Designing training models for lumbar puncture and spinal anesthesia for the first time in Iran and using them in numerous training workshops

Mohammad Reza Afhami

Medical Education Research Center, Tabriz University of Medical Sciences, Tabriz, Iran
Afhamy_Dr@yahoo.com

Abstract: Background: Simulation has been used as an educational method since 1900 in order to teach and assess some practical syllabi. As medical science advances, it becomes more evidently necessary to stop using old educational methods. Students of various medical courses are now enjoying a range of facilities such as computer programs and other educational accessories and training aids. In fact, the age of conducting practical work directly on the patient by students is over. The present study aimed to assess the extent of elevating lumbar puncture and spinal anesthesia training by designing training models at the lowest possible cost and easy maintenance, and guaranteeing training with acceptable standards. **Materials and methods:** This part covers the details of how training models were designed. The study was conducted through holding numerous training workshops for 100 medical students. The target students were responsible for holding the workshops according to their job description. The workshops were assessed through a questionnaire with pre-test, post-test, and the instructor's observation. The questionnaire used the 6-point Likert style with 10 skill indices. The findings were analyzed using the dependent t test and P_Value <0.05 considered significant. **Results:** The results of the training workshops showed that the mean practical scores of students on the technique without using a model using 6-point Likert scale was 43.36±12.85, and increased to 85.12±10.12 after training (p=0.00). The satisfaction of the trainees was 82.65%. **Conclusion:** As the results show, the study provided the trainees with access to safe, stress-free learning. Monotony and loquacity was minimized in training sessions, which enhanced the motor skills and psychological energy of the students. It should be noted that the model has been introduced to clinical skill centers at Iranian universities and some of them have purchased the model and are using it.

[Afhami MR. **Designing training models for lumbar puncture and spinal anesthesia for the first time in Iran and using them in numerous training workshops.** *J Am Sci* 2013;9(7s):99-103]. (ISSN: 1545-1003). http://www.jofamericanscience.org. 15

Key words: Training Model, Lumbar Puncture, Training Method

1. Introduction

Simulation is a technique or a means used to recreate features and characteristics of real objects or phenomena (Durham and Alden, 2008). Using simulation as a training technique means activities that simulate a real clinical environment. Simulation uses methods like role-playing and accessories like training films and simulators for the purpose of showing the process, the decision-making and critical thinking (Jeffries, 2005). Simulation in medical science dates back to ancient times, when they would show the clinical features of diseases and their effects by simulating them on clay and stone. Modern simulation, however, dates back to World War II when it was for the first time used by pilots. Modern simulation techniques have long been employed in other branches of science like aviation, military and nuclear industries. In the past two decades, simulation techniques have been growingly used in various medical courses (Ricketts, 2011). Simulation, models and computer programs have been used for a long time to teach theories and practical skills for various medical courses. Simulation is not limited to using mechanical simulators, but role-playing, writing a scenario, case studies, etc. is all examples of simulation. Technically, an assumed problem similar to realities of the student's daily life is presented, and they are required to experience that situation and solve the problems while observing the rules of the training (Shifflet and Brown, 2006). In simulation, each and every effort is made to make the simulated situation seem like the one in reality. Thus, what is learned can be realized in the real world? The technique is used in some theoretical subjects, in the assessment of health status and particularly in practical subjects (Rauen, 2004). Students of various medical courses do clinical practices in real world situations. For this reason, if they are not skillful enough, they may cause serious physical and psychological harm to the patient. This usually causes fear among the students and reduces their confidence (Pazargadi and Sadeghi, 2011). Simulation helps the teacher save his energy and prevents him from getting exhausted. Simulation also obviates the need for lectures and helps increase experience in an environment outside the hospital with great calmness. Thus, the class is no longer monotonous nor is it teacher-oriented (Morton,

1997). It helps boost the motor skills and physical activity of students and also saves psychological energy. The advancement of medical sciences has rendered the old techniques obsolete more than ever before. Medical students enjoy access to computer-based educational programs and other training aids. Hence, in November 1993, a program was devised to make a wide range of training aids domestically for anesthesiology. This was of high significance given the fact that, for spinal anesthesia, the student must have sufficient scientific competence. This model was unveiled at the Third Congress of Anesthesia and Resuscitation in Isfahan Iran. However, its new version was made in 2007. The model is being used at different training workshops for students. It is currently available at clinical skill centers of Iranian universities. The aim was to elevate the training of lumbar puncture and spinal anesthesia for the first time in Iran using the model at Tabriz University of Medical Sciences.

2. Material and Methods

The model was designed according to human anatomy. The spine was made of waste vertebrae of the Dissection Department of Medical Faculty of Tabriz University, Iran. Certain plastic catheters were used for the epidura and the sub-arachnoid space. They were inserted between the vertebrae. Then, the mold of the upper part of the body was prepared and the vertebrae and sub-arachnoid space were placed in the mold. The upper end of the catheters was kept open so that water can be poured as cerebrospinal fluid (CSF) and the lower end was kept open so that it can be drained. Thus, during anesthesia and lumbar puncture, when the catheters are filled, the lower part is clamped. After anesthesia, the clamp is removed so that the water can be drained. As the figure shows, the model was exactly designed according to human anatomy. The student pushes the needle slightly upward to the sub-dermal tissue and ligaments toward the epidural space. This is done after they detect the cutaneous spinous processes in the middle of the space between spinous processes. After he feels the click or pop as it occurs in human being the inner part of the needle (stylet) is removed and the anesthesia medication is injected beneath dura mater. The stages of using the model at the workshop are as follows: After students were introduced to the center of clinical skills, the instructor attended the center and distributed the pre-test evaluation forms among them before the lumbar puncture. The forms were collected after they were completed. The students then began the procedure according to the hospital routine. They washed their hands before they began to work and the trainers made the procedure look like the real situation as far as possible. Then, the students were asked to brief the patient. Before putting on the gloves, the students checked the equipment, poured the antiseptic into the basin, chose the suitable needle and determined the spot of the lumbar puncture. The patient was placed in a proper position. After the students wore the gloves, they shook the powder off and covered patients back with a drape with a hole in the middle. The puncture procedure was carefully taught involving the stages of identifying the spot, the manner to insert the needle and injecting the medication. Correctly removing the needle was a separate part of the training. After the training and evaluation session, the post-test form was completed by the students. The model has been used at workshops by 100 anesthesiology residents and medical and anesthesiology students. The workshops were assessed using a questionnaire with pre-test, post-test, and the instructor's observation. The questionnaire used 6-point Likert scale with 10 skill indices of the technique. The findings were analyzed using the dependent t test and Pvalue <0.05 considered significant. An example of the lumbar puncture process is shown in figure 1.

3. Results

The results of the training workshops showed that the mean practical scores of students on the technique was 43.36 ± 12.85 before using a model and 85.12 ± 10.12 after being trained using a model. ($p=0.00$) The satisfaction of the trainees was 82.65%.

4. Discussions and conclusion

Conducting lumbar puncture successfully requires inserting the needle sufficiently though the lumbar subarachnoid space just below the spinal cord. The technique is used for diagnosing problems in central nervous system, managing and treating the problems including the lymphoreticular system tumors, removing the cerebrospinal fluid for the controlling the intracranial pressure, measuring intracranial pressure, radiological diagnosis of the central nervous system diseases and the subarachnoid nerve block. Relative and absolute contraindications for lumbar puncture include increased intracranial pressure due to brain tumors, local infection of the lumbar puncture spot, patient’s reluctance, coagulation disorders, systemic infection, advanced neurological diseases (as for spinal anesthesia). The layers covering of the spinal cord are often punctured beneath the distal part of the spinal cord. This aims to prevent damage to the spinal cord.

Figure 1- The model and stages of lumbar puncture

Therefore, risk-free locations for lumbar puncture of the inter-vertebrate spaces are L2/L3, L3/L4 and L4/L5. A line drawn from posterior superior iliac crests passes through the inter-vertebrate space L3/L4 or the fourth spinous process (Tuffier line). The spinal needle is chosen based on different factors: age, predicting a difficult puncture and the reason for the puncture (Baskett, 1994). The back of patient is washed and covered 6 to 8 centimeters around the marked spot. The puncture technique is then chosen and performed after selecting the suitable needle. Simulation is a method that was first used in 1900 as training technique. Simulations are used to make it possible for the trainee to enjoy risk-free learning without having to bear the costs and complications of real life. Educational simulation involves training elements that help the trainee gain more information or clues about the system or the environment. It includes information that cannot be obtained through other channels. Simulation is an activity that imitates the basic aspects of a real situation. It is usually used when real training is expensive, time-consuming and dangerous or it is for any reason impractical (Nickless, 2011). The word simulation means offering a stunt instead of a real thing, a process or display of the status quo.

The simulation of any phenomenon entails offering the key features or behavior of a physical or abstract system. Gilbert (1981) defines simulation as a display of the bigger thing that involves the abstract elements of the system. The main characteristics of the system must be determined by the designers and included in simulation in a simple way. The system's less significant elements are not included in simulation. Simulation underscores the need for simplifying the key elements and eliminating less important elements (Nickless, 2011). Using simulation for various medical courses helps enhance the knowledge, skill and performance of students. Students gain access to higher levels of critical thought through practice and acquire new professional skills without harming the real patients (Jeffries, 2008). Implementing the simulated scenarios by the student under special circumstances helps him to develop his skills besides gaining experience and to acquire the necessary competence without fear and anxiety. Using simulation for medical courses results in better care and produces positive results for the patient. Simulation is based on

learning principles of adults and results in the student's active participation in the learning process. It develops his problem-solving skills, critical thinking, clinical reasoning and self-confidence (Mass and Flood, 2011). Practicing frequently in a simulated environment can help students acquire correct skills and take appropriate actions when exposed to patients in clinical settings (Nehring, 2008).

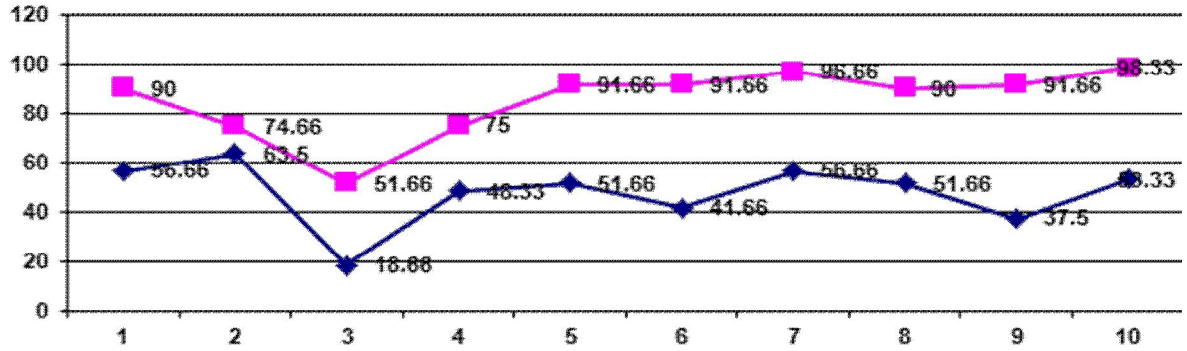

Figure 2- A comparison of the mean of the student practical knowledge on lumbar puncture technique before and after practicing

Hwansk and et al. believe that the main reason for using simulation in medical courses is safety and security of the patient and that simulation can prepare them for confronting the crisis (Hovancsek, 2009). Studies show that the knowledge acquired through simulation is lasting and the student can master the skill he needs much faster in this way (Ost, 2001). Meanwhile, learners will be more satisfied with the method (Engum, 2003; Jeffries, 2003). Simulation boosts self confidence of the student and enhances his clinical judgment and ability to solve problems (Lasater, 2007; Nehring and Lashley, 2004; Larew, 2005). Simulations of the patient and models help reduce anxiety, and facilitate mastering a skill. It decreases the number of errors and reduces the possibility of harm to the patient and it can be used at all levels of education (Smith and Roehrs, 2009). Using a model in simulation gives the student a feedback and he observes and experiences it directly. Despite its numerous advantages, simulation has some disadvantages such as its expensive equipment and need for large space. Each workshop can accommodate 5 to 10 students and it takes much time and space to achieve educational goals. Lack of sufficient academic space is a barrier to conducting the technique (Seropian, 2004). Other common challenges facing the use of simulation for educational purposes are the faculty member's lack of familiarity with simulators and how they work; the need for training and resistance against changing the educational method. King and et al. found that many faculty members of universities had not received any training on simulators and had little experience in this regard (Childs and Sepples, 2006). Simulators and in particular, simulation of the patient have been growingly used in medical sciences over the recent years for numerous reasons. Studies have shown that using the technique is also interesting and attractive for students and increases their satisfaction and confidence.

Simulation is less effective for learning conceptual principles and skills compared to traditional methods. However, it is appropriate for teaching practical and clinical skills and more easily helps students memorize what they have learned and speed up the process of mastering skills. This is the case particularly when conceptual subjects have already been taught in a different way (Zaghari, 2012). As you know, a key procedure used by the anesthesiology residents and students and medical science students is lumbar puncture, removing the spinal fluid and conducting spinal anesthesia. There are a number of very expensive models for this purpose. They are shown in Figure 3. In the event that other models fail to work, they need to be replaced by the expensive models. To this end, in November 1993, a program was devised to build a wide range of training aids domestically for anesthesia. This model was unveiled at the Third Congress of Anesthesia and Resuscitation in Isfahan-Iran. But its new version was made in 2007. The model can be provided inside Iran at a very low cost. In the event of a leak, it can be repaired quickly and used again. This is while foreign models leak after several times of use and they are put aside because they cannot be fixed, and they can, it is very expensive. The main disadvantages of educational models are their heaviness and impossibility to prevent their wearing out. It should be noted that the weight of the models was decreased from 65 kilograms to 20 kilograms thanks to the group's efforts and some changes by the producers in 2007.

Thus, it became easier to use and carry the models. Meanwhile, the flexibility of the new version of the models improved considerably. It should be noted that the model has been used in different training workshops by the medical and anesthesiology students as well as anesthesiology residents. It has been introduced to other clinical skill centers and a number of them have purchased the model and are using it. It is hoped that more advances will be made with the help and support of honorable relevant authorities.

Acknowledgements

We hereby appreciate the valuable efforts of dr.susan hasanzadeh, Mrs.parisa Golanbar, Ms. Hamideh Nouri Asl, Ms. Fariba Salek and Mr. Behzad Nasimi, the manager of Aisan Company.

Corresponding Author:
Dr. Mohammadreza Afhami
Medical Education Research Center, Tabriz University of Medical Sciences, Tabriz, Iran.
E-mail: Afhamy_Dr@yahoo.com

References

1- Durham CF, Alden KR(2008). Enhancing patient safety in nursing education through patient simulation. Patient safety and quality: Evidence – based handbook for nurses; 6(3):221-250.
2- Jeffries PR(2005). A framework for designing, implementing, and evaluating simulations used as teaching strategies in nursing. Nursing Education perspectives; 26(2):96-103.
3- Ricketts B(2011). The role of simulation for learning within pre-registration nursing education – A literature review. Nursing Education Today; 31(7):650-654.
4- Shifflet M, Brown J(2006). The use of instructional simulation to support classroom teaching: A crisis communication case study. Journal of Educational Multimedia and Hypermedia; 15(4):377-95
5- Rauen CA(2004). Simulation as a Teaching Strategy for Nursing Education and Orientation in Cardiac Surgery. Critical Care Nurse; 24(3):46-51.
6- Pazargadi M, Sadeghi R(2011). Simulation in Nursing Education. Iranian Quarterly of Education Strategies; 3(4):161-167.
7- Morton PG(1997). Using a critical care simulation laboratory to teach students. Critical care nurse; 17(6):66-9.
8- Baskett JF, Dow A, Nolan J, Maull K(1994). Practical Procedures in Anesthesia and Critical Care. Critical care nurse;1: 210-213.
9- Nickless LJ(2011). The use of simulation to address the acute care skills deficit in pre-registration nursing students: a clinical skills perspective. Nurse Education Practical; 11(3):199-205.
10- Jeffries PR(2008). Getting in S.T.E.P. with simulations: Simulations take educator preparation. Nursing Education Perspectives; 29(2), 70-3.
11- Mass NA, Flood LS(2011). Implementing High-Fidelity Simulation in Practical Nursing Education. Clinical simulation in Nursing; 7(6):229-35.
12- Nehring WM(2008). U.S. boards of nursing and the use of high fidelity patient simulators in nursing education.Journal of Professional Nurse;24(2):109-7.
13- Hovancsek M, Jeffries PR, Escudero E, Foulds BJ, Husebo SE, Iwamoto Y, et al(2009). Creating simulation communities of practice: An international perspective. Nursing Education Perspectives; 30(2): 121-125.
14- Ost D, DeRosiers E, Britt J, Fein A, Lesser M, Mehta A(2001). Assessment of a bronchoscopy simulator. American Journal of Respiratory Critical Care Medicine; 164(12): 2248 – 2255.
15- Engum SA, Jeffries P, Fisher L(2003). Intravenous catheter training system: Computer-based education vs. traditional learning methods. Am J Surg; 186(1): 67-74.
16- Jeffries PR, Woolf S, Linde B(2003). Technology-based vs. traditional instruction. A comparison of two methods for teaching the skill of performing a 12-lead ECG. Nurs Educ Perspect;24(2):70-4.
17- Lasater K(2007). High-fidelity simulation and the development of clinical judgment: Students' experiences. Journal of Nursing Education; 46(6): 269-276.
18- Nehring WM, Lashley FR(2004). Current use and opinions regarding human patient simulators in nursing education: An international survey. Nursing Education Perspectives; 25(5): 244-48.
19- Larew C, Lessans S, Spunt D, Foster D, Covington BG(2005). Innovations in clinical simulation: Application of Benner's theory in an interactive patient care simulation. Nursing Education Perspectives; 27(1): 16-21.
20- Smith SJ, Roehrs CJ(2009). High-fidelity simulation: Factor correlated with nursing student satisfaction and self-confidence. Nursing Education Perspectives; 30(2): 74-78.
21- Seropian MA, Brown K, Gavilanes JS, Driggers B(2004). An approach to simulation program development. J Nurs Educ; 43(4):170-4.
22- Childs JC, Sepples S(2006). Clinical teaching by simulation: Lessons learned from a complex patient care scenario. Nursing Education Perspectives; 27(3): 154-8.
23- Zaghari TM, Rasoli M, Sajadi M(2012). Simulation in Nursing Education. Iranian medical Journal; 12(11): 888-894.

7/21/2013