Development and Implementation of a Best Practice Training Program to Reduce Complications of Tube Thoracostomy Placement by Emergency Medicine Residents and General Surgery Residents

Morsal Tahouni, MD; Chaitan Narsule, MD, Kerry McCabe, MD, Tracy Dechert, MD Patricia Mitchell, RN, James Feldman, MD, Peter Burke, MD, Brian Carmine, MD, Joe Blansfield, RN, Elizabeth Wallace, MD, Allison Jaworski, MD, Elena Cotto, Ron Medzon, MD

BACKGROUND

- Many BMC departments have trainees who perform tube thoracostomy
- The largest trainee groups performing tube thoracostomy are Emergency Medicine residents and General Surgery residents
- There is no standardized checklist for the procedure.
- Major complications due to tube thoracostomy include injury to the lung, infection, some requiring surgical intervention, increased hospital length of stay, and worse patient outcomes.

Project Scope

- Emergency Medicine residents and General Surgery residents were selected to receive training using a TraumaMan tube thoracostomy simulation trainer in the Solomont Center for Clinical Simulation and Nursing Education

AIM

Objectives

- Develop new protocol for resident placement of tube thoracostomy
- Implement educational program to introduce protocol
- Provide training to faculty and residents on the protocol
- Ensure that the program is integrated into the yearly resident training

Project outcome metrics

- Documented training of faculty and staff
- Measurable decrease in the complications related to tube thoracostomy procedure

METHODS

- Inter-professional team researched tube thoracostomy best practice from the literature

- Developed protocol using modified Delphi method
  - First draft of protocol was disseminated to every BMC physician who performs tube thoracotomy, to obtain their input
  - Final draft incorporated all improvements

- Curriculum included:
  - Creation of educational video (special thanks to Rafael Ortega, MD, Vafa Akhtar-Khavari, dept. of Anesthesia)
  - Development of training checklist
  - Documentation of training through HealthStream learning management system
  - Scheduling of a four-hour simulation program using TraumaMan simulator to:
    - Teach procedure and protocol
    - Allow learners to perform skills under observation by attending-level physicians and senior residents
    - Provide feedback

SOLUTIONS

- Process improvement
  - Standardization of procedure and practice across departments
  - New protocol requires a more senior operator to oversee the procedure using checklist

- Standardization of training
  - Video and checklist were disseminated to the Emergency Medicine residents and General Surgery residents
  - Jointly targeting Emergency Medicine and General Surgery faculty and residents will foster increased adherence to the procedure and checklist
  - Secondary gain of better interdisciplinary communication during work due to training together

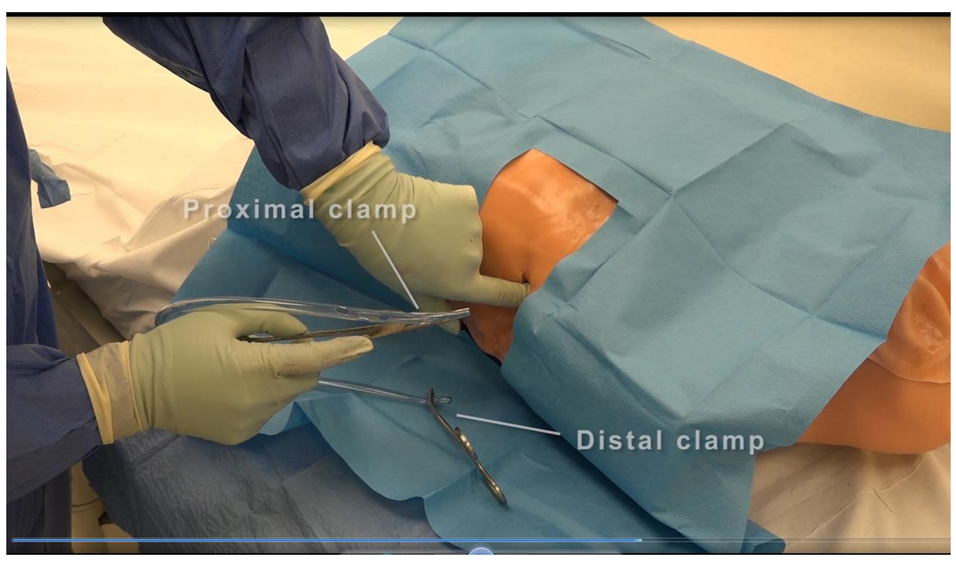

Figure 1: Still shot from tube thoracostomy training video developed by team and disseminated online to Emergency Medicine residents and General Surgery residents

Tube Thoracostomy Checklist

Patient, operator, and equipment preparation

- ❑ Indications for procedure, and laterality, confirmed
- ❑ Operator and physician senior to operator identified to supervise
- ❑ Informed consent obtained, including explanation of procedure, risks, benefits
- ❑ Time out performed
- ❑ Insertion equipment organized
- ❑ Chest tube size selected: 28 Fr.
- ❑ Closed chest drainage system opened and prepped
- ❑ Prophylactic antibiotics administered
- ❑ Appropriate site chosen and marked with marking pen
- ❑ Clinician sterilizes hands and dons full barrier equipment (automatic fail if not completed)
- ❑ Chest wall prepped with Chlorhexidine or Betadine
- ❑ Chest wall draped with appropriate anatomy visible (nipple in men, inframammary fold in women)
- ❑ Site anesthetized with local anesthetic (1% lidocaine with epinephrine)

Procedure

- ❑ Operator confirms with supervisor incision line drawn with non-sterile marking pen
- ❑ Adequate incision is made (no larger than 3.5 cm or 1.5 in)
- ❑ Tissue-spreading technique utilized to dissect through subcutaneous fat
- ❑ Additional local anesthetic injection applied to block intercostal nerve
- ❑ Tissue-spreading technique utilized to dissect through intercostal muscles and enter pleural space
- ❑ Digital confirmation of entry into pleural space (parietal pleura and lung is felt)
- ❑ 28 Fr chest tube placed and positioned
- ❑ Chest tube is sutured in place (wound reapproximated as necessary)
- ❑ Chest tube is connected to closed chest drainage system
- ❑ Tubing connections reinforced with tape.
- ❑ Insertion site dressed with petroleum gauze, gauze sponge, and tape.
- ❑ Tape mesentery placed to attach distal tube to anterior thorax.

Post-procedural tasks

- ❑ Obtains CXR
- ❑ Procedure note
- ❑ Clean up of sharps

Figure 2: Tube thoracotomy checklist developed by team and disseminated to Emergency Medicine residents and General Surgery residents

RESULTS

- A new training program was developed
- Online curriculum content was created
- An educational video was created and distributed via the Internet
- First training session was held in July of 2017 for Emergency Medicine residents
- A joint Emergency Medicine and General Surgery trauma simulation session was adapted to introduce the tube thoracostomy program to 67 trainees
- General Surgery has scheduled future sessions of this training
- Emergency Medicine and General Surgery are coordinating their educational schedules to integrate Emergency Medicine and General Surgery faculty and residents into future programs

NEXT STEPS

- Plan for sustainability of program (e.g., scheduling, resourcing)
- Description of additional work to be completed
- Once all teams have been trained, complication rate from tube thoracostomy to be reviewed for any improvements in outcome
- Plan for expansion of program into other departments as appropriate

CONCLUSIONS

- Our robust training curriculum with visual aids and checklists has improved the teaching and performance of tube thoracostomy at BMC
- Interdepartmental simulation sessions between Emergency Medicine residents and General Surgery residents were useful in introducing the video and checklist to a broader audience and had a secondary benefit of improving communication between the two groups
- Best results will be obtained if this program continues and expands so that everyone who performs tube thoracostomy at BMC will have trained using this standardized program
- Lessons learned
  - Development and implementation of standardized protocols is difficult, especially when multiple departments are involved
  - There are significant barriers to implementation of a single training program across departments, including scheduling conflicts among individual staff and between the residency programs
  - It is crucial to have champions in each participating department