

## Scenario Overview

### Summary

R. B. is a 79-year-old man with a preoperative diagnosis of right inguinal hernia. He has been admitted as an outpatient to the ambulatory surgery center (ASC) for an elective right open inguinal herniorrhaphy with mesh. His past surgical history includes tonsillectomy (age 7), open appendectomy (age 26), and open radical retropubic prostatectomy (age 67). His medical history includes prostate cancer and atrial fibrillation. He regularly takes the anticoagulant warfarin and flecainide, a sodium channel blocker, for rhythm control of his atrial fibrillation. He stopped taking his warfarin 5 days before surgery and transitioned to enoxaparin per the surgeon's preoperative orders. The patient reports that he frequently uses pain patches for intermittent back pain and expresses some concern about managing pain after his surgery. He is allergic to penicillin. His weight is 70 kg (154 lb).

### Scenario Setting

- ASC

### Time

- Pre-simulation briefing: 10 minutes
- Simulation activity: 15 minutes
- Post-simulation debriefing: 30 minutes

### Participants

Interdisciplinary team members or embedded simulation personnel

- Surgeon or embedded simulation person
- Anesthesia professional (anesthesiologist, certified registered nurse anesthetist [CRNA])
- First assistant (RN or MD)
- RN circulator
- Scrub person
- Emergency response RN
- Charge RN

### Potential Systems Explored

- Local anesthetic systemic toxicity (LAST)
- Cardiac arrest
- Advanced cardiac life support (ACLS) algorithm for ventricular fibrillation/ventricular tachycardia (VF/VT) versus lipid rescue
- Regional anesthesia safety
- Teamwork and communication

## Learning Objectives

1. Describe potential risk factors for the development of LAST in patients undergoing surgery.
2. Recognize the neurologic and cardiac symptoms related to LAST that could potentially lead to cardiac arrest and death if left untreated.
3. Understand treatment priorities for the patient experiencing a LAST crisis.
4. Discuss how to effectively utilize checklists to optimize teamwork during a crisis in the perioperative setting.

## Participant Preparation

### Pre-Simulation

- Read
  - Ciechanowicz S, Patil V. Lipid emulsion for local anesthetic systemic toxicity. *Anesthesiol Res Pract*. 2012. doi: 10.1155/2012/131784
  - Arriaga AF, Bader AM, Wong JM, et al. Simulation based trial of surgical-crisis checklists. *N Engl J Med*. 2013;368(3):246-253.
  - American Society of Regional Anesthesia and Pain Medicine (ASRA). Checklist for Treatment of Local Anesthetic Systemic Toxicity. [https://www.asra.com/content/documents/asra\\_last\\_checklist.2011.pdf](https://www.asra.com/content/documents/asra_last_checklist.2011.pdf). Accessed October 30, 2017.
  - American Heart Association ACLS algorithm for VF/VT. American Heart Association. Web-based Integrated Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care – Part 7: Adult Advanced Cardiovascular Life Support. <https://eccguidelines.heart.org/wp-content/themes/eccstaging/dompdf-master/pdffiles/part-7-adult-advanced-cardiovascular-life-support.pdf>.
  - Care of the patient receiving local anesthesia. In: *Guidelines for Perioperative Practice*. Denver, CO: AORN, Inc; 2017:617-628.
- Review contents of the emergency cart.
- Identify the location(s) of 20% lipid emulsion in the facility.
- Review contents of “LAST” kit if available.

## 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.
    - o Treat this patient as if he were your perioperative patient.
    - o 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
  - 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 by 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

### Room

- Simulation operating room (OR) or OR not in use

### Equipment

- OR bed
- Back table
- Mayo stand with cover
- Laparotomy (minor) instrument set
- Anesthesia machine with monitors (pulse oximetry, electrocardiogram [ECG], blood pressure [BP])
- Airway management equipment (laryngoscope, endotracheal tube [ETT], bag valve mask, oxygen mask)
- Stethoscope
- Suction tubing with Yankauer tip x 2 (anesthesia and sterile field)
- IV poles x 2
- Emergency cart with defibrillator
- Laparotomy drape
- Surgical head coverings, masks with eye protection, and nonsterile gloves for all participants
- Surgical gowns and sterile gloves for scrubbed team members
- IV catheters and IV tubing
- 10 mL and 60 mL syringes
- Medication labels and marking pens
- Hypodermic needles (27 gauge and 19 gauge)
- Suture (assorted)
- Needle mat
- Graduate pitcher or basin
- Surgical skin antisepsis preparation tray
- Crisis checklist for LAST
- Consent form (simulated)
- Surgical safety checklist
- Phone with simulated phone number list
- Code button (simulated)
- Sharps disposal container

### Simulator Preparation

- Mannequin with identification and allergy band, positioned supine with safety strap across thighs
- Peripheral upper extremity IV catheter in place
- Right inguinal hernia incision site with visual surgical site verification marking
- Cardiac arrest program for mannequin with vital signs monitoring (if available)
- Active warming device in place
- Intermittent pneumatic sequential compression device and wraps in place

### Simulated Medications

- Midazolam IV
- 0.5% bupivacaine
- 1% lidocaine
- 0.9% NaCl IV 1 L bag
- 20% lipid emulsion 1 L IV
- Cardiopulmonary resuscitation medications

### 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

The simulation begins with the patient in the OR after he has received a transverse abdominis plane (TAP) block in the preoperative area using ropivacaine for postoperative pain control. The surgical team (surgeon, RN circulator, first assistant, and scrub person) is present. The anesthesia professional is preparing the patient for induction and insertion of the ETT. The perioperative RN performs preoperative surgical skin antisepsis of the surgical site. The surgeon and scrub person drape the patient; the team performs the surgical time out. Initial vital signs (first stage of mannequin program) are BP 110/70, heart rate (HR) 72, respiratory rate (RR) 15 (intubated), and arterial oxygenation (SpO<sub>2</sub>) 100%.

The anesthesia professional comments, "The patient should be fine since he received a block, although the anesthesiologist who administered the block said it was difficult, so I wonder if the block is going to be effective. Perhaps you should give him a little local." The surgeon asks, "How much can I give him?" The anesthesia professional responds, "You can give him about 10 mL of bupivacaine." The surgeon asks for bupivacaine and the RN circulator leaves the room to retrieve the medication. The RN circulator returns to the OR and transfers the medication to the sterile field. The surgeon begins injecting the bupivacaine and continues to make the surgical incision.

Within 3 minutes of the local injection (the second stage of the mannequin program), the patient displays seizure activity, and the ECG shows ventricular tachycardia (HR 150) with the BP jumping to 130/85. The anesthesia professional administers benzodiazepines for seizure suppression, and the seizures subsequently stop.

The patient then progresses to hemodynamic depression (next stage of the mannequin program) as the BP drops to 90/40 with a downward trend (88/40, then 85/35, then 80/30). The ECG displays ventricular fibrillation (next stage of the mannequin program). The anesthesia professional and surgeon assess the patient, and the team responds. The simulation proceeds under the guidance of the embedded simulation personnel until the team has administered the first bolus of 20% lipid emulsion IV, initiated the continuous infusion of 20% lipid emulsion IV, and stabilized the patient.

## Sequence of Events

### Skills Assessment - LOCAL ANESTHETIC SYSTEMIC TOXICITY (LAST)

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 is announced	00:00		
Call for help is made			
Crisis leader is identified			
Patient is ventilated with 100% oxygen			
IV access is verified			
Benzodiazepines are administered for seizure suppression			
ACLS algorithm for VF/VT is initiated			
20% lipid emulsion* bolus (1.5 mL/kg) is administered over 1 minute			
Lipid emulsion infusion (0.25 mL/kg/minute to 0.5 mL/kg/minute) is continued			
20% lipid emulsion bolus is repeated as needed x 2			
20% lipid emulsion infusion is continued for 10 minutes after cardiac stabilization			

\* Upper limit for 20% lipid emulsion: 10 mL/kg over the first 30 minutes

### What is 20% Lipid Emulsion?

Intravenous 20% lipid emulsion, sometimes labeled as “fat emulsion” or “intralipid,” is administered to reverse the toxic effects of a local anesthetic overdose. Though the mechanism of action is not entirely understood, the theory is that the lipophilic toxins bind to the lipid emulsion, resulting in a decrease of unbound circulating toxin, thereby decreasing the level of cardiotoxicity. The lipid emulsion is a white, opaque solution available in 250 mL, 500 mL, or 1000 mL bags or bottles for IV injection. IV tubing and 60 mL syringes with large bore needles are also needed to draw up and deliver the bolus doses of medication. A 70-kg (154-lb) patient would need 105 mL for the initial dose (1.5 mL/kg).



## Role Guidance for Local Anesthesia Systemic Toxicity (LAST) Crisis Response

	Surgeon	Anesthesia Professional	RN Circulator	Scrub Person	Charge RN	Emergency Response RN
Announce crisis		X				
Call for help; ask "Who will be the crisis leader?"			X			
Consider possible need for cardiopulmonary bypass; coordinate transfer if necessary		X			X	
Secure airway and ventilate with 100% oxygen		X	X			
Stop surgical procedure if possible	X			X		
Move and protect sterile table; provide sterile packing/dressings as needed				X		
Remove surgical drapes to facilitate resuscitation	X			X		
Confirm IV access	X	X	X		X	X
Administer benzodiazepines for seizure suppression (AVOID propofol)		X				
Begin ACLS algorithm for VF/VT (AVOID vasopressin, calcium channel blockers, beta blockers or local anesthetic; DECREASE epinephrine to < 1 mcg/kg)	X	X	X	X	X	X
Administer 20% lipid emulsion bolus (1.5 mL/kg) over 1 minute		X				X
Continue with lipid emulsion infusion 0.25 mL/kg/minute		X				X
Repeat lipid emulsion bolus (1.5 mL/kg) as needed x 2		X				X
Double lipid emulsion infusion rate to 0.5 mL/kg/minute for persistent cardiac instability		X				X
Continue lipid emulsion infusion for 10 minutes after cardiac stabilization		X				X
Assist with patient transfer to a monitored unit		X	X	X	X	X
Notify the family of the patient's condition	X					



### 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

- Which of the following medications, if injected intravascularly, could lead to LAST? Choose all answers that apply.
  - Bupivacaine
  - Fentanyl
  - Ropivacaine
  - Lidocaine
- The degree of LAST is directly dependent on the
  - total volume of local anesthetic injected.
  - age of the patient.
  - serum plasma level of circulating local anesthetic.
  - cardiac history of the patient.
- Recognizing the various factors that might place a patient at higher risk for LAST, which of the following patients would the perioperative RN be most concerned about after performing the preoperative nursing assessment?
  - A 56-year-old man with hypertension undergoing repair of a right femur fracture
  - A 10-year-old boy with type 1 diabetes undergoing a laparoscopic appendectomy
  - A 72-year-old woman with ischemic heart disease undergoing a carotid endarterectomy
  - A 33-year-old woman with paraplegia undergoing a right carpal tunnel release
- A surgeon has just placed a pudendal block in preparation for a dilation and curettage procedure. The anesthesia professional is concerned about LAST because the patient is exhibiting which of the following symptoms? Choose all answers that apply.
  - Confusion
  - Metallic taste
  - Periorbital numbness
  - ringing in the ears (tinnitus)
- If unrecognized, LAST can lead to cardiovascular collapse and death.
  - True
  - False
- Central nervous system symptoms (eg, confusion, seizures) of LAST may not be apparent in the patient receiving general anesthesia.
  - True
  - False
- A 70-kg (154-lb) man is undergoing a right carotid endarterectomy. He has a tonic-clonic seizure and exhibits signs of respiratory arrest. The anesthesia professional administers benzodiazepines and suspects LAST due to the recent injection of lidocaine. Which medication should be obtained and prepared for immediate administration to reverse the effects of toxicity?
  - Epinephrine
  - Lidocaine
  - Lipid emulsion
  - Propofol
- What is the initial recommended bolus dose of 20% lipid emulsion therapy for a 70-kg patient?
  - 35 mL (0.5 mL/kg)
  - 70 mL (1 mL/kg)
  - 105 mL (1.5 mL/kg)
  - 140 mL (2 mL/kg)
- During cardiac resuscitation of a patient with suspected LAST, it is recommended that individual doses of epinephrine be decreased to less than 1 mcg/kg.
  - True
  - False
- The patient who was treated for a LAST event in the OR is being recovered post procedure. The patient only experienced mild symptoms so may be evaluated and discharged to home since there is no risk for relapse of the local toxicity.
  - True
  - False

## Resources

### Test Answers

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

### References

- American Heart Association. Web-based Integrated Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care – Part 7: Adult Advanced Cardiovascular Life Support. <https://eccguidelines.heart.org/wp-content/themes/eccstaging/dompdf-master/pdffiles/part-7-adult-advanced-cardiovascular-life-support.pdf>. Accessed October 30, 2017.
- American Society of Regional Anesthesia and Pain Medicine. (ASRA) Checklist for Treatment of Local Anesthetic Systemic Toxicity. [https://www.asra.com/content/documents/asra\\_last\\_checklist.2011.pdf](https://www.asra.com/content/documents/asra_last_checklist.2011.pdf). Accessed October 30, 2017.
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- Ciechanowicz S, Patil V. Lipid emulsion for local anesthetic systemic toxicity. *Anesthesiol Res Pract*. 2012. doi: 10.1155/2012/131784
- Core Stanford Anesthesia Cognitive Aid Group. Emergency Manual: Cognitive Aids for Perioperative Critical Events. Version 3.1. Fall 2016. Available from <http://emergencymanual.stanford.edu/>. Accessed October 30, 2017.

## Resources

### **Considerations for Simulation Variation**

- Include transfer of the patient from the ambulatory surgery setting to higher level of care (inpatient hospital facility)
- Include embedded simulation personnel to challenge team dynamics

### **Acknowledgments**

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*Special thanks to members of the 2017 Simulation Task Force for their assistance in the development of this simulation scenario.*