Scenario Overview

Summary

A 45-year-old woman is undergoing a robot-assisted laparoscopic cholecystectomy. During the minimally invasive surgical procedure, an intraoperative robotics system failure occurs, which may include one or more of the following:

- set-up joint malfunction
- arm malfunction
- power error
- monocular monitor loss
- camera malfunction
- metal fatigue/break of surgeon's console hand piece
- software incompatibility

Setting

- Hospital operating room (OR)

Time

Pre-brief: 5-7 minutes
Simulation: 10-15 minutes (facilitator will determine end point)
Debrief: 30 minutes

Participants

Multidisciplinary team members necessary to perform a robot-assisted laparoscopic cholecystectomy with the support of embedded simulation persons:

- Surgeon
- Anesthesia professional (anesthesiologist, certified registered nurse anesthetist)
- RN circulator
- First assistant (RN first assistant, physician assistant, resident)
- Scrub person (RN or surgical technologist)
- Support personnel
- Resource RN
- Nursing professional development specialist/Clinical educator
- Manufacturer's representative

Potential Systems Explored

- Roles of the perioperative team members during a robotic system failure emergent event
- Support for the development of increasing technical skills
- Interprofessional reinforcement of team communication and professionalism

Learning Objectives

1. Demonstrate interprofessional communication and professionalism with respectful interactions to facilitate the appropriate response to a robotics system failure and minimize patient harm.
2. Describe potential risk factors for an intraoperative robotic system failure during surgery.
3. Discuss how to effectively use critical event checklists and an emergent conversion-to-open procedure checklist.
4. Optimize teamwork during an intraoperative robotic system failure.
5. Identify the appropriate steps to take when technological warnings point to a system failure.

Participant Preparation

Pre-Simulation

- Review the facility policy for Care of the Patient During Intraoperative Robotic System Failure.
- Review the facility policy for Troubleshooting an Intraoperative Robotic System Failure.
- Review the contents of the emergency cart.
- Review the vendor-provided instructions for emergency undocking.
- Read:
  - Carlos G, Saulan, M. Robotic emergencies: are you prepared for a disaster? *AORN J*. 2018;108(5):493-501. doi: 10.1002/aorn.12393
  - Intuitive Surgical. da Vinci Xi Surgical System Instrument Release Kit. https://manuals.intuitivesurgical.com/c/document_library/get_file?uuid=cc2edacc-b3a2-a891-4302-2467ccf8f853&groupId=73750789. 2016. Accessed February 24, 2020.
  - Intuitive Surgical. (2018). da Vinci Xi Surgical System User Manual. https://manuals.intuitivesurgical.com/c/document_library/get_file?uuid=254a7743-0f1e-812e-e72c-7aa279f38a9b&groupId=73750789. 2018. Accessed February 24, 2020.
  - Kim JH, Baek NH, Li G, et al. Robotic cholecystectomy with new port sites. *World J Gastroenterol*. 2013;19(20):3077-3082. doi: 10.3748/wjg.v19.i20.3077

Standard Introduction

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 the 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 course objectives.
5. Describe the learning environment:
    a. Simulation is a safe and confidential learning environment.
    b. Acknowledge participants' anxiety.
    c. Assure the participants of confidentiality of participants' performance and the procedure.
    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.
    e. Participants will be video recorded for purposes of debriefing. The video will be destroyed/deleted per the simulation laboratory guidelines. (optional)
6. Discuss expectations of the participants:
    a. Clinical role (be yourself).
    b. Assure participants that the embedded simulation persons 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. Cameras
    d. Monitors displaying vital signs
    e. Phone list
    f. Documentation
8. Orient participants to the patient's situation and their 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

Room

- Simulation OR or OR not in use

Equipment

- OR table with safety strap
- Mannequin
- Identification band for the mannequin
- Back table basic set up including robotic laparoscopy instruments and supplies (trocars, drapes)
- Mayo stand basic set up
- Electrosurgical unit
- Emergency cart (will be requested by the team)
- Anesthesia machine
- Airway equipment (endotracheal tube [ETT], bag valve mask)
- Surgical robot, surgeon console, patient cart, and vision cart
- Robot instrument release kit

Medications

- For the purpose of this simulation, no medication is needed; the focus is on the system failure of robot technology.

Simulator Preparation

Mannequin:

- Intubate with an ETT
- Place IV in the right arm
- Simulator program
- Positioning per physician preference

Sequence of Events

Suggested flow of simulation events:

- Abdominal prep and draping, handing off of all cords.
- All pause for Time Out.
- The initial incision is made.
- Trocars are strategically placed for robotic cholecystectomy.
- Bed is positioned for cholecystectomy: reverse Trendelenburg, tilt to left.
- The RN circulator brings the robot into position.
- The assistant docks the arms to the trocars.
- Camera and instruments are placed.
- The surgeon is at the console to perform the procedure.
- As the surgeon is taking down tissue to get to the cystic duct/artery, the robot's power goes off.
- The team recognizes the problem and announces a robotic system failure.
- The RN circulator turns on the room lights and begins troubleshooting for a power error.
- All consoles are checked for power cord placement.
- The RN circulator discovers the power plug has become disconnected from the wall socket.
- After re-plugging in the plug, the robot power button is pushed to reboot the system.
- The procedure resumes.
- The surgeon dissects the cystic duct and artery. As the artery is being clipped, the instrument fails to open and release.
- The surgeon announces the problem.
- A team member states that the releasing instrument must be located and placed on the field.
- The releasing instrument is located (note: the instrument location should mimic the real environment to support simulation validity).
- The RN circulator presents the peel-packed releasing instrument to the sterile field.
- The assistant has never performed this maneuver before and rotates the wrench in the wrong direction, which then damages the grip-release mechanism and moves, tearing the artery.
- The surgeon has the assistant at the field manually hold the instrument and apply pressure to the bleeding artery.
- The surgeon calls out, "emergency undock prepare to open" for conversion to an open procedure.
- The surgeon re-gowns and re-gloves.
- The scrub person removes all unattached instruments and the camera, undocks the arms from the trocars, and prepares for an open procedure.
- The assistant maintains pressure to control the bleeding.
- The RN circulator obtains the needed items for an open procedure: electrosurgical unit hand piece, Yankauer suction, and a #10 blade.
- The procedure continues as open procedure to control the hemorrhaging cystic artery.
- The surgeon controls and ligates the cystic artery to complete the gall bladder removal.
- The abdomen is irrigated and closed.
- The patient is stabilized in coordination with the anesthesia professional.

Sequence of Events

Skills Assessment - Emergency Undocking of the Robot

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

Action/Treatment Checklist	Time	Skill met	Skill not met
Announce the robotic system failure crisis and the need for conversion to a conventional laparoscopic or an open surgical approach or to abort	00:00		
If necessary, push the code button to receive additional assistance.			
Remove the instruments from the patient*			
Remove the endoscope from the patient			
Disconnect the cannulae from the arms			
Move the arms away from the patient			
If necessary, move the patient cart away from the patient			
If necessary, activate the patient cart to manual drive			
Continue to stabilize patient in coordination with the anesthesia professional			

*follow the manufacturer's instructions for robot instrument release

Debrief

Begin debriefing by soliciting the participant's 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 the instrument failed to open."
- "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

Intraoperative Robotics System Failure Pre/Post Test

1. Perioperative robotic surgery staff members should demonstrate use of robotic and computer-assisted equipment and accessories in accordance with the manufacturer's instructions for use and in a manner that minimizes the potential for patient and personnel injuries.
   a. True
   b. False

2. Port placement for a robotic assist laparoscopic cholecystectomy is usually:
   a. 1st port below the umbilicus
   b. 2nd and 3rd ports 7-10 cm distant from the endoscope
   c. At the discretion of the surgeon
   d. All of the above

3. The robotics system includes the:
   a. Surgeon console
   b. Vision cart
   c. Patient cart
   d. All of the above

4. Perioperative staff members should obtain specialized training to participate in robotic procedures.
   a. True
   b. False

5. Robotic emergencies can be classified by the following factors:
   a. Anesthesia
   b. Technical
   c. Surgical
   d. All of the above

6. Potential risk related to robotic surgery include:
   a. A broken instrument tip during the procedure.
   b. An inadvertent cut, tear, puncture or injury to organ structure, or tissue.
   c. There is no risk related to robotic surgery.
   d. a and b

7. How do you release a robotic instrument that fails to open?
   a. Push the emergency stop button
   b. Insert the wrench into the access hole at the top of the instrument
   c. Rotate the wrench ¼ turn counterclockwise
   d. Remove the wrench and remove the instrument
   e. All of the above, following the manufacturer's instructions

8. Immediate management of intraoperative robotic failure includes:
   a. Stopping the surgery
   b. Documenting observations
   c. Providing immediate patient care
   d. All of the above

9. Which part of the robotic system has both a power and emergency button?
   a. Patient cart
   b. Vision cart
   c. Surgeon console
   d. Both a and b

10. Specific patient positioning depends on the procedure and is not based on surgeon preference.
    a. True
    b. False

Resources

Intraoperative Robotics System Failure Test Answers

1. a
2. d
3. d
4. a
5. d
6. d
7. e
8. c
9. d
10. b

Resources

Other Resources

AORN Robotics Took Kit

Considerations for Simulation Variation

- Conversion to a conventional laparoscopic cholecystectomy
- Conversion to an open surgical approach: cholecystectomy
- Ending/suspension of the surgical procedure

References

Abdel Raheem A, Song HJ, Chang KD, Choi YD, Rha KH. Robotic nurse duties in the urology operative room: 11 years of experience. *Asian J Urol*. 2017;4(2):116-123. doi: 10.1016/j.ajur.2016.09.012

Carlos G, Saulan, M. Robotic emergencies: are you prepared for a disaster? *AORN J*. 2018;108(5):493-501. doi: 10.1002/aorn.12393

Intuitive Surgical. *da Vinci Xi Surgical System Instrument Release Kit*. https://manuals.intuitivesurgical.com/c/document_library/get_file?uuid=cc2edacc-b3a2-a891-4302-2467ccf8f853&groupId=73750789. 2016. Accessed February 24, 2020.

Intuitive Surgical. (2018). *da Vinci Xi Surgical System User Manual*. https://manuals.intuitivesurgical.com/c/document_library/get_file?uuid=254a7743-0f1e-812e-e72c-7aa279f38a9b&groupId=73750789. 2018. Accessed February 24, 2020.

Kang MJ, De Gagne JC, Kang HS. Perioperative nurses' work experience with robotic surgery: a focus group study. *Comput Inform Nurs*. 2016;34(4):152-158. doi: 10.1097/CIN.0000000000000224

Kim JH, Baek NH, Li G, et al. Robotic cholecystectomy with new port sites. *World J Gastroenterol*. 2013;19(20):3077-3082. doi: 10.3748/wjg.v19.i20.3077

Lenihan JP Jr. How to set up a robotic-assisted laparoscopic surgery center and training of staff. *Best Pract Res Clin Obstet Gynaecol*. 2017;45:19-31. doi: 10.1016/j.bpobgyn.2017.05.004

Song JB, Vemana G, Mobley JM, Bhayani SB. The second "time out": a surgical safety checklist for lengthy robotic surgeries. *Patient Saf Surg*. 2013;7(1):19. doi: 10.1186/1754-9493-7-19

Sutton S, Link T, Makic MB. A quality improvement project for safe and effective patient positioning during robot-assisted surgery. *AORN J*. 2013;97(4):448-456. doi: 10.1016/j.aorn.2013.01.014

The Joint Commission. (June 2014). Potential risks of robotic surgery. *Quick Safety*, 6(3). https://www. jointcommission.org/assets/1/23/Quick_Safety_Issue_Three_June_2014.pdf.

Uslu Y, Altinbaş Y, Özercan T, van Giersbergen MY. The process of nurse adaptation to robotic surgery: a qualitative study. *Int J Med Robot*. 2019;15(4):e1996. doi: 10.1002/rcs.1996

Zattoni F, Morlacco A, Cattaneo F, et al. Development of a surgical safety training program and checklist for conversion during robotic partial nephrectomies. *Urology*. 2017;109:38-43.

Resources

Acknowledgments

Lead authors:

Nancy Alverio, MSN/Ed, MHA, RN, CNII, Cook County Health, John H. Stroger, Jr. Hospital, PeriOperative Division, Main Operating Room, Chicago, Illinois; Jean Franks, BSN, RN, CNOR, CRNFA, Sole Proprietor, Eastside Surgical Assistants; Staff Nurse, Northwest Surgery Center, Houston, Texas; and Christine Kennedy, MA, BSN, RN, CNOR, Nurse Application Specialist OpTime, Information Technology Services, New Haven, Connecticut.

Special thanks to members of the 2019-2020 Simulation Task Force for their assistance in the development of this simulation scenario.