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Multipurpose Simulator for Technical Skill Development in Thoracic Surgery

Yvonne M. Carter, M.D.,[1] Brette M. Wilson, RN-MS, Erin Hall, M.D., and M. Blair Marshall, M.D.

Division of Thoracic Surgery, Georgetown University Medical Center, Washington, DC

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Background. **Our appreciation for the increased role of simulation in surgical education has led us to develop a simulator for effective training of fundamental invasive thoracic skills.**

Materials and Methods. **Study subjects were fourth year medical students (MS-4, $n = 6$) rotating on a surgery clerkship, and surgical interns (PGY-1, $n = 6$). All subjects completed demographic surveys and rated their comfort level performing the thoracic skills. A computerized instructional module was given to all participants. Additionally, interns attended a boot camp with didactics, live demonstrations, and supervised practice sessions. Subjects were asked to perform a thoracentesis and insert a chest tube on the models, repetitively, during three sessions, and their skills were rated. Participants were asked to rate their comfort levels performing the procedure before and after the sessions.**

Results. **Interns reported a greater exposure to surgery (9.7 ± 3.2 wk *versus* 6 ± 1.8 wk; $P = 0.03$). Although interns were initially faster, operative times were comparable by the third session. Initially, technical skill ratings for thoracentesis were significantly lower in the MS-4 group ($P < 0.03$). The scores significantly increased by the final simulation ($P \leq 0.04$), and were similar to the PGY-1 skill ratings. Significant improvement with chest tube placement each week ($P \leq 0.05$), resulted in scores comparable to the intern group as well. Both groups reported higher comfort levels after the simulation sessions.**

Conclusions. **Our simulation trainers were effective educational tools for fundamental thoracic procedures. Our study demonstrates improved technical skill and higher comfort levels with the simulated procedures.**

[1] To whom correspondence and reprint requests should be addressed at Division of Thoracic Surgery, Georgetown University Medical Center, 3800 Reservoir Road, NW 4 PHC, Washington, DC 20007. E-mail: ymc01@gunet.georgetown.edu.

Key Words: **simulation; thoracentesis; chest tube; education.**

INTRODUCTION

The statement, "the operating room is not the place to learn new techniques" is more valid now than ever. The replacement of the well-established apprenticeship model of surgical education to competency-based programs impose new challenges for surgical educators to both teach and assess skill proficiency. This fact is exemplified by recommendations such as FLS certification–cognitive and manual skill assessment for those opting to perform laparoscopic procedures as part of their practice. Such assessment of technical skills is necessary with competency-based training.

Educational researchers have shown that adequate skill development is dependent on deliberate and repetitive practice, assigned level-appropriate tasks, and immediate feedback for error correction [1, 2]. Leaders in surgical education appreciated the ability of simulation laboratories to offer all these necessities in a low stress learning environment. Consequently, surgical training programs are now required to provide and integrate skills and simulation facilities [3]. Although not yet mandated, simulation has the potential to have an invaluable role in subspecialty training as well. The present study describes the development and evaluation of a high fidelity simulator effective in technical skill development utilized in invasive thoracic procedures.

MATERIALS AND METHODS

Study Design

A prospective cohort study was designed to evaluate a bench-top simulation of two basic cardiothoracic surgery procedures to train

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FIG. 1. Simulated chest wall segment constructed of a 4–5 rib segment and thin felt covering a taut bag of intravenous fluid. The model is then enveloped in a piece of Ioban2 sealant. (Color version of figure is available online.)

junior trainees. Approval for the study was obtained from the institutional review board, and informed consent was obtained from each participant prior to enrollment. Demographic information was obtained from a pre-study questionnaire.

Study Setting and Population

Six fourth year medical students (MS-4) and six surgery interns (PGY-1) were enrolled in the study from July 2009 to August 2009, evaluating a thoracic simulator developed to teach thoracentesis and thoracostomy tube insertion. All subjects were provided a computerized instruction manual, which included step by step pictorial modules for both procedures. One month before the study, the PGY-1 group participated in boot camp orientation, which included instructional lecture, observation of both procedures performed by a thoracic surgeon on the models, and supervised practice on the simulators with immediate feedback from a thoracic surgeon.

THORACENTESIS/THORACOSTOMY TUBE INSERTION

ITEM	Not Done/ Done Incorrectly	Done Correctly
Thoracentesis		
1. Chest radiograph interpretation (effusion vs. lobar collapse)	0	1
2. Selects intercostal space to enter pleural cavity	0	1
3. Inserts needle above the selected rib	0	1
4. Aspirates during needle insertion	0	1
5. Seldinger technique for catheter insertion	0	1

Start Time: _____End Time: _____ Total Time:_____ Score:__

_____

Notes:

Thoracostomy tube		
1. Chest radiograph interpretation (pneumothorax vs. large bullous)		
2. Appropriate (size/direction) incision made	0	1
3. Clamp used to bluntly enter pleural space	0	1
4. Pleural space entered above the selected rib	0	1
5. Sutures tube in place	0	1

Start Time: _____ End Time: _____ Total Time:_____ Score:_____

Notes:

FIG. 2. Procedure-specific scales to assess the performance of specific skills. A value of 0 is given if the task is either not done or performed incorrectly, whereas a 1 is assigned if the task is correctly performed. Maximum score is 5 for each procedure.