Transportable Simulation-Based Training Curriculum

Module 4

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Module 4

1.1 Scenario Title: Iatrogenic patient deterioration in CT scan
(IV contrast anaphylactoid reaction)

1.2 Date Created: November 7, 2004
Date Revised: November 22, 2007

1.3 Categories: Airway; Nursing; Teamwork; Resident Core Curriculum

1.4 Target Audience: Physicians / Nurses (Acute Care and Radiology);
CT scan / radiology technicians

1.5 Learning and Assessment Objectives

A. Primary
i. proper transition of care from team requesting CT scan (RN / MD)
ii. recognition and management of IV contrast anaphylactoid reaction
iii. recognition and management of anaphylactic shock
iv. recognition and management of oral contrast aspiration
v. critical communications with patient family
vi. crisis resource activation
vii. teamwork training
viii. proper transition of care to team providing subsequent care (EMS)

B. Critical actions checklist (see Appendix A)

1.6 Patient Safety Issues Addressed

A. **Transitions in care**
i. acceptance of patient (recognition of incomplete / misleading patient information
ii. transfer of patient (proper communication of patient information for further delivery of care)

B. Medical resuscitation skills in radiology staff

C. Teamwork (see Appendix B)

1.7 Graduate Medical Education Competence Domains Addressed

A. Patient Care
Interviewing
Develop / carry out plans
Performance of routine procedures
Work within a team
Clinical Skills Addressed
i. Pre-CT scan evaluation
1. Patient report and acceptance
ii. Critical event response
1. Patient assessment
2. Cardiopulmonary resuscitative management
3. Airway management
4. Vascular access
5. Supportive hemodynamic intervention
iii. Transition of care
1. Patient report and transfer

B. Medical Knowledge
Investigatory + Analytic Thinking

C. Systems-based Practice
i. Understand interaction of practices with the larger system
1. Simulation scenarios to stress the inter-disciplinary and inter-service coordination required in the care of out-of-hospital patients
ii. Knowledge of practice + delivery systems
1. Simulation exercise to experience clinical patient care in the context of out-of-hospital settings, including patient transfer issues
2. Simulation exercise to re-create resource limitations occurring during the care of out-of-hospital patients

1.8 Environment and Equipment (see <<Appendix C>>)

1.9 Personnel (see <<Appendix C>>)

1.10 Scenario Narrative

A. IV contrast anaphylactoid reaction in an outpatient radiology patient with prior unrevealed contrast reaction who is given IV contrast for an urgent abdominopelvic CT scan. Patient is groggy, so history of prior contrast reaction is available only on questioning husband after reaction starts. Proper patient assessment, treatment, and resource utilization stabilizes patient's anaphylactoid reaction and contrast aspiration events. Inadequate treatment results in cardiac arrest and "rescue" by simulated resuscitation team. Patient care needs to be transferred to, then from Radiology staff.

i. *Patient name / DOB / Sex*: Bethany Akers 11/10/1953 female

ii. *Mode of arrival*: private vehicle

iii. *Accompanied by*: husband in waiting area

iv. *ED medical forms*: see <<Appendix D>>
Prior medical records: n/a

v. *Chief complaint / History of present illness*:
Primary care physician Dr. Baker is requesting an oral and intravenous contrast-enhanced abdominopelvic CT scan. The patient has a history of recurrent abdominal pains over past two months, worse for two days, along with nausea, vomiting, fevers, and some diarrhea. Oral contrast has been administered as per protocol. The patient has no active complaints on arrival in suite, but is groggy from leftover hydrocodone-containing analgesics (Vicodin) she had taken prior to arrival for pain. Her husband has stepped outside.

vi. *Past medical history*: diverticulosis
hypertension
Past surgical history: appendectomy
breast biopsy

vii. *Medications*: lisinopril
hydrocodone / acetaminophen
Medication allergies: none known
(**patient does not offer history of ? of "minor intravenous dye allergy" due to grogginess; not mentioned in primary physician medical forms and not conveyed to CT staff; if picked up by simulation participants, should be minimized as "GI upset without serious reaction"**)

viii. *Social history*: ex-smoker. no alcohol or drugs. lives with husband, two grown children
Family history: non-contributory

ix. *Physical examination*: groggy but appropriate; one word answers only

1. Vital signs: heart rate: 84 / minute
   blood pressure: 138 / 92 mmHg
   respirations: 16 / minute
   oxygen saturation: 98% on room air
   temperature: 99.5 degrees F / 37.5 degrees C
2. Head / Neck: normal
3. Chest: normal, equal breath sounds
4. Heart: normal, no murmurs or heave
5. Abdomen: mild generalized tenderness,
   diminished bowel sounds
6. Genitourinary: normal
7. Extremities: normal
   20gauge right hand intravenous catheter
8. Neurologic: groggy but arousable, non-focal

x. *Laboratory Values:*

1. serum creatinine: 0.8
2. all others: pending (see <<Appendix E>>)

xi. *Imaging Studies:*

1. chest x-ray: pending (hyperinflated lungs)
   see <<module 4 -image- >> files

B. Scenario Flow

expected interventions in **bold**

pre-scenario Patient placed on CT scan gantry.

□ **Pre-CT scan evaluation**
(□ **Patient report and acceptance)**

time 0 Scan is initiated with routine protocol, and IV contrast is administered.

2 minutes After injection of contrast, patient becomes nauseous and starts actively vomiting.

□ **CT scan should be interrupted at this point if not "completed"**

3 minutes Vomiting slightly better, but patient starts complaining of itching in throat and hands, with funny feeling in back of throat.

□ **Patient assessment reveals mild generalized itching; some tachycardia developing**
□ **Call for assistance (e.g. 911)**
□ ***Investigative probes: Contact with family should lead to recognition of prior allergic reaction***

5 minutes Patient with active throat closing sensation, starts wheezing and stridoring.

□ **Patient assessment reveals anxious patient, generalized itching, stridor, wheezing, tachycardia**
Vital signs: heart rate: 128 / minute
blood pressure: 116 / 70 mmHg
respirations: 25 / minute
oxygen saturation: 90% on room air or with oxygen
temperature: 99.6 degrees F / 37.6 degrees C

□ **Considers major differential diagnosis elements (angioedema, aspiration / choking, asthma, cardiac dysfunction (myocardial infarction, cardiogenic shock / flash pulmonary edema), pulmonary embolism, septic shock)**

□ ***Investigative probes: Activation of protocol for IV contrast anaphylactoid reaction***

□ **Oxygen administration (non-rebreather mask)**

□ **Additional vascular access (> 18 gauge)**

□ **Adrenergic medication administration (SQ epinephrine)**

□ **Anti-histamine treatment (IV)**

□ **Steroid medication administration (IV)**

□ **Preparation for airway management**
- setup endotracheal intubation equipment
- check suction
- call for respiratory personnel if available

10 minutes Florid anaphylactoid reaction with hemodynamic compromise

□ **Patient assessment reveals unresponsiveness, warm and flushed skin, stridor, worse wheezing, tachycardia.**
Vital signs: heart rate: 145 / minute
blood pressure: 72 / 40 mmHg
respirations: 6 / minute
oxygen saturation: 77% with oxygen
temperature: 99.6 degrees F / 37.6 degrees C

□ **Basic airway management**
- bag-valve mask ventilation (BVM)

□ **Advanced airway management**
- endotracheal intubation (ETT)
- laryngeal mask airway (LMA)

□ **Adrenergic medication administration (IV or repeat SQ epinephrine)**

□ **Intravenous fluid administration (2 liter bolus)**

20 minutes If adequate treatment (basic airway management, additional vascular access, proper medications)
-> hemodynamic stabilization adequate for transfer of care
-> persistent hypoxia from contrast aspiration

□ **Patient assessment reveals unresponsiveness, warm and flushed skin, stridor, wheezing, tachycardia.**
Vital signs: gradual improvements in heart rate, blood pressure; persistent mild hypoxia (92%) due to contrast aspiration
Physical examination:
Chest: right posterior rales; generalized wheezing
Heart: tachycardic
Abdomen: soft, diminished bowel sounds
Neurologic: unresponsive
□ **Arrange transfer of patient to acute care facility**
□ **Arrange qualified patient transportation**
□ **Formal transition of care (with report of patient presentation, resuscitative events, and treatment)**

If inadequate treatment (no basic airway management, no additional vascular access, no medications)
-> cardiopulmonary collapse with ventricular fibrillation and cardiac arrest requiring routine ACLS, to be taken over by 911 paramedics

□ **Patient assessment reveals cardiopulmonary arrest**
Vital signs: heart rate: 0 / minute
blood pressure: no pulses
respirations: assisted ventilations
oxygen saturation: no tracing
Physical examination:
Chest: minimal air movement with assisted ventilations
Heart: no heart sounds
Abdomen: soft, no bowel sounds
Neurologic: unresponsive
□ **Formal transition of care with report of patient presentation, resuscitative events, and treatment**

C. Distracters – None

D. Trends Needed – in SimMan case

1.11 Instructor Notes

A. Tips to keep scenario flowing in lab and via computer:
- presentation of patient with rapidly progressive deterioration should keep the case moving quickly and with learner stress.
- lulls in activity may be broken with entry of agitated husband

B. Tips to direct actors: as above

C. Scenario programming: see <<Appendix F>>

1.12 Debriefing Points

A. Transitions in Patient Care
i. Patient report and acceptance
ii. Patient report and transfer

B. Critical Event Response
i. Crisis resource activation
ii. IV contrast anaphylactoid reaction management
iii. Airway management
iv. Vascular access

C. Teamwork

D. Systems-based Practice
i. Understand interaction of practices with the larger system
1. Simulation scenarios to stress the inter-disciplinary and inter-service coordination required in the care of out-of-hospital patients
ii. Knowledge of practice + delivery systems
1. Simulation exercise to experience clinical patient care in the context of out-of-hospital settings, including patient transfer issues
2. Simulation exercise to re-create resource limitations occurring during the care of out-of-hospital patients

1.13 Performance Measurement Instruments

A. Global Competency Rating Scale (see <<Appendix A>>)

B. Investigative probe: Activation of protocol for IV contrast anaphylactoid reaction with transfer of patient for definitive care
Contact with family should lead to recognition of prior allergic reaction

C. BARS (see <<Appendix B>>)

1.14 Pilot Testing and Revisions

A. Numbers of participants- 3-5 learners (1-2 leaders)

B. Performance expectations, anticipated management mistakes
-failure to recognize and manage (severe) contrast anaphylactoid reaction
-failure to properly transfer and transition care to acute care facility

1.15 Authors and their Affiliations

A. RIHMSC CMS Transportable Simulation-Based Training Curriculum Project team
Marc Shapiro, MD; RIHMSC, Rhode Island Hospital, Providence RI
Leo Kobayashi, MD; RIHMSC, Rhode Island Hospital, Providence RI

1.16 Additional Debriefing Materials

Print Materials

American College of Radiology (ACR). American College of Radiology Manual on Contrast Media. 4th ed. Reston, VA: American College of Radiology, 1998.

Federle MP, Willis LP, Swanson DP. Ionic versus nonionic contrast media: a prospective study of the effect of rapid bolus injection on nausea and anaphylactoid reactions. *J Comput Assist Tomogr* 1998; 22(3): 341-5.

Tran TP, Muelleman RL. Allergy, hypersensitivity, and anaphylaxis. In: Marx JA, Hockberger RS, Walls RM et al (eds.), *Rosen's Emergency Medicine: Concepts and Clinical Practice*. Philadelphia, PA: Mosby Elsevier 2006, p.1818-34.

Online Materials

Siddiqi NH. Contrast Medium Reactions, Recognition and Treatment. In eMedicine Specialties > Radiology > Vascular / Interventional. Siskin GP, Coombs BD, Coldwell DM et al. (eds), eMedicine Web site. Updated Feb 11, 2008. http://www.emedicine.com/radio/topic864.htm (Accessed July 8, 2009)

Appendix A Module 4 Global Competency Rating Scale v1.0

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

No.	Competency Dimension and Descriptors	Time						Score
		start	2min	3min	5min	10min	20min	
1	APPROPRIATE ACTION PERFORMANCE							
	□ pre-CT scan evaluation							
	(□ patient report and acceptance)							
	□ CT scan interrupted if not “completed”							
	□ Patient assessment / re-assessment							
	□ Call for assistance (e.g.911)							
	□ Activate protocol for IV contrast anaphylactoid reaction							
	□ Oxygen administration (non-rebreather mask)							
	□ Additional vascular access (> 18 gauge)							
	□ Adrenergic medication administration (SQ epinephrine)							
	□ Anti-histamine treatment (IV)							
	□ Steroid medication administration (IV)							
	□ Preparation for airway management - setup endotracheal intubation equipment - check suction - call for respiratory personnel if available							

	□ Basic airway management - bag-valve mask ventilation (BVM)							
	□ Advanced airway management - endotracheal intubation (ETT) - laryngeal mask airway (LMA)							
	□ Adrenergic medication administration (IV or repeat SQ epinephrine)							
	□ Intravenous fluid administration (2 liter bolus)							
	□ Arrange transfer of patient to acute care facility							
	□ Arrange qualified patient transportation							
	□ Formal transition of care (with report of patient presentation, resuscitative events, and treatment)							
2	HISTORY / PHYSICAL EXAM □ Pre-CT scan evaluation □ Patient report and acceptance	Acquisition and acknowledgement of all vital signs Performance of history and exam targeted to situation and patient presentation						
3	DISEASE PROCESS - IV contrast anaphylactoid reaction - Anaphylactic shock - Oral contrast aspiration	Rapid recognition of disease process with appropriate management actions						

4	DIFFERENTIAL DIAGNOSIS - Angioedema - Aspiration / choking - Asthma flare - Cardiac dysfunction (myocardial infarction, cardiogenic shock / flash pulmonary edema) - Pulmonary embolism - Septic shock	Proper consideration of alternate diagnoses and precipitants Avoidance of premature diagnostic closure	
5	PRESENTATION SKILLS / INTERPERSONAL RELATIONS □ *Transition of care:* formal report of patient presentation, resuscitative events, and treatment	Succinct and complete verbal presentation to accepting personnel Respectful interaction with patient and staff Safe medication ordering	
6	SCENARIO SYNTHESIS / COGNITION	Recognition of critical patient state and need for emergent treatment with transfer of care Awareness of unresolved issues	
7	EXPERTISE / LEADERSHIP	Manages scenario and leads team members with fluency, automaticity, simultaneity, rapidity and knowledge base	
X	INVESTIGATIVE PROBES: □ Contact with family should lead to recognition of prior allergic reaction AND □ Activation of protocol for IV contrast anaphylactoid reaction		

Appendix B Module 4 BARS Teamwork Behavioral Ratings

Note: Team Dimensions Rating Form not included due to copyright issues.

Appendix C Module 4 Scenario Setup Checklist

key: solid text - minimum requirements
light text - optional

A. Environment Community Imaging Center CT Suite

☐ bed: [CT scan gantry]
☐ actor roles: husband
911 paramedics (expert)

☐ personnel: Manikin operator / Audiovisual technician
Facilitator x 1-2
Actor x 2-3
☐ patient medical forms (included in package)

B. Advanced medical simulation manikin

☐ gender: female
☐ clothing: hospital patient garb
☐ moulage / props: 20g IV right hand; supine

☐ programming: Laerdal SimMan scenario (included in package)
METI manikin systems will require on-site programming

C. Medical equipment

-patient assessment equipment
- ☐ blood pressure cuff
- ☐ cardiac monitor / defibrillator (incl. electrodes, defib gel, recorder paper)
- ☐ EKG machine
- ☐ pulse oximeter
- ☐ stethoscope
- ☐ ventilator

-standard resuscitation equipment (“code cart” / “crash cart”)
- ☐ protective equipment (gloves, goggles, gowns)
- ☐ CPR board
- ☐ basic airway management devices
  - ☐ oropharyngeal airway (OPA; assorted)
  - ☐ nasopharyngeal airway (NPA; assorted)
  - ☐ bag-valve mask (adult)
- ☐ intubation equipment
  - ☐ laryngoscope handles / blades / batteries (assorted)
  - ☐ water-based lubricant
  - ☐ endotracheal tubes (assorted)
  - ☐ laryngeal mask airway (LMA) - intubating or non-intubating

DE-IDENTIFY IMAGES AND PROPS TO COMPLY WITH HIPAA REGULATIONS!!!

- ☐ intravenous access equipment
  - ☐ tourniquets
  - ☐ gauze pads
  - ☐ intravenous catheters (assorted)
  - ☐ intravenous fluid tubing drip sets (micro + macro)
  - ☐ intravenous fluid bags (normal saline)
  - ☐ phlebotomy supplies
  - ☐ sterile saline for flushes
  - ☐ stopcocks and connectors
- ☐ dressings (assorted)
- ☐ naso-/oro-gastric tubes (assorted)
- ☐ nebulizer
- ☐ oxygen source
- ☐ oxygen delivery devices (face masks, nasal cannulas)
- ☐ syringes (catheter tip; assorted)
- ☐ syringes (lavage tip)
- ☐ tape
- ☐ urinary catheters (assorted)
- ☐ wall suction and suction tubing (Yankower and tracheal suction)

-medications

- ☐ general medications
  - ☐ adenosine
  - ☐ amiodarone
  - ☐ atropine
  - ☐ calcium chloride / calcium gluconate
  - ☐ dextrose (D50)
  - ☐ dobutamine infusion
  - ☐ dopamine infusion
  - ☐ epinephrine
  - ☐ glucagon
  - ☐ insulin (regular)
  - ☐ nitroglycerin / nitroprusside
  - ☐ norepinephrine infusion
  - ☐ sodium bicarbonate
  - ☐ vasopressin
- ☐ anaphylaxis medications
  - ☐ anti-cholinergic (inhalational + nebulization; e.g. ipratropium)
  - ☐ beta-agonist (inhalational + nebulization; e.g. albuterol)
  - ☐ histamine H1 receptor blocker (parenteral; e.g. diphenhydramine)
  - ☐ histamine H2 receptor blocker (parenteral; e.g. cimetidine)
  - ☐ steroid (parenteral; e.g. prednisolone)

rapid sequence induction / intubation medications (institution-specific)

- ☐ e.g. etomidate / midazolam / ketamine / propofol
- ☐ e.g. succinylcholine / vecuronium

DE-IDENTIFY IMAGES AND PROPS TO COMPLY WITH HIPAA REGULATIONS!!!

Sample “contrast reaction” kit (RIHMSC and Lifespan institutions, Providence RI)

D. Radiographs, electrocardiograms, and other patient data
(included in package)

☐ chest radiograph (normal)
☐ chest radiograph (contrast aspiration)

DE-IDENTIFY IMAGES AND PROPS TO COMPLY WITH HIPAA REGULATIONS!!!

Appendix D Module 4 Patient Chartwork

Community Medical Imaging Center
A Standard Medical Corporation Partner

OUTPATIENT CT SCAN REQUISITION FORM

PATIENT NAME: AKERs, Bethany REQUESTING PHYSICIAN
DATE OF BIRTH: 11/10/1953 OFFICE PHONE NUMBER:

CLINICAL HISTORY: abdominal pain for 2 days, nausea, vomiting, diarrhea, fever

TYPE OF CT REQUESTED:

HEAD + NECK:
- HEAD
- SINUSES
- FACIAL BONES INCLUDING ORBITS

- NECK SOFT TISSUES (with IV contrast)
- SPINE (specify level)

CHEST: (20gauge intravenous cannula or larger must be placed in antecubital vein. Hand vein access will not be utilized.)
- ROUTINE CHEST
- HIGH-RESOLUTION LUNG
- MEDIASTINUM / AORTA (with IV contrast)
- PULMONARY EMBOLISM (with IV contrast)

ABDOMEN + PELVIS:

~~ROUTINE ABDOMEN + PELVIS~~	2.5 hour oral prep and IV contrast
DIVERTICULITIS PROTOCOL	3 hour oral prep and IV contrast
APPENDICITIS PROTOCOL	2.5 hour oral prep and IV contrast (5mm collimation of pelvis)
RENAL STONE PROTOCOL	no oral or IV contrast (5mm collimation of pelvis)

OTHER: (if the examination you are requesting is not one of those indicated above, provide a detailed history and the radiologist will protocol the examination.)

CHECKLIST:

Has pregnancy been excluded in this patient?	YES	NO
Has serum creatinine been drawn?	YES	NO
Does the patient have any significant allergies	YES	NO

Appendix E Module 4 Patient Laboratory Values

Module 4 Chemistry Panel

BUN (6-24) MG/DL: 20

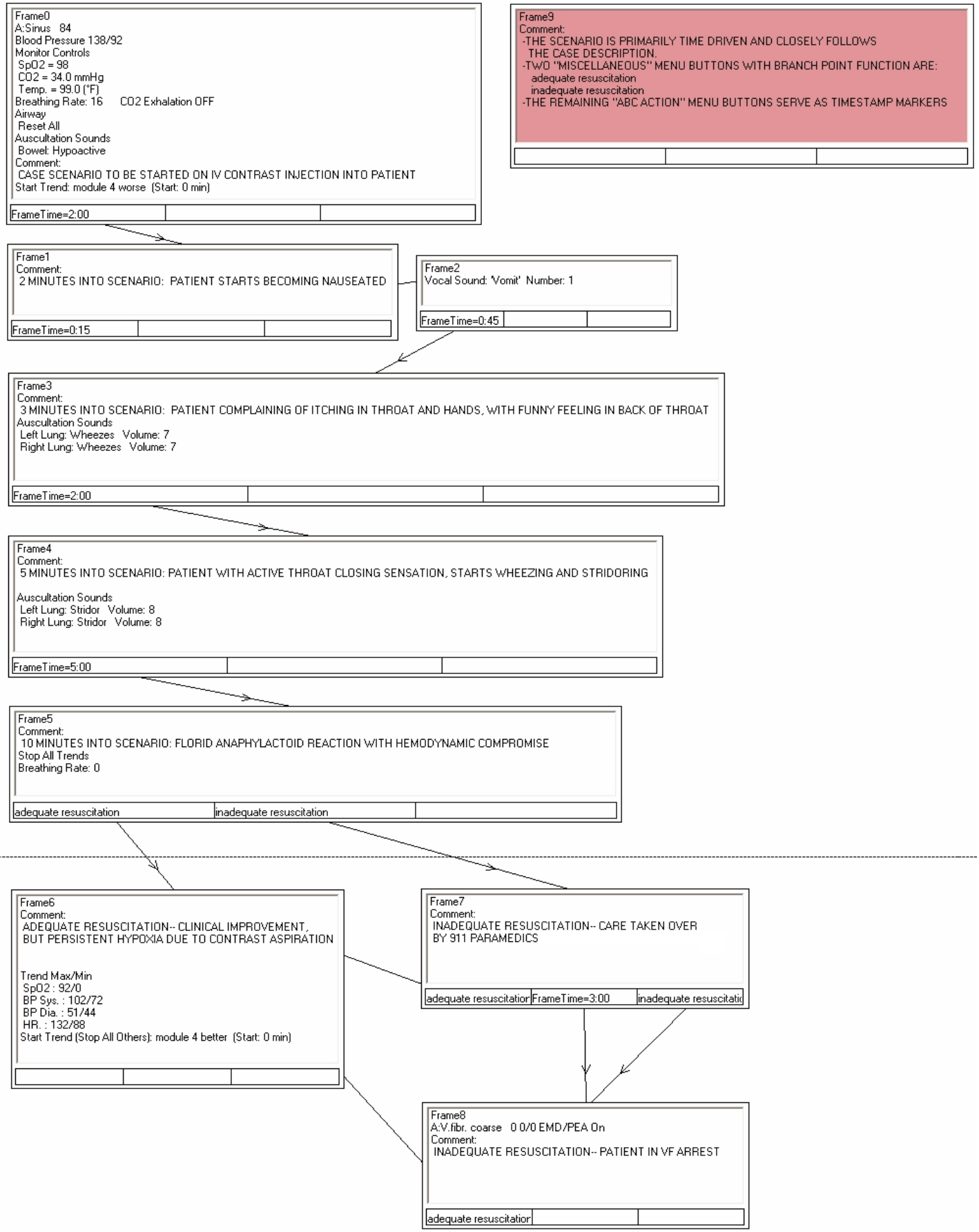
Creat (0.4-1.3) MG/DL: 1.1

Glu (67-109) MG/DL: 88

Module 4 Urinalysis

Urinalysis:	normal
Urine pregnancy test:	negative

Appendix F Module 4 SimMan v2.3 Scenario Programming



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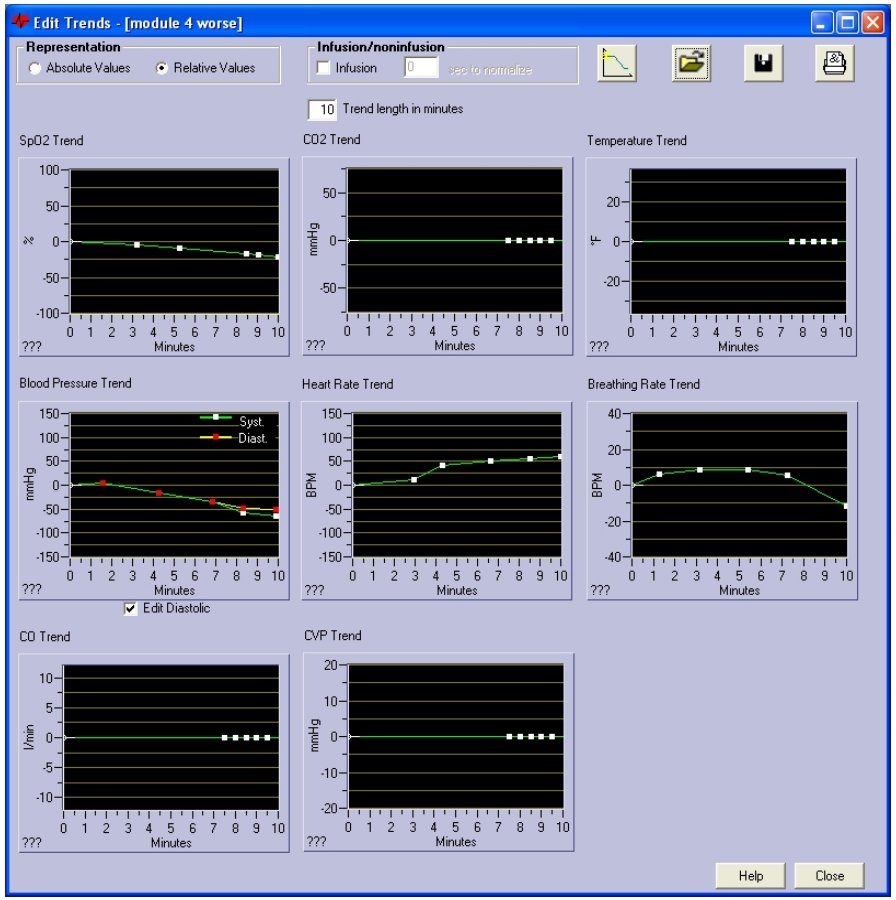
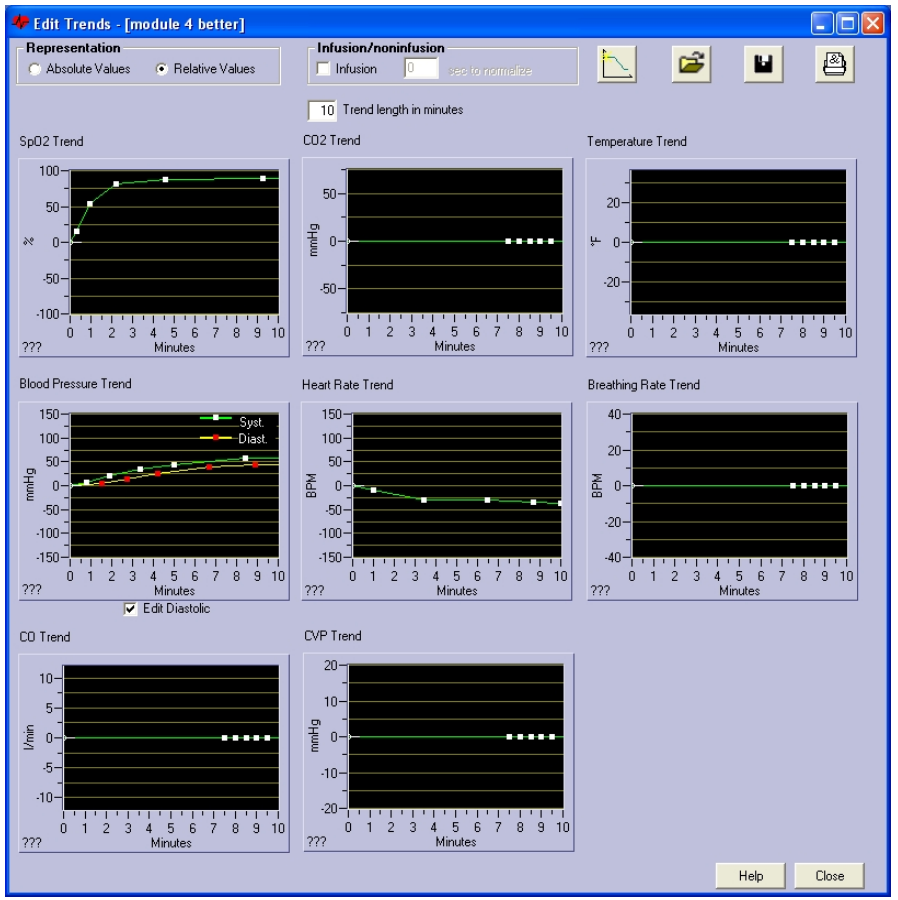
Module 4 SimMan v2.3 Scenario Trends





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