Medical simulation has been a transformative force in medical education. Through the use of increasingly sophisticated technology, we are now able to simulate everything from yearly family doctor visits and simple procedures to complex operations such as heart surgery. Now more than ever, simulation is an essential tool for delivering the highest quality training, and it can be particularly valuable to physicians who teach in the acute care setting, where it is not always possible or practical to allow students to learn by working directly with patients.

This book is written and designed specifically to guide medical educators in emergency medicine on how to integrate medical simulation into their teaching and achieve optimal results. Inside you’ll find:

- Clinical cases drawn from faculty at major teaching centers, formatted and annotated so that they can be tailored to novice or advanced learners and easily deployed in a diverse range of settings.
- Cases that cover the full spectrum of EM pathology.
- Valuable ‘tips or tricks’ accompanying images and patient data.
- A Companion Website including imaging and laboratory results pertinent to each case study – presented in Powerpoint format for easy download; video clips to simulate sonogram results.

An invaluable new resource for training emergency physicians, nurses, and EMTs/paramedics, Emergency Medicine Simulation Workbook: A Tool for Bringing the Curriculum to Life provides a roadmap to the unique educational benefits of medical simulation along with a wealth of material educators can adapt for use in their own teaching and assessment portfolios.

Also of Interest

A companion website with additional resources is available at: www.wiley.com/go/thoureen/simulation/workbook

The website includes: Imaging and laboratory results for each case study – Powerpoint format for printing out, downloading, or real-time use during simulation sessions; Video clips to simulate sonogram results for ruptured ectopic pregnancy.
Emergency Medicine Simulation Workbook

A TOOL FOR BRINGING THE CURRICULUM TO LIFE
Companion website

This book is accompanied by a companion website:

www.wiley.com/go/thoureen/simulation/workbook

The website includes:

- Imaging and laboratory results pertinent to each case study.
- Powerpoint format suitable for printing out, downloading, or real-time use on-screen during the simulation session.
- Additional video clips to simulate sonogram results are presented for the ruptured ectopic pregnancy case study (Chapter 8).
Emergency Medicine Simulation Workbook

A TOOL FOR BRINGING THE CURRICULUM TO LIFE

Edited by

Traci L. Thoureen, MD, MHS-CL, FACEP
Sara B. Scott, MD

Clinical Assistant Professors
Department of Emergency Medicine
University of Maryland School of Medicine
Baltimore, MD
Contents

List of contributors, vii

Foreword, xi

James A. Gordon

1 Introduction: How to use this book, 1

Traci L. Thoureen and Sara B. Scott

2 Vascular emergencies, 3

Sarah B. Dubbs and Traci L. Thoureen

3 Resuscitation emergencies, 28

Albert T. Nguyen, Dustin D. Smith, T. Kent Denmark,
Andrew Bard, and James W. Rhee

4 Gastrointestinal emergencies, 53

Corey R. Heitz and Raymond P. Ten Eyck

5 Renal/electrolyte emergencies, 85

Sara B. Scott and Catherine Pettit

6 Endocrine emergencies, 107

Sarah Farris

7 Environmental emergencies, 129

Moira Davenport

8 Obstetric emergencies, 154

Torrey A. Laack

9 Pulmonary/critical care emergencies, 178

Heather Mahoney and Ani Aydin

10 Toxicologic emergencies, 203

Rodney Omron, Harry E. Herverling, and Andrew I. Stolbach

11 Pediatric emergencies, 226

Jacqueline Nemer and Sandrijn van Schaik
List of contributors

Ani Aydin, MD
Resident Physician
Bellevue/NYU Langone Emergency Department
New York, NY

Andrew Bard
Medical Student
Loma Linda University School of Medicine
Loma Linda, CA

Moira Davenport, MD
Assistant Professor
Associate Residency Director
Allegheny General Hospital
Drexel University College of Medicine
Pittsburgh, PA

T. Kent Denmark, MD
Medical Director, Medical Simulation Center
Associate Professor of Emergency Medicine and Pediatrics
Associate Professor of Basic Science
Department of Emergency Medicine
Loma Linda University
Loma Linda, CA

Sarah B. Dubbs, MD
Resident Physician
University of Maryland Medical Center
Baltimore, MD

Sarah Farris, MD
Assistant Professor
Department of Surgery
Division of Emergency Medicine
Duke University
Durham, NC

Corey R. Heitz, MD
Assistant Professor of Emergency Medicine
Boonshoft School of Medicine
Wright State University
Dayton, OH

Harry E. Heverling, DO
Resident Physician
Johns Hopkins Hospital
Baltimore, MD

Torrey A. Laack, MD, FACEP
Assistant Professor of Emergency Medicine
Mayo Clinic
Rochester, MN
List of contributors

Heather Mahoney, MD
Assistant Professor
Assistant Residency Director
Bellevue/NYU Langone Emergency Department
New York, NY

Jacqueline Nemer, MD, FACEP
Director of Simulation Education
Emergency Medicine Associate
Professor of Emergency Medicine
Department of Emergency Medicine
University of California, San Francisco
San Francisco, CA

Albert T. Nguyen, MD
Resident Physician
Loma Linda University Medical Center
Loma Linda, CA

Rodney Omron, MD, MPH
Assistant Residency Director
Department of Emergency Medicine
Johns Hopkins Hospital
Baltimore, MD

Catherine Pettit, MD
Resident Physician
University of Maryland Medical Center
Baltimore, MD

James W. Rhee, MD, FACEP, FAAEM
Assistant Program Director of Emergency Medicine Residency
Assistant Professor and Director of Medical Toxicology
Loma Linda University Medical Center
Loma Linda, CA

Sara B. Scott, MD
Clinical Assistant Professor
Department of Emergency Medicine
University of Maryland School of Medicine
Baltimore, MD

Dustin D. Smith, MD
Associate Professor of Emergency Medicine
Program Director, Emergency Medicine Residency
Loma Linda University Medical Center
Loma Linda, CA

Andrew I. Stolbach, MD
Assistant Professor
Department of Emergency Medicine
Johns Hopkins Hospital
Baltimore, MD

Raymond P. Ten Eyck, MD, MPH
Professor of Emergency Medicine
Director of Simulation
Boonshoft School of Medicine
Wright State University
Dayton, OH
Traci L. Thoureen, MD, MHS-CL, FACEP
Clinical Assistant Professor
Department of Emergency Medicine
University of Maryland School of Medicine
Baltimore, MD

Sandrijn van Shaik, MD, PHD
Assistant Clinical Professor and Associate Fellowship Director
Pediatric Critical Care Medicine
University of California, San Francisco
Director of Education, Kanbar Center for Simulation, Clinical Skills and Telemedicine
Education Director of Pediatric Transport, UCSF Benioff Children’s Hospital
San Francisco, CA
The growth of technology-enhanced simulation training in health care over the last decade represents a transformative era in the history of medical education. No longer do “time and chance” clinical encounters alone dictate the experiential training profile of the learner; rather, realistic clinical scenarios can be animated through a combination of advanced technology and role-play, creating a safe and standardized environment in which to practice care of even the sickest patients.

This latter concept – caring for the sickest patients in the safest environment – captures a unique intersection between Emergency Medicine and modern simulation-based learning. Only with the benefit of advanced simulation tools can the sickest patients be realistically portrayed for real-time teaching and learning. This creates a unique opportunity for educators in the field of Emergency Medicine to make important contributions to modern medical education, across disciplines. This book, essentially providing a ready-to-deploy experiential curriculum that touches all specialties, represents just such an advance.

The synergy between Emergency Medicine and simulation education is not only practical, but also highlights important aspects of human cognition and learning theory that we are only just beginning to understand. Encountering a critically ill robot simulator, as paradoxical as that may sound, can reliably stimulate a unique level of emotional engagement among learners. This kind of intense engagement, in and of itself, provides a foundation for critical thought, action, and memory that many associate only with key moments of actual clinical experience – but without any of the inherent risk to real patients. Not surprisingly, medical simulation is becoming a core element of the global patient safety effort, and simulation practice across all fields is increasingly viewed as a quality and safety imperative.

While this book represents an invaluable resource to any Emergency Medicine educator, it also provides a roadmap to help all medical educators explore the unique benefits of medical simulation. The cases chosen for inclusion are drawn from a diverse group of faculty authors across a wide range of medical teaching centers, and represent a full spectrum of pathology. The material is formatted and annotated so that cases can be tailored to novice or advanced learners, and easily deployed in a diversity of settings. Key “tips or tricks” are included to accompany case images and other patient data which complete the compendium, allowing for standardized use as part of a tailored teaching and assessment portfolio.

I have been fortunate to witness the evolution of modern simulation in health care from a handful of pioneering initiatives to a unified specialty field that is flourishing across the globe. This book represents a movement to consolidate and distribute
lessons learned during this period of extraordinary growth, providing a key tool to make simulation more accessible to all medical educators.

James A. Gordon, MD, MPA

Director, MGH Learning Laboratory
Chief, Division of Medical Simulation
Department of Emergency Medicine
Massachusetts General Hospital
Director, Gilbert Program in Medical Simulation
Associate Professor of Medicine
Harvard Medical School
Boston, MA
CHAPTER 1  Introduction: How to use this book

Traci L. Thoureen and Sara B. Scott
University of Maryland School of Medicine, Baltimore, MD

Simulation has become an integral tool in medical education and the specialty of emergency medicine (EM) is no exception. Simulation curriculums have increasingly become integrated into standard EM training. In fact, as of 2008, one study reported that of 134 EM residencies surveyed in the United States, 91% used some form of simulation in their postgraduate training.1

With increasing utilization of simulation as a teaching tool, there has been more demand from educators for workshops and training that focus on how to teach using simulation. This workbook is designed with those demands in mind. It is meant to act as a “lesson plan” for physician educators to use at the “bedside” in the simulation laboratory or in any space that is used to conduct simulation.

This workbook is organized with the basic clinical competencies of EM in mind. The chapters incorporate topics listed by the American Board of Emergency Medicine as included in the certification examination. Each chapter includes 3–4 individual simulation cases that highlight subject material pertinent to the chapter topic. In many of the cases, alternative options are described for use with multiple levels of learners (students, junior or senior postgraduate learners).

Although each individual simulation case is unique, the presentation format for all of the cases is the same. The layout for each case starts with specific educational objectives for that case, together with a list of suggested critical actions. For those who are working within the United States postgraduate training system, we have notated the relevant Accreditation Council of Graduate Medical Education (ACGME) clinical competencies for each learning objective and critical action.

Immediately following the critical actions, you will find an outline for the case set-up. This includes a description of the physical environment, mannequin, props, distractors, and actors that are recommended for each simulation. To aid in the case set-up, an online resource is provided with this workbook (at www.wiley.com/go/thoureen/simulation/workbook) and includes imaging and laboratory studies pertinent to each case. The online resource is presented in a PowerPoint format and can be printed out, downloaded, or shown in real time on computer screens/monitors during the simulation session.

After the section on set-up, you will find a brief narrative of the case, which essentially contains the information found on most emergency department triage sheets. There is a description of the initial mannequin conditions and a case narrative which details the changes in conditions that will occur in the mannequin after a specific time...
interval or in response to a learner intervention. Accompanying flow sheets also outline the general sequence of actions for each case.

Throughout the case, you will see text boxes. These text boxes highlight specific details in the case that can be altered based on the degree of fidelity of your mannequin or on the skill level of your learner. In this way, each case can be manipulated to fit your teaching needs and available resources.

At the end of each case, you will find information to aid in debriefing. Instructor notes provide basic background information for your facilitators about the specific case topic. There is also a list of potential questions that can be used during the debriefing session with your learners. Finally, you will find a list of selected reading that can be used in preparing for the simulation and some are suitable to be distributed to learners either prior to or following the simulation.

We hope that you will find this workbook a useful tool in the development or continuation of a successful emergency medicine simulation curriculum at your institution. Keep in mind that each simulation case is dynamic and can be modified in a variety of ways to suit best the needs of your learners and/or the fidelity of your mannequin. As such, this workbook provides a basic template for the design of an emergency medicine simulation curriculum for learners at any stage in their education and for facilities with varying levels of technical capability.

Reference

CHAPTER 2  **Vascular emergencies**

Sarah B. Dubbs and Traci L. Thoureen  
University of Maryland School of Medicine, Baltimore, MD

**Pulmonary embolism**

**Educational goals**

**Learning objectives**

**Primary:**
1. Recognize clinical signs of pulmonary embolism (PE) [*Medical Knowledge*].
2. Order appropriate diagnostic tests for PE [*Medical Knowledge*].
3. Order appropriate treatment for PE and its complications [*Medical Knowledge, Patient Care*].

**Secondary:**
1. Demonstrate professionalism and communication skills in consultation with other physicians and in working with ED nurse [*Interpersonal and Communication Skills, Professionalism*].
2. Direct proper disposition to/appropriate consultation with the ICU [*Systems-based Practice*].

**Critical actions checklist**

☐ Assess airway, breathing, and circulation [*Patient Care*]
☐ Place patient on cardiac monitor and establish IV access [*Patient Care*]
☐ Order CT angiography (or locally appropriate imaging) and recognize signs of PE [*Medical Knowledge*]
☐ Initiate proper therapy: (1) heparin and/or thrombolytic for PE, (2) high-flow oxygen/non-invasive positive-pressure ventilation/intubation for hypoxia, and (3) IV vasopressor for hypotension/shock [*Medical Knowledge, Patient Care*]
☐ Call and communicate to ICU for disposition [*Interpersonal and Communication Skills, Professionalism*]

Critical actions can be changed to address the educational needs of the learner. For example, a resident preparing for the oral board examination may have more specific critical actions such as ordering a pregnancy test before radiologic imaging, etc.
**Simulation set-up**

*Environment:* Emergency Department treatment area.

*Mannequin:* Simulator mannequin, on a stretcher or hospital bed. Mannequin should be female, moulaged with left leg swelling.

This moulage may be accomplished in both high and low-tech ways. You may purchase SimLeggings\textsuperscript{TM} (Eriter Creations, Stirling, AB, Canada) or, for a lower tech version, nude-colored self-adherent elastic wrap can be placed overtop of memory foam ($\frac{1}{4}-\frac{1}{2}$ inch) with nude pantyhose on top, or simply a label or photograph of your desired appearance can be placed on the extremity.

*Props:* To be displayed on plasma screen/computer screen or printed out on handouts in scenario room when asked for/return from laboratory.

- Images (see online component for Pulmonary Embolism, Scenari 2.1.ppt, at www.wiley.com/go/thoureen/simulation/workbook)
  - ECG with sinus tachycardia.
  - Chest X-ray showing normal cardiac silhouette.
  - CT angiography of chest showing right-sided PE.
  - Venous Doppler ultrasound of left leg showing deep venous thrombosis.
- Labs (see online component as above)
  - Complete blood count.
  - Chemistry panel.
  - Coagulation panel.
  - Urinalysis.
  - Urine pregnancy test.
  - D-dimer.

*Available in the treatment room:*

- Basic airway and code cart.
- High-flow face mask.
- Medications:
  - Liter bags of 0.9% normal saline (NS) and lactated Ringer’s (LR).
  - Rapid sequence intubation (RSI) medications pre-labeled in syringes (paralytic and induction medication of choice for your institution).
  - Heparin in pre-labeled liter bag.
  - Thrombolytic typically utilized at your institution.
- Non-invasive positive pressure airway equipment (BiPAP or CPAP).

*Distractor:* None.

*Actors:*

- Husband (optional). Available to provide additional information either in person or via telephone.
- Patient voice is female. Patient should sound short of breath, speaking in truncated sentences at the beginning of the scenario.
- ED nurse can start IVs and administer medications/fluids. The nurse does have some medical knowledge base and may cue learners if needed.
- ICU physician can be available via “phone consultation.”
Case narrative

Scenario background
A 27-year-old female with shortness of breath and pleuritic chest pain that started this morning. She used her albuterol inhaler a few times this morning without any improvement in her symptoms. She reports a mild cough and chest discomfort with the cough. No fever or orthopnea.

Background may be presented prior to case, by husband, or given as a triage sheet.

CC: Shortness of breath.
PMH: Asthma.
Meds: Albuterol inhaler, oral contraceptive pill.
Allergies: None.
Family Hx: Unremarkable.
Social Hx: Smokes one pack per day, occasional alcohol, no illicit drugs. She was recently married and returned one week ago from honeymooning in Europe (she lives in the United States).

Travel history can be volunteered or given only if asked to adjust to level of learners.

Initial scenario conditions
Patient is tachypneic, anxious:
“I just...can’t...breath...it hurts...it feels...tight...”

VS: Temp. 37.5 °C (99.5 °F), HR 118, RR 24, BP 110/60, O₂ sat 91% RA.
Heart: Tachycardia, no murmurs.
Lungs: Tachypneic, equal bilaterally, clear to auscultation.
Extremities: Left lower leg swollen, calf is slightly tender if palpated by the examiner.

Physical examination findings not available on your mannequin can be reported verbally if asked for by learners, e.g. left leg swelling can be reported by patient if asked by the participants if none of the suggested moulage techniques listed above are available for your scenario.
See the flow diagram in Figure 2.1 for further scenario changes described below.

**Case narrative, continued**
The respiratory distress will continue and gradually worsen as the scenario progresses, despite bronchodilator treatment and supplemental oxygen. Diagnostic tests (mainly imaging) should be ordered prior to decompensation of the patient, but may also be obtained after intubation and stabilization if the learner does not pick up on prompts.

Whether or not the correct diagnosis of PE is made, the patient will continue to deteriorate and develop hypoxia and hemodynamic instability in the form of significant hypotension. At this point, the patient should be intubated and mechanically ventilated. If not intubated, the patient will go into pulseless electrical activity (PEA) rhythm and require resuscitation. You may make the option for students and junior learners to have the case end after intubation and heparin administration.

For senior learners, you can move on to Phase II and the patient will have worsening hypoxia and hypotension necessitating vasopressors and thrombolytics for stabilization.

Ultimately, the learner will need to admit the patient to an ICU level of care. However, if the learners try to admit the patient to the ICU prior to thrombolytics, the intensivist may be “unavailable” or state that the ICU is full and the patient must be managed in the ED until they have a bed.
Although the patient believes that she is having an asthma exacerbation, learners should be prompted (if needed) to consider PE in their differential. These prompts can include additional history of risk factors, or findings of classic signs or symptoms.

To increase the complexity of the case, the HCG can be positive, forcing the participants to consider risks/benefits of CT versus alternative diagnostic modalities.

Figure 2.1 Scenario flow diagram: pulmonary embolism.
Optional Phase II: Senior Learners

HR 110
RR vent
BP 79/40
O₂ sat 96%

**Deterioration**
HR 135
RR vent
BP 70/35
O₂ sat 89%

- **Vasopressor**
  - HR 115
    - RR vent
    - BP 90/50
    - O₂ sat 89%

- **Vasopressor + thrombolytic**
  - Thrombolytic
    - HR 110
      - RR vent
      - BP 100/50
      - O₂ sat 95%

- **No thrombolytic**
  - HR 115
    - RR vent
    - BP 88/50
    - O₂ sat 82%

**Disposition to ICU**

---

If the learner tries to disposition the patient before thrombolytics, the intensivist can be unavailable or state that the ICU is full, requiring them to further manage in the ED.

Figure 2.1 (Continued)
Instructor notes

Pathophysiology
PE describes the process where a pulmonary artery is occluded by thrombus, fat, air, or amniotic fluid:
• Impaired gas exchange due to ventilation/perfusion (VQ) mismatch.
• Increased pulmonary vascular resistance.
• Increased wall tension in the right ventricle → bulging of the interventricular septum → compression of the left ventricle → decreased in cardiac output.

Clinical features
• Dyspnea is the most common chief complaint.
• Other symptoms:
  ○ Pleuritic pain.
  ○ Cough.
  ○ Hemoptysis.
  ○ Syncope.
• Clinical signs can include:
  ○ Tachypnea.
  ○ Tachycardia.
  ○ Hypoxia.
  ○ Low-grade fever.
  ○ Neck vein distention.
  ○ Examination findings consistent with DVT, i.e. extremity swelling.

Diagnosis
• Clinical decision rules
  ○ Risk-stratifying tools that do not definitively rule out PE.²,³
  ○ PERC (pulmonary embolism rule-out criteria): If all eight are positive there is <2% chance of PE:
    ■ Age <50 years.
    ■ Pulse <100 beats/min (-1).
    ■ O₂ sat ≥95%.
    ■ No hemoptysis.
    ■ No estrogen use.
    ■ No surgery/trauma requiring hospitalization within 4 weeks.
    ■ No prior venous thromboembolism (VTE).
    ■ No unilateral leg swelling.
  ○ Wells criteria: Assigns risk of PE based on points; >7.5 points is high-risk group, ≤4 points is low-risk group.
    ■ Clinical signs and symptoms of DVT (+3).
    ■ PE as most likely diagnosis (+3).
    ■ Tachycardia (+1.5).
    ■ Immobilization for at least 3 days or recent surgery within 4 weeks (+1.5).
History of PE or DVT (+1.5).
- Hemoptysis (+1).
- History of malignancy (+1).

**Imaging**
- CT angiogram:
  - Preferred modality.
  - PE is indicated by a filling defect within the pulmonary artery.
- Ventilation-perfusion scan:
  - High probability for a PE indicated by a segmental area of decreased perfusion that has normal ventilation.
- Venous ultrasound of the lower extremities:
  - The loss of vein compressibility in the legs indicates a DVT.
  - A negative study cannot definitively rule out PE.

**Less specific diagnostic tests include:**
- D-dimer serum assay:
  - May use in groups assessed as low risk to rule out PE.
- Electrocardiogram:
  - Sinus tachycardia.
  - S1Q3T3 (inverted S in lead I, Q wave and inverted T wave in lead III).
  - Right ventricular strain pattern.
- Chest X-ray:
  - Usually normal, but may show focal oligemia (Westermark’s sign), peripheral wedge-shaped density (Hampton’s hump), or enlarged right descending pulmonary artery (Palla’s sign).

**Management**
- Supplemental oxygenation ± ventilatory support.
- Anticoagulation:
  - Unfractionated heparin is usually the initial drug of choice:
    - Initial bolus 80 units/kg followed by initial infusion rate 18 units/kg/h. Titrate to therapeutic activated partial thromboplastin time of twice the control value.
- Inotropic support:
  - Dobutamine:
    - Positive inotrope and a pulmonary vasodilator, making it a prime choice during right heart failure caused by PE.
    - Initial rate: 2 μg/kg/min.
  - High-morbidity patients:
    - Surgical embolectomy.
    - Thrombolysis:
      - Tissue plasminogen activator (tPA): 100 mg IV over 2 h.
Debriefing plan
Plan for ~30 min for discussion.

Potential questions for discussion
• What other diagnoses should be considered in a patient who presents like the woman in this case?
• What risk factors for PE should be ascertained in the history?
• What decision rules (PERC, Wells) are available to aid in risk stratification, and how should they be used?
• How and when should a D-dimer test be used?
• What are the characteristic ECG findings of pulmonary embolism?
• How do the diagnostic work-up and treatment choices change if the patient is pregnant?
• What is the vasopressor of choice in right heart failure due to PE?

Selected reading
Aortic dissection

Educational goals

Learning objectives
Primary:
1. Recognize clinical signs of aortic dissection (AD) [Medical Knowledge].
2. Order appropriate diagnostic tests for AD [Medical Knowledge].
3. Order appropriate therapy for management of acute AD and its complications [Medical Knowledge, Patient Care].

Secondary:
1. Demonstrate professionalism and communication skills in consulting the surgeon and working with ED nurse [Interpersonal and Communication Skills, Professionalism].
2. Direct proper disposition/appropriate consultation [Systems-based Practice].

Critical actions checklist

- Assess airway, breathing, and circulation [Patient Care]
- Place patient on a cardiac monitor and establish IV access [Patient Care]
- Order ultrasound or CT and recognize signs of dissection [Medical Knowledge]
- Initiate proper therapy: IV beta-blocker ± sodium nitroprusside or calcium channel blockers [Medical Knowledge, Patient Care]
- (Optional) Perform pericardiocentesis ± intubation [Medical Knowledge]
- Call and communicate to cardiothoracic surgeon for disposition [Interpersonal and Communication Skills, Professionalism]

Critical actions can be changed to address the educational needs of the learner.
Simulation set-up

Environment: Emergency department treatment area.

Mannequin: Male simulator mannequin, no moulage, on a stretcher or hospital bed. Option: additional torso trainer for performing pericardiocentesis in the simulation area hidden under a sheet until the procedure is needed.

Props: To be displayed on plasma screen/computer screen or printed out on handouts in scenario room when asked for/return from laboratory:

- Images (see online component for Aortic Dissection, Scenario 2.2.ppt, at www.wiley.com/go/thoureen/simulation/workbook)
  - ECG showing a sinus rhythm with no abnormalities.
  - Chest X-ray showing a widened mediastinum.
  - CT angiography of chest, abdomen, and pelvis (one slice shown from the chest portion) showing a filling defect indicating false lumen of aortic dissection, originating from the ascending aorta through the left proximal iliac artery.
  - Ultrasound image of pericardial effusion.
- Labs (see online component as above)
  - Complete blood count.
  - Chemistry panel.

Other labs that the learners order can be “pending.”

Available in the treatment room:

- Basic airway and code cart.
- Medications:
  - Liter bags of 0.9% normal saline (NS) and lactated Ringer’s (LR).
  - Rapid sequence intubation (RSI) medications pre-labeled in syringes (paralytic and induction medication of choice for your institution).
  - IV beta-blockers in pre-labeled syringes/IV bags (e.g. labetalol, esmolol, propranolol).
  - IV calcium channel blockers.
  - Nitroprusside.
  - IV analgesics in pre-labeled syringes (e.g. morphine, fentanyl).
- Pericardiocentesis kit or spinal needle and 30 cc syringe.

Distractor: The patient may be distracting to the learners as he continually tries to ask for pain medication for his leg, “I have a high tolerance, my leg really hurts!”

Actors:

- Patient voice is male and may be demanding (see distractor above)
- ED nurse can start IVs and administer medications/ fluids. The nurse does have some medical knowledge base and may cue learners if needed.
Cardiothoracic surgeon available via “phone consultation.”

Making the consulting surgeon temporarily unavailable (scrubbed in a case, performing a procedure, or just not returning pages) will enhance the difficulty of the scenario for advanced learners.
Case narrative

Scenario background
A 55-year-old male presents to the Emergency Department from home complaining of severe, gnawing chest pain onset shortly after a breakfast of two egg sandwiches from the fast food restaurant. “It must have been those sandwiches; I just don’t feel good.” He denies any shortness of breath in the initial portion of the scenario, if asked.

Background may be presented prior to case or given as a triage sheet.

CC: Chest pain.
PMH: Hypertension.
Meds: Methadone, amlodipine, lisinopril, hydrochlorothiazide.
Allergies: Haloperidol.
Family Hx: Hypertension, diabetes.
Social Hx: Smokes one pack of cigarettes per day, occasional alcohol, on methadone for history of opioid abuse, occasionally smokes cocaine (last used yesterday).

Initial scenario conditions
Middle-aged male is uncomfortable sitting up on the stretcher. He asks for pain medicine frequently during the interview, stating “My (left) leg hurts.”

VS: Temp. 36.6 °C (97.8 °F), HR 98, RR 14, BP 210/108, O₂ sat 97% RA.
Neck: No jugular venous distention (JVD).
Heart: Regular rate and rhythm, no murmurs.
Lungs: Equal bilaterally, clear to auscultation.
Extremities: Femoral and pedal pulse decreased on left (1+) as compared with right (2+). Strength and sensation are grossly intact.

Physical examination findings not available on your mannequin can be reported verbally if asked for by learners, e.g. pulse discrepancy may not be easily simulated and may need to be verbally reported by the nurse when the learners feel for a pulse.
See the flow diagram in Figure 2.2 for further scenario changes described below.

**Case narrative, continued**

The patient, despite presenting to the emergency department chiefly for chest pain, continuously complains about pain in his leg, and will ask multiple times for more pain medications. The learner must manage these requests throughout the case.

The blood pressure and heart rate will be remain elevated, requiring aggressive use of parenteral antihypertensive medications. If the learner does not order blood pressure medication, the patient will become nauseous and vomit, becoming even more hypertensive. If the learners do not increase dosing of antihypertensives or add a second antihypertensive medication, the patient will be crying in pain from his leg and the nurse notes that she now cannot feel a pulse in the leg. The nurse may prompt learners at this time to give medications to address the problem or can guide the learners to come up with the diagnosis and order imaging if they have not done this already. Students and junior learners can end the scenario with surgery consultation after the CT reading returns.

Senior learners or astute students and junior learners who have managed the case easily can then progress to Phase II: cardiac tamponade. The patient will become tachypneic and hypotensive, indicating proximal propagation of the dissection that is now causing cardiac tamponade. The nurse may prompt the learners that an ultrasound if available if they do not order it. An emergency pericardiocentesis will need to be performed or the procedure may be verbally explained if a torso trainer is not available. The learners may also intubate the patient for his critical status and to obtain a CT safely if not already done. If the learner does not recognize tamponade, the patient will go into PEA arrest and require CPR and pericardiocentesis for resuscitation.

Ultimately, the patient will be transferred to the care of a surgeon at the end of the scenario.