VT/VF Cardiac Arrest with Patient in Prone Position

Scenario Overview

Summary

A 59-year-old woman with significant cardiac history and diabetes is anesthetized, positioned, and draped for a lumbar microdiscectomy in the prone position. Ten minutes after the incision is made, the patient develops ventricular tachycardia (VT) followed by ventricular fibrillation (VF) cardiac arrest.

The perioperative team responds by

- coordinating a safe and efficient repositioning of the patient into the supine position to optimize chest compressions,
- providing interventions to address cardiac arrest in accordance with the established checklist and algorithm,
- following the facility's protocols for crisis management, and
- exhibiting effective technical and nontechnical skills for managing an intraoperative crisis.

The patient returns to clinical baseline. The simulation is concluded when an appropriate member of the team verbalizes the next step in the patient's plan of care.

Scenario Setting

- Hospital operating room (OR)

Time

Pre-brief: 15 minutes
Simulation: 10 minutes
Debrief: 20 minutes

Participants

Multidisciplinary team necessary to perform a spinal procedure with the support of embedded simulation personnel

- Surgeon
- First assistant (RN first assistant [RNFA], physician's assistant [PA], resident)
- Anesthesia professional (anesthesiologist, certified RN anesthetist [CRNA])
- RN circulator
- Scrub person
- Radiology technician
- Anesthesia technician
- Perioperative care technician
- Front desk personnel
- Float personnel (anesthesia professional, perioperative RN)
- Observers (as needed)

Potential Systems Explored

- Facility protocols for crisis management
- Technical skills of defibrillator use and emergency cart management
- Nontechnical skills of interdisciplinary communication and role identification

Learning Objectives

1. The learner will demonstrate effective management of an intraoperative VT/VF cardiac arrest of a patient in the prone position.
2. The learner will demonstrate use of a surgical crisis checklist to ensure delivery of required interventions during a VT/VF cardiac arrest.
3. The learner will demonstrate the necessary technical skills of using a defibrillator and managing an emergency cart.
4. The learner will demonstrate effective nontechnical skills through professional interdisciplinary communication and role identification.

Participant Preparation

Pre-Simulation

- Read the following articles:
  - Kazaure H, Roman S, Rosenthal R, Sosa J. Cardiac arrest among surgical patients: analysis of incidence, patient characteristics, and outcomes in ACS-NSQIP. *JAMA Surg*. 2013;148(1):14-21.
  - Murdock D. Perioperative cardiopulmonary arrest competencies. *AORN J*. 2013;98(2):116-130.
  - Seifert P, Hillberry C, Astle S, Ilkhanoff L. Crisis management of cardiac arrest in the OR. *AORN J*. 2016;104(1):55-66.
- Review the facility's protocol for cardiac arrest.
- Review the facility's crisis checklist on cardiac arrest. See *Resources* for a list of available OR crisis checklists.

Introduction/Pre-Brief

1. Sign in and obtain participant consents for video or research, if necessary.

2. Have participants introduce themselves:
   a. Specialty
   b. Experience and role
   c. Something personal

3. Orient participants to simulation process:
   a. Briefing
   b. Case (simulation)
   c. Debriefing-Discuss and review what went well and where there are opportunities for improvement
   d. Feedback and closing

4. Discuss the course objectives.

5. Describe learning environment.
   a. Simulation is a safe and confidential learning environment.
   b. Acknowledge anxiety.
   c. Assure participants of confidentiality about their performance.
   d. Obtain buy-in for simulation activities. Treat the simulation as a real-life situation, given the limitations of working with a mannequin, simulated medications, etc.
      - Treat this patient as if it were your perioperative patient.
      - Inject medications as usual.
   e. Notify participants that they will be video recorded for purposes of debriefing. The video will be destroyed/deleted per the simulation laboratory guidelines.

6. Discuss expectations of participants:
   a. Clinical role (Be yourself.)
   b. Assure participants that the embedded simulation personnel are there to help them, and there are no tricks.
   c. Agree on a code word for a real event (the simulation will end immediately).

7. Identify equipment that is live or partially functional and explain any related safety issues:
   a. Mannequin
   b. Defibrillators/emergency equipment
   c. Electrosurgical units (ESUs)
   d. Cameras
   e. Vital signs displayed on monitoring devices
   f. Phone list
   g. Documentation

8. Orient participants to patient's situation and assumed roles; provide role cards if applicable.
   a. "It is 10:00 am on a Thursday and you are taking care of a patient with…."
   b. "Your table is set up, and all items have been counted."
   c. "You will start with conducting a time out."

9. Ask the "float/supporting" personnel to leave the simulation environment and await communication they would receive during an actual crisis.

10. Ask participants if there are any questions before beginning.
    a. Answer any additional questions/clarify the shared mental model.
    b. Announce that the simulation is starting.

Set-up

Simulation Environment

- Simulation OR—make every effort to mimic a live OR setting and consider the following:
  - Where are the phones located?
  - Where are the phone extension lists posted?
  - Where are the surgical crisis checklists located?
  - How much space will be required for equipment (see below)?

Simulation Equipment and Supplies

- Low-fidelity mannequin with the following:
  - mobile joints in the upper and lower extremities
  - trachea for endotracheal tube (ETT)
  - urethra or a genital orifice for Foley catheter placement
  - chest that allows for recoil to facilitate chest compressions
- Mock incision (ie, suturing practice pad)
- Foley catheter
- Defibrillator unit with pads identical to the ones used in the facility OR
- Simulation emergency cart (Make every effort to duplicate the facility emergency cart [eg, locking tabs, trays wrapped in plastic, location as it relates to proximity of an OR].)
- Mock patient chart (May contain a single sheet with pertinent mock patient information such as history and physical, laboratory values, electrocardiogram [ECG], etc.)

OR Equipment and Supplies

- Spine table with chest pads or prone positioning frame
- Prone anesthesia face positioner (mirror/frame or foam pad)
- Anesthesia circuit, ETT, pulse oximetry sensor, blood pressure cuff, IV line
- Safety strap
- Back table (large)
- Mayo stand
- ESU
  - bipolar
  - monopolar with dispersive pad
- Suction machine
- Patient gurney
- Portable C-arm
- Microscope

Simulator Preparation

- Place the ETT into the mock patient and secure it with tape.
- Position the mock patient on top of the chest pads or prone positioning frame in the prone position as would be used for a spinal procedure.
- Connect the anesthesia supplies:
  - Place the ECG leads.
  - Connect the anesthesia circuit to the ETT.
  - Apply the blood pressure cuff and pulse oximeter sensor.
  - Hang 1 L of IV fluid (lactated Ringer's solution or normal saline), and connect it to an IV line secured to an upper body extremity.
  - Place the Foley catheter.
- Place an upper and/or lower body warmer.
- Drape the patient in routine fashion with the mock incision exposed.
- Position the C-arm for a lumbar spine procedure.
- Connect suction, ESUs and the dispersive pad (do not turn ESUs on), and a body warmer as would be used for a lumbar spinal procedure.
- Prepare a basic back table and Mayo stand set up (instruments, sponges, etc.).
- Drape the patient, and place the Mayo stand over the patient.

Safety Considerations

- Be sure that all medications are clearly labeled and identified as for simulation use only.
- Simulated medications should not be available in patient care areas.
- Ask participants to take a moment and check their pockets and personal belongings before leaving the simulation environment to minimize the risk of simulation supplies being carried into patient care areas.

Sequence of Events

Participants assume their roles, and the RN circulator initiates a time out, which signifies the beginning of the simulation.

At this time, the patient is in sinus rhythm:

- Heart rate (HR): 68
- Blood pressure (BP): 110/90
- Respirations (RR): 14
- Oxygen saturation (SpO2): 98%
- End-tidal carbon dioxide (ETCO2): 41
- ECG: sinus rhythm

About 2 minutes after the incision is made, the patient exhibits the following vital signs:

- HR: 176
- BP: 86/62
- RR: 14
- SpO2: 98%
- ETCO2: 41
- ECG: prolonged QT with VT

The anesthesia professional alerts the team of the unexpected changes in vital signs.

Over the next 15 seconds, the patient's vital signs change to the following:

- HR: undetectable
- BP: 60/40
- RR: 14
- SpO2: 88%
- ETCO2: 49
- ECG: VF

The anesthesia professional states, "The patient is in ventricular fibrillation with no pulse, we need to flip! All hands on deck! Bring the code cart!"

The anesthesia professional turns off volatile anesthetics and turns on FiO2 (fraction of inspired oxygen) to 100% with RR setting to 8.

The team's response includes the following (some actions may take place simultaneously):

- Calling for help and the emergency cart
- If a crisis manager does not immediately emerge, identifying him or her by asking, "Who will be the crisis manager?"
- Crisis manager stating, "Shock the patient as soon as the defibrillator arrives."
- Crisis manager identifying roles and actions to be taken, including
  - covering and/or packing the wound;
  - moving the C-arm away from the operative field;
  - bringing in a gurney and placing a backboard upon it;
  - coordinating patient repositioning onto the gurney;
  - referring to the crisis checklist;
  - beginning cardiopulmonary resuscitation (CPR) and defibrillation per the crisis checklist;
  - performing chest compressions as soon as the patient is supine on the gurney;
  - managing the airway (ETT, circuit);

Sequence of Events

- obtaining vascular access as needed, verifying all lines are clear when the patient is repositioned;
- documenting all events;
- monitoring timing of all events;
- obtaining the emergency cart;
- placing defibrillator pads; and
- preparing epinephrine (eg, assembling jet-syringe).

The first defibrillation shock and a dose of epinephrine is given. The patient's clinical status does not change. CPR continues for 2 minutes (the team may change providers performing chest compressions). The team begins to search for a cause by verbally evaluating H's and T's:

- Hydrogen ion acidosis
- Hyperkalemia
- Hypothermia
- Hypovolemia
- Hypoxia
- Tamponade (cardiac)
- Tension pneumothorax
- Thrombus (coronary/pulmonary)
- Toxin (local anesthetic, beta blocker, calcium channel blocker)

A second defibrillation shock is delivered, and the patient's vital signs change to the following:

- HR: 120
- BP: 78/56
- RR: 8
- SpO2: 90%
- ETCO2: 45
- ECG: sinus tachycardia

The presence of a pulse is confirmed.

Appropriate members of the team (eg, surgeon, anesthesia professional) communicate the next step in the patient's care, which is confirmed by the RN circulator.

End of simulation is announced by the embedded simulation personnel.

Sequence of Events

Skills Assessment -
VT/VF CARDIAC ARREST with PATIENT IN PRONE POSITION

Continue with the simulation until the following actions/treatments are completed.
Treatment action time points are referenced from time of crisis announcement

Action/Treatment Checklist	Time	Skill met	Skill not met
Crisis and the need to reposition the patient is announced			
Call for help and the emergency cart is made			
Crisis manager is identified			
Roles and actions to be taken are assigned			
Incision is packed and/or covered			
Equipment and personnel are effectively coordinated and the patient is safely repositioned			
Float personnel (ie, anesthesia professional, perioperative RN) are in the room			
Emergency cart is in the room			
Patient is positioned supine on the gurney with backboard			
First chest compression is delivered			
Defibrillator is on and pads are connected			
First defibrillation shock is delivered			
Crisis checklist is utilized			
Crisis interventions on the checklist are implemented			
Emergency cart is effectively managed			
Jet-syringe is correctly assembled and medication is administered			
Professional interdisciplinary communication is effectively employed: • Commands and requests are clear • Commands and requests are confirmed (ie, no closed loop communication is used) • Personnel are addressed directly (ie, no “thin air” statements are used)			

Debrief

Begin debriefing by soliciting the participants' reactions to the simulation experience.

- Clarify confidentiality and expectations.
- Review the learning objectives.
- Discuss what happened in the simulation.
- Review what went well.
- Consider opportunities for improvement.
- Encourage expression of reactions.
- Ask participants:
  - "How did participating in this simulation make you feel?"
  - "Describe your thinking when…?"
  - "Were there performance gaps?"
  - "What could be changed in the OR?"
- Review the participant's roles and team expectations.
- Review principles of effective interprofessional teamwork.
- Review expectations for effective communication.
- Discuss appropriate post-event actions:
  - Consider keeping the patient intubated and sedated.
  - Monitor the patient for 24 hours post-recovery.
- Identify learner issues.

Resources

Pre/Post Test

1. A 52-year-old man is scheduled for a left knee arthroscopy. The patient states that he works as a computer programmer, smokes one pack of cigarettes per day, and that his father died from a stroke. The perioperative RN understands that the following factors place this patient at increased risk for an intraoperative cardiac arrest:
   Choose all answers that apply.
   A. Age
   B. Sedentary lifestyle
   C. Tobacco use
   D. Previous history of myocardial infarction
   E. Family history of cardiovascular disease

2. Due to the low-frequency/high-risk nature of intraoperative cardiac arrests, surgical team members can be better prepared to manage these events when the following are employed:
   Choose all answers that apply.
   A. Crisis checklists
   B. Practice using simulation-based scenarios
   C. Reinforcement of competencies and protocols
   D. Effective communication techniques
   E. Collaborative teamwork

3. Current literature suggests the mortality rate for patients who experienced intraoperative cardiac arrest can be as high as 61.1%.
   A. True
   B. False

4. Role assignment is a critical function during a cardiac arrest. Select all of the roles/actions that need to be assigned/taken during CPR:
   Choose all answers that apply.
   A. Chest compressions
   B. Airway management
   C. Vascular access
   D. Safety Officer
   E. Documentation
   F. Emergency cart management
   G. Risk Manager
   H. Timekeeper
   I. Nurse Manager

5. The scrub person should always break down the sterile field during CPR.
   A. True
   B. False

6. A first-line medication administered during VT/VF cardiac arrest is:
   Choose the best answer.
   A. Epinephrine 1 mg IV, repeat every 3 to 5 seconds
   B. Epinephrine 1 mg IV, repeat every 3 to 5 minutes
   C. Epinephrine 10 mg IV, repeat every 3 to 5 seconds
   D. Epinephrine 10 mg IV, repeat every 3 to 5 minutes

7. A first-line antiarrhythmic administered for refractory ventricular fibrillation/pulseless ventricular tachycardia is:
   Choose the best answer.
   A. Atropine
   B. Amiodarone
   C. Vasopressin
   D. Epinephrine

8. A cardiac arrest is in progress in the OR. Chest compressions are ongoing and an emergency cart with a defibrillator is being rolled into the OR. At this time, the perioperative RN understands the following action is a priority:
   Choose the best answer.
   A. Opening the emergency cart
   B. Assembling the epinephrine jet-syringe
   C. Connecting the defibrillator electrodes
   D. Looking for an extension cord to plug in the defibrillator
   E. None of the above

9. Select the cardiac rhythms that are shockable:
   Choose all answers that apply.
   A. Asystole
   B. Pulseless electrical activity
   C. Ventricular fibrillation
   D. Pulseless ventricular tachycardia

Resources

10. The rate of chest compressions administered during CPR should be:
Choose the best answer.

A. 50 compressions per minute
B. 60 compressions per minute
C. 80 compressions per minute
D. 100 compressions per minute

Test Answers

1. A, B, C, E
2. A, B, C, D, E
3. A
4. A, B, C, E, F, H
5. B
6. B
7. B
8. C
9. C, D
10. D

References

- Kazaure H, Roman S, Rosenthal R, Sosa J. Cardiac arrest among surgical patients: analysis of incidence, patient characteristics, and outcomes in ACS-NSQIP. *JAMA Surg*. 2013;148(1):14-21.
- Murdock D. Perioperative cardiopulmonary arrest competencies. *AORN J*. 2013;98(2):116-130.
- Seifert P, Hillberry C, Astle S, Ilkhanoff L. Crisis management of cardiac arrest in the OR. *AORN J*. 2016;104(1):55-66.

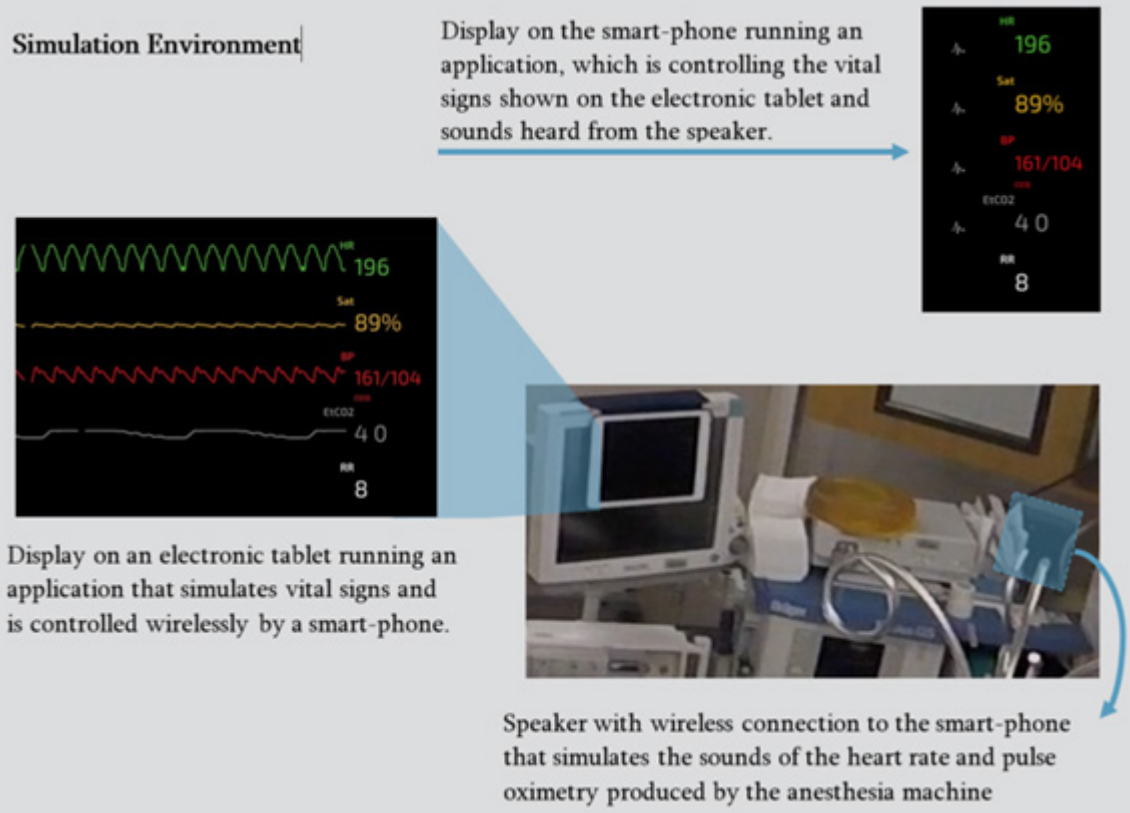
Resources

Crisis checklists

- http://www.projectcheck.org/crisi-checklist-download.html Note: Checklists are available and downloadable at no charge with registration.
- http://emergencymanual.stanford.edu/development.html Note: Checklists are available and downloadable at no charge with registration.
- http://checklist.americananesthesiology.com Note: Checklists are available at no charge, but are not downloadable.

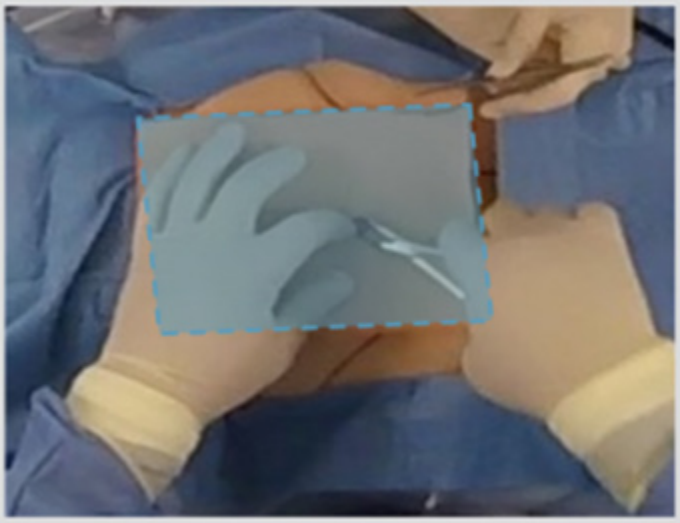
Apps

- http://cpr.heart.org/AHAECC/CPRAndECC/Training/HealthcareProfessional/FullCodePro/UCM_476262_Full-Code-Pro.jsp American Heart Association (AHA) Full Code Pro App (FCP 3.0) is a free mobile application that facilitates compliance with established protocols and efficient documentation during cardiac arrest resuscitation
- Various third-party applications that simulate anesthesia machine display and sounds are available for smart phones and electronic tablets. These apps are available on the Internet and from web-based retailers at minimal cost.



Resources

Incision pad



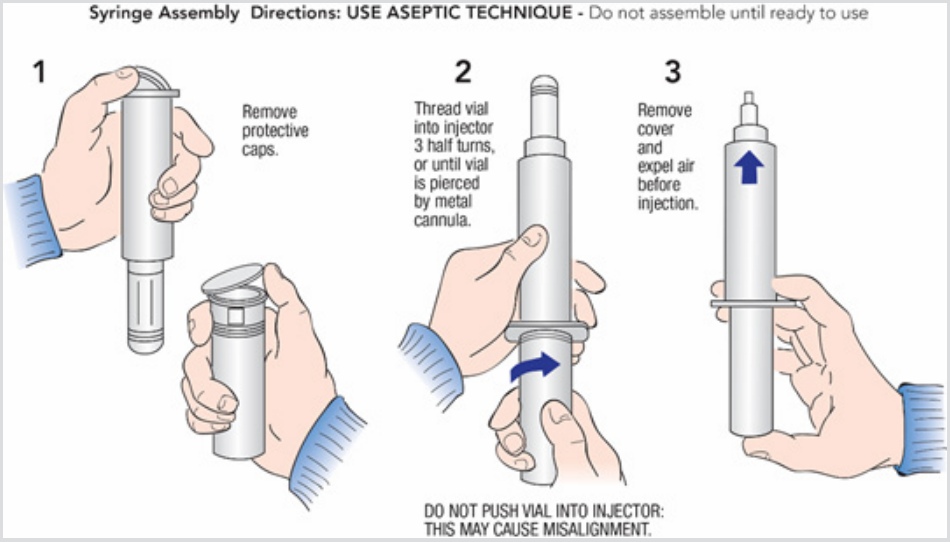
Suturing practice pad simulates a surgical incision

Emergency cart

Simulation emergency cart tray with simulated medications.

Scenario Overview

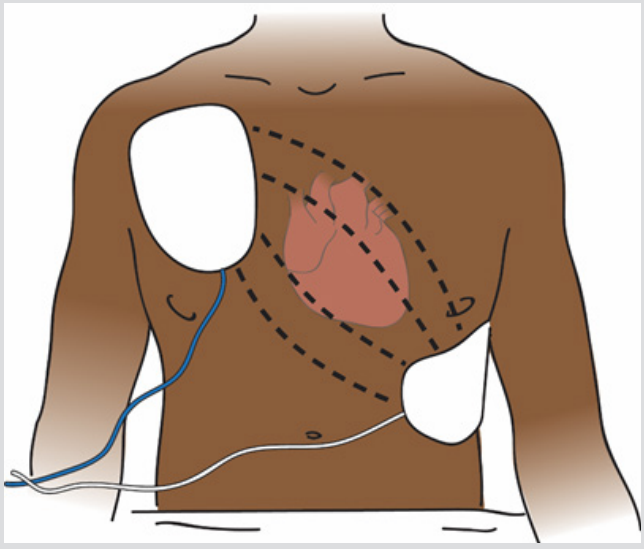
Jet-Syringe assembly



Safety Considerations

- Engaging the syringe incorrectly may cause glass breakage and subsequent injury.

Defibrillator electrode placement



Resources

Considerations for Simulation Variation

- Focus on one or more specific phases of the simulation as the entire scenario (eg, safe and effective repositioning of the patient from prone on the OR bed to supine on the gurney with a consideration for equipment such as the C-arm).
- Incorporate a microscope into the scenario and initiate clinical deterioration of the patient while the OR room lights are off and the surgeon is using a microscope placed above the patient.
- Include the neuromonitoring team and secure routine neuromonitoring wires to the mock patient using tape before draping the patient.
- Modify the surgical procedure to a posterior cervical fusion that requires prone positioning of the patient on top of a prone positioning frame and using a 3-pin head positioner.
- Combine the elements above into a single posterior cervical case scenario (ie, repositioning, microscope, neuromonitoring, and use of a 3-pin head positioner).

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