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RAPID COMMUNICATION

How Can We Sustain the Training Quality of Radiologic Technology Students During COVID-19 Outbreaks: A Lesson from Vietnam

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Abstract: Radiologic technology training required a substantial amount of practice. The traditional teaching approach includes in-hospital placement along with theory classes. During the COVID-19 outbreaks, clinical rotations become impossible. Direct contact with patients raises safety concerns for staff and students. The COVID-19 pandemic created unprecedented challenges for medical universities worldwide. We developed in-house simulation software that can be used for training in radiologic technology. Our preliminary results yielded good efficacy of this novel teaching approach in training radiologic technology students.

Keywords: radiologic technology, simulation-based training, COVID-19

Introduction

Simulation-based training (SBT) is a teaching method to develop and maintain clinical skills for students as well as the medical staff.[1] SBT has the advantage of allowing students to repeat technical practice numerous times without the risk of causing medical error or any increase in radiation dose for the patients and the staff.[2] This teaching method has been applied in many fields such as pilot training, surgery, and nursing.[3–7] SBT helps students to gain more confidence before performing operations at medical facilities and ensuring patient safety.[2,8,9]

Clinical instructions for radiologic technology students have traditionally been mainly carried out directly in the radiology departments, directly on patients.[10] Most students are concerned with radiation safety and medical ethics in the early days of patient contact.[11,12] During the COVID-19 outbreak, many universities remained closed for unprecedentedly long periods.[13,14] In the context of pandemic prevention, too many students gathering within the x-ray room may raise concerns about viral control.[15] Shortage of teaching staff puts pressure on management and coordination of clinical instruction. Universities worldwide have moved rapidly from onsite training to online classes.[16] Besides, applying simulation software is an alternative solution and has been used by many institutions.[3,17,18] However, commercial software is currently quite expensive with many requirements related to the infrastructure. On that basis, we developed in-house software that simulates the radiography techniques to create a virtual reality environment. This software was used for students to practice preclinically, with simulated situations that are close to clinical reality.

Methods

The Simulation Software Package

The software was built on the idea of creating an environment for students to practice preclinical within small groups to ensure disease prevention with the flexibility to practice at home. The interface was designed similarly to available commercial X-ray machines' interfaces. The tools, function keys, and user-friendly interface are designed to help students easily approach reality in pre-clinical practice sessions. The C# programming language was used to write the

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software. Regarding the learning level of the undergraduate students, we focused on common radiographic techniques such as standard posterior-anterior chest film, plain abdominal X-ray, lumbar spine, and extremities films. In addition, the software also focuses on evaluating the student's performance after each procedure. The level of completeness is notified to students by the software and scored for the entire operation on a 10-point scale, with 1 being very completely wrong and 10 being completely right. Correctly implementing the process and identifying and evaluating images is one of the important goals of the program. After performing the techniques, students were asked to self-assess the level of completion and image quality against the standards of each projection. Students performed self-assessments by selecting the criteria that match the displayed image. From there, it helps to increase students' critical thinking ability and improve clinical skills.

Preliminary Evaluation

57 full-time 3rd-year radiologic technology students participated in training sessions using the simulated software at the University of Medicine and Pharmacy, Hue University, Hue, Vietnam during the first semester of 2021. The study was approved by the Research Ethics Committee of the University of Medicine and Pharmacy, Hue University. All participants gave consent to participate in the study.

The effectiveness of the SBT practice sessions was preliminarily evaluated based on the software's automatic evaluation score (based on the proper choice of imaging parameters and the students' self-assessment of proper parameter settings) and tests before and after the SBT practice sessions with 3 main contents: chest X-ray, abdominal X-ray and lumbar spine techniques following four main assessment criteria (Table 1). Statistical analysis was performed using SPSS 20 software (IBM, USA). Paired t-tests were used to compare the student's performance before and after SBT with a p-value less than 0.05 considered to be statistically significant.

Results

Students participating in the tutorials were in the 1st semester of the third-year program in radiologic technology. The overall academic performance of the students was mainly at a good level or higher, accounting for more than 50%. The proportion of male and female students accounted for 45.6% and 54.4%, respectively. All students participated in the simulation practice class and were evaluated before and after completing the simulation practice sessions.

The assessment before and after SBT practice sessions showed that students' performance was statistically significantly improved. In particular, the basic requirements of an X-ray technique such as choosing the right imaging parameters (kVp and mAs), choosing the right distance from the source to the detector, choosing the right grid for each body part, and the ability to self-assess film standards significantly improved after SBT. The average score before the training was 7.42 (lowest score was 5, highest score was 9), and the average score after SBT was 8.16 (lowest score was 6, the highest score was 9). The number of students achieving a good score (≥8) after SBT increased from 43.9% to 84.2% (Table 2).

Discussion

Our study shows that students' performance was significantly improved after SBT. The SBT method helped students achieve basic skills in radiography without the risk of radiation exposure. Our data has shown that SBT is an effective and suitable training approach for radiology technology students.

Table 1 Assessment Criteria for Students' Performance

1. Students can generate proper X-ray images using the simulation software
2. Has the ability to adjust the parameters and optimize the image quality
3. Consciously reduce radiation dose
4. Has the ability to make a preliminary self-assessment of image quality

Table 2 Students' Performance Before and After SBT

Grade	Before SBT(n = 57)		After SBT (n = 57)	
	No	%	No	%
≤ 4	0	0%	0	0%
5–7	32	56.1%	9	15.8%
8–10	25	43.9%	48	84.2%
Total	57	100%	57	100%

In the context of the pandemic outbreak, this approach can be a solution for universities. It helps to avoid mass gatherings, which is mandatory during the virus outbreak. In addition, the SBT approach may help to resolve key challenges in radiologic technology training.[19] The special aspect of radiography that uses X-rays and other ionizing radiation requires preclinical training to avoid harmful effect on patients. Furthermore, through SBT students can raise awareness about radiation safety for medical staff and patients and develop a patient-first attitude in work processes. This helps students to better shape the work they will do and to be aware of radiation safety issues for patients as well as themselves. Previous studies have also shown that SBT can improve students' clinical skills and help students become more confident when facing clinical situations.[20]

Our study has limitations. The small number of participants may limit the statistical analysis of the efficacy of SBT. Our in-house software only provides a small number of radiography techniques and may contain technical faults. Further simulation software improvement and external validation are needed to guarantee educational quality.

Conclusion

Simulation-based training has a positive impact on radiologic technology students' performance. Our preliminary results yielded good efficacy of this novel teaching approach in training radiologic technology students. This educational approach can be the problem-solving solution for medical universities during COVID-19 outbreaks.

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Disclosure

The authors report no conflicts of interest in this work.

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