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Original Article

Studying the Frequency of Medical Errors and Their Causes Among Operating Room Nurses in Birjand Teaching Hospitals in 2024, Iran

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Abstract

Background: The operating room is one of the high-risk areas of the hospital, and nurses are also at a high level of error. Accordingly, this study aimed to investigate the rate of medical errors (MEs) and their causes among operating room nurses of teaching hospitals in Birjand in 2024.

Methods: This descriptive-sectional study was conducted on 72 operating room nurses in Birjand academic hospitals selected by census sampling. Their views were investigated with a questionnaire that included three sections related to demographic information, frequency of MEs, and causes of MEs. The obtained data were analyzed by SPSS 26 using descriptive statistics.

Results: From the viewpoints of operating room nurses, the use of inappropriate equipment (2.86 ± 1.104), non-observance of sterile techniques (2.56 ± 1.073), and lack of knowledge of the patient's allergy (2.50 ± 1.075) were some of the most important errors.

The most serious factors affecting the occurrence of errors included obligations to perform several tasks simultaneously (3.47 ± 0.822), lack of personnel (3.35 ± 0.808), and fatigue (3.33 ± 0.839).

Conclusion: Examining the frequency of errors plays an important role in identifying significant and recurring errors. Moreover, by identifying the causes of errors, steps can be taken to reduce them, especially frequent errors.

Keywords: Safety, Medical errors, Operating room

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Introduction

Medicine is based on the principle of "First, not harm" (1); in other words, the primary and most important requirement in hospitals is not to harm the patient (2). Therefore, ensuring the provision of quality and safe services in the health sector is of particular importance and priority (3).

Despite advancements in technology within the healthcare system, medical errors (MEs) still pose a threat to patient safety (1). MEs are defined by healthcare organizations (JCAHO) as "patient injury due to inappropriate and unethical behavior, inadequate and negligent actions by healthcare providers in their professional activities" (4). Due to the human-centered nature of providers and recipients of services, as well as the sensitivity and importance of medical professions, human errors are of high significance in healthcare systems (5). Various studies have identified the causes of human errors as a combination of different factors, such as human factors, managerial and organizational factors, environmental conditions, equipment design, task complexity, work methods, and the like (6). MEs have numerous clinical and economic consequences. According to the World Health Organization (2018), about 10% of individuals under medical care are harmed due to MEs. Additionally, MEs rank as the third leading cause of death in the United States (7). Furthermore, 79% of medical malpractice complaints are related to errors that occurred within hospitals (8).

The occurrence of errors among nurses is higher compared to other healthcare and medical professions (9). Additionally, according to a study conducted in China, the prevalence of MEs among operating room nurses was higher compared to other nurses (10). Senders also found that in developed countries, nearly 50% of all unwanted incidents in hospitals occur in operating rooms (11). Furthermore, Shiyasi and Norouzinia reported that up to 35% of complaints are associated with errors occurring in operating rooms (12). The operating room is considered one of the most high-risk areas in hospitals in terms of organizational, educational, environmental, and

technological needs (13). Operating rooms exhibit high levels of errors due to high complexity and interdisciplinary activity, high technical skill requirements, complexity in patient care and treatment protocols, advanced technology, and high coordination needs (14). Errors occurring in the operating room are primarily related to human errors and skills, including performing surgery on the wrong site or patient, positioning the patient incorrectly, and leaving sponges, needles, and instruments inside the patient (15). Numerous factors, such as high workload, a large number of patients, unstable patient conditions, lack of nurse awareness, unsuitable work environment, and lack of support and cooperation with experienced personnel, contribute to these errors (9).

By revealing errors, not only can patient safety be maintained, but potential patient injuries, hospital stay duration, financial costs, and the occurrence of similar future errors can be prevented as well (14). By reducing and timely identifying errors, patient care can be enhanced, ensuring patient safety (16). To reduce errors, it is essential to recognize, define, and measure them (17). Moreover, controlling, monitoring, and reducing errors require understanding the behaviors that lead to their formation (13). Considering that the operating room is considered a high-risk area in the hospital and nurses are at a high risk of making errors, maintaining patient safety and health is of greater importance and requires more consideration. Additionally, recognizing errors and their causative factors has a direct impact on reducing errors and subsequently increasing patient safety levels. Therefore, this study seeks to examine the frequency of MEs and their causes among operating room nurses in educational hospitals of Birjand.

Materials and Methods

This descriptive cross-sectional study was performed in the educational hospitals of Birjand University of Medical Sciences in 2023-2024. The study population consisted of operating room nurses, selected through census sampling from the operating rooms of Razi, Vali-Asr (AJ), and Imam Reza (AJ) Hospitals. The inclusion criteria were working in the operating room for a minimum of six months, being employed in the operating room at the time of the study, holding at least an associate degree in operating room technology, and providing informed consent. On the other hand, the exclusion criterion was incomplete completion of the questionnaire, resulting in 73 nurses being studied, with one excluded due to incomplete responses, leaving a final sample of 72 nurses. The data collection tool used in this study was a questionnaire entitled "Nursing Errors in the Operating Room", designed by Chard in 2010. Its reliability was reported by Taifoori and Valiee in 2015, with a Cronbach's alpha coefficient of 0.89 (9). The validity of the questionnaire was also confirmed, and all items had a content validity index of > 0.7 and a content validity ratio of > 0.622 (18). The questionnaire included sections on demographic information (age, gender, marital status, educational level, work experience, and monthly shift hours), types of errors (15 items with responses ranging from "strongly agree" to "strongly disagree"), and causes of errors (24 items with responses ranging from "strongly agree" to "strongly disagree"). Error incidents and their causes were assessed using a 4-point Likert-type scale, where "strongly disagree", "disagree", "agree", and "strongly agree" scored 1 to 4, respectively. Items with higher mean scores were considered to have a greater impact on the frequency and causes of errors. After receiving ethical approval from the Ethics Committee of Birjand University of Medical Sciences, questionnaires were distributed to all personnel based on their work shifts, and informed consent was obtained from the participants. They were assured that their information would remain confidential. Upon collecting the questionnaires, the data were analyzed using descriptive statistics (frequencies, means, and standard deviations) in SPSS software (version 26).

Results

Of the 73 distributed questionnaires, one was excluded from the study due to incomplete responses, resulting in the analysis of data from 72 participants. Among the 72 participants, 55 (76.4%) were women, and 17 (23.6%) were men. Additionally, 62 (86.1%) were married, while 10 (13.9%) were single. Regarding educational qualifications, 66 (91.7%), 4 (5.6%), and 2 (2.8%) had a bachelor's, a master's, and an associate degree, respectively. The average age and average work experience of the studied nurses were 33.29 ± 6.55 years and 9.66 ± 6.92 years, respectively, and they worked an average of 28.5 ± 4.28 shifts per month (Table 1).

The results revealed that the highest rate of errors was related to the use of inappropriate equipment (2.86 ± 1.1), followed by lack of following sterile techniques (2.56 ± 1.07), unawareness of patient allergies (2.5 ± 1.07), unclear surgical site (2.49 ± 1.16), and incorrect use of equipment (2.47 ± 1.07). Conversely, the error of incorrect counting of surgical sponges (2.18 ± 1.15) had the lowest rate of occurrence (Table 2).

Additionally, from the perspective of nurses, the most

Table 1. Demographic Information of the 72 Nurses Analyzed in This Study

Demographic Variable	Groups	Count (n)	Percentage (%)
Gender	Men	17	23.6
	Women	55	76.4
Marital status	Married	62	86.1
	Single	10	13.9
Education level	Associate degree	2	2.8
	Bachelor's degree	66	91.7
	Master's degree	4	5.6
	Mean ± Standard Deviation		
Age	33.29 ± 6.55		
Work experience	9.66 ± 6.92		
Shifts per month	28.5 ± 4.28		

significant causes of errors were multitasking (3.47 ± 0.82), staff shortages (3.35 ± 0.8), fatigue (3.33 ± 0.83), lack of proper supplies and equipment (3.01 ± 0.86), deficiencies in the service delivery system (3 ± 0.87), and distraction (3 ± 0.85), respectively. Contrarily, acting beyond personal competence (2.52 ± 0.88) was considered the least important cause by the nurses (Table 3).

Discussion

The results of this study showed that among the error

Table 2. Distribution of Frequencies, Means, and Standard Deviations of Errors From the Perspective of Operating Room Nurses

Errors	Completely Agree Number (%)	Agree Number (%)	Disagree Number (%)	Completely Disagree Number (%)	Mean ± Standard Deviation
Unclear surgical site	13 (18.1)	22 (30.6)	15 (20.8)	22 (30.6)	2.36 ± 1.104
Unclear surgical side (right or left)	16 (22.2)	26 (36.1)	7 (9.7)	23 (31.9)	2.49 ± 1.163
Incorrect placement of electrosurgical pads	12 (16.7)	21 (29.2)	26 (36.1)	13 (18.1)	2.44 ± 0.977
Improper patient positioning	15 (20.8)	15 (20.8)	26 (36.1)	16 (22.2)	2.40 ± 1.057
Medication errors	14 (19.4)	17 (23.6)	18 (25.0)	23 (31.9)	2.31 ± 1.121
Incorrect counting of surgical sponges	14 (19.4)	13 (18.1)	17 (23.6)	28 (38.9)	2.18 ± 1.155
Incorrect counting of surgical instruments	15 (20.8)	21 (29.2)	17 (23.6)	19 (26.4)	2.44 ± 1.099
Not following sterile techniques	17 (23.6)	21 (29.2)	19 (26.4)	15 (20.8)	2.56 ± 1.073
Incorrect use of equipment	15 (20.8)	21 (29.2)	19 (26.4)	17 (23.6)	2.47 ± 1.074
Using inappropriate equipment	26 (36.1)	23 (31.9)	10 (13.9)	13 (18.1)	2.86 ± 1.104
Reaction to blood or blood products	14 (19.4)	16 (22.2)	24 (33.3)	18 (25.0)	2.36 ± 1.066
Incorrect surgical site identification	11 (15.3)	23 (31.9)	18 (25.0)	20 (27.8)	2.35 ± 1.050
Unawareness of patient allergies	16 (22.2)	20 (27.8)	20 (27.8)	16 (22.2)	2.50 ± 1.075
Incorrect patient identification	17 (23.6)	13 (18.1)	19 (26.4)	23 (31.9)	2.33 ± 1.163
Retained foreign objects	16 (22.2)	11 (15.3)	20 (27.8)	25 (34.7)	2.25 ± 1.160

Table 3. Distribution of Frequencies, Means, and Standard Deviations of Causes of Errors From the Perspective of Operating Room Nurses

Cause of Errors	Completely Agree Number (%)	Agree Number (%)	Disagree Number (%)	Completely Disagree, Number (%)	Mean ± Standard Deviation
Unfamiliarity with procedure	12 (16.7)	38 (52.8)	15 (20.8)	7 (9.7)	2.76 ± 0.847
My error due to another's error	10 (13.9)	38 (52.8)	17 (23.6)	7 (9.7)	2.71 ± 0.830
Lack of sufficient information	10 (13.9)	42 (58.3)	12 (16.7)	8 (11.1)	2.75 ± 0.835
Quick decision-making	12 (16.7)	44 (61.1)	12 (16.7)	4 (5.6)	2.89 ± 0.742
Distraction	22 (30.6)	28 (38.9)	15 (20.8)	7 (9.7)	2.90 ± 0.952
Inadequate supervision by managers	19 (26.4)	17 (23.6)	25 (34.7)	11 (15.3)	2.61 ± 1.042
Staff shortage	37 (51.4)	26 (36.1)	6 (8.3)	3 (4.2)	3.35 ± 0.808
Lack of proper equipment and tools	22 (30.6)	34 (47.2)	11 (15.3)	5 (6.9)	3.01 ± 0.864
Fatigue	37 (51.4)	26 (36.1)	5 (6.9)	4 (5.6)	3.33 ± 0.839
Deficiency in the service delivery system	22 (30.6)	33 (45.8)	12 (16.7)	5 (6.9)	3.00 ± 0.872
Not following standard procedures	15 (20.8)	37 (51.4)	14 (19.4)	6 (8.3)	2.85 ± 0.850
Non-compliance with standards and hospital policies	10 (13.9)	32 (44.4)	22 (30.6)	8 (11.1)	2.61 ± 0.865
Unfamiliarity with procedure	15 (20.8)	36 (50.0)	12 (16.7)	9 (12.5)	2.79 ± 0.918
Lack of proper communication among team members	12 (16.7)	31 (43.1)	22 (30.6)	7 (9.7)	2.67 ± 0.872
Multitasking	45 (62.5)	20 (27.8)	3 (4.2)	4 (5.6)	3.47 ± 0.822
Distracted focus	21 (29.2)	35 (48.6)	11 (15.3)	5 (6.9)	3.00 ± 0.856
Momentary forgetfulness	16 (22.2)	28 (38.9)	24 (33.3)	4 (5.6)	2.78 ± 0.859
Making the wrong decision	10 (13.9)	35 (48.6)	21 (29.2)	6 (8.3)	2.68 ± 0.819
Misjudging the situation	10 (13.9)	36 (50.0)	20 (27.8)	6 (8.3)	2.69 ± 0.816
Ignoring warning signs	14 (19.4)	24 (33.3)	25 (34.7)	9 (12.5)	2.60 ± 0.944
Incorrect information or insufficient data	13 (18.1)	34 (47.2)	19 (26.4)	6 (8.3)	2.75 ± 0.852
Relying on others' judgement	16 (22.2)	29 (40.3)	19 (26.4)	8 (11.1)	2.74 ± 0.934
Beyond personal competence	7 (9.7)	35 (48.6)	18 (25.0)	12 (16.7)	2.52 ± 0.888
Lack of effective communication	13 (18.1)	31 (43.1)	20 (27.8)	8 (11.1)	2.68 ± 0.901

categories, the highest mean scores were related to using inappropriate equipment and not following sterile techniques. In contrast, Azarbad et al, using the same questionnaire as the present study, found that not following sterile techniques was the most common error (9). The difference between the result of our study and that of the above study lies in the target population. The mentioned study focused on students, whereas our study addressed nurses. Similarly, Mahmoud Shaker Mohamed et al, in their study on nursing errors in the operating room, reported that the lack of proper equipment and a poor aseptic technique were the most frequent errors (19). The findings of the study by Song et al are somewhat similar to our results, indicating that improper disinfection of surgical instruments and equipment and poor sample management were the most common errors in the operating room (20). The findings of the aforementioned studies (19, 20) regarding sterilization and disinfection errors conform to those of our study because issues such as disinfection and sterilization of instruments are common errors worldwide. However, Nemati et al found that operating on the wrong patient or the wrong site and leaving instruments inside the patient were common operating room errors (13). This discrepancy could be due to differences in healthcare systems and reporting practices among the nurses in the two studies, and nurses participating in the study by Nemati et al were more willing to report these life-threatening errors.

According to our results, the highest mean scores among the causes of errors were related to multitasking, staff shortages, fatigue, lack of proper supplies and equipment, and deficiencies in the service delivery system, while the lowest mean score belonged to acting beyond personal competence. The results of other studies are also consistent with those of our research. In the study by Khalili et al, high workload, a large number of patients, and fatigue were among the contributing factors to the causes of errors (16). Reason also demonstrated that working conditions, such as lack of time, shortage of human resources, inadequate facilities and equipment, and inexperience, lead to increased unsafe clinical activities and clinical errors (21). Moreover, Vinagre and Marques concluded that work pressure is one of the factors that increases the rate of errors in the operating room (22). The results of the study by Mahmoud Shaker Mohamed et al somewhat corroborate those of the present study, indicating that factors related to nursing staff, including the physical and psychological conditions of employees exposed to stress and painful working conditions in the operating room (e.g., standing during long surgeries), were among the important factors in nursing errors. They also mentioned that the unavailability of materials and equipment, as well as inadequate and ineffective facilities, were significant factors in nursing errors in the operating room (19). The difference between the findings of the above study and those of this study was in the classification of factors affecting MEs; in our study, there was no classification of factors. The results of studies conducted by Mohammad Shaker Mohamed et al, Vinagre and Marques, and Ugur et al somehow contradict the results of this study; these researchers considered the lack of effective relationships and lack of coordination in the team as important factors in the occurrence of errors. This discrepancy may be due to differences in the perspective of the studied nurses (19, 22, 23).

One of the limitations of this study was the use of questionnaires for data collection, which may have led some participants to withhold their true responses or provide inaccurate answers. The large number of questions in the questionnaire also extended the implementation time, which might have affected the accuracy of participants' responses. Additionally, this study had a small sample size and only examined the frequency and causes of MEs in the operating room. Therefore, it is recommended that future studies include a larger sample size and cover more aspects of errors, including error reporting and its barriers.

Conclusion

Based on the findings, MEs in the operating room occur frequently and due to various reasons. The most common errors in this study were related to the use of inappropriate equipment, lack of following sterile techniques, unawareness of patient allergies, unclear surgical site, and incorrect use of equipment. Appropriate measures should be taken to reduce these errors, which can be achieved through suitable educational programs. In addition, our findings revealed that staff shortages and fatigue have the most significant impact on the occurrence of errors; therefore, managers should take steps to recruit new staff. Revising nurse shift planning by the management could also be helpful in this regard.

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Authors' Contributions

Conceptualization: Maryam Tolyat, Ehsan Hemmati, Fatemeh Nakhei.
Data curation: Ehsan Hemmati, Fatemeh Nakhei.
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Competing Interests

The authors declared that they have no conflict of interests.

Ethical Approval

This study was approved by the Ethics Committee of Birjand

University of Medical Sciences (ethical code IR.BUMS.REC.1402.322). Informed consent was obtained from participants, and they were given the right to withdraw from the study. In addition, all participants' data and information remained confidential.

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