SPLENIC INJURIES

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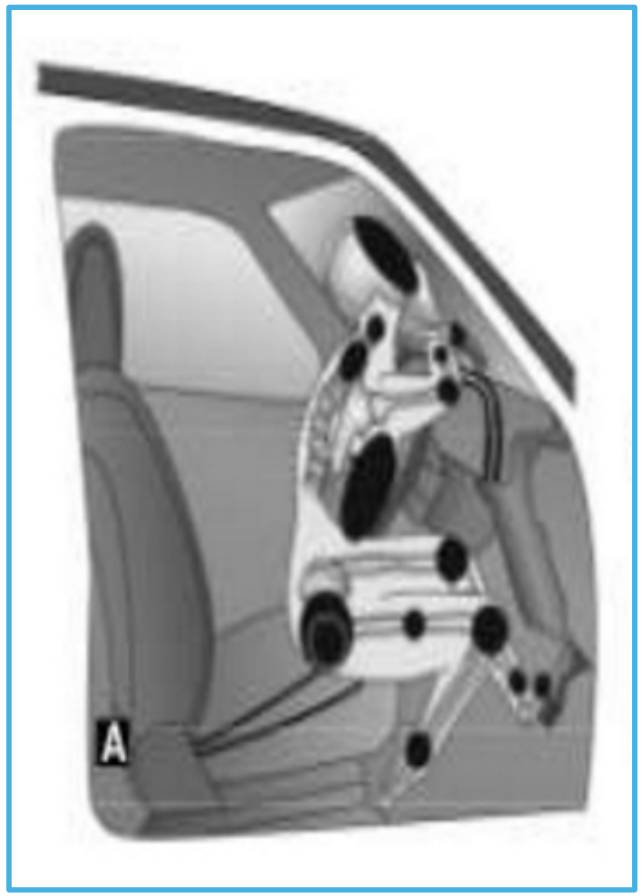
Chair of NORDTER

Nothing to disclose

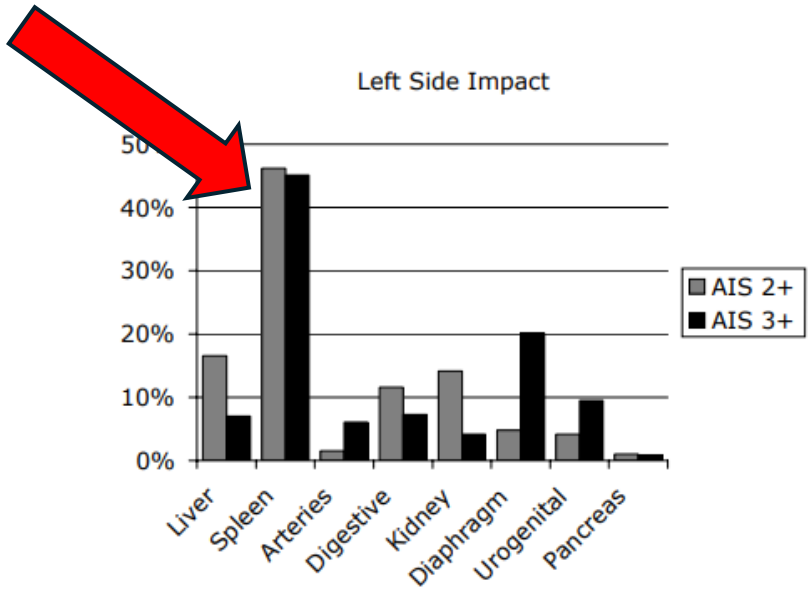
Synopsis

- Clinical facts
  - Trauma mechanism
  - Symptoms and signs
  - Cave
- Radiological findings
  - CT with different protocols
  - Follow-up examinations
- Summary

Mechanism of injury

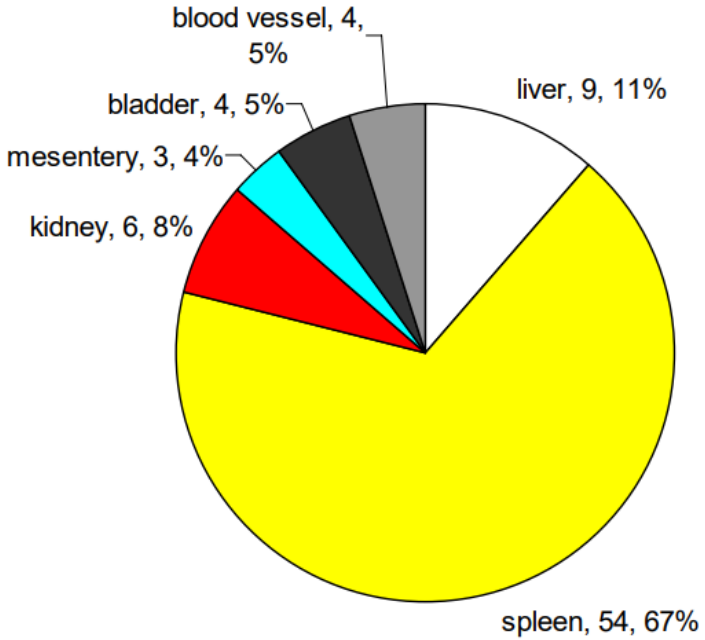


High risk of occupant in left side impact



Yoganandam 2000

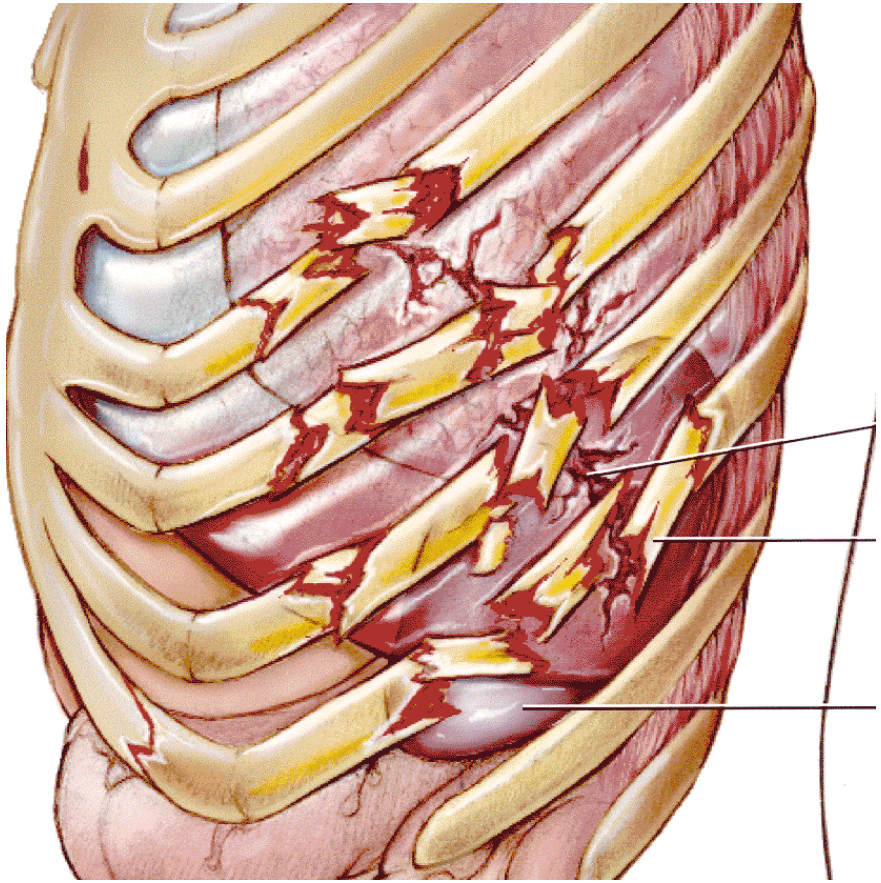
Highest risk of injury for drivers or left front passanger in left side impact

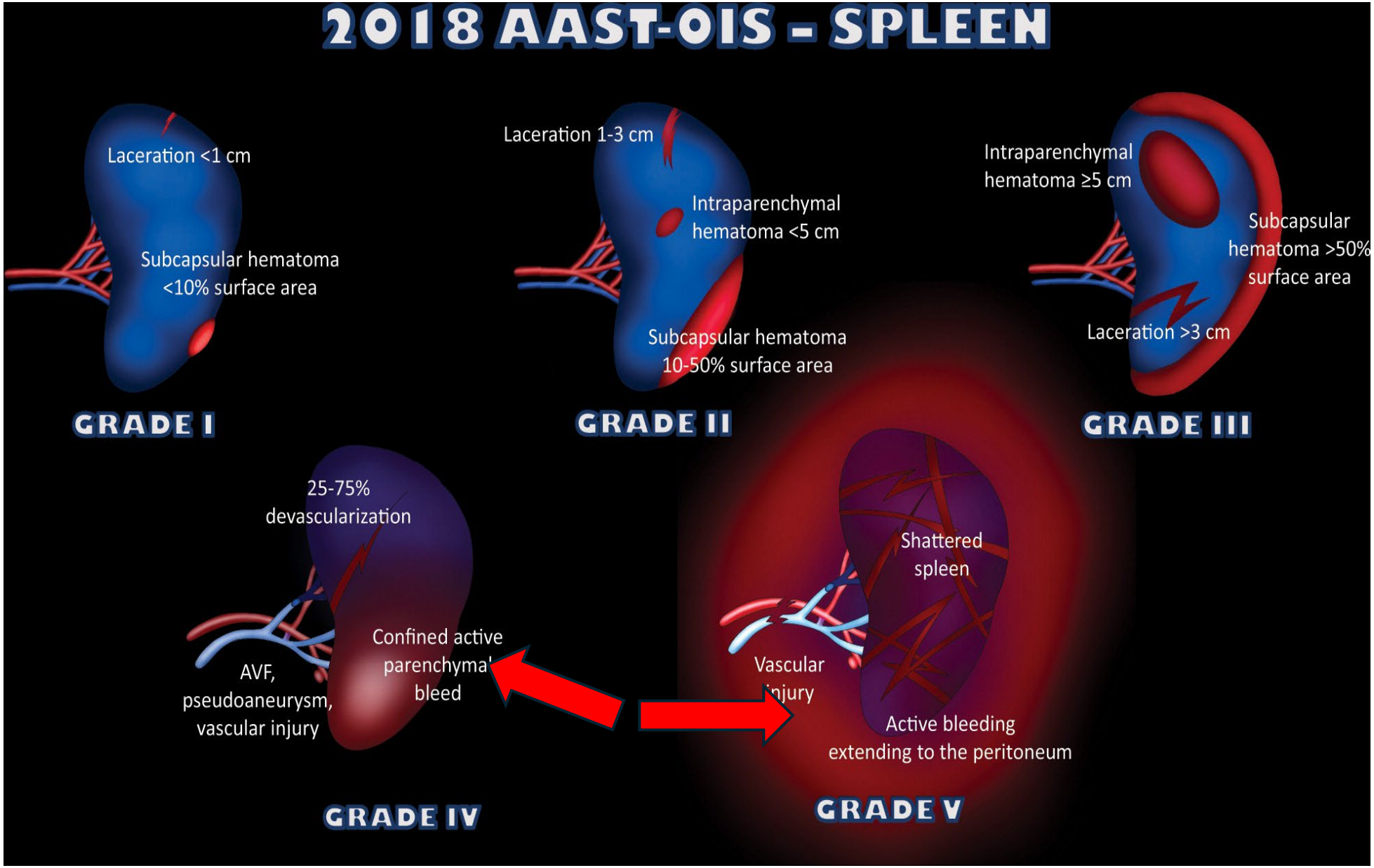


Other Mechnisms of injury

Symptoms and signs of splenic injury

- Abdominal tenderness
- Left chest wall or left shoulder pain
- Abdominal wall contusions
- Hematomas





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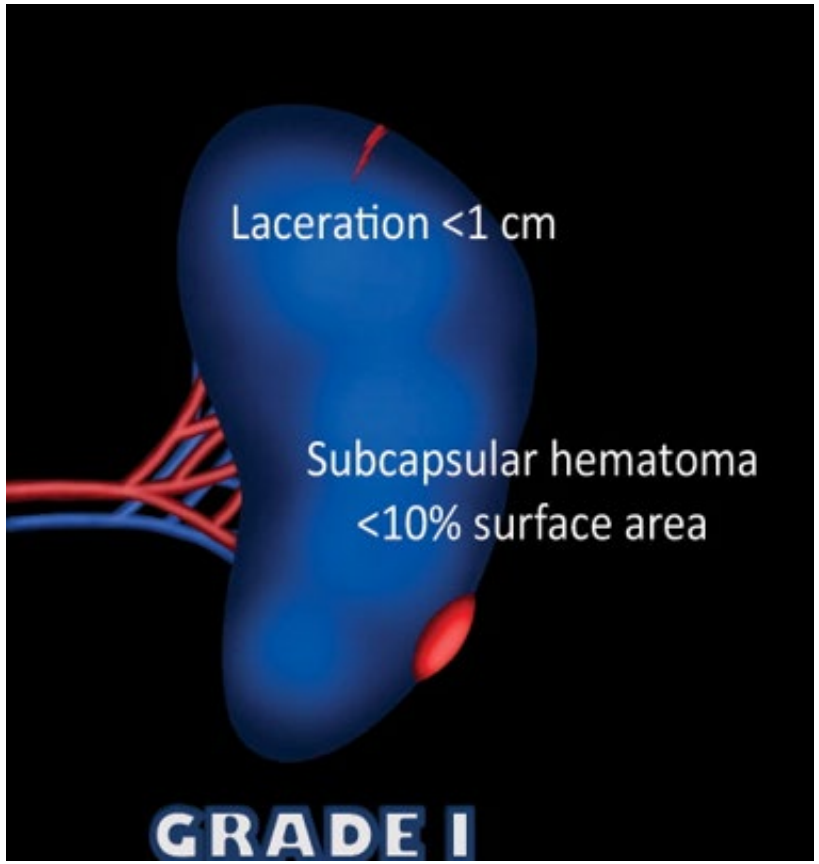
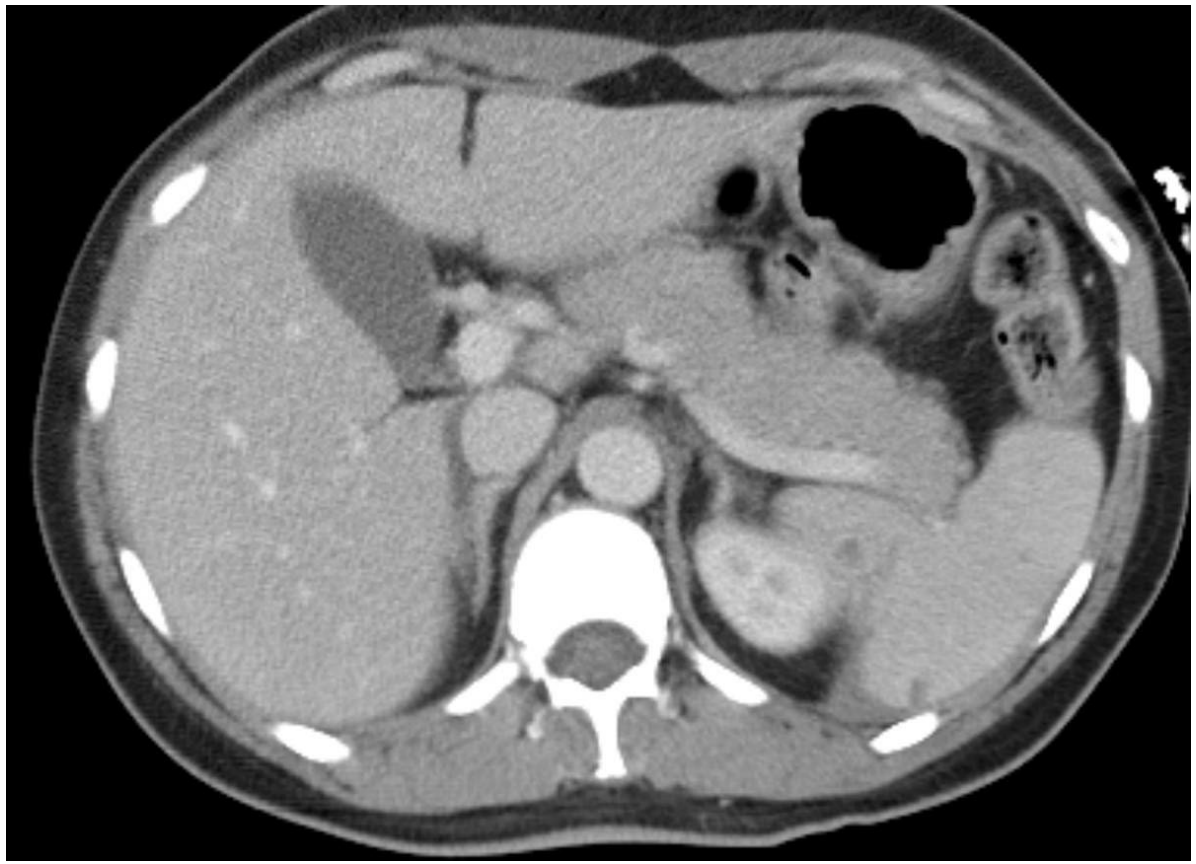
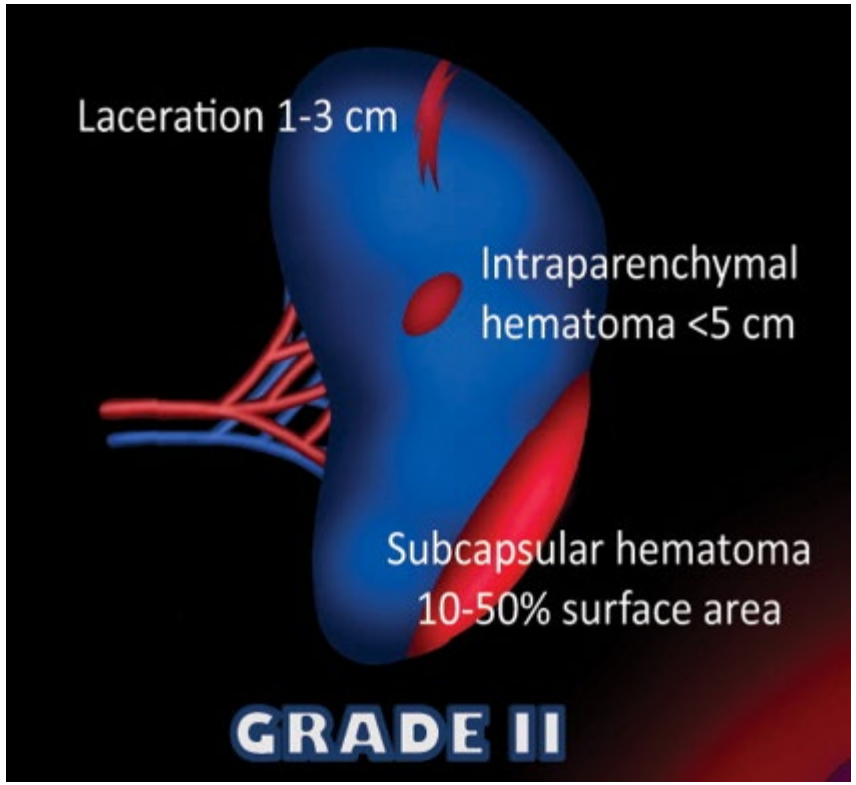
GRADE 1

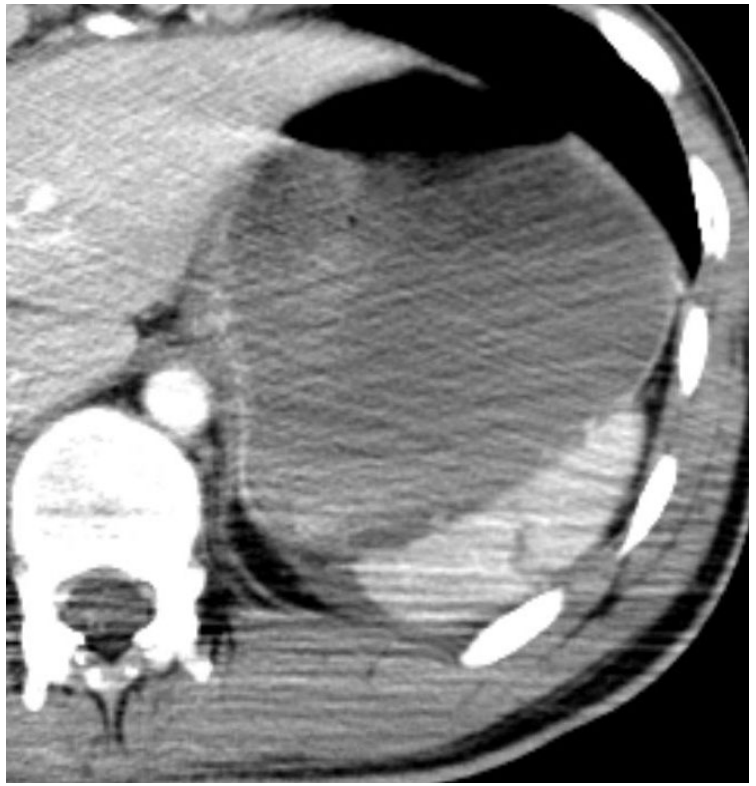




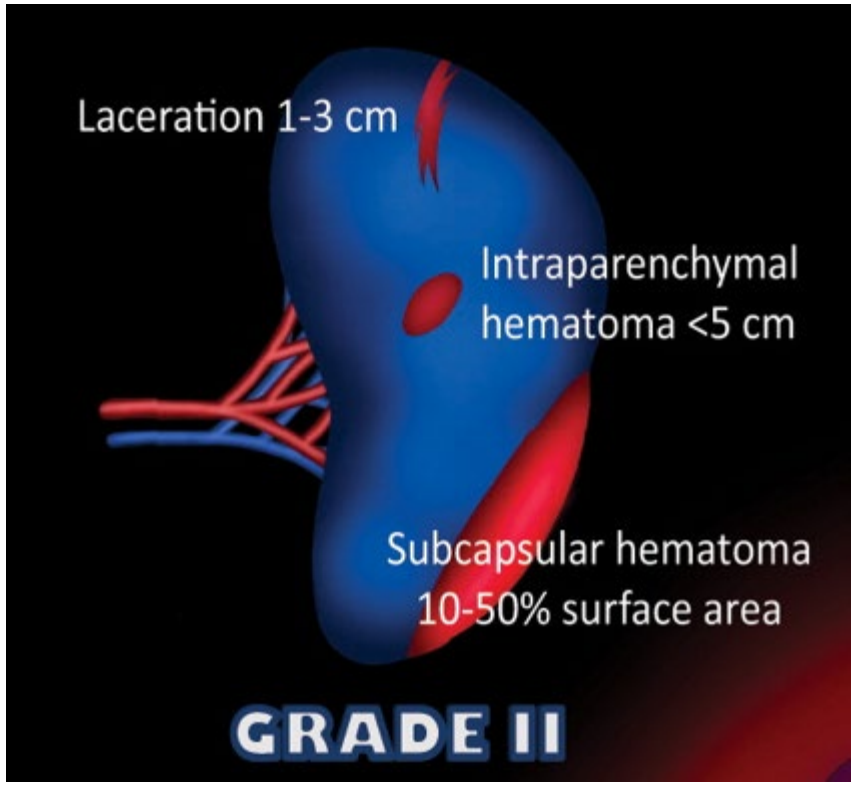
No intraparenchymal hematoma. Laceration of the capsula

GRADE 2


Laceration 1-3 cm
Intraparenchymal hematoma <5 cm
Subcapsular hematoma 10-50% surface area
GRADE II



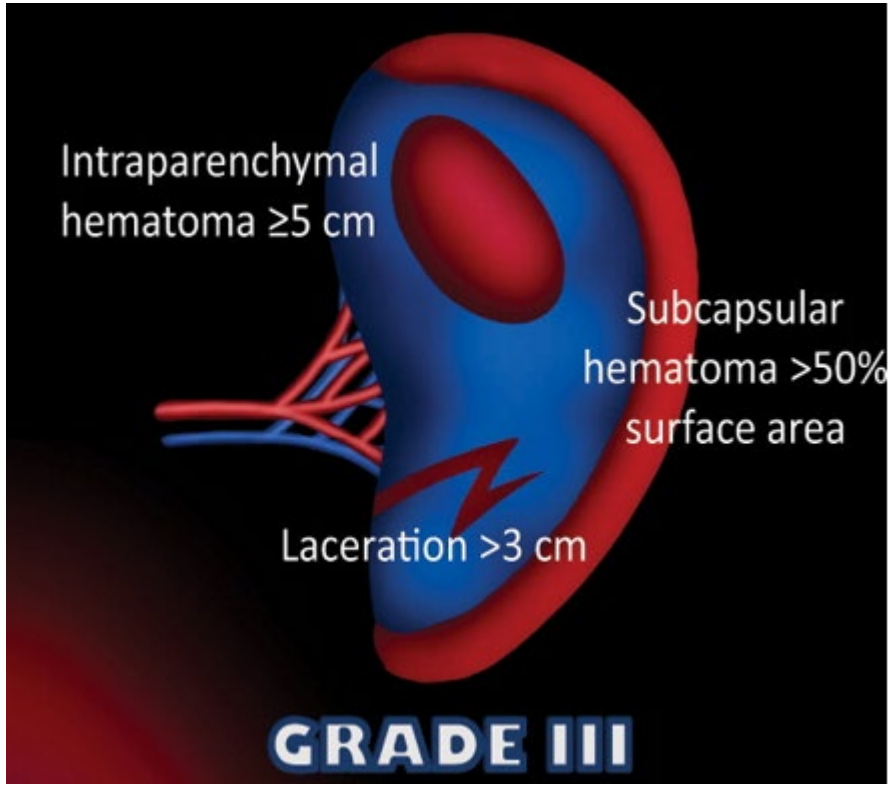
GRADE 2 ?



Subcapsular hematoma 10-50% of surface

Laceration 2 cm. 2 grade 2 injuries result in grade 3

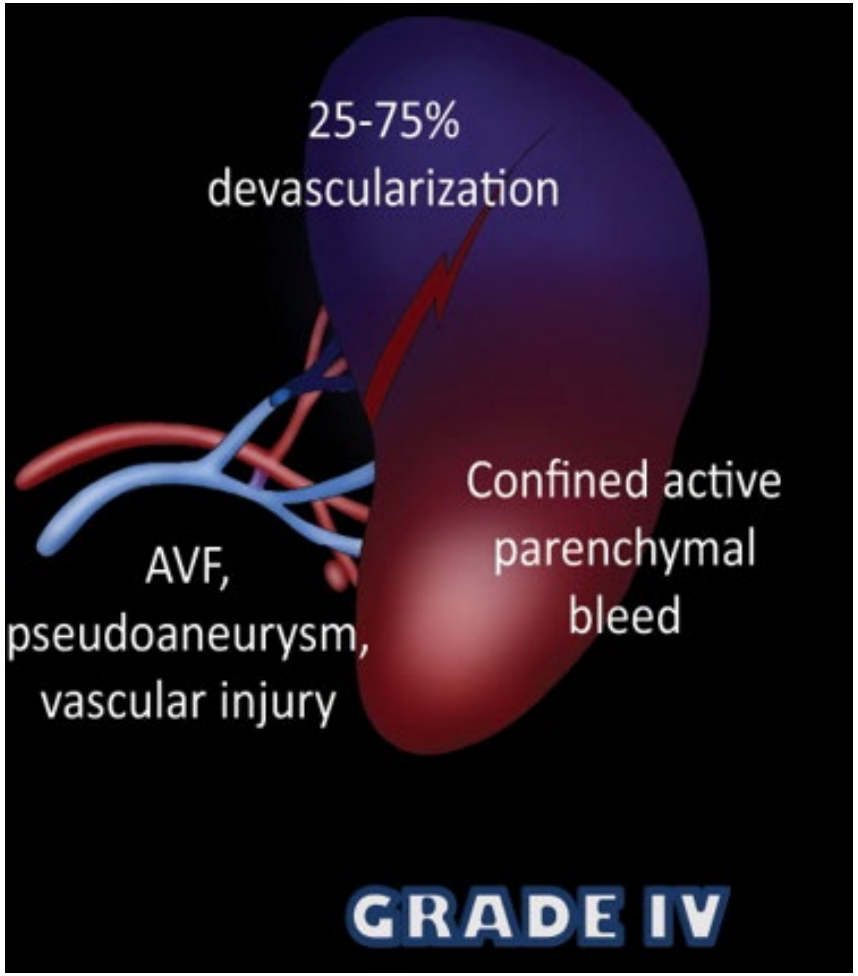
GRADE 3

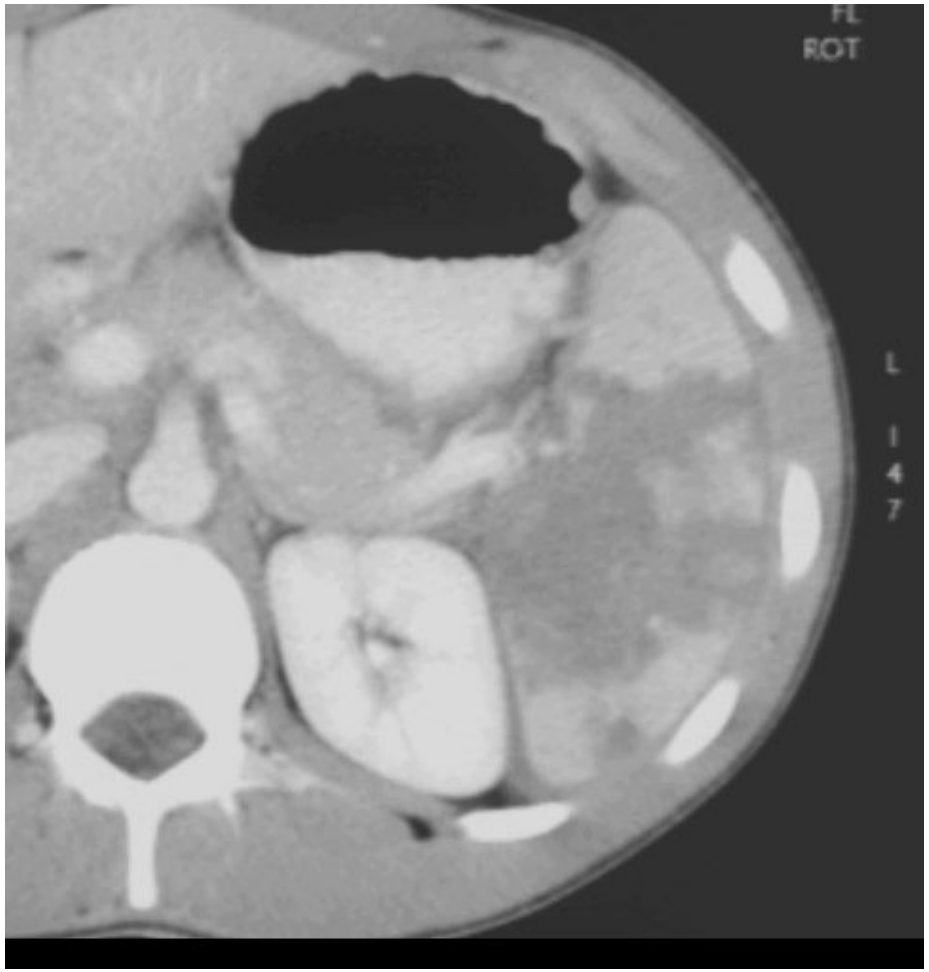


Laceration > 3 cm

Subcapsular
hematoma > 50%

GRADE 4


25-75%
devascularization
Confined active
parenchymal
bleed
AVF,
pseudoaneurysm,
vascular injury
GRADE IV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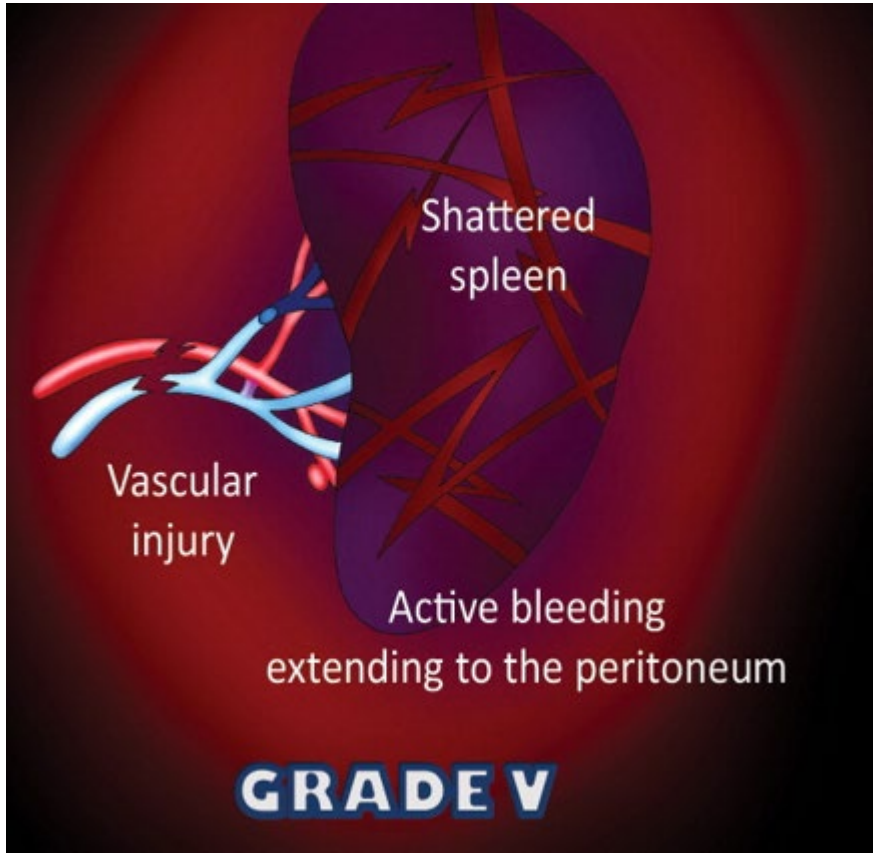
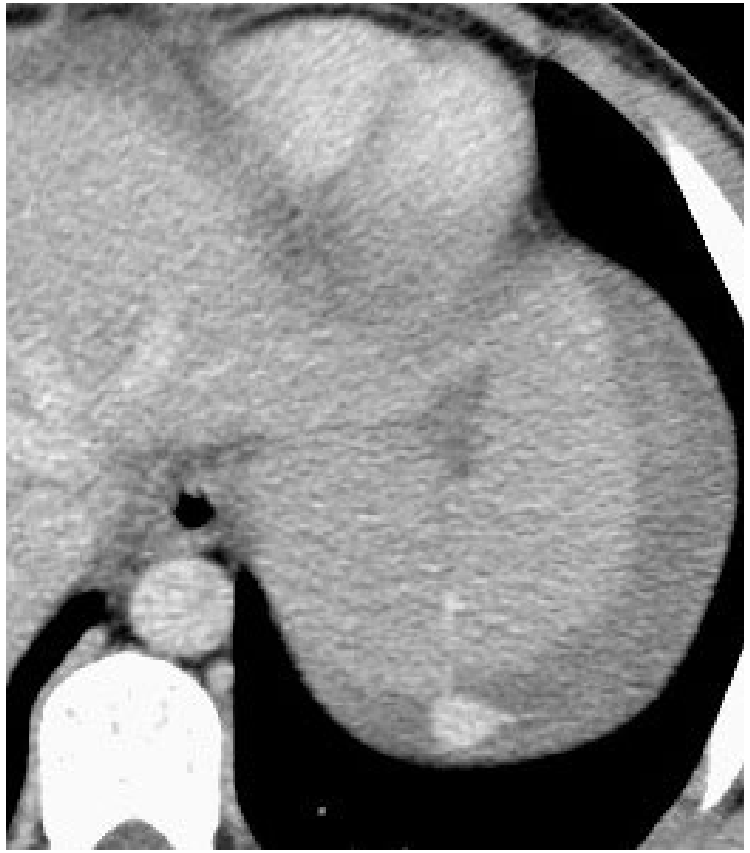
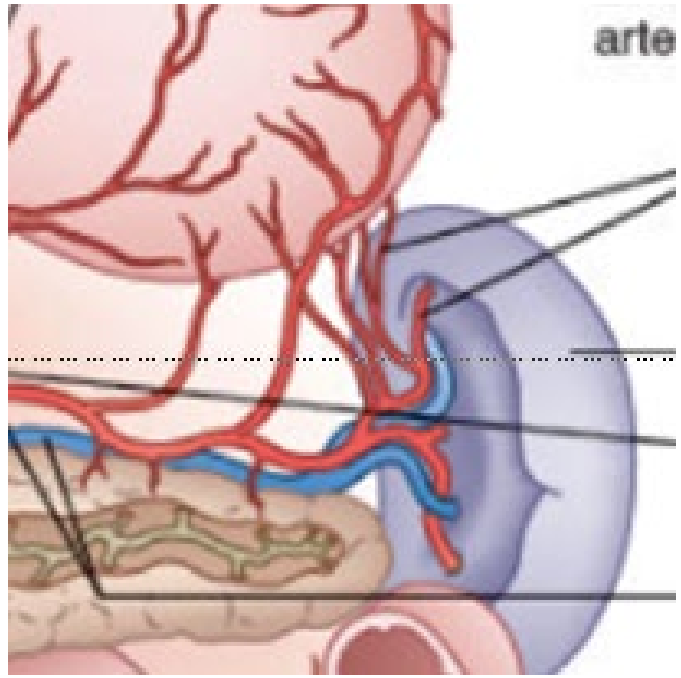
GRADE 5


Shattered
spleen
Vascular
injury
Active bleeding
extending to the peritoneum
GRADE V

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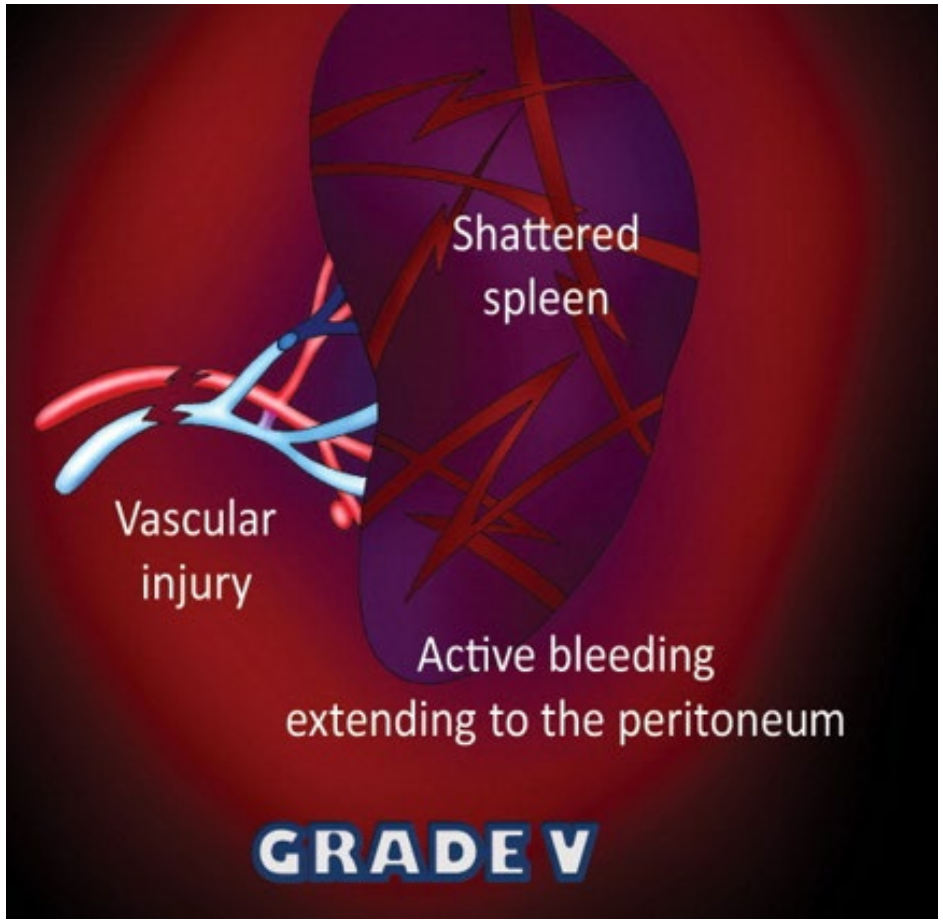
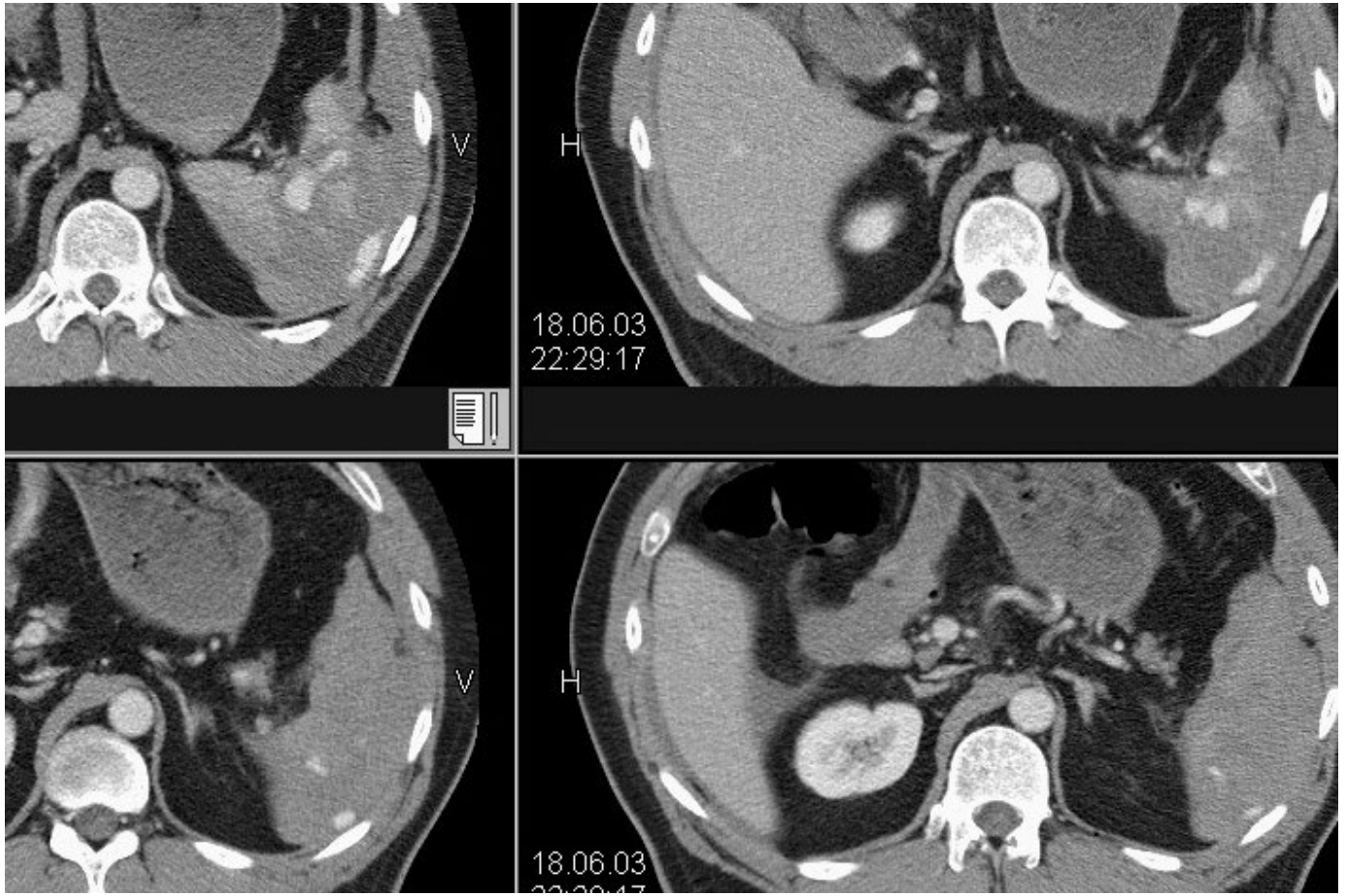
GRADE 5


Shattered
spleen
Vascular
injury
Active bleeding
extending to the peritoneum
GRADE V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H
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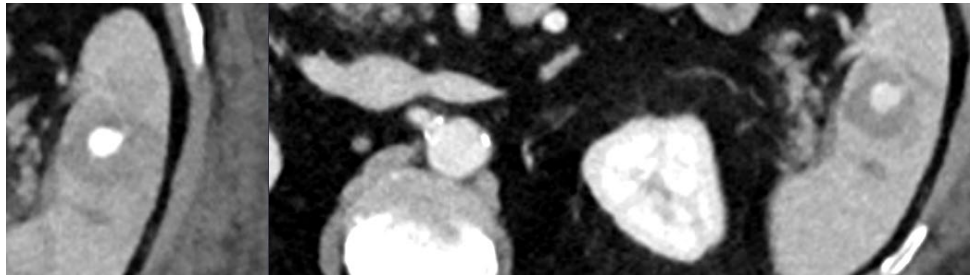
V
H
18.06.03

What are the differences between PSA and extravasation?

PSA

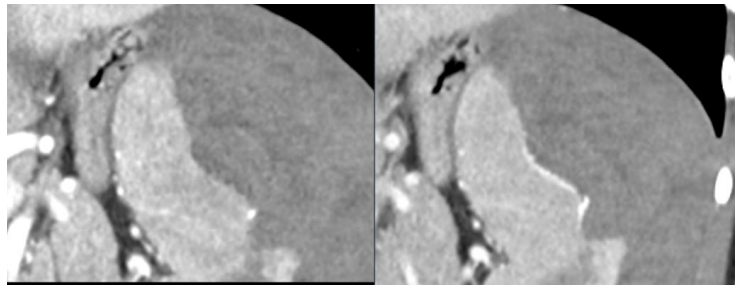
- Contained injury
- Well –circumscribed focal hyperattenuating area
- Does not increase in size and has attenuating as blood pool

  - AV fistulas are extremly rare. They look very similar to PSA but demonstrate early filling of adjacent veins

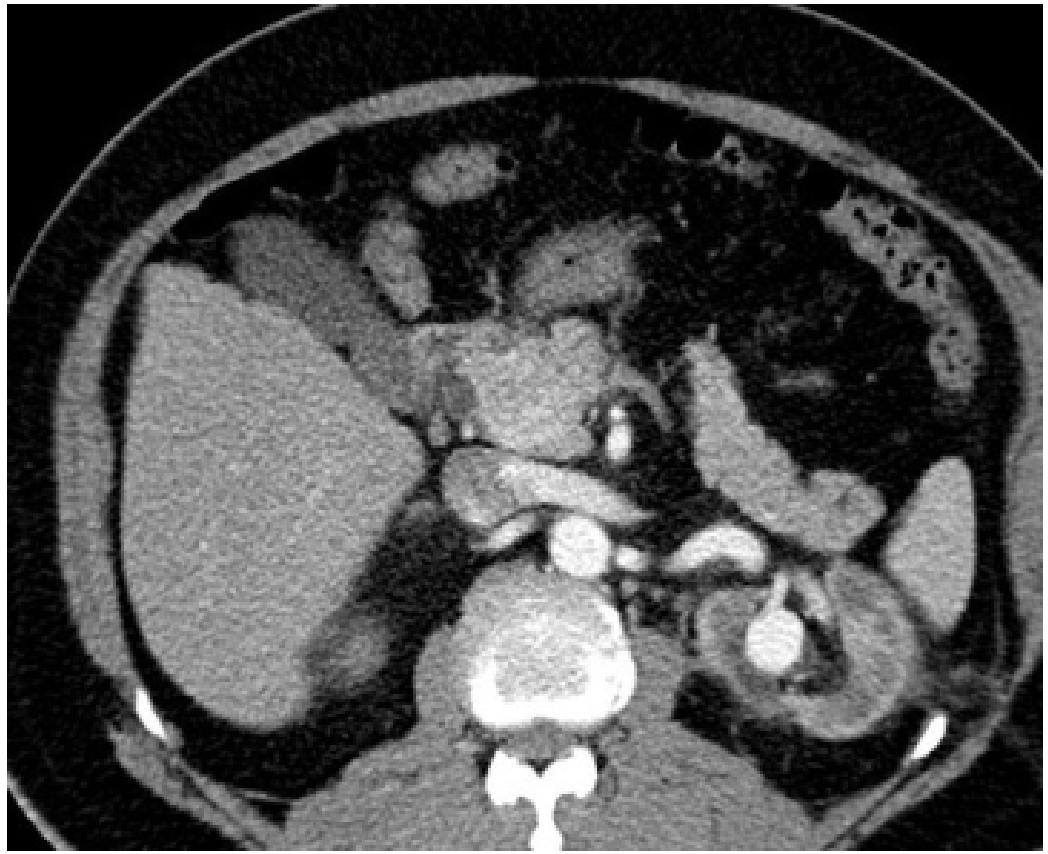


Extravasation

- Contrast actively escaping from blood vessels
- Normally > 100 HU
- Classic jet-like appearance
- Focal, irregular area that
  - Increases in size
  - Decreases in attenuation but still remains hgiher in HU than the blood pool

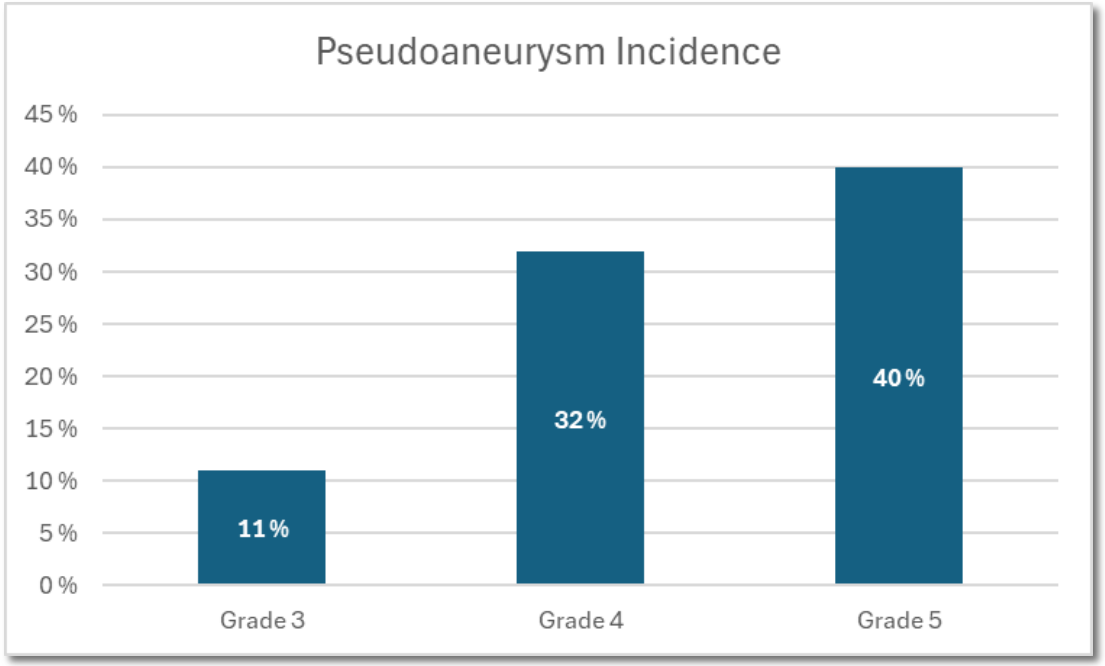


Example of an AV fistula in left kideny



Incidence of PSA in splenic trauma

- Overall incidence 2-27% (Kittara 2015)
- Some PSA are found incidentally, other are found because of delayed hemorrhage
- Delayed hemorrhage due to ruptured PSA in 5-15%
- Higher incidence of PSA in high grade injuries



Wallen 2022

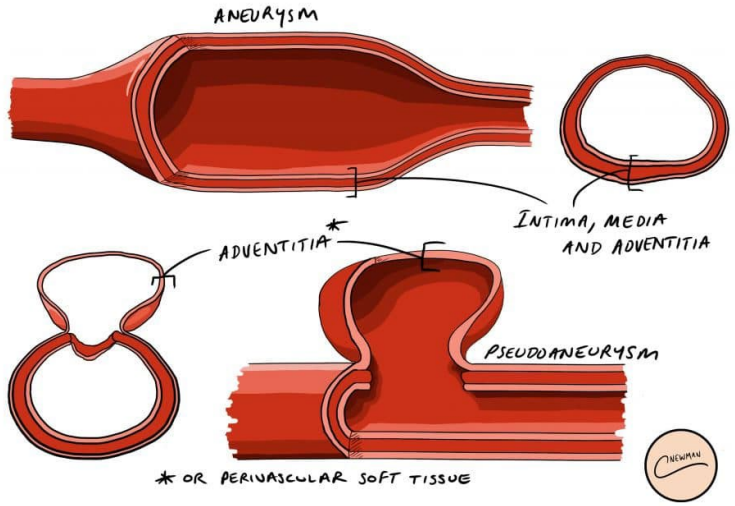
What is the natural development of PSA?

RESEARCH ARTICLE

The Investigation of Posttraumatic Pseudoaneurysms in Patients Treated with Nonoperative Management for Blunt Abdominal Solid Organ Injuries

Hirotada Kittaka*, Yoshiki Yagi, Ryosuke Zushi, Hiroshi Hazui, Hiroshi Akimoto

Department of Emergency, Osaka Misihima Emergency Critical Care Center, 11-1, Minami-Akutagawa-cho, Takatsuki City, Osaka Prefecture, Japan



mediately after follow-up CT, and no delayed bleeding was seen. All of the remaining six patients had PAs measuring less than 10 mm in diameter and were managed by observation only, without TAE or a restriction of activity. In all of these six patients, spontaneous disappearances of the PAs were observed on follow-up CT 3 to 26 days (median: 8 days) after the detection.

What is the natural development of PSA?

Delayed formation of splenic pseudoaneurysm following nonoperative management in blunt splenic injury: Multi-institutional study in Osaka, Japan

Takashi Muroya, MD, Hiroshi Ogura, MD, PhD, Kentaro Shimizu, MD, PhD, Osamu Tasaki, MD, PhD, Yasuyuki Kuwagata, MD, PhD, Takashi Fuse, MD, Yasushi Nakamori, MD, PhD, Yusuke Ito, MD, Hiroshi Hino, MD, *and* **Takeshi Shimazu, MD, PhD,** *Suita, Osaka, Japan*

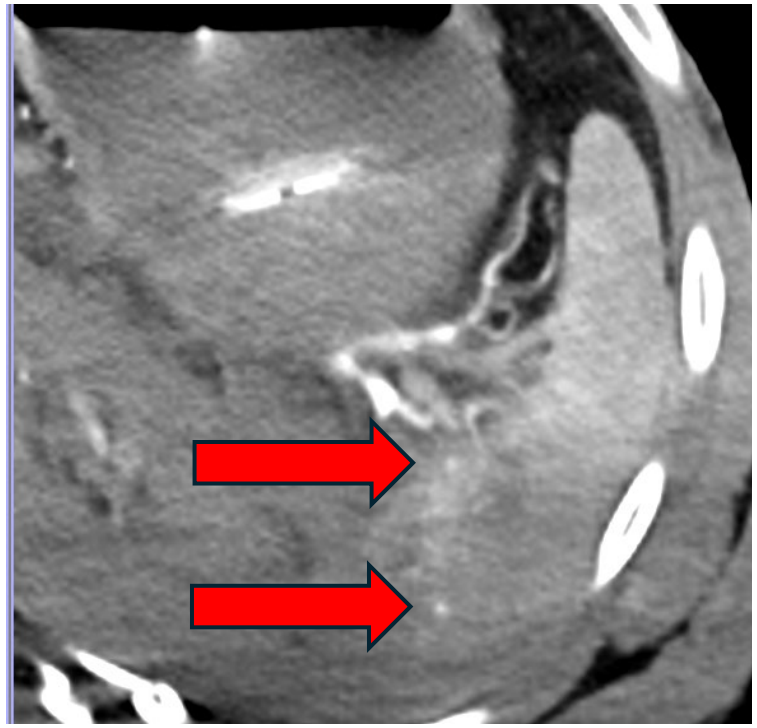
Eight patients with delayed formation of SPAs including the previously mentioned two patients were observed without TAE during their entire hospital stay. These SPAs were 8.7 (5.5) mm (range, 3.5–25 mm) in size and were spontaneously occluded on follow-up enhanced CT or angiography. Spontaneous occlusion of the SPAs was confirmed at 5.2 (2.6) days (range, 2–10 days) after diagnosis of delayed SPA. Relapse of these SPAs was not observed on follow-up enhanced CT.

CT protocols – three options

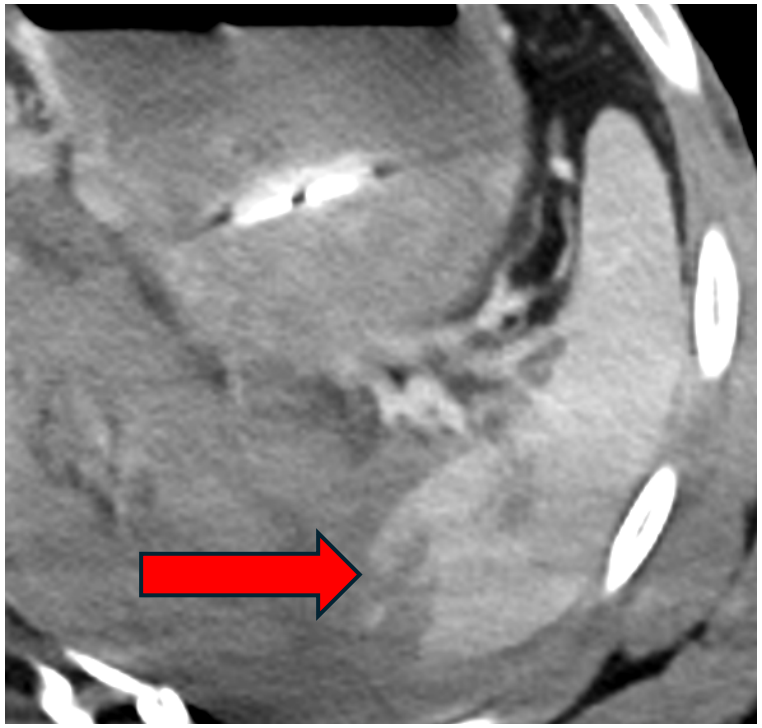
- Portal venous phase imaging
- Biphasic imaging: One injection – two scans
- Split bolus imaging: Two injections- one scan
- The choice of protocol depends on the local experience and preferences and on the pre test probability of high grade splenic injuries

Biphasic imaging

Artrial phase



Portal-venous phase



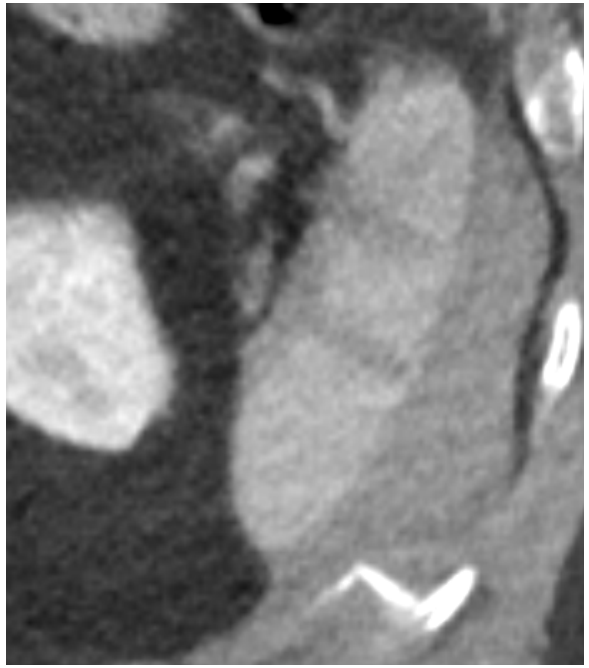
–Arterial phase superior for small PSA

PV phase for parenchymal injuries

Combination detects ongoing bleeding

Portal-venous phase imaging

Admision CT pv phase

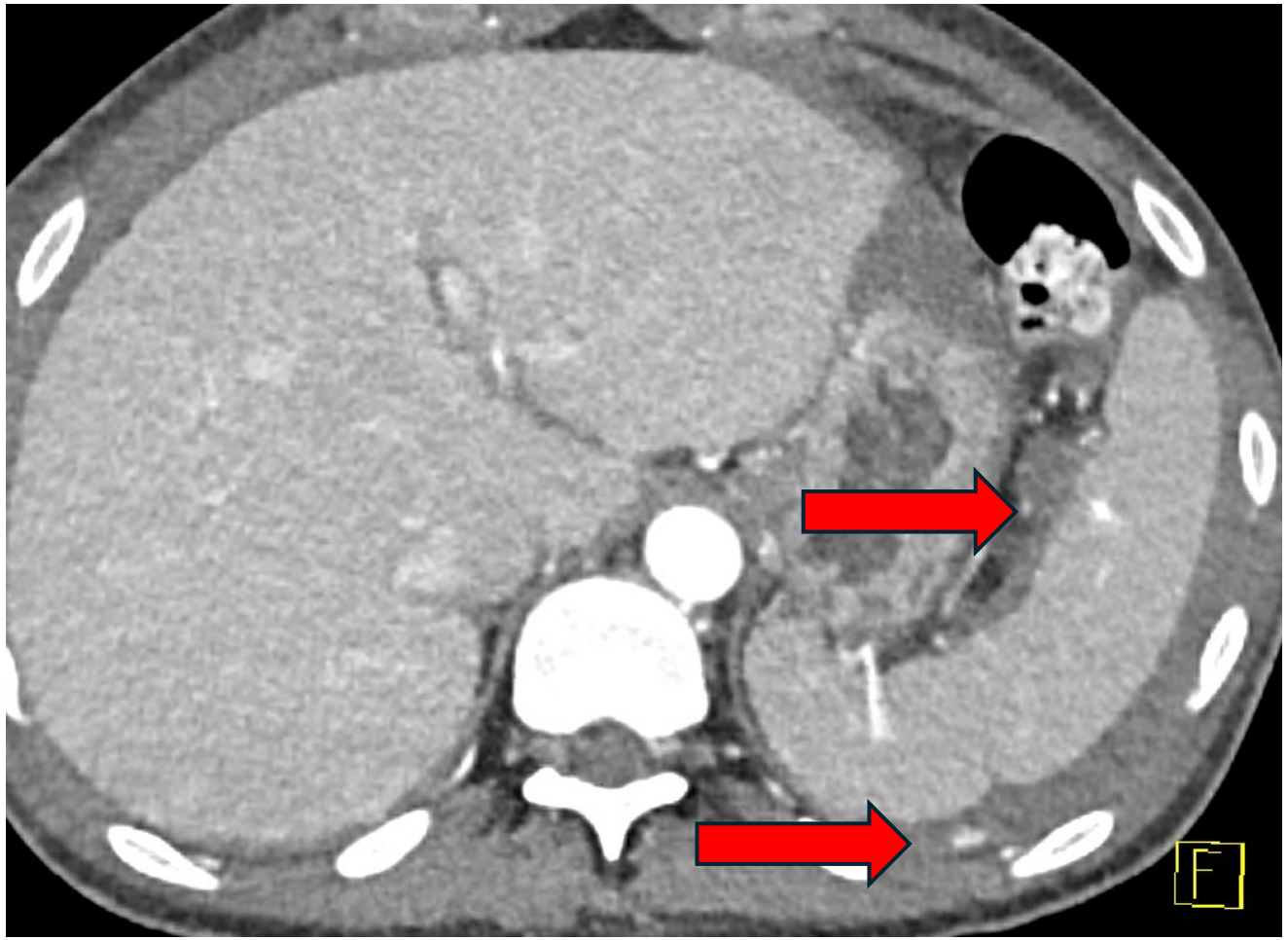


FU day 7 pv phase

Detects parenchymal injuries

Detects larger PSA and activ bleeding

Split bolus imaging



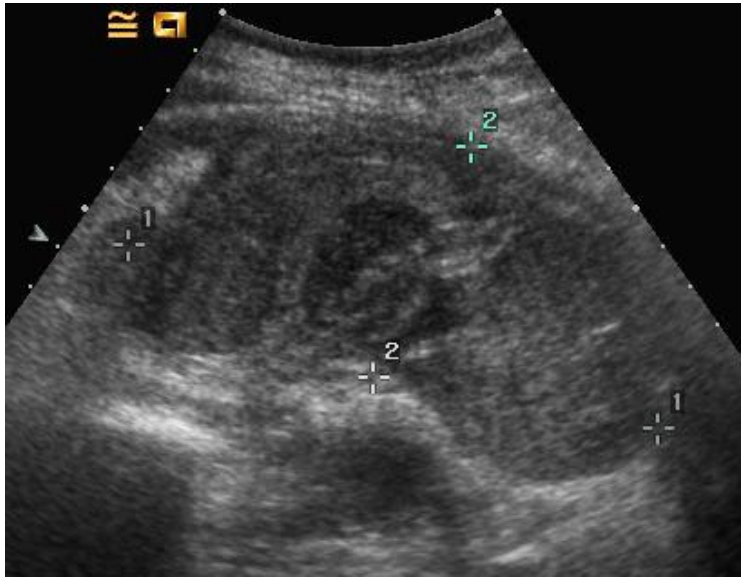
Detects minor PSA

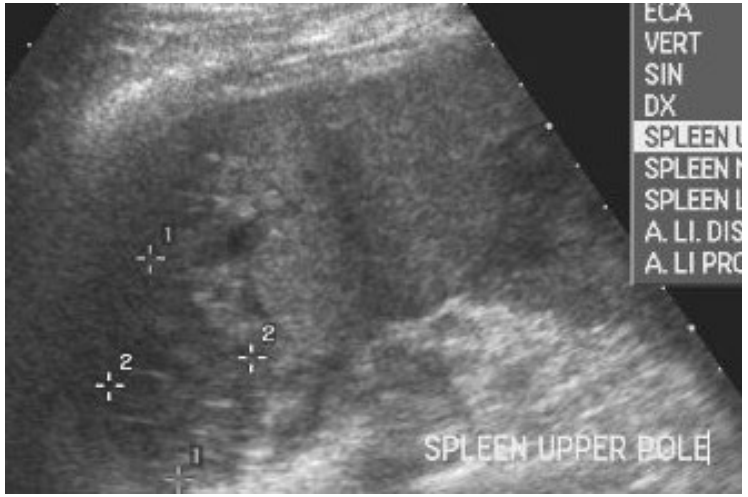
Detects active bleeding

Does ultrasound play any role in splenic trauma?

Ultrasound

- Low sensitivity 50-70%
- Hematomas appear as iso-, hypo- or hyperdense
- Fluid around the spleen
- Can be useful in controls

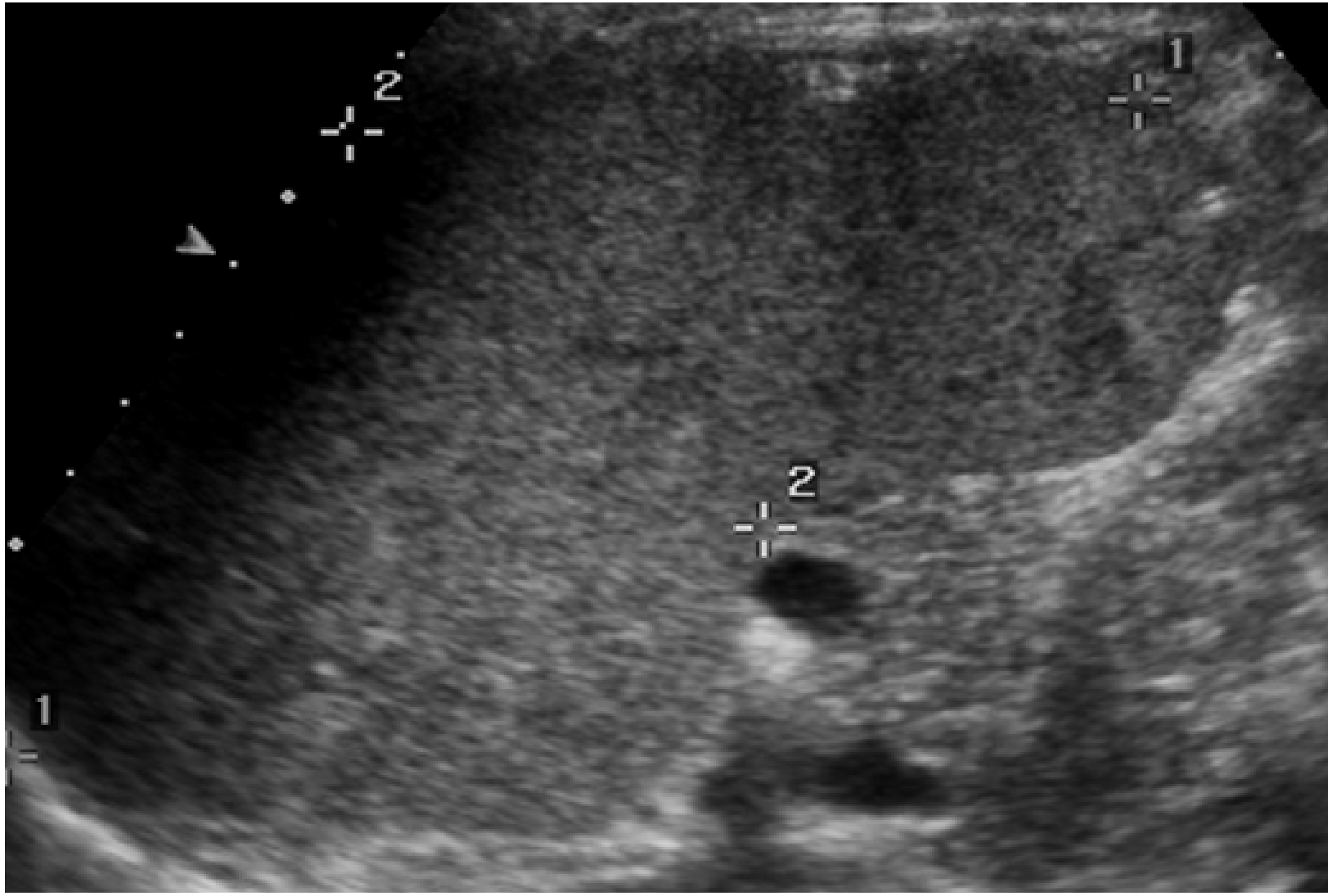




Contrast enhanced ultrasound (CEUS)

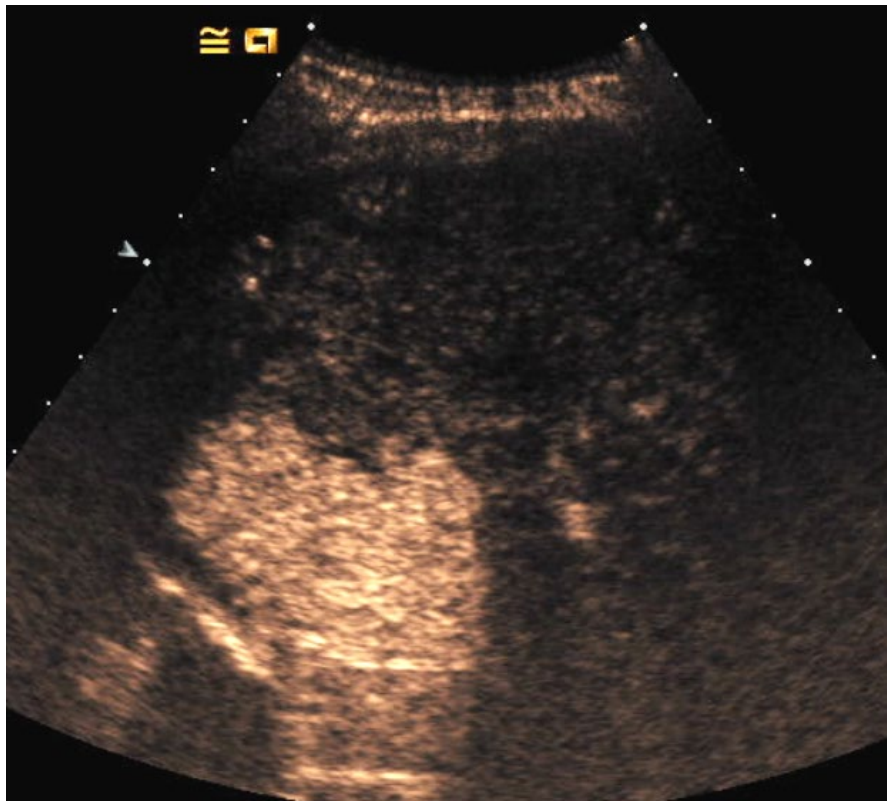
- High sensitivity
- Can detect active bleeding, vascular injuries and hematomas
- Useful in F/U after PSA detection and embolisation

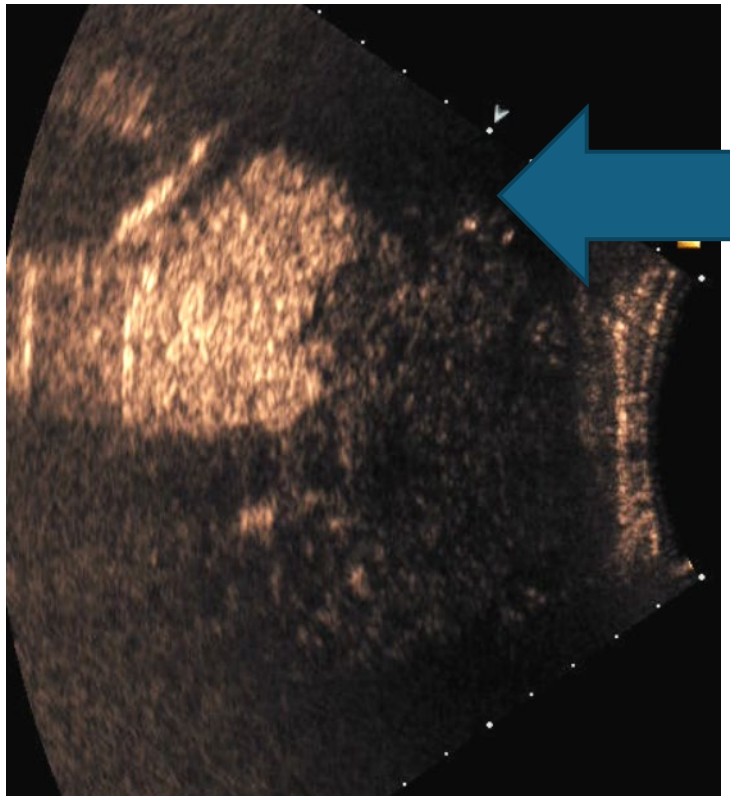
Embolized grade 4 injury - grayscale

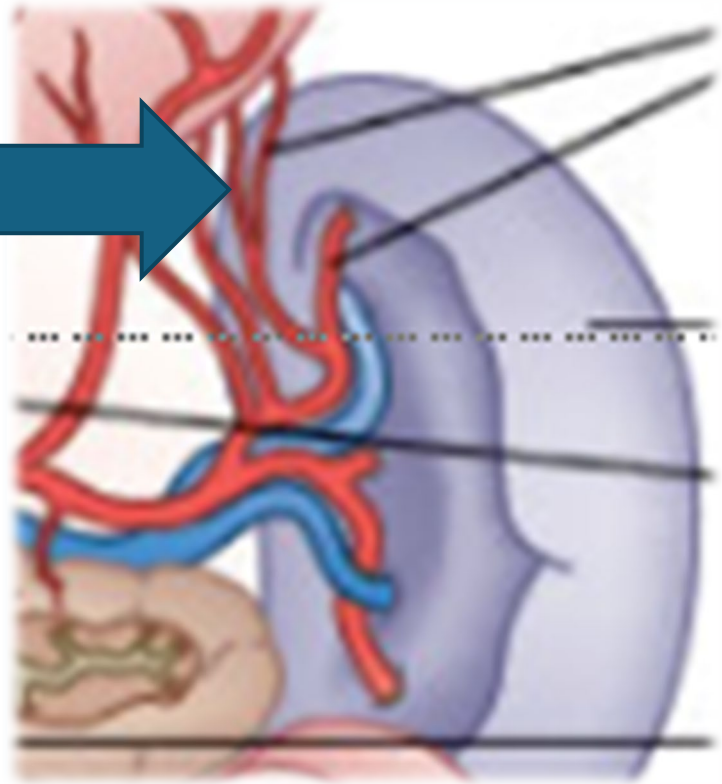


dormagen

Embolized grade 4 injury - CEUS







The upper pole is perfused by the gastrica sinister arteries
The major part of splenic tissue is hypoperfused

Case

- 15 y/o male
- Down hill skiing, crashed into a tree
- Fast +

CT findings

- Multipe lacerations and hematoma
- Possible extravasation, vascular injury
- NOM with observation

Controll day 5

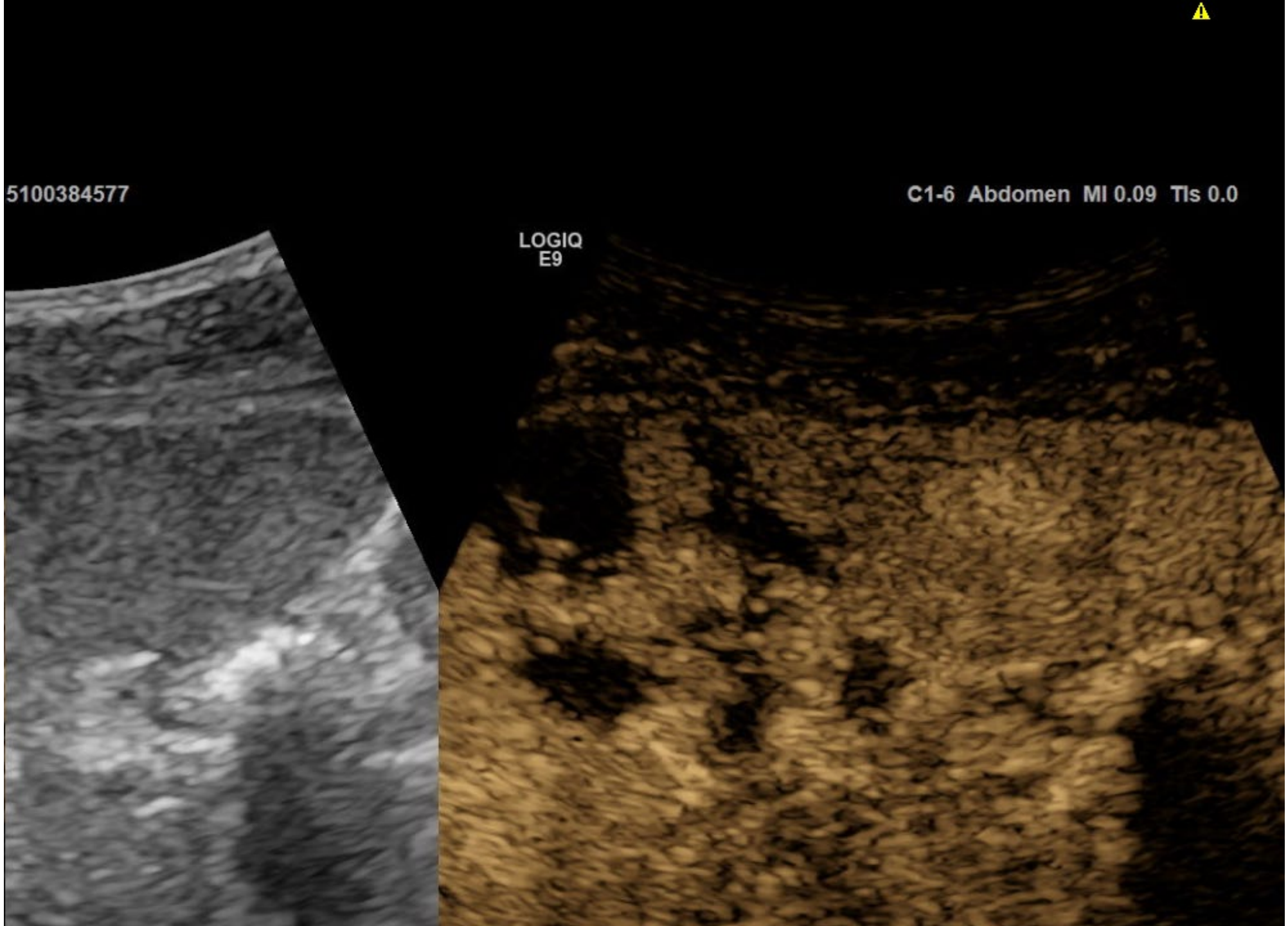
- Kontrast ultralyd

Technical tips for CEUS in splenic injuries

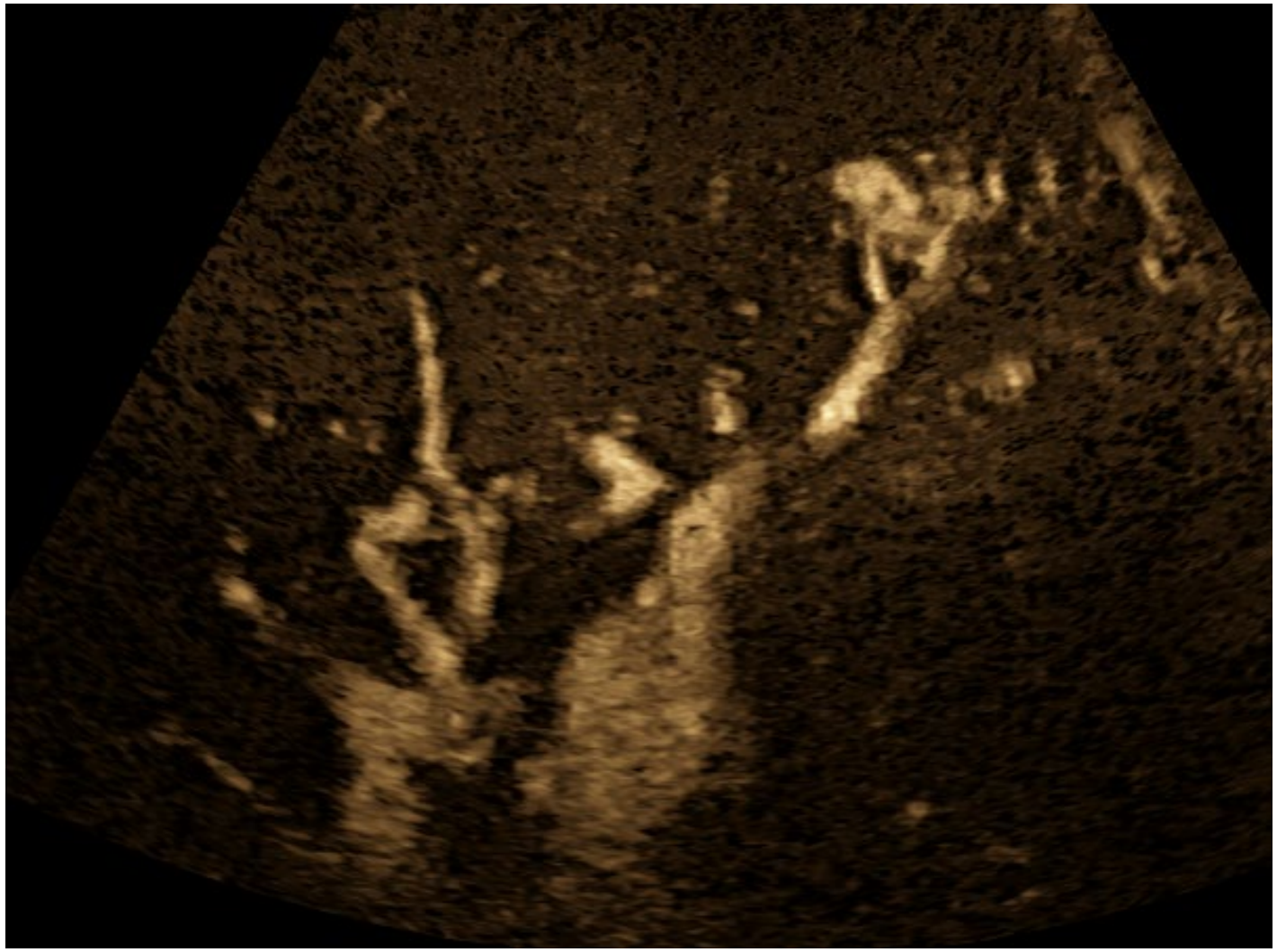
- Teknikk:

1. Check admission CT, whera are the injuries?
2. Exam the region of interest with grayscale
3. Move the probe slightly fanlike over the injured region
4. Inject the contrast
5. Start uptake immediately after injection

Contrast


5100384577
C1-6 Abdomen MI 0.09 TIs 0.0
LOGIQ
E9

B-mode



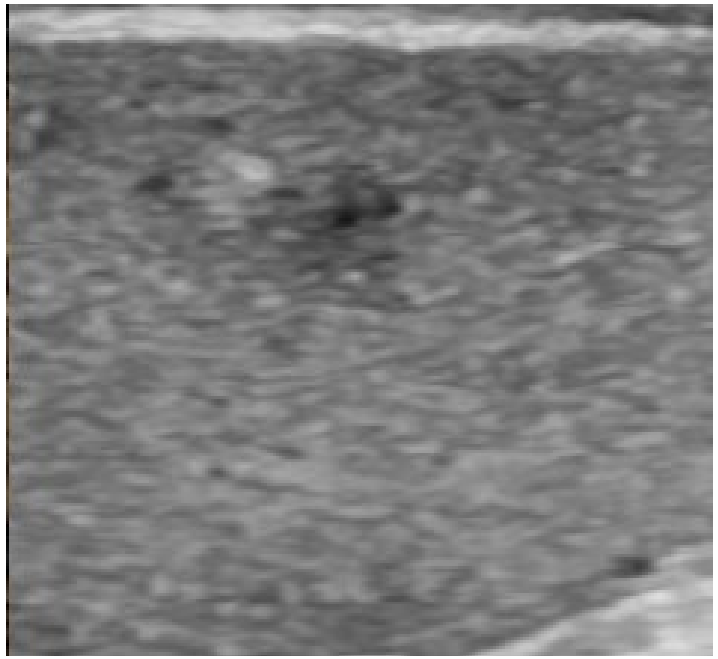
Signs of PSA on CEUS

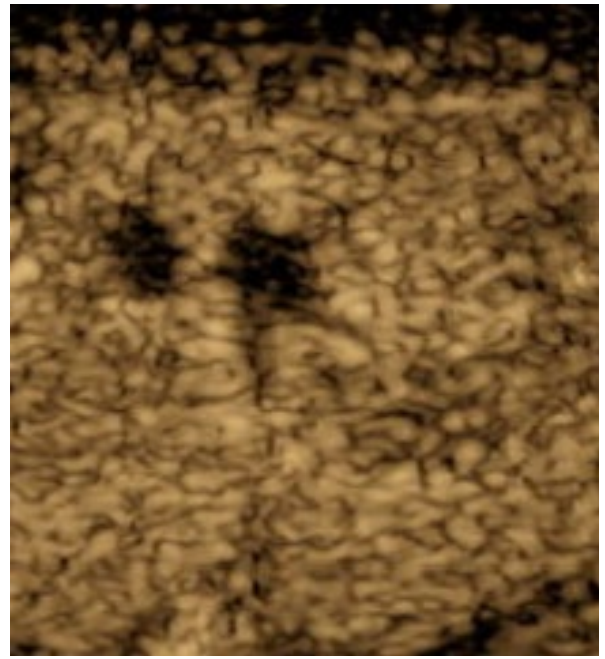
- Very early and focal uptake
- Mushromlike appearance
- «Feeding artery»
- In late phase: Still slighlty hyperenhancing compard to non injured splenic tissue

Second control after 7 days

CEUS findings after second control

- 2 Completely thrombotized PSA
- Grayscale:
  - Hyperechoic or hypoechoic lesion
  - No Doppler
  - No B-flow
- CEUS
  - No contrast enhancment





Summary - Keypoints

- Grading of splenic injuries is important because grading defines treatment and outcome
- Look carefully for vascular injuries, PSA and ongoing bleeding
- PSA in children and småll PSA in adults can thrombotise spontaneously
- CEUS is the modality of choice in F/U of isolated splenic injuries