I. Title: USS case 2
Cardiogenic Shock Secondary to Malignant Pericardial Effusion

II. Date Created: February 12, 2006
Date Revised: December 8, 2006

III. Category: Ultrasound Simulation; Teamwork / Resident Core Curriculum; ACLS

IV. Target Audience: undergraduate and graduate medical trainees and staff, nurses, paramedics

V. Learning Objectives or Assessment Objectives

A. Primary -
- a.) recognition and management of non-traumatic hypotensive patient
- b.) recognition and management of cardiac tamponade causing hemodynamic instability or collapse
- c.) integration of bedside ultrasonography into an organized medical resuscitation
- d.) deployment of teamwork behaviors

B. Secondary -
- a.) appropriate airway management
- b.) appropriate circulatory support
- c.) appropriate consultation and disposition

C. Critical actions checklist (see Appendix A)-

1. Simple checklist of critical actions
   - a.) recognition of respiratory failure (dyspnea, hypoxia)
   - b.) recognition of impending circulatory failure
   - c.) call for help
   - d.) establishment of team structure with role assignment
   - e.) deployment of appropriate communications and teamwork behaviors
   - f.) basic airway management (100% oxygen administration with bag-valve-mask or BiPAP ventilation)
   - g.) advanced airway management (endotracheal intubation or BiPAP deployment, placement confirmation and securement, ventilator management)
   - h.) advanced circulatory support (cardiac monitor, fluid hydration)
   - i.) non-traumatic hypotension evaluation + management (reviews differential diagnosis, implements specific testing + treatment)
   - j.) recognition of pericardial effusion and cardiac tamponade as possible source of hypotension in non-traumatic elderly patient; use of bedside echocardiography to assess cardiac tamponade
   - k.) institution of aggressive fluid administration
   - l.) pericardiocentesis
   - m.) supportive therapies upon improvement of circulatory function
   - n.) emergent Cardiac Surgery / Interventional Radiology consultation

2. Optimal sequence of critical actions- expected sequence as above
3. Duration to critical actions- resuscitation to be completed within 20-25 minutes of starting scenario
4. Behavioral ratings- see Appendix A

VI. ACGME Competencies Assessed

A. Patient Care
B. Medical Knowledge
C. Interpersonal/Communication Skills

VII. Environment and Props

A. Lab Set Up – Emergency Department in simulation center / lab
B. Manikin Set Up –
    a.) advanced medical simulation manikin
    b.) male patient moulage with bedtime clothing
    c.) lines needed: none
    d.) drugs needed: pt prescription bottles, IV fluid (NS)
C. Props – see "USS CASE 2 IMAGES" folder
    (basic airway and code blue cart is assumed)
    a.) ECGs: narrow complex rhythm 100s, low voltage, strain pattern
    b.) bedside ultrasound: pericardial fluid with tamponade
    c.) special resuscitative equipment (BiPAP, pericardial drainage kit)
D. Distractors – none

VIII. Simulation Personnel and Assigned Roles (Faculty, Actors, etc)

A. Roles – paramedic x 1, nurse x 1
B. Who may play them – other residents, other students, actors
C. Action Role – supportive (see narrative)

Case Narrative (describes what the learner will experience)

A. Paragraph narrative overview of case and how case starts-

At 1am, EMS brings in a 67 year old man who developed severe SOB and weakness in bed at home while trying to get to sleep. He has been ill for the past week or so with loss of energy and appetite, taking aspirins for generalized malaise, aches, and swelling Further history is limited due to severe dyspnea. Medics were able to bring his medications bottles. No family / contact is available at this time.

B. Board format overview of patient:

1. Name/Age/Sex: Demetrios Staikopoulos, 67 year old male
2. Mode of arrival: EMS
3. Accompanied by: n/a
4. Triage Note: n/a
5. Chief Complaint: **"i...can't...breathe...suffocating"**
6. Past Medical History: **"blood clots", (EMS ? emphysema, gout, HTN, prostate CA (prostatectomy, radiation treatment in past), perforated colonic diverticulum (colostomy + reversal)**
7. Medications and Allergies: **"can't...remember"**
   (EMS brought bottles of Cardizem, Bumex, Proscar, lisinopril, aspirin)
   - allergic to sulfa
8. Family and Social History: smoker
9. Patient's Initial Exam:

Vital signs:	heart rate:	**112 bpm**
	blood pressure:	**62/48**
	respiratory rate:	**32**
	oxygen saturation:	**91%**
	temperature:	98.8
Airway:	intact	
Breathing:	**dyspneic / tachypneic**	
Circulation:	**weak femoral pulses, cool extremities**	

Secondary Exam: elderly male

HEENT:	NCAT
Neck:	**JVP noted at 7cm**
Lungs:	**coarse rhonchi + rales throughout**
Cardiac:	**tachycardic, sl. muffled heart sounds**
Abdomen:	sl. distended, non-tender, **diminished BS**
Extremities:	**cool, 2+ edema**
Neurologic:	GCS 15 (E4/V5/M6).

Additional information:

Fingerstick blood sugar: **168**
EKG: **narrow complex 100s, low voltage, strain pattern**
CXR: **cardiomegaly, pulm edema**
Bedside ultrasound: +large amount pericardial fluid, RV collapse

C. Flow diagram with branch points, times of expected interventions and reactions from Sim Man with notes (see Appendix A + B)

Case progression:

1. Airway and breathing management with O2, endotracheal intubation or BiPAP mask ventilation. Some improvement in oxygenation, but persistent hypotension. After positive-pressure ventilation (intubation / BiPAP), auto-PEEP with reduced systemic venous return compounded by effects of CHF treatments result in worsening tamponade physiology:
   Vital signs: heart rate: 122 / minute
   blood pressure: 54 / 40 mmHg
   respirations: ventilated
   oxygen saturation: poor waveform, 90s?

2. If performed, bedside emergency echocardiography will reveal a large amount of pericardial fluid and RV collapse. FAST and abdominal ultrasonography will be unremarkable (slight abdominal ascites). This should lead to both aggressive isotonic fluid infusion and pericardiocentesis (non-guided, "ultrasound battery just died") within 5 minutes, or the patient will go into PEA and arrest. If not performed previously, the arrest should prompt bedside echocardiography and reveal the diagnosis. Disposition for further definitive treatment (pigtail pericardial catheter, pericardiotomy, pericardial window, etc) will need to be arranged for case completion.

D. Distracters in case: broad differential, including the following etiologies
   -cardiogenic (+cardiac risk factors, DVT Hx)
   -endocrine
   -hemorrhagic
   -hypovolemic
   -iatrogenic / medication
   -neoplastic / paraneoplastic
      occult lung CA with metastases
      unclear history of prostate CA extent
   -sepsis

E. Trends needed: none

IX. Instructors Notes (what the instructor must do to create the experience)

A. Tips to keep scenario flowing in lab and via computer
   - presentation of patient in extremis / hypotension.

B. Tips to direct actors- as above

C. Scenario programming- see Appendix B
   1. Optimal management path
   2. Potential complications path(s)
   3. Potential errors path(s)
   4. Program debugging

Debriefing Plan

A. Method of debriefing

1. This scenario involves a non-traumatic hypotensive presentation in an elderly patient. Non-detected lung cancer with metastatic pericardial lesions is causing pericardial effusion and cardiac tamponade. Necessary resuscitative ventilatory management (endotracheal intubation or BiPAP) results in further clinical deterioration due to intra-thoracic mechanical consequences of positive-pressure ventilation. Bedside ultrasonographic examinations can rapidly narrow the differential and establish the cause of cardiopulmonary instability for definitive intervention. Early resuscitation with crystalloid and pericardial fluid evacuation can prevent arrest.

2. Debriefing Topics

a.) didactic content

- bedside emergency echocardiography
    - indications
    - windows (subxiphoid, parasternal)
    - findings (structural, functional)

- airway management
    - indications and technique of endotracheal intubation
    - complications of positive pressure ventilation

- pericardial effusion with tamponade physiology
    - presentation
        -size and rapidity of volume accumulation critical
        -21% of cancer patients have pericardial metastases (primary: lung, breast, leukemia / lymphoma)
        -inconsistent nature of Beck's triad
        -pulsus paradoxus
        -can be overlooked as "just CHF"
    - evaluation
        -EKG, chest xray may be misleading
        -role of bedside echocardiography to assess presence of pericardial fluid (>1cm = large)
        - formal echocardiography (transthoracic, transesophageal), CT / MRI if patient is hemodynamically stable
    - treatment
        -hypotension
            -aggressive hemodynamic resuscitation
            -bedside pericardiocentesis (ultrasound-guidance)
    -disposition
        -VIR vs. OR (pigtail pericardial catheter, pericardiotomy, pericardial window, etc)

- PEA
    - assessment of “electrical” cardiac activity
    - assessment of “mechanical” cardiac activity
    - differential diagnosis (reversible causes)
        - -hypovolemia
        - -hypoxia
        - -hydrogen ion
        - -hyper- or hypo-kalemia
        - -hypothermia
        - -tablets
        - -tamponade
        - -tension PTX
        - -thrombosis (coronary)
        - -thrombosis (PE)
    - use of epinephrine (not vasopressin)
    - specific interventions
        - -sodium bicarbonate
        - -fluid bolus
        - -needle decompression: bilateral
        - -pericardiocentesis: use kit
        - -thrombolytics
        - -rewarming: target 92deg F
    - continuing (prolonged) resuscitative efforts
        - -hypothermia
        - -PE

b.) teamwork behaviors
- -leadership
    - -resuscitation leadership establishment
    - -role and responsibility assignment
- -collaboration
    - -recognition and integration of team input
    - -error recognition and correction
- -communication
    - -callouts of critical information
    - -callbacks for confirmation of information
- -situational awareness
    - -continued patient reassessment
    - -plan development and execution
    - -task prioritization
    - -workload assessment
    - -team member cross-monitoring
    - -requests for assistance
- -professionalism

X. Pilot Testing and Revisions

A. Numbers of participants- 3-5 learners (1-2 leaders)
B. Performance expectations, anticipated management mistakes
-not considering pericardial effusion and tamponade
-not exploiting ultrasonography to include or exclude life-threatening diseases on the differential
-premature termination of resuscitative efforts

XI. Authors and their affiliations

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XII. Additional Debriefing Materials:

Meltser H, Kalaria VG. Cardiac tamponade. *Catheter Cardiovasc Interv* 2005; 64(2): 245-55.

Shabetai R. Pericardial effusion: haemodynamic spectrum. *Heart* 2004; 90(3): 255-6.

Strimel WJ, Noe S. Pericardial effusion. In eMedicine Specialties > Medicine, Ob/Gyn, Psychiatry, and Surgery > Cardiology. Pearlman JD, Talavera F, Oudiz RJ et al. (eds), eMedicine Web site. Updated September 7, 2006. Available at: http://www.emedicine.com/med/topic1786.htm Accessed December 11, 2006.

Tang A, Eueule B. Emergency department ultrasound and echocardiography. *Emerg Med Clin North Am* 2005; 23(4): 1179-94.

Yarlagadda C, Hout WM. Cardiac tamponade. In eMedicine Specialties > Medicine, Ob/Gyn, Psychiatry, and Surgery > Cardiology. Kelly RF, Talavera F, Oudiz RJ et al. (eds), eMedicine Web site. Updated September 1, 2005. Available at: http://www.emedicine.com/med/topic283.htm Accessed December 11, 2006.

Appendix A

Scenario Evaluation Form

BrownMed
BROWN MEDICAL SCHOOL

Resident Name _____

Examiner _____

Case Title _____

RIH MSC
RHODE ISLAND HOSPITAL
MEDICAL SIMULATION CENTER

Scenario Type Single Patient ☒ Multiple Patient ☐

Critical Actions Checklist

	Critical Action	Yes	No	Time
1	recognition of respiratory failure (dyspnea, hypoxia)			
2	recognition of impeding circulatory failure			
3	call for help			
4	establishment of team structure with role assignment			
5	deployment of appropriate communications and teamwork behaviors			
6	basic airway management (100% oxygen administration with bag-valve-mask or BiPAP ventilation)			
7	advanced airway management (endotracheal intubation or BiPAP deployment, placement confirmation and securement, ventilator management)			
9	advanced circulatory support (cardiac monitor, fluid hydration, vasoactive solutions if needed			
10	non-traumatic hypotension evaluation and management (reviews differential diagnosis, implementation of specific testing and treatment)			
	continued			

	Critical Action	Yes	No	Time
11	recognition of pericardial effusion and cardiac tamponade as possible source of hypotension in non-traumatic elderly patient; use of bedside echocardiography to assess for cardiac tamponade			
12	institution of aggressive fluid administration			
13	pericardiocentesis			
14	emergent Cardiology / Cardiothoracic Surgery / Interventional Radiology consultation			

ACGME Competencies		
Competency	**Required Skill**	**Check**
Patient Care		
	Caring and respectful behaviors	
	Interviewing	
	Informed decision-making	
	Develop & carry out patient management plans	
	Performance of procedures	
	a) Routine physical exam	
	b) Medical Procedures	
	Work within a team	
Medical Knowledge		
	Investigatory and analytic thinking	
Practice-Based Learning and Improvement		
	Analyze own practice for needed improvements	
	Use of information technology	
	Facilitate learning of others	
Interpersonal & Communication Skills		
	Creation of therapeutic relationship with patients	
	Listening skills	
Professionalism		
	Respectful, altruistic	
	Ethically sound practice	
System-Based Practice		
	Understand interaction of their practices with the larger system	
	Knowledge of practice and delivery systems	
	Practice cost-effective care	

MedTeams

Teamwork Assessment Form

Date_____ Unit_____ Team_____ Shift_____

1. Maintain Team Structure & Climate	
a. Establish the leader	
b. Designate roles and responsibilities	
c. Communicate essential team information	
d. Resolve conflicts constructively	
	Overall rating:
2. Plan & Problem Solve	
a. Engage team members in the decision making process	
b. Identify established protocol to be used or develop a plan	
c. Communicate the plan to teammates	
d. Cross monitor actions of team members	
	Overall rating:
3. Communicate with the Team	
a. Effective use situational awareness updates	
b. Call out critical information during emergent events	
c. Use check-backs to verify information transfer	
d. Systematically hand off responsibilities during team transitions	
	Overall rating:
4. Manage Workload	
a. Re-prioritize patients care in response to overall caseload of team	
b. Execute team established plan	
c. Balance workload within the team	
d. Request assistance for task overload	
	Overall rating:
5. Improve Team Skills	
a. Conduct event reviews	
b. Conduct shift reviews	
	Overall rating:

Very Poor	Poor	Marginal	Acceptable	Good	Very Good	Superior
1	2	3	4	5	6	7

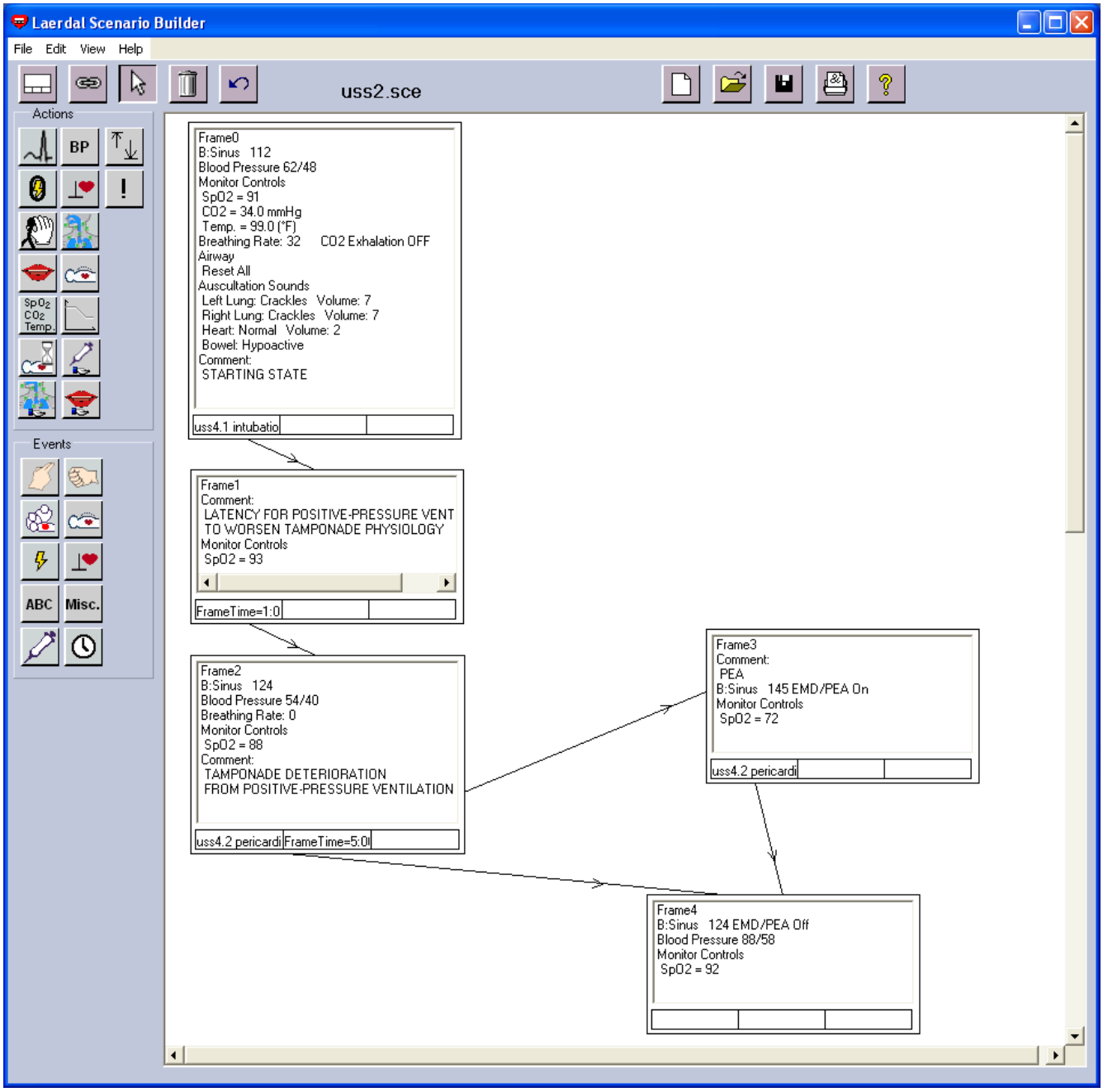
Teamwork Assessment Form

Likert Scale Descriptors

1. Very Poor
   - ❖ Teamwork principles operating minimally
   - ❖ Evidence of a hostile negative environment
2. Poor
   - ❖ Elements of teamwork observed about ten percent of the time
3. Marginal
   - ❖ Elements of teamwork observed about twenty-five percent of the time
4. Acceptable
   - ❖ Elements of teamwork observed about fifty percent of the time
5. Good
   - ❖ Elements of teamwork observed about seventy-five percent of the time
6. Very Good
   - ❖ Elements of teamwork observed about ninety percent of the time
7. Superior
   - ❖ Elements of teamwork observed ninety-eight percent of the time

Appendix B

Laerdal SimMan v2.2 scenario content



Note: The events to force transitions to a new frame will need to be edited via the “Edit Event Menus” feature within Scenario Builder