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An Effective Training Program for Chest Tube Drainage for Medical Interns in a Clinical Simulation Laboratory

Akinobu Yoshimura[1–3], Seiji Kosaihira[2,3], Taisuke Morimoto[2], Chol Kim[3,4], Takaya Tsueshita[3,4], Kohji Adachi[1,5], Ryoko Aso[1,3], Toshiro Shimura[1,3], Hiroshi Nakano[6,7] and Akihiko Gemma[2]

[1]Academic Quality and Development Office, Nippon Medical School
[2]Division of Pulmonary Medicine, Infectious Diseases and Oncology, Department of Internal Medicine, Nippon Medical School
[3]Working Committee of Clinical Simulation Laboratory, Nippon Medical School
[4]Department of Anesthesiology, Nippon Medical School
[5]Department of Neurosurgery, Nippon Medical School
[6]Training Center for Medical Interns, Nippon Medical School Hospital
[7]Division of Geriatrics, Department of Internal Medicine, Nippon Medical School

Abstract

The Department of Respiratory Medicine of Nippon Medical School Hospital and the Working Committee of Clinical Simulation Laboratory have held training sessions for chest tube drainage since 2007. The training program consists of the preparation of a training manual, a small-group session, and a review of the process of chest tube drainage using a checklist of steps after the session. A total of 21 medical interns of Nippon Medical School Hospital participated in training sessions from April 2010 through February 2011. A questionnaire survey at the end of the session revealed that most participants rated highly both the explanations given by the instructors and the descriptions in the manual for comprehensibility. Only 3 interns felt that they had successfully acquired the clinical skill, and the other 18 interns felt that they had somewhat acquired the skill. Research after the interns had completed the program of the department showed that 80% of interns had performed chest tube drainage for patients during the rotation. The interns assessed the training program as useful, and some interns felt they could perform the skill with confidence or without anxiety. Other systematic programs of skill training for medical interns are recommended to ensure definite acquisition of basic skills.
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Key words: training program, chest tube drainage, medical interns, clinical simulation laboratory

Correspondence to Akinobu Yoshimura, Academic Quality and Development Office, Nippon Medical School, 1–1–5 Sendagi, Bunkyo-ku, Tokyo 113–8603, Japan
E-mail: ay1004@nms.ac.jp
Journal Website (http://www.nms.ac.jp/jnms/)

Introduction

Educational programs for medical interns have been provided by all teaching hospitals and university hospitals since the new training system for clinical interns was established in Japan in 2004[1]. A stated objective of internship programs is for interns to acquire clinical skills, including airway management, cardiopulmonary resuscitation, collection of blood samples from vein and artery, lumbar puncture, and tracheal intubation[1].

Clinical skills training early in medical internship would be of great benefit, from the viewpoints of both motivation and risk management[2]. Therefore, since 2007, the Working Committee of the Clinical Simulation Laboratory has been holding training sessions designed to improve the clinical skills, such as tracheal intubation, chest tube drainage, and lumbar puncture, of newly recruited medical interns[3,4]. In the beginning, participants in the training programs were recruited without relation to the skills relevant to each department. Since 2010, however, they have gotten a workout of skill associated with the department from the standpoints of the motivation of medical interns and educational effects. The Department of Respiratory Medicine of Nippon Medical School Hospital and the Working Committee of Clinical Simulation Laboratory have held training sessions for chest tube drainage, based upon the established program, for medical interns since 2007.

We describe an effective training program, which consists of the preparation of a training manual, a small-group session, and a review of the process of chest tube drainage using a checklist of steps after the session. We also present the results of a questionnaire survey conducted at the end of training and at after the interns had completed the program of the department.

Subjects and Methods

We have held training sessions for chest tube drainage for medical interns, who are assigned to the Department of Respiratory Medicine, since April 2010. It was recommended that interns perform chest tube drainage for patients during rotations in the department. Before the training session, all participants are required to read the training manual, in which the objectives, principal anatomy, indications, devices and medical agents used, and the procedure and complications of chest tube drainage have been described by one of the authors (Morimoto) (**Table 1, 2**). After the training session, medical interns are required to review the process of chest tube drainage using a checklist of steps. Furthermore, they are required to have basic surgical skills, particularly suturing.

Table 1 Contents of the training manual for chest tube drainage

1	Objectives
2	Principal Anatomy
3	Indications
4	Devices and medical agents used
5	Procedure
	positioning of incision
	sterilization
	local anesthesia
	incision
	blunt dissection
	insertion of chest tube
	securing with sutures
	removal
6	Complications

Training sessions were held every 2 months in a clinical simulation laboratory and were attended by 3 or 4 interns each time. The simulator (Chest Drain Simulator, Nihon Light Service, Inc., Tokyo, Japan), a disposable chest drainage set (Akiyama Medical Mfg. Co., Ltd., Tokyo, Japan), and a 20-Fr trocar catheter (Covidien Group Japan, Tokyo, Japan) were used (**Fig. 1**). All procedures, including the positioning of incisions, sterilization, local anesthesia, incisions, blunt dissection, insertion of the chest tube, securing it with sutures, and removal, were performed under supposedly aseptic condition using actual surgical instruments (**Fig. 1**).

At the end of the training session, medical interns were required to complete a questionnaire survey in which they answered 4 questions using a 4-point scale (1=poor, 4=good). The 4 items in the questionnaire were as follows: Q1: "Were the

Table 2 The procedures of chest tube drainage (Abstract)

1 Positioning of incision
In the case of pleural effusion, the chest tube is placed (on the correct side) in the midaxillary line at the upper border of the rib below the intercostal space between the 5th and the 7th ribs. A mark should be made at the incision site after an echo-free space is checked with ultrasonography.
2 Sterilization
The skin over the area of insertion is first cleaned with an antiseptic solution, such as iodine, before sterile drapes are placed around the area.
3 Local anesthesia
A local anesthetic is infiltrated under the skin along the line of the incision. The needle is then directed perpendicular to the skin, and the local anaesthetic is infiltrated through the layers of the chest wall down onto the rib below the intercostal space. The needle is advanced slowly until fluid is aspirated in cases of pleural effusion. A sufficient volume of local anesthetic is then injected into the pleural space.
4 Incision
An incision is made along the upper border of the rib below the intercostal space to be used.
5 Blunt Dissection
The drain track will be directed over the top of the lower rib to avoid the intercostal vessels lying below each rib. The track is developed by blunt dissection
6 Insertion of chest tube
The chest tube is passed along the track into the pleural cavity.
7 Securing with sutures
Once the tube is in place, it is sutured to the skin to prevent it falling out, and a dressing is applied to the area. The tube is connected to an underwater seal. A chest X-ray film is obtained to confirm placement and position.
8 Removal
The tube should be removed either at the end of expiration or at peak inspiration, to avoid further air being entrained into the pleural cavity. The area is cleaned and sterilized, and the incision is sutured.

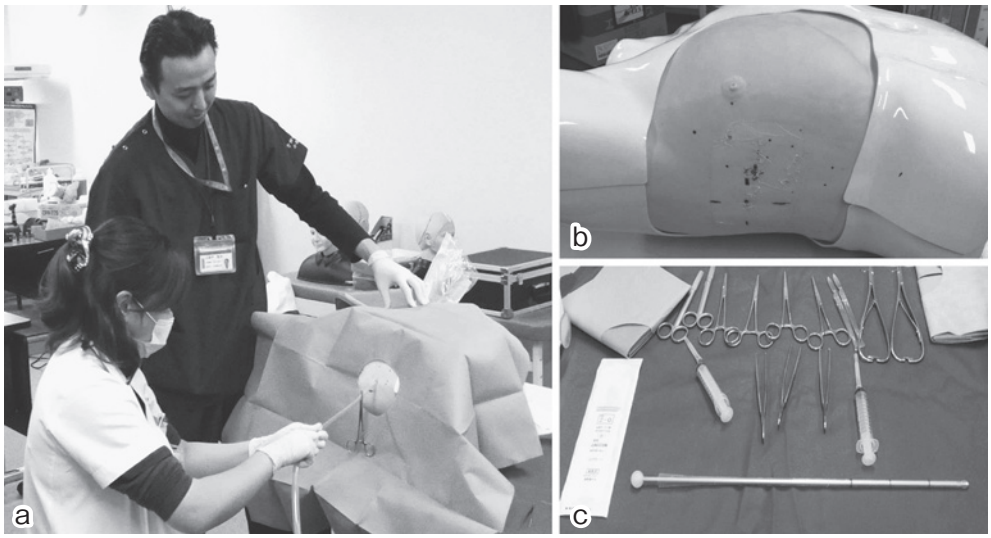

Fig. 1 Photographs of training session of chest tube drainage (a), chest drain simulator (b), and surgical instruments (c).

instructions comprehensible?" (i.e., comprehensibility of the instructions); Q2: "Were the descriptions in the manual comprehensible?" (i.e., comprehensibility of the manual); Q3: "To what extent did you acquire clinical skills?" (i.e., acquisition of clinical skills); and Q4: "To what extent were you content with the session?" (i.e., contentment with the session).

After the interns had completed the program in the Department of Respiratory Medicine, we asked them about their experience of chest tube drainage and the value of the training session. As to the value of the training session, the interns answered the question using a 4-point scale (1 = not valuable, 2 = not very valuable, 3 = almost valuable, 4 = valuable).

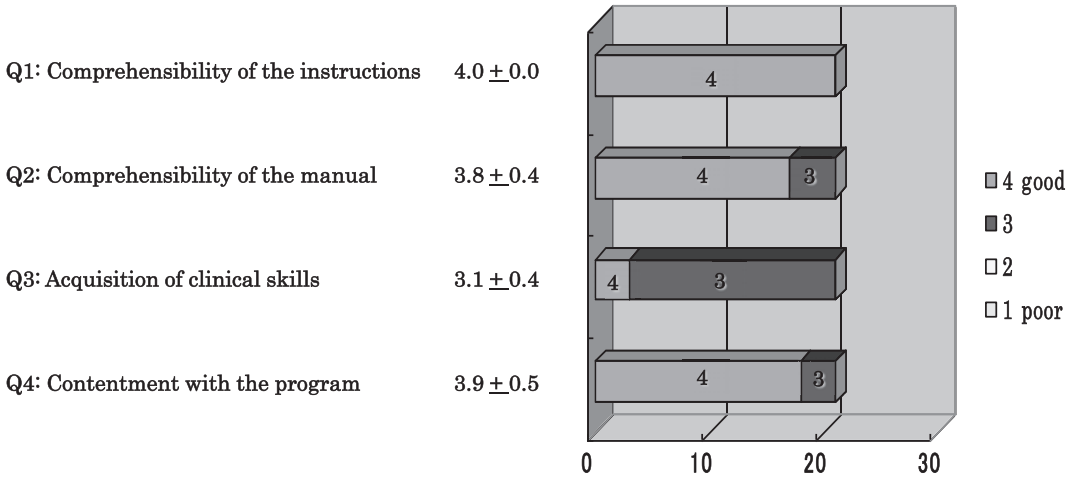

Fig. 2 Results of questionnaire survey at the end of the training session
After they had completed the training session, the medical interns were required to complete a questionnaire survey in which they answered 4 questions using a 4-point scale (1 = poor, 4 = good).

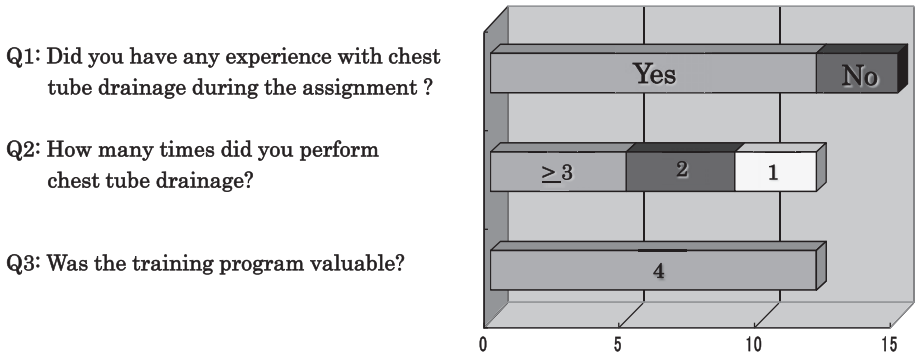

Fig. 3 Results of questionnaire survey at the completion of the program of the Department of Respiratory Medicine
After the interns had completed the program in the Department of Respiratory Medicine, we asked them about the experience of chest tube drainage and the value of the training session. As to question 3, the interns answered using a 4-point scale (1 = not valuable, 2 = not very valuable, 3 = almost valuable, 4 = valuable).

Results

A total of 21 medical interns of Nippon Medical School Hospital, consisting of 20 first-year interns and 1 second-year intern, participated in training sessions from April 2010 through February 2011. After an instructor performed orientation according to the training manual, all participants practiced the process of chest tube drainage under the supervision of 2 instructors (**Table 1, 2**). The entire session lasted 90 minutes and consisted of 30 minutes of orientation and 60 minutes of skill practice in most settings.

All 21 medical interns answered a questionnaire survey distributed at the end of the training session. The mean scores were as follows: Q1: comprehensibility of the instructions, 4.0; Q2: comprehensibility of the manual, 3.8; Q3: acquisition of clinical skills, 3.1; and Q4: contentment of the session, 3.9 (**Fig. 2**). All participants considered that explanations given by the instructors to be easily understandable. Seventeen interns thought that the descriptions in the manual were easily comprehensible. Although only 3 interns felt that they had successfully acquired the clinical skill and the other 18 interns assessed that they somewhat acquired the skill, 18 interns were satisfied with the

program.

Upon completion of the program 15 of the 21 interns answered questions about the experience of chest tube drainage and the value of the training session (**Fig. 3**). Twelve interns (80%) had performed chest tube drainage for patients during the rotation. Three, 4, and 5 interns had performed chest tube drainage in 1 patient, 2 patients, or 3 or more patients, respectively. Of the 12 interns who had performed chest tube drainage for patients, all assessed the training program as useful.

We received much feedback from the participants. The main remarks were as follows: appreciative words, the need to improve the simulator, convenient time schedule, confidence in performing the skill, and requests for training sessions for other clinical skills, such as central venous catheterization and management of mechanical ventilation.

Discussion

We have described a systematic and effective training program and presented the results of a questionnaire survey conducted after the end of the training and after the interns had completed a rotation in the Department of Respiratory Medicine.

Simulation-based education has been identified as an effective educational method because of the safe environment, proactive and controlled training, trainee/team/system-centered education, feedback and debriefing-based education, and a reproducible, standardized objective[5]. All healthcare professionals have a responsibility to provide appropriate treatment and to assure patients' safety and well-being. Simulation-based medical education can be a valuable tool for reducing these ethical tensions and practical dilemmas[5]. Multiple studies have demonstrated the effectiveness of simulation in the teaching of basic science and clinical knowledge, procedural skills, teamwork, and communication and in assessment at the undergraduate and graduate levels[6]. Simulation-based medical education leads to greater improvements in procedural skills than does standard training or no training at all[7].

Since the change from medical student to intern is a big cultural leap for newly recruited medical interns, we have held training sessions for clinical skills for newly recruited medical interns since 2008 as a component of organized orientation programs[3]. Moreover, consecutive training programs for tracheal intubation, chest tube drainage, and lumbar puncture have been held since 2007. We chose these basic skills as being appropriate for medical interns.

In the beginning, participants in the training programs were recruited without relation to the skills relevant to each department. Since 2010, however, they have gotten a workout of skill associated with the department from the standpoints of the motivation of medical interns and educational effects.

In the questionnaire survey provided at the end of the session, most participants considered that both the explanations given by the instructors and the descriptions in the manual were easily understandable. Only 3 interns felt that they had successfully acquired the clinical skill, and the other 18 interns assessed that they had somewhat acquired the skill. The medical interns attributed their inability to acquire the skill to the insufficient quality of the simulator, especially the fragile and rubbery skin. In simulation-based medical education, the reality of the simulator is an important factor in increasing the educational effect. The simulator must be improved to promote the effects of simulation-based medical education. However, we were pleased that 18 interns (86%) were satisfied with the program.

After completing the program in the Department of Respiratory Medicine, 15 interns filled out the administered questionnaire. Twelve interns (80%) had performed chest tube drainage for patients during the rotation, and 5 interns had done so for 3 or more patients. The respondents also assessed the usefulness of the training program. Some interns remarked that they could perform the skill with confidence or without anxiety.

Although medical interns are permitted to freely use the Clinical Simulation Laboratory and are recommended to perform voluntary skill-training, they do not take sufficient advantage of the laboratory. Taylor has reported that undergraduate training in procedural skills is inadequate and has

recommended comprehensive training programs and techniques for quality assurance[8]. In a similar manner, Boots et al have advocated that both mandatory supervision of key skills and opportunities to supplement limited experience are needed during the intern year to ensure a uniform experience[9]. The Training Center for Medical Interns of Nippon Medical School Hospital has held training sessions for central venous catheterization since 2010. Systematic programs for skill training for medical interns are recommended to ensure definite acquisition of basic skills.

We have described here a systematic and effective training program for chest tube drainage held by the Department of Respiratory Medicine and the Working Committee of the Clinical Simulation Laboratory.

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