Embodying the "Patient" Role: How Immersive Simulation Enhances Surgical Positioning Skill Acquisition?

Leila Sadati[1], Rana Abjar[1], Zahra Nouri Khaneghah[2], Fatemeh Edalattalab[1], Sahar Karami[1]

[1] Department of Operating Room, School of Paramedical Sciences, Alborz University of Medical Sciences, Karaj, Iran

[3] Center for Educational Research in Medical Science (CERMS), Department of Medical Education, School of Medicine, Iran University of Medical Sciences, Tehran, Iran

Received: 10 Mar. 2024; Accepted: 14 Nov. 2024

Abstract- According to importance in correct surgical positioning on surgical outcomes by surgical team members, this study was done to evaluate the effects of simulation-based learning (SBL) on surgical technologist students' knowledge and clinical skill in surgical positioning. This non-randomized quasi-experimental study utilized a one-group pretest-post test design. The participants were 32 surgical technology students who had enrolled in a course on scrub principles. Surgical positions were taught using both lecture and SBL methods. To compare the educational outcomes of the two teaching methods, students' knowledge and clinical skills were assessed before and after the course using multiple choice questions and a researcher-developed checklist. Thirty-eight second-semester surgical technologist students with a grade point average of 15.74±1.96 participated in this study. Mean score of knowledge(pre and post test) was (4.79±1.58 to 8.21±1.63, *P*=0.021). Mean score of clinical skill (pre and post test) was (0 to 8.13±1.73, *P*=0.030). The results showed that the mean knowledge and clinical skill scores after teaching by SBL were improved. SBL promotes students' clinical skill in correct surgical positioning, so this method of teaching recommends clinical instructors in operating room field to achieve optimal learning outcomes.

Acta Med Iran 2024;62(November-December):363-367.

Keywords: Operating room; Patient positioning; Simulation training; Clinical competence

Introduction

Surgical technologists' ability to provide standard and safe care to patients undergoing surgery in the operating room is dependent on their knowledge and various competencies, which are acquired through effective training (1). One of these competencies is surgical positioning, which, if not done correctly, can result in a variety of complications for the patient, including neurovascular injury (2). Proper surgical Positioning in operating room is critical for patient safety and effective surgery (3). Proper positioning ensures that the surgical team member has ready access to the patient and clear exposure of the surgical site during surgery without skin damage and mechanical pressure on the patient's body (4). Parts of the patient's body are under high pressure or tension outside the anatomical position of the body that must be considered in each type of surgical position, depending on how the patient is placed on the operating table (5). Undoubtedly, safe positioning necessitates specialized knowledge in the field of anatomy and physiology of the body, familiarity with the tools and equipment required for positioning, and the ability to use them, all of which can be obtained with proper training (6). There are numerous techniques such as lectures, painting, demonstration and experience in real workplace and simulation-based learning (SBL) that are used in teaching of surgical positioning in medical and nursing schools (7).

The SBL is one of the teaching methods that allows learners to learn and practice skills in a safe and stress-free environment (8). Increasing patient safety awareness and attention, limited opportunities to face

Corresponding Author: S. Karami
Department of Operating Room, School of Paramedical Sciences, Alborz University of Medical Sciences, Karaj, Iran
Tel: +98 9124645926, E-mail address: saharkarami465@gmail.com

various clinical situations and the ability of this teaching method in the development of clinical practice have caused this teaching method to find a special place in the process of teaching and learning technical and non-technical skills in a stressful and crowded environment of the operating room (9). According to the findings of studies, using SBL in teaching operating room personnel leads to the development of their knowledge, skills, and practice in providing safe care to patients (10,11). Because this method provides a valuable opportunity to repeat learned skills in a safe environment without endangering patients' safety (12). Meling & Meling also believes that SBL improves surgical team practice in terms of applying correct techniques and reducing surgery time (13). Given the benefits of this teaching method and the poor practice of some staff in the standard surgical positioning in the operating rooms (3,4), the researchers decided to teach this course using a SBL.

Aim: This study was done to evaluate the effects of simulation-based learning (SBL) on surgical technologist students' knowledge and clinical skill in surgical positioning.

Materials and Methods

Design and setting(s)

The current quasi-experimental study, with the code of ethics No. IR.ABZUMS.REC.1397.004 was done using single group pre-post design in Alborz University of Medical Sciences, school of paramedical sciences in 2019.

Participants and sampling

The samples of study were 38 second-semester surgical technology students who entered the study using convenience sampling. The inclusion criteria included taking the introduction to surgery course, passing the operating room equipment course and having consent to participate in the research, and the exclusion criteria were including absence from training course more than one session or absence in pre-posttest sessions. All students participated fully in both the training and assessments; no students were excluded.

Tools/instruments

A multiple-choice question and a researcher-made checklist were used to learners' knowledge and clinical skill. The content and face validity of the MCQ were confirmed through an evaluation by eight educational experts in the field of surgery, medical education, and the operating room. As a result of the evaluation, some test items were modified, and others were deleted to improve the test's validity. To construct validity was considered the determination of key checks by experts' opinions. It has been recommended conduct by a number of expert persons in the content area. If there was variation in the answer perceived to be correct, the MCQ should be reviewed until there is consensus (14). Based on eight educational experts' opinions, the final exam questions were prepared with 40 questions consisting of five specific questions for each surgical position. In total, for each group of teaching methods, twenty specific questions were allocated, and half a mark was considered for each question. The reliability of the MCQ items (internal consistency of questions) was confirmed by calculation of kappa coefficient (0.83). Also, the correlation coefficient of even and odd test scores was calculated using Pearson's r .(0.79)

The checklist included ten items related to preparing the surgical table, connecting the attachments and using protective devices such as wedges and rolls on pressure points to prevent skin and nerve injuries. It was prepared based on the association of perioperative registered nurses (AORN) guideline. For each item, one point was considered, so, the total score of the checklist was ten points. For each of the eight positions, an individual checklist was prepared, because in each case, the elements related to the support of pressure or tension points were different. The face and content validity of the checklists were confirmed by the educational experts' opinion in the field of surgery, medical education, and the operating room. Inter-rater reliability was assessed by having two expert operating room staff simultaneously evaluate students' skills during the practice exam. The inter-rater reliability coefficient calculated using the Kappa statistic was 0.89.

Data collection methods

First, the researcher, based on the course content, selected eight common surgical positions including Prone, Reverse Trendelenburg, Jackknife, Knee-chest, supine, Trendelenburg, lithotomy, and lateral positions. Then, a pre-test was administered followed by four simulation-based learning (SBL) sessions in a simulated operating room using an actual surgical table, different attachments for positioning and a simulated mannequin. Next four SBL sessions continued with students role-played as simulated patients, experiencing pressure points, excessive tension, discomfort, and fall risks first-hand. The students laid down on the operating room table while assuming different surgical positions. In this

way, they could actually experience the points under pressure or tension personally and, at the same time, could explain their experience to their peers and help them learn better. During the simulations, the simulated patients and other students discussed potential issues, with the instructor providing feedback and corrections via debriefs. Finally, after doing a post test for assessment of student's knowledge improvement, two operating room professors observed and evaluated each student's clinical skills in the surgical positioning procedures using position-specific checklists in the simulated operating room in situation where a student play role of a patients in surgical table. At the end of study, pre-post test scores were compared for both knowledge and clinical skills variables. The flow chart of the study is shown in Figure 1.

Data analysis

Data was analyzed using SPSS 26. The normality of the data was measured by the Kolmogorov-Smirnov test, paired t-tests were used for comparison of students' knowledge and skill before and after intervention.

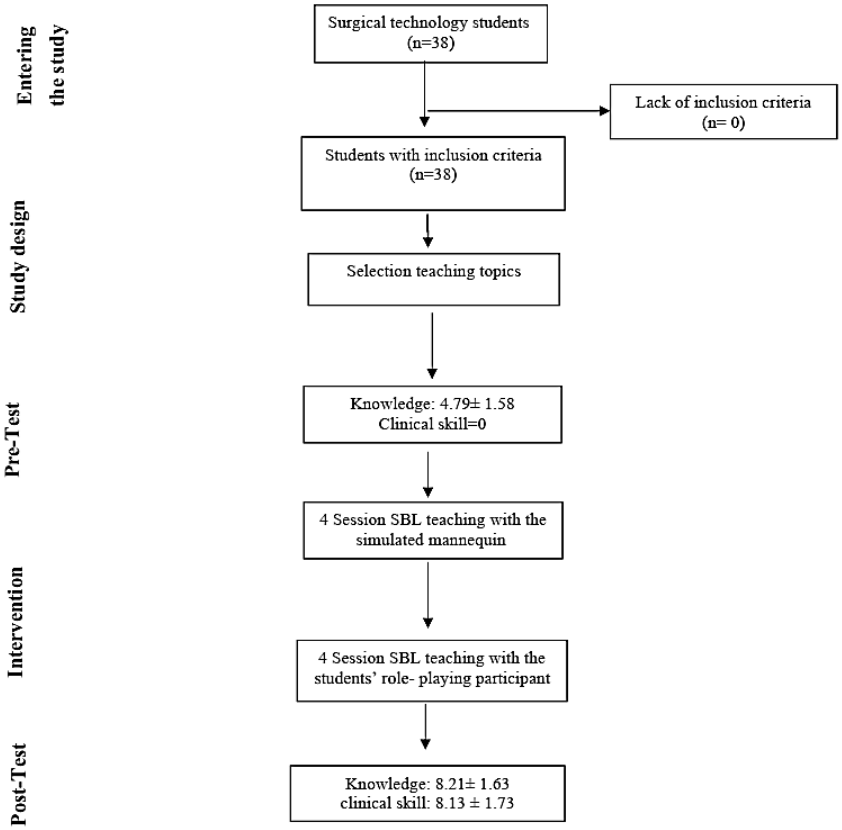

Figure 1. Study design flowchart

Results

Thirty-eight second-semester surgical technologist students with a grade point average of 15.74±1.96 participated in this study, 12 (31.58%) of whom were male and 26 (68.42%) of whom were female. The mean age of students was 19.01±1.74 years (Table 1).

The paired t-test shows the score of students' knowledge and clinical skill increased significantly after teaching (Table 2).

Table 1. General characteristics of students

Variable	Marital status		Sex		Age			
	Married	Single	Female	Male	Min	Max	SD	Mean
Frequency	1(2.7%)	37(97.3%)	26(68.5)	12(31.5)	18	21	0.88	19.3
Total	38(100%)		38(100%)					

Table 2. Comparing students' knowledge and clinical skill average scores in pre-and post -test

Assessment parameter	Pre-Test M±SD	Post-Test M±SD	t	*P**	Effect size
Knowledge	4.79±1.58	8.21±1.63	1.54	0.021**	2.13
Clinical skill	0 ±0	8.13 ±1.73	1.32	0.030**	6.64

**P* calculated by Paired t-test for intra-group comparisons
**Significant *P*

Discussion

According to the findings of this study, SBL teaching methods increased the knowledge and clinical skills of surgical technologist students. Interactive climate, knowledge sharing, and students’ participation in learning surgical positions in simulated operating room created a positive climate for students learning. Wang and collogues believe that SBL is an effective teaching method that can improve the reflective capacity and communication skills of undergraduate medical students thereby resulting in their relatively improved knowledge and performance (15). In the study of afrasiabifar & asadolah, was emphasized on the use of techniques to convert traditional lectures into interactive lectures in nursing education (16). Also, Alaafin *et al*., emphasize on interactive lectures that students are involved in teaching and learning process (17). These findings are consistent with the findings of this study. Results of Younes and *et al*’ study show too that after the SBL, knowledge and attitudes of students were significantly higher than the control group (18).

According to the findings of this study, SBL method resulted in a. Acharya *et al*., investigated simulation as an effective tool for teaching clinical medicine and discovered that the SBL method could be used to teach clinical skills very effectively (19). In this regard, the results of Baradaran-Binazir et al study confirmed the positive effect of SBL method on standard urinary catheterization (20). The results of philippon, AL and *et al*’ study show too that the simulation-based education increased student s’ self-confidence and willingness to participate in clinical education and changes in their practice (21). Lee *et al.* investigated the impact of SBL on nursing students’ clinical skills and practice that there was a positive effect on the five competencies (22). Also, result of Wang *et al*., study confirmed that SBL method significantly improves the practical or theoretical achievements of students (15). In this regard, Chang-Chiao Hung and et al in an interventional study showed that SBL is effective in improving nursing students' perceived competence, self-efficacy, and learning satisfaction (23). In the present study, teaching was conducted in four initial sessions using SBL with simulated mannequin, followed by four subsequent sessions utilizing SBL methods with student’s participant and role-playing as a patient and circular nurse, an approach emphasized by Gholine jadzirmanlou *et al*., in their study (24).

The results of the above studies are consistent with the findings of the current study. In this study, instead of learning on the just mannequin, the students laid down on the operating room table while assuming different surgical positions. In this way, they could actually experience the points under pressure or tension personally and, at the same time, could explain their experience to their peers and help them learn better. This is a strong point of study.

According to the findings of this study, the use of SBL method in teaching surgical positions helps students to understand the patient’s real condition in a simulated environment, develop their knowledge, acquire and improve their clinical skill by practicing and repeating different surgical positions in a stress-free environment. So, this teaching method is recommended to education of critical procedures such as surgical positioning in surgical technologists’ curriculum.

Limitations

As the skill of correct positioning, as well as the standards related to the prevention of serious complications associated with it, are highly dependent on anatomical knowledge, students’ prior anatomical knowledge may have influenced their knowledge in this study, which was not reviewed in this study and is considered as a study limitation .

Acknowledgements

The authors would like to thank the vice chancellor for research at Alborz University of Medical Sciences for all of support, as well as the second-semester operating room students for their collaboration with this research.

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