

Angiography and intervention in abdominal organ injury: when and how?

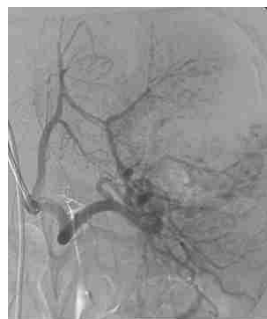
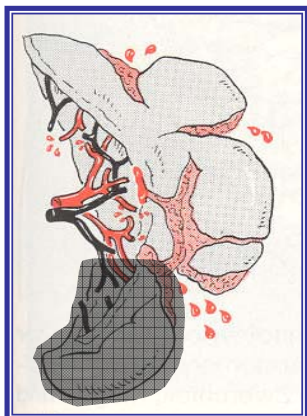


Trauma radiology, 5th Nordic Course
May 2008



NE Kløw

When and how?





Angiography and embolization

- Spleen injuries at UUS 2002-4.
 - N=64/2 yrs
 - Angiography: 31 (48%)
 - Embolization: 27 (42%)
- Liver injuries at UUS 2002-4
 - N=59/2 yrs
 - Angiography: 26 (44%)
 - Embolization: 9 (15%)
- Kidneys at UUS
 - 1-3/yr



The angio team

- Day time: two of four angio suites can be used.
First available lab to be used
- After hour:
 - 1 MD and 2 techs on call
 - Anesthesia and trauma team leader present in the lab
- The angio team also does PCI and embolization of GI and post partum bleeding



Requirement for the angio team

- Technical skills of the MD's
- Detailed knowledge of the arterial anatomy, variations and collaterals for each organ
- Well trained techs
- Updated procedure manuals

- Close collaboration with the trauma team



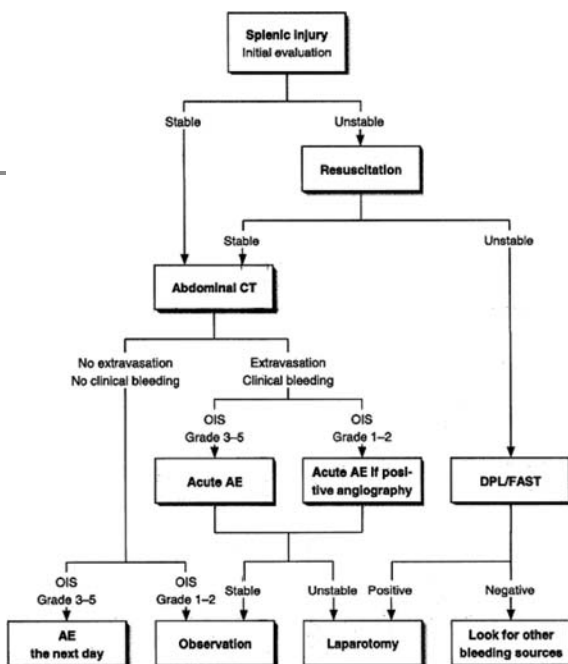
Equipments

- Regular peripheral angiography catheters
- Microcatheters
- Material for embolization:
 - Coils (macro or microcoils)
 - Metal strings that coils in their artery
 - Added material to stimulate coagulation
 - Permanent occlusion
 - Spongostan (gelfoam)
 - To be mixed with contrast and saline
 - May be precut or self made
 - Temporary occlusion

Angiography - indications

- CT should be done before angiography
- Indications are individual for each organ injury
- Important factors:
 - The bleeding status
 - Hemodynamic stability
 - Other injuries
 - CT findings

Flow chart for spleen injuries

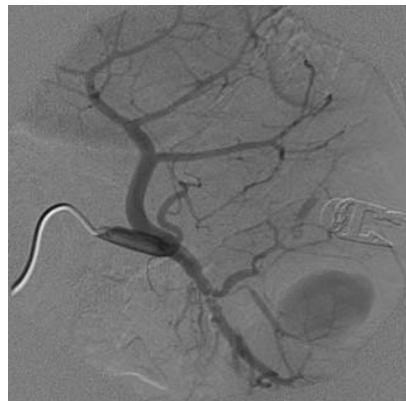
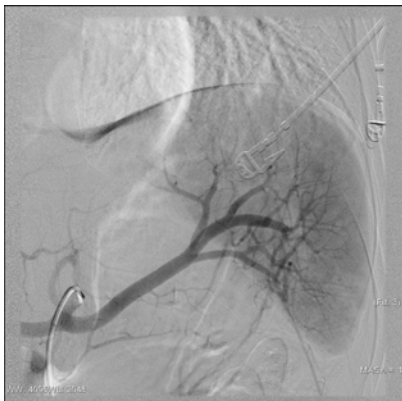


AAST Organ injury Scale - Spleen injury

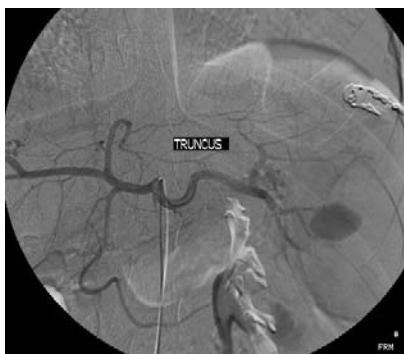
Grade	Injury	Description
I	Haematoma	Subcapsular, <10% surface area
	Laceration	Capsular tear, <1 cm parenchymal depth
II	Haematoma	Subcapsular, 10-50% surface area, intraparenchymal <5cm diameter
	Laceration	1-3 cm parenchymal depth not involving a parenchymal vessel
III	Haematoma	Subcapsular, >50% surface area or expanding. Ruptured subcapsular or parenchymal haematoma. Intraparenchymal haematoma >5cm
	Laceration	>3cm parenchymal depth or involving trabecular vessels
IV	Laceration	Laceration of segmental or hilar vessels producing major devascularization (>25% of spleen)
	Laceration	Completely shattered spleen
V	Laceration	Completely shattered spleen
	Vascular	Hilar vascular injury which devascularized spleen

Advance one grade for multiple injuries to same organ up to Grade III.

Angiography - spleen



Angiography - findings

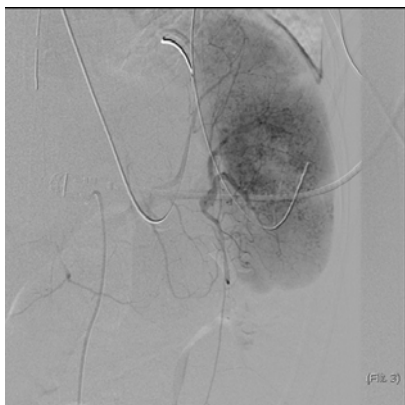


Pseudoaneurysm



Extravasation

Angiography - findings



Multiple punctations



Normal



Angiography - findings

- Ekstravasation (39%)
- Pseudoaneurysm (6%)
- Vessel truncation (19%)
- Normal or multiple punctations

C Gaarder et al. J of Trauma 2006



Embolization - spleen

- Mostly coils, addition of gelfoam in some
- Active bleeding, vessel truncation, PSA:
 - Peripheral and sentral embolization
- All others: sentral embolization
- Rebleeding: reangiography and 2nd attempt

Results – embolization (27)

Primary technical success	96%
2nd tech success	100%
Reangiography	2 – 1 was reembolized
Splenectomy after AE	3 (11%) – 1 was failure
Necrosis >50% of spleen	1 – no therapy
Perisplenic hematoma	1 – percutaneous drainage

Table 2 Management Strategies and Outcome

	Group 1	Group 2	p Value
n	69	64	
Attempted NOM (%)	39 (57)	47 (73)	0.04
NOM success rate (%)	31 (79)	45 (96)	0.02
Total laparotomy rate (%)	38 (55)	19 (30)	0.003
Splenectomy rate (%)	30 (43)	16 (25)	0.02
Mortality rate (%)	10 (15)	7 (11)	0.54
Laparotomy per patient	1.0 (0–7)	0.6 (0–4)	0.02
Transfusion first 24 h (PRBC)	7.6 (0–67)	6.0 (0–60)	0.46
LOS per patient (days)	9.3 (0–76)	9.3 (0–66)	0.64

Values are given as mean and total range where not stated otherwise.

NOM, nonoperative management; LOS, length of stay; PRBC, packed red blood cells; CI,

Embolization protocol of spleen injuries grade 3+ resulted in more saved spleens, fewer operations and complications, but no increase in mortality



CT after embolization

Placement of coils	n	FINDINGS					
		No infarct	<25%	25-50%	>50%	Gas	New subcapsular fluid
Proximal	24	9	8	4	3	2	3
Distal	22	0	11	9	2	3	0
Combined	7	2	3	1	1	2	1

KL Killeen et al. JVIR 2001;12:209



Litterature - spleen

- No systematic reviews or randomized clinical trials, but many reports from trauma centers
- AE improve NOM results and saves the spleen
- Discussion:
 - level of embolization
 - embolization of normal angiograms
 - hemodynamic unstable pts.
 - Children
 - OIS grade, CT extravasation

Haan JM et al. J Trauma 2005

Blunt liver injuries

- Similar flow chart as for the spleen
 - Angiography also after liver surgery and packing
- CT liver
 - The injury should be OIS grade 4 and more
 - CT finding of ongoing bleeding

Angiography - liver





Embolization of the liver

- Only when positive findings
- Embolize as peripheral as possible
- Use coils (our recommendation)
- Caution
 - Gall bladder artery
 - Central occlusion



Results – embolization

Angiography	26
Embolization	9
Technical success	8 of 9 (1 was packed afterward)
Large necrosis	1 – hemihepatectomy (probably unrelated to embolization)
Coeliac intima dissection	1 – no consequences



Results

	Group 1	Group 2	sign
Attempted NOM (%)	28 (51)	45 (76)	0.005
Failure rate (%)	5 (18)	6 (13)	0.85
Total laparotomy rate (%)	32 (58)	20 (34)	0.00
Mortality rate (%)	5 (9)	6 (10)	0.82
Complications per patient	1.5 (0–9)	0.9 (0–8)	0.03

Embolization protocol of liver injuries grade 3+ resulted in fewer operations and complications, but no increase in mortality

C Gaarder et al. Int J Care Injured 2007



Litterature - liver

- No systematic reviews or randomized clinical trials
- AE improve NOM results and probably reduce number of deaths from bleeding
- Pts with CT finding of extravasation are candidates
- No conclusion about OIS grade and AE

Angiography – kidney injuries



Abdominal aortography



Selective angiography

All kidney injuries should not go to angiography





Embolization of the kidneys

- Renal arteries are end-arteries - embolization will result in necrosis
- Do not embolize the whole kidney
- Embolize peripherally
- Microcatheters and coils are recommended



General concerns for angiography in trauma patients

- Technically demanding
- Unintended embolization may result in necrosis of normal tissue
 - Locally
 - At distant areas
- The treatment may delay other life saving operations
- Other pathology may be missed



Summary

- Embolization may be a life saving procedure, but mostly preserve organs and reduce complications
- Important to come to angio suite early
- Good preoperative CT is helpful
- Good knowledge of arterial supply and collaterals necessary
- Placement of catheters peripherally may be demanding
- Procedure require a full competent on-call team



Thank you for the attention