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Endotracheal intubation training to medical practitioners: Comparison of the modified 4-step Payton's training method and Halsted's training method in a simulated environment

Majid Zamani, Mohammad Nasr-Esfahani, Mostafa Forghani, Mohammadreza Asadollahian Sichani, Athar Omid¹

Abstract:

INTRODUCTION: The ability of physicians to perform endotracheal intubation by laryngoscope is one of the essential skills. The purpose of this study was to evaluate the effectiveness of the four-step python training method with the Halsted's "See one, Do one, and Teach one" training method in endotracheal intubation competency in simulated environment.

MATERIALS AND METHODS: This quasi-experimental study was performed on two independent groups with posttest. The statistical society consisted of eighth-semester medical students referred to the emergency medicine unit. The experimental group received a modified four-step python's training method that modified for small groups, and the control group received the Halsted's "See one, Do one, and Teach one" training method. Researcher-made checklist used to rate participant competency as posttest. Data were analyzed using SPSS 19 software.

RESULTS: Sixty-seven students volunteered for the experimental group and 57 students for the control group. In posttest, the experimental group more competent than the control group significantly ($P < 0.001$). Furthermore, the training course satisfaction of the experimental group was significantly higher than the control group ($P < 0.001$).

DISCUSSION AND CONCLUSION: Modified python training method for small groups has shown a better effect on student performance. This finding is consistent with previous researches. Modified four-step python's training for small group with an emphasis on peer to peer teaching and receiving feedback from peer can be related to the effectiveness of this training. Further research is recommended in other clinical education settings.

Keywords:

Cardiopulmonary resuscitation, endotracheal intubation, medical student, simulation training, teaching method

Introduction

The ability to do cardiopulmonary resuscitation is essential for physicians and graduate students. Establishing a proper airway is the first step in cardiopulmonary resuscitation procedure. Tracheal intubation is one of the safest and

assured ways to manage airways. For some patients, tracheal intubation is necessary for postcardiopulmonary resuscitation observations. In the recent years, combitubes have removed the need for laryngoscope in tracheal intubation.^[1] However, combitubes are expensive and are not available in all centers. They cannot be used for infants and

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Department of
Emergency Medicine,
Al-Zahra Hospital, Isfahan
University of Medical
Sciences, ¹Department
of Medical Education,
Medical Education
Development Center,
Isfahan University of
Medical Sciences, Isfahan,
Iran

Address for correspondence:

Dr. Athar Omid,
2nd Floor, Department
of Medical Education,
Medical Education
Development Center,
Isfahan University of
Medical Sciences,
Isfahan, Iran.
E-mail: athar.omid@
gmail.com

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children. Tracheal intubation is still the easiest, cheapest, and the most common way of airways management in all the hospitals. Learning tracheal intubation with laryngoscopy is essential though it was seen that physicians' capability to do it was not acceptable.^[2]

Mastering the tracheal intubation on a real patient is actually the accepted capability, but for moral observations students should learn it in a simulated environment. In simulated environments, students suffer less pressure, and mistakes have less damages on their self-confidence.^[3] The best way of learning tracheal intubation by juniors is training in a simulated environment, studies show.^[4-6]

Besides providing a good environment for learning, there should be methods of training which help the students have a deeper and more robust understanding of articles so that students forget contents less.^[2] In this regard, more studies show that durable learning is not very much in tracheal intubation, and thus, more interactive methods of learning are recommended.^[7] The four steps method of Payton is one of the methods introduced to teach practical clinical skills.^[8] These four steps include demonstration, deconstruction, comprehension, and execution. Some researches imply the effectiveness of these methods in practical skills,^[9,10] and some do not^[11,12]. For learning tracheal intubation this four steps approach is recommended.^[13,14] In catheterization training for medical students, some modifications are done on the fourth steps on small group of trainees, and it is implied that this method is applicable for instructors and was welcomed by students.^[15] Expanding the third step from the fourth Payton step by instructors was recommended in former studies.^[16] The aim of this study is to evaluate the effectiveness of modified for steps Payton approach of skill training for small groups of interns learning tracheal intubation.

Materials and Methods

This quasi-experimental study was done on two groups with posttest. The study was done on two independent groups of medical students (interns) in Esfahan Medical College. These students had just Enter Clinical Centers from October to December 2018. During that semester, interested students joined a group called control group. There was a second group from students who Entered Clinical Centers between March and April 2018. This group of students entered the study as experiential group. Both experiential and control groups were divided into 10-member group for training. Participating in this study was voluntary. Those students who were not interested in the study received training as usual and no posttest was given. The procedure and method of doing the study was illustrated in chart 1.

Method of training in 2 groups

Experiential groups were trained with Payton four steps approach, and each 10-member group was trained in separated days. The four steps were such that in the first step students watched intubation on a special maquette with real speed like real condition of becoming present on the patient by trainer, then the trainer talked for 2 min about the skill. In the second step, the trainer did the training job step by step with low speed and mentioned all the clinical hints in each step did the intubation with the maquette. In third step, students one by one did step by step intubation procedure on maquette. While getting the training each student were obliged to talk about important clinical points with other students and the trainer. In the fourth step, the trainer with the help of other students, helped under training students and weaknesses, and strengths point were told. Feedback for correct and incorrect activities was given to the students. During these activities, students continuously watched other students doing intubation. At the end of the course, each student with classmates exercised the skills and got feedback from them. The method of training in control group is known as Halsted "See one, Do one, Teach one" approach. In control group, first all students watched an educational movie about intubation, and at the same time, the trainer explained all the clinical details. After the movie, students saw the trainer doing stepwise intubation on model or maquette. In the next step, all the students one by one did the skill and explained to group members.

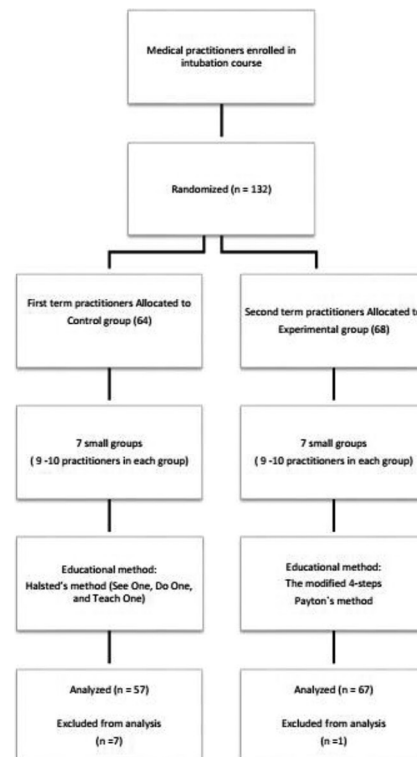


Chart 1: The Consort diagram of this study

Both groups were being trained in the clinical skills learning center. Ninety minutes were spent for every 10-member group. Trainers for courses for all groups were EM assistants. Trainers were taught about the training approaches, and finally, proficiency of trainers was confirmed by two board members of the education service.

Data collection tools

Data collection tool was a designed checklist named "Direct observations of tracheal intubation skill registrations." Using this checklist, we could see if students did the 16 steps of tracheal intubation with laryngoscopy or not. These skills include preparing the tools and patient, doing laryngoscopy, tracheal intubation, and checkings. When the student did each step with an acceptable and proper speed got 2 scores, if the speed was not acceptable 1 score was given, and 0 was for inability to do the job. Domain scores were between 0 and 32. Five EM board members gave credit to the content and formal validity of the forms. Observing and score giving was done by one of the EM assistants who could not identify, control, and interfere. The assistant received cautions and instructions before the study, and to be qualified to monitor and evaluate the students, forms were filled by the assistant for 30 anesthetic technicians who were in course in the surgery ward. Pearson correlation coefficient was used between scores given by the tester assistant and EM specialist to know about sustainability of the tester. The value calculated was 0.88. Eventually, the assistant was appointed as the final examiner and arbiter for the study. Pretest was not done in this study due to a lack of knowledge and experience in students. To perform posttest in this study, at the end of the semester, all the students in the clinical center did the intubation in the presence of an examiner; and the same time, checklists were filled out. All the students from all groups of training methods at the end of the study took part in a survey and were polled by filling a form with 18 questions which indicated their opinions about the study. The answer to each question was a Likert scale 5 points about the quality of training. Points from 18 to 90 of the mentioned questionnaire indicated the student's satisfaction from the methods. Formal and content validity of forms were acknowledged by five scientific delegation board members. The sustainability of this tool in Cronbach's alpha test was 0.86. To reduce the side effects of the posttest on satisfaction of students, the survey was done before the posttest. Results of this study were analyzed by SPSS version 23 (IBM Corp, Armonk, NY, USA) (a statistical software package). Independent *t*-test was used to do comparison between posttest marks and survey results. Pierson test was used for accreditation between age and posttest marks and survey results.

Results

The number of students entering the clinical center was 64 in the first semester, and 68 in the second semester. In the first semester, 57 expressed consent to participate in the study and joined as control group. Seven students did not become present in posttest. Forty percent of participants in control group were male. The average of ages was 25.67 ± 0.97 years. Sixty-eight persons were in the second semester who expressed consent to be in the study and formed the experiential group. One student was absent in the posttest and was removed from the study. Sixty-eight percent were male, and the average of ages was 25.39 ± 0.96 years. In both groups, none of the students had former clinical experience and doing intubation independently. Results of the posttest are illustrated in Table 1. Average and standard deviation of marks in Payton four steps group were 30.09 ± 1.16 . Average and standard deviation of marks in control group were 26.6 ± 2.14 . Independent *t*-test shows a meaningful difference between results of two groups. These results show that experiential group had better functionality. Correlation test results show that total score or mark of the intubation skill test and satisfaction rate does not have explicit relation with the age of students. In the two groups of experiential and control using independent *t*-test, it was seen that total score or mark of intubation skill test and satisfaction rate in both genders were almost the same. Results of comparisons of students' opinions about methods of training are illustrated in Table 1. Payton for steps group gave scores with average and standard deviation of 74.52 ± 12.94 in the survey. The control group gave scores with average and standard deviation of 57.67 ± 10.81 in the survey. Independent *t*-test showed big difference in the two groups. The experiential group expresses more satisfaction about the training. Observers of the study saw more interactions in the Payton four steps group. In this method, students were obliged to explain the skill to other students. Participants of the Payton four steps group called cooperative learning a pleasant experience in this course.

Discussion

This study was done to evaluate the effectiveness of the two clinical methods on the skillfulness of medical students in tracheal intubation using laryngoscopy.

Table 1: Comparisons of averages of intubation skill proficiency marks and satisfaction rates between two groups using independent *t*-test

	Experimental group	Control group	<i>t</i>	df	<i>P</i> value
Intubation skill	30.09±1.16	26.6±2.14	10.36	122	001/0>
satisfaksin	74.52±12.94	57.67±10.81	7.78	122	001/0>

Results of the study show that functionality of students participating in trained with Payton four steps method was better than those who were in control group. These results are consistent with former studies on this issue.^[9,10,15,17] It should be mentioned that the group which was trained with Payton four steps method expressed more satisfaction about learning. In Payton, four steps method doing a clinical skill step by step together with explanations while doing the skill job helps modulation of knowledge and practice. Modulation of knowledge and practice leads to sustainable learning in this training method.^[17] In this method, students in turn are placed in the position of the teacher or instructor and experience cooperative teaching and learning. They always keep their attentions high.^[18] The second step of this method emphasizes reducing a complicates skill to smaller steps. Reducing skill to smaller steps is a good solution in learning complicated skills.^[19] The third step is the most important one and has been emphatic in the modifications to the method. The illustration of mind done in the third step helps deeper learning.^[20] Explaining and describing how you do the skill job to other students deepens learning.^[21] Through comprehension and execution phase, the students receive feedback from their classmates and help them correct their mistakes and learn important points.^[22] Modifying Payton four steps method for smaller groups leads to improvement of effectiveness. Training small groups have several advantages. Students are very active while learning. They are either learning or teaching from or to their classmates.^[23] Teaching in and training small groups needs special skills.^[24] In this study, there is no probability of release of intervention, and if there is it is not considerable. The control group had been trained first and was not aware of intervention. Biased choices were little in this study because many of EM students were voluntary to be in the study. In the second semester, all the students were volunteers, and only one student was removed because of absence in the posttest.

Conclusion

Results of this study indicate that Payton four steps method with modification has more effectiveness in small groups than Halsted "See one, Do one, Teach one" method in learning tracheal intubation skill with laryngoscopy to medical students. It is suggested that in future studies and researches effectiveness of this method on the speed of tracheal intubation and the amount of damages to soft tissues in other clinical environments be evaluated. In addition, effects of this training career in making sustainable learning of graduated physicians and keeping the knowledge along time should be evaluated.

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Conflicts of interest

There are no conflicts of interest.

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