

JOINT TRAUMA SYSTEM



RADIOLOGY: IMAGING TRAUMA PATIENTS IN A DEPLOYED SETTING

CLINICAL PRACTICE GUIDELINE (CPG) TRAINING

Joint Trauma System Trauma Care Educational Program



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- ◆ The view(s) expressed herein are those of the author(s) and do not reflect the official policy or position of Brooke Army Medical Center, the U.S. Army or Air Force Medical Department, the U.S. Army or Air Force Office of the Surgeon General, or the Department of Defense or the U.S. Government.

AGENDA



- ◆ Purpose
- ◆ Summary
- ◆ Background
- ◆ Radiographs
- ◆ FAST Examinations
- ◆ CT Scans
- ◆ Special Situations
- ◆ References
- ◆ Performance Improvement (PI) Monitoring
- ◆ Appendices in CPG
- ◆ Contributors

PURPOSE



- ◆ These slides are based on the JTS Radiology: Imaging Trauma Patients in a Deployed Setting CPG which provides an overview of the imaging modalities available in austere settings, the equipment required, and the role that each plays in triaging and diagnosis of the acutely injured poly-trauma patients.
- ◆ Date of CPG publication: 13 May 2017
- ◆ JTS CPGs are evidence-based guidelines developed by subject matter experts in the military and civilian communities. CPGs are compiled from DoD Trauma Registry data, health data abstracted from patient records and after action reports.
- ◆ Information contained in this presentation is only a guideline and not a substitute for clinical judgment.

SUMMARY



- ◆ The goal of this CPG is to provide guidelines and recommendations for the optimum integration of high-quality diagnostic imaging into the treatment and management of casualties with multiple mechanisms of traumatic injuries and how to facilitate the transfer of this information with the patient across the continuum of care.
- ◆ Imaging is a critical component in the evaluation of military trauma patients.
- ◆ There are multiple modalities available depending on location and need.

BACKGROUND



- ◆ Medical imaging plays a critical role in the rapid diagnosis, triage, and management of complex poly-trauma patients.
- ◆ High quality medical imaging can be performed in a deployed or wartime setting.
 - ◆ Pre-operative imaging can provide life saving information.
 - ◆ Aggressive resuscitation and speed of computed tomography (CT) scan often allow for imaging prior to the operating room in significantly injured patients.



CT with IV contrast of patient with penetrating trauma with associated liver and right kidney injury (area of red arrow). Penetrating fragment is bright white object.

BACKGROUND



◆ Equipment limitations

- ◆ Anterior Posterior (AP) Projection is adequate on most portable units.
- ◆ Many portable units, especially at Role 2, have limited penetration of soft tissue making lateral views of limited quality.

◆ Radiation safety

- ◆ Recommended minimal distance for unshielded medical team members from radiograph is 6 feet.
 - ◇ Cross table films produce much higher radiation exposures and should be obtained only when necessary.
 - ◇ Team members should don shielding prior to patient's arrival under personal protective equipment.
- ◆ Radiologists should monitor mAs and kVp settings to minimize radiation dose while achieving sufficient diagnostic image quality.

BACKGROUND



◆ Role of radiologist

◆ During the trauma evaluation:

- ◇ Radiologist can free other providers by doing the Focused Abdominal Sonographic Assessment for Trauma (FAST).
- ◇ Can also provide preliminary interpretations of portable radiographs.

◆ Once CTs are obtained on trauma patients, the radiologist is required to evaluate images and other providers will need to perform FAST and interpret radiographs.

◆ Images taken of evacuated patients should be sent electronically ahead of time and a CD created to send with the patient.

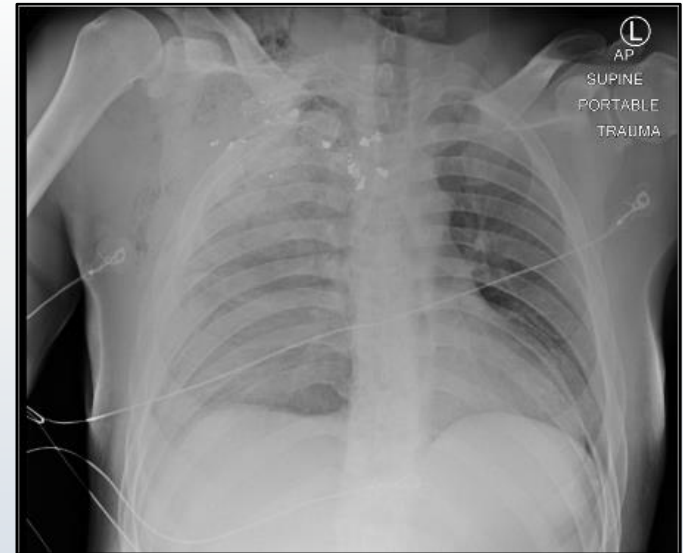
◆ Attempt to update patient information with accurate information as soon as possible to ensure images can be reviewed.

RADIOGRAPHS



◆ Radiograph

- ◆ Initial radiographic evaluation begins with supine AP chest and pelvic radiographs.
 - ◇ Identifies major cardiopulmonary injury.
 - ◇ Identifies major fracture dislocations of the pelvis.
- ◆ Other areas of the body can be imaged to easily identify metallic fragments to determine sites of injury.



Radiograph of chest of patient with penetrating injury to the chest. Fragments seen from sternum to apex of right lung. Right hemothorax present.

SPECIFIC RADIOGRAPHS



- ◆ Other specific radiographs
 - ◆ Cervical spine radiograph
 - ◇ Largely replaced by CT
 - ◇ Only perform when a CT not available
 - ◆ Extremity radiograph
 - ◇ Can be obtained when extremity injury suspected
 - ◇ Obtaining these should not delay more diagnostic imaging with CT
 - ◆ Retrograde urethrogram
 - ◇ Useful for identifying urethral injury
 - ◇ Can be obtained by injecting contrast through a Foley catheter placed at tip of urethra



**Fracture of ulna
seen on radiograph.**
*Emergency War Surgery 5th
Edition*

FAST EXAMINATION



FAST Examination

- ◆ Adjunct to the primary trauma survey
 - ◆ Sensitivity of 56% and specificity of 98%
 - ◆ Negative scan cannot be relied upon to rule out injury



Portable ultrasound device.

Photo by Sgt. Bethanie Sahms, Courtesy of Defense Visual Information Distribution Service.

FAST EXAMINATION



Commonly performed and interpreted in real time with portable machine using a standard 3-7 MHz curved array ultrasound probe.

- ◆ Evaluating intraperitoneal fluid in:
 - ◆ the right upper quadrant between the liver and kidney
 - ◆ the left upper quadrant between the spleen and kidney
 - ◆ the pelvis at the level of the bladder
 - ◆ epigastrium for cardiac activity and hemopericardium
- ◆ May also aid in identifying pneumothorax and assessment of heart after resuscitation.

Abnormal FAST Exam Findings

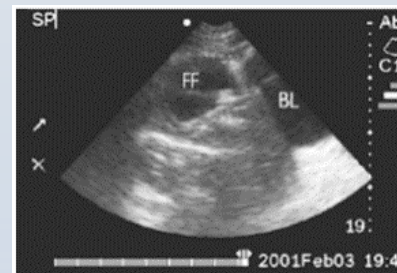
Right Upper



Left Upper



Pelvis



Epigastrium



Source: *Emergency War Surgery 5th Edition*

TRAUMA CT SCAN



Trauma CT Scan

- ◆ Provides additional information by identifying unsuspected and potentially clinically significant injuries.
 - ◇ If possible, obtain a trauma CT before going to the OR.
 - ◇ Can be obtained after continued resuscitation and surgical intervention.
- ◆ CT protocol includes:
 - ◆ Non-contrast CT through head and face to include the entire mandible at 1 mm axial slice thickness.
 - ◆ Contrast enhanced CT from the level of the circle of Willis through the bottom of the pelvis.
 - ◆ Optional: Scan performed through the lower extremities to evaluate for skeletal and vascular injuries.

CONTRAST CT



◆ CT Contrast Injection

- ◆ Typical dose: 150 cc of Isovue 300 or 340
- ◆ Use dual phase injection: 80 cc at 1.4 cc/sec followed immediately by 70 cc at 3.5 cc/sec for the pan scan.
- ◆ CT scan started is started 2-3 seconds before completion of contrast injection.

◆ Intravenous (IV) Access for CT

- ◆ An 18g antecubital IV is typically used.
 - ◇ More distal upper extremities should typically not be used.
 - ◇ Recheck IV function prior to use to ensure function and avoid contrast extravasation.
- ◆ Central line and large lumen resuscitation catheters can usually handle contrast power injection.
 - ◇ Discontinue infusion of fluid/blood products through lines prior to use for contrast.

◆ ***Do not use interosseus needles for contrast injection.***



SPECIAL CONTRAST OPTIONS

- ◆ Delayed images
 - ◆ Routinely performed for further evaluation of solid organ injury, identification of active extravasation or pseudoaneurysm formation, or excretion within the ureters and bladder.
- ◆ CT cystogram
 - ◆ 50 cc of IV contrast diluted into 500 cc of saline infused through indwelling urinary catheter (300 cc minimum) and clamp catheter for CT examination.
 - ◆ Can follow routine trauma CT with 1 mm thick images through the pelvis with the bladder filled.
- ◆ Rectal contrast
 - ◆ Useful for evaluating flank or rectal injuries below the peritoneal reflection.
 - ◆ If needed, can infuse 50 mL of IV contrast in 1 L of saline or water through a Foley catheter placed in the rectum

SPECIAL SITUATIONS



- ◆ CT language settings
 - ◆ Be familiar with languages available on CT scanner for patient breathing instructions.
 - ◆ May have to use interpreters to record messages if different languages commonly used in coalition or by host country.
- ◆ Military working dogs
 - ◆ Examinations should be coordinated with veterinarians.
- ◆ MRI has been available in theater but use in acute management of combat trauma has not been established.

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PI MONITORING



◆ Intent (Expected Outcomes)

All trauma patients arriving at a Role 3 hospital will receive proper and expeditious radiologic screening of injuries.

◆ Performance/Adherence Metrics

Identify missed injuries with appropriate radiographic imaging and/or reading.

◆ Data Source

- ◆ Patient Record
- ◆ Department of Defense Trauma Registry
- ◆ Theater Image Repository

APPENDICES



- ◆ **Appendix A: Detector Trauma Ct Protocol**
- ◆ **Appendix B: 64 Detector Pediatric (MWD) IV Contrast Injection Protocols**
- ◆ **Appendix C: Additional Information Regarding Off-label Uses In CPGs**

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