

# Promoting Knowledge and Practical Skills of Interns in Transport of Critically Ill Patients: Small Group Teaching Method

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**Background:** Transport of the critically ill patient is potentially risky and the transport team should be careful in making decision and be prepared to deal with them in any condition. Our physicians are not qualified in safe transport. We want to evaluate the effect of small group teaching method for promotion of physicians' skills in transport of critically ill patients.

**Methods:** In an interventional study, 161 interns took part in one day workshop planned in small group system. Each participant under observation of an anesthesiologist in operation room and intensive care unit (ICU) was acquainted with mask ventilation, intubation and learned working with defibrillator, infusion pump, portable ventilator and pulse oximeter. Their knowledge and skill was scored by pre and post tests in all items.

**Results:** In our precipitants, 62 males and 99 females; training caused improvement in their abilities about care and monitoring of patient during transport. The offered training caused improvements in the interns' knowledge and ability of intubation, ventilation and use of defibrillator and ventilator ( $P < 0.005$ ). The competency of males was better than females in laryngoscopy but progress of females was significantly better than males ( $P = 0.003$ ).

**Conclusion:** This method could promote knowledge and skill of interns in transport of critically ill patients.

**Keywords:** knowledge; skill; small group; transport; critically ill

One of the current affairs in large and general hospitals is 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 for them [1-2]. 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 scattered buildings and services in diverse places. The known risk factors for incidence of adverse events include clinical status of the patient, organizing and indication, equipment (technical), and human factors (transfer team) [2-3]. Despite

progress in the intra-hospital transport, there are still serious risks which threaten patients' life [3-6]. 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 have significant impact on the critically ill patients [8-9]. On the other hand leaving the safe environment of the intensive care unit, changes of equipment and sound, hardness of transport bed and treatment procedure all can cause distress in patient and impose additional physiological stress [8-10]. These disturbing factors show that having clear guidelines for the issue is 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% [7-11]. The minor incidents include a 20% reduction in physiologic status comparing to the patient's conditions before transferring and the problems caused by the equipments [7-11]. The serious incidents include life threatening cases which require emergency treatment [7-11]. Different studies revealed 0.34-1.6% of cardiac arrest among the patients [7,12,9,11]. Eighty three percent of adverse events in patient transferring process are related to the human factors [13]. In our medical centers, despite standardization of patient transfer regarding equipments, sometimes the patients' life are threatened due to the weakness of scientific knowledge and practical skills of accompanying interns and assistants that could lead to

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morbidity and mortality. This study by offering guidelines for transport of critically ill patients and performing small group teaching system aims to improve the doctors' scientific data and promote their practical skills in order to increase safety in patient transport.

## Methods

In an educational intervention study was carried out at the Imam Khomeini Hospital Complex, affiliated to Tehran University of Medical Sciences, Iran, during 4 month, 161 interns, male and female, took part in one-day workshop planned in small group system (2-4 persons per day). The participants' knowledge and skills were evaluated by a project colleague and the required questioners were filled. The questioner included 7 parts: a) Mask ventilation with 5 score, b) Laryngoscopy and endotracheal intubation with 9 score, c) Portable ventilator with 8 score, d) Infusion pump with 6 score, e) Pulse oximetry with 5 score, f) Defibrillator with 7 score and g) Theoretical questions with 6 questions score. At the pretest, each intern's knowledge and skill was evaluated by questioner and scored by the project colleague before start of workshop. 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 were also made familiar with different airway devices.

After learning intubation, teaching continued in ICU where the interns had to learn working with: defibrillator devices (modes, options, knowing arrhythmias and recognizing them if they are shockable or non shockable, degree of suitable shock; external pace maker, 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 O<sub>2</sub> 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 supervision of a project colleague.

At the end of the day the interns' knowledge and skills in intubation, working with a portable ventilator, infusion pump, electroshock and pulse oximeter devices (as the post test) were evaluated based on checklist method and scored by the project colleague. Before beginning the teaching, 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 workshop. The average and total earned score by interns ( $\alpha < 5\%$ ) in pre and post test in all items were analyzed by paired t-test. Thereafter with analytical method of paired t-test and repeated measures sex effect on pre/post-test score difference and time-sex interaction was analyzed.

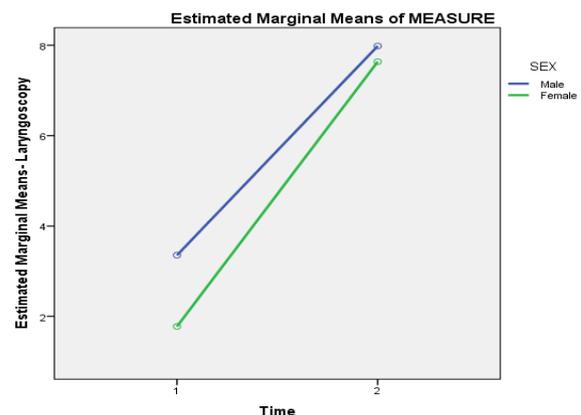
## Results

Some 161 interns ( $23 \pm 2$  years old) comprised of 62 men and 99 women were trained for four months and then their knowledge and skills in transport of critically ill patients, ventilation with mask, intubation, working with portable ventilator, infusion pump, pulse oximeter and electroshock devices were assessed. In all cases, except working with pulse oximeter device that the interns had enough skill ( $P=0.69$ ), the offered training caused improvements in the interns' theoretical and practical abilities ( $P<0.005$ ) (Table 1). Interns' gender did not affect differences in total average scores ( $P=0.08$ , 95% CI= - 0.515 to 0.030) as well as the scores of mask ventilation skill, both before and after teaching ( $P=0.68$ , 95% CI= - 0.524 to 0.798). But in laryngoscopy and intubation skills male interns received better scores comparing to the female interns. 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).

**Table 1- Comparison of variables between pretest and post test in our precipitants**

Variable	Pre-test	Post-test	P value	95% CI Lower	upper
Mask ventilation	1.31±1.2	4.31±1.6	0.015	-2.24	-2.56
Laryngoscopy	2.28±2.2	7.68±1.9	0.002	-6.68	-5.46
Ventilator	2.41±2.7	7.15±1.2	0.025	-2.34	-4.58
Perfuser	2.11±1.9	5.6±0.7	0.002	-4.29	-3.19
Puls oximetry	4.6±0.6	4.53±0.8	0.69	-0.86	0.65
DC shock	3.32±1.6	6.48±0.8	0.001	-2.68	-4.66
Knowledge	3.12±1.6	5.27±1.1	0.025	-2.76	-1.56
Total score	2.42±1.2	5.24±0.8	0.001	-4.75	-2.45

**Figure1- Gender effect on laryngoscopy and intubation education in our participants with repeated measurement ( $P=0.003$ ).**



## Discussion

Despite progress in 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% including hypotension, arrhythmia [12,14-15] hypoxia caused by lack

of coordination of ventilator or other events [12,15-16] and increasing intracranial pressure [7]. Specific technical and organizational problems associated with unexpected events are between 10.4 and 72% in recent studies. The studies have also demonstrated that the major part of problems is related to the human factor. Lahner and Gillman [9,11] claim that low prevalence (less than 40%) of unexpected events in their study is related to the educational status and the skill of transfer doctors.

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 [17-18]. Basic education, good clinical evaluation and pros and cons analysis in patient's transfer are the most influential factors that affect making 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) [3,19]. In addition to equipment progress and checklist use expansion, 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 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 to take 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 transport of patient became more qualified by small group teaching method.

This finding has been achieved based on the Beckman's [16] and Papson's [7] study that shows a trained and experienced physician can reduce the adverse events in patient transfer. The evaluation has illustrated that 80.9% of participated interns were satisfied and very satisfied with the offered training quality. 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 before and after the training. The results uncovered that there was no difference in the skill of ventilation with 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 [20]. The patient aged over 43 and in need of fraction of inspired oxygen (FiO<sub>2</sub>) > 0.5 can be a predictor of a respiratory problem at the time of intra-hospital transport [21]. The incidence of adverse events announced in different studies indicates that first; transferring the critically ill patient is potentially risky and the transfer team should be careful in making decision and

should be prepared to deal with them in any respect. Second; it is multi factorial. The factors such as technical, organizational and human factors play principal roles in 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 monitoring the patient during the transport are also essential in transport of critically ill patients [1-2,4,6].

Limitations of this study were that coordinating with different educational departments and having interns for one working day were the most important challenges in performing the project and caused difficulty in the implementation of the program. The physician's career experience such as working in emergency department is a factor that can alter the training result, though it was ignored in this project as the number of experienced ones was very low.

## Conclusion

Inters' knowledge and skill was very low in transport of critically ill patients in our center. Our center does not have any specific and focused learning about this and small group teaching improved their skills. Initially, males were better than females at laryngoscopy and mask ventilation but promotion of females were better than males at training during.

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