Making Sense of Non-operative management for Solid Organ Injury

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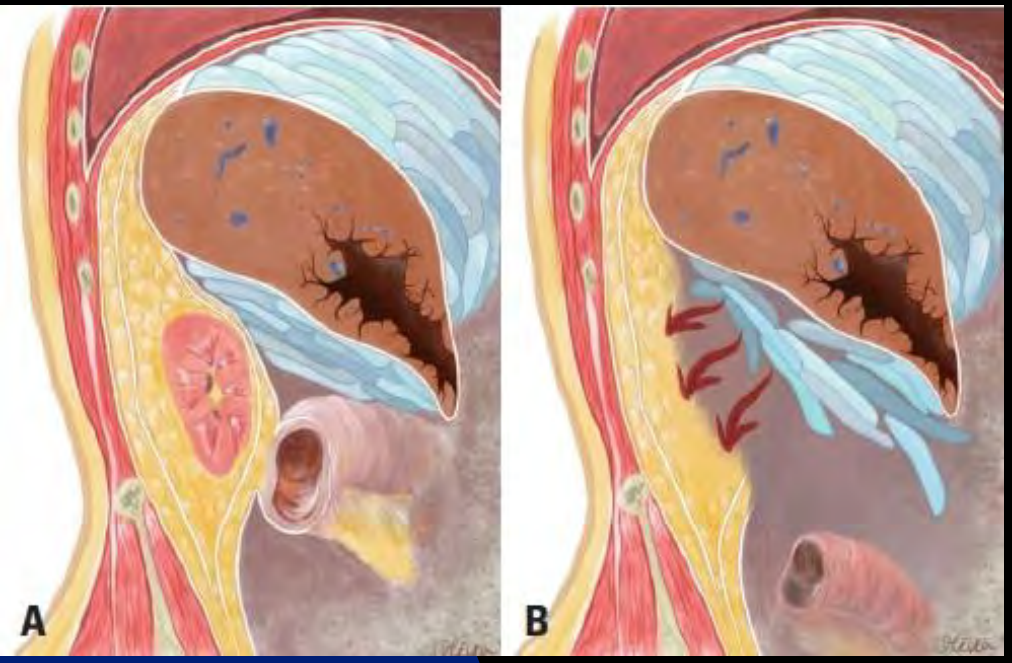
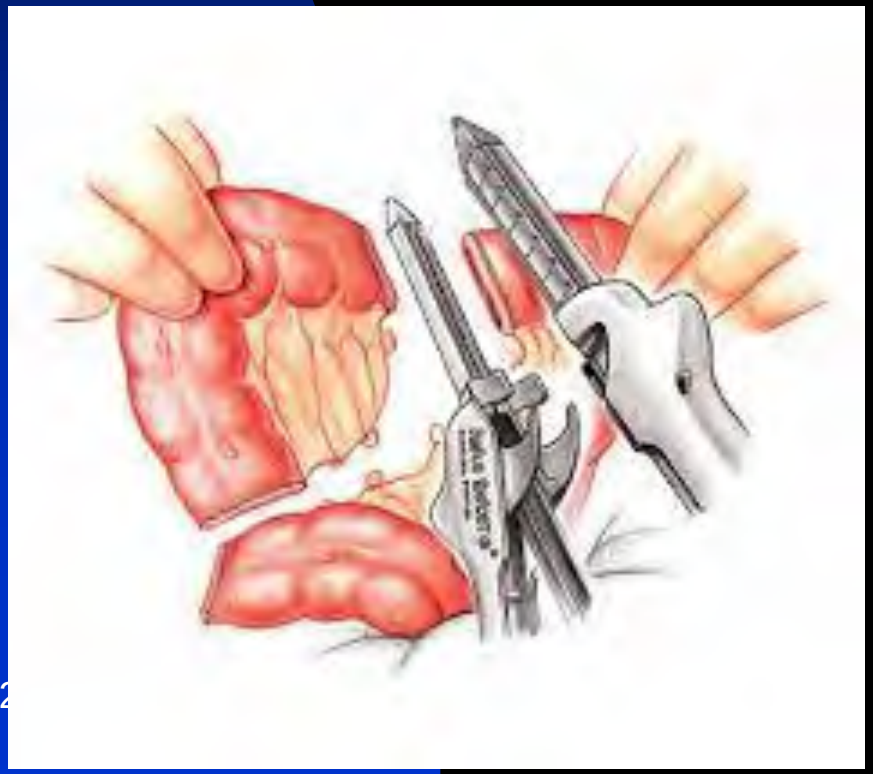
Lap belt injury

Priorities of management

- Hemodynamic stability
  - Hypotensive resuscitation**
  - Unstable
    - Find the Blood
      - CXR, FAST, Long Bones, Neuro
      - MTP + TXA
      - OR – Angio
  - Stable – work-up

Damage Control Operation





Blunt Abdominal Hematoma

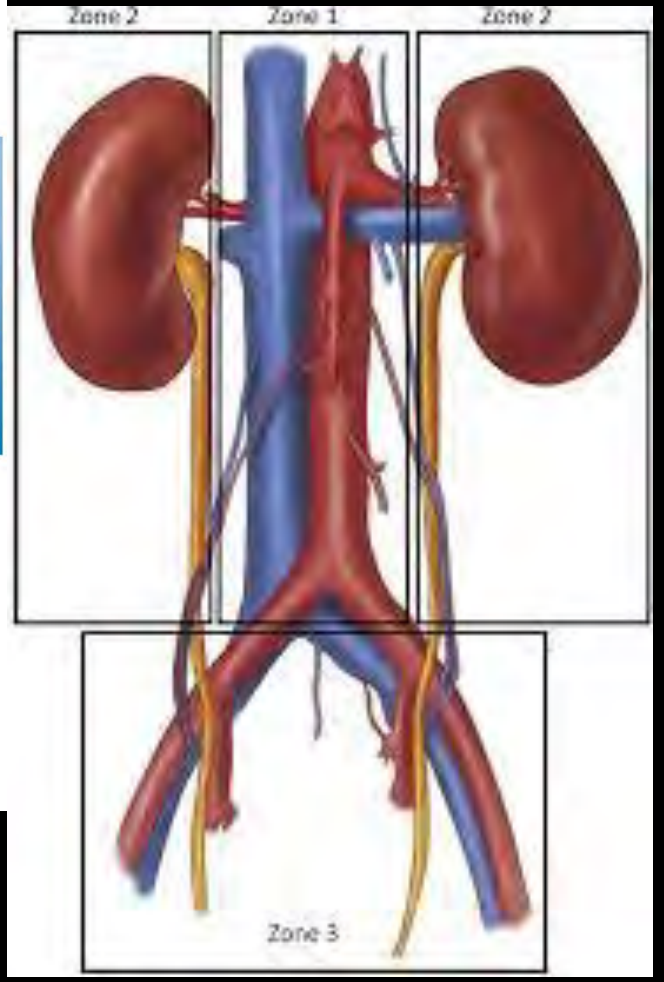
Blunt injury to the abdomen with presence of hypotension, peritonitis, and retroperitoneal hematoma

Zone 1
Explore

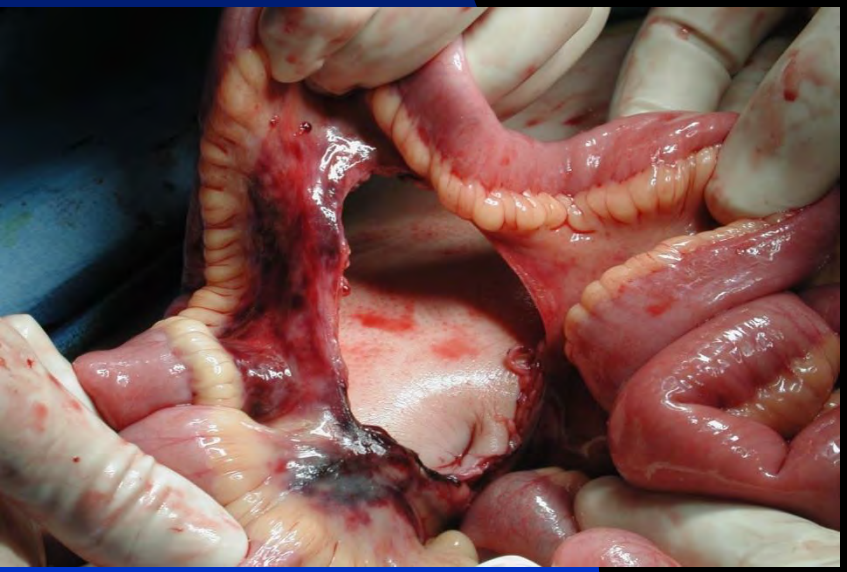
- **Supramesocolic**
  Perform left medial visceral rotation
- **Inframesocolic**
  Obtain exposure at base of transverse mesocolon

Zone 2
Do Not Explore unless expanding, ruptured, or pulsatile hematoma

Zone 3
Do Not Explore unless expanding, ruptured, or pulsatile hematoma, or if ipsilateral femoral pulse absent



Likelihood of injury



- Spleen
- Liver
- Kidney
- Pancreases

- Vascular

Abdominal Compartment Syndrome Treatment

*

Gun shot wound, 7yo

Find the Blood

- MTP. +/- TXA
- CXR
- Undress and examine quickly for holes
- Cefoxitin 100mg/kg. IV

Penetrating Injury

- Initiate Massive Transfusion Protocol
- MORE likely to employee damage control
- Manage the Zones differently
- Prepare for vascular stabilization

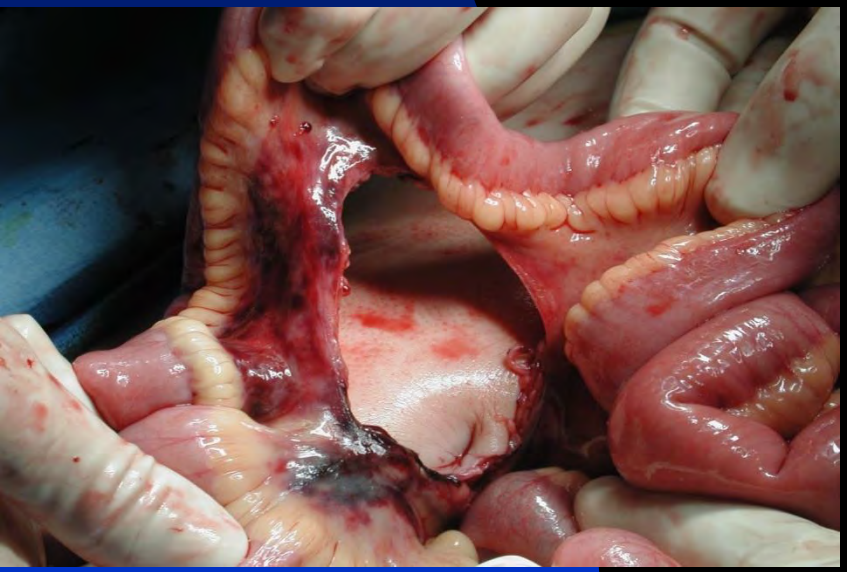
VERY Stable

- Flank, retroperitoneal, two cavities
  - CT with IV contrast
- Appropriate to ”Start” laparoscopically - particularly flank into the chest.

Stable Blunt

- Mechanism of injury
- FAST
- Labs
  - Transaminases
  - UA
  - Lipase, amylase
- Re-examine

Likelihood of injury

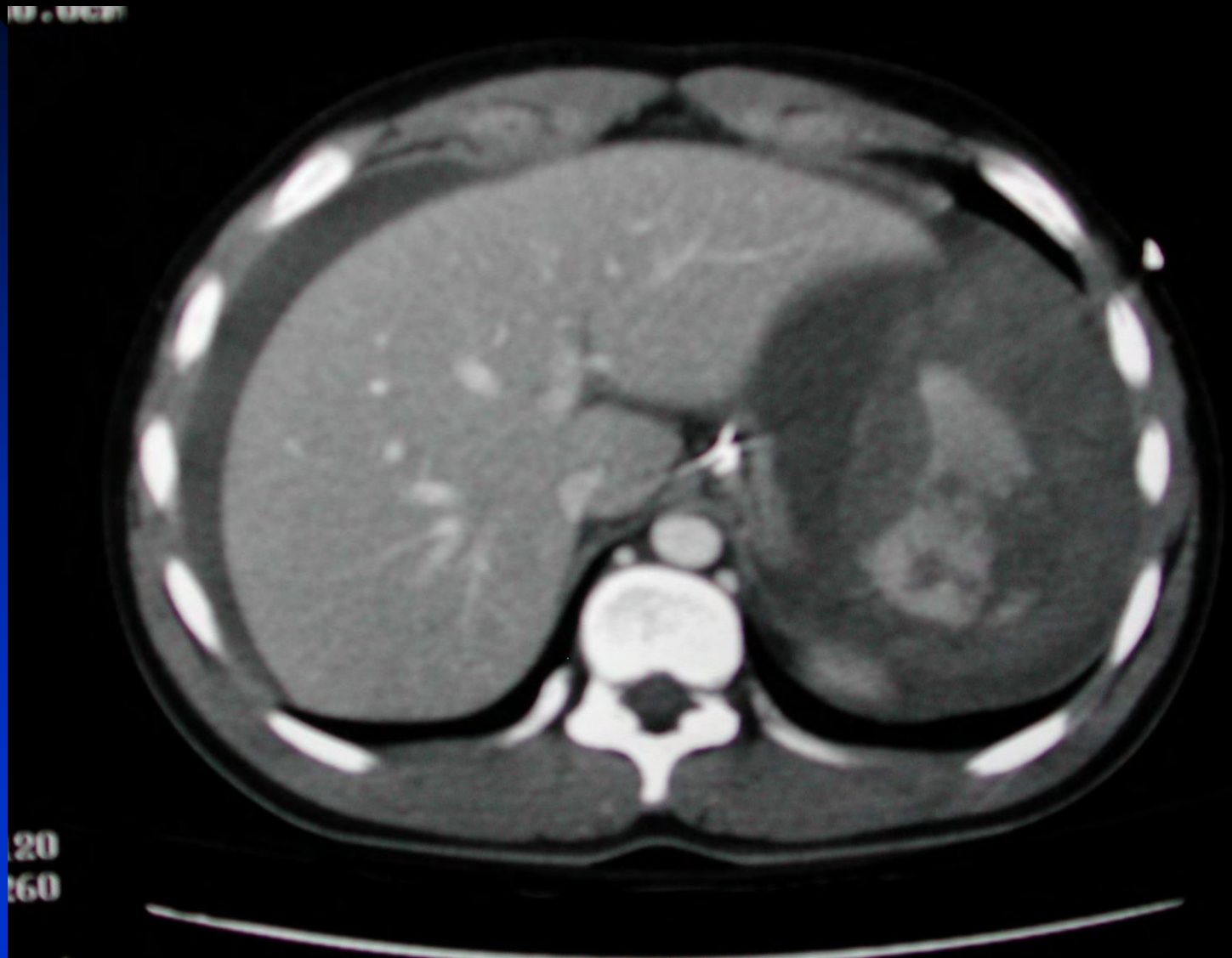


- Spleen
- Liver
- Kidney
- Pancreases

Decision to Scan

- Do I need the information to provide care?
- Can I obtain the information in another way ?
- Can the information be obtained at the lowest possible “cost”

Splenic Injury



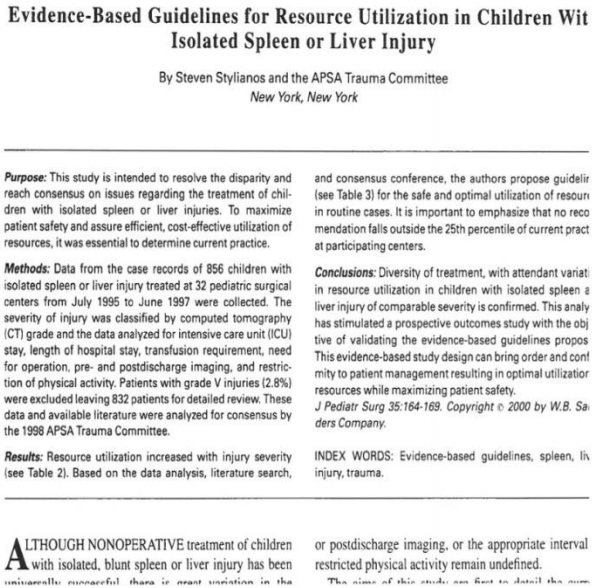
Criteria for Non-operative management

- HEMODYNAMICALLY STABLE
- Below blood threshold
  - (1/2 blood volume)
- No other indication of operation

- *Examinable patient*
- *No significant intracranial injury*

Pathway for non-operative management

J Pediatr Surg. 2000 Feb;35(2):164-7; discussion 167-9



Evidence-Based Guidelines for Resource Utilization in Children Wit Isolated Spleen or Liver Injury

By Steven Stylianos and the APSA Trauma Committee
New York, New York

Purpose: This study is intended to resolve the disparity and reach consensus on issues regarding the treatment of children with isolated spleen or liver injuries. To maximize patient safety and assure efficient, cost-effective utilization of resources, it was essential to determine current practice.

Methods: Data from the case records of 856 children with isolated spleen or liver injury treated at 32 pediatric surgical centers from July 1995 to June 1997 were collected. The severity of injury was classified by computed tomography (CT) grade and the data analyzed for intensive care unit (ICU) stay, length of hospital stay, transfusion requirement, need for operation, pre- and postdischarge imaging, and restriction of physical activity. Patients with grade V injuries (2.8%) were excluded leaving 832 patients for detailed review. These data and available literature were analyzed for consensus by the 1998 APSA Trauma Committee.

Results: Resource utilization increased with injury severity (see Table 2). Based on the data analysis, literature search, and consensus conference, the authors propose guidelir (see Table 3) for the safe and optimal utilization of resour in routine cases. It is important to emphasize that no reco mendation falls outside the 25th percentile of current pract at participating centers.

Conclusions: Diversity of treatment, with attendant variati in resource utilization in children with isolated spleen a liver injury of comparable severity is confirmed. This analy has stimulated a prospective outcomes study with the obj tive of validating the evidence-based guidelines propos This evidence-based study design can bring order and conf mity to patient management resulting in optimal utilizatior resources while maximizing patient safety.

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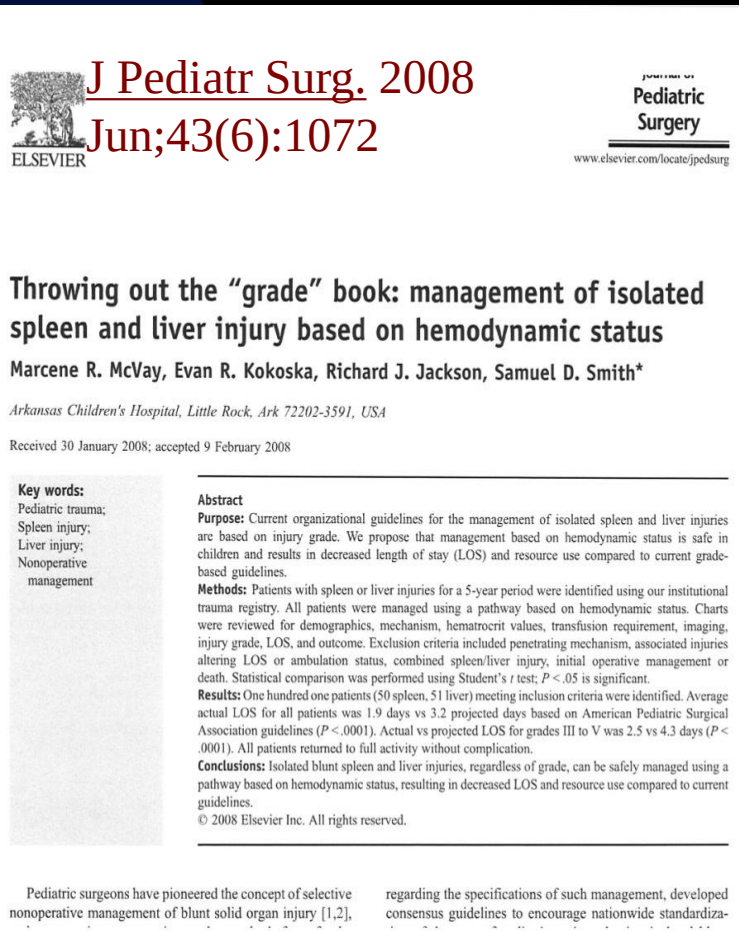
INDEX WORDS: Evidence-based guidelines, spleen, li injury, trauma.

ALTHOUGH NONOPERATIVE treatment of children with isolated, blunt spleen or liver injury has been

or postdischarge imaging, or the appropriate interval restricted physical activity remain undefined.

- Based on grade
- What it did well
  - ICU stay
  - Hospital stay
  - Imaging
  - Activity

Pathway for non-operative management



J Pediatr Surg. 2008 Jun;43(6):1072

Pediatric Surgery

www.elsevier.com/locate/jpedsurg

Throwing out the "grade" book: management of isolated spleen and liver injury based on hemodynamic status

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Key words:
Pediatric trauma;
Spleen injury;
Liver injury;
Nonoperative management

Abstract

Purpose: Current organizational guidelines for the management of isolated spleen and liver injuries are based on injury grade. We propose that management based on hemodynamic status is safe in children and results in decreased length of stay (LOS) and resource use compared to current grade-based guidelines.

Methods: Patients with spleen or liver injuries for a 5-year period were identified using our institutional trauma registry. All patients were managed using a pathway based on hemodynamic status. Charts were reviewed for demographics, mechanism, hematrocrit values, transfusion requirement, imaging, injury grade, LOS, and outcome. Exclusion criteria included penetrating mechanism, associated injuries altering LOS or ambulation status, combined spleen/liver injury, initial operative management or death. Statistical comparison was performed using Student's *t* test; $P < .05$ is significant.

Results: One hundred one patients (50 spleen, 51 liver) meeting inclusion criteria were identified. Average actual LOS for all patients was 1.9 days vs 3.2 projected days based on American Pediatric Surgical Association guidelines ($P < .0001$). Actual vs projected LOS for grades III to V was 2.5 vs 4.3 days ($P < .0001$). All patients returned to full activity without complication.

Conclusions: Isolated blunt spleen and liver injuries, regardless of grade, can be safely managed using a pathway based on hemodynamic status, resulting in decreased LOS and resource use compared to current guidelines.

Pediatric surgeons have pioneered the concept of selective nonoperative management of blunt solid organ injury [1,2], regarding the specifications of such management, developed consensus guidelines to encourage nationwide standardiza-

- Protocol driven
- Changed the game
  - Hemodynamics mattered more
  - ICU utilization was decreased
  - Decreased LOS without complications

AV fistula

The Journal of TRAUMA® Injury, Infection, and Critical Care

Nonoperative Management of Blunt Splenic Injury: A 5-Year Experience

James M. Haan, MD, FACS, Grant V. Bochicchio, MD, MPH, N. Kramer, RN, and Thomas M. Scalea, MD, FACS

Objectives: The purpose of this study was to examine the success rate of nonoperative management of blunt splenic injury in an institution using splenic embolization.

Methods: We conducted a retrospective review of all patients admitted to a Level I trauma center with blunt splenic injury. Data review included patient demographics, computed tomographic (CT) scan results, management technique, and patient outcomes.

Results: A total of 648 patients with blunt splenic injury were admitted, 280 of whom underwent immediate surgical management. Three hundred sixty-eight underwent planned nonoperative management, and 70 patients were treated with observation, serial abdominal examination, and follow-up abdominal CT scanning. All were hemodynamically stable, with a 100% salvage rate. One hundred sixty-six patients had a negative angiogram, with a nonoperative salvage rate of 94%, and 132 patients underwent embolization, with a nonoperative salvage rate of 90%. Overall salvage rates decreased with increasing injury grade; however, over 80% of grade 4 and 5 injuries were successfully managed nonoperatively. The salvage rate was similar for main coil embolization versus selective or combined embolization techniques. Admission abdominal CT scan correlated with splenic salvage rates. Significant hemoperitoneum, extravasation, and pseudoaneurysm had acceptable salvage rates, whereas arteriovenous fistula had a high failure rate, even after embolization.

Conclusion: Splenic embolization is a valuable adjunct to splenic salvage in our experience, allowing for the increased use of nonoperative management and higher salvage rates for American Association for the Surgery of Trauma splenic injury grades when compared with prior studies. Main coil embolization has a similar salvage rate when compared with other angiographic techniques. An arteriovenous fistula as a CT finding was predictive of a 40% nonoperative failure rate.

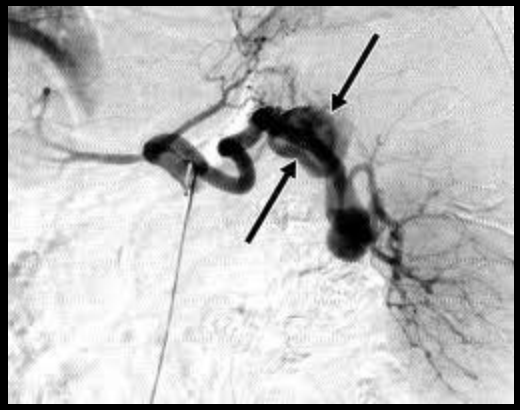
Key Words: Nonoperative management, Blunt, Splenic injury, Embolization, Arteriovenous fistula, Angiography.

J Trauma. 2005;58:492–498.

Nonoperative management in hemodynamically stable patients with blunt splenic injury is the standard of care.[1–26] Several groups, including our own, use splenic angioembolization as a nonoperative adjunct.[1,6–13,15,22,26] The multi-institutional Eastern Association for the Surgery of Trauma (EAST) trial established that pure observational management can be used successfully for patients with blunt splenic injury who are hemodynamically stable.[2] The utility of adding angiography to these purely observational protocols is an area of controversy.

Retrospectively, data on the use of angioembolization and its efficacy in higher grade injuries have been

bleeding on admission computed tomographic (CT) scan.[1] We have shown that equally good salvage rates can be obtained while restricting the use of angiography to those with the greatest level of injury. This is a review of our progression from the use of admission angiography for all patients to a more recent protocol in which a more selective use of admission angiography is used to improve salvage rates.[1,9] We analyzed all patients who underwent operative and nonoperative management at our institution over a 5-year period, reviewing outcomes in an effort to better delineate the role of angiography versus pure observational management.



Things that have fallen OUT as reasons to operate

- High grade
- Brain injury
- Blush on CT
  - Consider angiography

Recommendations for care

- Admission criteria
  - Grade I – III floor – bathroom privileges until hct. is stable X 2
    - Clear liquids and advance
    - Zofran prn
    - Saline lock
    - h/h every 6 hours until stable X 2
  - Grade IV and IV - ICU and bed rest until hct is stable X 2
    - Everything else is the same

Recommendations for care

- Hemoglobin stable (within 0.7mg/dl) X 2 then every 12 hours X 24 hours then daily*** if staying

- Discharge when:
  - Hemoglobin stable X 24 hours
  - Tolerating liquids
  - Able to ambulate with minimal assistance
  - No fever

Recommendations for care

- Follow up 1 week – home
- No imaging for any grade

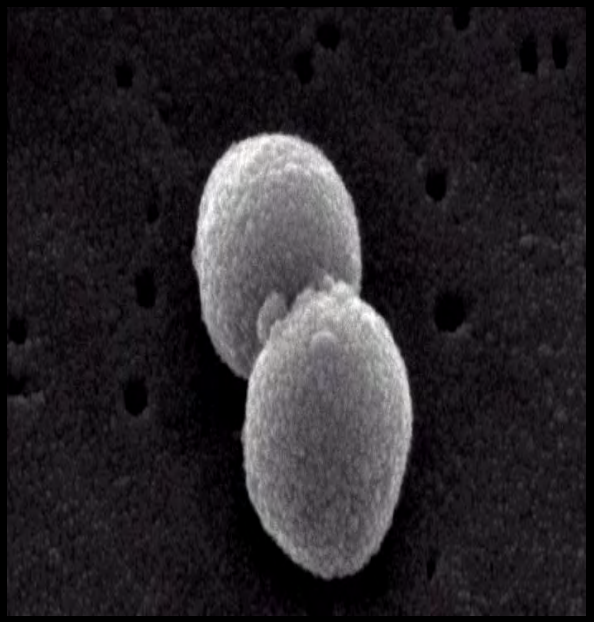
- Limit contact activity
  2 weeks per grade of injury

When to operate

- Unstable
- “relatively unstable” with a significant brain injury
- Require ≥ 40 cc/kg of PRBCs
- “Significant” systemic inflammatory response or concern for bowel injury

Complications

- Overwhelming Post-Splenectomy Sepsis (OPSS):
  - Encapsulated organisms:
    - Pneumococcus
    - Meningococcus
    - H Flu
  - <1% incidence – mortality 50%
  - more important in pediatric age range
  - Immunization timing controversial –Be Consistent !!



Streptococcus pneumoniae

Liver injuries

- No different than adult management
- Same admission and management algorithm as for splenic injuries
- With sustained SIR – consider HIDA, washout , ERCP on or after day # 5 (4%) - WAIT

Mechanism of Injury

Pancreas

Laboratory Evaluation

- Serum Amylase
  - Poor sensitivity and specificity
    - 35% duct injuries with normal amylase
  - Isoenzymes not useful
  - Serial or delayed values?
    - Takishima et al, *Ann Surg*1997 - 100% with pancreatic injury had elevated delayed amylase

Diagnosis of injury

- Initial CT is often mis-leading
- Delay of repeat CT for 12 – 18 hours with newer generation scanners:
  - Allows edges to delineate with interposing fluid
  - Fine cuts specific to the area of injury
  - Higher resolution of scan
  - Orally contrast the c-loop of the duodenum

16 hour delay CT

AAST Grading Scale

Grade[a]		Injury description[b]
I	Haematoma	Minor contusion without ductal injury
	Laceration	Superficial laceration without ductal injury
II	Haematoma	Major contusion without duct injury or tissue loss
	Laceration	Major laceration without duct injury or tissue loss
III	Laceration	Distal transection or parenchymal injury with duct injury
IV	Laceration	Proximal (to right of superior mesenteric vein) transection or parenchymal injury, *not* involving ampulla
V	Laceration	Massive disruption of pancreatic head

[a] Advance one grade for multiple injuries to the same organ.

[b] Based on most accurate assessment at autopsy, laparotomy or radiological study.

Non-operative Management

Houben, C., Ade-Ajayi, N., Patel, S. Kane, P., Karani, J., Devlin, J.,

Traumatic pancreatic duct injury in children: minimally invasive approach to management. *Journal of Pediatric Surgery,* (2007). 42(2), 629-635.

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Keller MS, Stafford PW, Vane DW. Conservative management of pancreatic trauma in children.*J Trauma*.1997Jun;42(6):1097-100

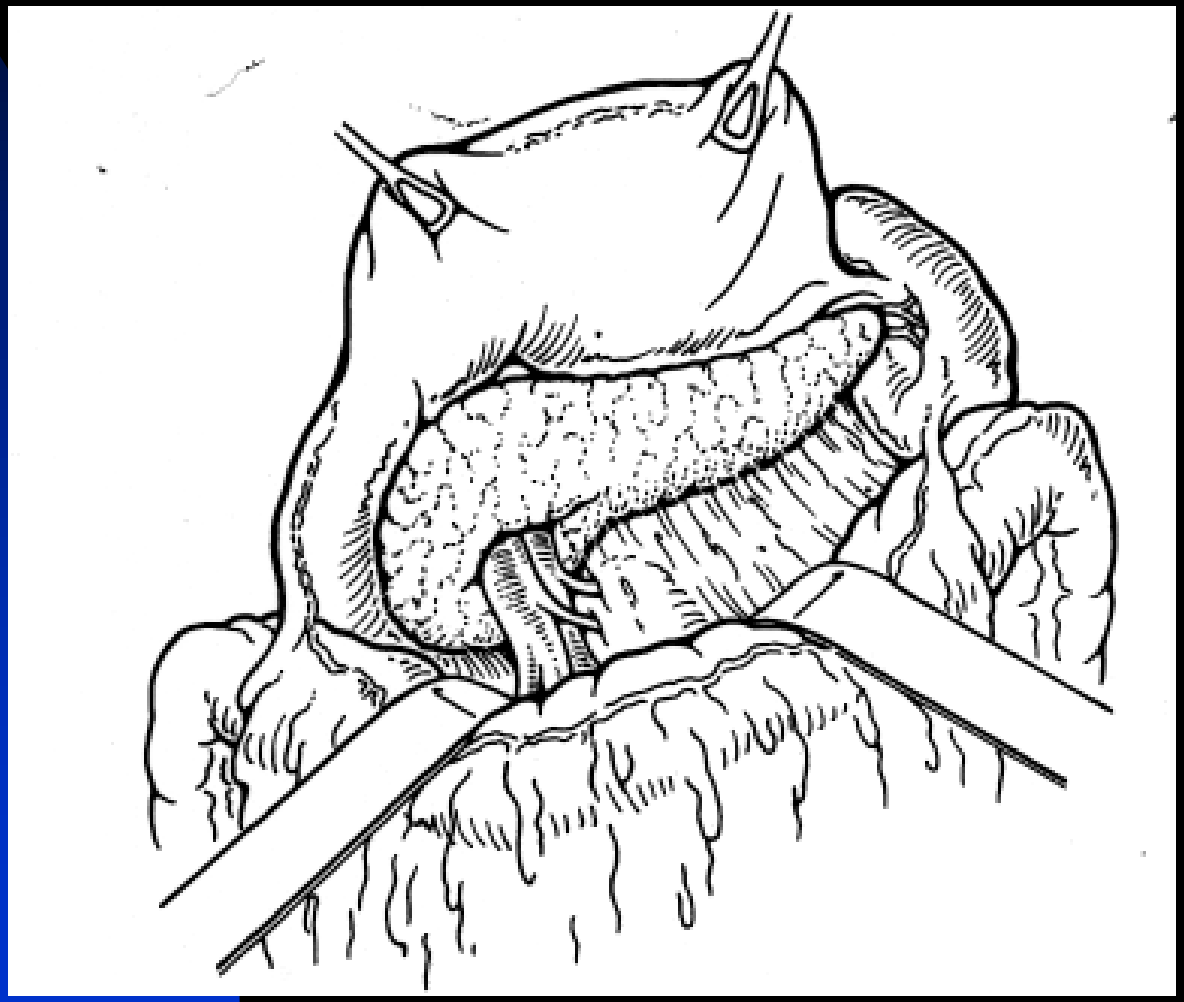
The problem with the data

- Small case series
- Diagnosis made mostly by CT
- Very few ERCP or definitive evaluation of the duct
- Rarely another need for operative intervention
- Almost no AAST grade V
- No RCT

Nonoperative Management

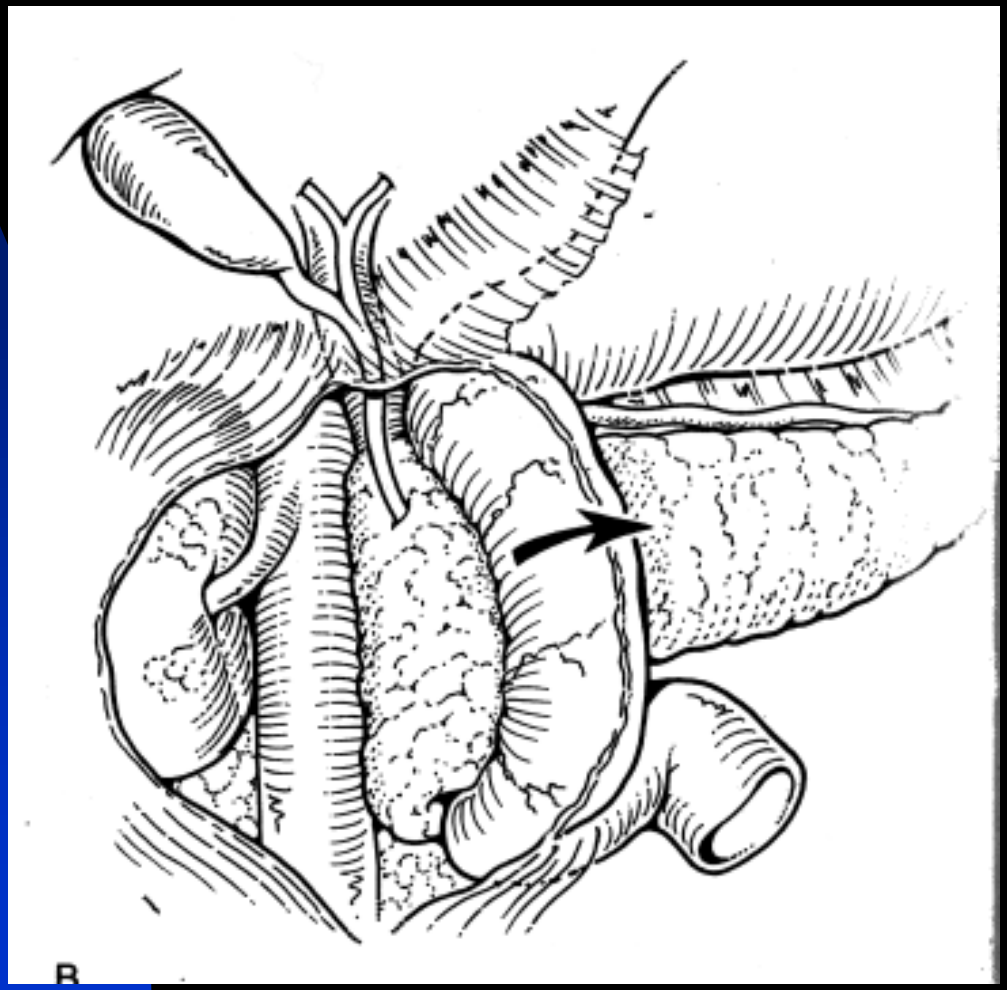
- Hemodynamically stable
- Benign abdominal exam
- Grade I and II injuries by CT scan, repeat limited CT or ERCP

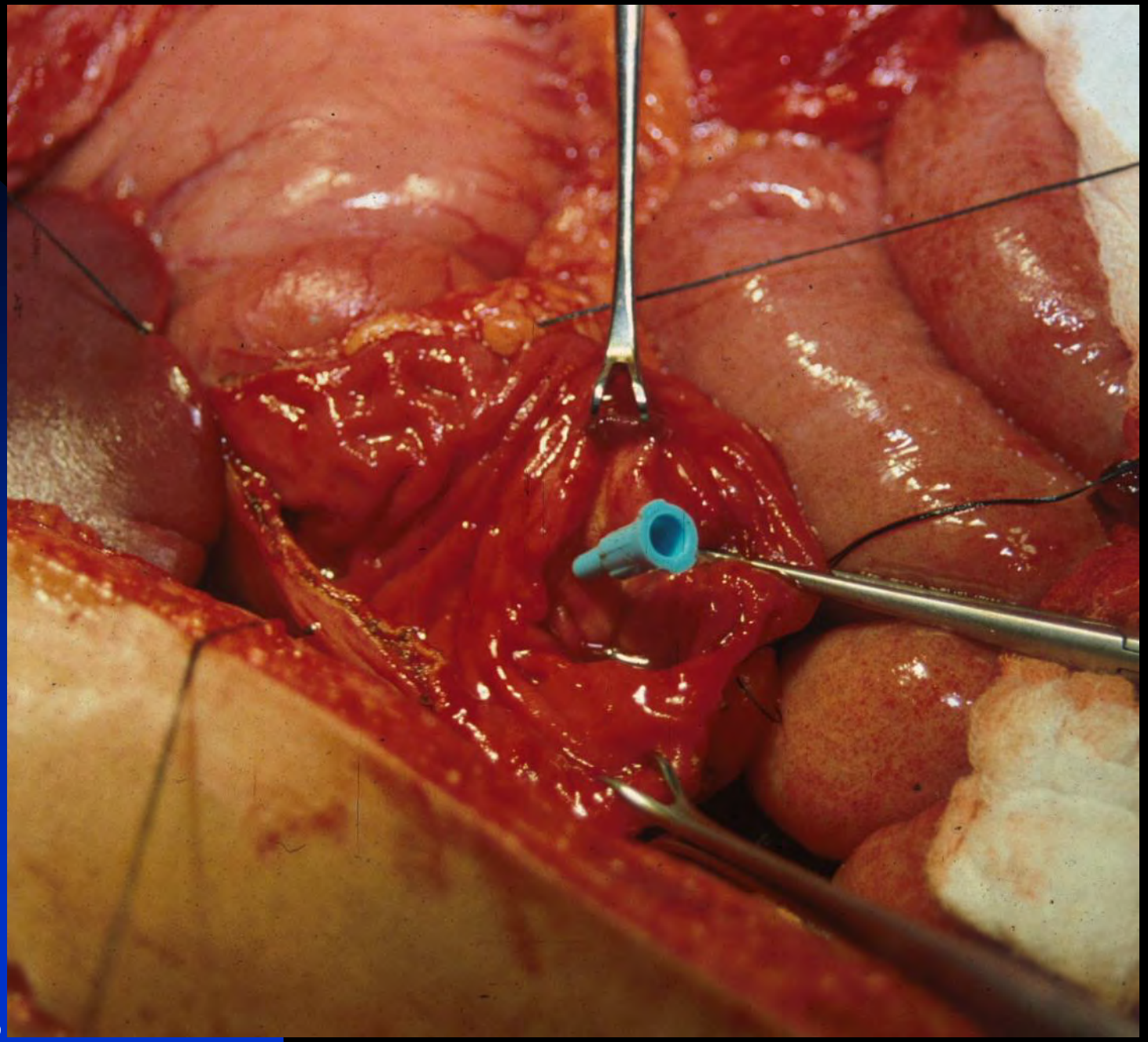
Intraoperative Evaluation



Intraoperative Evaluation

Intraoperative Evaluation





Recommendations

- If ductal anatomy ***<u>can</u>*** be deliniated then treat according to accepted practice:
  - I & II
    - Non-operative
    - Operative
      - Debridement
      - Hemostasis
      - Wide Drainage

Recommendations

- Standard disruption of the body over the spine –
  - distal pancreatectomy with splenic preservation
- Higher grades – treat the same as adult patients

Recommendations

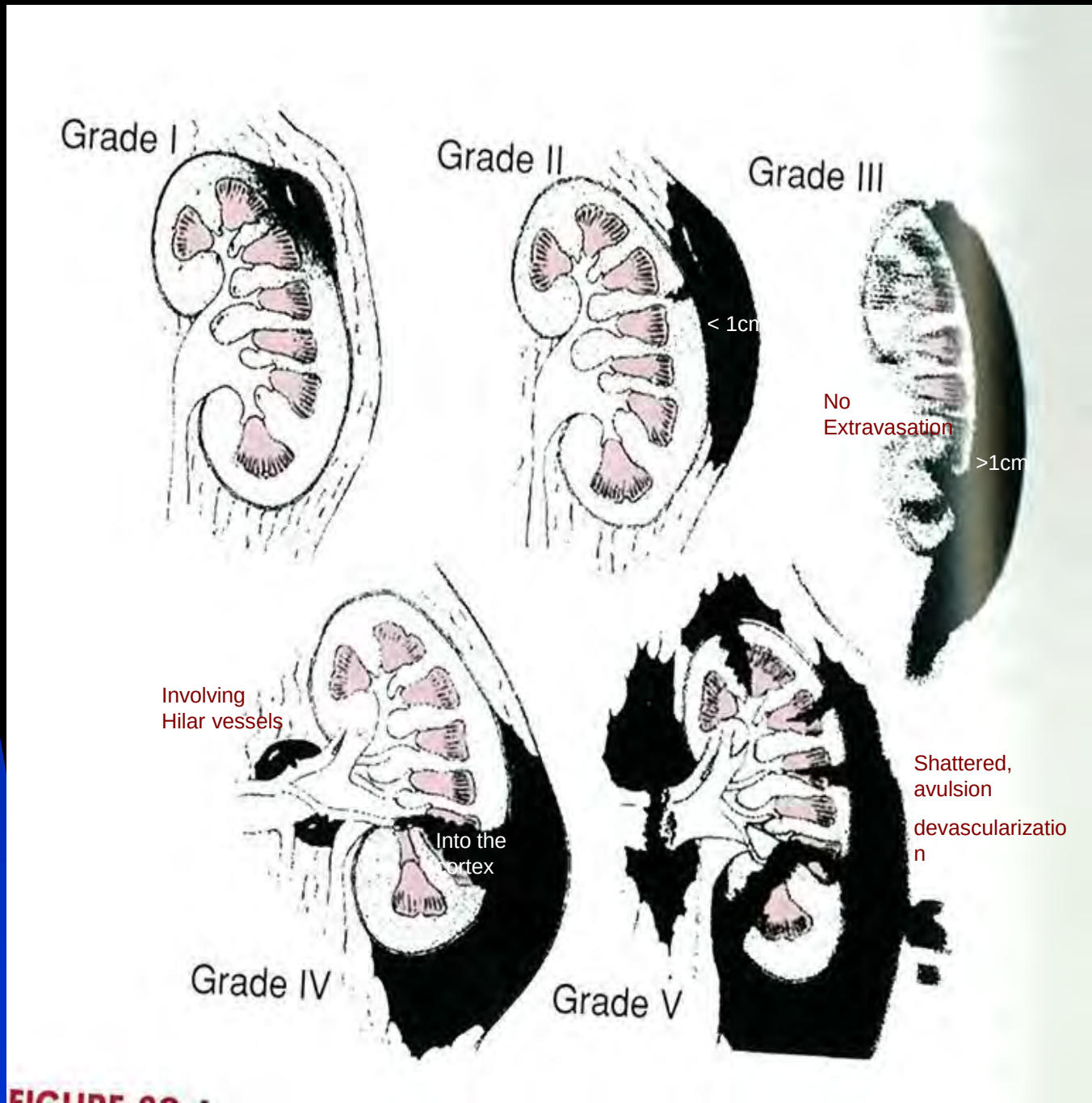
- Stable
- Utilize repeat imaging
- No evidence of ductal disruption – watch (drain later)

- Fail or evidence of ductal disruption - operate

Shattered Kidney

- Hematoma is contained
- Delayed images needed

AAST
Grading Scale



Pediatric Renal Injuries

- Need repeat imaging
- Need to limit radiation exposure

- Recommendation
  - Renal ultrasound with Doppler while in the hospital

Renal Injuries

- Same management scheme as splenic injuries
  - except – bed rest until urine is no longer grossly bloody
- Follow up in 1 month and 6 months
  - Ultrasound – hydro
  - Blood pressure checks

Conclusion

- Changing
- Hemodynamics
- Treatment algorithms
- Prepare for the complications

Thanks Again