21st ANNUAL CONTROVERSIES AND PROBLEMS IN SURGERY SYMPOSIUM 2017
Date: 06-07 October 2017 Venue: Sanlam Centre, University of Pretoria Main Campus
Theme: *Making Wise Choices for Difficult Surgical Problems*

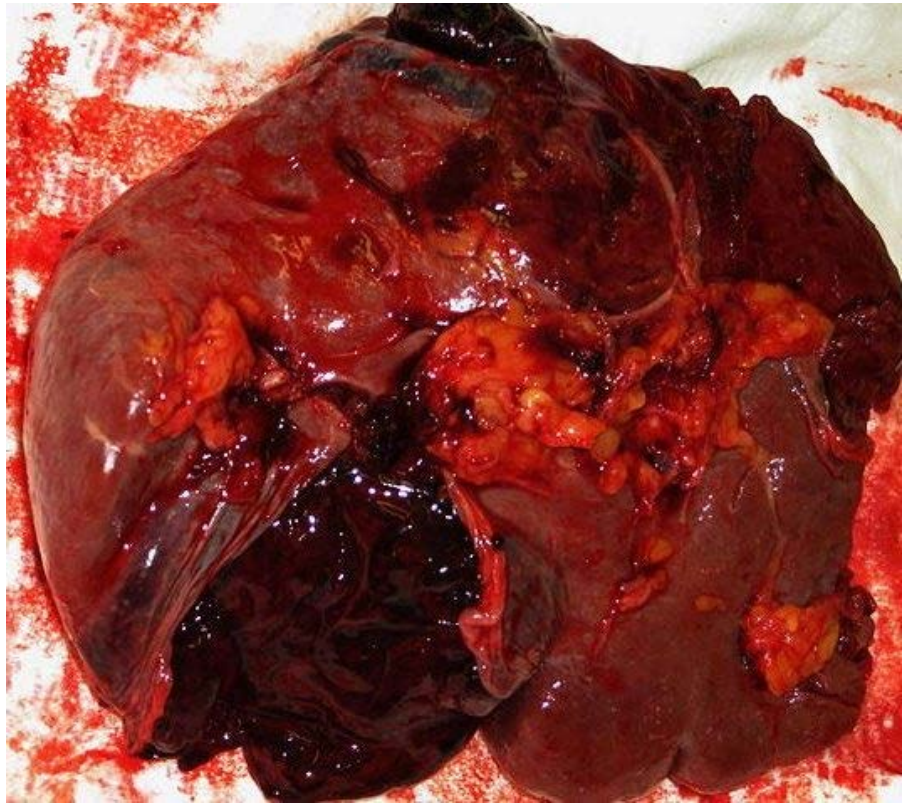
Pros and Cons of Surgery vs Therapeutic Arterial Embolization of Spleen in Trauma

DR MS MOENG

06 October 2017

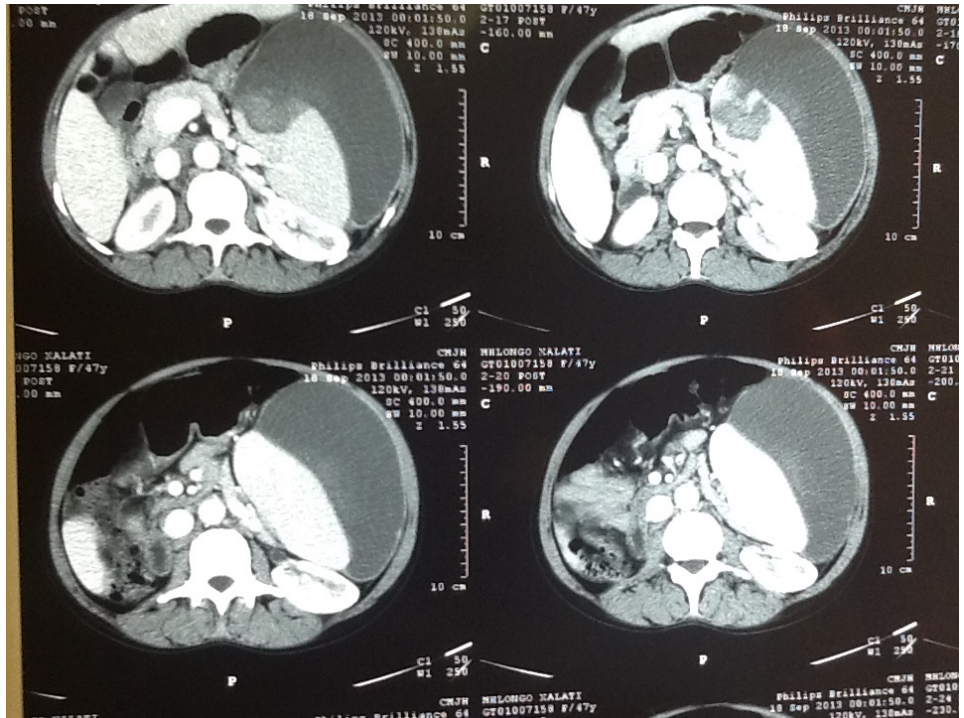
Overview

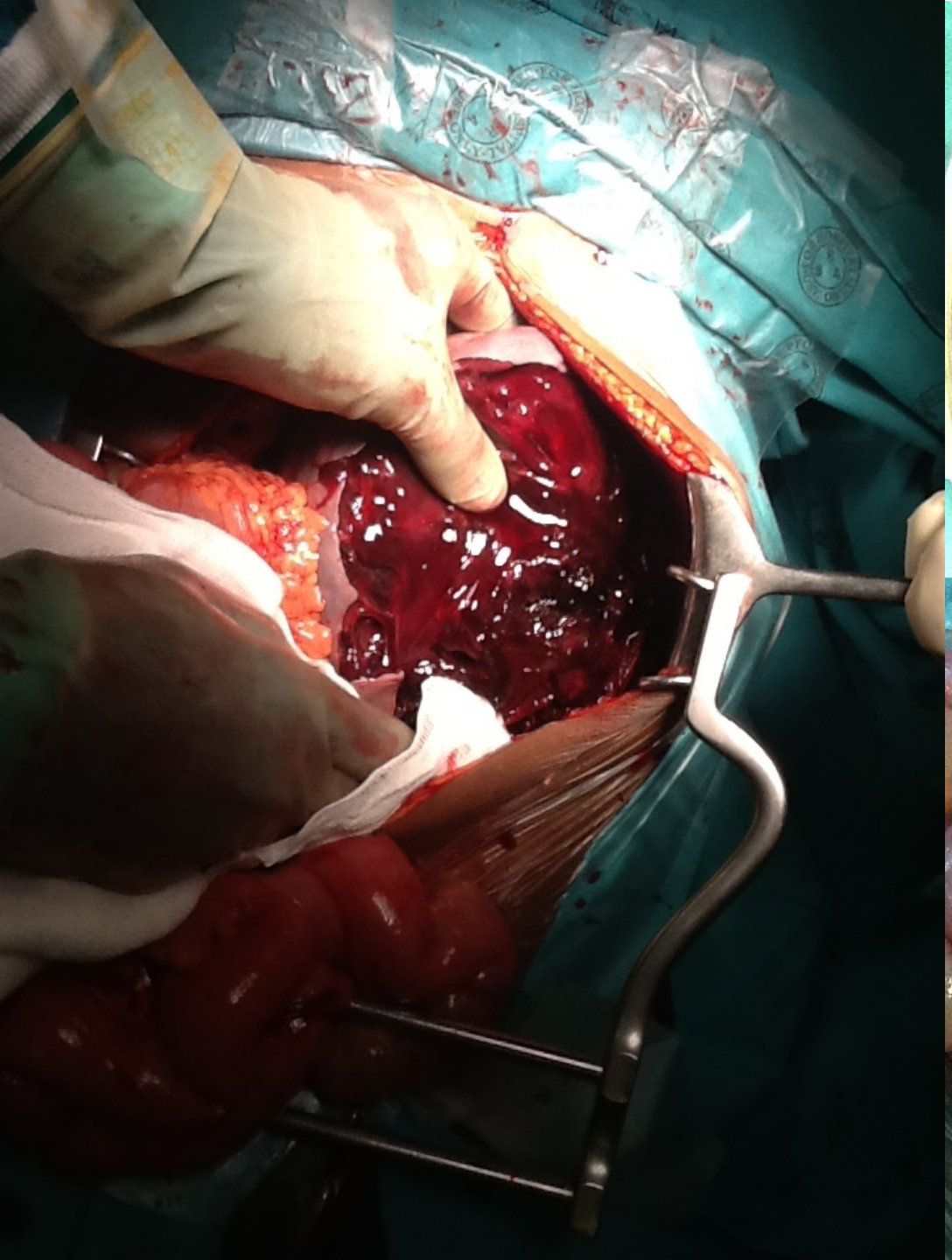
- Clinical case
- Remind re the basics
- Surgical options
- NOM
- Angioembolization
- Follow up
- Practical approach summary



Case Report

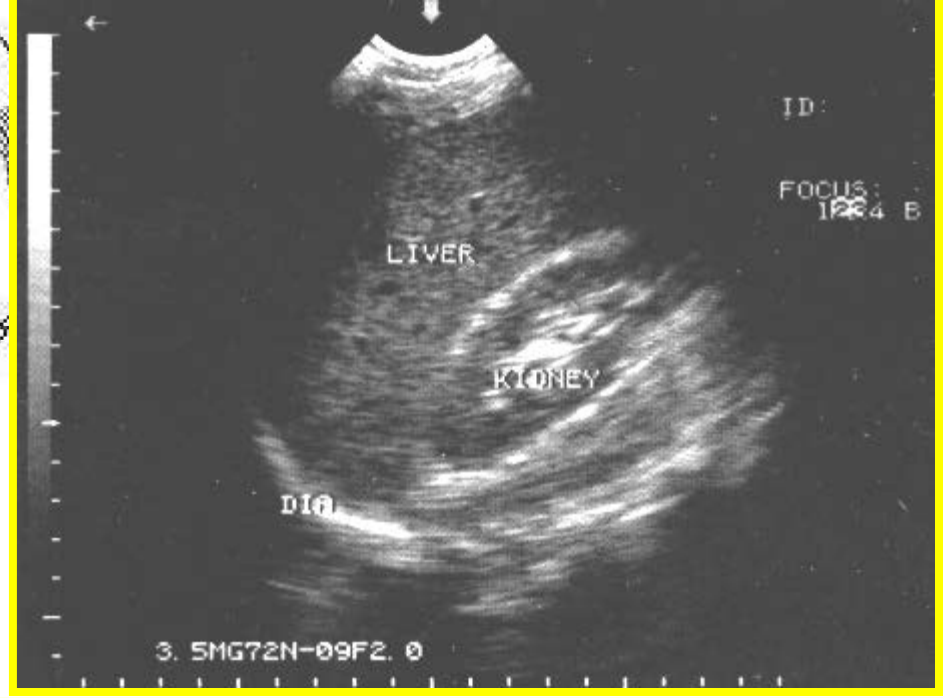
- 47 Year old female
- Treated with NOM in Private
- Complains of LUQ pain since injury that is not settling

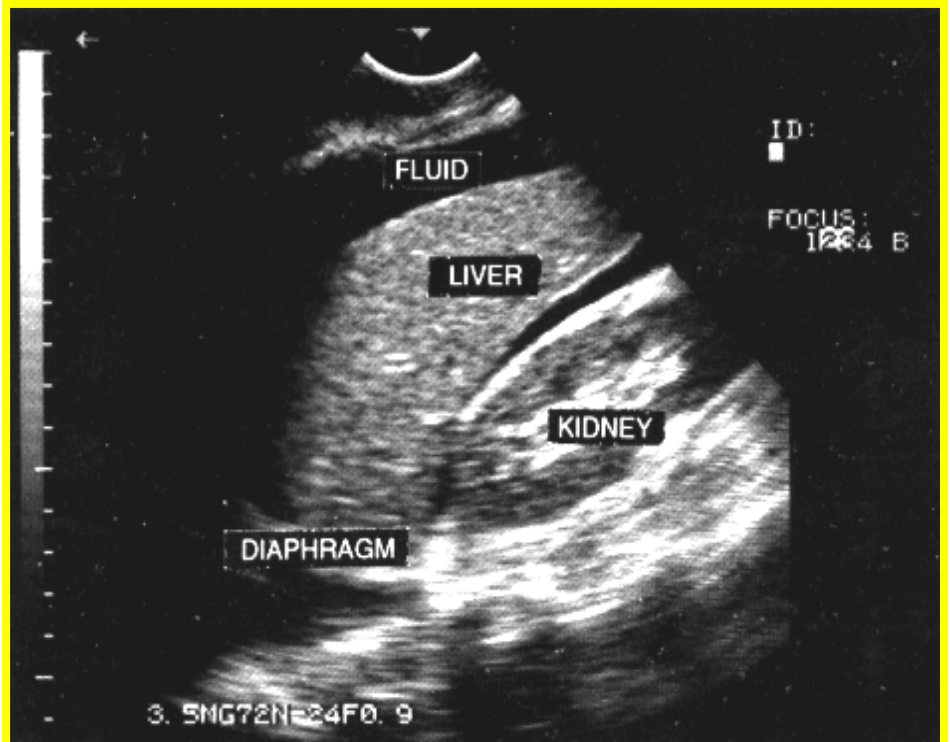




Good outcome

FAST





FAST IN ED to Augment clinical evaluation

Surgical Principles

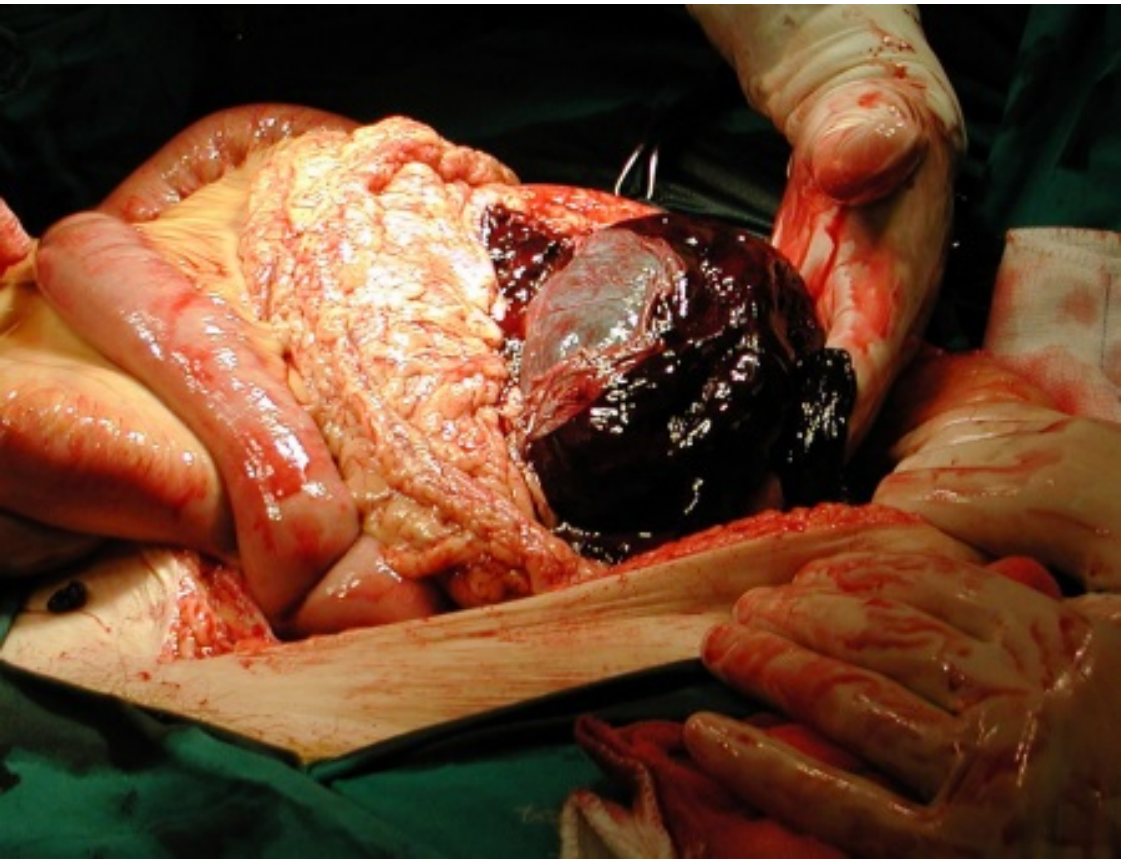
UNSTABLE or STABLE?

??Transient Responders

URGENT SURGERY

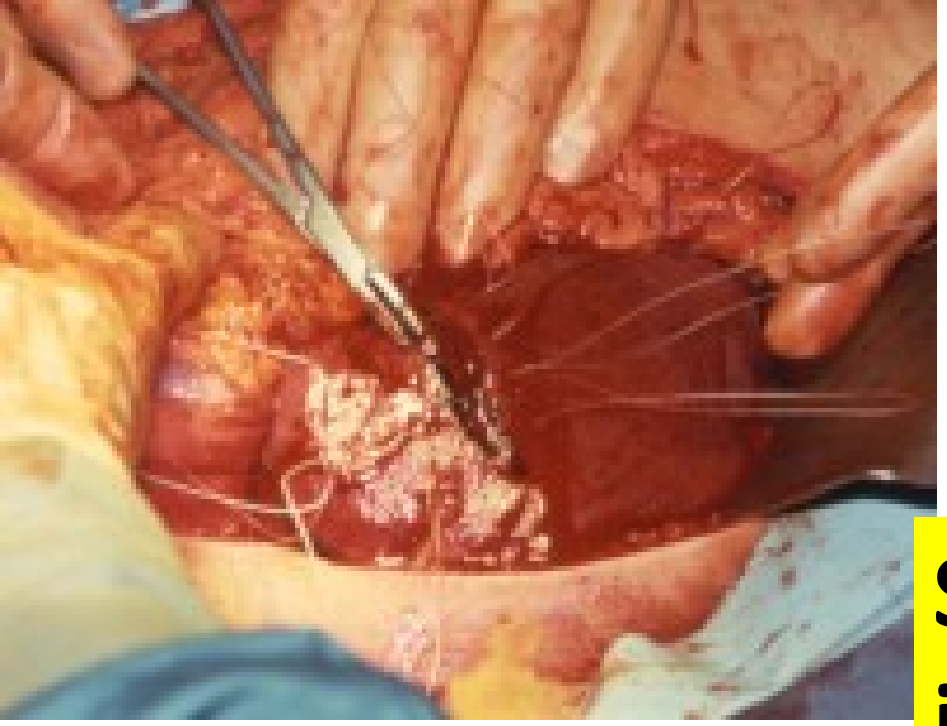
INVESTIGATE FURTHER
Theatre if hollow viscus injury

MAJOR DECISION

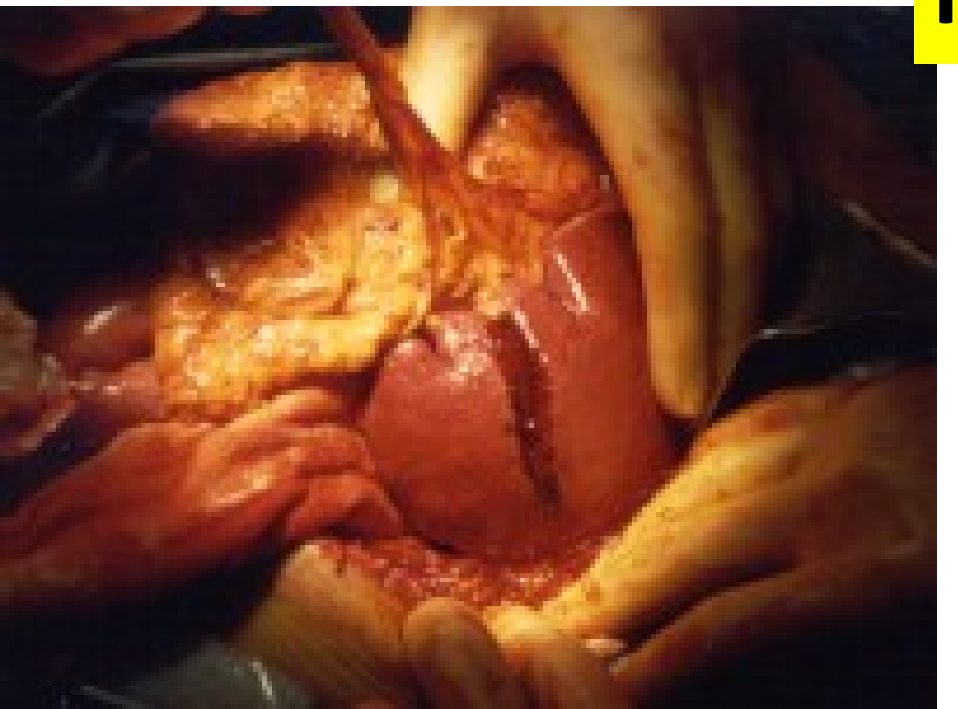


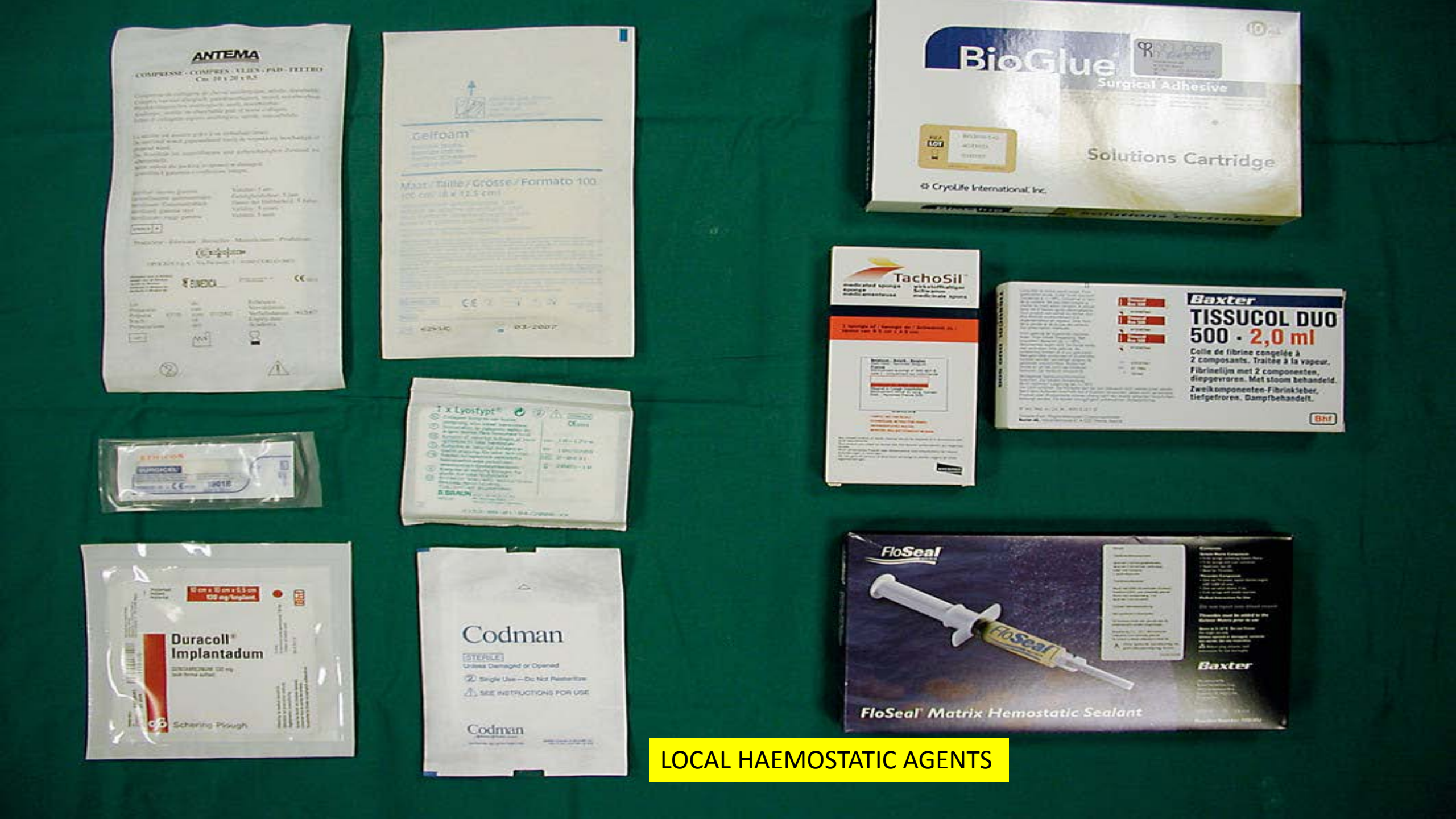
Splenectomy if

- major vascular injury
- or shattered spleen
- or HD instability



Splenic salvage
is it possible?





LOCAL HAEMOSTATIC AGENTS

Complication Rates after Splenectomy

	Fry 1980	Wiseman 2006	Demetriades 2012	U of L 09-10	U of L Isolated Spleen
Abd Abcess	11%	9%	6.2%	5%	0%
Wound Infection	16%	4%	8.2%	1.0%	0%
Pancreatitis Panc Fistula	17%	-----	-----	1.0%	0%
Wound Dehis	5%	-----	-----	0%	0%
Hemorrhage	-----	-----	-----	1.0%	0%
Pneumonia	33%	30%	14.4%	23%	6%
Sepsis/Bacteremia	8%	19%	12.4%	3.0%	0%
UTI	-----	12%	2.1%	6.0%	6%
DVT/PE	-----	-----	-----	12%	0%

NOM
(Non operative management)

Is the Use of Pan-Computed Tomography for Blunt Trauma Justified? A Prospective Evaluation

Areti Tillou, MD, MSEd, Malkeet Gupta, MD, MS, Larry J. Baraff, MD, David L. Schriger, MD, Jerome R. Hoffman, MD, MPH, FACEP, Jonathan R. Hiatt, MD, and Henry M. Cryer, MD, PhD

Objective: Many trauma centers use the pan-computed tomography (CT) scan (head, neck, chest, and abdomen/pelvis) for the evaluation of blunt trauma. This prospective observational study was undertaken to determine whether a more selective approach could be justified.

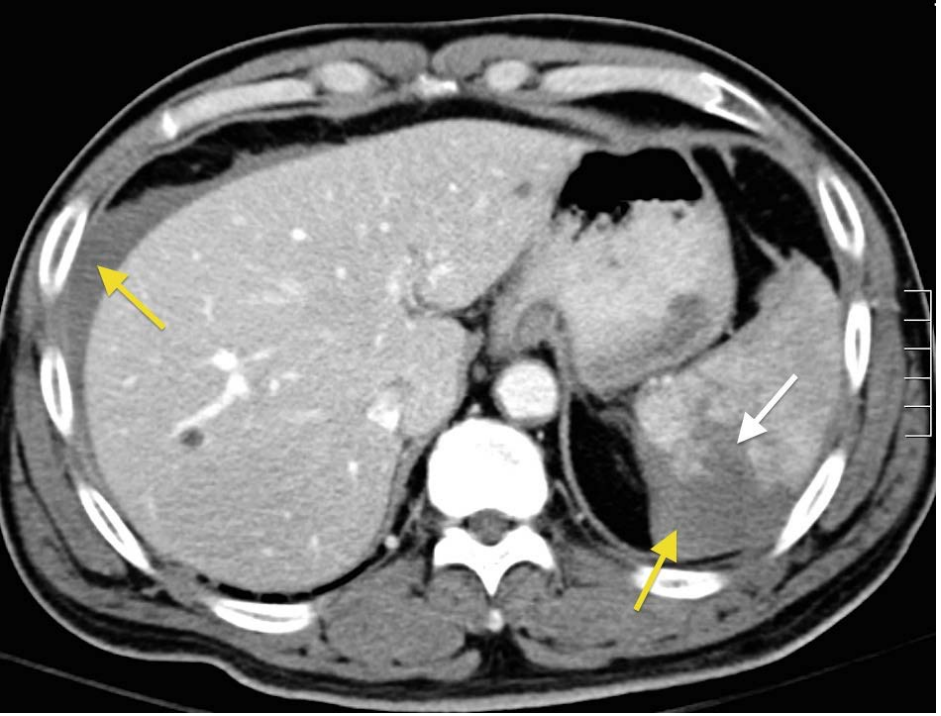
Methods: We evaluated injuries in blunt trauma victims receiving a pan-CT scan at a level I trauma center. The primary outcome was injury needing immediate intervention. Secondary outcome was any injury. The perceived need for each scan was independently recorded by the emergency medicine and trauma surgery service before patients went to CT. A scan was unsupported if at least one of the physicians deemed it unnecessary.

Results: Between July, 1, 2007, and December, 28, 2007, 284 blunt trauma

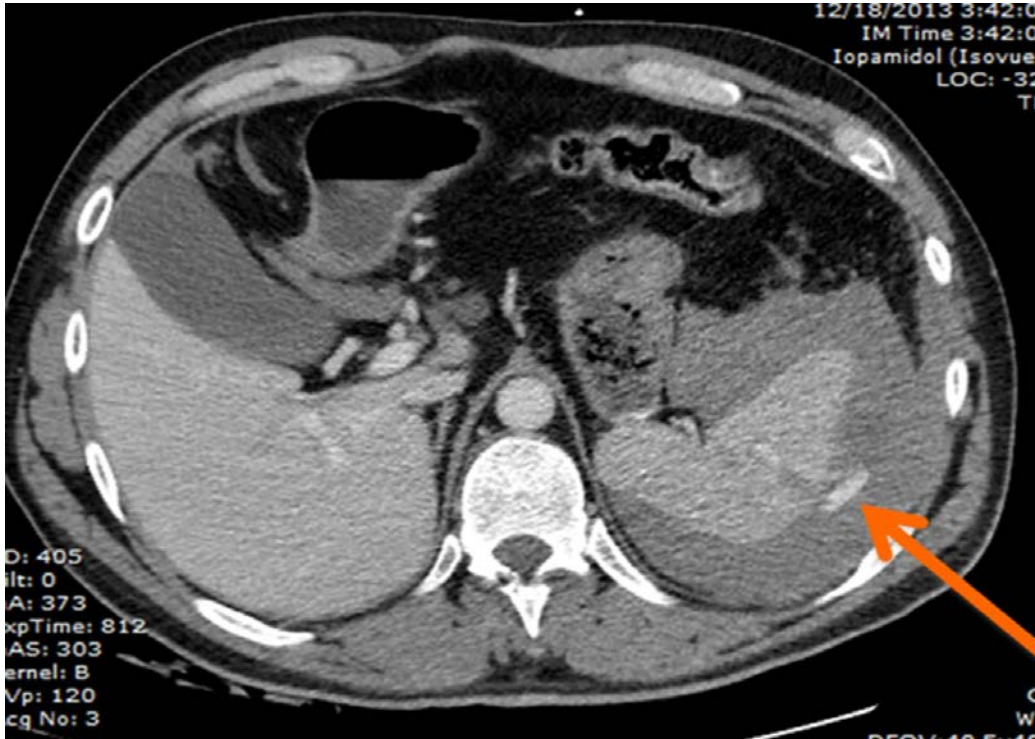
Advances in the technology of computed tomography (CT) have markedly altered the management of blunt trauma. The most dramatic example is the evolution of nonoperative management of solid organ injuries diagnosed by CT.[1–5] CT angiography (CTA) has supplanted invasive diagnostic angiography, allowing rapid diagnosis of injuries, such as pelvic arterial bleeding requiring embolization and aortic transection requiring operative or stent repair. In addition, CT has improved the care of patients by rapidly characterizing multiple injuries so that priorities of management and timing of operations can be established with more precise information. Finally,

Non-operative management :RULES

- Only if haemodynamically stable
- NO hollow viscus injury
- CT scan available to grade the solid organ injury
- ICU or High dependency bed available for monitoring
- Not more than 2-3units for transfusion in 24hrs

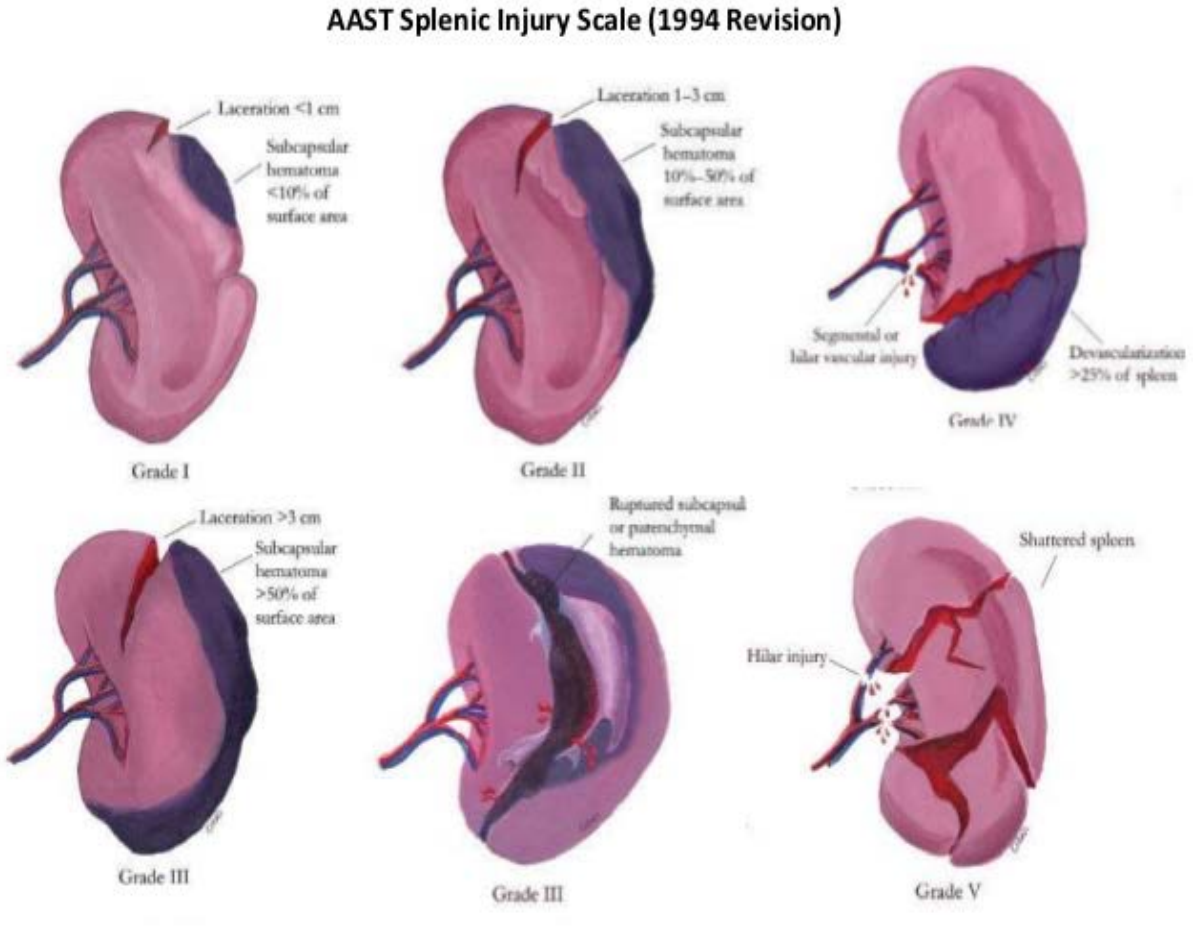


Contrast CT SCAN

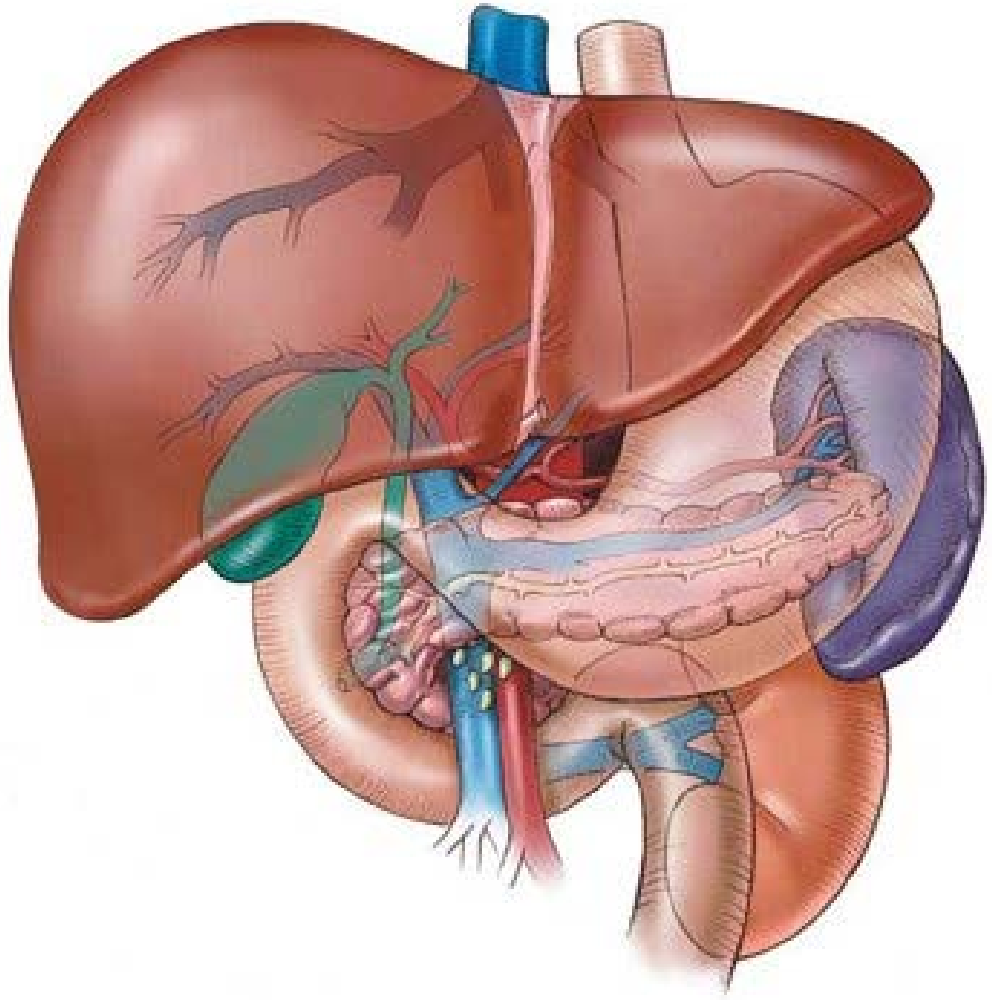


OIS Grading System

Grade*	Injury Description
I	Hematoma subcapsular, <10% surface area Laceration capsular, <1 cm parenchymal depth
II	Hematoma subcapsular, 10–50% surface area, <5 cm diameter Laceration, 1–3 cm depth which does not involve trabecular vessel
III	Hematoma subcapsular, >50% surface area or expanding Ruptured subcapsular or parenchymal hematoma Intrapaenchymal hematoma >5 cm or expanding Laceration >3 cm depth or involving trabecular vessel
IV	Laceration involving segmental or hilar vessels producing major Devascularization (>25% of spleen)
V	Laceration, completely shattered spleen Vascular, hilar vascular injury which devascularizes spleen



Beware of **penetrating** splenic injury!
Associated injuries!

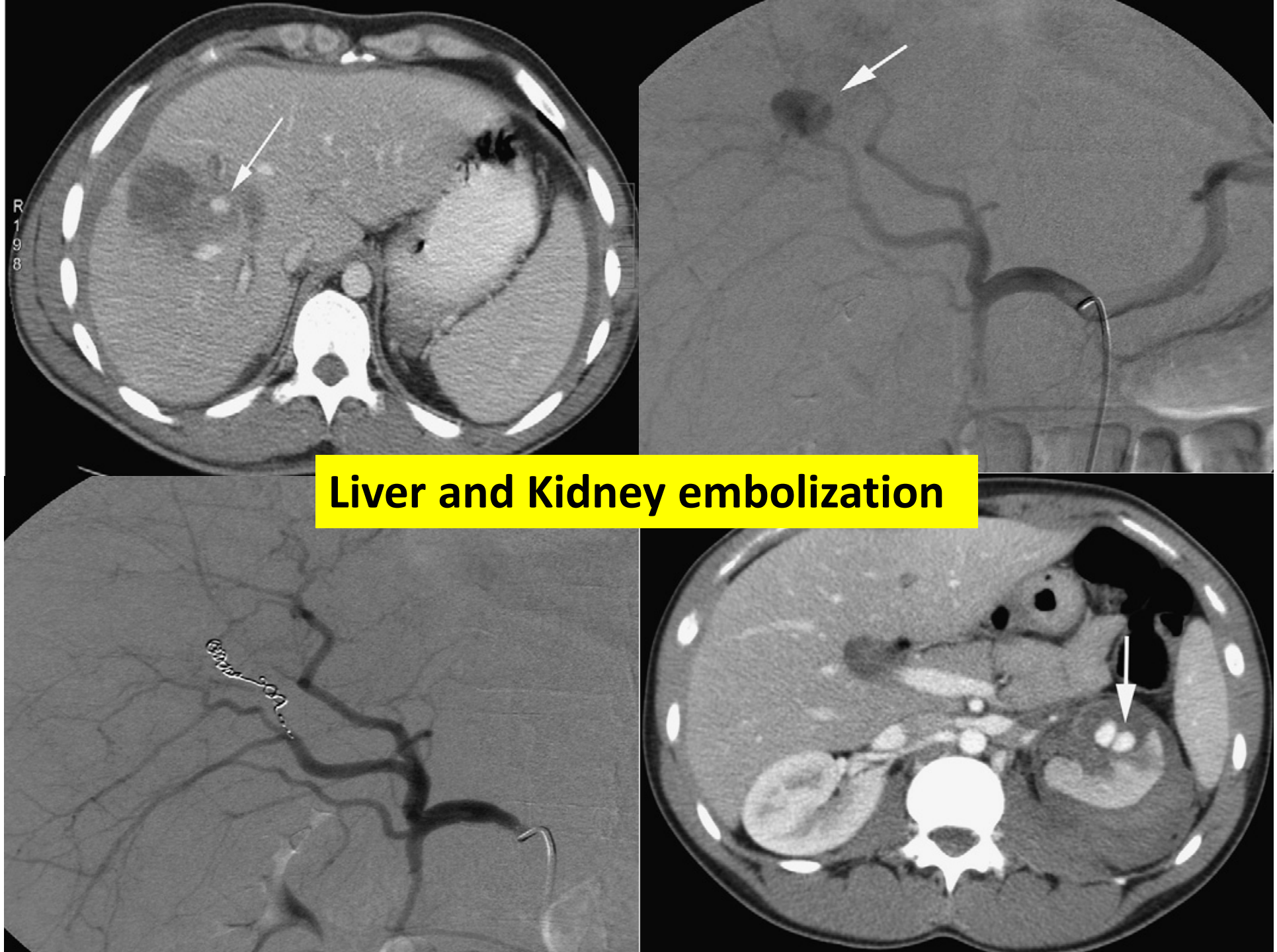


Beware

- Fluid in abdomen not explained by solid organ injury
- Keep the trajectory in mind
- Retroperitoneal stabs may give false positive results

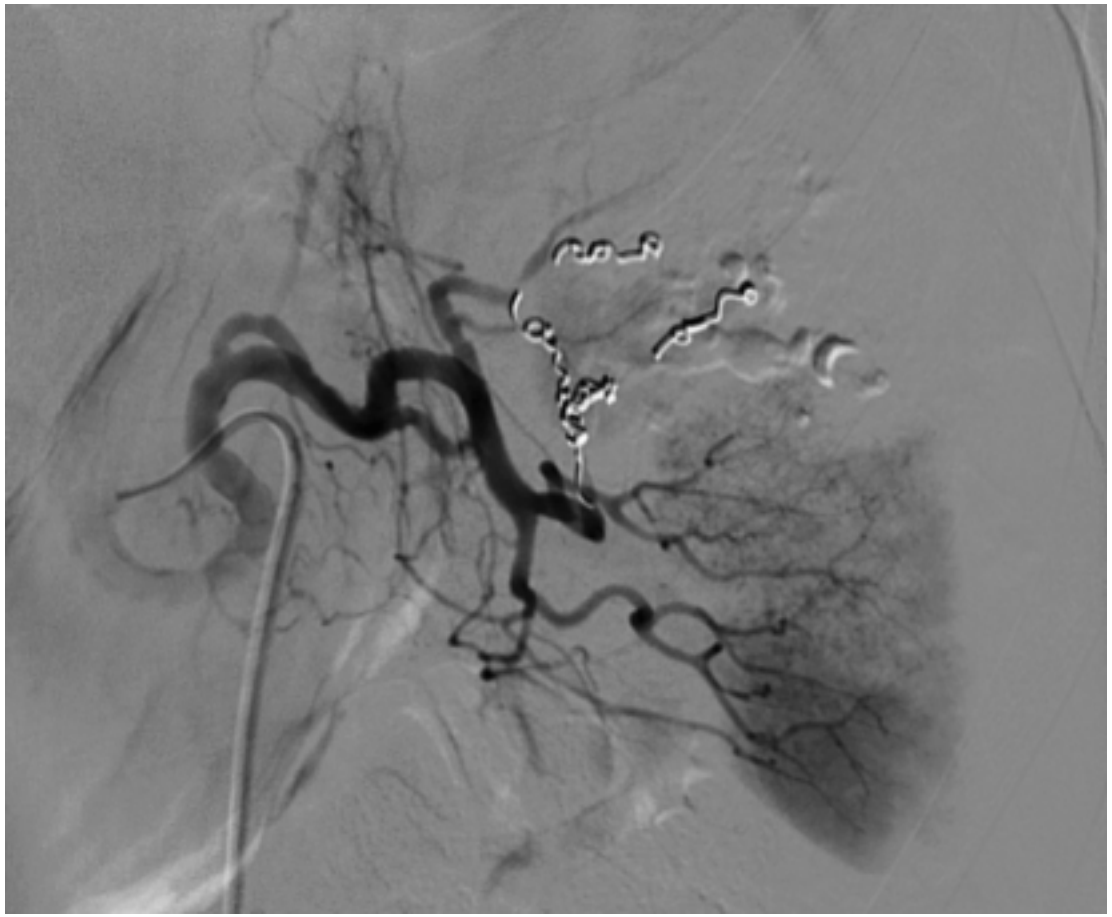
"Never Be Wrong": The Morbidity of Negative and Delayed Laparotomies After Blunt Trauma

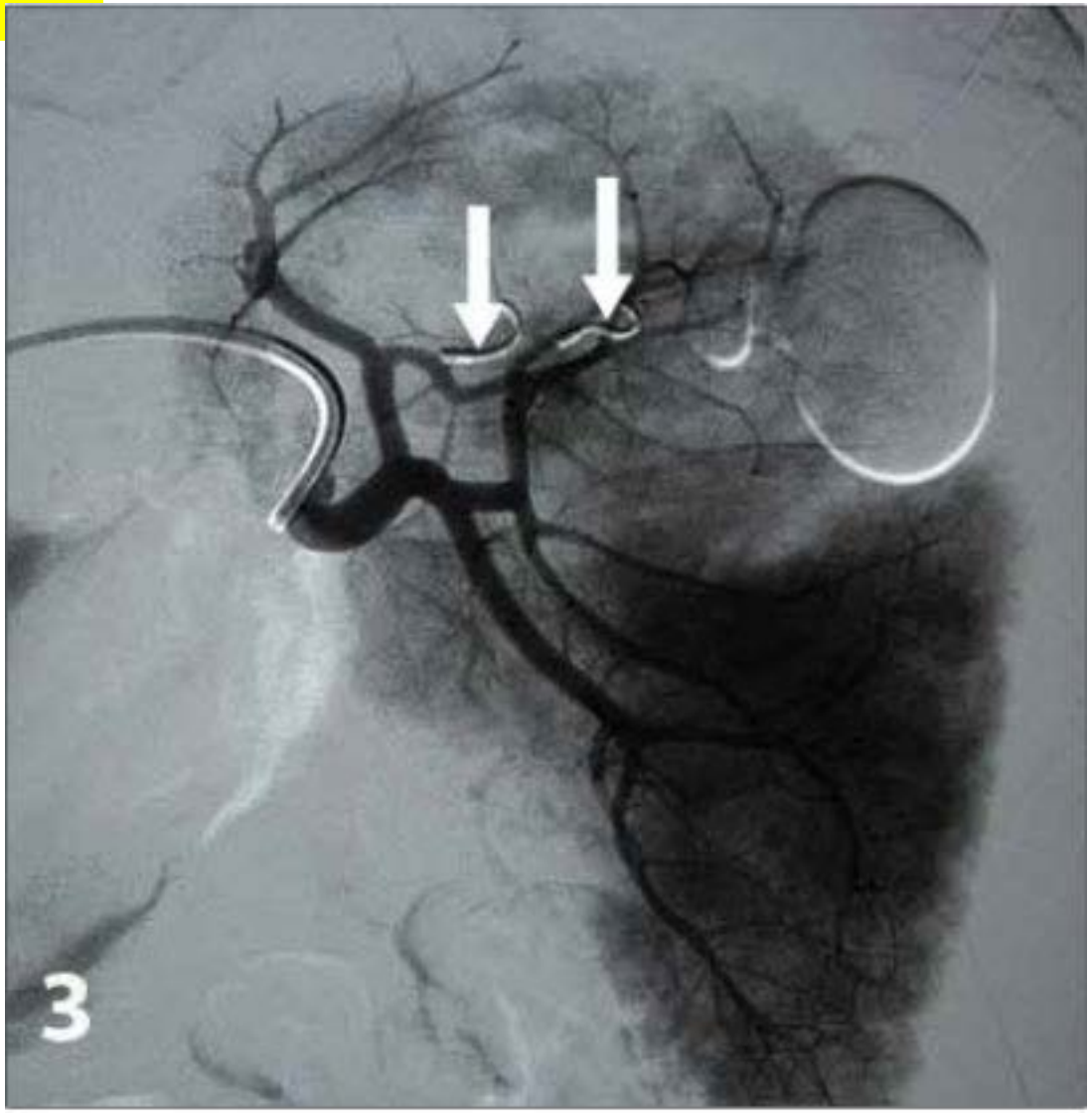
Bruce Alan Crookes, MD, FACS, Steven R. Shackford, MD, FACS, Jennifer Gratton, RN, Maseeha Khaleel, MD, John Ratliff, JD, and Turner Osler, MD, FACS



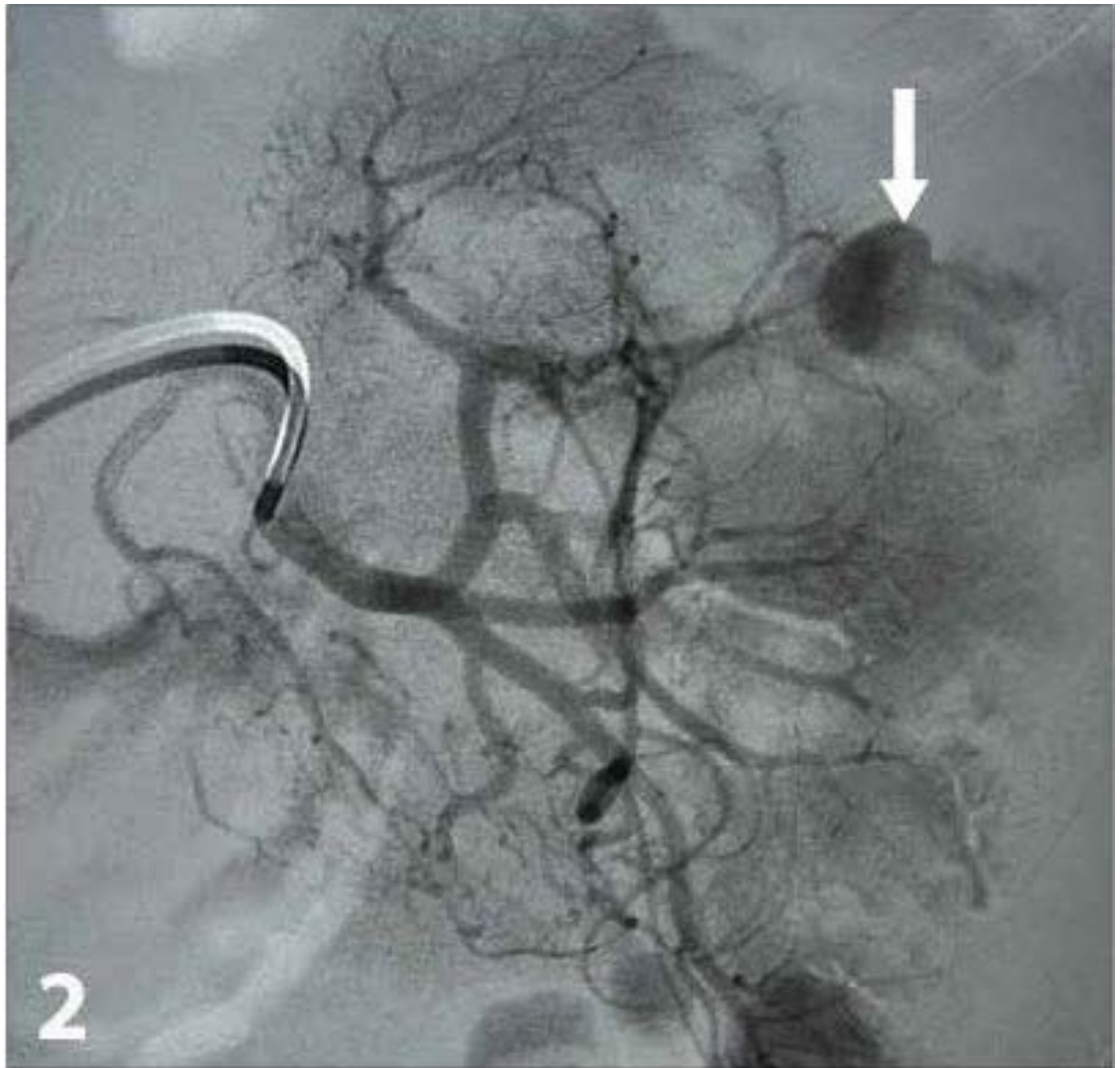
Liver and Kidney embolization

Distal Embolization: coils





Recognizing the Blush on CT scan



Splenic artery embolization with coils

FIGURE 3: Fluoroscopic images demonstrating: (a) angiography of the main splenic artery showing pseudoaneurysm and arteriovenous fistula formation in the lower pole of the spleen and (b) combined distal and proximal coil embolisation.

CT: Splenic injury. Patient was having worsening abdominal pain, tachycardia, decreasing hemoglobin

Proximal Splenic Angiogram – No active extravasat or pseudoaneurysm

Distal Splenic Angiogram – No active extravasation or pseudoaneurysm

Proximal Splenic artery embolization with coils placed distal to Dorsal Pancreatic Artery

General success regarding NOM high grade injuries

RECENT STUDIES	N	OUTCOMES HIGH GRADES
EAST STUDY Group	**1488**	**Splenectomy in 78/99% of Grade 4/5**
Watson et al	**3085**	**Splenectomy 78% of Grade 4/5**
Smith et Al	**23424**	**58% NOM failure in Grade 4/5**

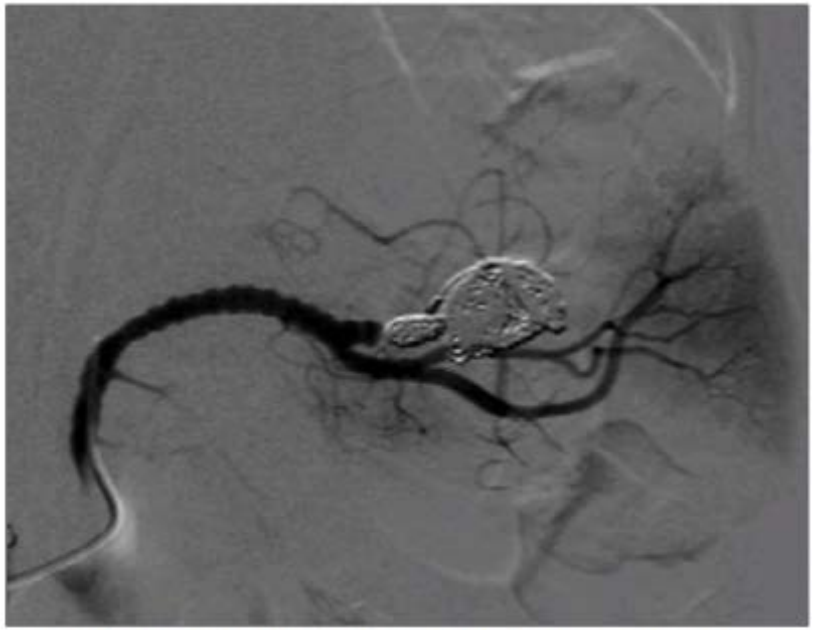
Parameter	Number	Splenic Injury Grade				
		1	2	3	4	5
Splenectomy[a]	62	0	6	10	22	24
Splenorrhaphy[a]	18	4	5	5	3	1
Nonoperative success	322	85	122	69	39	7
Nonoperative failure	22	1	5	6	8	2
Blush	31	2	6	12	10	1

[a] Those having preoperative CT scans.

Table 2. Management according to splenic injury grade

Pre-emptive embolization

- Embolization based on the Higher Grades despite absence of a blush!
- Grade IV and V lesion
- No prospective randomized studies
- Suggest better outcomes with pre-emptive approach
- BUT: 25% of Pseudoaneurysms are in Grade I/II injuries
- Up to 50% Grade I-III



Refining the role of splenic angiographic embolization in high-grade splenic injuries

Jorunn Skattum, MD, Paal Aksel Naess, MD, PhD, Torsten Eken, MD, PhD,
and **Christine Gaarder, MD, PhD,** *Oslo, Norway*

A protocol with mandatory SAE in OIS Grades 4 and 5 injuries resulted in an overall 95% success rate among the 70% eligible for NOM. In OIS Grade 3 splenic injuries, mandatory SAE does not seem justified. (*J Trauma Acute Care Surg.* 2013;74: 100–104. Copyright © 2013 by Lippincott Williams & Wilkins)

Only 296
Increased their success rate on NOM in Grade IV/V to 70%
from previous 90% splenectomy rate
Preemptive embolization contributed to improvement

Complications of Angioembolization

- 20% complication rate
- 11% failure of Angio requiring re angio or splenectomy
- 3%missed injuries
- Even reported vascular injury during the procedure
- Local vascular injuries fewer

Is Splenic immunity preserved?

Does Splenic Preservation Treatment (Embolization, Splenorrhaphy, and Partial Splenectomy) Improve Immunologic Function and Long-Term Prognosis After Splenic Injury?

Haruhiko Nakae, MD, Takeshi Shimazu, MD, PhD, Hiroshi Miyauchi, MD, Junya Morozumi, MD, Shoichi Ohta, MD, PhD, Yoshihiro Yamaguchi, MD, PhD, Masanobu Kishikawa, MD, PhD, Masashi Ueyama, MD, PhD, Mitsuhide Kitano, MD, PhD, Hisashi Ikeuchi, MD, PhD, Tetsuo Yukioka, MD, PhD, and Hisashi Sugimoto, MD, PhD

Background: To assess the immunologic alteration and long-term prognosis after splenic injury from preservation treatment (PT) (embolization, splenorrhaphy, partial splencetomy) and to compare with splenectomy (SN).
Methods: The long-term prognosis of patients with blunt splenic injury treated at seven tertiary emergency centers in Japan was retrospectively studied. Patients were followed up by telephone interview and written questionnaire. Blood samples and abdominal computer tomography scans

Conclusion: PT did not show discernible advantage over SN in immunologic indices including IgM and 14 serotypes of anti-*S. pneumoniae* antibodies, suggesting prophylactic measures and close follow-up are necessary after PT and SN.
Key Words: Spleen, Trauma, IgM, anti-*Streptococcus pneumoniae* IgG antibodies, Howell-Jolly body.

(*J Trauma.* 2009;67: 557–564)

Is Splenic immunity preserved?

Immunologic Function After Splenic Embolization, Is there a Difference?

Gail T. Tominaga, MD, Fred J. Simon, Jr., MD, Imad S. Dandan, MD, Kathryn B. Schaffer, MPH, Jess F. Kraus, PhD, Michael Kan, MD, Stephen R. Carlson, MD, Stephen Moreland, III, MD, Trevor Nelson, MD, Peter Schultz, MSN FNP-BC, and A. Brent Eastman, MD

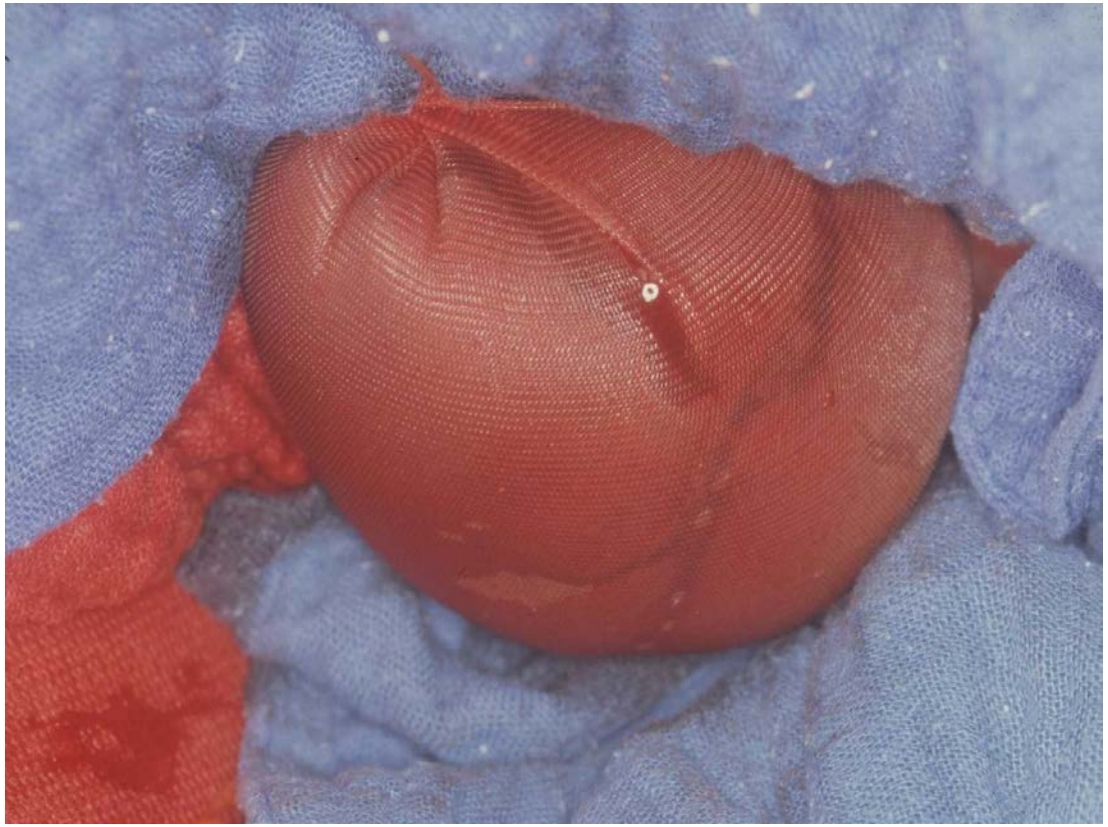
Conclusion: The data suggest that the immunologic profile of embolized patients is similar to controls. This supports the safe use of SE in managing the traumatically injured spleen. Larger studies examining the immune function after SE will be needed to make definitive vaccination recommendations.

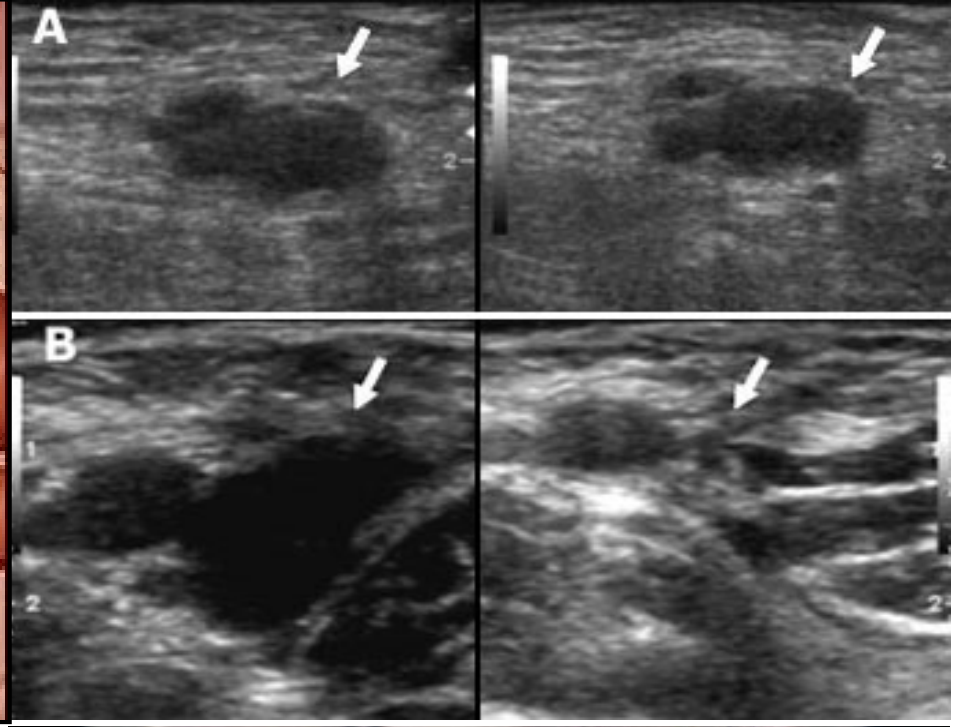
Key Words: splenic embolization, immunologic function, splenic vaccination.

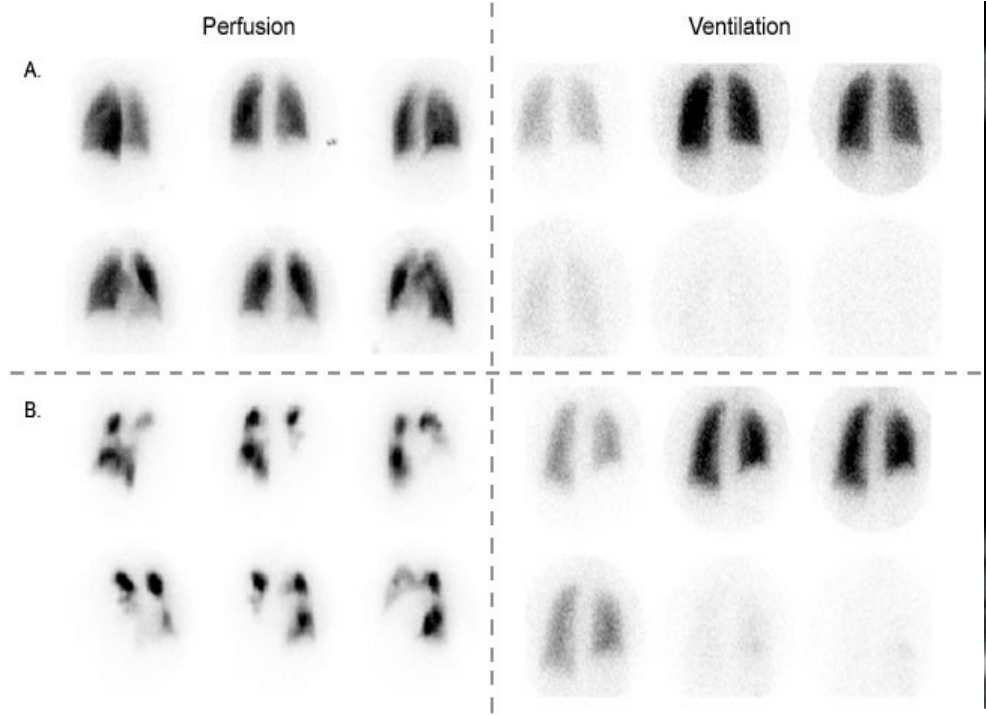
(*J Trauma.* 2009;67: 289–295)

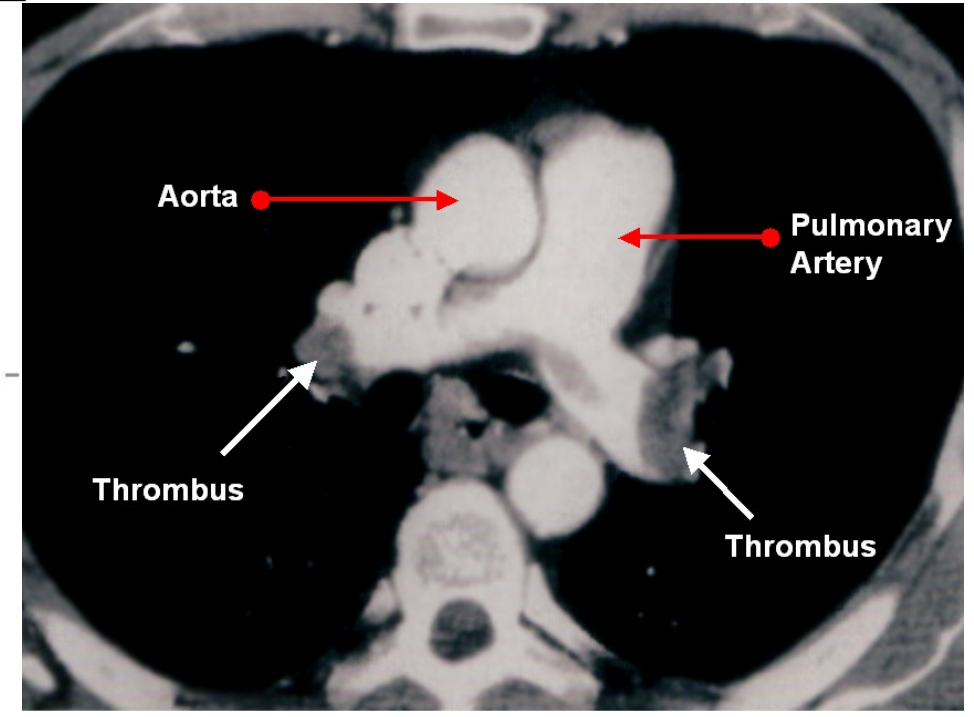
Practical challenges relating to splenic injury

- How long in high-care environment?
- Chemical thrombo-prophylaxis?
- Follow up post-splenectomy?
- How soon should we mobilize?
- What about contact sport?



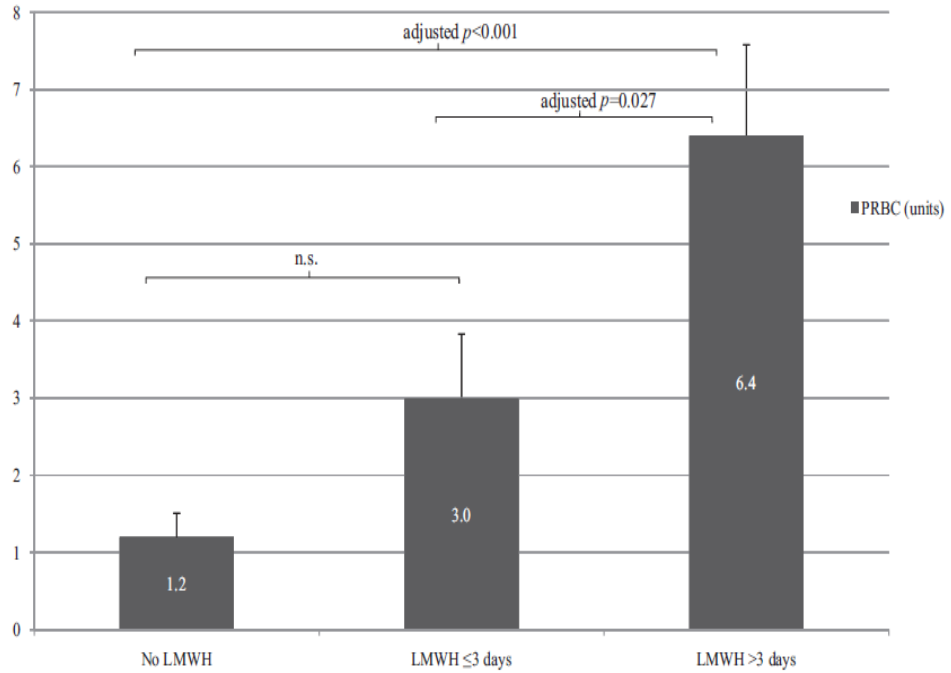

A
B


Perfusion
Ventilation
A.
B.


Aorta
Pulmonary Artery
Thrombus
Thrombus

Pharmacologic Thrombo-prophylaxis

Thromboembolic Prophylaxis With Low-Molecular-Weight Heparin in Patients With Blunt Solid Abdominal Organ Injuries Undergoing Nonoperative Management: Current Practice and Outcomes



- 489 patients
- NOM in 312
- 154 splenic injury
- 144 liver injury
- 65 renal injury

Eberle et al, J Trauma 2011;70:141-147

Thromboembolic Prophylaxis With Low-Molecular-Weight Heparin in Patients With Blunt Solid Abdominal Organ Injuries Undergoing Nonoperative Management: Current Practice and Outcomes

TABLE 2. Failure Rates of NOM Stratified According the Severity of Solid Abdominal Organ Injury and Risk Factors for Failur NOM on Abdominal CT Scan

	Total, % (n)	No LMWH, % (n)	LMWH ≤3 d, % (n)	LMWH >3 d, % (n)	p*	Adjusted p
Failure NOM splenic injuries						
Overall	7.8 (12/154)	7.2 (7/97)	9.1 (2/22)	8.6 (3/35)	0.939	0.579
Low grade (I–II)	1.2 (1/83)	0.0 (0/51)	0.0 (0/11)	4.8 (1/21)	0.224	0.180
High grade (III–V)	15.5 (11/71)	15.2 (7/46)	18.2 (2/11)	14.3 (2/14)	0.961	0.766
Risk factors for failure NOM‡	17.0 (9/53)	16.7 (6/36)	14.3 (1/7)	20.0 (2/10)	0.950	0.865
Failure NOM liver injuries						
Overall	2.1 (3/144)	1.1 (1/90)	5.6 (1/18)	2.8 (1/36)	0.457§	0.255
Low grade (I–II)	1.4 (1/73)	2.0 (1/50)	0.0 (0/8)	0.0 (0/15)	0.792	0.515
High grade (III–V)	2.8 (2/71)	0.0 (0/40)	10.0 (1/10)	4.8 (1/21)	0.189§	0.095
Risk factors for failure NOM‡	4.9 (2/41)	0.0 (0/26)	25.0 (1/4)	9.1 (1/11)	0.073	0.023
Failure NOM kidney injuries						
Overall	3.1 (2/65)	2.4 (1/42)	0.0 (0/6)	5.9 (1/17)	0.702	0.661
Low grade (I–II)	0.0 (0/31)	0.0 (0/18)	0.0 (0/3)	0.0 (0/10)	—	—
High grade (III–V)	5.9 (2/34)	4.2 (1/24)	0.0 (0/3)	14.3 (1/7)	0.547§	0.510
Risk factors for failure NOM‖	16.7 (1/6)	33.3 (1/3)	0.0 (0/1)	0.0 (0/2)	0.549	0.168
Failure NOM in combined solid organ injuries	9.4 (5/53)	10.0 (3/30)	0.0 (0/5)	11.1 (2/18)	0.744	0.848
Overall failure NOM solid organ injuries	5.4 (17/312)	4.5 (9/201)	7.3 (3/41)	7.1 (5/70)	0.596	0.621

Eberle et al, J Trauma 2011;70:141-147

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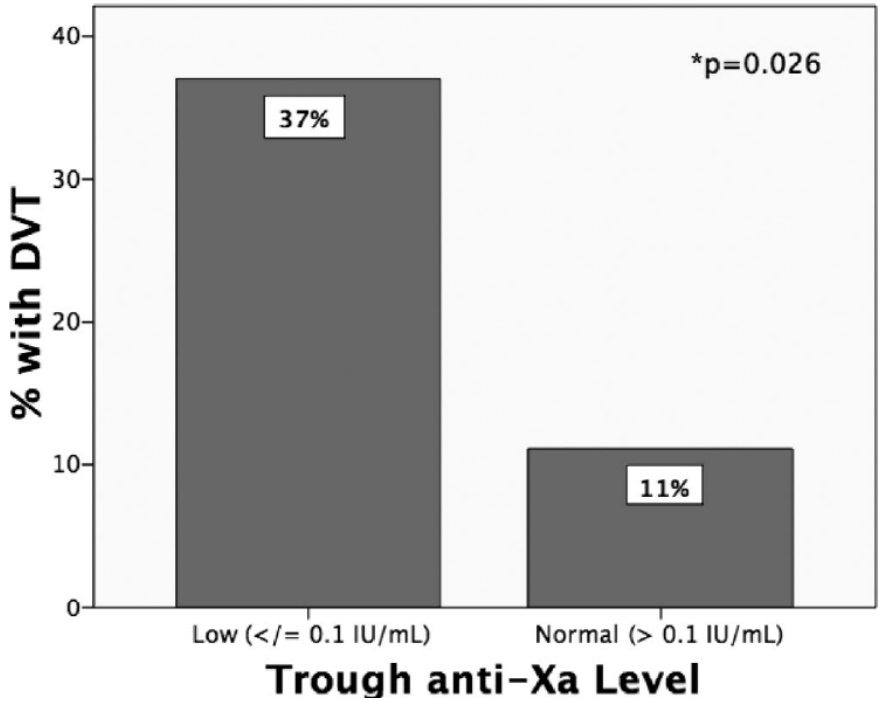
Eberle et al, J Trauma 2011;70:141-147

Standard Prophylactic Enoxaparin Dosing Leads to Inadequate Anti-Xa Levels and Increased Deep Venous Thrombosis Rates in Critically Ill Trauma and Surgical Patients



But
N=54 out of 892

30mg BD dose

NB 12hour anti Xa level

Malinosky et al. J Trauma 2010;68:874-880

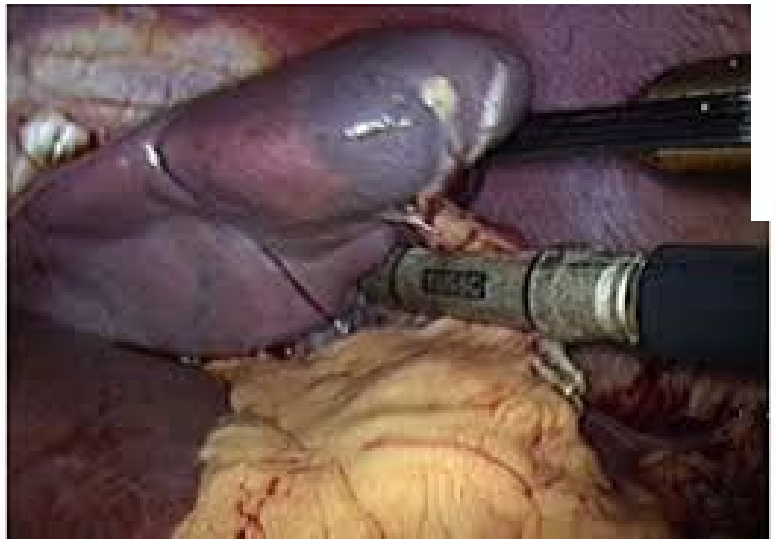
NOM

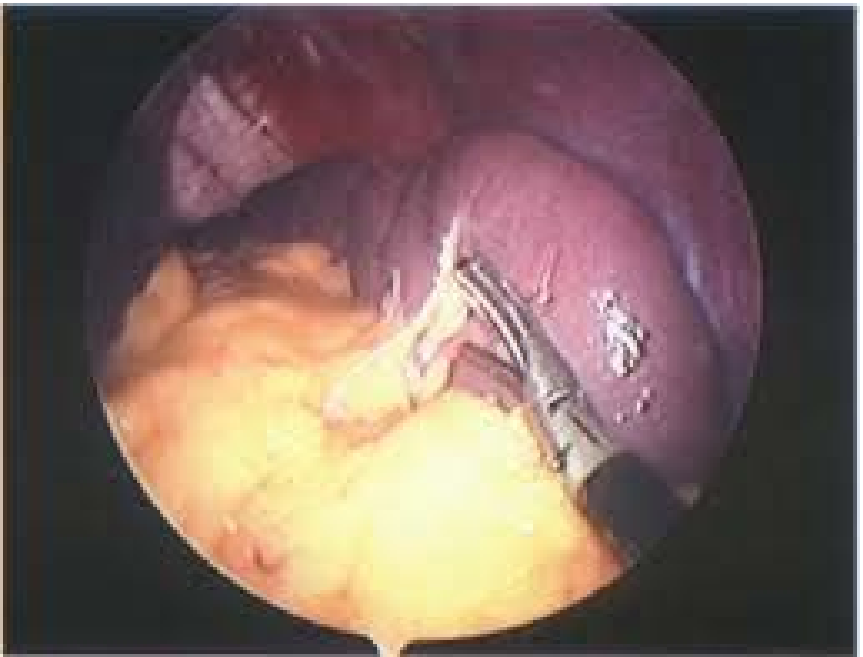
- **Best timing for chemical prophylaxis post NOM**

- Affected by:
  - Severity of injury
  - Evidence of bleeding
  - Availability of angioembolization

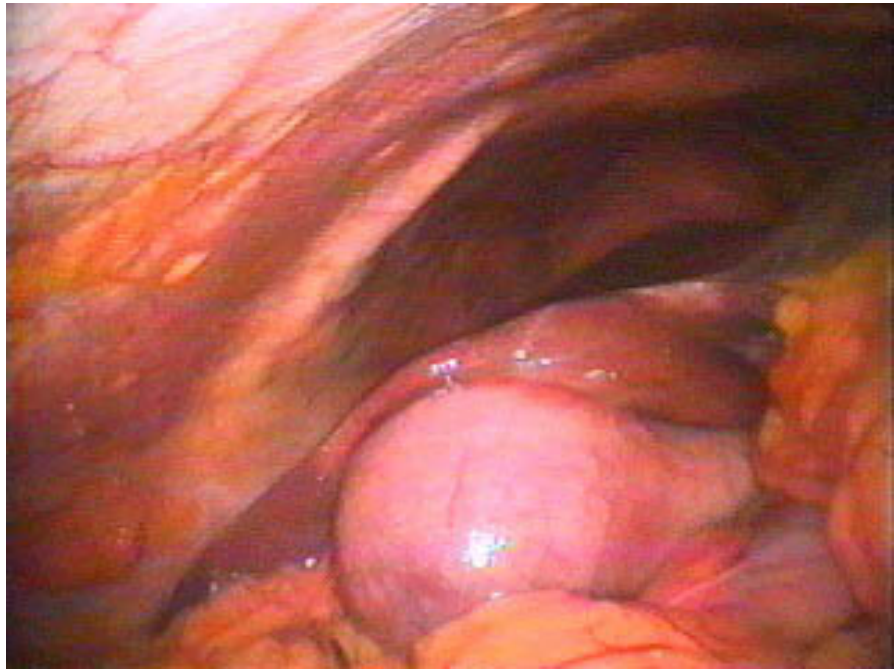
Table 3: POST SPLENECTOMY VACCINATIONS	Dose	Route	Revaccination
Polyvalent pneumococcal	0.5 mL	SC	Every 6 years
Quadra valent meningococcal/diphtheria conjugate (16-55yr old)	0.5 mL	IM upper deltoid	Every 3-5 years
Quadra valent meningococcal polysaccharide (55yr old)	0.5 mL	SC	Every 3-5 years
Haemophilus b conjugate	0.5 mL	IM	None

Mainly in elective cases (??iatrogenic injury)





Limited Role in Trauma splenectomy



What are the trends in Splenic injury management

Table 1 Updated United States Adult Splenic Trauma Case Series Since 2000

	Total	NOM, n (%)	Angio (%)	Failure (%)	Mortality (%)
UT Houston 2000[21]	461	276 (58%)	NR	13%	1%
UT Knoxville 2001[35]	542	407 (75%)	0%	8%	5%
UT San Antonio 2004[29]	168	139 (83%)	10%	2%	NR
University of Michigan 2004[30]	164	131 (80%)	18%	5%	NR
University of Maryland 2005[31]	648	368 (57%)	81%	8%	NR
Case Western 2005[32]	403	344 (85%)	25%	2%	1%
UT Memphis 2007 [33]	426	341 (80%)	12%	4%	4%*
University of Pittsburgh 2007[34]	570	349 (61%)	13%	9%	4%

Table 2 Hemodynamic Instability Score[38]

Grade 0: No significant hypotension (systolic blood pressure [SBP] <90 mm Hg) or serious tachycardia (heart rate [HR] >130)

Grade 1: Hypotension or tachycardia by report but none recorded in emergency department (ED)

Grade 2: Hypotension or tachycardia responsive to initial volume loading with no ongoing fluid or PRBC requirement

Grade 3: Hypotension or tachycardia responsive to initial volume loading with modest ongoing fluid (<250 mL/h) or PRBC requirement

Grade 4: Hypotension or tachycardia only responsive to >2 L of volume loading and the need for vigorous ongoing fluid infusion (>250 mL/h) and PRBC transfusion

Grade 5: Hypotension unresponsive to fluid and PRBC transfusion

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SELECT PATIENTS CAREFULLY
AVAILABILITY OF RESOURCES
MAINTAIN PRICIPLES OF SURGERY