

Clinical Course Teaching in Transport of Critically Ill Patients: Small Group Methods

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Received: 19 Nov. 2015; Accepted: 04 Mar. 2016

Abstract- Critically ill patient transfer is potentially risky and may lead to morbidity and mortality. Physicians' skill is very important for safe transport. We want to evaluate the effect of clinical course teaching on the promotion of physicians' abilities in the transport of critically ill patients. In an interventional study, 320 interns, male and female, were taught about patient transfer in two groups include in one day clinical course as the small group system (n=160) and other group the lecture base learning (n=160). In the clinical course, each participant under observation of an anesthesiologist in the operation room and ICU was acquainted with mask ventilation, intubation and learned to work with a defibrillator, infusion pump, portable ventilator and pulse oximeter. In lecture group, the anesthesiologist explained the topics by video and dummy. At the end of education course, the interns' abilities were evaluated based on checklist method and scored by the project colleague in all educational items. Three hundred twenty interns, 122 males, and 198 females; were enrolled, two groups. The clinical course training caused improvements in the interns' knowledge and abilities in intubation and use of the defibrillator and portable ventilator vs.lecture group significantly ($P<0.005$). The males were better than females in laryngoscopy, but the progress of the females was significantly better than males ($P=0.003$). The rate of adverse events was reduced significantly after clinical course teaching ($P=0.041$) Clinical course teaching could promote interns' clinical competencies in the transport of critically ill patients.

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Acta Med Iran, 2016;54(9):590-594.

Keywords: Teaching; Clinical competence; Patient transfer; Critical illness

Introduction

One of the current affairs in large and general hospitals is the transport of critically ill patients for treatment and diagnosis; the patients with certain conditions such as those ones with tracheal intubation, angina, and heart failure as well as the patients with hemodynamic instability. However, transferring critically ill patients, due to averting the essential care and monitoring potential patients, is threatening to them (1), in many cases, this transfer is inevitable for treatment and diagnostic procedures. The noted risk becomes greater when the transfer is done within hospital complexes with the scattered buildings and services in diverse places. The known risk factors for incidence of adverse events include the clinical status of

the patient, organizing and indication, equipment (technical), and human factors (transfer team) (2). Despite progress in the intra-hospital transport, there are still serious risks which threaten patients' life (2-6). On the one hand, changes in the body position of the patient during the transport and his moving from one place to the other place as well as the patient's hemodynamic, respiratory, neurological, psychological conditions and pain status are factors which play significant roles in impact on the critically ill patients (7-8).

On the other hand, leaving the safe environment of the intensive care unit, changes of equipment and sound, the hardness of transport bed and treatment procedure, all can cause distress in patient and impose additional physiological stress (7,9). These disturbing factors show that having qualified teaching and clear guidelines is so

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essential for each hospital. The appearance of the known serious adverse incidents is 68% while the frequency of the events which need medical intervention is 4.2-8.9 percent (6,10).

The minor incidents are the cases including 20% reduction in physiologic status comparing to the patient's conditions before transferring and the problems caused by the equipment (6,10). The serious incidents include life threatening cases which require emergency treatment (6,10). Different studies revealed 0.34-1.6 percent of cardiac arrest among the patients (6,8,10-11). Eighty-three percent of adverse events in the patient transferring process are related to the human factors (12). In our medical centers, despite standardization of patient transfer regarding equipment, sometimes the patients' life is threatened due to the weakness of scientific knowledge and practical skills of accompanying interns and assistants that could lead to morbidity and mortality. This study by offering clinical areas of operation room and intensive care unit and performing small group teaching system aims to improve the physicians' scientific data and promote their practical skills in order to increase safety in patient transport.

Materials and Methods

Study design and setting

After approval from the Research and Ethics committee of Tehran University of Medical Sciences, code No.85100163, in an educational intervention study carried out at the Imam Khomeini Hospital Complex, Tehran, Iran, we compared the educational outcome of two different learning methods in the transport of critically ill patients.

Description of course and participants

Three hundred twenty interns, male and female, were classified two group: a) one hundred sixty persons in a one-day clinical course in small group system (2-4 intern per day during 4 months) and b) one hundred sixty persons in lecture base learning at three sessions underwent teaching of critically ill patients transport. In the clinical course, each participant under the observation of an anesthesia specialist in the operating room became acquainted with mask ventilation and intubation in patients with general anesthesia. They also became familiar with different airway devices. After learning intubation, teaching continued in ICU where the interns had to learn to work with: Defibrillator devices (modes, options, knowing arrhythmias and recognizing if they are shockable or non-shockable,

degree of suitable shock; external pacemaker, indications, and selection of output); Infusion pump (including different parts, buttons, alarms, calculation and adjusting drug dose, syringe installation and infusing drug); Portable ventilator (parts of machine, terms, and concepts, checking of oxygen capsule and connecting to ventilator, checking ventilator performance, mechanical ventilation modes, monitoring of the patient under mechanical ventilation); Pulse oximetry (portable and digital, patient monitoring by checking heart rate and O₂ saturation percent). In ICU section they also learned tracheal tube maintaining principles, fixing and suctioning, became familiar with possible accidents and knew how to deal with them under the supervision of a project colleague. Before beginning the clinical course, the participated interns had to study two articles on the critically ill patient transfer (references 1 and 2) including subjects such as patient placement for transport, transfer coordination, legal considerations, transfer conditions based on the severity and type of the illness, transfer written form and documents. All the issues were discussed at the small group teaching course. In lecture group, the speaker explained all topics theoretically with slide and showed mask ventilation and endotracheal intubation by video and dummy.

Assessment of competency

The participants' competencies evaluation was performed by a project colleague. The required questioners were filled and the interns' knowledge and skills in care and monitoring the patient, as well as intubation, working with a portable ventilator, infusion pump, electroshock and pulse oximeter devices were evaluated based on checklist method and scored by the project colleague. The questioner included 7 parts: a) Mask ventilation with 5 scores, b) Laryngoscopy and endotracheal intubation with 9 scores, c) Portable ventilator with 8 scores, d) Infusion pump with 6 scores, e) Pulse oximetry with 5 scores, f) Defibrillator with 7 scores, and g) Theoretical questions with 6 questions-score.

Statistical analysis

Results are expressed as the mean±SD of teaching score. We aimed to detect a significant difference between to the mean teaching score of two the method education with a type I error protection of 0.05 and a power of 0.80. *t*-test analysis was used for compared to two group variables and repeated measure analysis of sex effect on education outcome and Time-Sex interaction. We used chi-square for comparison the rate

Interns' promoting in patients transport

of major (death, cardiac arrest, extubation) and minor (agitation, cyanosis, hypotension, ventilator and oxygen problem) adverse events by recorded hospital information in the 40 patient-transport before and after of clinical course. Data were analyzed by SPSS version 16 and *P*.value less than 5% was statistically significant.

Results

Three hundred twenty interns (23±2-year-old) composed of 122 men and 198 women in two groups

(clinical course=160 persons and lecture=160 persons) were trained. The interns' knowledge and skills in the care of critically ill patients transport, ventilation with a mask, intubation, working with a portable ventilator, infusion pump, pulse oximeter and electroshock devices, as well as to describe understanding were assessed. Distribution of sex was same in two group (*P*=0.91). Except working with pulse oximeter device (*P*=0.69) and knowledge score (*P*=0.1), two groups had statistically significant differences in other theoretical and practical values (*P*<0.005) (Table 1).

Table 1. Comparison variables studied in two groups

Variable	Lecture group score	Smallgroup score	<i>P</i> .value
Mask ventilation Mean±sd	1.25±1.5	4.35±1.3	0.003
Laryngoscopy Mean±sd	2.39±2.9	7.77±1.5	0.000
Ventilator Mean±sd	2.81±2.1	7.35±0.9	0.002
Perfuser Mean±sd	2.51±1.6	5.9±0.3	0.005
Pulsoximetry Mean±sd	4.8±0.4	4.93±0.3	0.690
DC shock Mean±sd	3.16±1.2	6.72±0.6	0.002
Knowledge Mean±sd	5.17±1.3	5.27±0.8	0.100
Total score Mean±sd	2.76±0.8	6.04±0.4	0.000

Interns' gender did not significant effect on the differences in total average scores in two groups (*P*=0.08, OR=1.2, 95% CI=-0.51 to 2.23) as well as the scores of mask ventilation skill (*P*=0.68, OR=1.1, 95% CI=-0.52 to 3.79). In a clinical course-small group, the male interns' skill was better than female interns in laryngoscopy and intubation. Although repeated measures analysis revealed that over the course of time, the progress of females was significantly better than males (*P*=0.003) (Figure 1).

The rate of major and minor adverse events decreased statistically significant after clinical course learning in the 40 patient-transport (12.5% and 10% respectively, *P*=0.041).

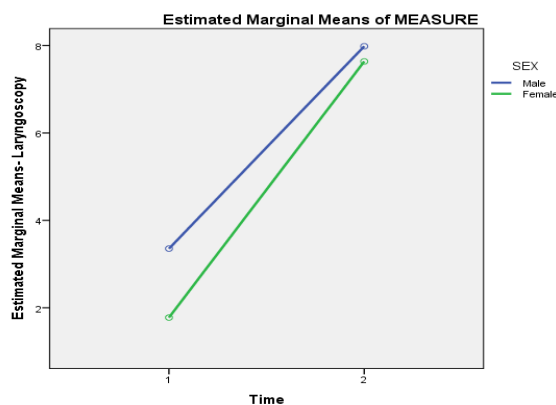


Figure 1. Sex effect on laryngoscopy and intubation education, Repeated measurement, *P*=0.003

Discussion

Despite progress in the intra-hospital transport of patients, there are still considerable risks. The incidence of specific adverse events associated with the decreasing of clinical status has been indicated from 17 to 33 percent including hypotension, arrhythmia (11,13-14) hypoxia caused by lack of coordination of ventilator or other events (11,14-15) and increasing intracranial pressure (6). Specific technical and organizational problems associated with unexpected events are between 10.4 and 72 percent in recent studies. The studies have also demonstrated that the major part of caused problems is related to the human factor (12). Lahner and Gillman (8,10) claim that low prevalence (less than 40%) of unexpected events in their study is related to the educational status and the skill of transfer physicians.

Small group system is the method that establishes a free communication between the group's leader and members as well as among members. Small group method, through face to face discussion, empowers the members in knowledge achievement from each other which is not possible in lecture method (16,17).

Basic education, good clinical evaluation, and pros and cons analysis in patient's transfer are the most influential factors that affect making a decision. A critically ill patient along with an unskilled team leads to a dangerous status and increasing several effects such as ventilator-associated pneumonia (VAP) (2,18). In addition to equipment progress and checklist use expansion, the educational program also promotes patient's safety and reduces short and long-term risks.

The physician in charge of patient transfer should have enough knowledge about the transport of critically ill patients and be familiar with the risks that threaten them. The physician also could be able to identify the risks of the patient's transfer and then make an appropriate decision. If a mechanically ventilated patient with hemodynamic instability and sedation is controlled by an unskilled team, he/she will be threatened by more risks in transport procedures. In order to minimize the unexpected events, it is essential the physician takes the required training and to have enough knowledge on the issue. The current study revealed that the physicians of our center who did not have enough knowledge and skills on the transport of patient had been more qualified by small group teaching method (Table 1). This finding has been achieved based on the Beckman's (15) and Papson's (6) study that shows a trained and experienced physician can reduce the adverse events in patient transfer. Teaching by clinical course could improve skill

abilities of physicians compared lecture method significantly (Table 1). Following small group teaching, care of the patient during transport was improved, and rate of adverse events (major and minor) were reduced up to 22.5% (80% vs. 57.5%, $P=0.041$). The evaluation has illustrated that 80.9 percent of participated interns were satisfied and very satisfied with the offered training quality in small group method vs. 32 percent in lecture group.

Mask ventilation and laryngoscopy are among those skills which are dependent on the doer's physical power and experience. Regarding the issue, men due to their more physical power were expected to have higher capabilities in the skills. To examine this belief, the effect of gender on the scores was assessed. The results uncovered that there was no difference in the skill of ventilation with the mask but in laryngoscopy, men had considerably higher efficiency from the beginning of the project in comparing to the women. Surveying effect of training on the skill promotion shows that over the course of time women indicate significantly better progress than men (Figure 1).

Statistics in Canada illustrated 7% serious morbidity and 1% mortality in intra-hospital transport while a physician in charge was attending the team (19). The patient aged over 43 and in need of $FiO_2 > 0.5$ can be a predictor of a respiratory problem at the time of intra-hospital transport (20). The incidence of adverse events announced in different studies indicates that first; transferring the critically ill patient is potentially risky, and the physician has to be careful in making a decision and should be prepared to deal with them in any respect. Second; it is multifactorial. The factors such as technical, organizational and patient factors play principal roles in the safety of the critically ill patient during intra-hospital transport and could prevent the adverse events relating to the patient's transfer. Moreover, contacting and coordination with relating ward and stabilizing the patient's condition before transferring are helpful. As well recording in a file, preparing documents for the patient and appropriate monitoring the patient during the transport are also essential in the transport of critically ill patients (1,3,5).

Inters' knowledge and skill were very low in the transport of critically ill patients in our center. Teaching by clinical course-small group method particularly could improve skill abilities of physicians compared lecture method significantly. Initially, males were better than females at laryngoscopy, but the promotion of females was better than males during training.

Acknowledgment

The authors thank the ICU and operation nurses who assisted with implementation of education course and management for the study. The Tehran University of Medical Sciences, Grant Services supported this study.

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