Eastern Association for the Surgery of Trauma

EAST Masters Course Part V: This is How I Do It

January 16, 2014
Waldorf Astoria Naples
Naples, Florida

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American College of Surgeons
Division of Education

How I Treat Complex Pelvic Fractures in Gainesville

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Disclosures

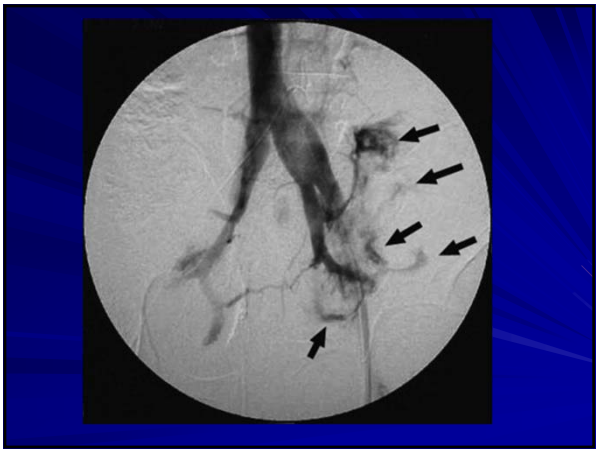
- Synthes / J&J – Consultant
- Vidacare – Consultant
- Haemonetics - Consultant

Objectives

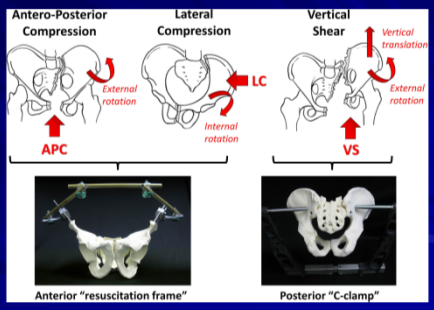
- Statement of the problem
- Initial hemodynamic management
- Pre-operative management
- Operative management
- Post-operative management

The Issue with Pelvic Fractures

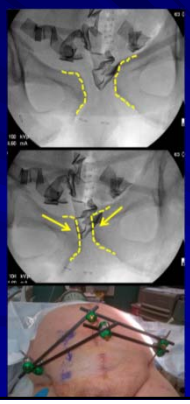
- Mortality is 20% to 60%
- Concomitant other injuries
- But still pelvic hemorrhage accounts for cause of death in 30% to 40%
- Three sources of bleeding
  - Arterial - 20%
  - Venous - 80%
  - Cancellous bone - 100%



Simple Classification of Pelvic Fractures



External Fixation



Classification

- Young and Burgess
- Anteroposterior compression (APC)
- Lateral compression (LC)
- Vertical shear (VS)
- Combined mechanism (CM).

Anterior Posterior Compression

- APC-1: Stable injury pattern with ‘‘sprain’’ of the pubic symphysis (G2.5-cm diastasis), no injury to the posterior elements.
- APC-2: Rotationally unstable injury pattern with complete disruption of pubic symphysis (92.5-cm diastasis)and disruption of the anterior SI ligament.
- APC-3: Rotationally and vertically unstable injury patternwith complete disruption of pubic symphysis (92.5-cmdiastasis) and complete disruption of the anterior and posteriorSI ligaments.

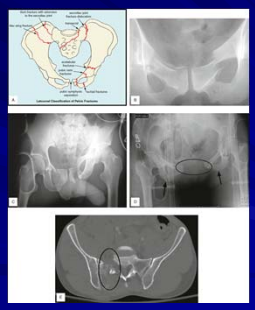
Lateral Compression

- LC-1: Stable injury pattern with transverse pubic rami fractures and stable impaction fracture of the ipsilateralsacrum. Minimal or no internal rotation deformity.
- LC-2: Rotationally unstable injury pattern with transverse pubic rami fractures, unstable posterior fracture/dislocation of the ipsilateral SI joint, and internal malrotationof the injured hemipelvis. The ‘‘classic’’ LC-2 pattern is reflected by a transiliosacral (‘‘crescent’’) fracture dislocation.
- LC-3: Rotationally and vertically unstable injury pattern with ipsilateral and contralateral injury to the posterior elements (‘‘windswept pelvis’’).

Vertical Shear

- The VS injury pattern consists of a complete disruption of the pubic symphysis (with or without associated pubic rami fractures) and a complete disruption of the SI joint (with or without associated fractures of the iliac wing and sacrum).
- The injured hemipelvis is externally rotated and vertically translated, resulting in a combined rotational and translation instability.

Combinations



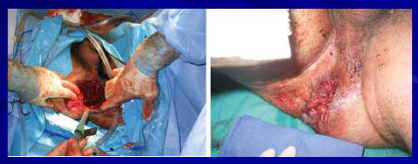
Treatment Modalities In The Trauma Center

ABCs

- Mechanism of injury
  - Straddle – MCC, ATV, Riding Lawnmower?
  - Ejection
  - Fall
- Physical examination
  - Palpate the symphysis pubis
  - Urethral inspection
  - Perineum/Rectal examination – **MUST DO!**
- Istat Labs
  - Hct, LA, INR, PT, Na, K, Cl, creatinine, Ca, ABG
- Rapid TEG
- Early intubation
- Intraosseous access
  - 15 gauge bilateral humerus
- 5F Arterial line in femoral artery
- 9F Introducer in subclavian vein

IO

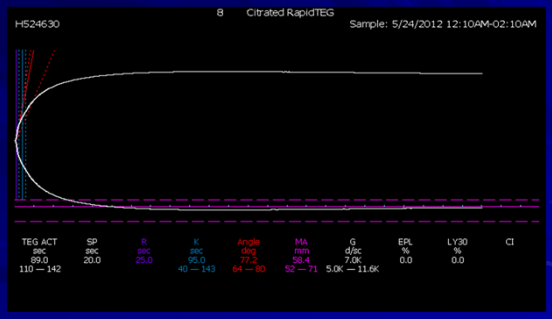
Physical Examination



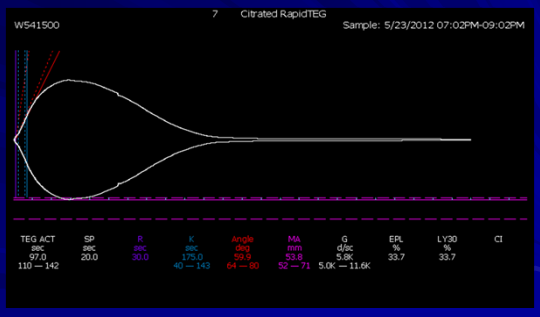
Physical Examination

ISTAT

Rapid TEG



Rapid TEG

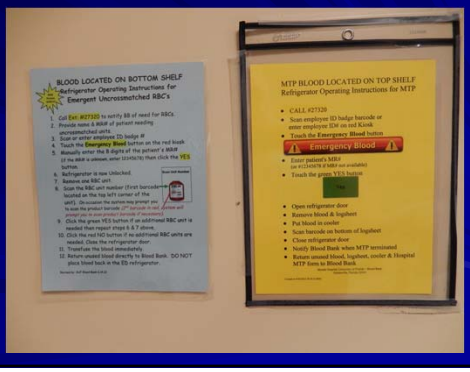


Massive Transfusion Protocol

- **"Injured patients bleed blood … not Ringer's Lactate"**
- 6 units of O (-) and 6 units O (+)
- 6 units of thawed plasma
- 10 unit platelet pack with second cooler (not on ICE!) from the blood bank
- Immediate activation
- rTEG guided resuscitation
- Tranxemic acid – 1 gm load / 1 gm 8 hours

MTP

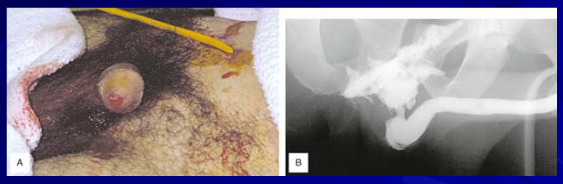
MTP



The Rest of the Story

- Pelvic radiograph
- FAST
- Retrograde Urethrogram
  - ?One pass of the Foley?
- Binder or Sheet wrap

Retrograde Urethrogram

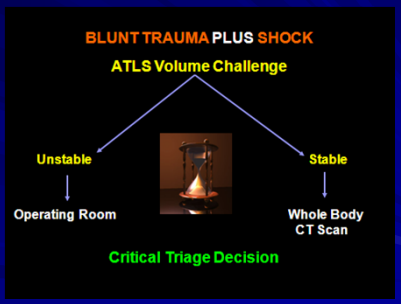


What next?

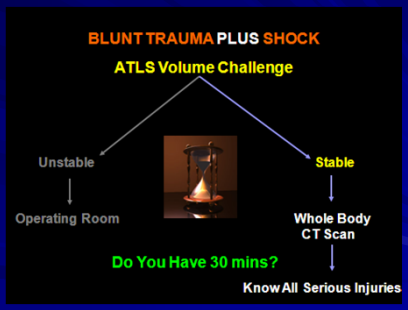
- CT scan
  - Fine cuts of pelvis
  - Must use contrast - protect for AKI
  - Fill the bladder with contrast
  - "Death begins in CT scan"
  - What to look for (you need to look !!!)
    - Arterial blush
    - Hematoma
    - Pear shaped bladder
- Angiography
- OR

BLUNT TRAUMA PLUS SHOCK
A Decision Making Conundrum

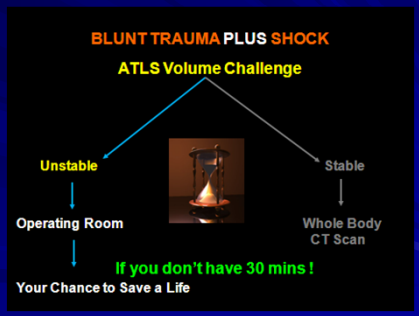
What is the conundrum?



What is the conundrum?



What is the conundrum?



OR

OR

Pre-peritoneal Pelvic Packing

- OR team must be ready for rapid packing
- Two Cell Saver suctions … rapid infuser filled and running into large bore lines above the diaphragm
- Radial arterial line must be in place
- Pfannenstiel preferred over midline
  - Keeps PPP and Laparotomy really separate
  - Open rectus in midline, push bladder down
- OR technician must have 7 or 8 moist laps folded in thirds rolled up ready
- Your **WHOLE** hand must be in retroperitoneal space … push back to sacrum
- **Three rolled up laps right and left, deep, one or two over middle**
- Close midline fascia with running suture
- Close skin with staples

Pre-peritoneal Pelvic Packing

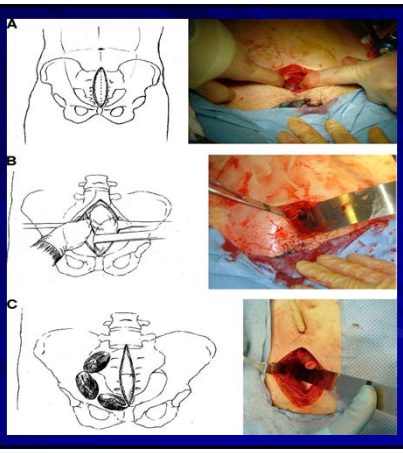
- Historically open surgical exploration with ligation of arterial bleeding advocated
  - Difficult to access the arteries
  - Uncontrollable bleeding and death
- Then packing via open laparotomy because the hematoma ruptured
  - Again uncontrollable bleeding and death
- Finally, operative interventions were always done late as a desperate maneuver

Pre-peritoneal Packing

- True pre-peritoneal packing done in Europe by trauma surgeons for the last 10 years
- Ertel et al. showed multiply injured patients with ISS 40 could be successfully treated with a C-clamp and packing without embolization
- The Denver group began to popularize in the US

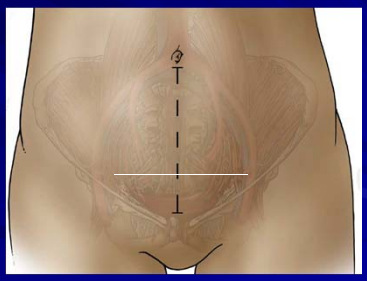
Preperitonal pelvic packing for hemodynamically unstable pelvic fractures: a paradigm shift.

- Cauthren, et al. J Trauma. 2007 Apr;62(4):834-9
- PPP is a rapid method for controlling pelvic fracture-related hemorrhage that can supplant the need for emergent angiography. There is a significant reduction in blood product transfusion after PPP, and this approach appears to reduce mortality in this select high-risk group of patients.



Pre-peritoneal Pelvic Packing

Pre-peritoneal Pelvic Packing



Pre-peritoneal Pelvic Packing

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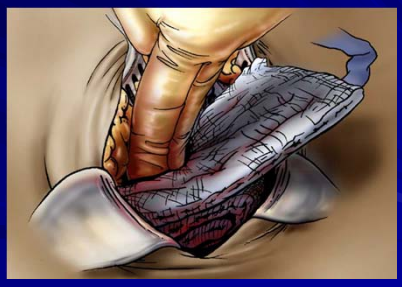


Pre-peritoneal Pelvic Packing

Pre-peritoneal Pelvic Packing

Pre-peritoneal Pelvic Packing

Plus

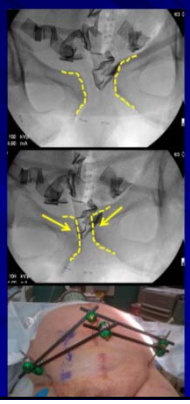
Midline Laparotomy

Plus

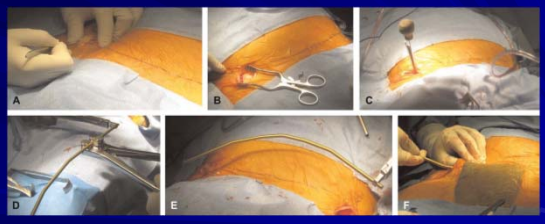
Packing

External Fixation

External Fixation



Treatment of Unstable Pelvic Ring Injuries With an Internal Anterior Fixator and Posterior Fixation: Initial Clinical Series



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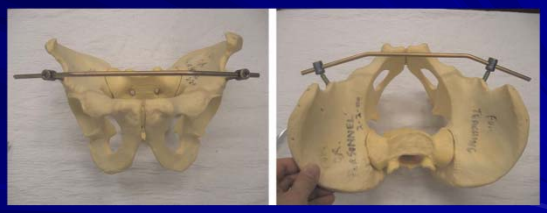

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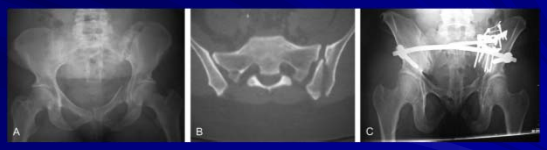


Angiography

- Where in the world (except Shock/Trauma) can you get the catheter in the femoral artery in less than **60 minutes** from the time you pick up the phone????
- Do you have a "hybrid" OR?
- Radiology or Vascular Surgery?
- Who manages the patient in angiography?
- Don't forget about that femoral a-line put in during the initial resuscitation.

Angiography

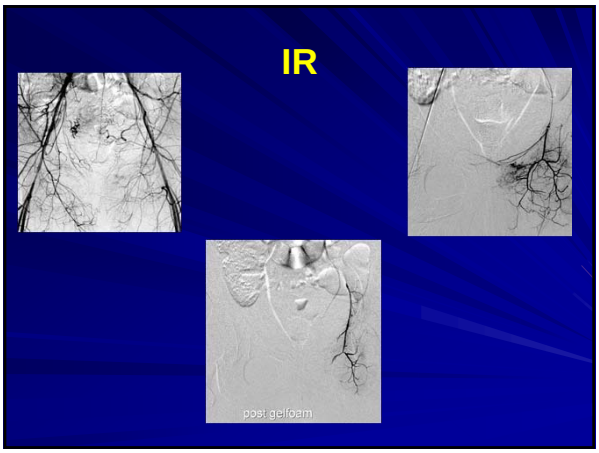
- Takes a minimum of 30 minutes and a maximum of 90 minutes to get patients on the table and the catheter in place
- Really only attacks arterial bleeding which requires pre-study diagnostic CT angiogram or flush study arteriogram
- Contrast induced nephropathy is a real issue among trauma patients, whether pre-existing renal disease or not, massive transfusion and resuscitation often compromise the vascular/renal axis whether or not vasopressors are needed

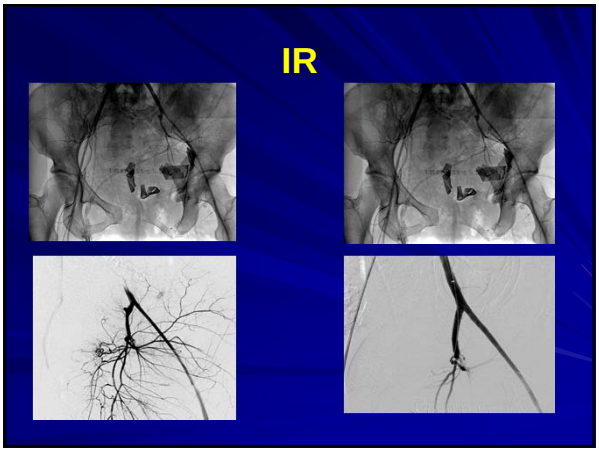
IR

- Go to Angio if hemodynamically unstable after pelvic packing
- Remember the femoral artery catheter
- Angiographers must be able to work around radiopaque laparotomy pads
- Coils better than gelfoam slurry
- Place IVC filter at conclusion of emobolization if hemodynamically stable (average time 5-7 minutes)

IR





IR
post gelfoam


IR


Complications of Angiography

Pelvic packing or angiography: competitive or complementary?

- Susiki, Moore, et al. Injury. 2009 Apr;40(4):343-53
- Pelvic angiography is an established technique that has evolved into a highly effective means of controlling arterial pelvic haemorrhage. The current dominant paradigm for haemodynamically unstable patients with pelvic fractures is angiographic management combined with mechanical stabilisation of the pelvis. However, an effective rapid screening tool for arterial bleeding in pelvic fracture patients has yet to be identified. There is also no precise way to determine the major source of bleeding responsible for haemodynamic instability. In many pelvic fracture patients, bleeding is from venous lacerations which are not effectively treated with angiography to fractured bony surfaces. Modern pelvic packing consists of time-saving and minimally invasive techniques which appear to result in effective control of the haemorrhage via tamponade.

Direct retroperitoneal pelvic packing versus pelvic angiography: A comparison of two management protocols for hemodynamically unstable pelvic fractures.

- Osborn, et al.;Injury. 2009 Jan;40(1):54-60
- The PACK group underwent operative packing at a median of 45min from admission; the median time to angiography in the ANGIO group was 130min. The PACK group, but not the ANGIO group, demonstrated a significant decrease in blood transfusions over the next 24h post intervention. In the ANGIO group, ten people required embolisation and six died, two from acute haemorrhage; in the PACK group, three people required embolization; four died, none due to uncontrolled haemorrhage.

Pre-peritoneal pelvic packing/external fixation with secondary angioembolization: optimal care for life-threatening hemorrhage from unstable pelvic fractures.

- Burlew, et al.J Am Coll Surg. 2011 Apr;212(4):628-35
- Among 1,245 patients admitted with pelvic fractures, 75 consecutive patients underwent PPP/EF (age 42 ± 2 years and injury severity score 52 ± 1.5). Emergency department systolic blood pressure was 76 ± 2 mmHg and heart rate 119 ± 2 beats/min. Time to operation was 66 ± 7 minutes, and 65 patients (87%) underwent 3 ± 0.3 additional procedures. Blood transfusion before PPP/EF compared with the first postoperative 24 hours was 10 ± 0.8 units versus 4 ± 0.5 units ($p < 0.05$). The fresh frozen plasma-red blood cell ratio was 1:2. After PPP/EF, 10 patients (13%) underwent angioembolization with a documented blush; time to angioembolization was 10.6 ± 2.4 hours (range 1 to 38 hours). Mortality for all pelvic fractures was 8%, with 21% mortality in this high-risk group. There were no deaths due to acute hemorrhage.

Post-op / ICU

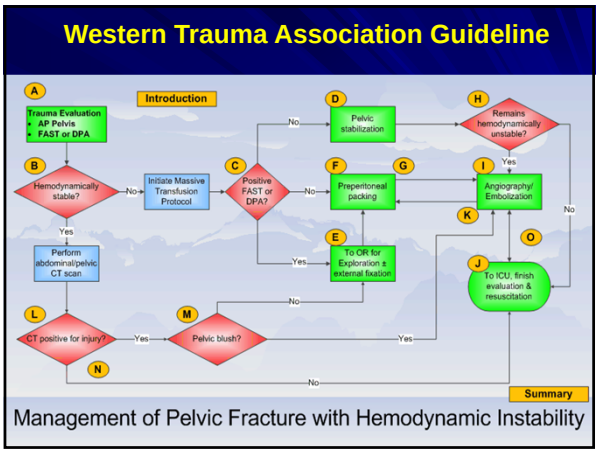
- TEG directed resuscitation
- Computerized decision support tree for resuscitation
- Minimalize crystalloids
- Correct lactic acidosis
- Binder on if no fixators
  - Binder for 24 hours at most
  - Start releasing as hemodynamic stability reached
- Back to OR within 24 hours
  - Remove all pelvic packs
  - +/- immediate internal pelvic fixation
  - Contrast cystogram a must
  - Closed suction drains in the pre-peritoneal space
  - Infix system

Summary

- **Save a life … go to the OR ASAP**
- No … MANDATORY angiography after packing is not necessary
- Packing is here to stay
- Most bleeding is venous
- Have an algorithm for management

PPP is here to stay …

- Hemodynamically unstable patients
- Better outcomes, less blood
- Three alternatives
  - Angioembolization alone
  - PPP alone
  - PPP with post-op angioembolization


Western Trauma Association Guideline
A
Introduction
Trauma Evaluation
AP Pelvis
FAST or DPA
B
Hemodynamically stable?
No
Initiate Massive Transfusion Protocol
C
Positive FAST or DPA?
No
D
Pelvic stabilization
No
H
Remains hemodynamically unstable?
Yes
F
G
Preperitoneal packing
I
Angiography/ Embolization
K
No
Yes
Perform abdominal/pelvic CT scan
E
To OR for Exploration ± external fixation
Yes
O
J
To ICU, finish evaluation & resuscitation
No
L
CT positive for injury?
Yes
M
Pelvic blush?
Yes
N
No
Summary
Management of Pelvic Fracture with Hemodynamic Instability


N911UF
SHANDS Care
Thank You!!!
Go Gators!!!!

MANAGEMENT OF THE POLYTRAUMA PATIENT WITH A COMPLEX NEUROLOGICAL INJURY

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USF HEALTH TRAUMA NETWORK
HCA FLORIDA

CURRENT ISSUES IN MANAGMENT

- What is the impact of extra-cranial injuries on outcome of patients with traumatic brain injury?
- What is the role of neuro-protective agents and techniques?
- What is the role of ICP monitoring?
- Do we use mannitol or HTS, or both?

IMPACT OF EXTRACRANIAL INJURIES

- In adults, the impact of extra-cranial injuries is inversely proportional to the severity of the traumatic brain injury

Lingsma H, Andriessen T, Haitsema I, et al.
J Trauma Acute Care Surg 74(2):639-646.

NEUROPROTECTIVE AGENTS AND TECHNIQUES

- Numerous trials in recent decades have had mostly negative results, and there remains a void in effective therapies.

Kolias AG, Guilfoyle MR, Helmy A, Allanson J. Pract Neurol 2013; 13: 228-235.

MORTALITY FROM TRAUMATIC BRAIN INJURY

- 150 Years of Treating Severe Traumatic Brain Injury: A Systematic Review of Progress in Mortality

Stein SC, Georgoff P, Sudha M, et al. J Neurotrauma 2010; 27:1343-1353.

EARLY MANAGEMENT OF TRAUMATIC BRAIN INJURY

- MAINTAIN / ACHIEVE HEMODYNAMIC STABILITY.
- LIMIT SECONDARY INSULTS FROM HYPOTENSION AND HYPOXIA.
- OBTAIN EARLY AND ACCURATE NEUROASSESSMENT.

CASE STUDY

- 32 YEAR OLD MALE
- HIGH SPEED MOTORCYCLE CRASH

CASE STUDY

- NO HELMET; UNCONSCIOUS
- BP = 100/60, P = 60, RR = 12
- PE at the scene: UNRESPONSIVE
  - 15 cm scalp laceration
  - deformity of the left thigh

PRE-HOSPITAL CARE

- 2 ATTEMPTS AT INTUBATION ARE UNSUCCESSFUL
- C-COLLAR & SPINE IMMOBILIZED
- 1 20 gauge IV INSERTED

ED ARRIVAL

- Initial Vital Signs: BP=80/40, P=58, SRR=8
- Large visible scalp laceration
- Open L distal femur fx
- Unresponsive to verbal or painful stimulation (GCS = 3)

ED PRIORITIES OF CARE

- AIRWAY: → INTUBATE

ED PRIORITIES OF CARE

- AIRWAY: → INTUBATE
- BREATHING: → DIMINISHED BILATERALLY, LEFT WORSE THAN RIGHT

ED PRIORITIES OF CARE

- AIRWAY: → INTUBATE
- BREATHING: → DIMINISHED BILATERALLY, LEFT WORSE THAN RIGHT

SpO_2 = 90% on 100% O_2

ED PRIORITIES OF CARE

- Five minutes have passed.
- BP=85/65, P=60, RR=18 (bvm)

- CIRCULATION:

ED PRIORITIES OF CARE

- Five minutes have passed.
- BP=85/65, P=60, RR=18 (bvm)

- CIRCULATION: ***MULTIPLE ATTEMPTS AT PERIPHERAL ACCESS ARE UNSUCCESSFUL***

ED PRIORITIES OF CARE

- A large-bore multi-port catheter is inserted via the left subclavian vein.
- POC laboratory studies obtained.
- MTP is activated.
- BP immediately increases to 105 systolic after 1 liter of NS.

ED PRIORITIES OF CARE

- BP 105/70, P 60, RR 12 (vent.)

OPTIMAL SBP ≈ 120 mmHg

Brenner M, Stein DM, Hu PF, Aarabi B, Sheth K, Scalea TM. Traditional systolic blood pressure targets underestimate hypotension-induced secondary brain injury. *J Trauma 2012; 72: 1135-1139.*

ED PRIORITIES OF CARE

- DISABILITY ASSESSMENT
- EXPOSE PATIENT/MAINTAIN BODY TEMPERATURE.

ED PRIORITIES OF CARE

- QUICK NEURO ASSESSMENT
- PUPILS:

  LEFT 4 mm, RIGHT 6 mm

  SLUGGISH LIGHT RESPONSE
- GCS 4(I)/15 (E2, V1, M1)
- TEMP = 34.5^0 C (94.1^0 F)

ED PRIORITIES OF CARE

A LARGE AMOUNT OF BLOOD IS COMING FROM UNDERNEATH THE "PRESSURE DRESSING" ON THE PATIENT'S HEAD, AND FROM THE LEFT LEG WOUND.

ED PRIORITIES OF CARE

- STOP THE BLEEDING!

ED PRIORITIES OF CARE

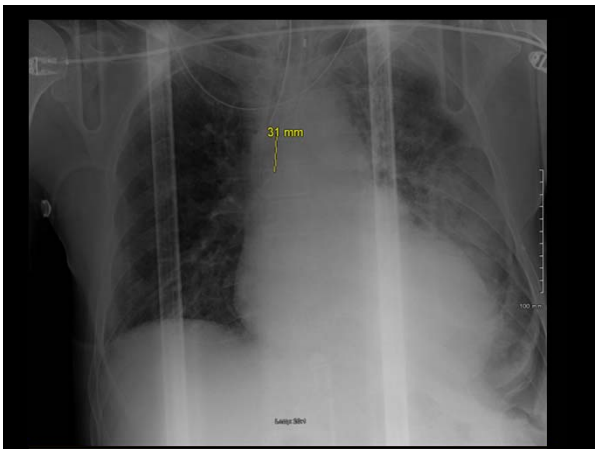
- REASSESS THE PATIENT……
- IS HE STABLE FOR TRANSPORT?
- SCALP & THIGH BLEEDING CONTROLLED
- BP=110/50, P=60,RR=12 (Vent.)

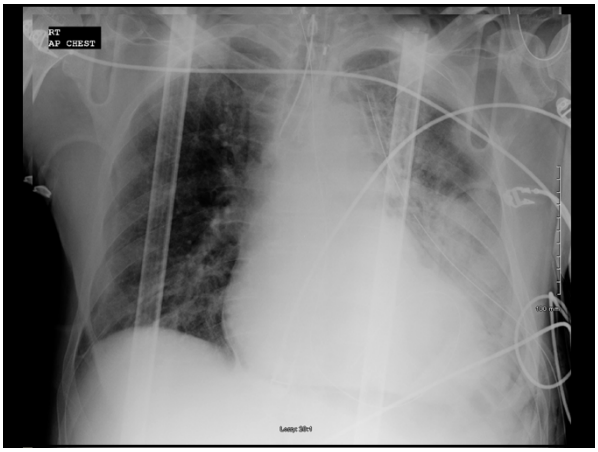
ED PRIORITIES OF CARE

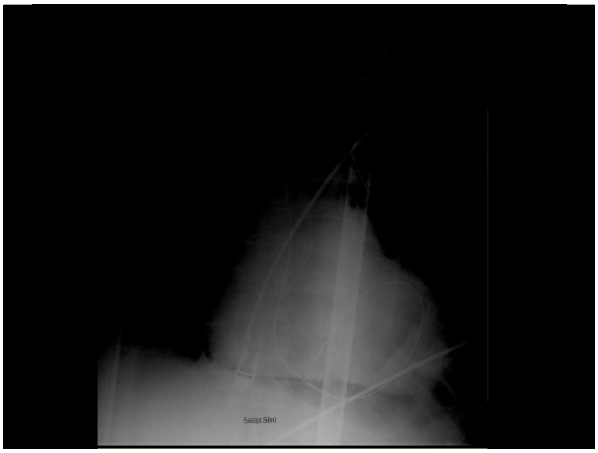
- LAB STUDIES: POC Hgb = 8.5
- ABG: Ph = 7.22, $PaCO_2$= 40, PaO_2= 95 Rate 12, FIO_2= 1.0, Vt = 500cc, PEEP = 5
- Radiographic studies:

ED PRIORITIES OF CARE

- RADIOGRAPHIC STUDIES:
  - Chest x-ray
  - AP-Pelvis
  - ± Lateral c-spine
  - ± L femur


31 mm


RT
AP CHEST



CASE STUDY

- PATIENT HAS STABILIZED AND HAS THE FOLLOWING KNOWN INJURIES:
  - Left Hemopneumothorax
  - Ruptured L. hemidiaphragm
  - R sacral fracture
  - L open femur fracture

CASE STUDY

- WHAT IS THE NEXT PRIORITY?

CASE STUDY

STILL HYPOTENSIVE?

CASE STUDY

YES

STILL HYPOTENSIVE?

GO TO THE OPERATING ROOM

CASE STUDY

YES

STILL HYPOTENSIVE?

GO TO THE OPERATING ROOM

INITIATE MTP 1:1:1 O-NEG /TYPE SPECIFIC BLOOD TXA

CASE STUDY

YES

STILL HYPOTENSIVE?

GO TO THE OPERATING ROOM

CASE STUDY

YES

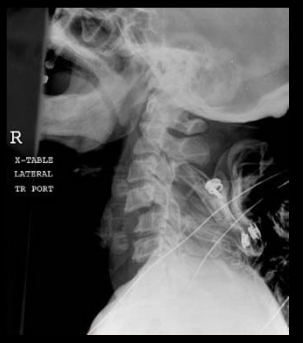
STILL HYPOTENSIVE?

GO TO THE OPERATING ROOM

CONSIDER QUICK LATERAL C-SPINE.
CONSIDER STARTING A VASOPRESSOR
IF SPINAL CORD INJURY IS SUSPECTED.

CASE STUDY

- DOES THIS CHANGE YOUR PRIORITY OF MANAGEMENT?



CASE STUDY

STILL HYPOTENSIVE?

NO

CT FOR FURTHER STUDIES

CASE STUDY

STILL HYPOTENSIVE? — NO → CT FOR FURTHER STUDIES

- CT HEAD
- CT FACIAL BONES
- CTA NECK
- CT C-SPINE
- CT CHEST
- CT ABD-PELVIS
- CT T AND L SPINE

CASE STUDY

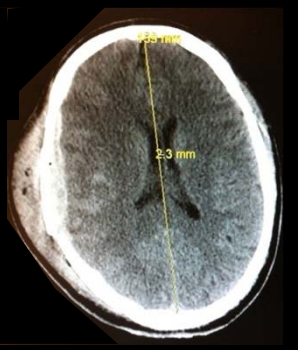
STILL HYPOTENSIVE? — NO → CT FOR FURTHER STUDIES

- CT HEAD
- CT FACIAL BONES
- CTA NECK
- CT C-SPINE
- CT CHEST
- CT ABD-PELVIS
- CT T AND L SPINE

DO YOU NEED ALL OF THESE TESTS?

CASE STUDY

- DOES THIS CHANGE YOUR PRIORITY OF MANAGEMENT?



HYPERTONIC SALINE FOR REDUCING ICP

Lazaridis C, Neyens R, Bodle J, DeSantis SM. *High-Osmolarity Saline in Neurocritical Care: Systematic Review and Meta-Analysis.* Crit Care Med 2013; 41: 1353-1360.

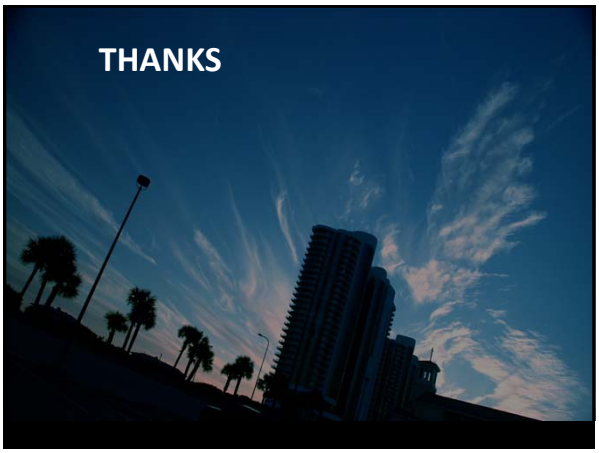
CASE STUDY

- OR PRIORITIES:
- STOP THE BLEEDING:
  - EXPLORATORY LAPAROTOMY
  - CONTROL THIGH BLEEDING
  - EMERGENCY CRANIOTOMY

CASE STUDY

- OR PRIORITIES:
- STOP THE BLEEDING:
  - EXPLORATORY LAPAROTOMY
  - CONTROL THIGH BLEEDING
  - EMERGENCY CRANIOTOMY

THE GOAL: PERFORM ONE OR MORE OF THESE OPERATIONS SIMULTANEOUSLY……


THANKS

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Traumatic Abdominal Wall Hernia

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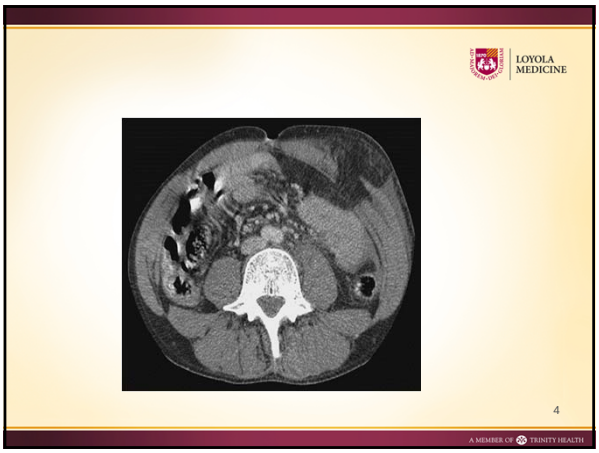
Loyola University Medical Center

Traumatic Abdominal Wall Hernia (TAWH)

- First Reported Case 1906
- Rare – 1% Of All Hernias
  - Prevalence 1% in Blunt Trauma Patients
- 100 Cases Reported World-Wide
- Most Commonly Ventral – Rare Lumbar/Flank

Classification

- Type 1 – Small Abdominal Wall Defect
  - Low Energy Trauma/Small Object (e.g. handlebar)
- Type 2 – Large Abdominal Wall Defect
  - High Energy Transfer (MVC, Fall From Height)
- Type 3 – Herniation of Intra-Abdominal Contents


LOYOLA MEDICINE
4
A MEMBER OF TRINITY HEALTH


LOYOLA MEDICINE
SMALL BOWEL
MUSCULAR DEFECT
A MEMBER OF TRINITY HEALTH


Pathophysiology
LOYOLA MEDICINE
Application of Force to Abdominal Wall
Direct/Shearing
Increased Intra-Abdominal Pressure
Disruption of Muscle and Fascia Maintaining Skin Continuity
Usually No Pre-Existing Hernia
Most Commonly Below Umbilicus
Weaker Abdominal Musculature
Can Transect Rectus
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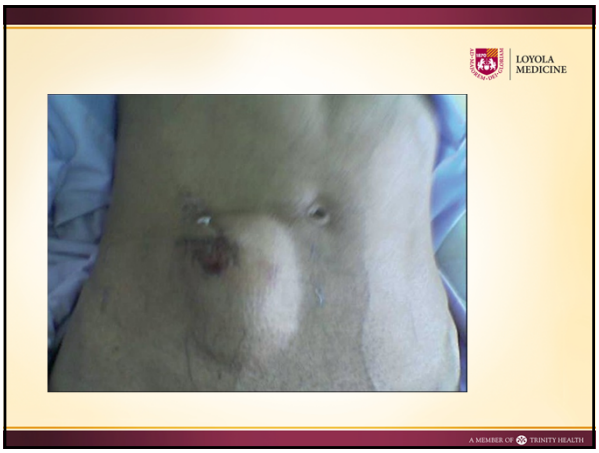

Physical Exam

LOYOLA MEDICINE

- Tenderness
- Cough Impulse/Reducibility (50%)
  - Confusion with Hematoma
- Seat Belt Sign (High Index of Suspicion)

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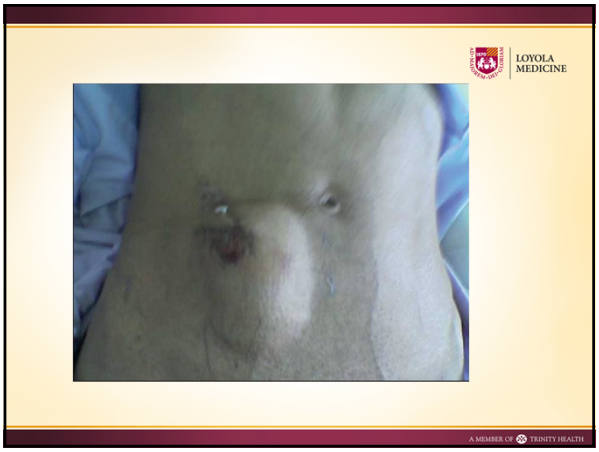

Imaging

LOYOLA MEDICINE

- Ultrasound
- CT Scan

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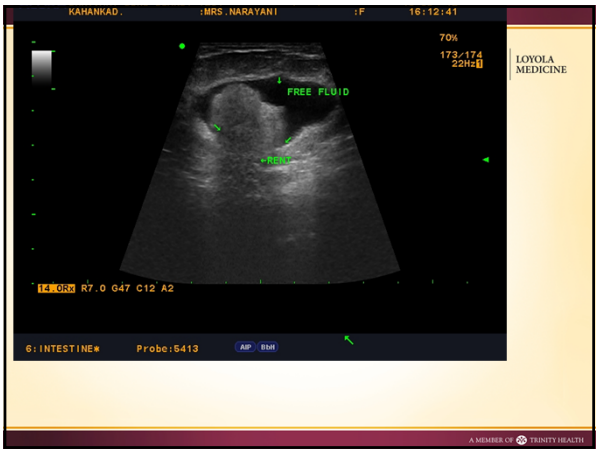

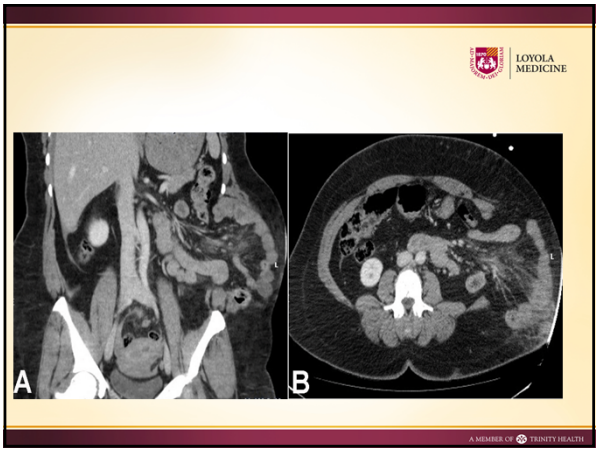

Management

LOYOLA MEDICINE

- Surgeon Judgement
- Timing of Diagnosis
- Hemodynamic Status
- Associated Injuries (30-44%)
- Comorbidities
- Complications
  - Incarceration
  - Strangulation
  - Perforation

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Management

- Immediate
- Planned Delay
- Delayed Diagnosis

Approach

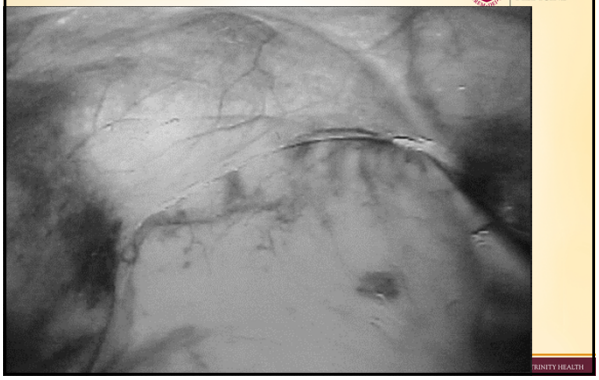
- Laparotomy
- Laparoscopy
- Retroperitoneal/Direct

Technique

- Primary
- Prosthetic
  - Synthetic
  - Biologic
- Component Separation/Tissue Flaps

Cases

- 38 yo female struck by tree branch in lower abdomen after MVC
- Awake, alert, normal VS
- Contusion and tender mass in RLQ
- No prior hx of hernia
- CT shows TAWH
- Exploratory Laparoscopy
- Reduction and repair with Gortex
- Secured to Coopers ligament and abdominal wall using autosuture tacks




LOYOLA MEDICINE
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LOYOLA MEDICINE
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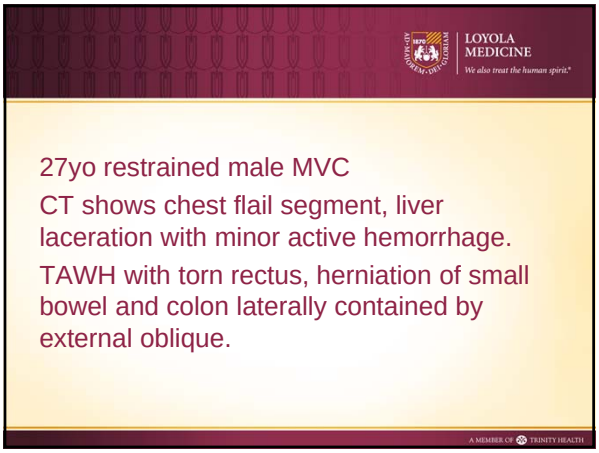
LOYOLA MEDICINE
We also treat the human spirit.®
27yo restrained male MVC
CT shows chest flail segment, liver laceration with minor active hemorrhage.
TAWH with torn rectus, herniation of small bowel and colon laterally contained by external oblique.
A MEMBER OF TRINITY HEALTH

LOYOLA MEDICINE
We also treat the human spirit.®

- Exploratory Laparotomy
- Spontaneous reduction, bowel intact
- Small bowel mesentery repair
- Abdominal wall defect repair with 20x30 crosslinked acellularporcine dermal collagen (Permacol)
- Non-absorbable suture, “bridge” technique with 5cm underlay

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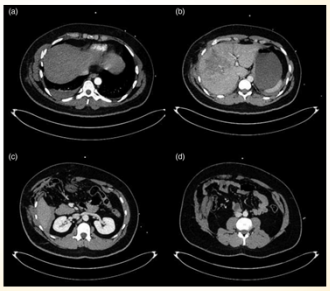
LOYOLA MEDICINE



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LOYOLA MEDICINE

A MEMBER OF TRINITY HEALTH

67 yo female restrained (3-point) driver

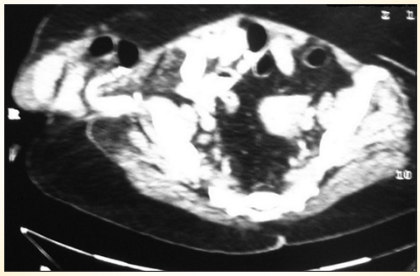
GCS 15, slight hypertension

Past hx- appendectomy, no flank incisions or incisional herniae

Seatbelt sign anteriorly above iliac crest

Protuberant, non-tender anterior abdomen

Right flank fullness and tenderness

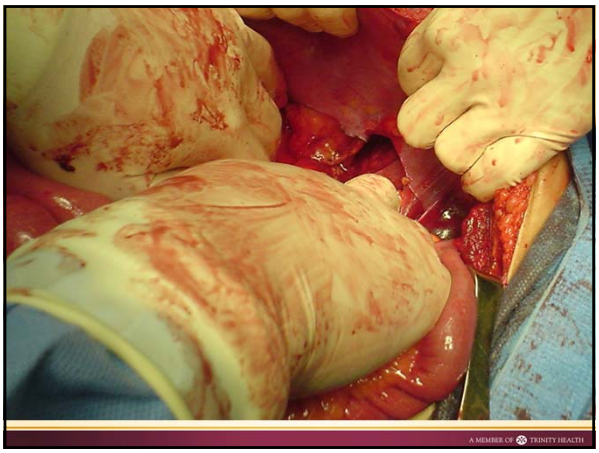


Exploratory Laparotomy

Acute right lumbar hernia and left rectus transection below umbilicus, omental and cecal hematomas

Reduction of peritoneal contents

Defect extending from iliopsoas toto superior iliac crest inferiorly and to subhepatic space superiorly and 8cm anterolaterally

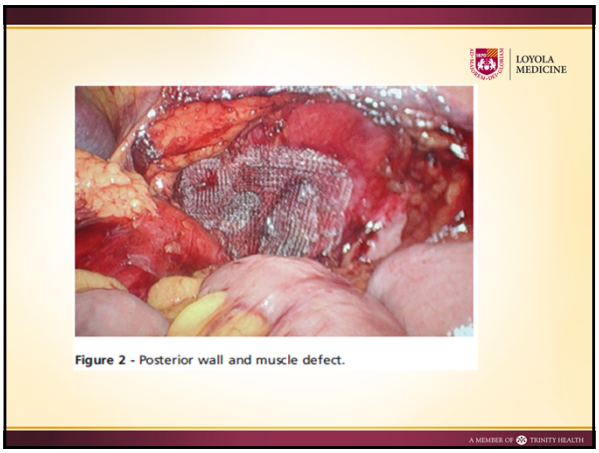


Repair

PTFE secured with non-absorbable suture topsoas muscle medially, transversus abdominis superiorly and laterally and iliac crest inferiorly.

Superior aspect of defect extending ito subhepatic space obliterated with omentum and omentopexy.

Left posterior rectus closed primarily



LOYOLA MEDICINE

- 56yo male
- Abdominopelvic crush injury
- Aggressive crystalloid resuscitation
- Hemodynamics stabilized → Imaged

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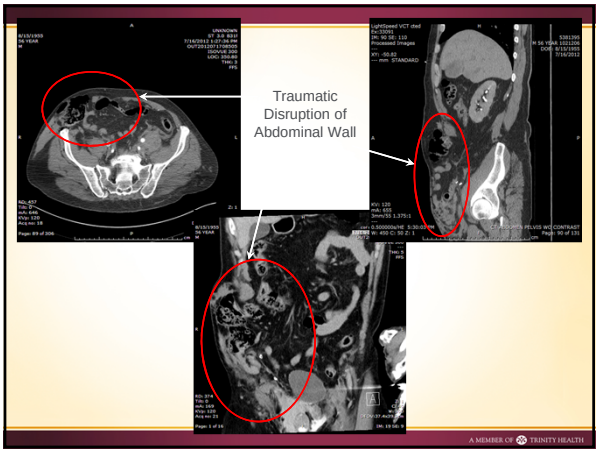


Injury Profile

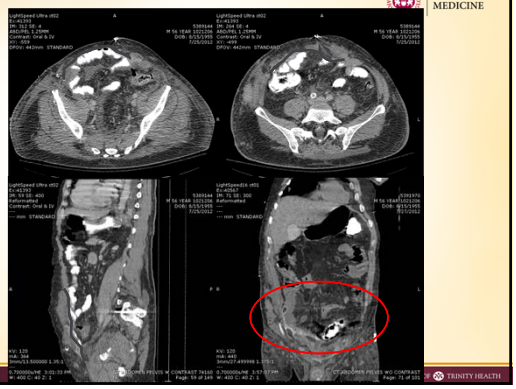
- TAWH
- Sigmoid colon perforation
- Multiple Pelvic Fractures with Hematoma
- L2 transverse process fracture
- Right 12th and left 10th rib fracture
- Urethral and bladder injury

- Damage control laparotomy
  - Sigmoid colectomy with Discontinuity
- B/L orchiopexy, Supra-pubic catheter placement
- Negative pressure dressing abdominal closure
- To SICU … Resuscitation and rewarming
- Second look 48h later → Washout, continuity and partial abdominal closure

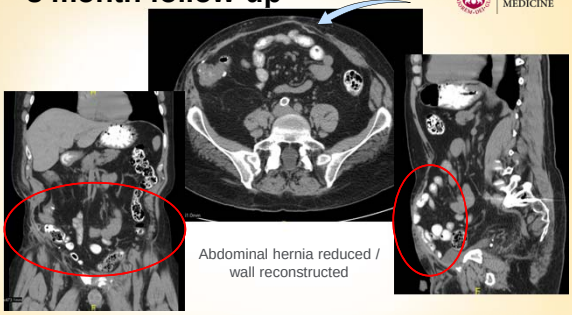
Reconstruction … Day 3

- Non-denatured collagen matrix (bovine dermis)
  - Bio-active, non-inflammatory, regeneration
  - Rapidly vascularized and incorporated
- Completely disrupted rectus abdominis above umbilicus on left
- Completely disrupted rectus abdominis on right below umbilicus
- 25cm x 40cm prosthetic sheet, secured to Semilunaris to transversus abdominis, internal and external oblique(s)
- 3–5cm underlay

Post Operative



8 month follow-up



Abdominal hernia reduced / wall reconstructed

Summary

- Rare Occurrence
- Presence in Association with Blunt Trauma – Immediate Surgical Indication
- Laparotomy Rather Than Laparoscopy Acutely

Summary

- Primary Repair vs Prosthetic
  - Size
  - Contamination
- Delayed Repair
  - Damage Control Situation
  - Extensive Contamination
  - Delayed Diagnosis

When to Operate on the Child With Blunt Abdominal Trauma (BAT)

David E. Wesson, MD FACS
Professor of Surgery
Baylor College of Medicine

Trauma Medical Director
Associate Surgeon-in-Chief
Texas Children's Hospital

Why This Topic Is Timely

- Many injured children are treated in general hospitals
- There are large differences between the care given in pediatric hospitals and general hospitals
- PTSF database
  - Spleen + liver procedures in 16% of cases at ATC's vs. 3% of cases at PTC's
  - OR 0.16; 95% CI: 0.08-0.36

Matsushima et al. *J Surg Res*. 2013;183:808.

The Main Messages

The decision to perform a laparotomy is almost always based on clinical parameters

Identification of the injured child who needs a laparotomy is not difficult

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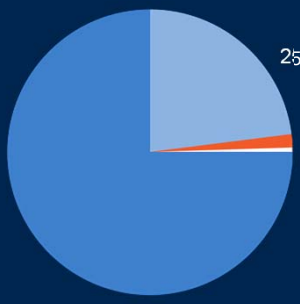
1 How to identify patients needing surgery

- Epidemiology
- Clinical Assessment
- Diagnostic Imaging

2 Case Presentations

- Ruptured spleen
- Seat belt syndrome
- Kick, punch etc.
- NAT

Few Need Surgery: an Example



1,000 BAT cases

Few Need Surgery: NTDB® 2008

- 99,513 cases < 18 years of age
- 8,593 (9%) liver, spleen or kidney injury
- 989 (1%) needed an abdominal operation for a solid organ injury

Davidson et al. *J Trauma Acute Care Surg.* 2012;73:162.

Abdominal Injuries at TCH 2009-2013

	Number	% of Total	Laparotomy
Liver	97	36	2
Spleen	76	27	0
Intestine	45	16	19
Kidney	43	15	1
Pancreas	17	6	2
Abdominal Wall	1	<1	1

7 Clinical Signs of Significant BAT

1. Abdominal wall trauma (seat belt sign)
2. GCS < 14
3. Abdominal tenderness
4. Chest wall trauma
5. Abdominal pain
6. Decreased or absent breath sounds
7. Vomiting

Holmes et al. *Ann Emerg Med.* 2013;62:107. (PECARN)

Diagnostic Approach

Anatomy
- Solid Organ
- Hollow Viscus

Physiology
- Blood Loss
- Peritonitis

Clinical Diagnosis

History

- Lap belt
- Direct blow over a small area (handle bar, kick, punch)
- NAT

Physical Examination

- Hypovolemia
  - Cool hands and feet
  - Weak pulses, tachycardia
  - Low BP
  - Need for volume and blood
- Peritonitis
  - Seat belt sign
  - Tenderness with rigidity

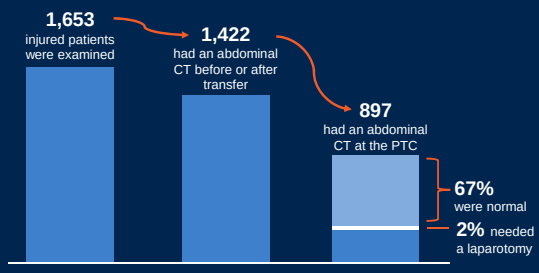
What to Look for on Abdominal CT

- Intra-peritoneal blood without a clear source
- Enhancement of the bowel wall
- Free air

Problems with Abdominal CT

- Radiation Exposure
  - ALARA
  - Can not repeat
- Pre-transfer CT Scans
  - Inadequate, unavailable, too “HOT”
- Most scans are normal
- They do not predict the clinical course

CT and the Pediatric Trauma Patient



Fenton et al. *J Pediatr Surg*. 2004;39:1877.

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Reducing Unnecessary Abdominal CTs

Clinical Prediction Model

- Hypotension
- Abnormal abdominal exam
- Elevated AST
- Elevated amylase
- Low hematocrit
- Blood in urine

Streck et al. *J Trauma Acute Care Surg*. 2012;73:371.

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Problems With FAST

- Insufficient sensitivity and negative predictive value to be used as a screening test[1]
- FAST has **95% specificity** but only **33% sensitivity** in identifying children who need a laparotomy[2]

+ positive FAST suggests hemoperitoneum

- Negative FAST adds little to patient care

1. Coley et al. *J Trauma*. 2000;49:902.
2. Patel and Tepas. *J Pediatr Surg*. 1999;34:44.

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Liver and Spleen Injury

- Injury grade and age are not useful indications for an operation
- Shock and ongoing bleeding are the main indications

NAT vs. "Accidental" Trauma

Patient Demographics	NAT (n = 267)	AT (n = 4781)	P-value
Age (months)	7	72	< 0.001
Male Gender	61%	64%	0.327
Private Insurance	19%	40%	< 0.001
Hispanic	36%	34%	0.507
African American	34%	15%	< 0.001
White	26%	36%	< 0.001
Median ISS	13	9	< 0.001
Length of stay (days)	3	1	< 0.001
% ICU Admissions	34%	9%	< 0.001
Mortality	7%	0.3%	< 0.001

NAT Abdominal Injuries

- 27 abdominal injuries
  - 63% solid organ (37% liver)
  - 33% hollow-organ (intestine)
- 7 of 9 patients with a hollow-organ injury had surgery (1 required a colostomy)

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1 How to identify patients needing surgery

- Epidemiology
- Clinical Assessment
- Diagnostic Imaging

2 Case Presentations

- Ruptured Spleen
- Seat Belt Syndrome
- Kick, punch etc.
- NAT

Case 1

- 15 year-old boy injured playing soccer
- Direct to ED via EMS
- Anxious
- Cool hands and feet with weak pulses
- P120 BP 95/65

Case 1

- Received one transfusion of 2 units of PRBC's
- Clinical evidence of bleeding resolved
- Arterial blush in 5 (8%) of 63 children with blunt splenic injuries; only one required an operation[1]
- CT blush in liver trauma associated with more blood loss and higher mortality[2]

1. Cloutier et al. *J Pediatr Surg.* 2004;39:969.
2. Eubanks et al. *J Pediatr Surg.* 2003;38:363.

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Case 2

- 14 year old girl injured in a MV crash
- Rear seat passenger with lap belt only
- VS stable but abdomen tender with rigidity

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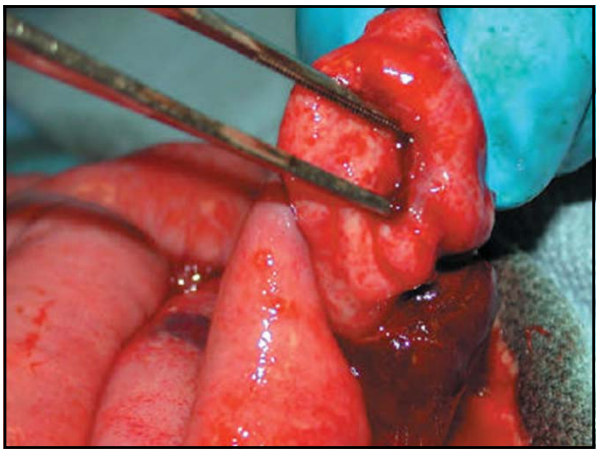
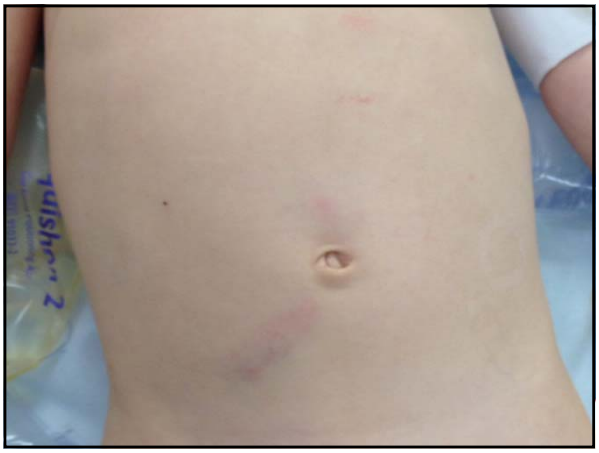
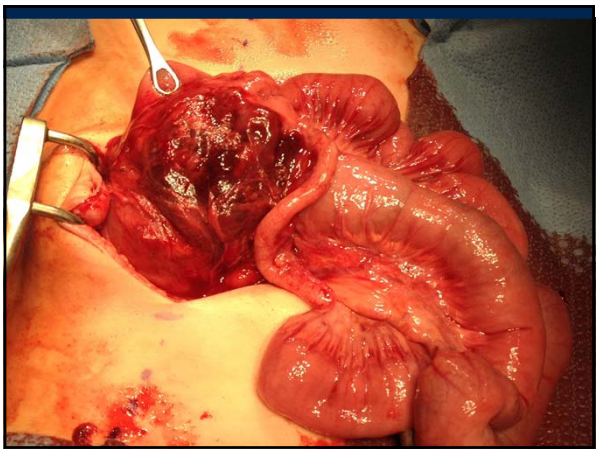


Case 3

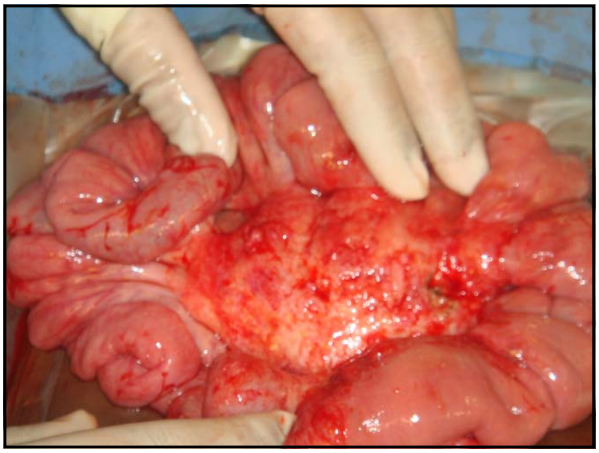
- Child kicked by a donkey
- Hemodynamically normal





Case 4

- 6-year-old girl presented with an abdominal mass in the small bowel mesentery
- No history of trauma



Case 4

- Biopsy consistent with resolving hematoma
- Step father confessed to child abuse
- Mortality for inflicted abdominal trauma 9% vs. 3% for non-inflicted[1]
- Mortality for inflicted abdominal injuries 53% vs. 21% for non-inflicted[2]

1. Lane et al. *Pediatrics*. 2011;127:e1400.
2. Maguire et al. *Child Abuse Negl*. 2013;37:430.

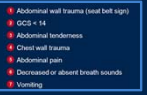
OR Strategy

- MT protocol
  - Hemodynamic instability
  - Ongoing blood loss after 40 ml/kg crystalloid
- Blood Components
  - 1:1:1 PRBC's:FFP:platelets >30 kg
  - 3:2:2 PRBC's:FFP:platelets <30 kg
- Cryoprecipitate for low fibrinogen

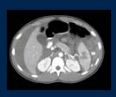
Summary

Relatively few patients with BAT require an operation

The decision to operate is based on the clinical features of each case



CT is often the basis for the diagnosis and the course of treatment but seldom is the sole indication for operative intervention




Texas Children's
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