

A Multidisciplinary Approach to Treating Traumatic Pelvic Fractures

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PURPOSE/GOAL

To provide the learner with knowledge of best practices related to treatment of traumatic pelvic fractures.

OBJECTIVES

1. Discuss pelvic fractures.
2. Identify treatment recommendations for pelvic fractures.
3. Discuss the advantages of providing patient care in a hybrid OR.

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Ramie Miller, MSN, RN, CNOR, has no declared affiliation that could be perceived as posing a potential conflict of interest in the publication of this article.

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ABSTRACT

Pelvic fractures are traumatic injuries that can be caused by motor vehicle accidents, motorcycle accidents, motor vehicle-related pedestrian injuries, or falls from a significant height. These injuries can be life threatening because of the high vascularity of the pelvis and the difficulty in being able to see bleeding occurring in this area. Traditional approaches to treat pelvic fractures have been pelvic binding, external fixation, and open preperitoneal packing; however, the use of angiography and embolization enables faster pinpointing of the location of the bleeding. Increased use of hybrid ORs for treating traumatic pelvic fractures combines the superior imaging of interventional radiology with an OR that can quickly provide open interventions without needing to move a patient from an interventional radiology suite to another OR. This improvement in technology has combined the resources and knowledge of more diverse disciplines to provide a more centralized approach to improving patient outcomes.

Key words: *trauma, pelvic fractures, pelvic injuries, hybrid OR, interventional radiology.*

The use of patient care protocols in trauma centers has significantly improved patient outcomes.¹ Certain injuries (eg, pelvic ring disruption or fracture) warrant an immediate transfer to a Level I trauma center and advanced trauma life support measures.¹ Trauma resulting from motor vehicle accidents, motorcycle accidents, motor vehicle-related pedestrian injuries, or falls from a significant height have a high energy transfer that often results in multisystemic injuries.¹ Exsanguination and life-threatening uncontrolled hemorrhage from a fracture of the pelvic surface or damage of major pelvic arteries and veins (eg, the presacral venous plexus) can quickly lead to death.¹ Most patients arriving with pelvic fractures also experience polytrauma (ie, injuries to multiple body parts and multiple organ systems).¹ The perioperative team working in concert with multidisciplinary teams (eg, trauma, emergency, orthopedics, interventional radiology [IR]) has been instrumental in reducing mortality by implementing

and standardizing pelvic fracture treatment protocols (eg, stabilizing, packing, externally fixating, using angiography and embolization).¹

In 2012, the Centers for Disease Control and Prevention published their *Guidelines for Field Triage of Injured Patients*.² This report is a culmination of years of collaboration between the American College of Surgeons Committee on Trauma (ACS-COT) and other professional organizations to define and recommend emergency first responses to injuries in the field.² The ACS-COT created algorithms for better identification, intervention, and application of routine practices during triage of injured patients.² Regardless of other injuries, patients with pelvic fractures warrant transport from the field to the highest level of care in a designated trauma care system. The ACS-COT specifically recommends that all patients with pelvic fractures be transported to a Level I or Level II trauma center where standardization of treatment protocols and

multidisciplinary team communication have significantly improved patient outcomes.³

When a patient with multiple or life-threatening injuries arrives at a Level I trauma center, a multidisciplinary trauma team assesses and manages his or her care. This team includes

- emergency and critical-care RNs,
- emergency physicians and residents,
- trauma surgeons and residents,
- perioperative RNs,
- certified RN anesthetists,
- anesthesiologists, and
- allied health personnel (eg, anesthesia assistants, radiology and blood bank technicians).³

In addition, on-call specialists assess the patient's injuries and coordinate care interventions. A patient who has sustained an unstable pelvic fracture should undergo an orthopedic specialist's consultation. This physician will help coordinate multidisciplinary care with the trauma team for optimal management of the injury.³

The American College of Surgeons and the Trauma Quality Improvement Program, in collaboration with the Orthopaedic Trauma Association, published a best practices guide for the management of orthopedic trauma.⁴ Protocols for determining the extent of a patient's injuries and their management include

- performance of cross-sectional imaging,
- verifying the presence of hemorrhage or hemodynamic instability,
- performing angiography with potential embolization,
- providing pelvic binding,
- activating an early mass transfusion protocol,
- providing preperitoneal packing or external fixation, and
- transferring the patient to a trauma center if angiography is not available.⁴

MANAGEMENT OF PELVIC FRACTURES

The pelvis is a bony, ring-shaped structure that acts as a support system for the spine and provides important

solid protection for internal organs including the bladder, reproductive organs, kidneys, colon, and rectum. However, because of the high-volume vascularity of this structure, damage can lead to significant hemorrhage that often cannot be seen or managed immediately.⁵ Management of pelvic fractures can be achieved through predetermined algorithms, such as the one used in a 10-year regional study by orthopedic trauma specialists in a multicenter setting in Italy.⁵ These researchers concluded that initial management of pelvic fractures using an emergent decisional algorithm was effective when reduction of the displacement was successful and stable before definitive surgical fixation.⁵ Basic first aid principles (ie, stop the bleeding, stabilize the fracture) apply when treating patients with pelvic fractures.

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Initially, securing a regular bedsheet circumferentially around the patient's pelvis and clamping it closed (ie, binding the pelvis) can stabilize the fracture and create an extraperitoneal tamponade to slow or stop bleeding and allow clots to form.^{5,6} If satisfactory stability and hemostasis are achieved, the patient can then undergo surgical fixation using a C-clamp, external fixation, or plates and screws.⁵⁻⁷ If the fracture is unstable and the surgical team cannot achieve satisfactory hemostasis, or if the patient has a positive, focused abdominal sonography for trauma, the next consideration is for the team to ensure the availability of angiography and perform an exploratory laparotomy for retroperitoneal assessment or preperitoneal pelvic packing (PPP).^{6,7} Angiographic embolization is preferred by polytrauma and orthopedic surgeons, and is most effective in controlling pelvic arterial and cancellous bone bleeding in patients with hemodynamically unstable pelvic fractures.⁷ However, this approach requires that appropriate personnel and equipment are readily available or on standby, and this may only be possible in trauma centers.

The availability of angiography and embolization may vary from location to location. Although angiography and

embolization may be viewed as the preferred methods of treatment, a Rutgers University study found that PPP can be an alternative for instances in which there is limited or no access to angiography, the patient has multiple emergent comorbidities, or the patient is too unstable for transport to an angiography suite.⁸ Patients with unstable pelvic fractures require transport either to an IR suite for angiography and embolization or to the OR for an open procedure. However, one limiting factor is that some facilities have no access to an IR suite or a hybrid OR; therefore, providers at these facilities prefer PPP. The increased use of hybrid ORs in which clinicians have simultaneous access to an OR and an IR suite has increased the demand for angiography and embolization.

THE HYBRID OR

The hybrid OR combines the functionality of a laparoscopic suite with the capability of performing open procedures. Angiography available in hybrid ORs enables surgeons to perform minimally invasive procedures in a sterile environment with the ability to convert to an open procedure easily if needed.⁹ A wide variety of cardiothoracic and endovascular surgical services (eg, endovascular aneurysm repair, thoracic endovascular aortic aneurysm repair, aortic arch aneurysm repair)⁹ are commonly performed in hybrid ORs that include a cardiac catheterization laboratory and an OR team; this interdisciplinary use has proven to be both time and cost effective.¹⁰

Trauma surgeons, orthopedic surgeons, and interventional radiologists are beginning to work together more frequently. Trauma and IR services are using angiography and embolization as a first-step solution for pelvic fractures.¹¹ In a review of the National Trauma Data Bank conducted from 2008 to 2010, researchers found an increased use of angiography and embolization in pelvic fractures. However, it should be noted that this increase also could be attributed to patients' higher acuity and injury severity scores as well as the presence of a higher number of comorbidities in older adult patients.¹²

In surgical management of a pelvic hemorrhage, it can be difficult for the surgeon to assess the extent of the injury and identify sources of hemodynamic instability; in these instances, minimally invasive angiography and embolization are beneficial. Sources of bleeding from arteries, veins, and fractured cancellous pelvic bone can conceal up

to 4 L of low-pressure bleeding, resulting in a retroperitoneal hematoma.¹³ Researchers conducting a retrospective analysis found value in using computed tomography for diagnosis and then performing angiography and embolization in the angiography suite to treat retroperitoneal hematomas.¹⁴

In a recent qualitative study, Swedish researchers also found benefit in *boundary work*, which they defined as the use of a hybrid OR in which resources are patient centered, knowledge is shared, and different disciplines and medical specialties (eg, radiology, surgery, anesthesia) are not operating separately and independently.¹⁵ In other words, the OR and the IR teams come to the patient and work together, thus providing more effective, efficient, and economically prudent care.

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Perioperative Nursing in the Hybrid OR

The perioperative nurse's role and responsibilities remain the same in the hybrid OR; however, the intraoperative role may be much more collaborative and less defined. In 2013, AORN published "Hybrid OR 101: a primer for the OR nurse,"⁹ in which the authors drew from real-life experiences to paint a picture for readers of this multidisciplinary merger and the perioperative nurse's role in the hybrid OR. The types of procedures currently performed in the hybrid OR include endovascular aortic repairs, thoracic endovascular aortic repair, and lead implantation or extraction;¹⁵ however, as more surgical service members see the benefits of the hybrid OR, its use and the requisite collaboration among different teams will become more prevalent.¹⁵

Personnel at University Medical Center, a Level I trauma center in New Orleans, Louisiana, have begun to address some of the issues that arise upon the initial request for use of the hybrid OR. The hybrid OR at this facility is located

Key Takeaways

- ◆ Traditional approaches to treat pelvic fractures have been pelvic binding, external fixation, and open preperitoneal packing; however, the use of angiography and embolization enables faster pinpointing of the location of the bleeding.
- ◆ Increased use of hybrid ORs for treating traumatic pelvic fractures combines the superior imaging of interventional radiology with an OR that can quickly provide open interventions without the need for moving a patient from an interventional radiology suite to another OR.
- ◆ Use of a hybrid OR in conjunction with minimally invasive angiography and embolization helps identify sources of bleeding from arteries, veins, and fractured cancellous pelvic bone and improve patient outcomes.
- ◆ The perioperative team working in concert with multidisciplinary teams (eg, trauma, emergency, orthopedics, interventional radiology) has been instrumental in reducing mortality by the implementation and standardization of pelvic fracture treatment protocols (eg, stabilizing, packing, externally fixating, using angiography and embolization).

in the IR laboratory. Crossover scheduling (ie, a procedure request viewable in both the IR and OR schedules) is now possible in the electronic health record. The responsibility for making the initial procedure request lies with personnel from the surgical service that requires the hybrid OR. For example, if a conventional IR procedure is requested, staff members from the IR, vascular, or neurosurgical service can proceed with requesting IR staff members according to IR protocols. However, if a trauma surgeon has a procedure request, the OR team will ready the hybrid OR according to OR protocols (Roxanne McNally, BSN, RN; supervisor and hybrid coordinator, University Medical Center; oral communication; June 2017).

An OR surgeon's request to add a procedure requires an OR charge nurse or supervisor to coordinate IR and OR staff members, anesthesia professionals, surgeons, interventional radiologists, and the patient. University Medical Center has provided a permanent supply room next to the hybrid OR stocked with items that are needed during these procedures (eg, sutures, vessel-sealing devices, extra gowns and gloves). Leaving the hybrid area to retrieve items is not prudent, so a room is available for personnel to access supplies inside the confines of the hybrid OR. Those currently using the hybrid OR at this facility include cardiothoracic and trauma surgeons performing resuscitative endovascular balloon occlusion of the aorta catheterization and advanced imaging for angiography and embolization of patients with multitrauma and pelvic fractures.

FUTURE APPLICATIONS OF MULTIDISCIPLINARY TEAMS AND HYBRID ORs

Hybrid ORs are increasingly being used for procedures that previously have not been performed in IR suites.¹⁶ Clinicians in India have used the hybrid OR to treat complex fractures of the pelvis, calcaneus, and tibial head, as well as to perform spine and scoliosis procedures.¹⁷ In a retrospective German study, surgeons inserting a percutaneous iliosacral screw were able to compare previous conventional imaging with image guidance in a hybrid OR to determine the accuracy of the screw's placement and found that the view of the entire dorsal pelvis was improved.¹⁸ This same group of individuals collected data for one year in a Level I trauma center in Germany and reported that they could use the hybrid OR to place implants for patients with orthopedic trauma, and that this setting was advantageous for performing spine and pelvic procedures. Confirmation with 3D imaging before leaving the OR had the additional benefit of eliminating the need for transporting the patient to radiology for a postoperative computed tomography scan.¹⁹ Orthopedists from the University of Virginia School of Medicine, Charlottesville, also found the hybrid OR's 3D technology to be a powerful tool for orthopedic procedures requiring complicated imaging (eg, syndesmotic injuries in ankle fractures).²⁰

Orthopedic specialists have investigated using the hybrid OR for more complex pelvic fractures, such as those in pregnant patients. Personnel at New York

University Hospital for Joint Diseases, New York City, and the Philadelphia College of Osteopathic Medicine, Pennsylvania, suggest the use of a specialized team (ie, an RN, obstetrician, perinatologist, orthopedic surgeon, general trauma surgeon, critical care specialist, emergency medicine specialist, anesthesiologist, radiologist) when treating pregnant patients with trauma and pelvic fractures.²¹ Coordination and collaboration are vital to the improvement of outcomes in patients who have sustained traumatic injuries, and the future of successful pelvic fracture management continues to move toward the hybrid OR.

MULTIDISCIPLINARY CARE

Multidisciplinary approaches to surgical procedures are not a new concept. For example, patients with breast cancer receive collaborative care that includes general surgery and plastic surgery teams performing a mastectomy followed by breast reconstruction. In trauma care situations, a vascular surgeon may repair the vascular structure of an extremity before an orthopedic team places an external fixator for support of an injury.

Collaboration between all health care providers using the hybrid OR should be carefully planned, adjusted logistically, and practiced to realize the fullest extent of the hybrid OR's capabilities. The OR team must adapt to being a cross-functional unit that ensures the best outcomes for patients.²² Breakdowns in communication rather than competency-related issues are associated with a greater number of adverse events and greater morbidity and mortality during the course of health care delivery.²² Planning before providing care for a patient can help teams identify potential problems, roadblocks, or missing resources.

Surgeons, clinical and ancillary staff members, anesthesia professionals, and environmental services personnel should be informed before a procedure in a hybrid OR begins. The scheduled procedure should be posted where all team members can see it and the specific needs for the procedure. Leaders should page or call other team members if they are not immediately present. In addition, leaders should

- identify areas where there may be communication issues and help resolve them,
- help locate resources,
- make a list of items needed for each procedure,

- restock items for the next team,
- advocate for the patient, and
- assess for additional needs (eg, policy changes, guidelines, supplies, personnel, training, checklists).

Chard and Makary²² have identified best practices for nursing communication. Essential elements to assist with this communication include a comprehensive surgical checklist, resources from the World Health Organization (eg, Surgical Safety Checklist); The Universal Protocol for Preventing Wrong Site, Wrong Procedure, and Wrong Person Surgery; the Safe Surgery 2015 campaign; and standardized team communication tools and protocols to promote the delivery of high-quality health care.²²

CONCLUSION

Pelvic fracture hemorrhage is a major life-threatening orthopedic injury that is difficult to see, isolate, and treat. Technologically advanced hybrid ORs provide greater ability to see the surgical field and offer 3D capabilities beneficial for treating patients with higher-acuity injuries and higher injury severity scores. Further, multidisciplinary approaches and collaborative practices are essential to improve safety and ensure better patient outcomes when treating traumatic pelvic fractures.

Editor's note: *The Universal Protocol for Preventing Wrong Site, Wrong Procedure, and Wrong Person Surgery is a trademark of The Joint Commission, Oakbrook Terrace, IL.*

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Continuing Education

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PURPOSE/GOAL

To provide the learner with knowledge of best practices related to treatment of traumatic pelvic fractures.

OBJECTIVES

1. Discuss pelvic fractures.
2. Identify treatment recommendations for pelvic fractures.
3. Discuss the advantages of providing patient care in a hybrid OR.

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QUESTIONS

1. Trauma resulting from motor vehicle accidents, motorcycle accidents, motor vehicle-related pedestrian injuries, or falls from a significant height can result in
 1. high energy transfer.
 2. low energy transfer.
 3. single-system injury.
 4. multisystemic injury.
 - a. 1 and 4
 - b. 2 and 4
 - c. 1, 2, and 4
 - d. 1, 2, 3, and 4
2. Most patients with pelvic fractures also experience
 - a. polytrauma.
 - b. multitrauma.
 - c. neurotrauma.
 - d. vascular trauma.
3. Pelvic fractures can be life threatening because of the
 1. polytrauma that accompanies pelvic fractures.
 2. uncontrolled hemorrhage from a fracture of the pelvic surface.
 3. exsanguination.
4. high vascularity of the pelvis.
5. difficulty in being able to see bleeding occurring in this area.
 - a. 4 and 5
 - b. 1, 2, and 3
 - c. 1, 2, 3, and 4
 - d. 2, 3, 4, and 5
4. The American College of Surgeons Committee on Trauma specifically recommends that all patients with pelvic fractures be transported to a Level I or Level II trauma center because of
 1. standardization of treatment protocols.
 2. multidisciplinary team communication.
 3. better access to emergency transport.
 4. significantly improved patient outcomes.
 - a. 1 and 4
 - b. 2 and 4
 - c. 1, 2, and 4
 - d. 1, 2, 3, and 4
5. Protocols for determining the extent of a patient's injuries and their management include
 1. performing cross-sectional imaging.
 2. verifying the presence of hemorrhage.

3. verifying hemodynamic instability.
4. performing angiography with potential embolization.
5. providing pelvic binding, preperitoneal packing, or external fixation.
6. activating early mass transfusion protocol.
 - a. 1, 3, and 5
 - b. 2, 4, and 6
 - c. 2, 3, 5, and 6
 - d. 1, 2, 3, 4, 5, and 6
6. Initial management of pelvic fractures includes
 1. using an emergent decisional algorithm.
 2. stopping the bleeding.
 3. stabilizing the fracture and creating an extraperitoneal tamponade to bind the pelvis.
 4. ensuring the availability of angiography.
 5. performing an exploratory laparotomy for retroperitoneal assessment.
 6. performing preperitoneal pelvic packing.
 - a. 1, 3, and 5
 - b. 2, 4, and 6
 - c. 2, 3, 5, and 6
 - d. 1, 2, 3, 4, 5, and 6
7. Hybrid ORs provide angiography capabilities and enable surgeons to perform minimally invasive procedures in a sterile environment with the ability to convert easily to an open procedure.
 - a. true
 - b. false
8. The term _____ refers to the use of a hybrid OR in which resources are patient centered, knowledge is shared, and different disciplines and medical specialties (eg, radiology, surgery, anesthesia) are not operating separately and independently.
 - a. team work
 - b. boundary work
 - c. collegial work
 - d. silo work
9. Collaboration between all health care providers using the hybrid OR should be carefully planned, adjusted logically, and practiced to realize the fullest extent of the hybrid OR's capabilities.
 - a. true
 - b. false
10. To provide better care in a hybrid OR, leaders should
 1. monitor traffic into and out of the hybrid OR.
 2. advocate for the patient.
 3. help locate resources.
 4. make a list of items needed for each procedure and restock items for the next team.
 5. identify areas where there may be communication issues and help resolve them.
 6. ensure participants arrive on time.
 - a. 1, 3, and 5
 - b. 2, 4, and 6
 - c. 2, 3, 4, and 5
 - d. 1, 2, 3, 4, 5, and 6

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OBJECTIVES

To what extent were the following objectives of this continuing education program achieved?

1. Discuss pelvic fractures.
Low 1. 2. 3. 4. 5. *High*
2. Identify treatment recommendations for pelvic fractures.
Low 1. 2. 3. 4. 5. *High*
3. Discuss the advantages of providing patient care in a hybrid OR.
Low 1. 2. 3. 4. 5. *High*

CONTENT

4. To what extent did this article increase your knowledge of the subject matter?
Low 1. 2. 3. 4. 5. *High*
5. To what extent were your individual objectives met?
Low 1. 2. 3. 4. 5. *High*

6. Will you be able to use the information from this article in your work setting?
 1. Yes
 2. No
7. Will you change your practice as a result of reading this article? (If yes, answer question #7A. If no, answer question #7B.)
 - 7A. How will you change your practice? (Select all that apply)
 1. I will provide education to my team regarding why change is needed.
 2. I will work with management to change/implement a policy and procedure.
 3. I will plan an informational meeting with physicians to seek their input and acceptance of the need for change.
 4. I will implement change and evaluate the effect of the change at regular intervals until the change is incorporated as best practice.
 5. Other: _____
 - 7B. If you will not change your practice as a result of reading this article, why? (Select all that apply)
 1. The content of the article is not relevant to my practice.
 2. I do not have enough time to teach others about the purpose of the needed change.
 3. I do not have management support to make a change.
 4. Other: _____