Regions EM Residency Invasive Procedure

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Background

The EM Residency Review Committee (EM-RRC) requires EM residents to perform certain numbers of procedures during their residents. While our patient population allows for ample opportunities to perform many of these procedures (i.e. central venous access, endotracheal intubation), other procedures are done rarely, if at all. Examples of these procedures include, but are not limited to cricothyroidotomy, resuscitative thoracotomy and diagnostic peritoneal lavage. Historically, the EM residency has utilized live animal labs (fully anesthetized sheep that are humanely euthanized after procedural training) in order to best recreate clinical scenarios and psychomotor feel for training EM residency in rare, invasive procedures. This allowed for intensive demonstration and practice in a low student:teacher ratio setting. Due to budgetary and ethical concerns, we are now unable to use live animals. This document describes the steps we are taking to best recreate procedure labs for EM residents

Short Term Plans

To date, no EM residents have completed procedure labs in the 2009-2010 academic year. One resident did have an individualized lab, but that was simply doing her intern lab a little bit late. We are not in a position to drastically change the format of the labs as we already nearly half-way through the academic year. In the short-term, we are simply focusing on changing the models on which the residents are practicing the procedures. We will focus on the most important invasive and/or rare procedures.

Long-Term Plans

While this time is challenging, it provides a wonderful opportunity to evaluate how we teach and assess procedural competency in EM residents. Lessons learned from this endeavor can be translated to medical student education and practicing physician continued procedural competency. We are assessing changes in lab format, models, instructor materials, preparatory material for learners.

Models

HealthPartners Clinical Simulation has numerous part-task trainers available for use in these labs. These models are fairly portable, allowing flexibility in time and location. The Regions EM residency and department also have a few part-task trainers. See Table One.

Table One: currently available part-task trainers within HealthPartners

HealthPartners Clinical Simulation	Procedures that could be done
Blue Phantom Head, Neck, Torso	US-guided central venous access
CentraLineMan	US-guided central venous access
Lumbar Puncture Trainer	Lumbar Puncture, Opening Pressure
Blue Phantom Paracentesis Trainer	Paracentesis, US-guided

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	chest tube insertion (small and large bore)
Laerdal Airway Head	Endotracheal Intubation, digital intubation, flexible bronchoscopy, LMA, King, iLMA
METI AirSim	Endotracheal Intubation, digital intubation, retrograde intubation, LMA, King, iLMA, certain types of cricothyroidotomy, transtracheal needle jet ventilation
Joint models	arthrocentesis (shoulder, elbow, knee, wrist)
PROMPT	vaginal deliveries (complicated and normal)

Regions Hospital EM Residency	Procedures that could be done
AirSim	Endotracheal Intubation, digital intubation, retrograde intubation, LMA, King, iLMA, certain types of cricothyroidotomy, transtracheal needle jet ventilation
Laerdal IV torso	Central Venous access - non-US-guided
Laerdal Pelvis	vaginal deliveries
Nita Newborn	neonatal vascular access

Procedures for 2009-2010

Airway

- Endotracheal intubation with endotracheal tube introducer
- Airway adjuncts
    - Intubating Laryngeal Mask Airway
    - King LT Airway
    - Combitube
- Surgical airway options
    - Retrograde intubation
    - Transtracheal needle jet ventilation
    - Cricothyroidotomy
    - Tracheostomy

Breathing

- Needle thoracostomy
- Pigtail catheter for pneumothorax
- Tube thoracostomy

Circulation

- Central venous access
    - Internal jugular
        - landmarks
        - ultrasound
    - subclavian
    - femoral
- Arterial line placement
- Intraosseous needle placement - all sites
- Venous cutdown
- Transcutaneous pacing

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- Defibrillation
- Resuscitative thoracotomy

Other

- Suprapubic catheter placement
- Diagnostic peritoneal lavage

Airway

Our residents have ample opportunities for intubations in the ED. In this lab, we will focus on procedures done in difficult airway situations. We will use airway trainers from HP Clinical Simulation and the residency to allow practice of intubation with an ET introducer as well as the insertion of various airway adjuncts such as the iLMA and King Airway. We will using a pig trachea in a fiberglass mold for transtracheal need jet ventilation, retrograde intubation, cricothyroidotomy and tracheostomy.

Breathing

The thoracentesis trainer owned by HP Clinical Simulation has insertable plates that allow the user to perform needle thorcostomy and insert a variety of chest tubes. With three users each doing 1-2 chest tubes, we will likely exhaust a lateral pad every one or two labs. We may be able to insert chest tubes in the fiberglass torso, which may be more cost-effective than replacing the $158 pad each lab.

Circulation

Central venous access: We will use the models and US machine owned by HealthPartners Clinical Simulation. We also have anatomic models that are helpful for instruction.

Intraosseous access: Intraosseous trainers have been using in chicken legs. The models also come with simulated bones. I will shop in grocery stores for other suitable analogs for adult tibia, femur and humerus.

Arterial line and venous cutdown: These are grouped together only because the model for each will be very similar. For venous cutdown, I casted a leg, then removed that cast. I placed a simulated vessel along the course of the greater saphenous vein. I then wrapped that in cast padding and an ACE wrap to simulate subcutaneous tissue and skin.

Thoracotomy: One of the main reasons we continued to use the live animal model so long was the fact that there are no commercially available trainers for the resuscitative thoracotomy (also known as the ED thoracotomy). We are developing a model for this as well as other invasive procedures. We modeled a human torso out of fiberglass and cut out several areas for procedures. An opening in the left lateral chest has been made. Simulated ribs are made out of oven-hardening clay so that the rib spreader could be used. Intercostal muscles will be replicated with cut portions of steak. Rip-stop nylon will serve as the parietal pleural. Tube thoracostomy could theoretically be performed on this model. A new "rib cage" will need to be made each time. For the internal thoracic anatomy, several schools have adopted the use of the "pluck". This is the larynx, trachea, lungs and heart of a pig. These organs are procured from a slaughterhouse that was already butchering the livestock. We are being charged $10 per pluck. We purchased 15 for the 2009-2010 academic year. These freeze well, so we bought in bulk and will thaw one out as needed.

bring over a mannequin for transvenous pacing. However, right now it seems like too much effort the small amount of time we'd be using it. *Transvenous pacing is a work in progress*.

Other

Suprapubic catheter placement and diagnostic peritoneal lavage will also be done on the fiberglass torso through an small elliptical cut-out. To simulate closed access to the peritoneum and/or bladder, we will stretch out a piece of latex band over a cup filled with the appropriate simulated body fluid.

Budget

Replaceable parts

- Blue Phantom thoracentesis trainer anterior pad $158
- Blue Phantom thoracentesis trainer lateral pad (non-ultrasoundable) $158

Model Fabrication

- Oven-bake clay - $45 for 8 pounds (should last all year)
- floral wire for connecting the ribs
- pasta roller for softening the clay
- fabric for abd wall

Animal tissue

- steak for intercostal wires
- Pluck - Pig trachea, lungs, heart, pericardium and aorta ($10 each)

Facility/Other department usage

- HealthPartners Clinical Simulation