Operating room trauma simulation: The St. Luke’s University Health Network experience

INTRODUCTION

The maintenance of readiness is an important component of care optimization for the critically injured trauma patient. This applies to the individual, the team, and the system levels. Evidence shows that there may be a correlation between trauma volumes and effective trauma team readiness and that there may also exist a relationship between clinical outcomes and the number of patients treated during a specific period of time. Simulated cases, especially those featuring realistic, high-fidelity scenarios, have the potential to materially enhance trauma team readiness, retention of process-specific skills, and knowledge, in addition to improving the critical thinking ability.

To help enhance our trauma team’s functional readiness in the emergency operative setting, we set out to design and implement an operating room (OR) trauma simulation (ORTS) exercise. The aim of this simulation exercise was to identify the key opportunities to further optimize our existing OR trauma procedures and performance.

OPERATIVE TRAUMA SIMULATION SCENARIO

Case simulation summary

Level A Alert (e.g., highest acuity) is called for a trauma patient who presents after sustaining a gunshot wound to the abdomen. He is unstable, is promptly brought to the OR, and massive transfusion protocol is called due to rapidly deteriorating patient condition. The attending trauma surgeon then decides to prepare for emergency thoracotomy, including open cardiac massage and direct application of internal defibrillation pads. In the meanwhile, the patient responds to less invasive resuscitative maneuvers, the thoracotomy is aborted, and the surgeon proceeds with the original plan to perform an exploratory laparotomy.

The setting

The simulated case scenario took place at the University Hospital OR (St. Luke’s University Hospital, Bethlehem, Pennsylvania, USA).

Key components and structure of the process

The overall ORTS process is simple but requires excellent operational integration due to ongoing primary OR activities. The overall exercise takes anywhere between 30 and 50 min, depending on the completion time for each of the preplanned phases [Figure 1]. The list of exercise participants, including their respective roles, is provided in Table 1. The ORTS is designed to evaluate the skills and system-based aspects specific to emergency OR trauma cases [Table 2]. A deliberate preparation process [Table 4] and simulation set-up process [Table 5] takes place before the exercise commences. The simulation itself is highly...
Table 1: Required participants of the current trauma simulation exercise

| Personnel description               | Personnel role                     |
|------------------------------------|------------------------------------|
| Simulation personnel               | Oversight/objective observers      |
| Trauma surgeon                     | Trauma team leader                 |
| Trauma residents/fellows           | Trauma team participants/members   |
| Anesthesiologist/certified         | OR team members                    |
| registered nurse anesthetist       |                                    |
| Registered nurse circulator (χ²)   | OR team members                    |
| Surgical technologist (χ²)         | OR team members                    |
| OR: Operating room                 |                                    |

Table 2: Summary of broadly defined categories of skills and systems-based aspects of the current trauma simulation exercise

| Item category                        | Specific skills and system-based aspects |
|--------------------------------------|------------------------------------------|
| Systems explored                     | Roles of the perioperative team members during an emergency trauma surgery/MTP event |
| Technical skills examined            | Familiarity with cell saver deployment/operation; defibrillator use, including internal pad placement |
| Interdisciplinary training in communication and professionalism | Participants must learn how to effectively delegate/collaborate |

Table 3: Summary of specific goals, objectives, and skills the learner should be exposed to and acquire as a result of this exercise

| Category/item | |
|---------------|---------------------------------------------------------------------------------|
| Demonstrate competence during an MTP | |
| Perform competently during a trauma code when the crash cart is involved | |
| Identify the appropriate treatment and equipment needed for a patient that needs an MTP or is hemodynamically unstable in the OR | |
| Observe/explore how to effectively delegate tasks such as having someone stay with the surgical technologist while the main circulating charts and delegates, having a second person scrub in to help at the field, and having someone help check/infuse blood. All of the above should be done in a clear, seamless, and respectful manner | |
| Upon examining the simulated OR scenario, an objective observer should be able to readily identify who is performing each respective job/function | |
| Demonstrate the knowledge of, and the ability to use, the equipment needed to perform thoracotomy | |
| Demonstrate the proper use of the defibrillator device and R2 defibrillation pads | |

DISCUSSION

Simulation is one of the most important tools to achieve and maintain readiness in trauma scenarios, especially when dealing with the less commonly encountered patient who is in extremis. Among the cornerstones of effective trauma response is the right combination of team coordination, communication, and collaboration. Without these three components, an organized trauma response is bound to have inherent inefficiencies, and patient outcomes may suffer as a result.[6,8]

Barriers to implementing effective simulation include low fidelity/lack of realism, inadequate logistics, insufficient time, financial consequences of “nonproductive” time, intimidating or stressful environment, and fear of being judged/critiqued.[9] Of importance, without institutional commitment to high-quality simulation, critical processes used in emergent scenarios may suffer when put to the real-life test. Previous research suggests that lower-than-usual trauma volumes, even for very busy trauma centers that experience a “temporary slow-down,” may result in worse outcomes during such slower periods.[10] Consequently, fostering some form of “mission readiness” may be beneficial to ensure that appropriate levels of critical thinking and cognitive skills, along with technical competency, are maintained [Table 7].[10-13]

Simulated scenarios, especially high-fidelity ones, promise to provide an effective platform for the maintenance of readiness, especially in the context immediately relevant to this commentary.[10,11,13,14] In addition, simulation-based training may also be beneficial in provider confidence building and patient safety promotion.[12,15-17] These concepts take on further significance and depth when considered in the inter-professional environment of modern trauma practice, where large and intricately interconnected teams are required to perform highly coordinated, complex task sequences in patient-centered fashion.[18-20]

In conclusion, the current report of our institutional experience with ORTS provides a readily implementable framework for other, similarly structured institutions. Following exercise completion, the majority of participants identified a number of opportunities for improvement, at personal, team, and institutional levels. Consequently, we recommend other trauma centers (and institutions where similar experiences may be of value) to consider this approach to maintaining readiness, especially across “mission-critical” areas of team performance.

Acknowledgment

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The patient is immediately intubated and taken directly to OR, foregoing any additional testing. This is as an

| Table 6: Sequence of events during simulation |
|---------------------------------------------|
| **Step**                   | **Comment/Description**                                            |
| Introduction                | A 35-year-old male arrives by ambulance to an emergency department/trauma bay with a GSW to the abdomen. The patient is alert and oriented X1, and rapidly declining |
| Initial vital signs         | Heart rate: 120 beats/min  |
|                            | Blood pressure: 65/30 mmHg |
| Adjunctive physiological    | Respirations: 16 breaths/min |
| indicators                  | Electrocardiogram: Sinus tachycardia |
| Immediate actions           | SpO₂: 90% |
|                            | The patient is immediately intubated and taken directly to OR, foregoing any additional testing. This is as an emergency measure to attempt hemorrhage control: (a) Circulator and scrub assigned to trauma and prebriefed; (b) Patient arrives in the OR and vital signs continue to decline: (c) Attending trauma surgeon enters the OR and requests "cell saver and MTP" to be called immediately; (d) Anesthesiologist requests a technician to be called to help them; (e) At least two other staff members will walk into the room to ask if they can help, with the intent for the circulator to delegate tasks to them |

Contd.....
The main circulator is now prompted to request any staff members who are no longer needed, given the death of one of the patient's organs.

**Skill met**

The trauma simulation now ends, followed by a detailed debrief. The team focuses on what went well and whether the team was able to stabilize the patient. Staff in the OR will be asked to reflect on their ability to connect and operate the defibrillator.

**Skill not met**

Once the patient is defibrillated, the vital signs begin to stabilize. Simultaneous MTP is in progress. Thoracotomy is now aborted. Anesthesia team announces that blood pressure has now stabilized, and the attending trauma surgeon asks if the patient is sufficiently stable to proceed with the originally planned laparotomy. Anesthesia team confirms that “we are now stable enough”.

**Laparotomy proceeds**

The main circulator is now prompted to request any staff members who are no longer needed, given the improvement in the patient’s condition, to leave the room. In parallel, the OR charge nurse will call into the room asking how things are proceeding. The charge nurse will specifically ask for additional staff in other rooms if no longer required in the trauma room.

**Conclusion and debrief**

The trauma simulation now ends, followed by a detailed debrief. The team focuses on what went well and whether there were any opportunities for improvement. Begin debriefing by soliciting the participant’s reactions to the simulation experience. Ensure clarity by providing a brief overview of the simulated patient scenario so that everyone is on the same page: (a) Emphasize confidentiality; (b) Again clarify expectations; (c) Review learning objectives; (d) Discuss what happened during the simulation; (e) Review what went well; (f) Consider opportunities for improvement.

**Self/group reflection strategies**

Encourage open expression and sharing of immediate reactions to the exercise. Examples of questions to ask participants: (a) “How did participating in this simulation make you feel?”; (b) “Describe your thinking when…?;” (c) “Were there performance gaps?”; (d) “What could be changed in the OR?”

Perform a review of the participant’s roles and team expectations.

Review key principles of effective interprofessional teamwork.

Review expectations for effective communication and identify any learner issues/concerns.

Provide simulation exercise participants with postsimulation survey.

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Table 6: Contd.....

| Step                      | Comment/Description                                                                 |
|---------------------------|-------------------------------------------------------------------------------------|
| OR events                 | After preparations take place in the OR for a few minutes, the attending trauma surgeon will state that he/she needs to perform an emergency thoracotomy. Around the same time, the patient’s heart rhythm degenerates into ventricular tachycardia. Given the gravity of this rapidly evolving clinical scenario, OR staff reach for thoracotomy instruments, call for “crash cart” (if not already in the room), and push to obtain and apply R2 pads on the patient as quickly as possible. |
| Patient stabilizes        | The attending trauma surgeon states that he/she will now defibrillate the patient, at minimum once. Staff in the OR are now stable enough. |
| Laparotomy proceeds       | The main circulator is now prompted to request any staff members who are no longer needed, given the improvement in the patient’s condition, to leave the room. In parallel, the OR charge nurse will call into the room asking how things are proceeding. The charge nurse will specifically ask for additional staff in other rooms if no longer required in the trauma room. |
| Conclusion and debrief    | The trauma simulation now ends, followed by a detailed debrief. The team focuses on what went well and whether there were any opportunities for improvement. Begin debriefing by soliciting the participant’s reactions to the simulation experience. Ensure clarity by providing a brief overview of the simulated patient scenario so that everyone is on the same page: (a) Emphasize confidentiality; (b) Again clarify expectations; (c) Review learning objectives; (d) Discuss what happened during the simulation; (e) Review what went well; (f) Consider opportunities for improvement. |
| Self/group reflection     | Encourage open expression and sharing of immediate reactions to the exercise. Examples of questions to ask participants: (a) “How did participating in this simulation make you feel?”; (b) “Describe your thinking when…?;” (c) “Were there performance gaps?”; (d) “What could be changed in the OR?” Perform a review of the participant’s roles and team expectations. Review key principles of effective interprofessional teamwork. Review expectations for effective communication and identify any learner issues/concerns. Provide simulation exercise participants with postsimulation survey. |

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Table 7: Formal skills assessment

| Action/treatment checklist | Time | Skill met | Skill not met |
|---------------------------|------|-----------|---------------|
| The lead circulator is determined and announced | | | |
| Basic OR trauma setup done (surgical boat and rack) | | | |
| Lead circulator delegates to other nursing team members clearly and respectfully | | | |
| The team recognizes patient deterioration and calls for cell saver deployment | | | |
| Learner initiates MTP when asked | | | |
| Participant recognizes to get crash cart into the room and/or calls for it | | | |
| Participant demonstrates how to use/set up cell saver | | | |
| Learner is able to use crash cart and defibrillator | | | |
| Participant shows sufficient knowledge of surgical instruments needed to open the chest | | | |
| Surgical team carries out trauma in an organized fashion | | | |
| Learner is able to demonstrate how to place R2 pads | | | |

Comment: The team should continue the simulation exercise until all predetermined actions and/or treatments are completed. Treatment action time points are clearly referenced, beginning with the “time of crisis” announcement. MTP: Massive transfusion protocol.

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