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Original Article

Compliance of operating room sterilization procedures with valid Scientific guidelines

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Abstract

introduction: Infections caused by surgeries have always been considered a primary concern of medical centers and are associated with irreversible complications. Using appropriate sterilization procedures reduces these complications. This study aimed to investigate how compliant are the current sterilization procedures of operating room (OR) environment and instruments with valid scientific standards.

Methods: This cross-sectional, descriptive-analytical study examined ophthalmology, gynecology, and otorhinolaryngology ORs of Valiasr Hospital in Birjand. With the presence of the researcher in the OR, a standard 41-item checklist consisting of three parts (environmental cleaning, equipment cleaning, and sterilization procedure) was completed for each OR in each shift. The data were analyzed using the Mann-Whitney and Kruskal-Wallis test by SPSS(Version18) in significant level (a=0.05).

Results: A total of 50 questionnaires were filled out for ORs. The highest number of questionnaires were completed for the gynecology OR, and the most elective surgeries were performed in the morning shift. There was no significant difference between the median score of OR instruments cleaning and that of valid scientific guidelines in terms of steralization (P> 0.05). The median scores of sterilization procedures and steps in hospital ORs were significantly different from those of scientific guidelines in the field of sterilization of surgical operations (P <0.05).

Conclusion: The study findings indicate cases of mismatch between the quality of infection control and sterilization in the ORs of Vali-asar Hospital in Birjand and those recommended by valid scientific standards and guidelines.

Keywords: Sterilization, Operating Room, Infection Control Standard, Surgery

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Introduction

Nosocomial infections have always been one of the primary problems of medical centers. Today, due to the large number of medical centers, including hospitals, emerging diseases are on the rise. Increased microbial resistance and the need for various medical services make the incidence of healthcare-related infections inevitable (1). On the other hand, in addition to mortality, the complications of nosocomial infections lead to an increase in the length of hospitalization, which in turn gives rise to a higher cost of medical services and patient dissatisfaction. Alongside this, the application of effective sterilization procedures can reduce nosocomial infections (2). Studies show a high incidence of nosocomial infections ranging from at least 1.9 percent to more than 25 percent, indicating the depth of the disaster (3). A World Health Organization study assessing 55 hospitals in 12 countries indicated that the prevalence of nosocomial infections was 8.7% in hospitalized patients. In the countries of the Eastern Mediterranea and Southeast Asia, the rate amounts to 11.8% (4-5).

A major risk when using medical processes is the transmission of infection through surgical and medical equipment. To prevent and impede the transmission of nosocomial infections, it is necessary to use sterilized materials and equipment, especially in surgical centers where areas or parts of the human body are open. During the last decade, the incidence and prevalence of nosocomial infections have increased and have received substantial attention (1).

Useful use of sterilization and disinfection is very important in preventing infections related to health services. The sterilization service is responsible for the supply and distribution of sterile surgical and medical equipment, which is used in the diagnosis, treatment, and care of patients. This service works on removing and destroying infectious agents on the surface of medical equipment. When the equipment is properly disinfected and sterilized, we can ensure safety in the use of invasive and non-invasive equipment.

Sterilization is the use of physical and chemical procedures to destroy the structure of all bacteria and microbes resistant to endospores (1). The slightest negligence in maintaining the cleanliness of the OR environment and sterile parts leads to serious risks for patients who are to undergo surgery (6). Medical equipment used in ORs that are not isolated, cleaned, disinfected, and sterilized are a source of infection for patients and staff (7). Some researchers have stated that one of the reasons for the high degree of infection, especially in ORs, may be non-compliance with the principles and procedures of infection control. Although contaminated agents and devices have a more effective role in the spread of organisms in the hospital environment, human resources should be blamed more in the spread of nosocomial infections (8).

To prevent this, proper precautions should be taken and all measures should comply with reliable standards. Compliance of sterilization procedures with the current standards is necessary to prevent the infection of the patient and his/her contact with infectious agents. Sterilization is examined in three levels based on the importance of sterilization and the level of contact with the body, including 1. critical: for items that contact the body tissues such as surgical instruments 2. semicritical: items that are in direct or indirect contact with mucosal surfaces, such as endoscopes and anesthesia instruments, and 3. non-critical: items that contact intact skin, such as blood pressure cuffs (7). The manner of performing these measures should be evaluated to ensure the quality of services. Accordingly, there should be criteria to assess care provision, which is called the standard (9). Disinfection and sterilization are crucial in infection control. Unfortunately, however, disinfection errors and defects in sterilization standards are not uncommon in hospitals and health centers. Therefore, health centers should consider these possible errors seriously and try to fix the existing problems. Based on what was mentioned and studies conducted in this regard, we decided to evaluate the compliance of sterilization procedures in the OR of Valiasr

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Hospital in Birjand as per valid scientific standards.

Materials and Methods

This research is a descriptive-analytical study that assessed the sterilization of the ORs of Valiasr Hospital in Birjand, namely, the ophthalmology, gynecology, and otorhinolaryngology ORs. the research design was approved by the Research Council and the Ethics Committee of Birjand University of Medical Sciences, and the Ethic license is (IR.BUMS.REC.1397.294) and a standard checklist was prepared from the text of the 2006 sterilization guideline and other sterilization guidelines (10). The content validity of checklist was approved by a group of faculty members of Birjand University of Medical Sciences. Reliability of the questionnaire in our study was done using Cronbach' s alpha.The alpha value for the questionnaire was 0.76. It was completed in the presence of the researcher in the OR using the technique of direct observation and interview. The study was performed in the morning, evening, and night shifts for 14 days. In case there was an elective or emergency surgery in a shift, a separate checklist was completed for each OR. The mentioned checklist consisted of 41 items in three sections (cleaning the OR environment, cleaning the surgical instruments, and the procedure and steps of sterilization). Each item had two options, whether the statement was performed or not.

Part A: 12 items related to cleaning the OR environment

Part B: 6 items related to cleaning surgical instruments

Part C: 23 items related to the procedure and steps of sterilization

The actions that were performed were scored 1, and those that were not performed at all or were not performed completely were scored 0. Score of 1 was given only if there was definite compliance with the desired standard. For each checklist, the numbers were added together and announced as a total number. The collected data were analyzed in SPSS software version 18, and the results were reported as median and relative frequency distribution. Kolmogorov-Smirnov test was used to examine the normal distribution of data, and the Mann-Whitney test and Kruskal-Wallis test were used to analyze the data. The level of significance was set at ($P < 0.05\%$).

Results

In this study, a total of 50 questionnaires were completed for ophthalmology, gynecology, and otorhinolaryngology ORs in different work shifts. The highest number of questionnaires concerned with the gynecological OR and most surgeries were performed electively in the morning shift. The median scores were similar as regards cleaning OR equipment in the three ORs. There was no significant difference ($P > 0.05$) between the median scores of cleaning the OR environment and cleaning the OR equipment in ophthalmology, gynecology, and otorhinolaryngology surgeries. Regarding the procedures and steps of sterilization, the median score of otorhinolaryngology OR was significantly higher than those of the other two ORs ($P < 0.05$) (Table 1).

Also the median score of cleaning the OR environment and OR equipment cleaning between the two types of surgery was similar, and the median score of the steps and procedures of sterilization in elective surgery was higher than that of emergency surgery. There was no significant difference between the median scores of cleaning the OR environment and cleaning the OR equipment in elective and emergency surgeries ($P > 0.05$). Nevertheless, there was a significant difference between the median scores of sterilization procedures in elective and emergency surgeries ($P < 0.05$) (Table 2). In terms of OR shifts, the median score of OR environment cleaning in evening shift surgeries was higher than morning and night shifts. The median score of OR equipment cleaning was the same across different work shifts in the hospital, and the median score of sterilization procedures and steps in night shift surgeries was higher than those of the other two shifts. There was a significant difference between the median scores of sterilization procedures and steps with those of scientific guidelines ($P < 0.05$).

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However, there was no significant difference between the median score of OR equipment cleaning and OR environment cleaning with valid scientific guidelines (P> 0.05) (Table 3).

Table 1. Comparison of the median scores of OR environment cleaning, OR equipment cleaning, and sterilization procedures and steps in ORs of Valiasr Hospital in Birjand as per the type of OR

Operating room Variable	Gynecology Median(Q25,Q75)	ENT Median(Q25,Q75)	Ophthalmology Median(Q25,Q75)	Kruskal-Wallis test result
OR environment cleaning	8(8,8)	8(8,8.25)	8(7.75,8)	$\chi2 = 2,97$ P = 0.22
OR equipment cleaning	6(6,6)	6(6,6)	6(6,6)	$\chi2 = 0.000$ P = 1.0
sterilization procedures and steps	8(7,11.5)	11(7,13)	7(7,7.25)	$\chi2 = 6.86$ P = 0.03

Table 2. Comparing the median scores of OR environment cleaning, OR equipment cleaning, and sterilization procedure and steps in ORs of Valiasr Hospital in Birjand as per the type of patients

Type of patient Variable	elective Median(Q25,Q75)	Emergency Median(Q25,Q75)	Kruskal-Wallis test result
OR environment cleaning	8(8,8)	8(8,8)	Z = 0.000 P = 1.0
OR equipment cleaning	6(6,6)	6(6,6)	Z = 0.000 P = 1.0
sterilization procedures and steps	7(7,13)	7(7,7.5)	Z = 2.4 P =0.01

Table 3. Comparison of the median scores of OR environment cleaning, OR equipment cleaning, and sterilization procedures and steps in ORs of Valiasr Hospital in Birjand and valid scientific guidelines

Variable	OR Median(Q25,Q75)	Guideline Scores (Q25,Q75)	Mann-Whitney test result
OR environment cleaning	8(8,8)	12	Z = 9.629 P <0.000
OR equipment cleaning	6(6,6)	6	Z = 0.0 P = 1.0
sterilization procedures and steps	7(7,12.25)	23	Z = 9.380 P <0.000

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Discussion

According to this study, surgical instruments in the ORs of Valiasr Hospital in Birjand were cleaned according to valid scientific guidelines. As regards cleaning surgical instruments, metal and glass tools were cleaned perfectly using soap, water, and brushes.

Moreover, blood-contaminated items were cleaned immediately with cold water. The instruments were dried after they were cleaned and put in the autoclave, while the name of the center and the date of sterilization were placed on them using autoclave tape. The quality of cleaning the environment in the ORs was according the standards specified in scientific guidelines.

The results of this study also indicated that the performance of the OR staff of Valiasr Hospital regarding the procedure and steps of sterilization is not desirable and differs from international standards. One of the reasons for this discrepancy is the fatigue of the OR staff due to the large number of surgeries in each work shift. According to valid guidelines, the OR environment, shelves, and walls should be cleaned every day, and the cleaning should start from the highest part of the OR, such as the sialitic lights. The floor of the OR and its horizontal surfaces should be cleaned regularly with water, soap, and detergents and needs to be inspected frequently for optimal performance (11). In the study conducted by Nourian et al., the principles of sterilization were not compliant with the standards in most cases, and the performance of the personnel was reported to be poor compared to the standards (8).

Cases of more accurate implementation of sterilization and disinfection of OR equipment (12) and proper performance of OR personnel regarding standard guidelines have been reported in similar studies (8-13).

The difference in the median score of cleaning the OR environment is affected by various factors. The cleaning of surgical instruments is performed by trained people, who are often present during the surgical procedure and are fully acquainted with the sensitivity of the matter, while the OR environment is cleaned by non-specialized forces. The importance of cleaning the OR environment may be underestimated, and less emphasis is placed on educating the hospital cleaners.

On the other hand, the number of checklist items in the sterilization of surgical instruments is substantially higher, leading to higher accuracy of evaluation in this area.

Another factor influencing the results of this research is the design of the checklist. The checklist does not include an “incomplete” option, and the score of 1 is assigned to the very accurate execution of a given step. The statistical difference as such does not mean that the situation is undesirable in the exact sense of the word. Rather, it denotes the researcher’s scrupulousness with an aim to design an effective intervention.

According to the results of this study, there was no significant difference between the median scores of OR equipment cleaning vis-a-vis the type of OR. On the other hand, there was no difference with valid guidelines, indicating the compliance of cleaning hospital ORs. The median score of OR environment cleaning and the score of sterilization procedures and steps were significantly different as per the type of OR. Among the reasons for this discrepancy is the large number of surgeries in Birjand-based ORs, as the biggest general center in South Khorasan Province, leading to the fatigue and impatience of the OR staff and eventually causing these steps and procedures to be performed incompletely. The existing restrictions in this province due to the deprivation of the province can also be highlighted as a contributor to this discrepancy. The limitations have in fact led to the unavailability of some facilities in this provincial center. A similar study in Shahrekord hospitals, investigating the application of principles and procedures of infection control by OR staff, similarly showed that the quality of infection control in the studied hospitals was very far from international standards (8). Therefore, it is suggested to train personnel for the principles of infection control, to hold training courses, and to recruit professionals for sensitive procedures such

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as sterilization.

While the existing strengths and weaknesses of the sterilization process were identified in this study, they cannot be cited. To increase the accuracy of the results, designing a study with more sensitivity will help in evaluating the actual performance. In the present study, the evaluation was performed objectively and part by part, and the score obtained in some cases may not indicate the overall performance. This study did not include the differences in tenure and expertise of the personnel present at the time of completing the data in the research objectives, which affects the results.

Conclusion

The findings of this study indicated that the quality of infection control in the ORs of Valiasr Hospital in Birjand did not comply with valid guidelines in matters such as cleaning surgical equipment and other cases. Identifying strengths and weaknesses allows system managers to design effective training and monitoring strategies, including periodic retraining of employed personnel, training of new employees (project-based or transferred workforces from other units), peer review, and periodic supervision of managers.

It is necessary to emphasize the training of surgeons in the assistantship course in this field because the surgeon's performance as the head of the surgical team will play an effective role in changing professional behavior.

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Conflicts of interests

There is no conflict of interest.

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