Trauma in Pregnancy

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Taking Care of High-Risk OB Patients Obstetrical Symposium 11.03.2023







aura WOMEN'S HI INSTITUTE TEXAS TECH UNIVERSITY HEALTH SCIENCES CENTES

Disclosure

• No financial disclosures

Objectives

- Describe the approach to the general trauma patient
- List the ABCs of trauma care
- Differentiate between blunt vs penetrating trauma
- Explain the physiologic differences in the pregnant patient
- Describe the special considerations in trauma care of the pregnant patient

Epidemiology of Trauma

- A leading cause of mortality globally
- 5th overall cause of death in the US, preceded by heart disease, cancer, stroke, and chronic respiratory diseases
- #1 cause of death and disability in ages 1-34
- Intentional and nonintentional injuries
- Approximately 1/2 of traumatic deaths result from CNS injury, 1/3 from exsanguination

Gun Violence

- Increased rates of gun violence and IPV after COVID-19 pandemic
- Leading cause of death in children and teens (ages 1-19) in 2021
- Remains the leading cause of death for young adults under age 25
- More people died by guns than car crashes in 2021
- From 2019-2021:
 - Gun death rate increased by 22%
 - Gun homicide rate increased by 45%



https://publichealth.jhu.edu/sites/default/files/2023-06/2023-june-cgvs-u-s-gun-violence-in-2021.pdf

Epidemiology of Obstetrical Trauma

- 6-8% of pregnancies
- MVC, falls, and assault are most common
- #1 cause of non-obstetrical maternal death in the US
- Minor (90%) vs major trauma
 - 40-50% risk of fetal death with major trauma



Case Scenario

Page:

"Level 1: 23M, multiple gunshot wounds, HR 140, BP 100/45, tourniquet on leg. ETA 10 minutes"



Set Up



https://trauma.reach.vic.gov.au/guidelines/teamwork-and-communication/trauma-team-structure

On Arrival

- EMS handoff
- Vitals, access

Primary Survey

- Purpose is to address immediate threats to life
- ABCs
 - Airway
 - Breathing
 - Circulation
 - Disability
 - Exposure

Airway

- Priority since it's (usually) the greatest threat to life
- Ensure airway is patent, secure, and protected
- Ask patient to phonate
- Airway adjuncts
- Intubate via RSI
- "GCS <8 → intubate"
- Cricothyroidotomy
- C-spine stabilization



Breathing

- Assess ventilation
- Listen for breaths sounds
- Pneumothorax
- Hemothorax
- Hemopneumothorax
- Needle thoracostomy
- Chest tube
- Consider CXR



https://radiopaedia.org/articles/pneumothorax https://www.radiologymasterclass.co.uk/tutorials/chest/chest_tubes/chest_tray_chest_drain

Circulation

- Access- large bore IV x2, +/- central line
- Hemorrhage control
- Areas of exsanguination- "4 and the floor"
 - chest, abdomen, pelvis, thighs, externally into environment
- Tourniquets, pelvic binder
- Resuscitation, transfusion
- Reversal of anticoagulation
- Sometimes address before Airway if hypotensive

Disability

- GCS (3-15)
 - Motor (1-6)
 - Verbal (1-5)
 - Eye (1-4)
- Motor is most predictive
- Spinal precautions

Response	Scale	Score
Eye Opening Response	Eyes open spontaneously	4 Points
	Eyes open to verbal command, speech, or shout	3 Points
	Eyes open to pain (not applied to face)	2 Points
	No eye opening	1 Point
Verbal Response	Oriented	5 Points
	Confused conversation, but able to answer questions	4 Points
	Inappropriate responses, words discernible	3 Points
	Incomprehensible sounds or speech	2 Points
	No verbal response	1 Point
Motor Response	Obeys commands for movement	6 Points
	Purposeful movement to painful stimulus	5 Points
	Withdraws from pain	4 Points
	Abnormal (spastic) flexion, decorticate posture	3 Points
	Extensor (rigid) response, decerebrate posture	2 Points
	No motor response	1 Point

https://sttgmacom.wordpress.com/score-calculator/gcs/

Exposure

- Remove all clothing
- Evaluate for injuries
 - Spine/spinal cord
 - Rectal exam
- Temperature control

Adjuncts

- Chest X-Ray
- Pelvic X-Ray
- Cavitary triage
- FAST
- Diagnostic peritoneal lavage



https://www.cambridge.org/core/books/abs/color-atlas-of-emergency-trauma/diagnostic-peritoneal-aspiration/7F694F033629BE00D68D92B3574464F0

FAST - Focused Assessment with Sonography for Trauma



https://www.asra.com/news-publications/asra-newsletter/newsletter-item/asra-news/2022/07/29/pocus-spotlight-focused-assessment-with-sonography-in-trauma-%28fast%29-exam

eFAST



• extended focused assessment with sonography for trauma

https://www.pocus101.com/efast-ultrasound-exam-made-easy-step-by-step-guide/

Secondary Survey

- Thorough head-to-toe assessment
- Identify all injuries
- Guide follow-up imaging
- Medical history

Laboratory and Radiographic Tests

- Full set of labs
 - CBC
 - CMP
 - Coags
 - T&S
 - Pregnancy test
 - Utox
 - ROTEM/TEG



https://www.hematology.org/covid-19/covid-19-and-ve

Laboratory and Radiographic Tests

- Radiographic
 - <u>CT</u>
 - Head, max/face, neck, c-spine, t-spine, l-spine, abdomen/pelvis
 - CT angiograms
 - <u>XR</u>
 - Skull, extremities

Types of Trauma

Case Scenario

Page: "Level 1: 23M, multiple gunshot wounds, HR 140, BP 100/45, tourniquet on leg. ETA 10 minutes"

En route: 2L LR, TXA, 4L NC

Vitals on arrival: T 37°C, HR 142, SP 90/55, MAP 67, RR 22, SpO2 91% on 4L NC

Primary Survey: absent breath sounds in right hemithorax, pulsatile bleed from left thigh, GCS 12 - right chest tube placed with immediate return of 500cc blood

Adjuncts: white out of R hemithorax on CXR

Cavitary Triage: bullet in left thigh

Secondary Survey: ballistic wounds to anterior and posterior right hemithorax, anterior left thigh



https://www.dallasnews.com/news/2015/07/23/trauma-business-down-at-dallas-parkland-hospital/



Penetrating Abdominal Trauma

Penetrating Thoracic Trauma



Blunt Trauma



Trauma of Pregnancy

Anatomic and Physiologic Changes

<u>Cardiovascular</u>

- 个CO (20% at 8 weeks, 50% at term)
 - ↑preload due to ↑plasma volume (by 50% at 32 weeks)
 - \downarrow afterload due to \downarrow SVR
 - 个HR
- IVC compression from gravid uterus in supine position can \downarrow CO by 25-30% compared with LLD position
- Cardiac flow murmurs are common due to ↑CO
- Benign pericardial effusion
- Dilated pelvic vasculature; injury can result in rapid exsanguination

<u>Hematologic</u>

- Physiologic anemia of pregnancy
- 35% blood volume loss before signs of shock
- Shunting blood away from fetus occurs before systemic signs
- Procoagulant state

Pulmonary

.

- Hyperventilation due to ↑TV and respiratory drive
 Chronic respiratory alkalosis, ↓ serum bicarb
 - ↑PaO₂
 - \U00e902 consumption
 - \downarrow FRC due to upward displacement of diaphragm
- GI
- ↓LES tone and ↑intraabdominal pressure = high aspiration risk

<u>Renal</u>

<u>Uterus</u>

- Protected by pelvis in first 12 weeks
- Gravid uterus displaces bowel cephalad and laterally
- Uterine blood flow is high and not autoregulated
 - ↓maternal BP can cause significant ↓fetal blood flow and lead to ↓fetal oxygenation





Source: David V. Feliciano, Kenneth L. Mattox, Ernest E. Moore: Trauma, Ninth Edition Convrint & McGraw Hill, All rights received

Evaluation and Management

- First priority: treat the mother!
- Primary Survey same as for any trauma patient
 - ABCDE
 - Some unique considerations

Primary Survey – Caveats

<u>Airway</u>

- Consider early intubation (increased airway edema)
- Lower succinylcholine dose in RSI
- Cricothyroid pressure, oro/nasogastric tube

Breathing

- SpO₂ target >95%
- Chest tube in 3rd or 4th intercostal space due to elevated diaphragm

Primary Survey – Caveats

Circulation

- Uterine displacement to left
- Liberal fluids/transfusions, limit vasopressors only when no response to fluids
- Avoid femoral CVC placement
- Rh(-) blood products
- Resuscitative hysterotomy

Disability

• Assess for eclampsia



Evaluation and Management

- Adjuncts
 - FAST similar sensitivity and specificity
- Secondary Survey
 - Extensive obstetrical history
 - Examine for fundal height, uterine tenderness or rigidity, contractions
 - Discrepancy between fundal height and gestational age \rightarrow concern for uterine trauma/rupture
 - Vaginal exam

Fetal Assessment

External fetal HR monitoring

- all pregnancies >20 weeks
- Minimum of 6 hours
- Extend to 24 hours if signs of abruption present
 - Regular contractions, uterine tenderness, abnormal FHR tracing, vaginal bleeding, ROM, serious maternal injury

<u>Kleihauer-Betke test</u>

- all pregnant trauma patients >12 weeks gestation, regardless of Rh status
- 300mcg Rh immune globulin for every 30 mL fetal blood within 72 hours of injury

Fetal FAST

- Number and position of fetus(es)
- Placental location
- Amniotic fluid volume
- Fetal cardiac activity
- Fetal femur length

Radiology

- Similar to non-pregnant patient
 - CT mainstay for trauma eval; low-dose protocols give little diagnostic information
- Ionizing radiation
 - Risks: developmental delay, small head size, organ malformation, cancer, death
 - Risk Assessment:
 - Gestational age (8-15 weeks: organogenesis, neuronal development)
 - Radiation dose <5 rad has not been associated with an increase in fetal anomalies or pregnancy loss; deemed to be safe at any point during the entirety of gestation*

Estimated Fetal Exposure from Common Radiologic Procedures

Procedure	Fetal exposure
Chest XR (AP and lateral)	0.00002-0.00007 rad ^a
Abdominal XR (single AP view)	0.1 rad ^a
Pelvis XR (single AP view)	0.25-1.5 rad ^a
Hip XR (single view)	0.2 rad ^a
Complete spine XR series	0.37rad ^a
CT pulmonary angiogram	0.003-0.022 rad ^b
CT abdomen/pelvis	0.47-0.55 rad ^b
CT trauma protocol (head, neck, chest, abdomen, pelvis)	1.01–1.12 rad ^b

, anteroposterior; CT, computed tomography; XR, x-ray.

³Adapted with permission from Desai P, Suk M. Orthopedic trauma in pregnancy. Am J Orthop. 2007;36:E162. Copyright © 2007 Quadrant HealthCom Inc. All rights reserved.

^bAdapted from Keleranta A, Makela T, Kaasalainen T, Kortesniemi M. Fetal radiation dose in three common CT examinations during pregnancy: Monte Carlo study. Phys Med. 2017;43:199-206.

*per 2010 EAST Guidelines

Resuscitative Hysterotomy

- Indication: save mother's life during CPR by improving preload
- Cesarean should be initiated within 4 minutes of maternal cardiac arrest
- Fetus should be delivered within 5 minutes
- Pursued even if fetus is not of gestational age consistent with ex-utero survival

RESUSCITATIVE HYSTEROTOMY



https://stmungos-ed.com/obstetrics/hysterotomy

Emergent Cesarean Delivery

- Indications:
 - To save the fetus in setting of immediate maternal death if at age consistent with exutero survival (>23 weeks)
 - For adequate surgical exposure during laparotomy
- Fetal death is <u>not</u> an indication except in placental abruption resulting in maternal coagulopathy and hemodynamic instability
- Delivery is recommended for burn injury TBSA >50% and in third trimester

https://stmungos-ed.com/obstetrics/hysterotomy

Emergency Hysterectomy

- OR goal: control hemorrhage and contamination
- Small uterine lacerations ightarrow primary repair with chromic suture
- Large laceration + fetus of viable age ightarrow c-section
- Extensive hemorrhage \rightarrow emergency hysterectomy



EAST Guidelines*

- The best initial treatment for the fetus is the provision of optimum resuscitation of the mother and the early assessment of the fetus.
- All pregnant women >20-week gestation who suffer trauma should have <u>cardiotocographic monitoring for a minimum of 6 hours</u>. Monitoring
 should be continued and further evaluation should be carried out if uterine contractions, a nonreassuring fetal heart rate pattern, vaginal bleeding,
 significant uterine tenderness or irritability, serious maternal injury, or rupture of the amniotic membranes is present.
- Kleihauer-Betke analysis should be performed in all pregnant patients >12 week-gestation.
- All female patients of childbearing age with significant trauma should have a human chorionic gonadotropin (β-HCG) performed and be shielded for X-rays whenever possible.
- Concern about possible effects of high-dose ionizing radiation exposure should not prevent medically indicated maternal diagnostic X-ray
 procedures from being performed. During pregnancy, other imaging procedures not associated with ionizing radiation should be considered
 instead of X-rays when possible.
- Exposure to <5 rad has not been associated with an increase in fetal anomalies or pregnancy loss and is herein deemed to be safe at any point during the entirety of gestation.
- Ultrasonography and magnetic resonance imaging are not associated with known adverse fetal effects. However, until more information is available, magnetic resonance imaging is not recommended for use in the first trimester.
- Perimortem cesarean section should be considered in any moribund pregnant woman of ≥24-week gestation.
- Delivery in perimortem cesarean sections must occur within 20 minutes of maternal death but should *ideally start within 4 minutes* of the maternal arrest. Fetal neurologic outcome is related to delivery time after maternal death.
- Consider keeping the pregnant patient tilted left side down 15 degrees to prevent aortocaval compression and supine hypotension syndrome.
- <u>Obstetric consult</u> should be considered in all cases of injury in pregnant patients.

*from 2010, currently under revision

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Questions?

