



## **Eastern Association for the Surgery of Trauma**

### **Imaging in Trauma and Acute Care Surgery: A Crash Course!**

**January 10, 2012  
Disney's Contemporary Resort  
Lake Buena Vista, Florida**

#### **Course Faculty**

*K. Shanmuganathan, MD*

*Deborah Stein, MD*

#### **Course Overview**

Advances in diagnostic imaging and computer technology have permitted us to rapidly and comprehensively acquire, process, display, communicate, store, and archive the diagnostic imaging of large numbers of trauma and emergency patients in busy hospitals. Consequently, there has resulted an explosion in the number of diagnostic imaging studies of entire patients that we have become dependent upon to evaluate and to exclude injury. Frequently, the rate-limiting step is the wait for the radiologist report. Therefore, don't just read the report, read the imaging!

This Workshop featured exciting didactic and interactive sessions highlighting the imaging of acute injury and surgical emergencies. The hands-on skills station gave attendees the opportunity to interpret the imaging for selected cases, with interactive instruction. The Faculty are career dedicated Trauma Radiologists and the editors of the multimodality textbook reference "Imaging in Trauma and Critical Care" and the challenging self-assessment resource "Emergency Radiology: Case Review Series."

# Imaging in Thoracic & Aortic injury east Annual Scientific Assembly Workshop Florida 2012

K.SHANMUGANATHAN M.D.



## Thoracic & Aortic injury

### OBJECTIVES

- Traumatic aortic injury
- Non aortic vascular injury
- Relevance to management

## Traumatic Aortic injury

## Traumatic Aortic injury

- Changing role of imaging
- Typical/Atypical TRA
- Minimal TRA
- Definitive therapy – surgery vs endovascular Rx

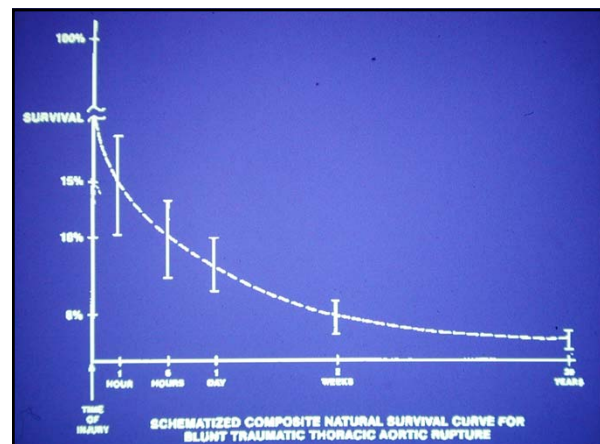
## Traumatic Aortic injury

### Nonpenetrating Traumatic Injury of the Aorta

By LOREN F. PARMLEY, LT. COLONEL, MC, THOMAS W. MATTINGLY, BRIG. GEN., MC,  
WILLIAM C. MANION, M.D., AND EDWARD J. JAHNKE, JR., MAJ., MC

Rupture or laceration of the aorta is a more common result of nonpenetrating traumatic injury than is generally appreciated. Approximately 15 per cent of individuals with traumatic rupture survive temporarily. If the lesion is promptly diagnosed appropriate surgical treatment may be life-saving. Diagnosis may be difficult and at times the rupture may remain clinically silent for variable periods. The natural course from aortic rupture to false aneurysm formation with secondary rupture of the aneurysm may be brief or extend over many years. Surgical treatment of a false aneurysm that has remained stable for a prolonged period has been successful, but in some instances conservative management may be the treatment of choice.

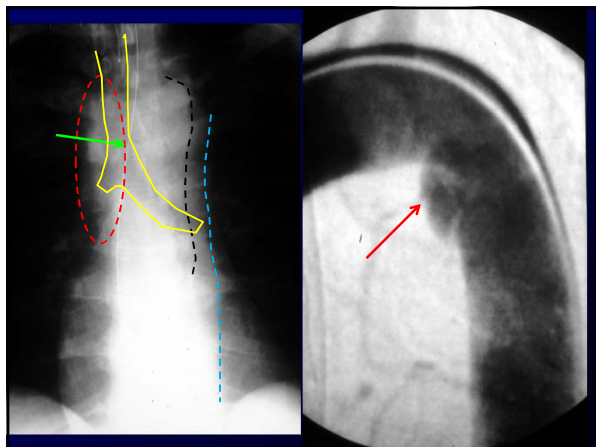
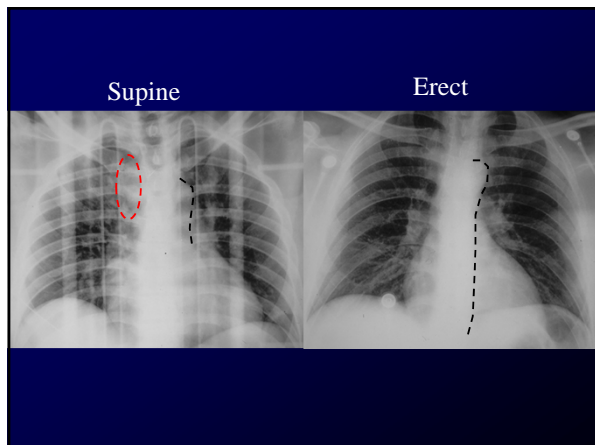
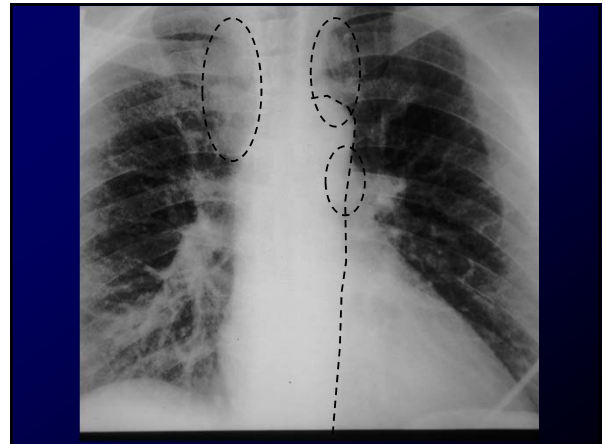
*Circulation 1958;17:1086-1101*



## Traumatic Aortic injury

### Sites of Rupture

- Isthmus 80-90%
- Ascending aorta 5-9%
- Diaphragmatic Hiatus 1-3%



## Contrast Enhanced CT

## Contrast Enhanced CT

- Indirect sign
- Direct signs

## Mediastinal Hemorrhage

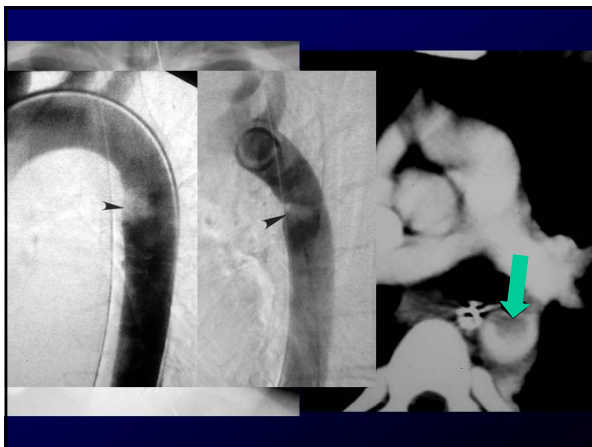
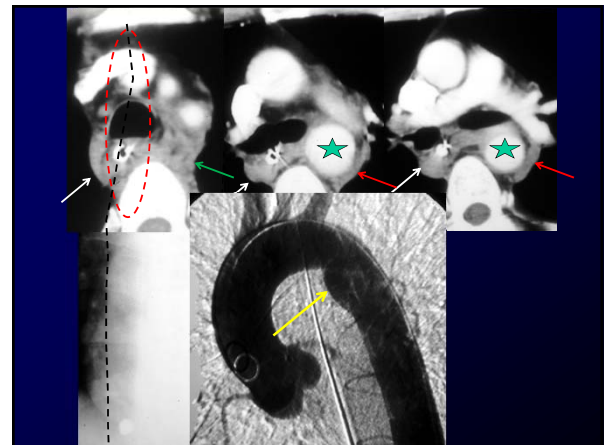
### Indirect signs – mediastinal hemorrhage

- Anatomical location – anterior, superior, peri & para-aortic, middle, posterior
- Relationship of MH – Major vessels / other mediastinal structures (sternum, vertebra)

## Traumatic Aortic injury

### Direct Signs

- Contour abnormality or intimal irregularity
- Intimal flap or thrombus
- Hematoma
- Pseudoaneurysm
- Active bleeding



## Traumatic Aortic injury

### CES- CT (n=7826)

- MH 118/1104 (10.7%)
- AORTIC INJURY 24/118 (20.3%)
- ALL CEST-CT 24/1104 (2.2%)

SEM, KS, JB, AR. J. TRAUMA NOV 1998

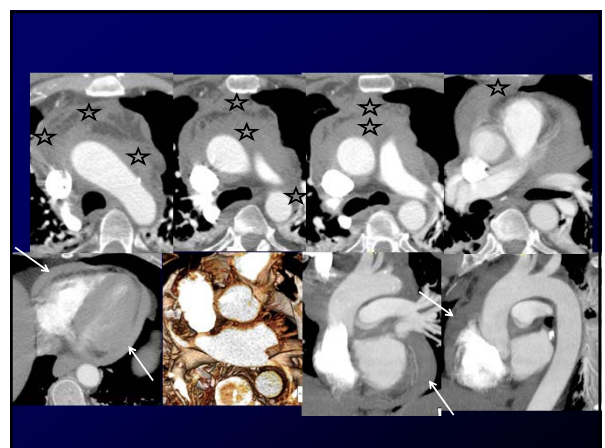
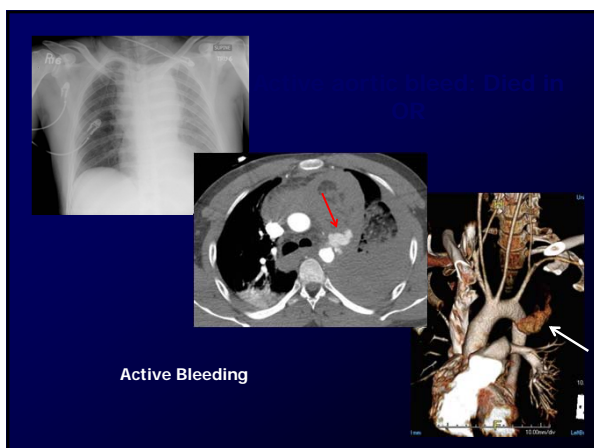
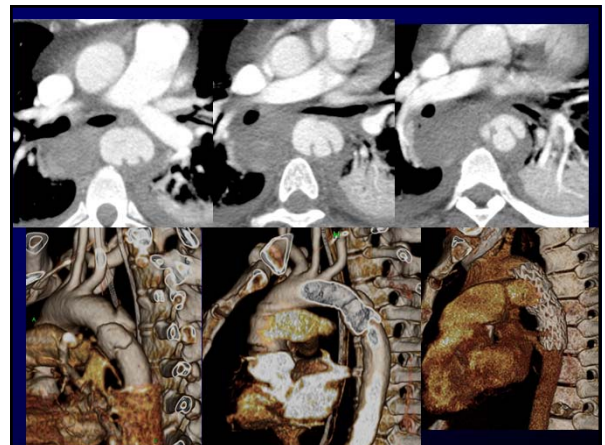
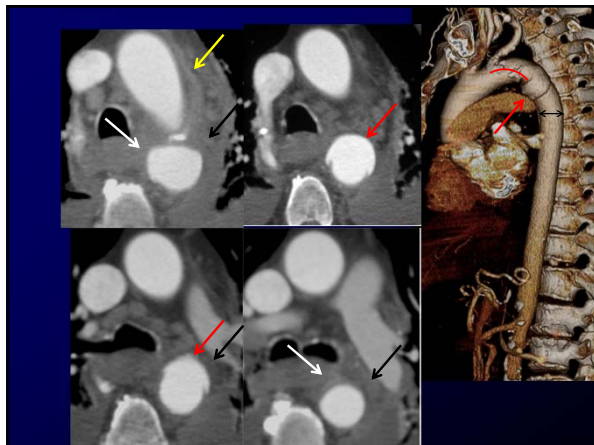
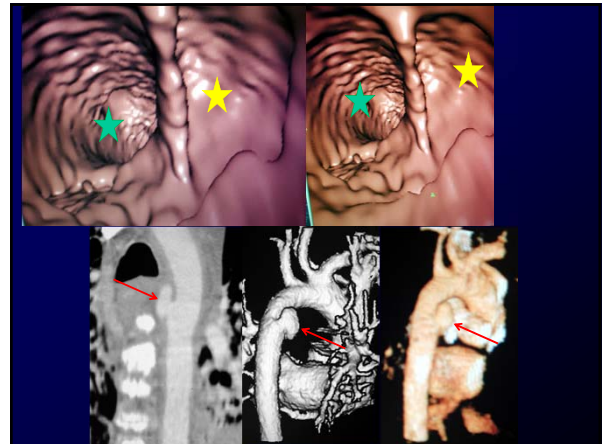


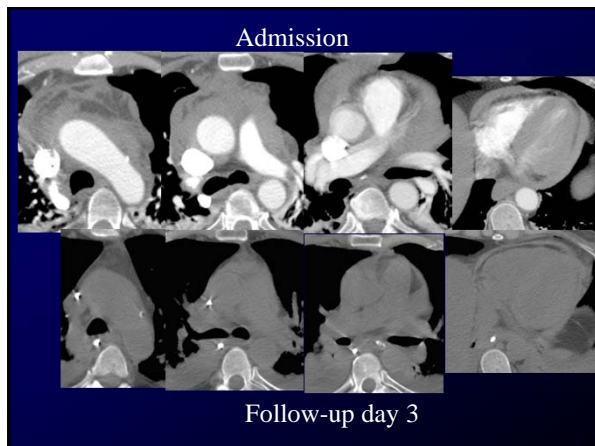
## Traumatic Aortic injury

### CES- CT (n=7826)

CEST-CT. In this prospective series, CEST-CT was 100% sensitive based on clinical follow-up; it was 99.7% specific, with 89% positive and 100% negative predictive values and an over-all diagnostic accuracy of 99.7%.

Conclusion: CEST-CT is a valuable ancillary study for the detection of traumatic aortic injury. Spiral computed tomography is accurate for the detection and localization of both hemomediastinum and direct signs of aortic injury.





## Traumatic Aortic injury

**CONCLUSION.** Direct signs of ATAI on contrast-enhanced 64-MDCT scans do not have to be confirmed with catheter angiography. In our population, diagnostic transcatheter angiography was of limited value for clarifying equivocal or indirect MDCT findings.

Scott D. Steenburg<sup>1</sup>  
James G. Ravenel

**OBJECTIVE.** At some institutions, catheter angiography is used for confirmation of aortic injuries and equivocal MDCT findings. Because of the speed and efficiency of 64-MDCT, findings needed surgical repair. The sensitivity of 64-MDCT was 96.0%; specificity, 99.8%; positive predictive value, 92.3%; negative predictive value, 99.9%; and accuracy, 99.8%.

## Traumatic Aortic injury

**Table 1** Diagnostic Modalities for TAI: AAST<sub>1</sub> vs. AAST<sub>2</sub>

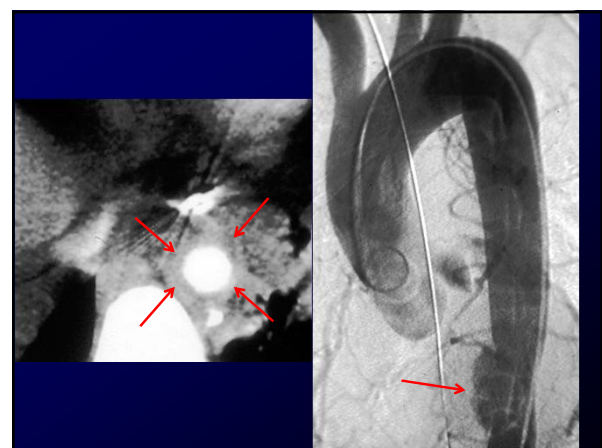
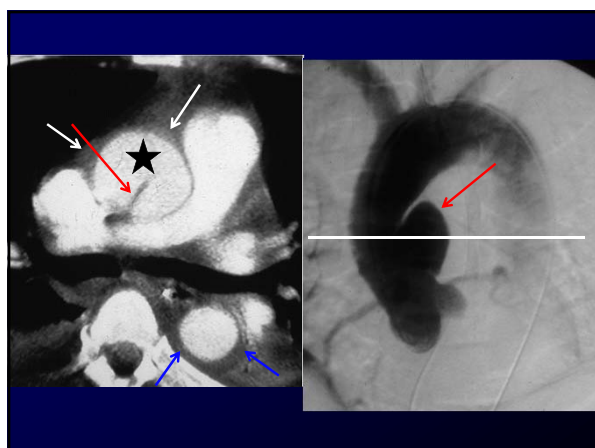
	AAST <sub>1</sub> , N = 253* (%)	AAST <sub>2</sub> , N = 193 (%)	p
Aortogram (n/%)	220 (87.0)	16 (8.3)	<0.001
CT scan	88 (34.8)	180 (93.3)	<0.001
TEE	220 (87.0)	16 (8.3)	<0.001

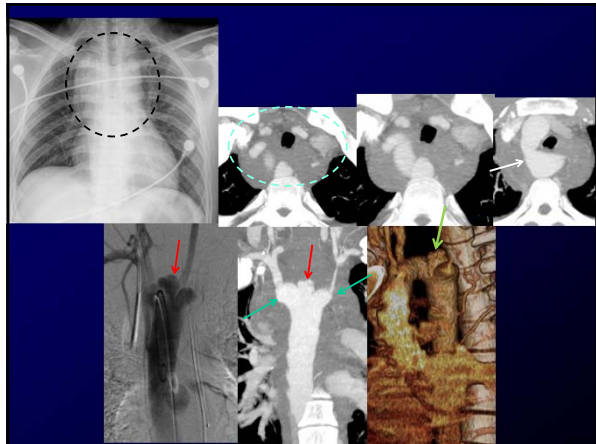
\* Excluding patients investigations.

*J Trauma.* 2008;64:1415–1419.

198 patients with TRA from 18 centers

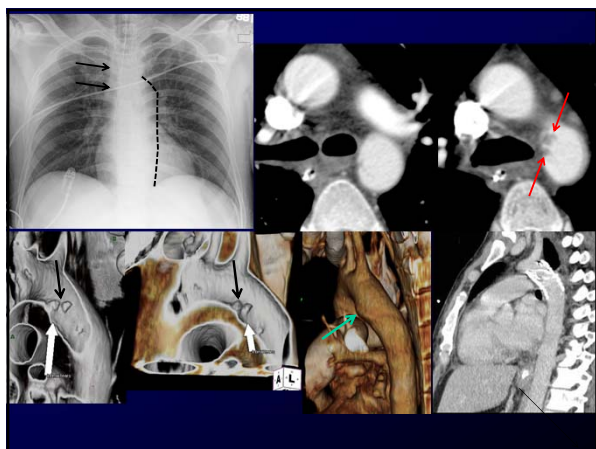
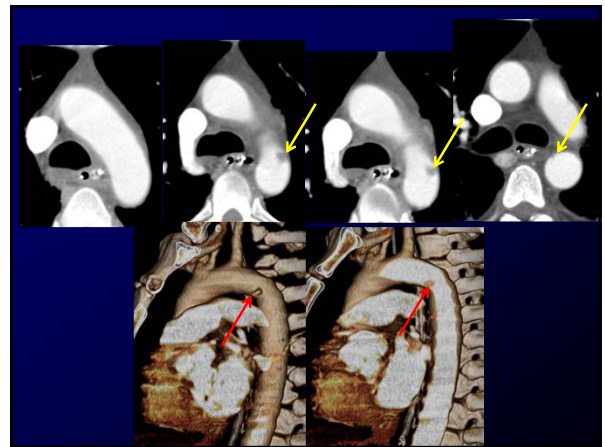
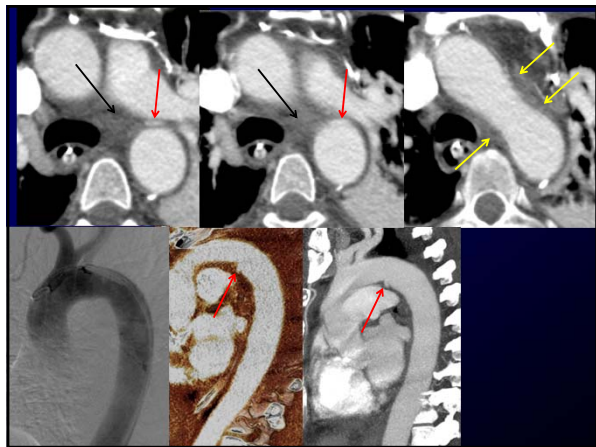
## Atypical Traumatic Aortic Injury



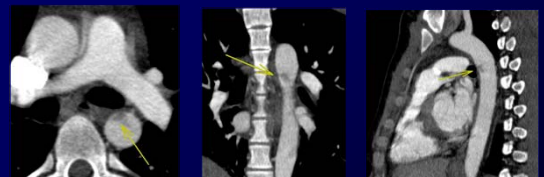


## Minimal Traumatic Aortic Injury

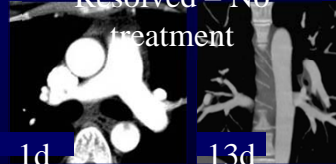
1 cm intimal flap with no or minimal mediastinal hemorrhage



Minor intimal tear; 0.5 cm



Resolved – No treatment



## Traumatic Aortic injury

**Table 2** Methods of Definitive Repair of TAI: AAST<sub>1</sub> vs. AAST<sub>2</sub>

	AAST <sub>1</sub> , N = 207* (%)	AAST <sub>2</sub> , N = 193 (%)	P
Open repair	207 (100)	68 (35.2)	<0.001
Clamp/sew	73/207 (35.3)	11/68 (16.2)	0.003
Bypass	134/207 (64.7)	57/68 (83.8)	0.003
Endovascular repair	0/207	125/193 (64.8)	<0.001

\* Excluding patients in extremis or those managed nonoperatively.

## Traumatic Aortic injury

### Endovascular Stenting for Traumatic Aortic Injury: An Emerging New Standard of Care

Sina L. Moainie, MD, David G. Neschis, MD, James S. Gammie, MD, James M. Brown, MD, Robert S. Poston, MD, Thomas M. Scalea, MD, and Bartley P. Griffith, MD

Divisions of Cardiac Surgery and Vascular Surgery, and R. Adams Cowley Shock Trauma Center, University of Maryland School of Medicine, Baltimore, Maryland

- Shorter length of stay
- Less intra-operative blood loss
- Less incidence of post-op tracheostomy



# Abdominal Solid Organ Injury east Annual Scientific Assembly Workshop Florida 2012

K.SHANMUGANATHAN M.D.



## ABDOMINAL TRAUMA

### OBJECTIVES

- Splenic injury
- Late arterial / early p-v phase imaging
- Liver injury

## Blunt Splenic Injury

## BLUNT SPLENIC INJURY

- Most commonly injured organ
- MDCT - 98% accurate
- Vascular lesions (AB & VI) – 83%
- 20% rib fractures
- Grading systems

HM, KS, SEM, et al. JACS 2008 ; 206:685-93

## Optimization of Selection for Nonoperative Management of Blunt Splenic Injury: Comparison of MDCT Grading Systems

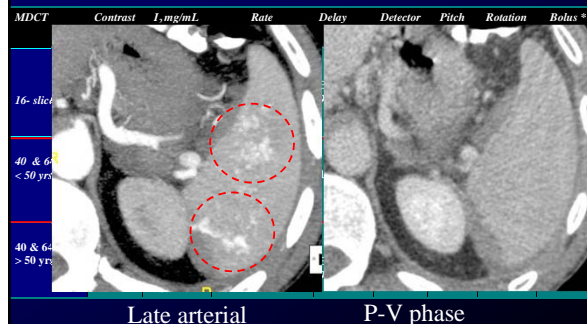
AJR:189, December 2007

Helen Marmery<sup>1,2</sup>  
Kathiramanathan Shanmuganathan<sup>1</sup>  
Melvin T. Alexander<sup>2</sup>  
Stuart E. Mirvis<sup>1</sup>

**OBJECTIVE.** The purpose of this study was to compare the usefulness of two CT grading systems of blunt splenic trauma in predicting which patients need surgery or angioembolization.  
**MATERIALS AND METHODS.** Four hundred patients in hemodynamically stable condition admitted with blunt splenic injury were included in the study. All patients underwent contrast-enhanced MDCT. Grade of splenic injury was prospectively assigned according to the

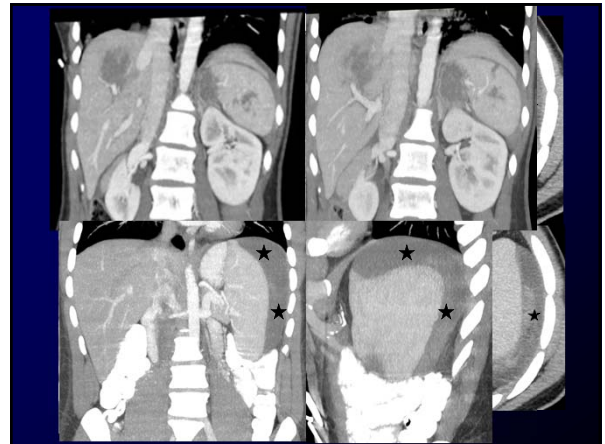
IVA	IV	Laceration	Laceration involving segmental or hilar vessels producing major devascularization (>25% of spleen)
V	V	Laceration	Completely shattered spleen
IVB	Vascular	Vascular	Hilar vascular injury which devascularizes spleen

## TRAUMA “WHOLE BODY” MDCT PROTOCOLS



## Optimizing Trauma MDCT Protocol for Blunt Splenic Injury: Need for Arterial and Portal Venous Phase Scans

Sens/ Spec	PA (pseudo-aneurysm)	AB (active bleeding)	NVI (nonvascular injury)	PSH (perisplenic hematoma)
Arterial	70 / 95	70 / 98	76 / 97	95 / 95
Portal Venous	17 / 96	90 / 100	90 / 90	98 / 97



## BLUNT SPLENIC INJURY

### VASCULAR LESIONS

- Active bleeding
- Vascular injury – PSA & A-V fistula
- Infarcts

## Contrast Extravasation

## BLUNT SPLENIC INJURY

### ACTIVE BLEEDING

- Irregular or linear area
- Increases in size (delayed phase)
- Seen - only on delayed imaging

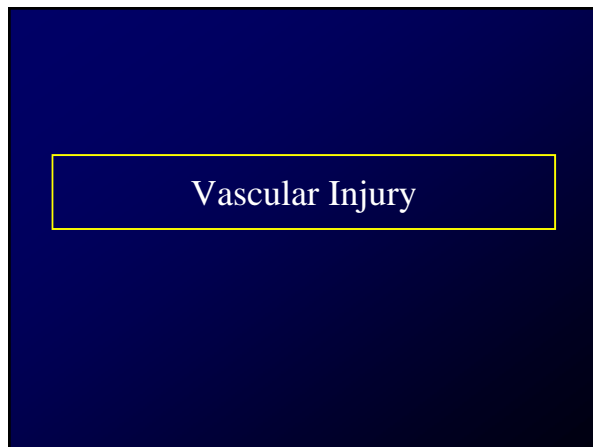
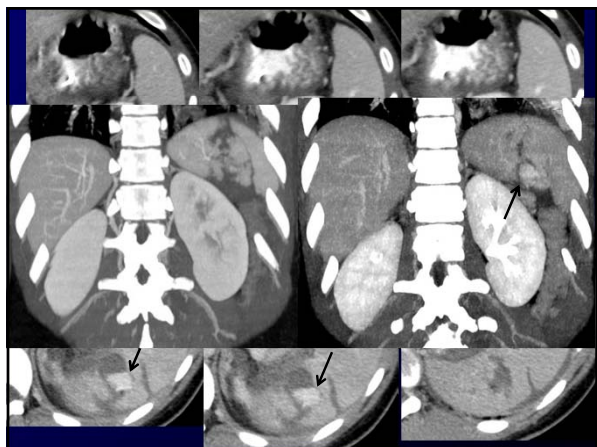
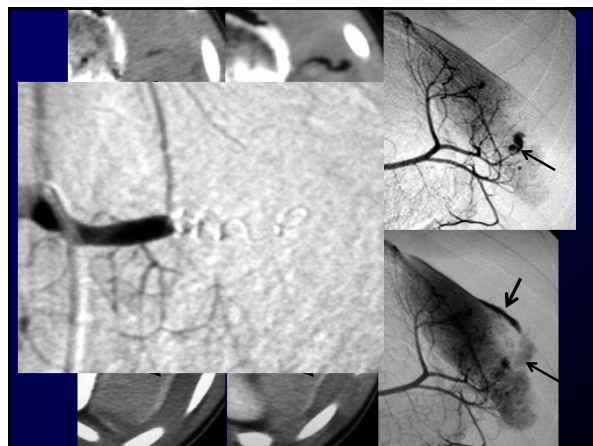
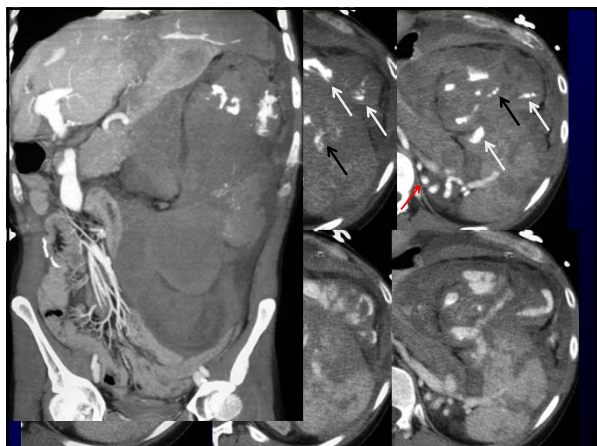
## BLUNT SPLENIC INJURY

### MDCT – Active Bleeding

- AB – Seen in 10% (40/392)
- AB – MDCT (16 slice) 84% Sen, 98% Spc, 95% Acc
- Splenectomy - 60% (24/40)
- Embolization – 94% (16/17)

HM, KS, SEM, et al. JACS 2008; 206:685-93





## BLUNT SPLENIC INJURY

VASCULAR INJURY

- Pseudoaneurysm
- Arterio-venous fistula

## BLUNT SPLENIC INJURY

VASCULAR INJURY

- Defined
- Low attenuation area
- Washout – isoattenuation or hyperattenuation

## BLUNT SPLENIC INJURY

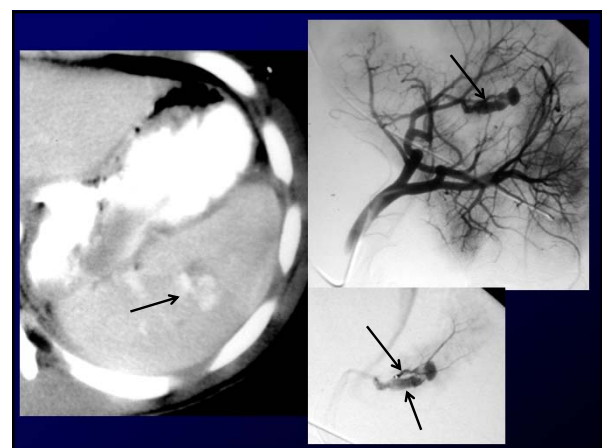
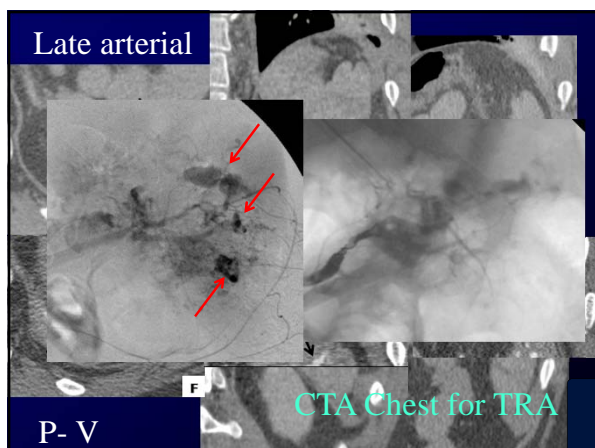
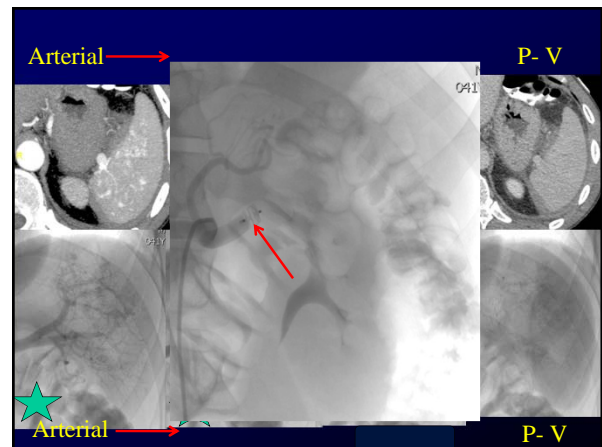
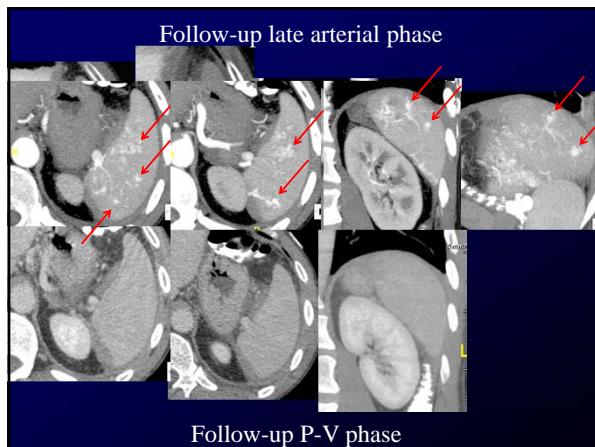
### MDCT – Vascular injury (PSA & AVF)

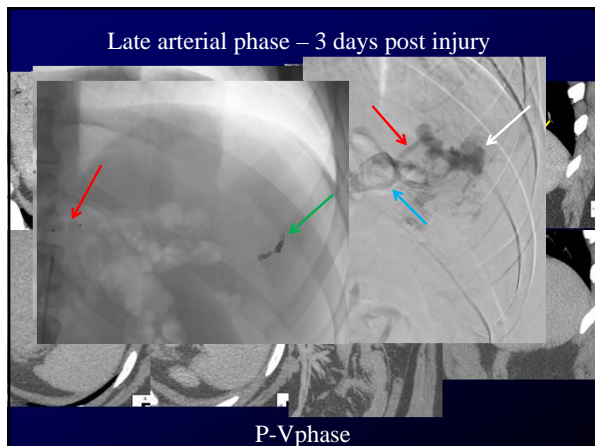
- VI – Seen in 12% (46/392)
- VI – MDCT (16 slice) – 63% Sen, 94% Spc, 95% Acc
- Embolization – 95% (40/42)
- Splenectomy - 9% (4/46)

HM, KS, SEM, et al. JACS 2008 ; 206:685-93

## Why Late arterial/ Early P-V Images?

- Demonstrates parenchymal vascular injury (PSA & fistulas) not seen on p-v phase images

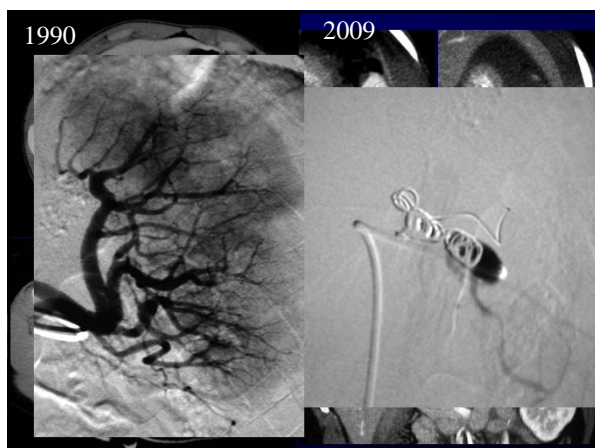




## Splenic Infarcts



## Impact of MDCT & Arteriography on Blunt Splenic Injury



## BLUNT SPLENIC INJURY

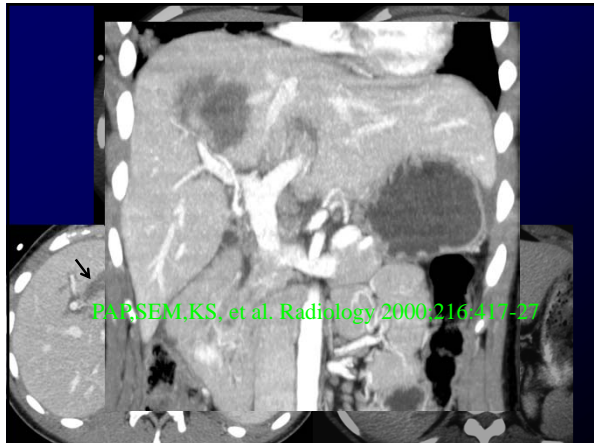
### OUTCOME

Period	Spl Inj	ISS	Splenic Surgery	Angio	ALOS
1996-98	468	24	38.25%	25 (8/yr)	13.57
1999-2007	2184	28	25.92%	376 (42/yr)	11.02

## Liver Injury

### BLUNT LIVER INJURY

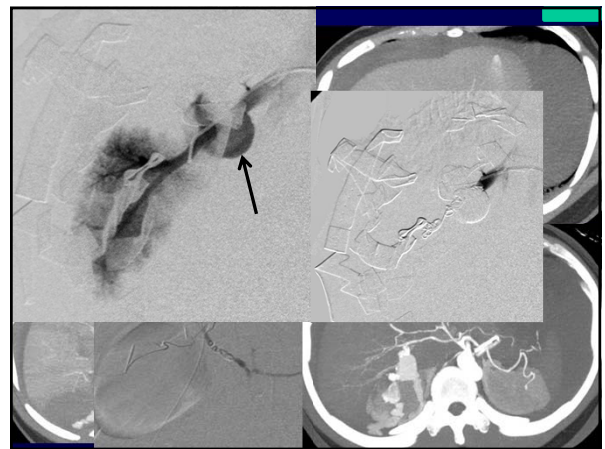
- Injury - 2<sup>ND</sup> most common
- Nonsurgical management - 50 % - 96%
- Hemorrhage - mortality
- Rx – multi-disciplinary approach  
IR & SURGERY



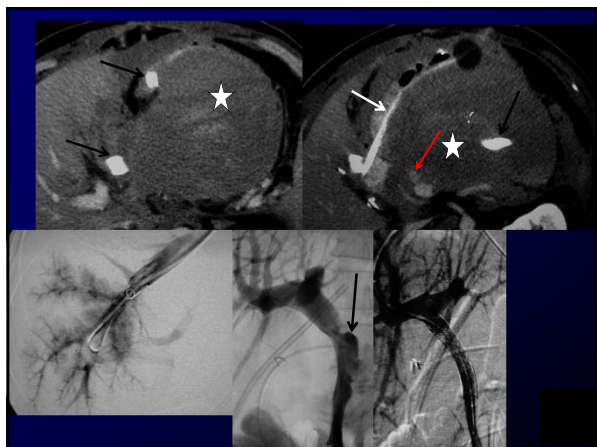
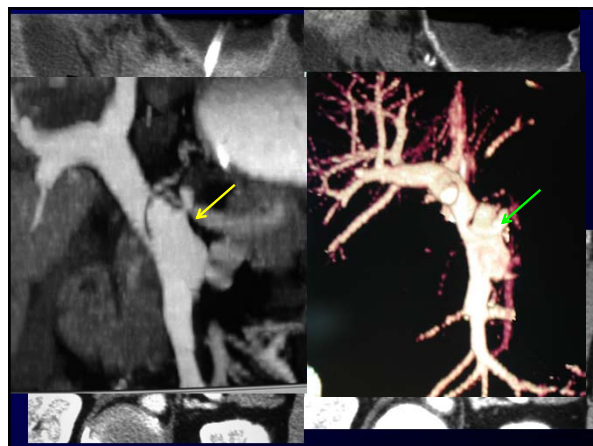
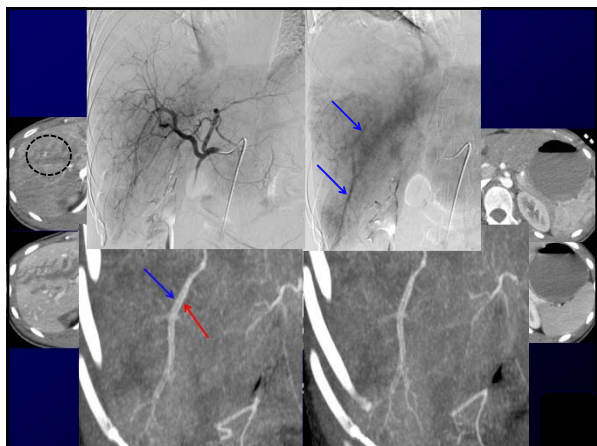
### BLUNT LIVER INJURY

#### VASCULAR INJURY

- Active bleeding – hepatic artery, portal, or hepatic veins
- Pseudoaneurysm - rare
- Fistula - three types  
A-V fistula, P-V fistula, A-P fistula







## Imaging in Bowel & Mesenteric Injury

Annual Scientific Assembly Workshop  
Florida 2012

K.SHANMUGANATHAN M.D.



## BOWEL & MESENTERIC INJURY

### OBJECTIVES

- MDCT findings
- Relevance to management
- Isolated free intraperitoneal fluid
- Importance of communication

## BOWEL ABDOMINAL & PELVIC TRAUMA

- Three distinct abnormalities
- Bowel injury - partial or full thickness
- “Shock bowel”
- Bowel edema from volume overload

## BOWEL INJURY

**Relatively Short Diagnostic Delays (<8 Hours) Produce Morbidity and Mortality in Blunt Small Bowel Injury: An Analysis of Time to Operative Intervention in 198 Patients from a Multicenter Experience**

*Samir M. Fakhry, MD, Michelle Brownstein, MD, Dorraine D. Watts, PhD, RN, Christopher C. Baker, MD, and Dale Oller, MD*  
J Trauma 2000;48:408-15

- Signs & symptoms – + + + - 84%
- No signs or symptoms – 52% ~ 64%

## MDCT: BOWEL & MESENTERIC INJURY

Surgical vs. Non-surgical		n = 150
• Sensitivity:	71%	(34/48)
• Specificity:	95%	(97/102)
• PPV:	87%	(34/39)
• NPV:	87%	(97/111)
• Accuracy:	87%	(131/150)

## BLUNT BOWEL INJURY



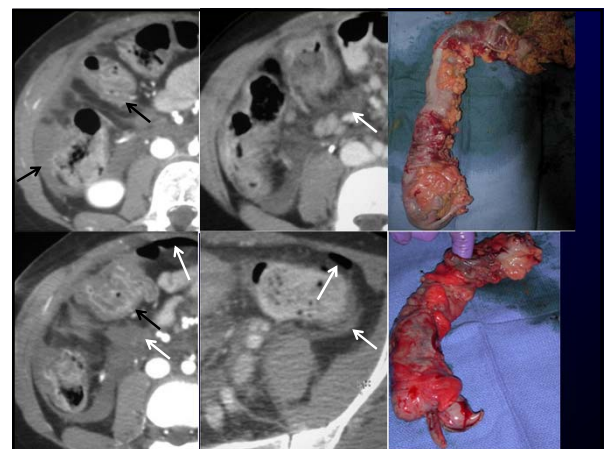
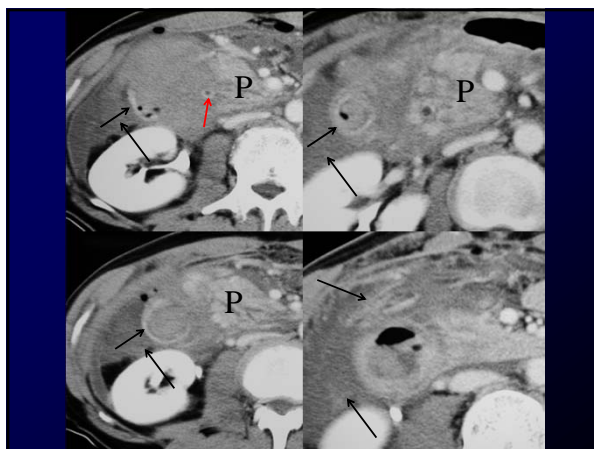
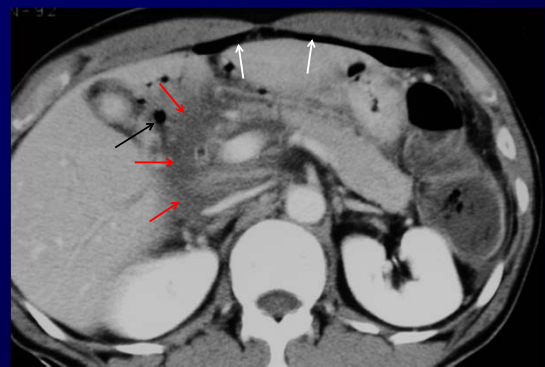
## BOWEL INJURY SPECIFIC CT SIGNS

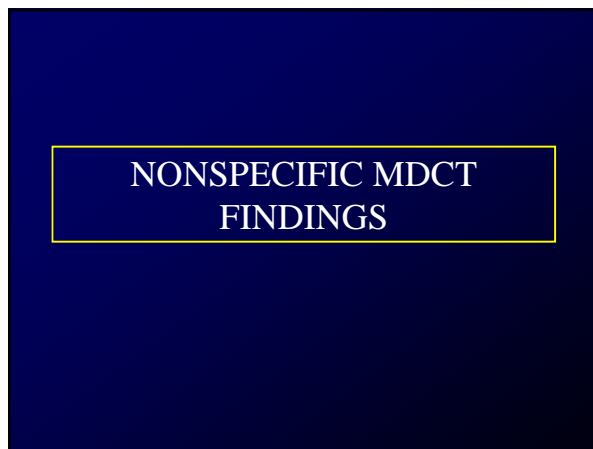
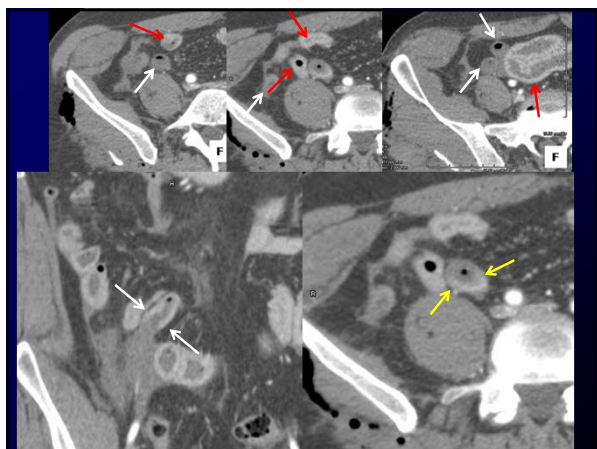
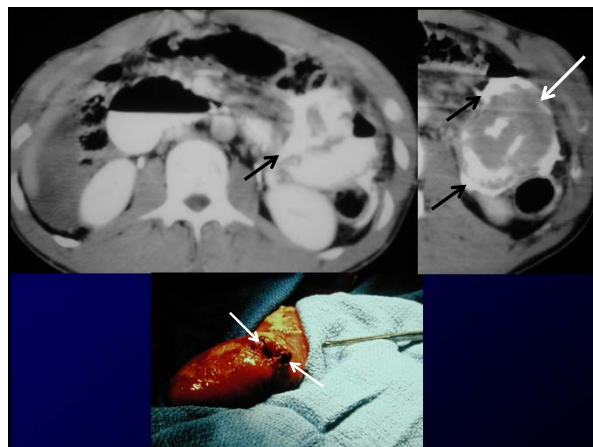
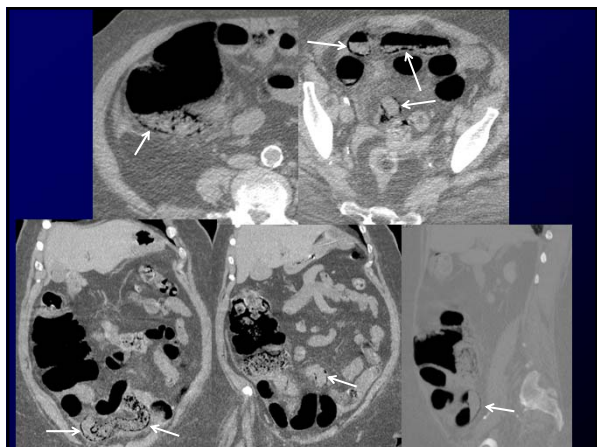
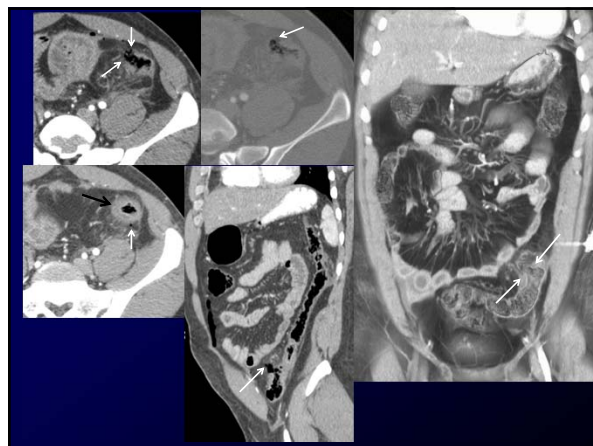
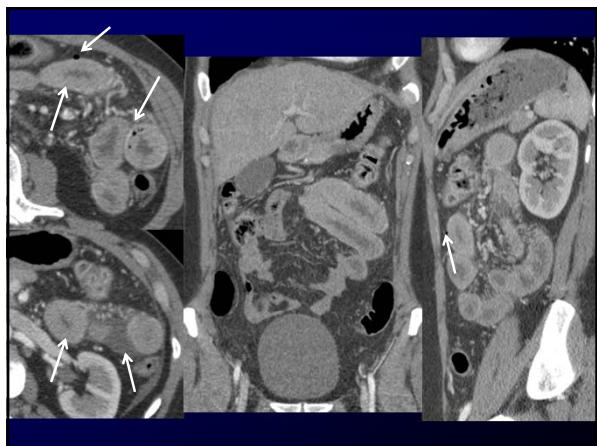
- Free extra intestinal air
- Oral contrast material extravasation
- Extravasation of intestinal content
- Discontinuity of bowel wall
- Air within bowel wall

## BOWEL INJURY SPECIFIC CT SIGNS

- Bleeding within lumen of bowel
- Perfusion abnormalities in bowel wall

## SPECIFIC MDCT FINDINGS





## BOWEL INJURY NONSPECIFIC CT SIGNS

- BOWEL WALL THICKENING
- FREE INTRAPERITONEAL FLUID WITH NO SOURCE

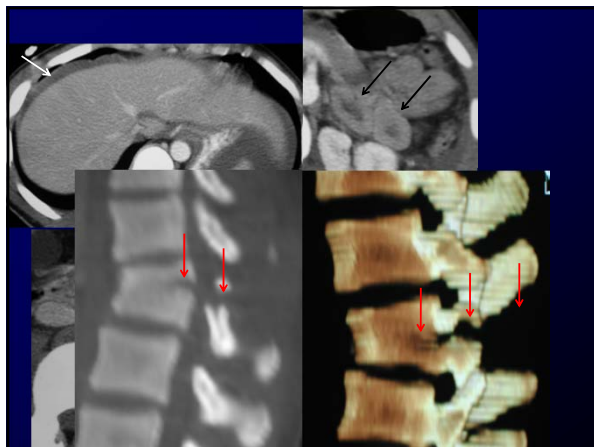
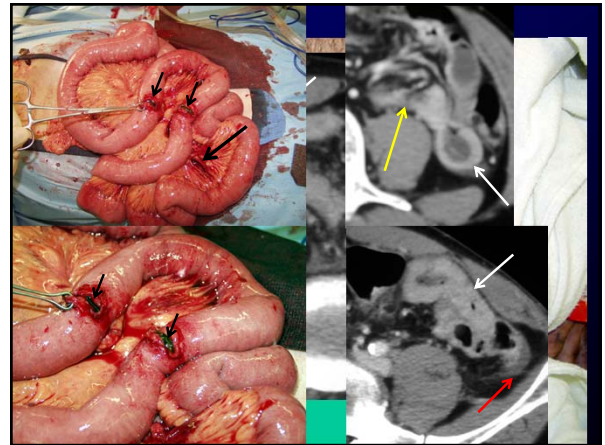
## BOWEL INJURY SPIRAL CT (SURGICAL)

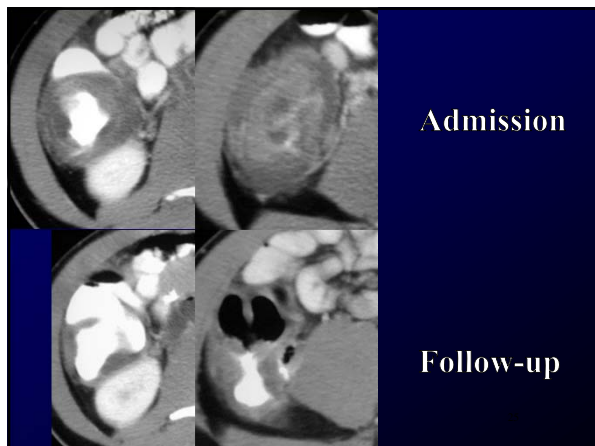
	SEN	SPE	ACC	NPV	PPV
FREE AIR	30%	98%	91%	89%	95%
FF	76%	39%	51%	76%	39%
BWT	44%	47%	46%	62%	30%
OCE	8%	100%	69%	68%	100%

KLK, KS, SEM, et al. J TRAUMA 2001;51:1-11

## BOWEL INJURY NONSPECIFIC CT SIGNS

- Serial clinical Examination
- Follow-up MDCT
- DPL
- Laparoscopy
- Laparotomy





## ISOLATED FREE INTRAPERITONEAL FLUID

## BOWEL INJURY

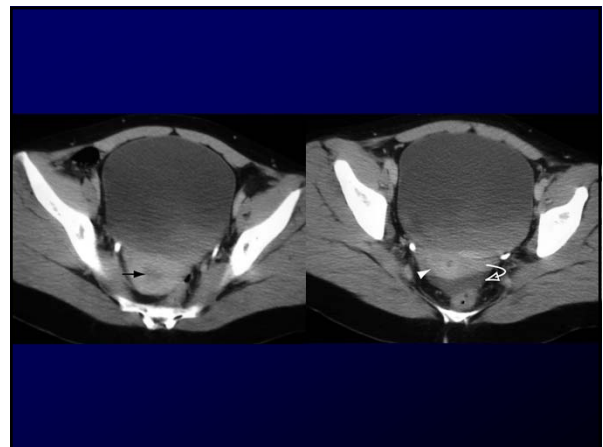
### ISOLATED INTRAPERITONEAL FLUID

- Liver & spleen – no injury
- No specific MDCT findings of bowel injury
- No active bleeding – intraperitoneal or retroperitoneal compartments

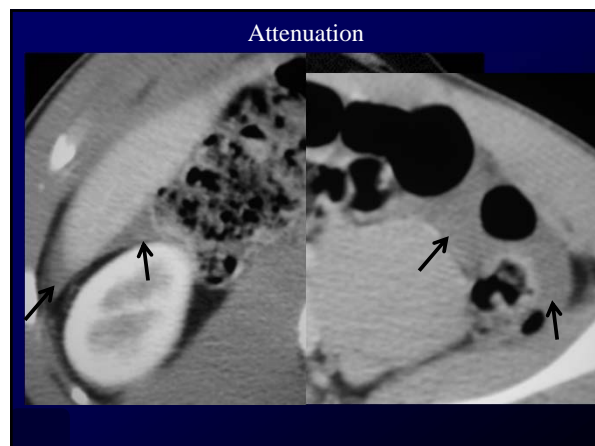
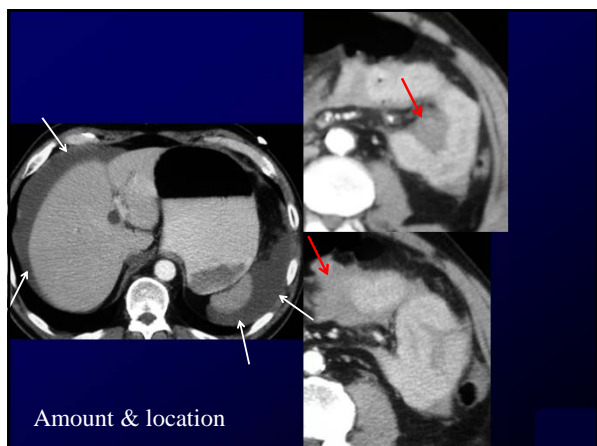
## BOWEL INJURY

### ISOLATED INTRAPERITONEAL FLUID

- Volume of fluid
- Anatomical location
- Appearance
- Attenuation







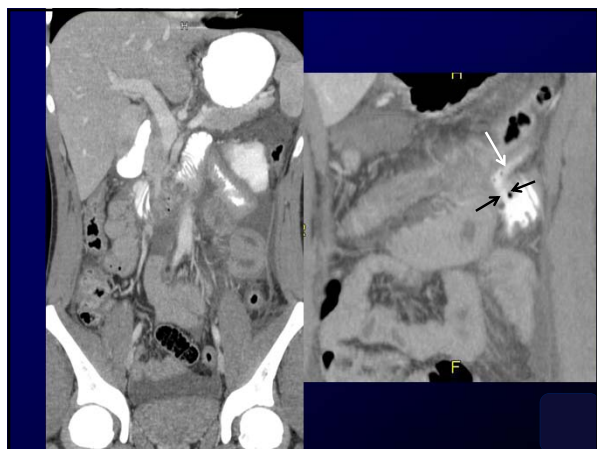
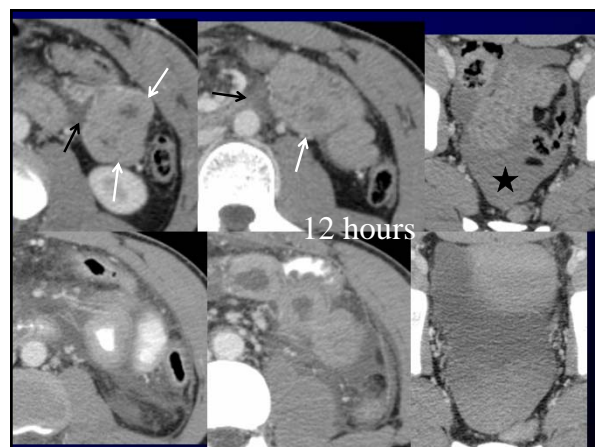
**BOWEL INJURY**

**Follow-up CT**

- 4 – 6 hours

**Relatively Short Diagnostic Delays (<8 Hours) Produce Morbidity and Mortality in Blunt Small Bowel Injury: An Analysis of Time to Operative Intervention in 198 Patients from a Multicenter Experience**

*Samir M. Fakhr, MD, Michelle Brownstein, MD, Dorraine D. Watts, PhD, RN, Christopher C. Baker, MD, and Dale Oller, MD*



# Imaging in Abdominal Penetrating Injury east

## Annual Scientific Assembly Workshop Florida 2012

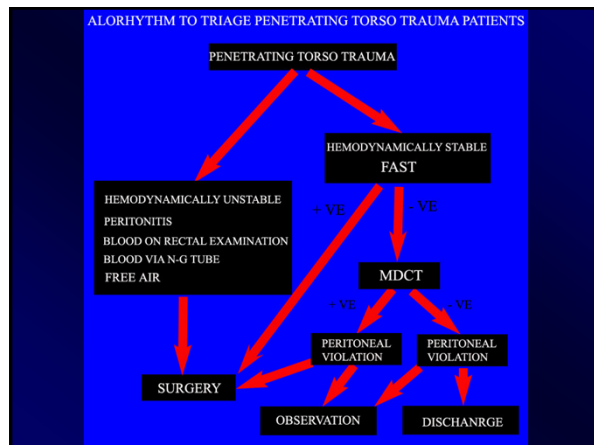
K.SHANMUGANATHAN MD



# PENETRATING TORSO TRAUMA

## OBJECTIVES

- Who & how - MDCT
- Peritoneal Violation
- Diagnosis of bowel & mesenteric injury



# TRIPLE CONTRAST MDCT CT IN PENETRATING TORSO TRAUMA

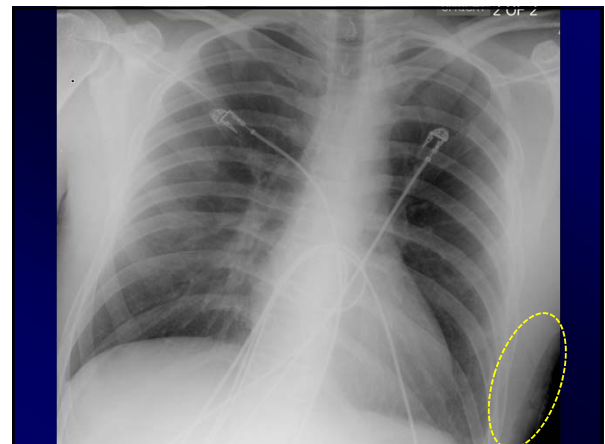
## TECHNIQUE

- Oral contrast material (500 - 600 mL)
- Rectal contrast material (1 - 1.5 L)
- IV contrast material - 100 ml 350 mg I<sub>2</sub>/ml

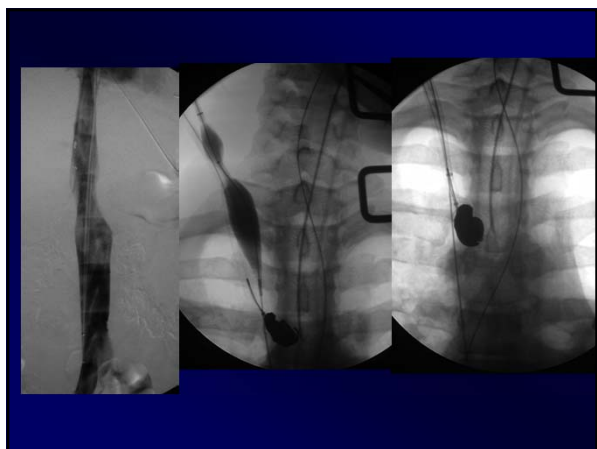
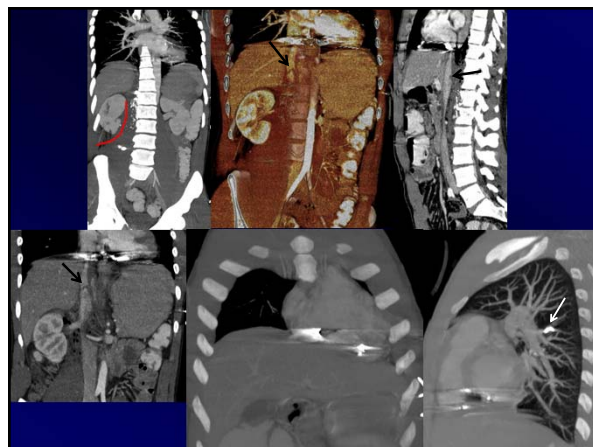
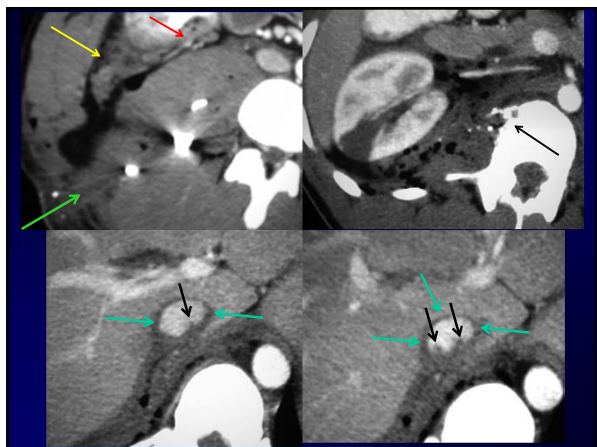
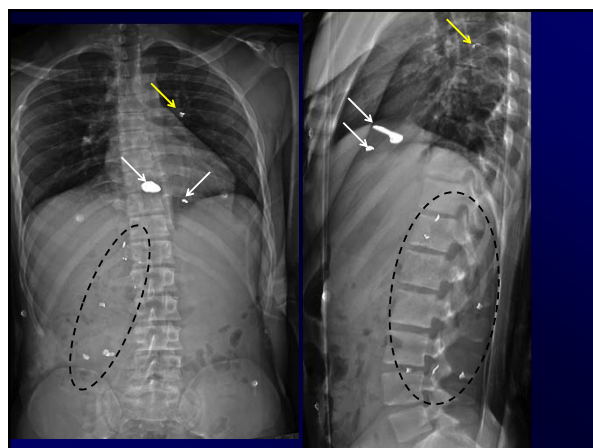
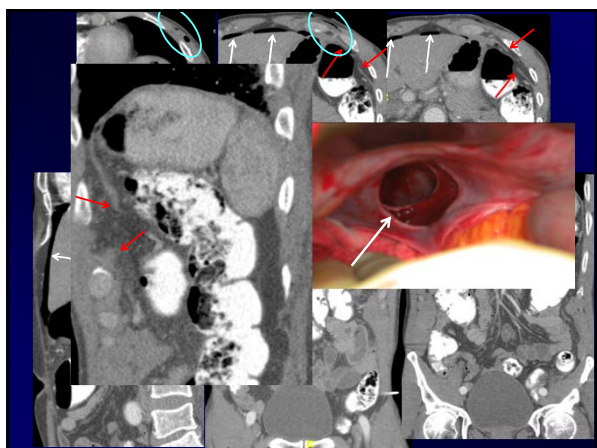
# TRIPLE CONTRAST SPIRAL CT IN PENETRATING TORSO TRAUMA

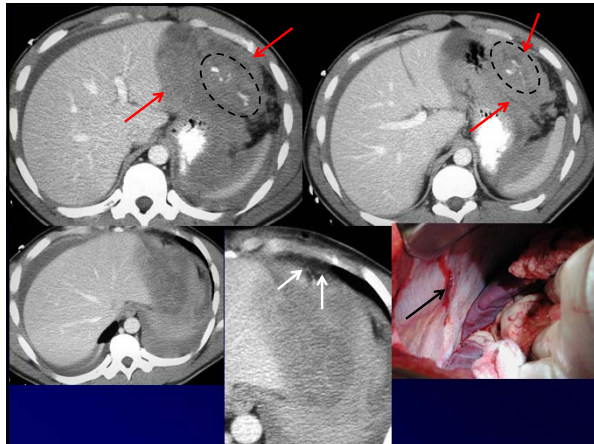
PERITONEAL VIOLATION = +CT

- Free intraperitoneal air
- Free intraperitoneal fluid
- Intraperitoneal organ injury
- Bullet or stab WT – peritoneal extension









## TRIPLE CONTRAST SPIRAL CT IN PENETRATING TORSO TRAUMA

Subjects (n=200)

Peritoneal violation

• CT POSITIVE	68/200	34 %
• CT NEGATIVE	132/200	66 %
• FALSE NEGATIVE	02/200	1 %
• FALSE POSITIVE	02/200	1 %

KS, SEM, WCC. RADIOLOGY 2004;231:775-84

## TRIPLE CONTRAST SPIRAL CT IN PENETRATING TORSO TRAUMA

RESULTS CT NEGATIVE (132/200)

- MINOR INJURIES 58% (76/132)  
DISCHARGED WITHIN 24 HRS
- NEEDED Rx 42% (56/132)  
THORACIC INJURIES (57%), ORTHO (23%),  
HEAD & SPINAL (9%), OTHERS (11%)

## TRIPLE CONTRAST SPIRAL CT IN PENETRATING TORSO TRAUMA

### BOWEL INJURY

- Oral or rectal contrast extravasation
- Extravasation of intestinal content
- Bowel wall thickening

## TRIPLE CONTRAST SPIRAL CT IN PENETRATING TORSO TRAUMA

### BOWEL INJURY

- Defect or discontinuity of bowel wall
- WT extending up to bowel

### BOWEL INJURY

	Blunt		Penetrating	
	SEN	SPE	SEN	SEP
FA	++	+++++	NA	NA
FF	+++++	++	NA	NA
OCE	+	+++++	++	+++++
BWT	+++	++	++++	++++

## TRIPLE CONTRAST SPIRAL CT IN PENETRATING TORSO TRAUMA

### MESENTERIC INJURY

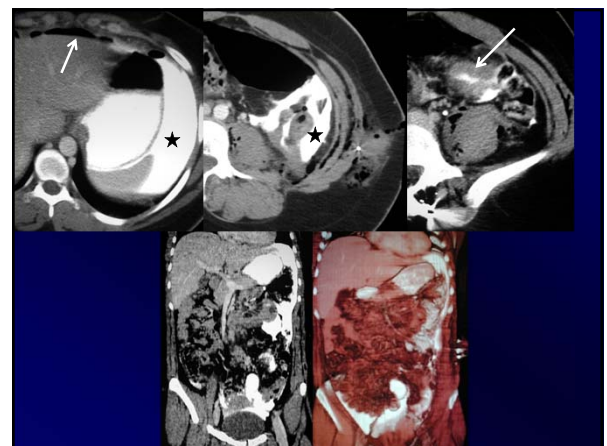
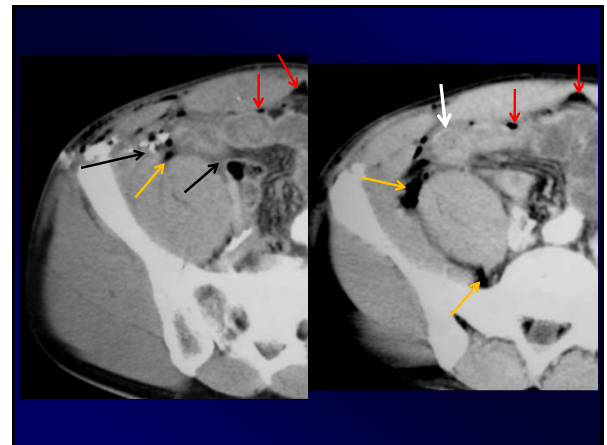
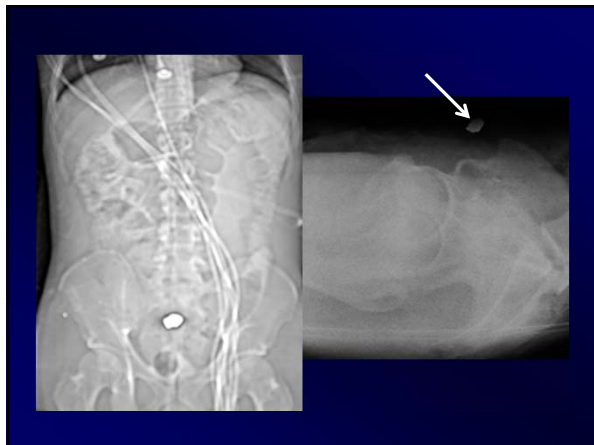
- Active bleeding - mesentery
- Focal hematoma
- Stranding or infiltration

## TRIPLE CONTRAST SPIRAL CT IN PENETRATING TORSO TRAUMA

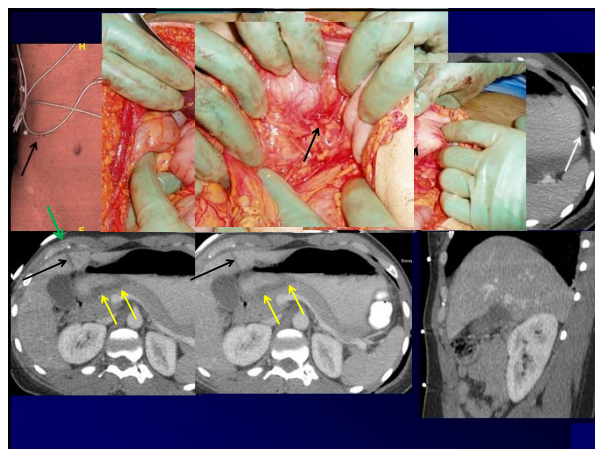
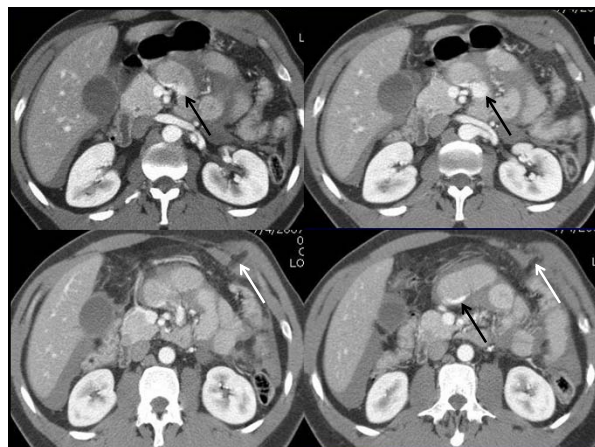
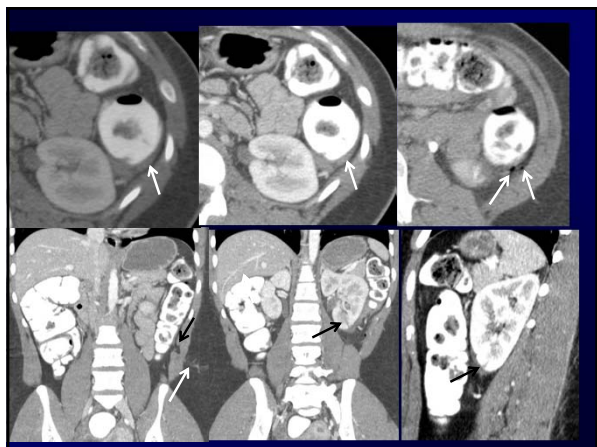
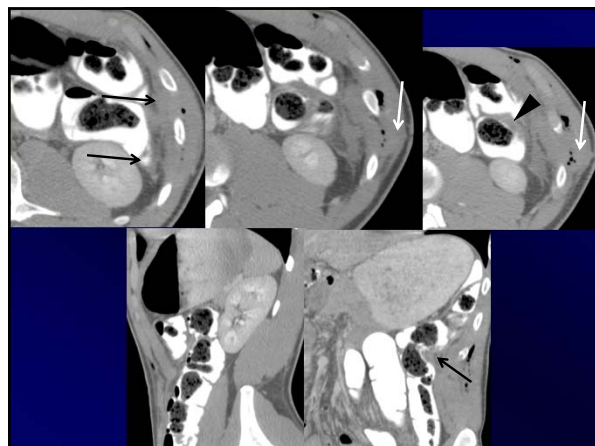
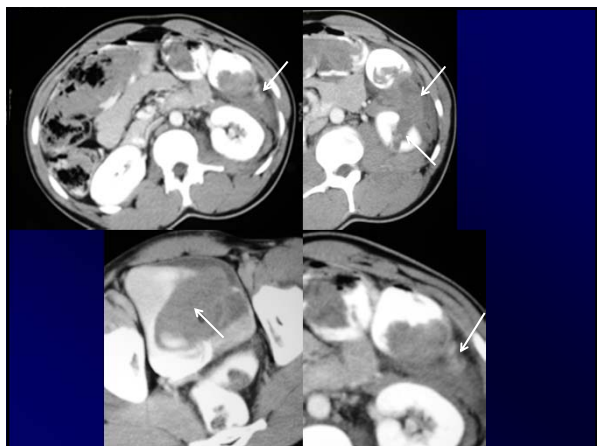
### RESULTS BOWEL INJURY 26/200

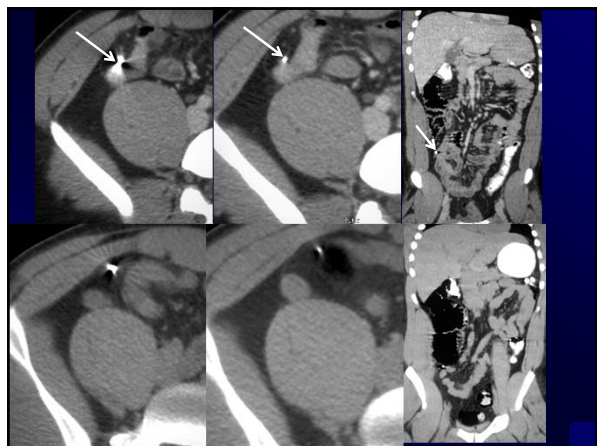
• WOUND TRACT	20/26	70 %
• BOWEL WALL THICKENING	11/26	42 %
• CONTRAST LEAK ORAL/RECTAL	5/26	19 %

KS, SEM, WCC, RADIOLOGY 2004;231:775-84









## IMAGING OF EMERGENCY GENERAL SURGERY

### EAST Scientific Assembly Workshop

Deb Stein as a poor stand-in  
Who is not  
"Professor, Director Emergency Radiology  
Department of Radiology & Maryland Shock-Trauma Center"

~~Shane Korman, M.D., FRCR~~  
Professor, Director Emergency Radiology  
Department of Radiology & Maryland Shock-Trauma Center  
University of Maryland School of Medicine

## Goals

- ☐ Review role of oral contrast in emergency abdominal/pelvic imaging
- ☐ Describe non-bowel surgical entities
  - Appendicitis
  - Cholecystitis
  - Complicated Pancreatitis
  - Complicated Diverticulitis
  - Ovarian torsion
- ☐ Describe bowel surgical entities:
  - Obstruction: hernia, tumor, volvulus
  - Strangulation
  - Bowel ischemia
  - Bowel perforation

## Oral Contrast ?

- Increases study time
- Risk of contrast aspiration (rare!)
- NG tube needed for some patients
- Cost increased
- Improved image quality at 64+ MDCT
- For non-traumatic abdominal pain-no difference (Anderson SW, et al. AJR:193, Nov. 2009)

## When to Use Oral Contrast (+IV) 2-hr split dose

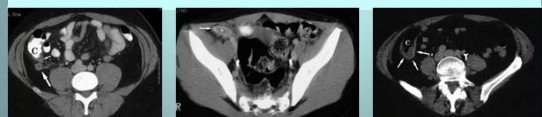
- Inflammatory bowel disease
- ? Malignancy
- Recent surgery
- High likelihood of abscess
- Radiologist discretion
- ? Complicated pancreatitis
- Generalized abdominal pain high likelihood of admission
- Suspect enteric fistula

## Abdominal Infection/Inflammation

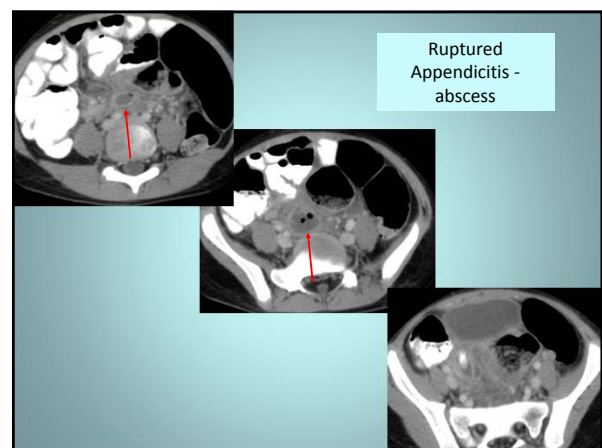
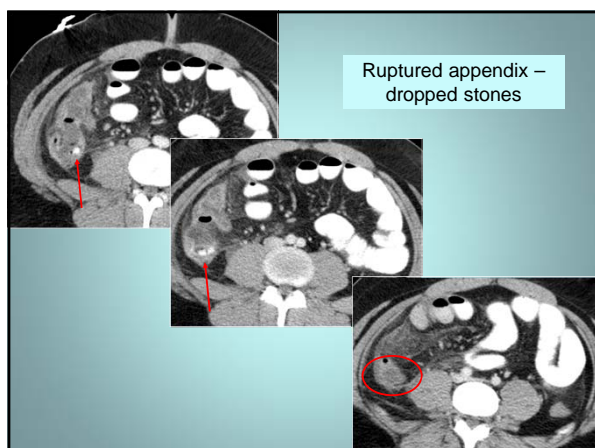
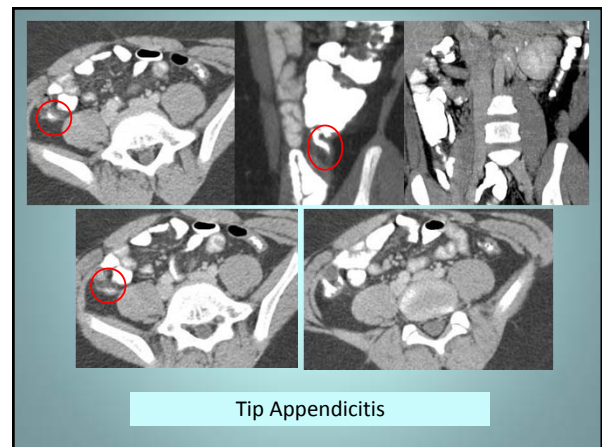
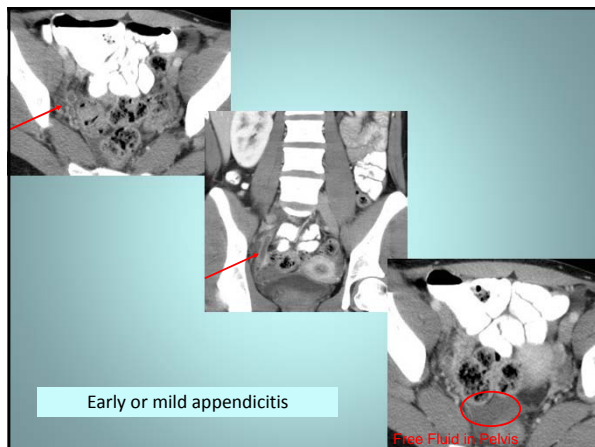
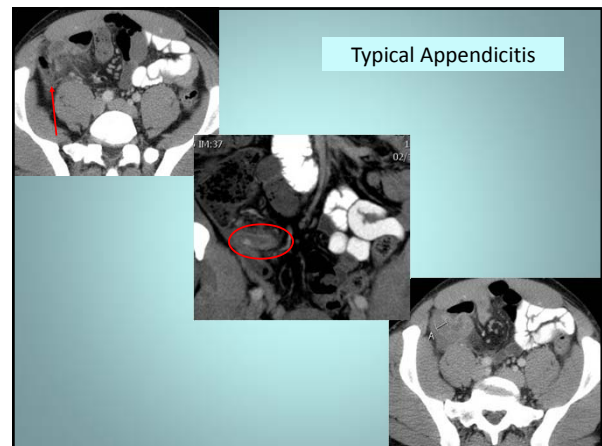
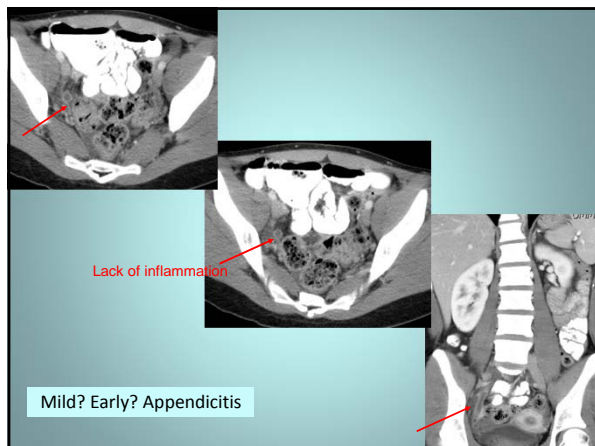
- Appendicitis
- Complicated Diverticulitis
- Complicated Cholecystitis
- Complicated Pancreatitis (rare)
- Surgical Mimics

## CT Findings - Appendicitis

- Wall thickening
- Wall enhancement
- Increased diameter ( >7 - 8 mm)
  - But ....42% of appendices 6-10mm are normal
- Periappendiceal fat opacification
- Thickened lateral conal fascia
- Paralytic ileus or obstruction
- Appendicoliths
- Arrowhead sign – mural thickening in cecum at appendix base
- Must see to blind ending tip

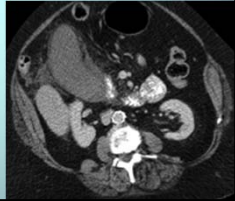




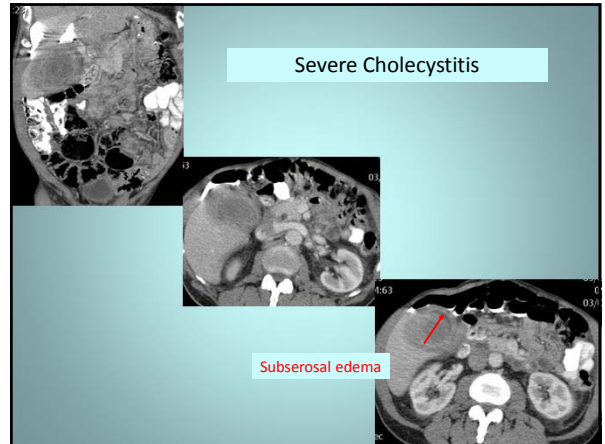


## Acute Cholecystitis – CT Findings

- Wall thickening (>4 mm in non-collapsed GB)
- Pericholecystic stranding/fluid
- Distension (> 5 cm short - 8 cm long)
- Mucosal hyperenhancement
- Subserosal edema
- High attenuation bile
- Sloughed mucosa
- Stones (90-95%)



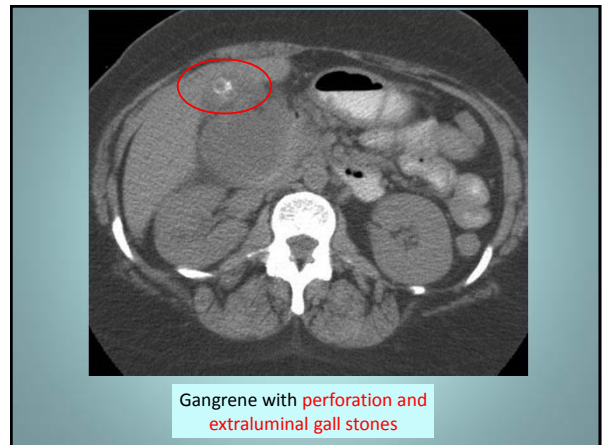
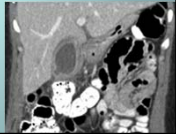
## Severe Cholecystitis



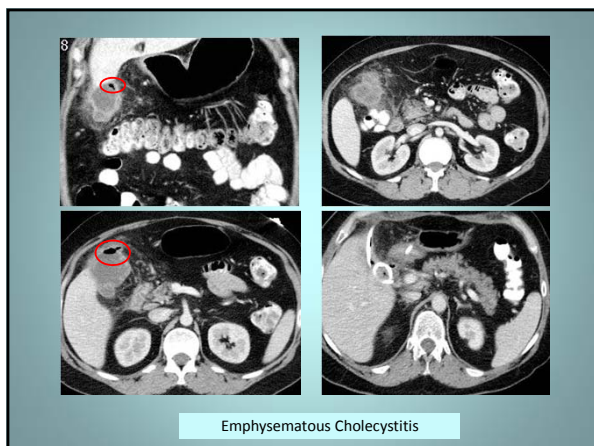
Subserosal edema

## Acute Cholecystitis Complications

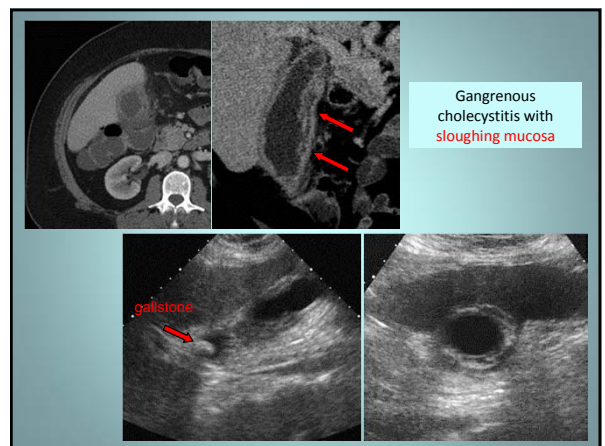
- Gangrene (2-38% cases) defect or sloughed membrane; free bile
- Emphysematous – diabetic, male, 40-60 yr
- Pericholecystic abscess (3-19%), enhancing
- Portal vein thrombosis
- Cystic artery aneurysm
- GB bleeding – inflammatory erosion
- CT has 89% NPV



Gangrene with perforation and extraluminal gall stones

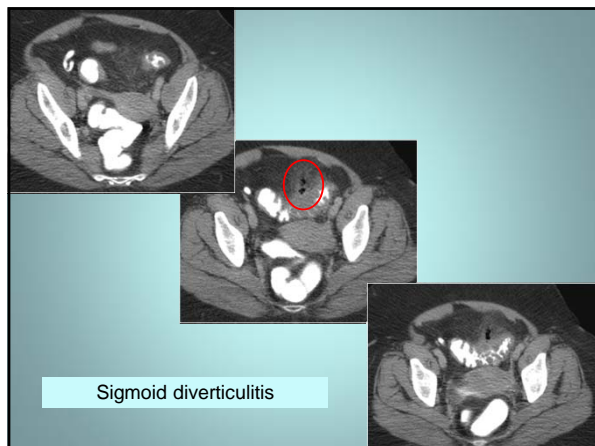


Emphysematous Cholecystitis



Gangrenous cholecystitis with sloughing mucosa

gallstone



## Imaging of Diverticulitis

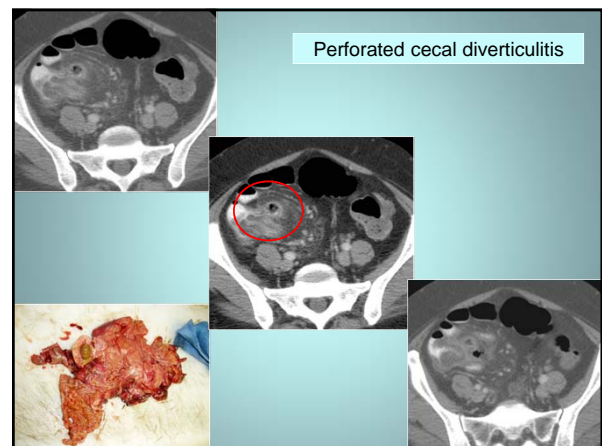
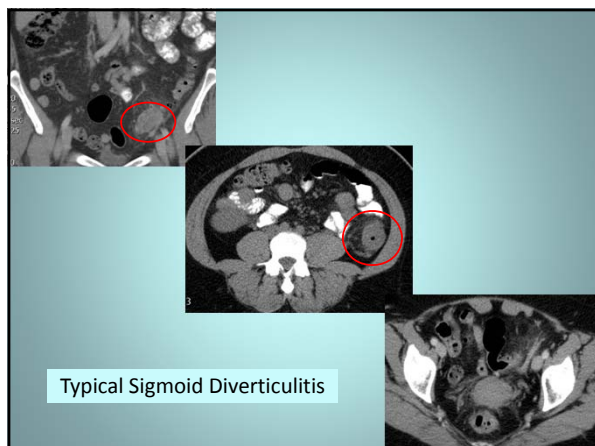
- 95% left-sided. Almost always colonic
- Pericolic fat stranding > wall thickening
- > 80% at least 1 diverticulum seen
- Comma sign – thickening of root of sigmoid mesentery
- Centipede sign – multiple parallel dilated mesenteric vessels supplying segment
- “Fuzzy diverticulum”

## Diverticulitis

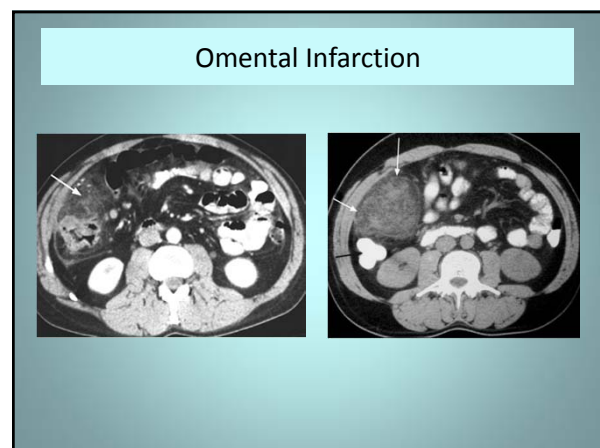
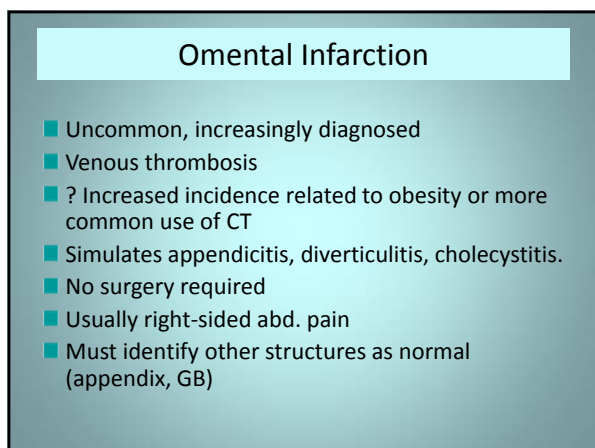
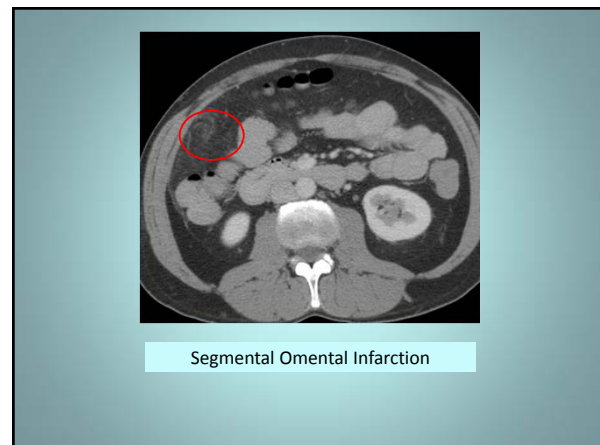
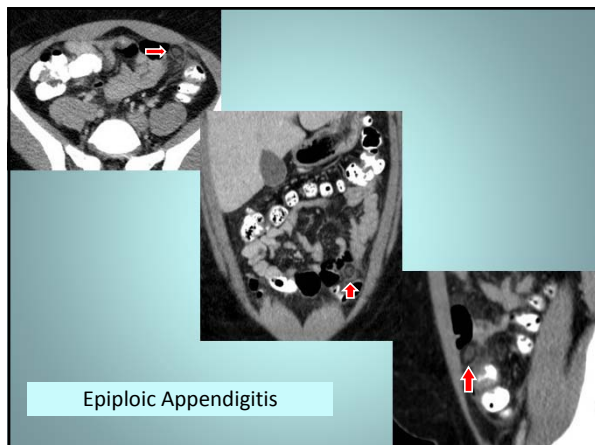
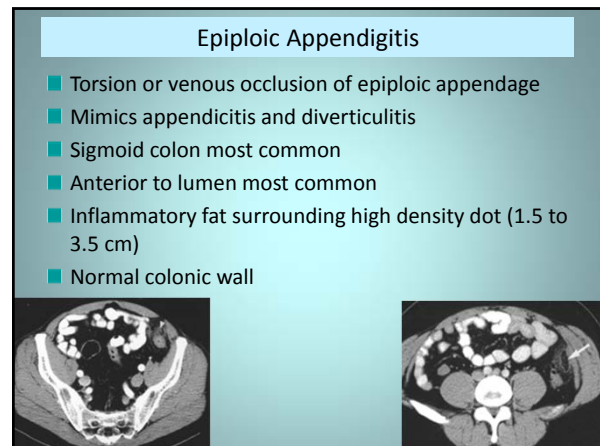
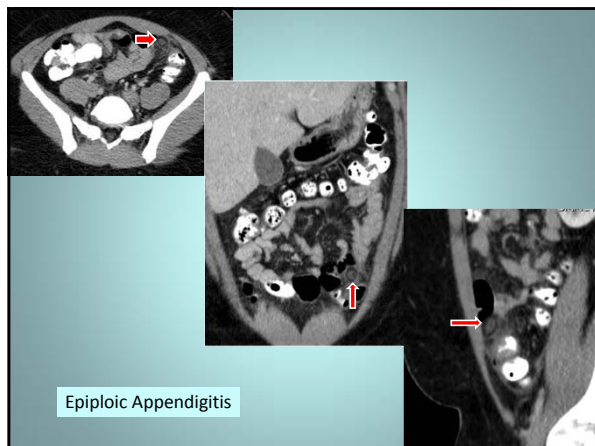
- Differential Dx. Adenocarcinoma
  - large regional nodes
  - prominent bowel wall thickening
  - F/U after resolution of acute sx

## Diverticulitis

- Complications:
  - intra or extramural abscess
  - sinus tract or fistula (colo-vesical)
  - bowel & ureteral obstruction
  - Perforation
  - Peritonitis
  - septic thrombosis
  - liver abscess







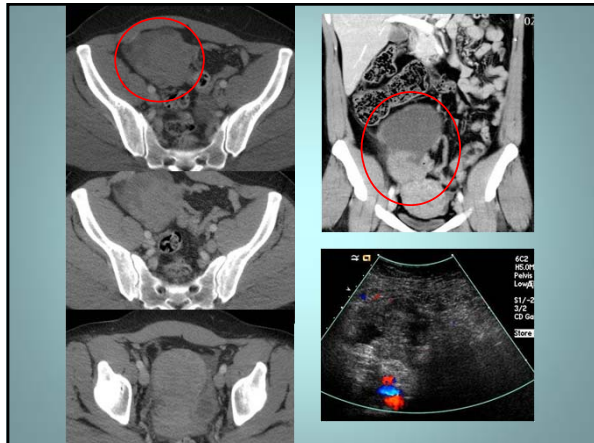


### Ovarian torsion

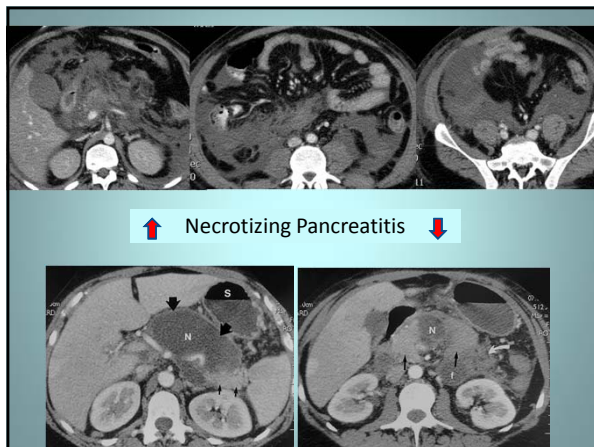
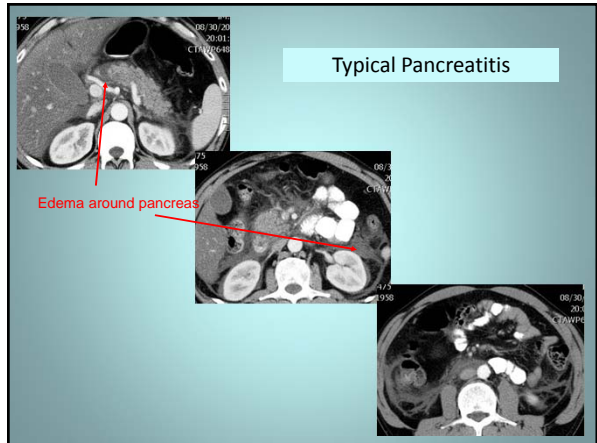


### Ovarian Torsion +/- tube

- 75% < 30 yr.
- 20% pregnant
- Long mesosalpinx, ovarian tumor, trauma, normal
- Extreme lower abdominal pain, emesis
- Enlarged ovary (28X) with peripheral cysts and co-existent mass, pelvic fluid
- Complex adnexal or pelvo-abdominal mass
- Diagnosis on US, color-flow Doppler
- Laparoscopy – confirm and Rx

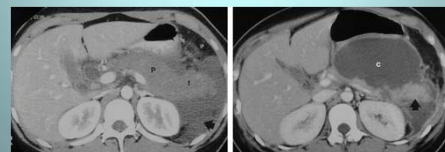


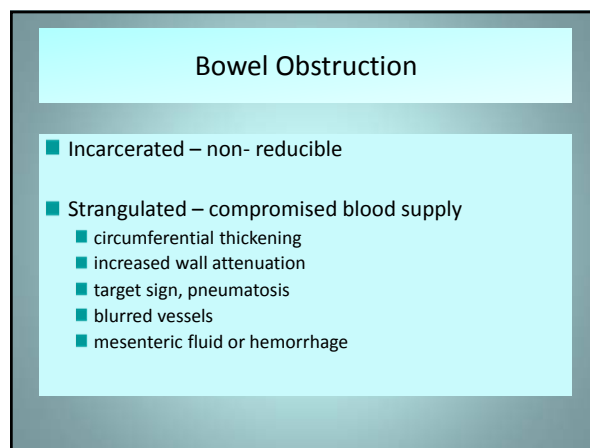
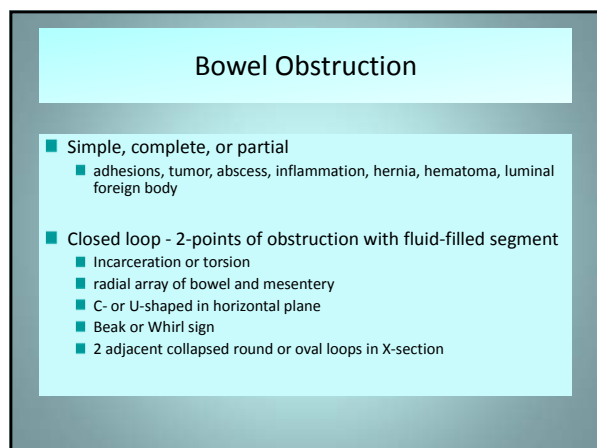
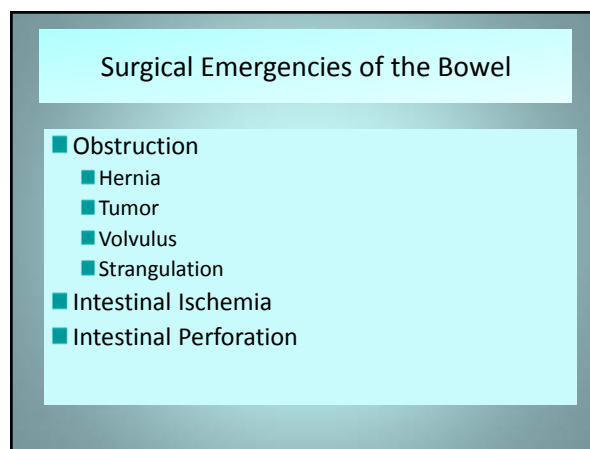
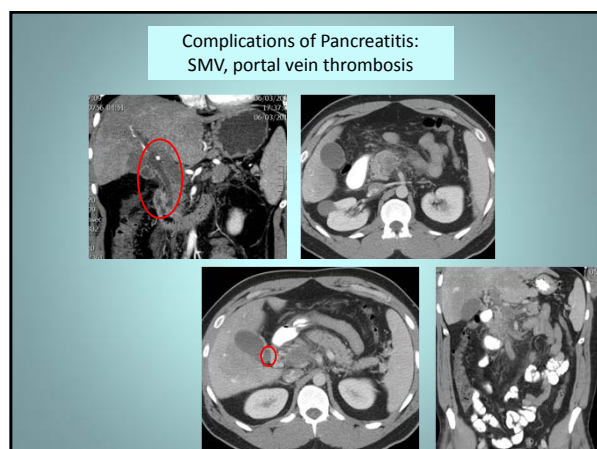
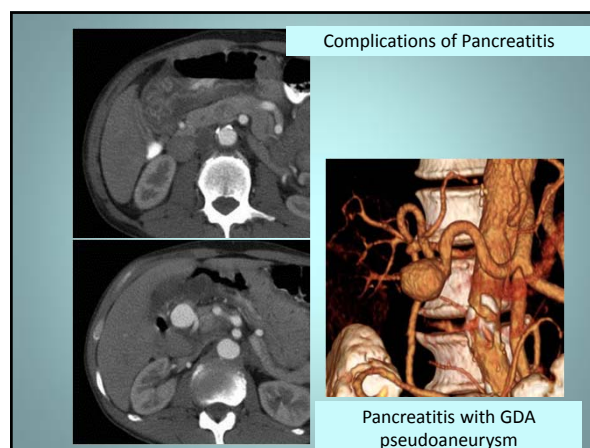
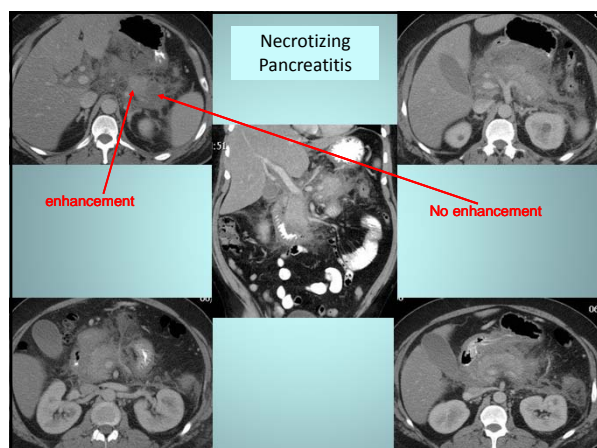
### Typical Pancreatitis

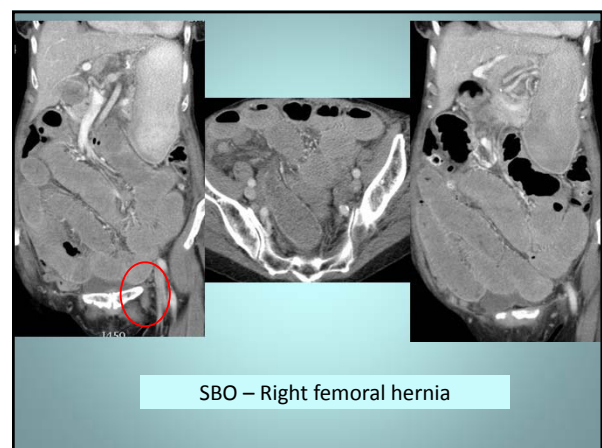
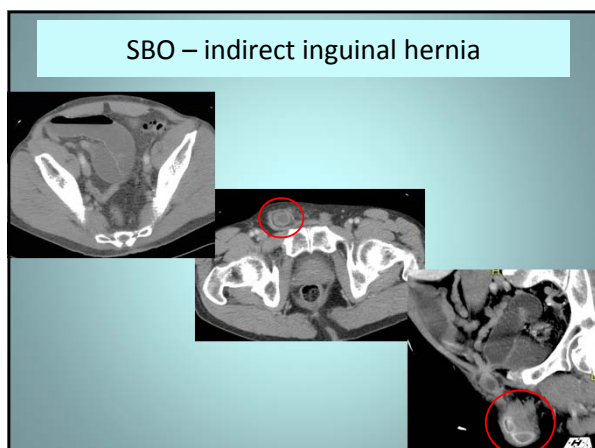
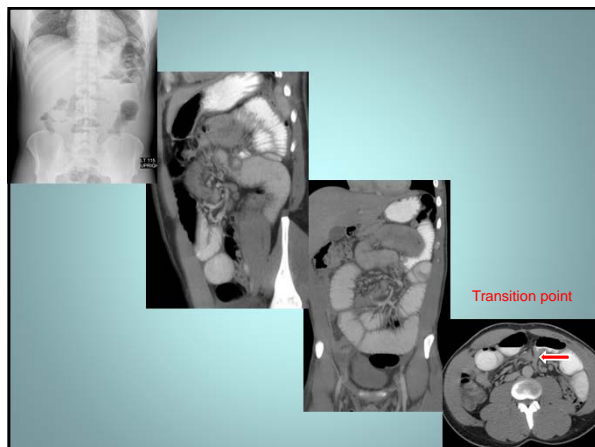
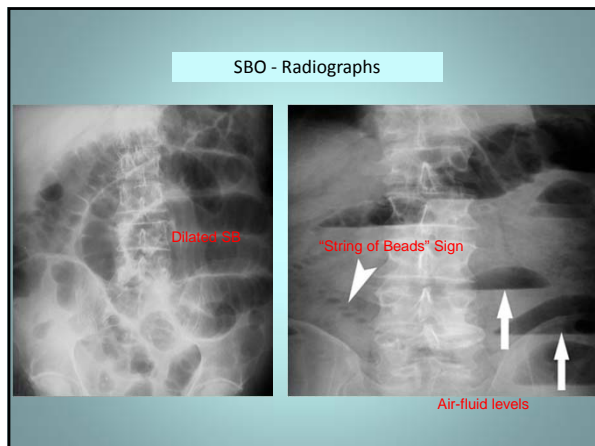


### Necrotizing Pancreatitis

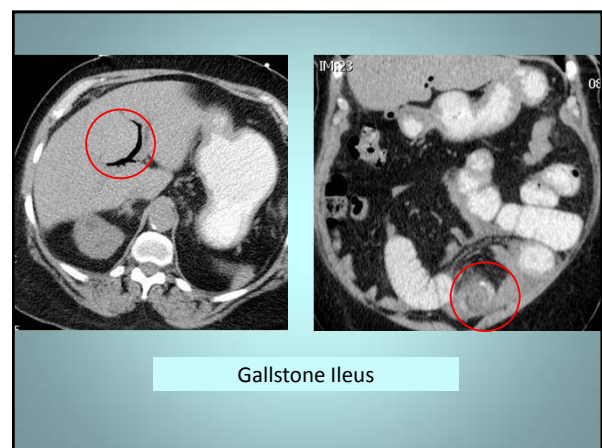
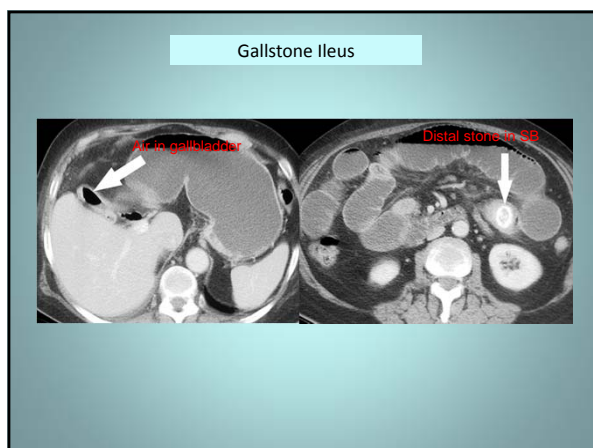
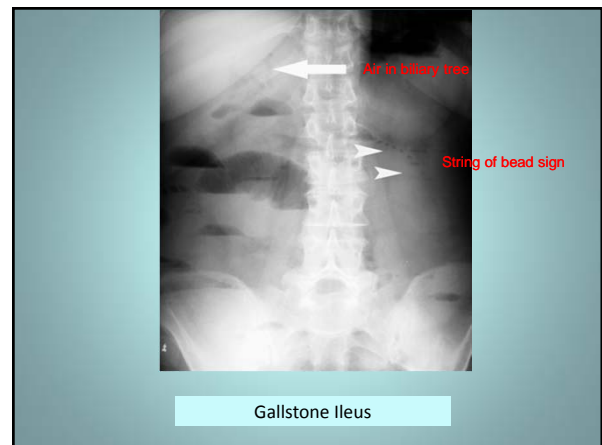
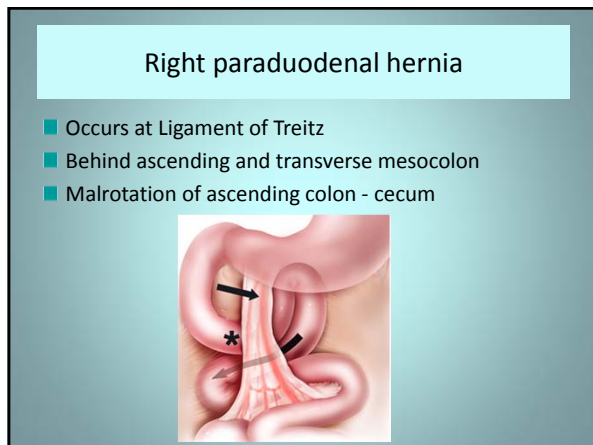
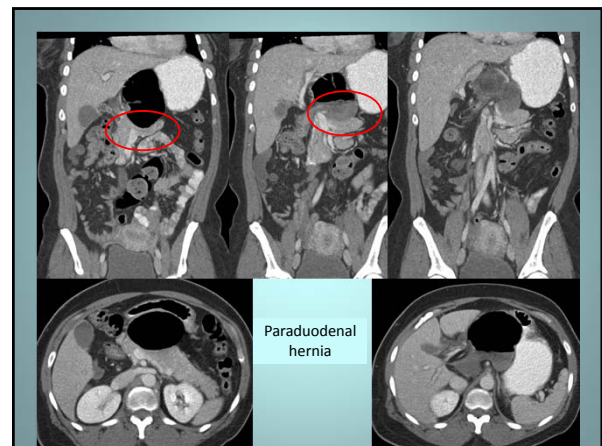
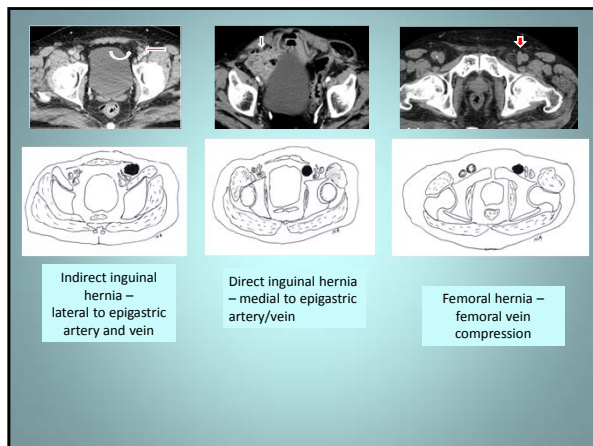
- Severe pancreatitis in 20-30%
- Mortality correlates with extent of necrosis
- Lack of IV contrast enhancement (< 30%, 30-50%, > 50%)
- Peripancreatic fluid collections
- CT more accurate for necrosis after 24 hr







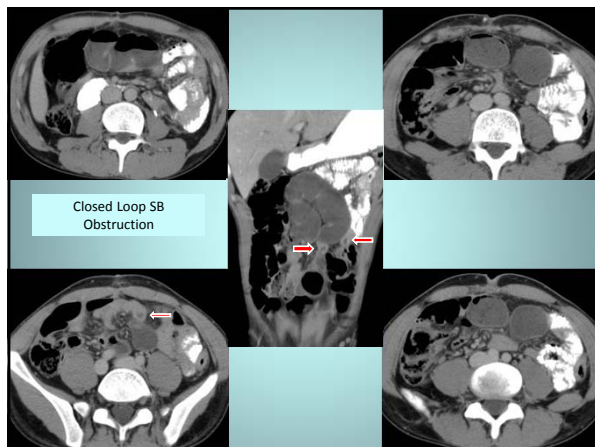








- Whirl sign of twisted mesentery – increases need for surgery 25x versus when sign absent.
- Malrotation
- Primary (long –mesentery length, short base), large meal after fasting (Ramadan)
- Secondary – adhesions, mesenteric and omental defects, pregnancy, stoma

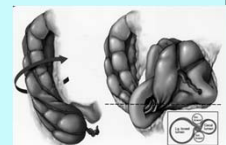


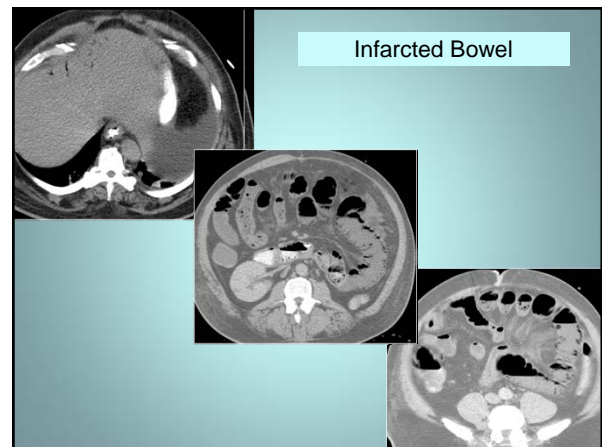
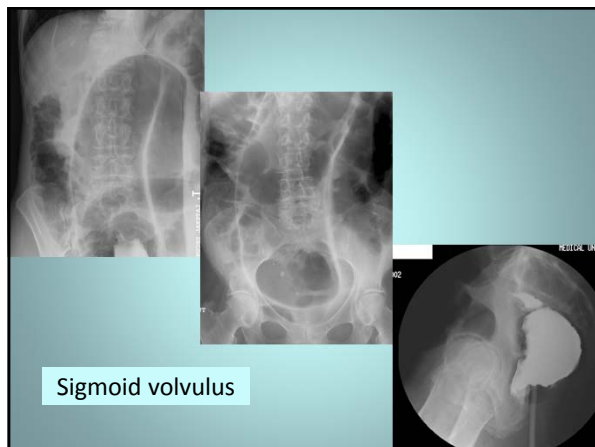
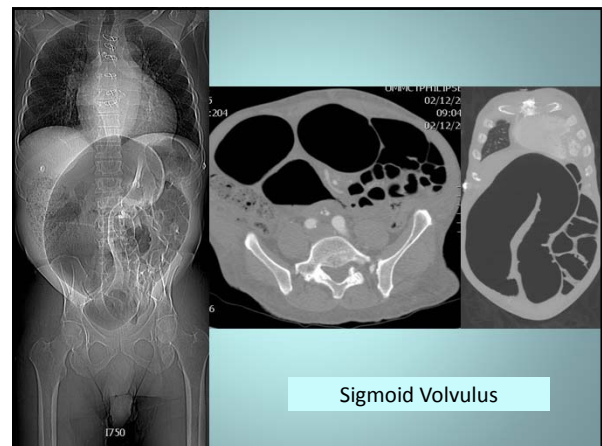
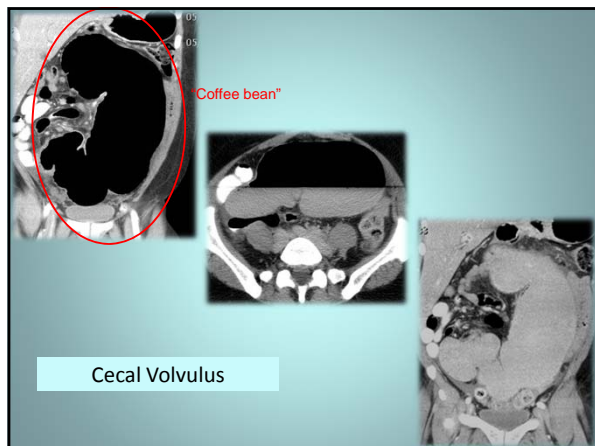
## Gastric volvulus

- Organoaxial volvulus is more common
  - the stomach rotates around an axis that connects the gastroesophageal junction and pylorus
- Mesenteroaxial volvulus
  - occurs around axis that from the center of the greater curvature of the stomach to porta hepatis
- Most cases of organoaxial volvulus are total
  - usually associated with paraesophageal diaphragmatic hernia, or diaphragmatic eventration
- The mesenteroaxial volvulus is most often idiopathic and partial

## Cecal Volvulus

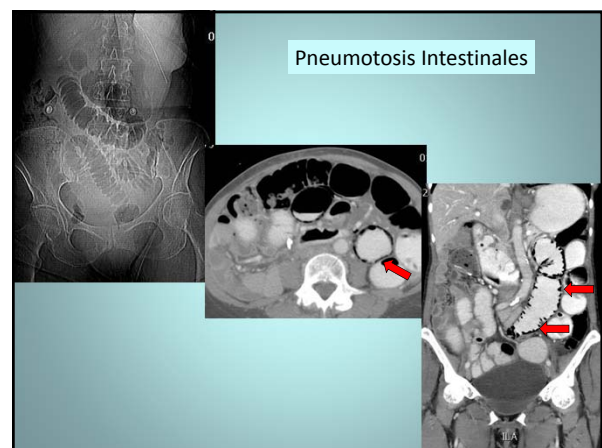
- Failure of cecal peritoneal fixation
- Fixed point of narrowing – fulcrum of rotation
- 11% of volvulus
- Prior surgery, pelvic mass, violent cough, atonia of colon, extreme exertion, unpressurized air travel
- Coffee bean, bird beak, whirl

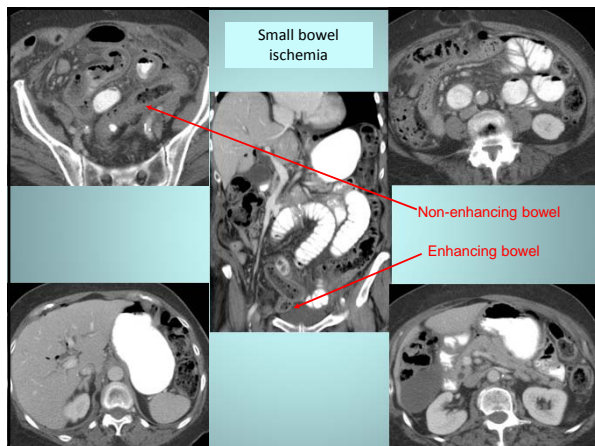




### Bowel Ischemia

- Linear streaks of air in bowel wall
- Thickened walls common (edema, hemorrhage) and target sign
- No enhancement of bowel wall (most specific)
- Mesenteric venous and portal venous air
- Engorged mesenteric veins and mesenteric edema

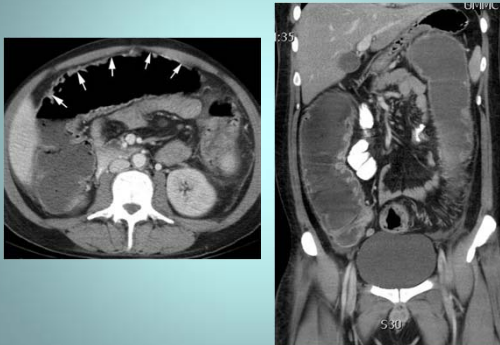




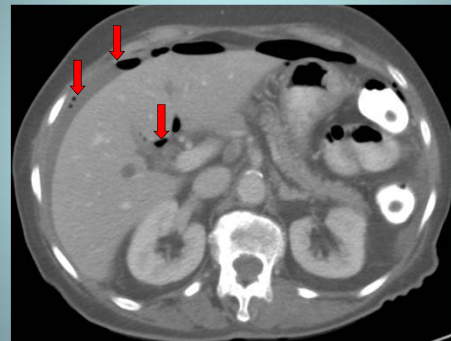
## Toxic Megacolon

- UC, Crohn, ischemic colitis, infectious colitis (C. diff, HIV, CMV, bacterial)
- ? Smooth muscle paralysis (Nitrous oxide, inflammatory mediators)
- Dilatation (> 6cm) , ahastral pattern
- Thin wall, nodular or shaggy mucosa (thumbprinting = hemorrhage or edema)
- Complications: Perforation, pneumatosis, septic thrombosis

## UC- toxic megacolon



## Perforated duodenal ulcer



## Bowel Perforation – duodenal ulcer



Thanks!

Questions?

Direct them to Dr. Shan!

## A Surgeon's Perspective Imaging in Trauma and Acute Care Surgery: A Crash Course!

Deborah M. Stein, MD, MPH  
R Adams Cowley Shock Trauma Center



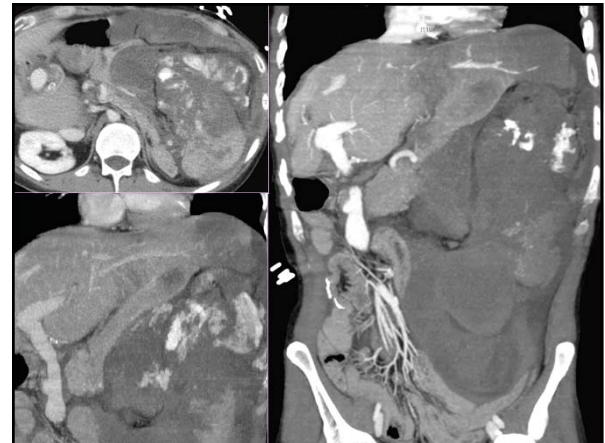
A few key points from the perspective of a surgeon...

- Some patients don't belong in CT

FAST - Pt. admitted 0628 Initial assessment Cephalic region  
Don't know (F) Fast abrasions 1 pair to  
sob. Present to CT scan. Diaphoretic pale x/o  
Chest pain 1st 2nd 3rd 4th 5th 6th 7th 8th 9th 10th  
Pt. Daughter

“...+ FAST...Pt. diaphoretic c/o SOB. Emergent to CT scan, bypass labs per Dr. X...”

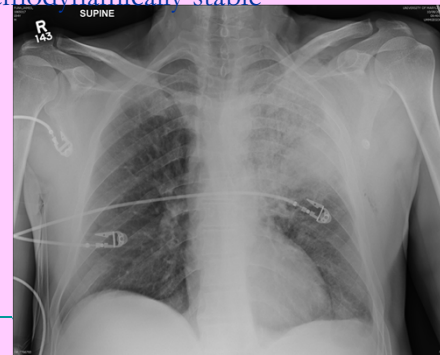
“...Multiple labs returned abnormal. Repeat labs sent. SBP 70s. 2uFFP hung...to IR with RN...”



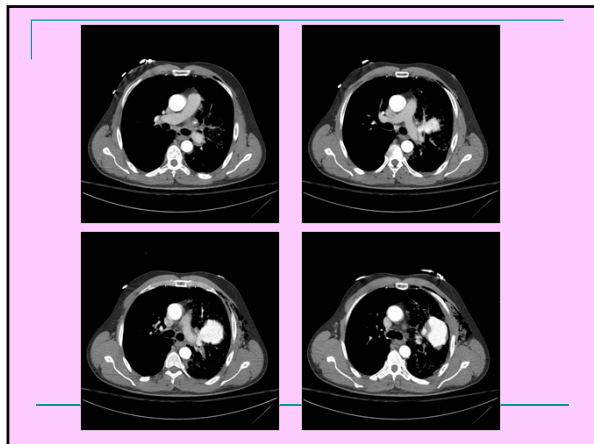
A few key points from the perspective of a surgeon...

- Some patients don't belong in CT
- And some patients do...

47 yo male s/p single sw to L chest.  
Hemodynamically stable

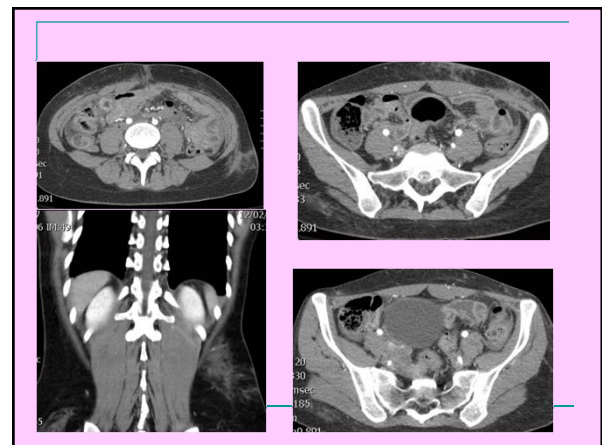






A few key points from the perspective of a surgeon...

- Some patients don't belong in CT
- And some patients do...
- **Examine the patient**

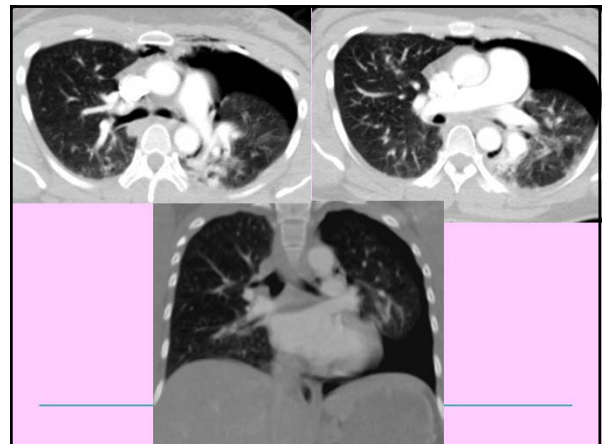
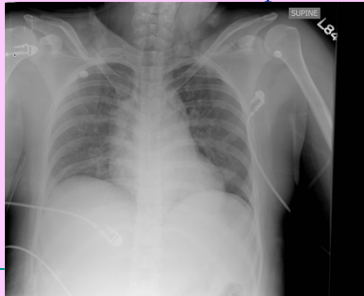


A few key points from the perspective of a surgeon...

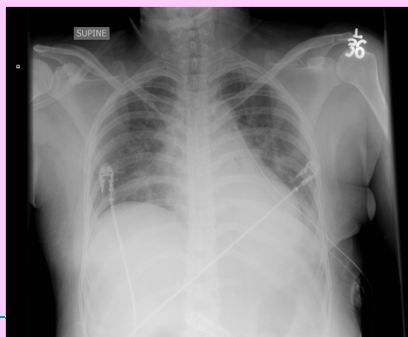
- Some patients don't belong in CT
- And some patients do...
- Examine the patient
- **Listen to the patient**



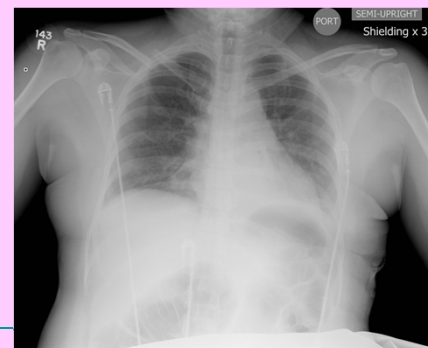
32 yo (32 week pregnant) female.  
 Restraigned back seat passenger in a T-  
 bone MVC. C/O L chest pain.



HD #2 – CT watersealed

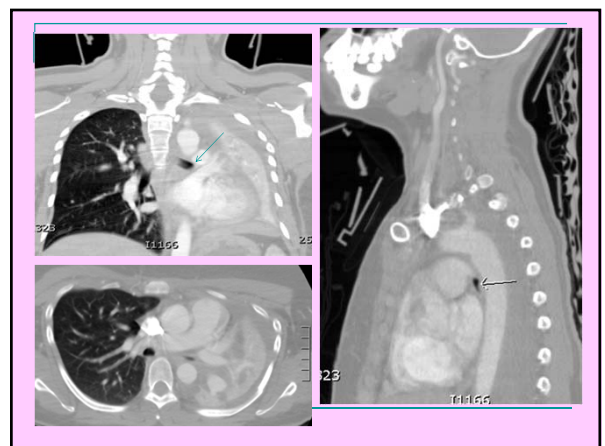
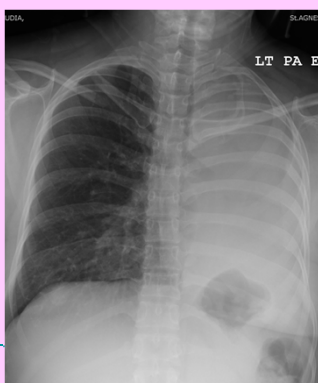


HD #3 – Pt d/ced home



Post injury day #16

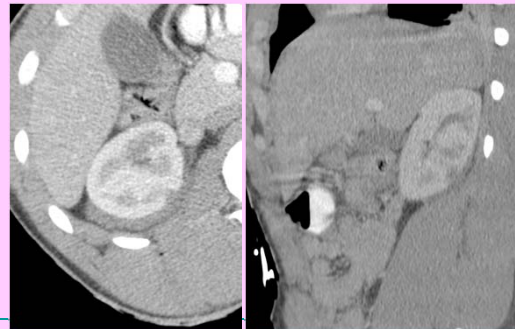
- Patient comes to the ED with shortness of breath



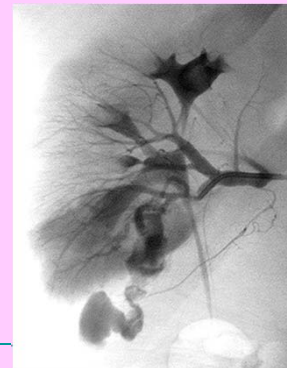
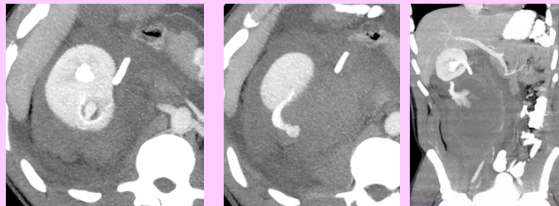
A few key points from the perspective of a surgeon...

- Some patients don't belong in CT
- And some patients do...
- Examine the patient
- Listen to the patient
- **Listen to your radiologist**

24 yo male S/P stab wound to the R back.



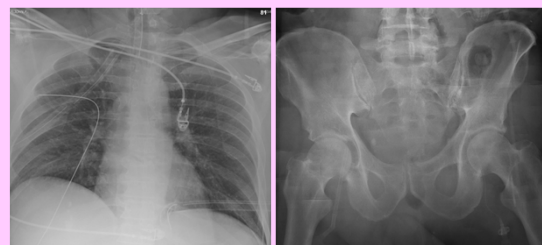
Develops hematuria on post-injury day #5



A few key points from the perspective of a surgeon...

- Some patients don't belong in CT
- And some patients do...
- Examine the patient
- Listen to the patient
- Listen to your radiologist
- **If something doesn't make sense, there is usually a reason**

66 yo male s/p MVC, ejected. Intubated in field. Hypotensive en route. Arrests shortly after arrival



- ACLS
- B/L chest tubes

- Persistent profound hypotension/episodes of PEA with responses to Epi

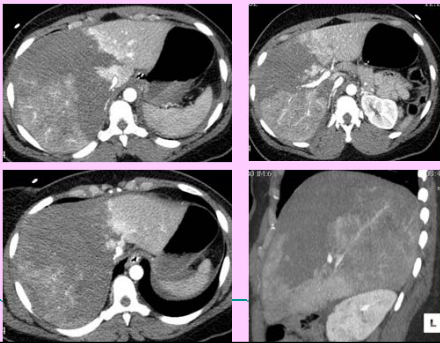
- Abrasions over flank and abdomen
- Pelvis stable
- No deformities
- FAST negative
- No obvious source of bleeding



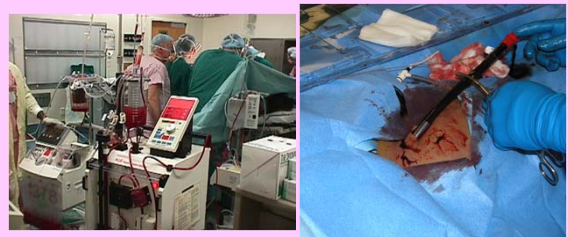
### A few key points from the perspective of a surgeon...

- Some patients don't belong in CT
- And some patients do...
- Examine the patient
- Listen to the patient
- Listen to your radiologist
- If something doesn't make sense, there is usually a reason
- **Pre-operative imaging is not a failure...use it to plan your operation**

52 yo woman s/p MVC. Initially stable then becomes hypotensive in CT



Veno-venous bypass initiated. R hepatic lobectomy. Left open and packed. 7L EBL



Patient unpacked the next day. Extubated on POD#3. Tolerating a regular diet on POD#5

Questions?

