreviations

CSSD: Central sterile supply department

Declarations

Ethics approval and consent to participate

This study was conducted in accordance with the Declaration of Helsinki, and this study was approved by the Medical Ethics Committee of West China Second University Hospital, Sichuan University (No.: YXKY2020LSP(171)). Verbal consent to participate in this study was obtained from all participants. The Medical Ethics Committee of West China Second University Hospital, Sichuan University reviewed and approved the research proposal and procedure of verbal consent of this study, and felt that it was not necessary to obtain written consent from participants. All data collected were confidential and used only by this study.

Consent for publication

Not applicable

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding authors on reasonable request.

Competing interests

The authors declare that they have no competing interests.

Funding

This study was supported by Sichuan Provincial Health Department (No. 100374). The founder was not involved in the questionnaire design, on-site investigation, data collection, data analysis or preparation of

the manuscript.

Authors' contributions

YH (Yongdeng Huang), JH and LY contributed to the questionnaire design. All the authors carried out on-site investigation and data collection. YH (Yongdeng Huang) and YH (Yan Huang) conducted data analysis. YH (Yongdeng Huang) drafted the manuscript. JH revised the manuscript. All the authors read and approved the final manuscript.

Acknowledgements

The authors would like to thank the nurses and workers working in the 22 clinical departments of the West China Second Hospital, Sichuan University.

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Figures

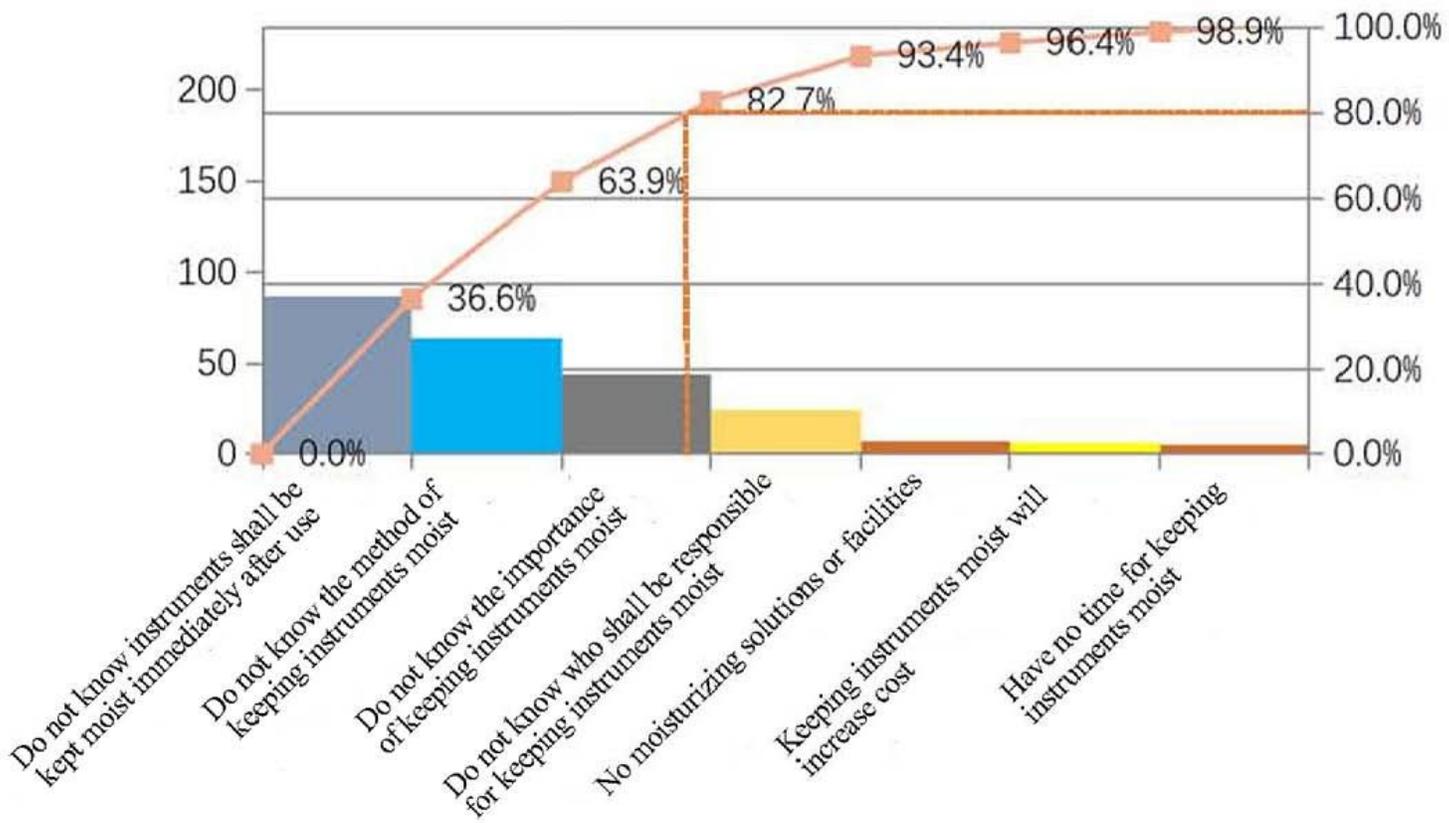


Figure 1

Reasons why surgical instruments were not kept moist

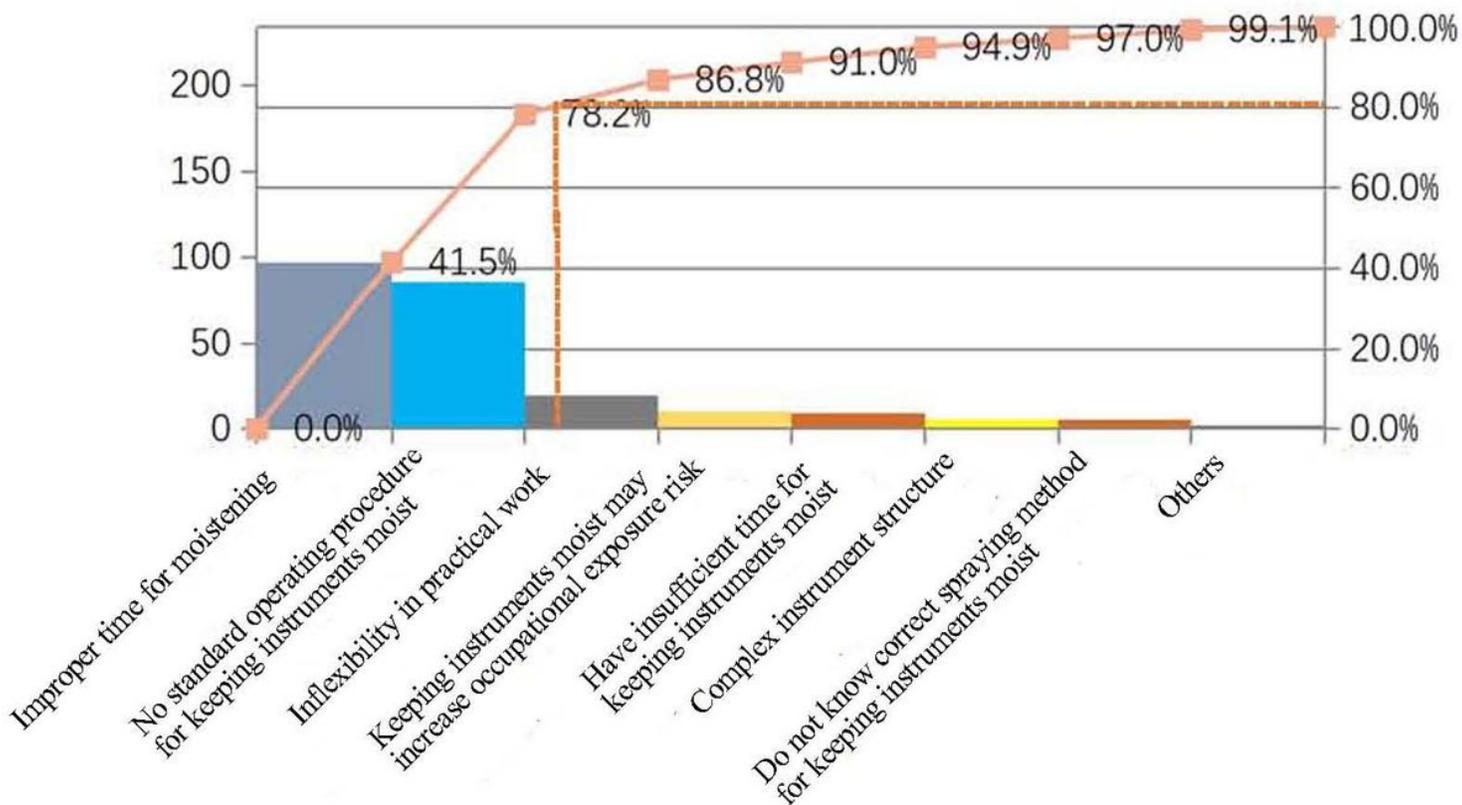


Figure 2

Reasons why moistening failed