Abdominal Trauma

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Objectives

1. Evaluation of Abdominal Trauma

2. Mechanisms of Injury

3. Assessment of Unstable Patients

4. Assessment of Stable Patients
   - Diagnostic tests
   - Decision making
Epidemiology

- BLUNT AND PENETRATING ABDOMINAL TRAUMA ARE MAJOR CAUSES OF MORBIDITY AND MORTALITY.
- Combination injuries from bombs and explosive devices are on the increase.
- In blunt abdominal trauma the spleen and liver are the most commonly injured organs and contribute to a mortality of 8.5%.
- ¾ s attributable to RTA.
- 2/3RDS occur in males with a peak incidence in age 14 – 30 yrs..
- Penetrating injury has a higher mortality of up to 12% and accounts for 1/3rd of all abdominal trauma.
- Gunshot and stab wounds account for 90% of penetrating trauma.
- Abdominal trauma more common in the urban set.
- Males > females
MECHANISMS OF INJURY

• Shearing of organs and blood vessels due to acceleration/deceleration forces.
• Crush injury.
• Rapture of hollow viscus due to rise in intraluminal pressure following compression.
• Penetrating injury occurs directly from the object causing the injury or from kinetic energy released by the object. This can cause cavitation.
Mechanism of Injury: Penetrating

- **Stab**
  - Low energy, lacerations

- **Gunshot**
  - Kinetic energy transfer
    - Cavitation
    - Fragments
penetrating abdominal trauma
### Pattern of Injury in Blunt Abdominal Trauma

<table>
<thead>
<tr>
<th>Organ</th>
<th>Injury Rate</th>
<th>Organ</th>
<th>Injury Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spleen</td>
<td>40.6%</td>
<td>Colorectal</td>
<td>3.5%</td>
</tr>
<tr>
<td>Liver</td>
<td>18.9%</td>
<td>Diaphragm</td>
<td>3.1%</td>
</tr>
<tr>
<td>Retroperitoneum</td>
<td>9.3%</td>
<td>Pancreas</td>
<td>1.6%</td>
</tr>
<tr>
<td>Small Bowel</td>
<td>7.2%</td>
<td>Duodenum</td>
<td>1.4%</td>
</tr>
<tr>
<td>Kidneys</td>
<td>6.3%</td>
<td>Stomach</td>
<td>1.3%</td>
</tr>
<tr>
<td>Bladder</td>
<td>5.7%</td>
<td>Biliary Tract</td>
<td>1.1%</td>
</tr>
</tbody>
</table>

Blunt abdominal trauma
Management

• Initial assessment and resuscitation. Establish that an abdominal injury exists rather than emphasis on exact diagnosis.

• Initial examination and resuscitation should be simultaneous.

• Principles of ABC should be applied ie adequate airway, breathing and treating hypovolumia.

• Rule out other injuries.

• Insert wide bore IV cannula.
• Continuous monitoring of BP, pulse rate, oxygen saturation.
• Initial fluid resuscitation; rapid infusion of 2 litres of crystalloid solution followed by colloids if necessary.
• Transient responders and non responders for immediate laparotomy.
Secondary survey

• History of incident.
• Physical examination of the exposed patient.
• Examination of anterior and posterior abdomen.
• Palapte for tenderness, guarding and rebound tenderness.
• Percussion and auscultation.
• Rectal examination.
• Perineal examination.
• Insert NG tube and urethral catheter.
Assessment: History

- AMPLE
- Mechanism
- MVC:
  - Speed
  - Type of collision (frontal, lateral, sideswipe, rear, rollover)
  - Vehicle intrusion into passenger compartment
  - Types of restraints
  - Deployment of air bag
  - Patient's position in vehicle
A.M.P.L.E. - a simple mnemonic for key information

- **A**: allergies (e.g. penicillin or aspirin)
- **M**: medication (e.g. a beta-blocker or warfarin)
- **P**: previous medical history (e.g. previous surgery or anaesthetic mishap)
- **L**: last mealtime (i.e. drink versus major meal)
- **E**: events surrounding the incident (e.g. fell 5 metres with immediate loss of consciousness)
- Examine each body region meticulously
Abdominal Injury

Factors that Compromise the Exam

- Alcohol and other drugs
- Injury to brain, spinal cord
- Injury to ribs, spine, pelvis

A missed abdominal injury can cause a preventable death.
Decision Making

- Airway
- Breathing
- Circulation

Hemodynamically Stable

SHOCK

- Transient Responder

Hemodynamically Unstable

How are you going to assess?
Decision Making

• Stable patient
• CT Scan
• Operative
  – Solid organ injury, hypotensive
  – Hollow viscus organ injury
  – Intraperitoneal bladder injury
  – Diaphragmatic injury
• Non-operative management
  – Observation
  – Interventional Radiology
Options for Management

Diffuse Abdominal Tenderness

Yes

Laparotomy

No

Hemodynamic Stability?

Indications for Laparotomy – Penetrating Trauma

- Hemodynamically abnormal
- Peritonitis
- Evisceration
- Positive DPL, FAST, or CT
- Violation of peritoneum
Options for Management

- Hemodynamically stable penetrating injury
  - Serial Observation
  - Wound Exploration
  - DPL
  - CT scan +/- Contrast
  - Laparoscopy
  - Laparotomy
  - Ultrasound/echo – cardiac box
  - Pericardial window – cardiac box
Investigations

In haemodynamically stable patients.

• Full blood count and haematocrit.
• Urea and electrolytes.
• FAST; Focused Abdominal Sonography for Trauma- detects free fluid in the peritoneal cavity. Non invasive and rapid. 88% sensitive, 99% specific and 97% accurate.
Focused Abdominal Sonography for Trauma (FAST)

- Demonstrate presence of free intraperitoneal fluid
- Evaluate solid organ hematomas

**Advantages**
- No risk from contrast media or radiation
- Rapid results, portability, non-invasive, ability to repeat exams.

**Disadvantages**
- Cannot assess hollow visceral perforation
- Operator dependent
- Retroperitoneal structures are not visualized
FAST

- Four View Technique:
  - Morrison’s pouch (hepatorenal)
  - Douglas pouch (retropelvic)
  - Left upper quadrant (splenic view)
  - Epigastric (View pericardium)
Diagnostic peritoneal lavage

- 98% sensitive in detecting intra abdominal bleeding.
- Does not detect diaphragmatic injuries.
- Poor at detecting retroperitoneal bleed.
- Invasive procedure.
- Contraindicated in patients with previous surgery, pregnancy.
Diagnostic Peritoneal Lavage
Objective criteria for assessing DPL

- **Positive criteria:** blood in chest tube or urethral catheter. > 10 mls blood on opening abdomen. RBC count > 100,000/ul. WBC count > 500/ul. Amylase > 175U/ml. Presence of fecal matter or bile.

- **Equivocal criteria:** RBC count 50,000 - 100,000 (in penetrating trauma 25,000 – 50,000). WBC count 100 - 500/ul. Amylase 75 – 175 U/ml.
• Negative criteria; RBC count < 50,000/ul (in penetrating trauma <25,000). WBC count < 100/ul. Amylase < 75U/ml.

• Interpretation.; laparotomy if there is a positive criteria. Reassess or consult if the results are equivocal or repeat lavage in 2 hours. Or do US/CT Scan.
Contraindications of DPL

• Absolute:
  – Peritonitis
  – Injured diaphragm
  – Extraluminal air by x-ray
  – Significant intraabdominal injury by CT scan
  – Intraperitoneal perforation of the bladder by cystography

• Relative:
  – Previous abdominal operations (because of adhesions)
  – Morbid obesity
  – Gravid Uterus
  – Advanced cirrhosis (because of portal hypertension and the risk of bleeding)
  – Preexisting coagulopathy
CT Scan

• Replacing DPL.

• 98% sensitive in detecting intraperitoneal bleeding.

• Contrast enhanced CT Scan gives useful anatomical and functional information on organs.

• Can identify organ injuries and be used to determine which injuries can be managed conservatively in stable patients.

• Useful in grading solid organ injuries (liver and spleen)
Laparoscopy

• Increasingly used in assessing trauma.
• Useful in determining peritoneal penetration and identifying diaphragmatic injuries.
• Also can be used for treating certain injuries.
Mangement

Principles of management are;
• Stop haemorrhage.
• Debride devitalised tissues.
• Repair injured bowel by suturing or resection.
• Eliminate foreign bodies/contamination and intestinal contents.
Preoperative preparation

• Immediate surgery once significant injury is confirmed or in haemodynamically unstable patients.
• Broad spectrum antibiotics to cover both aerobic and anaerobic organisms.
• Investigations and clinical findings should guide management in stable blunt injury patients.
Management cont`d

• Blunt abdominal trauma.
• Initial assessment and resuscitation; Haemodynamically stable or unstable.
• Haemodynamically stable and no peritonitis, negative DPL, negative FAST, Negative CTScan – observation and serial examinations.
• Haemodynamically unstable; Laparotomy.
• Positive DPL – Laparotomy
• Intra-peritoneal fluid seen on FAST – Laparotomy.
• CT Scan findings of solid viscus (liver /spleen) injury - grade of injury
Indications for Laparotomy – Blunt Trauma

- Hemodynamically abnormal with suspected abdominal injury (DPL / FAST)
- Free air
- Diaphragmatic rupture
- Peritonitis
- Positive CT
Abdominal trauma

- Gun shot
  - Mandatory laparotomy
    - LAPAROTOMY

- Stab wound
  - Evisceration, positive DPL, Haemodynamic instability, peritonitis
    - LAPAROTOMY

- Blunt abdominal trauma
  - Unstable haemodynamically
    - Stable; FAST, CT Scan, DPL
Liver

- The liver, is the most vulnerable abdominal organ to blunt injury because of its size and location.
- Injured in about 5% patients admitted for trauma.
- Also vulnerable to penetrating trauma.
- Liver injuries present a serious risk for shock because the liver tissue is delicate and has a large blood supply and capacity. Injuries include laceration or contusion, a hematoma may develop. Injury may be associated with bile leak and biliary peritonitis.
Spleen

• Spleen is the commonest injured organ in blunt abdominal trauma.
• Fractures of the left lower ribs are associated with spleen lacerations in 20% of cases.
• Most splenic injuries can be managed conservatively after grading with CT Scan.
Solid Organ Injuries

- Grading of injured solid organs such as Spleen, Liver & Kidneys are on the basis of subcapsular hematoma, capsular tear, parenchymal lacerations & avulsion of vascular pedicle

- Bleeds significantly and cause rapid blood loss

- Difficult to identify injury by physical exam

- Repeated assessment is required to make the diagnosis

- Slowly oozing blood into peritoneal cavity
Grade 1 SPLENIC INJURY
Grade 3 injury
Bowel

- The small intestines takes up a large part of the abdomen and is likely to be damaged in penetrating injury.
- The bowel may be perforated. Gas within the abdominal cavity seen on plain abdominal X-Ray or CT is diagnostic.
- Bowel injury may be associated with complications such as infection, abscess, bowel obstruction, and the formation of a fistula.
- Bowel perforation requires surgery.
Stab wound with evisceration
Management

• Splenic and liver injuries grade 1, 2 and 3 may be treated conservatively.

• Grade IV and V – Laparotomy. Evisceration - laparotomy
Abdominal Compartment Syndrome

• Common problem with abdominal trauma
• Definition: elevated intraabdominal pressure (IAP) of ≥20 mm Hg, with single or multiple organ system failure ± APP below 50 mm Hg
• Primary ACS: associated with injury/disease in abdomen
• Secondary (“medical”) ACS: due to problems outside the abdomen (eg sepsis, capillary

Abdominal Compartment Syndrome

Table 1

Risk factors for abdominal compartment syndrome

- Severe penetrating and blunt abdominal trauma
- Ruptured abdominal aortic aneurysm
- Retroperitoneal hemorrhage
- Pneumoperitoneum
- Neoplasm
- Pancreatitis
- Massive ascites
- Liver transplantation
- Abdominal wall burn eschar
Abdominal Compartment Syndrome

• Effects of elevated IAP
  – Renal dysfunction
  – Decreased cardiac output
  – Increased airway pressures and decreased compliance
  – Visceral hypoperfusion

Abdominal Compartment Syndrome

• Management
  – Surgical abdominal decompression
  – Nonsurgical: paracentesis, NGT, sedation
  – Staged approach to abdominal repair
  – Temporary abdominal closure

Figure 2
The abdomen was reopened due to abdominal compartment syndrome and approximated with an intravenous bag, sterile side down.

Figure 3. Patient with a vacuum-assisted closure dressing in place, controlling abdominal secretions on low suction
The healthy granulation tissue seen after vacuum-assisted closure dressing on the patient previously shown (Fig. 1) following management of intra-abdominal sepsis.

Sugrue M. Curr Opin Crit Care 2005; 11:333-338
Thank you