Original Article

Analysis of the handling of ophthalmic surgical instruments in hospitals

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Background: We investigated the procedures used by medical institutions in Guangdong Province for reprocessing ophthalmic surgical instruments and analyzed the problems identified in order to improve the quality of cleaning medical instruments and its management.

Methods: The reprocessing of ophthalmic surgical instruments was investigated in 72 hospitals in Guangdong Province using a questionnaire designed for this purpose.

Results: Ophthalmic surgical instruments underwent centralized reprocessing in the disinfection and supply centers in 50% of the 72 hospitals. Cataract phacoemulsification surgery was the main ophthalmic surgery performed in 94% of the 72 hospitals. The main reasons for using centralized reprocessing were an insufficient supply of ophthalmic surgical instruments, short turnaround times between surgeries, and the high cost of losing these precise and fragile instruments. Manual processing was the predominant method of reprocessing ophthalmic surgical instruments; enzyme detergents were used in 63.89% of the hospitals; and 48.61% of the hospitals used N-model small pressure-steam sterilizers for the ophthalmic surgical instruments.

Conclusions: In order to improve the quality and management of the cleaning of medical instruments, and guarantee high-quality medical care, the following measures are recommended. Centralized management of ophthalmic surgical instruments should be based on the instruments' characteristics. Pay more attention to reprocessing site locations and staff training. Choose detergents based on manufacturers' instructions for use with specific instruments. Increase the number of available ophthalmic instruments in accordance with their demand and select appropriate small pressure-steam sterilizers.

Keywords: Ophthalmic surgical instruments; centralized reprocessing; analysis

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Introduction

Given the technological developments in ophthalmic surgery, more intricate and precise surgical instruments are needed, especially micro-instruments, which are slimmer, more delicate, and precise. These expensive instruments are likely to be damaged or incompletely disinfected during the process of cleaning and packaging (1). Ophthalmic surgery is difficult to perform and requires a high level of accuracy, such that the performance of surgical instruments has a direct effect on surgical outcomes. Incomplete sterilization of surgical instruments can have negative effects, such as eye infection (2). Toxic anterior segment syndrome (TASS), which was first identified by Monson and his coworkers (3) in 1992, is a set of acute anterior chamber aseptic

Table 1 Basic information about the hospitals

Hospital characteristics	Number of hospitals (homes)	Percentage (%)
Hospital level		
Class Three/Grade A hospital	27	37.5
Class Two/Grade B hospital	42	58.3
Class One/Grade A hospital	3	4.2
Hospital region		
Pearl River Delta	25	34.7
West Guangdong	21	29.2
East Guangdong	10	13.9
North Guangdong	16	22.2
Hospital type		
General hospital	65	90.3
Ophthalmology hospitals	4	5.6
Specialized hospitals	3	4.1

inflammatory reactions that occur within 12 to 24 hours after cataract surgery or other anterior segment surgeries. In recent years, the incidence of TASS has gradually increased due to increases in phacoemulsification (4), causing concerns about the handling of instruments for ophthalmic surgery. The present cross-sectional study was conducted with72 hospitals in Guangdong Province in October 2016, to investigate the handling of ophthalmic surgical instruments.

Methods

Objective

To investigate the handling of ophthalmic surgical instruments in 72 hospitals in Guangdong Province using a questionnaire.

Design of the questionnaire

The questionnaire was designed using the standard (WS 310.1-2016) specifying the requirements for the management of the Central Sterile Supply Department (CSSD). Relevant domestic and international research on the handling of surgical instruments and interviews with managers overseeing the handling of hospital surgical instruments were also used. The contents of the questionnaire included basic information about the hospitals, their methods of processing ophthalmic surgical instruments, difficulties encountered in centralized processing, personnel allocations, cleaning methods, type cleaners, and the types of the sterilizers used.

Procedure

We created alinkon Wenjuanxing, an online survey website, and included the contents of the questionnaire. We distributed the questionnaire using WeChat to departments that oversee ophthalmic surgical instruments at all levels in medical institutions in Guangdong Province (e.g., head nurses of central sterile supply departments and operating rooms). The questionnaires were analyzed after they were completed and submitted

Results

Basic information about the hospitals (Table 1)

The basic information about the hospitals, including hospital characteristics and the number and percentage of hospitals in each category, are shown in *Table 1*.

Management of ophthalmic surgical instruments by hospital characteristics (Table 2)

The number and percentage of hospitals using different ways of management for ophthalmic surgical instruments in each category are shown in *Table 2*.

Methods of cleaning, cleaning agents, and sterilizers used by the hospitals (Table 3)

The number and percentage of hospitals using different methods of cleaning, cleaning agents, or sterilizers for ophthalmic surgical instruments are shown in *Table 3*.

Discussion

Management of the handling of ophthalmic surgical instruments is lacking

The present study found the major ophthalmic operation performed in most hospitals was phacoemulsification, which has the following characteristics: it has a short duration, is performed frequently, and uses expensive surgical instruments. An important reason for the centralized treatment of the instruments was the basic organizational

Table 2 Management of ophthalmic surgical instruments by hospital characteristics

Hospital characteristics	Centralized management, n (%)	Non-centralized management, n (%)		
		Disposed only by operating room	Disposed by both operating room and supply room	Others
Hospital level				
Class Three/Grade A hospital	14 (51.9)	0	7 (25.9)	6 (22.2)
Class Two/Grade B hospital	21 (50.0)	4 (9.5)	12 (28.6)	5 (11.9)
Class One/Grade C hospital	1 (33.3)	0	2 (66.7)	0
Hospital type				
General hospitals	33 (50.8)	4 (6.2)	18 (85.7)	10 (15.4)
Ophthalmology hospital	2 (50.0)	0	1 (25.0)	1 (25.0)
Specialized hospital	1 (33.3)	0	2 (66.7)	0
Hospital region				
Pearl River Delta	16 (64.0)	1 (4.0)	5 (20.0)	3 (12.0)
North Guangdong	8 (50.0)	0	6 (37.5)	2 (12.5)
West Guangdong	6 (28.6)	3 (14.3)	8 (38.1)	4 (19.0)
East Guangdong	6 (60.0)	0	2 (20.0)	2 (0.0)
Number of ophthalmic surgeries/day				
<10	27 (55.1)	3 (6.1)	14 (28.6)	5 (10.2)
10–30	6 (31.6)	1 (5.3)	6 (31.6)	6 (31.6)
>30	3 (75.0)	0	1 (25.0)	0
Total	36 (50.0)	4 (5.6)	21 (29.2)	11 (15.2)

structure of a number of hospitals that could not meet the requirements associated with frequent operations. One reason why CSSDs were afraid or unwilling to accept and reprocess ophthalmic instruments was that the fragile instruments could be damaged easily. Some departments reprocessed the instruments by themselves. However, inadequate cleaning and improper disinfection and sterilization methods were often used due to a shortage of the preferred cleaning and sterilizing equipment and lack of guidance for the reprocessing of specialized instruments used in ophthalmic operations. Another issue was that the workers who cleaned the instruments were not staff members of the CSSD. They had not received systematic training nor did they have the professional knowledge to meet the personnel requirements of WS310.1-2016; therefore, they did not have the technical skills necessary for cleaning and sterilizing these instruments. To meet the demand for precision instruments given the advances in medical practice, and to improve the safety and efficiency of the inventory of instruments, a definition of CSSD centralized management was added to WS 310.1-2016.This criterion explicitly stipulates that centralized management involves centralized reprocessing and unified management. It also stipulates requirements for managing the CSSD area; methods for recycling reusable medical instruments, appliances, and other articles; and requires methods to be used by the CSSD for cleaning, disinfecting, and sterilizing instruments. For example, decentralized hospitals should jointly establish a CSSD. For hospitals whose existing CSSD area is restricted, all cleaning, disinfecting, and sterilization should be managed uniformly by the CSSD. Standards for reprocessing are also part of centralized management according to WS310.1, WS310.2, and WS310.3 (5).

Medical institutions can determine the appropriate number of instruments they actually need to fulfill equipment needs based on the frequency of operations, and they can use centralized reprocessing and unified

Table 3 Methods of cleaning, cleaning agents, and sterilizers used by the hospitals

Item	Number of hospitals (home)	Percentage (%)
Methods of cleaning		
Manual cleaning	29	40.3
Manual + ultrasonic cleaning	26	36.1
Mechanical cleaning	2	2.8
All the three methods	15	20.8
Cleaning agent		
Enzyme detergent	51	70.8
Alkaline detergent	10	13.9
Neutral cleaning agent	6	8.3
Non-detergent	5	6.9
Small pressure-steam sterilizer		
N-model	35	48.6
S-model	20	27.8
B-model	17	23.6

management for ophthalmic surgical instruments. However, regardless of the management method used, attention to establishing reprocessing sites and personnel training is required. Sites for reprocessing precision ophthalmic instruments should be established, and personnel at these sites should be trained professionally and have basic knowledge of CSSD, including relevant knowledge about controlling ophthalmic infections and the skills needed to reprocess ophthalmic instruments.

The quality of the cleaning of the instruments varies greatly

Methods of cleaning ophthalmic instruments vary among hospitals, and the effectiveness of the cleaning of instruments used for internal ocular operations has not received adequate attention. Half of the hospitals in the present study cleaned instruments manually. Other hospitals used both manual and ultrasonic cleaning, or mechanical cleaning, or all three methods. Some of the hospital respondents to the questionnaire had insufficient knowledge of the cleaning agents selected by their hospitals. A total of 63.89% hospitals chose enzyme detergents, and other hospitals chose alkaline cleaners or did not use a detergent. The hospitals mainly reprocessed ophthalmic surgical instruments through manual cleaning. The quality of the cleaning varied widely, which might have been caused by many factors, and differences in the operating methods used by the individual hospitals (6).

Incorrect type of small pressure-steam sterilizer

The small pressure-steam sterilizer is widely used in stomatology and ophthalmology departments, and operating rooms because it is small and easy to operate (7). Most ophthalmic instruments have tubes with small diameters, and when a small pressure-steam sterilizer is used, one should choose the correct sterilization cycle, which is based on the type of instrument. This study showed that only 23.61% of the hospitals used the B-model small pressure-steam sterilizer to sterilize ophthalmic instruments, and 48.16% used the N-model small pressure-steam sterilizer. However, the N-model small pressure-steam sterilizer is not suited for sterilizing surgical instruments, cavity instruments or instruments for oral cavity operations, because of the features of its sterilization cycle (8).

In conclusion, Guangdong Province has difficulties with the centralized treatment of ophthalmic surgical instruments because the workers who clean the surgical instruments do not belong to the CSSD, their knowledge and training related to methods of cleaning instruments vary, and many other factors affect the quality of the cleaning process, making it impossible to guarantee the quality of the cleaning. Because of sensitivity of the eyes, many types of substances, such as detergents, water, endotoxins, metal ions, and viscoelastic substance scan cause TASS if they enter the eyes. During phacoemulsification, a common ophthalmic operation, noninfectious substances can enter the anterior chamber different ways and cause TASS (9). Therefore, precautions should be taken to protect the corneal endothelium when viscoelastic substances are used (10) during an operation, and instruments that contact viscoelastic substances should be immersed in sterile water immediately. Phacoemulsification handles and other piping instruments should be washed with appropriate cleaning tools. Standardized processes should be followed and efficient rinsing should be performed. Ophthalmic surgical instruments should be treated using specialized cleaning protocols, disinfecting machines should be treated using verified procedures, and ophthalmic instruments should not be mixed with other surgical instruments in

the loading process. Hospitals should choose the correct detergent based on manufacturers' instructions for use and sterilized water should be used to rinse instruments fully to guarantee high quality cleaning to prevent TASS. Due to the inadequate supply of ophthalmic surgical instruments and the rapid turnaround times of operations, a quick cycle of sterilization can be used as the conventional cycle.

American researchers have noted that the quick sterilization method has been used for the sake of convenience i.e., to save time. However, it has become a controversial topic because of the risk of infection after operations with its excessive and incorrect use, and has increased healthcare costs due to infections (11). Moreover, if the type of small pressure-steam sterilizer is incorrect, the intended effects of sterilization cannot be guaranteed. Therefore, it is advisable for hospitals to place the basic number of ophthalmic instruments in the machine based on the requirements from operation turnover and sterilization. In an emergency, hospitals should use small pressure-steam sterilizers based on the sterilization requirements of the instruments to guarantee the effects of sterilization and medical safety.

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Footnote

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at http://dx.doi.org/10.21037/aes.2019.02.03). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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