CT in penetrating truncal trauma

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History

- Penetrating injury once meant a mandatory exploratory laparotomy
- That has changed over the years, and patients are now managed more conservatively
- An unstable patient, particularly with a positive FAST will generally still go straight to OT

Methods of evaluation

- Serial examination
- LWE
- DPL
- Ultrasound (FAST)
- CT
- Laparoscopy
- Laparotomy

Serial examination

- Involves frequent (hourly) repeated examination for developing peritonitis
- Requires admission
- Time consuming
- Variably reported sensitivity and specificity

Local Wound Exploration

- Usually performed in theatre
- Wound explored to confirm/refute peritoneal breach
- May avoid non-therapeutic laparotomy
- Breach of peritoneum does not necessarily mean injury to other structures

DPL

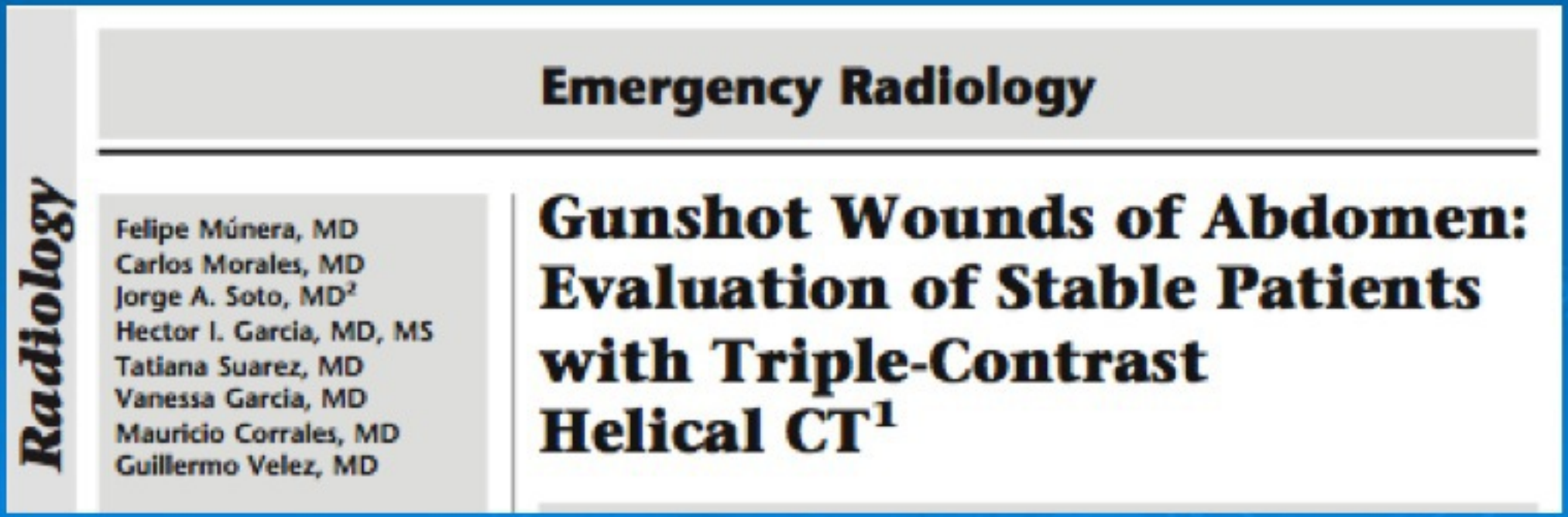
- Well established role in blunt abdominal trauma (although being replaced by FAST?)
- More controversial in penetrating trauma
- What red cell count do you use?
- 5,000/ml?
- 20,000/ml?
- 100,000/ml?

Ultrasound (FAST)

- Well established role in blunt trauma
- As little as 100cc of fluid needed
- Operator dependent
- The presence of free fluid does not necessarily imply an injury requiring laparotomy
- Does not evaluate the retroperitoneum

CT

- Use has increased along side blunt trauma
- Fewer studies, and those there are often in combat setting



Radiology

Emergency Radiology

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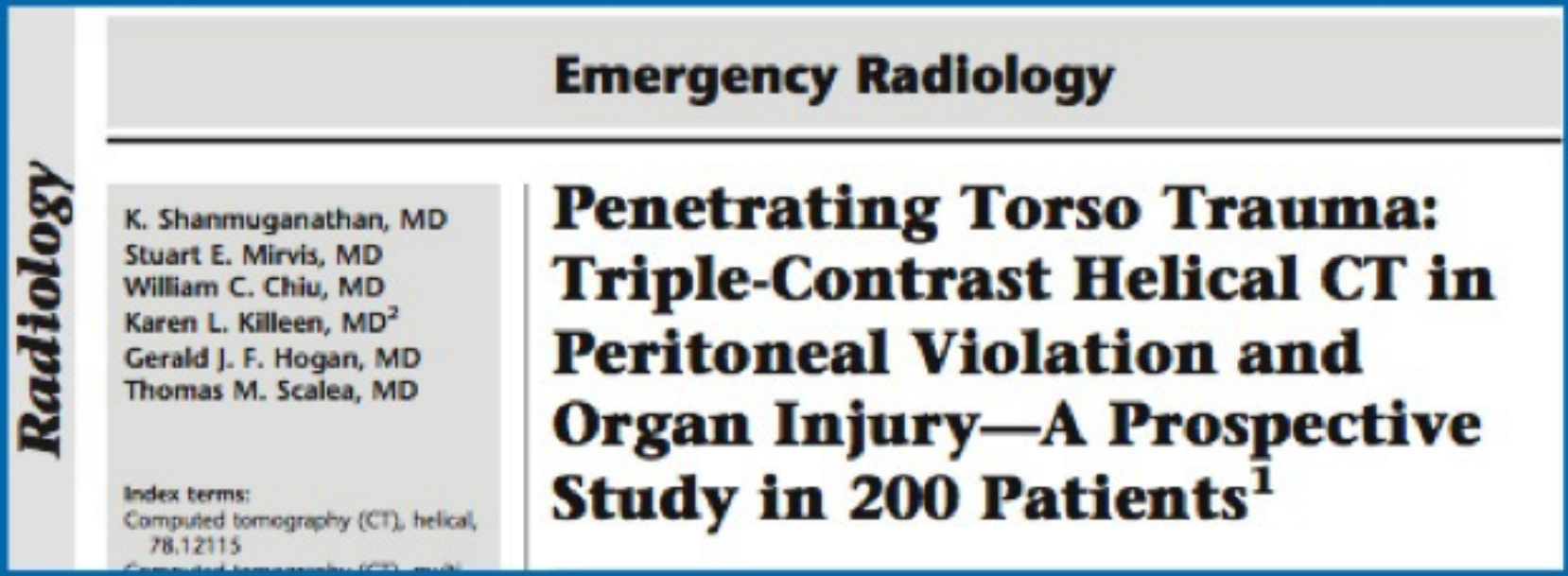
Gunshot Wounds of Abdomen: Evaluation of Stable Patients with Triple-Contrast Helical CT[1]

What is role in suburban ED?



Radiology

Emergency Radiology

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Index terms:
Computed tomography (CT), helical,
78.12115

Penetrating Torso Trauma: Triple-Contrast Helical CT in Peritoneal Violation and Organ Injury—A Prospective Study in 200 Patients[1]

- This small prospective study found for peritoneal violation
  - Sensitivity 97%
  - Specificity 98%
  - Accuracy 98%

Laparoscopy/Laparotomy

- Laparoscopy does not have clear role, except in suspected diaphragmatic injury
- Laparotomy is considered the gold standard but carries morbidity, and cost

Today

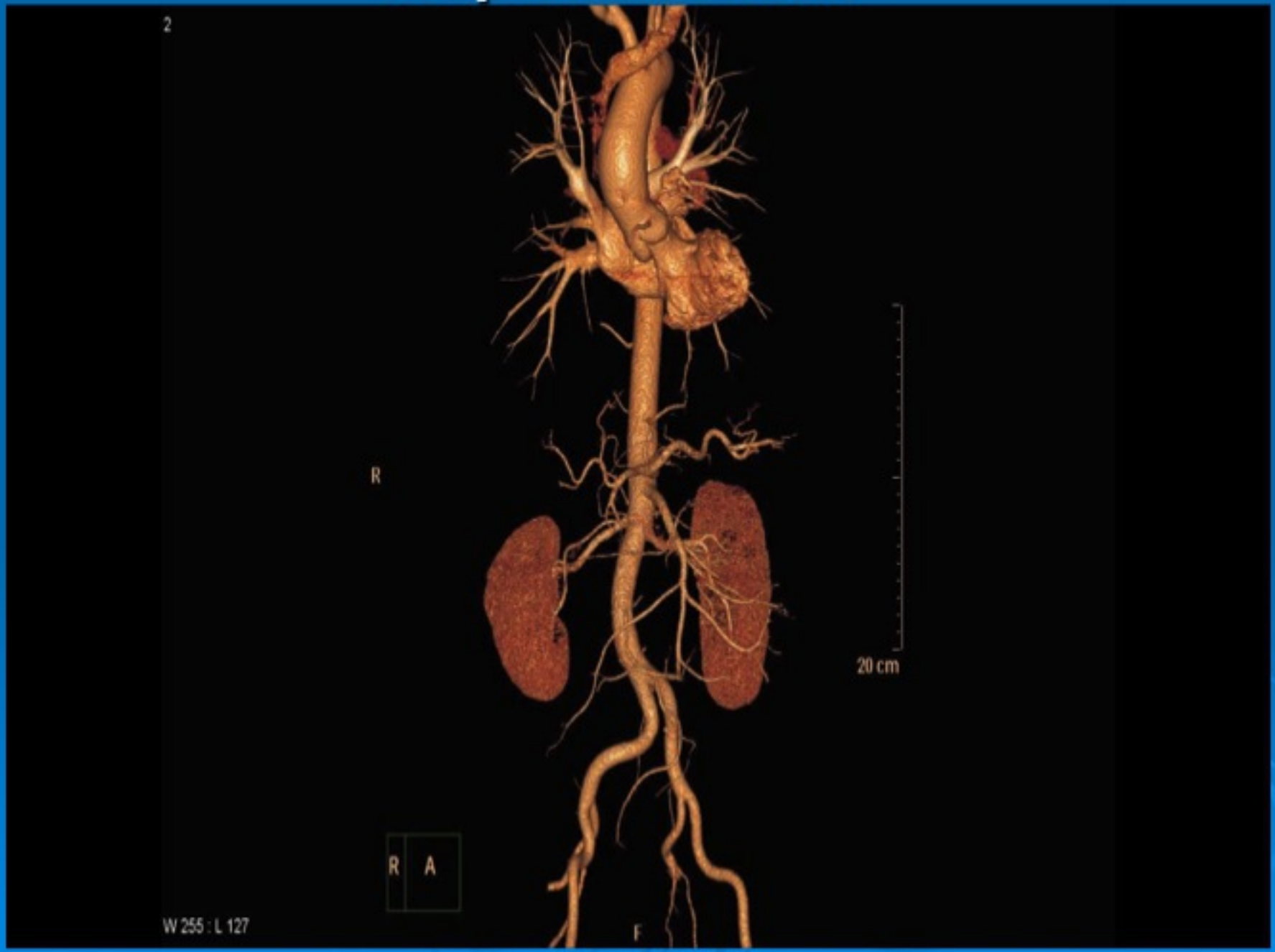
- CT has become the imaging modality of choice in both blunt and penetrating trauma
- The advent of multidetector CT means that rapid high quality imaging can be obtained with isotropic voxel acquisition, and speed allows multiple vascular phases
- Many centres (including ACH) have scanner positioned for easy access from the resuscitation area

ACH

- Our current 128 slice scanner can perform a chest/abdo/pelvis acquisition in 10 seconds
- Remember though that the total time for an examination is also determined by transfer time…

Because voxels are acquired isotropically, images can be displayed in any plane

This high resolution imaging can give exquisite detail



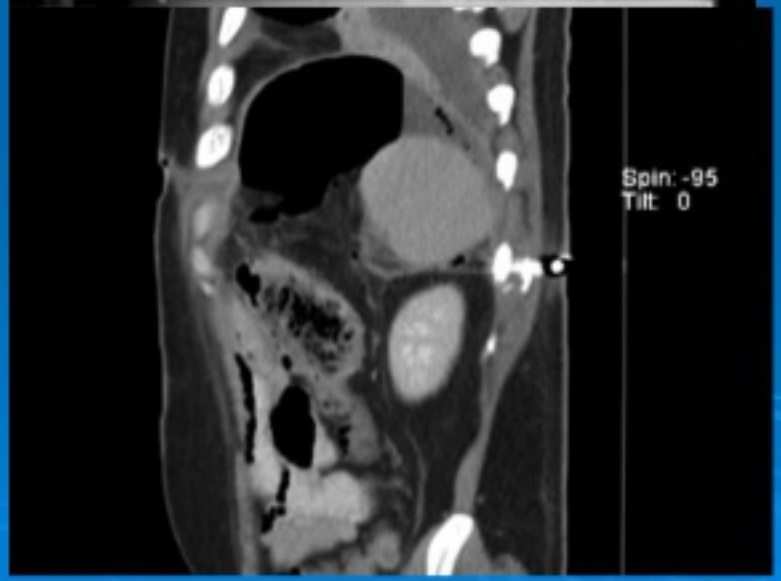
Choice of management/ imaging

- Stable vs unstable
  - Unstable with obvious site of injury/bleeding - straight to theatre
  - Unstable with no obvious site of injury/bleeding - Trauma views? FAST? CT?
  - Stable - FAST? CT? Observe?
- Consideration needs to be given to nature and velocity of injury eg stab vs GSW
- The former may be low velocity and superficial, while the latter is high velocity and deeper penetrating

Complimentary studies

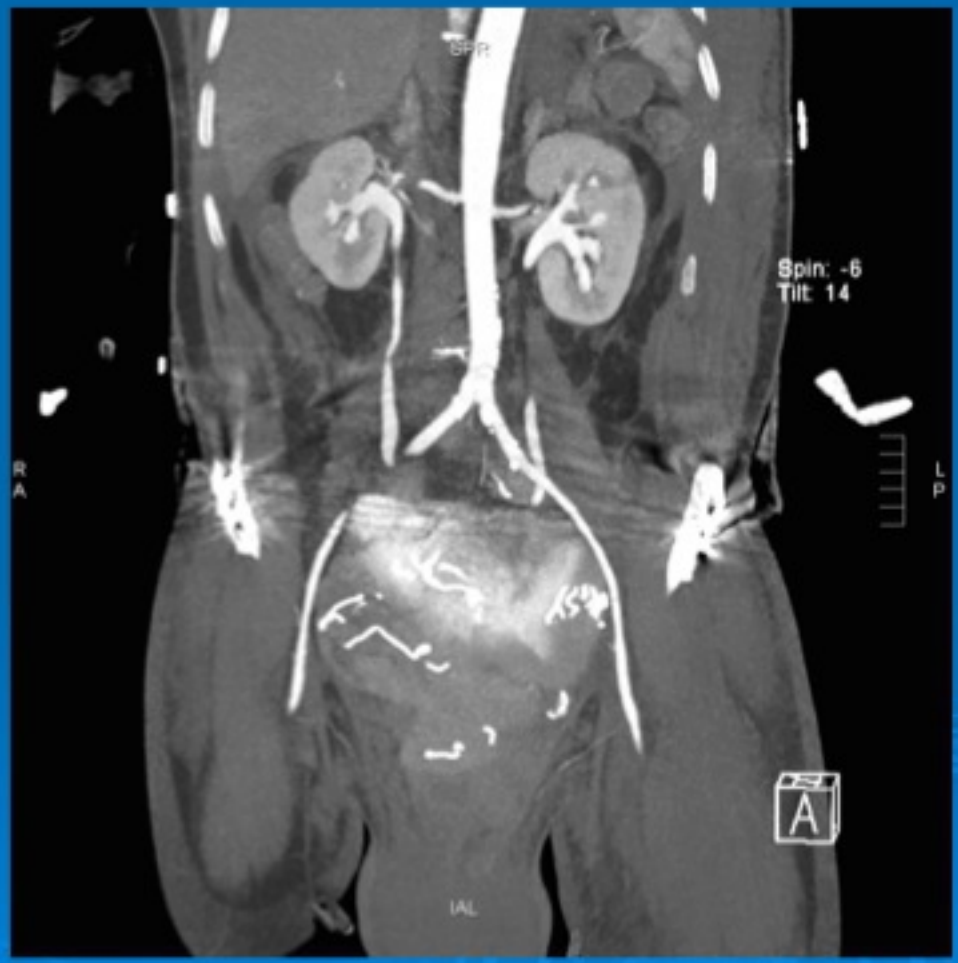
- Plain AXR show pellet superimposed on LUQ

- CT confirms position in soft tissues



Utilise technology

- A single CT data acquisition can be displayed or reconstructed in a number of ways

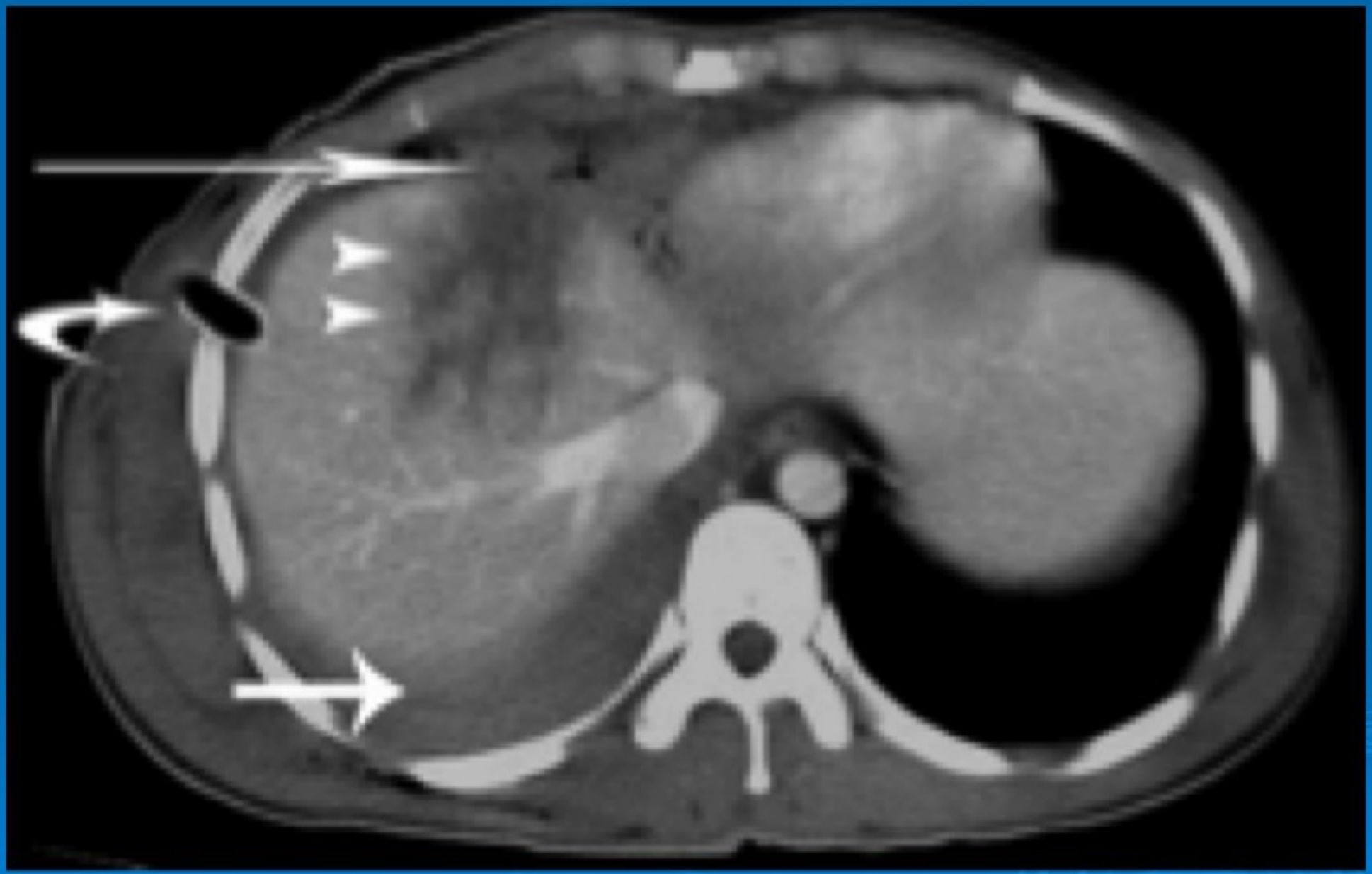


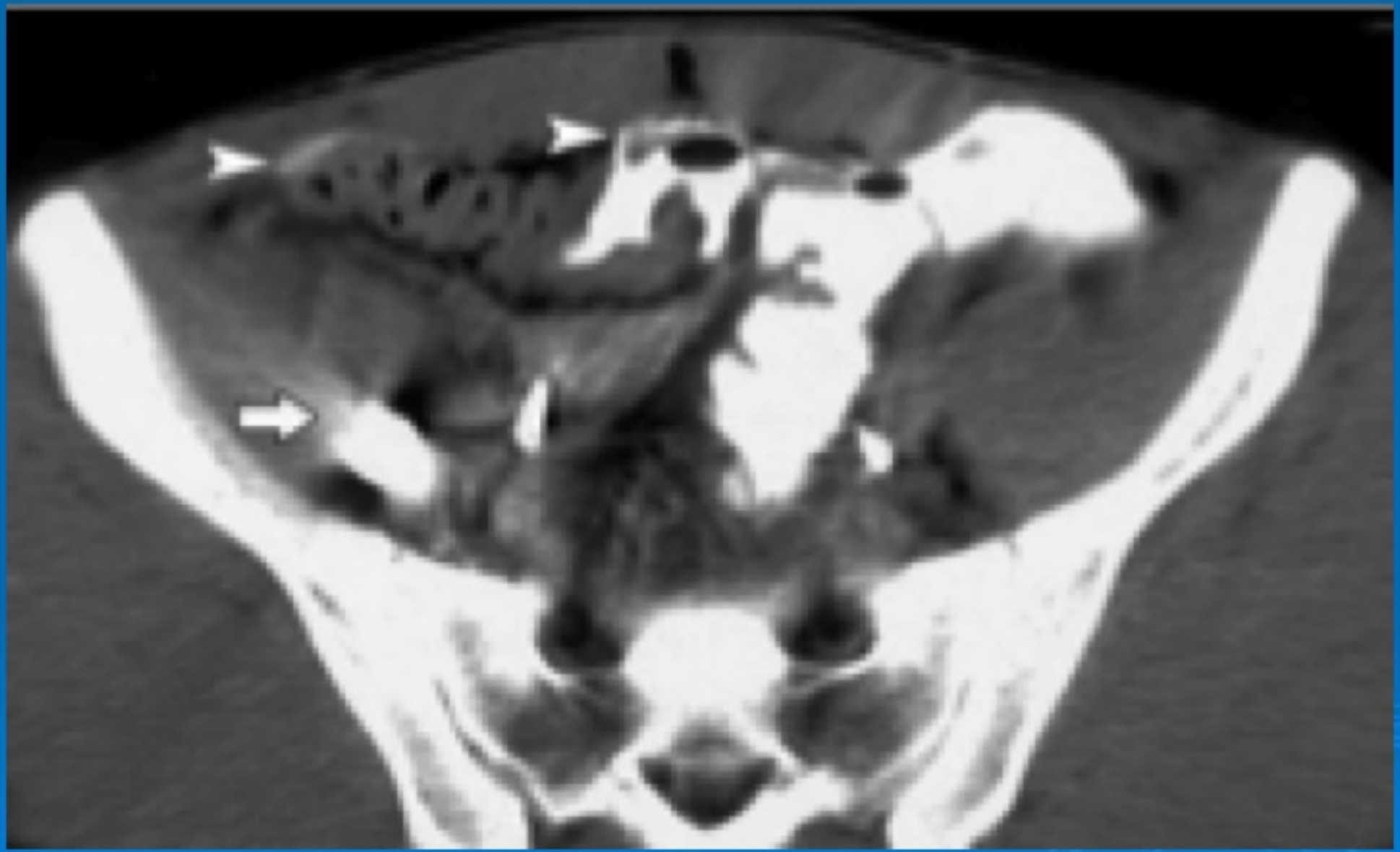
- CT angiography with volume rendering

- 3D reconstructions of bony structures

Look for…

- Entry site - particularly if posterior as retroperitoneal injuries may be occult
- Breach of pleura/peritoneum - remember that gas may be from outside or lungs/ hollow viscus
- Trajectory and structures along route
- Exit site if appropriate
- Secondary signs such as free fluid/ contrast outside vessels/bowel





Expect the unexpected

- Penetrating objects can come from within the body

Algorithm

- Divide into stable vs unstable
- Can definition be pushed out with fast access to scanner and speed of acquisition?
- Protocol? IV? Oral? Rectal?
- Don’t forget dose - often young patients, utilise single phase where possible

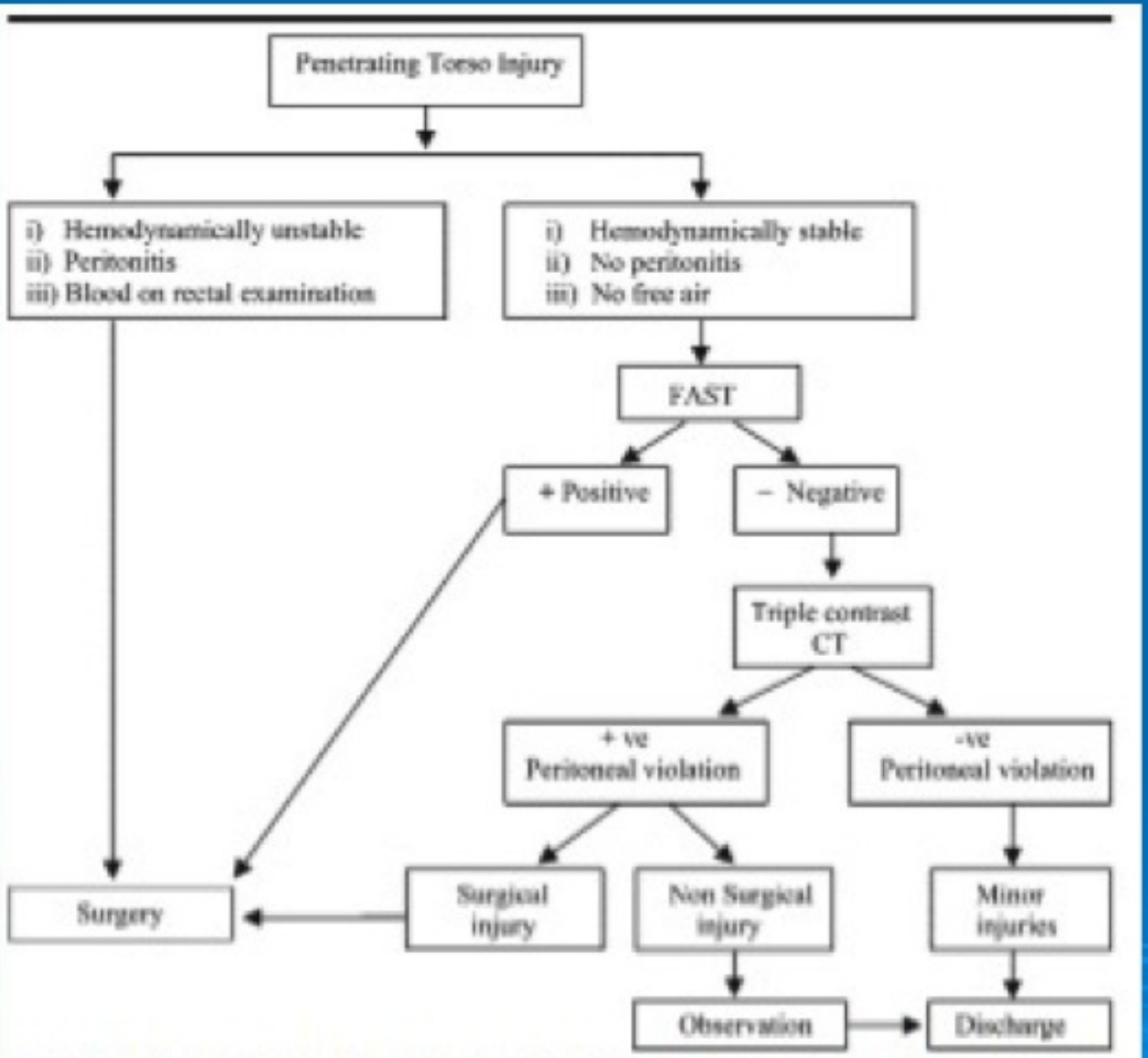
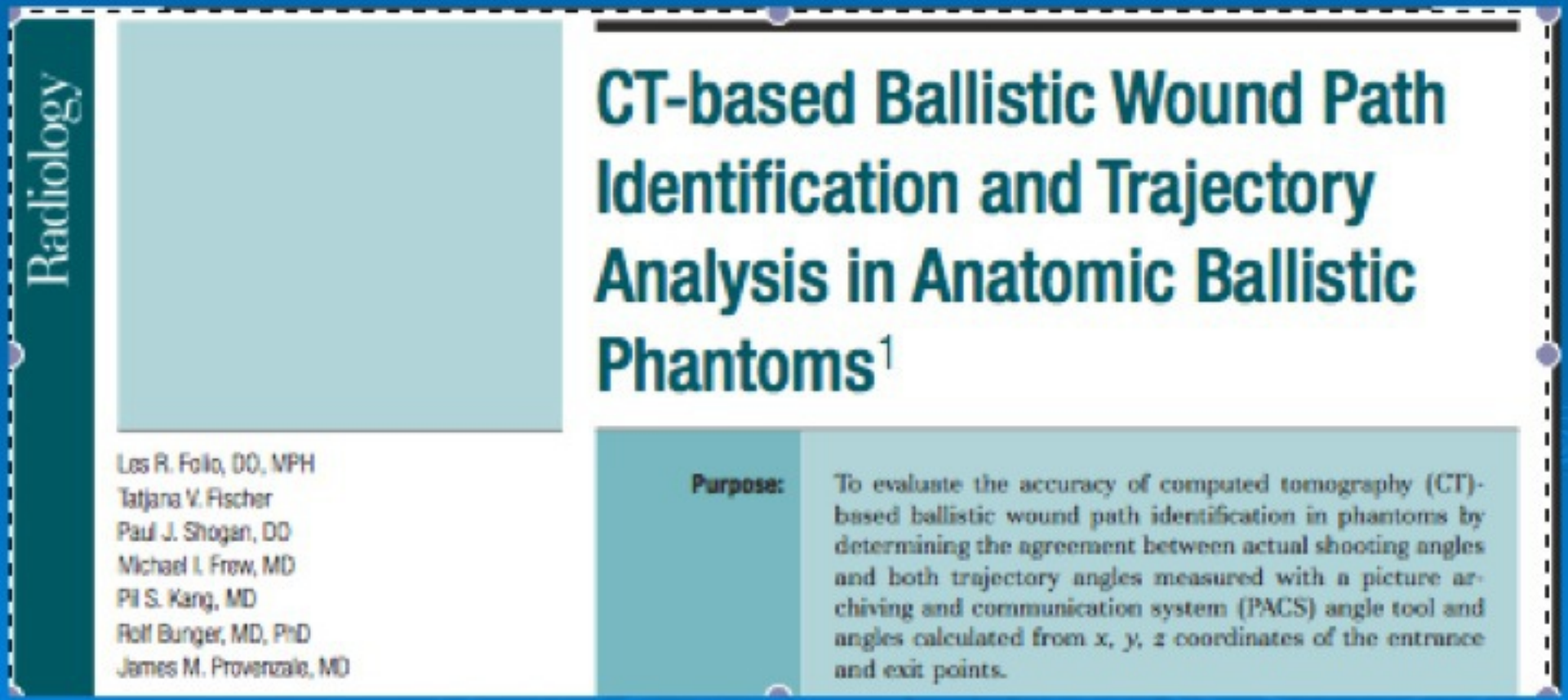


Figure 10. Schematic shows imaging algorithm for hemodynamically stable patients with penetrating torso trauma.

For the future

- Technology keeps changing and advancing, and computer power is huge



Radiology

CT-based Ballistic Wound Path Identification and Trajectory Analysis in Anatomic Ballistic Phantoms[1]

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Purpose: To evaluate the accuracy of computed tomography (CT)-based ballistic wound path identification in phantoms by determining the agreement between actual shooting angles and both trajectory angles measured with a picture archiving and communication system (PACS) angle tool and angles calculated from *x*, *y*, *z* coordinates of the entrance and exit points.


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