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Why Children Are Susceptible To Have Abdominal Injury?

- The relative small size of the child allows a single impact to multiple organ injuries
- Less muscle and subcutaneous fat to protect the organs
- Ribs are more pliable
- Liver & spleen take up a large proportion of the abdominal cavity
Why Children Are Susceptible To Have Abdominal Injury?

• Diaphragm is more horizontal, tending to push liver and spleen lower than the rib cage

• Adult protection system, such as seat belts, are often ill fitting or wear incorrectly, causing deceleration injuries to the upper abdomen
Primary Survey & Resuscitation

• Resuscitation done simultaneously

• **A**irway with C-spine immobilisation
• **B**reathing : Ventilation & oxygenation
• **C**irculation : Stop bleeding & fluid boluses
• **D**isability : Neurological status
• **E**xposure : Environment & body temperature
Secondary Survey

Perform a thorough
• back & front,
• head-to-toe examination for other injuries
Abdomen Organs At Risk

• Solid organ injury
  - Liver
  - Spleen
  - Pancreas

• Intestinal injury
  - Stomach
  - Duodenum
  - DJ flexure
  - Small & large bowel

• Genito-urinary injury
  - Kidney
  - Bladder
  - Urethra

• Pelvic injury
Assessment - History

Children are at risk include those with:

- High impact / deceleration injuries
- Direct blow to the abdomen
- Evidence of injuries above and below the abdomen
- Seat-belt injuries (duodenum or pancreas)
- Bicycle handlebar injuries to upper abdomen (duodenum or pancreas)
- Straddle injuries (perineum, vagina or urethra)
- Penetrating injury to chest, abdomen or pelvis, especially of the entry and exit sites are above and below the diaphragm
- Injuries suggestive of non-accidental injury
Examination

- Better to have the presence of the carer(s) to calm and relax the child with adequate explanation, reassurance and analgesia

- Check for:
  - Any signs of circulatory compromise
  - Marks, bruises or wounds to the abdomen

- PR or PV examination is rarely required unless there is evidence of trauma to the area
Management In General

- ABCDE

- Establish IV access for aggressive fluid resuscitation
- Consider blood transfusion if further fluid resuscitation > 40ml/kg

- Consult surgeon
- Require laparotomy if free gas present on AXR
- All penetrating wounds should be explored in OT under GA
Management In General

- Pass gastric tube
- NPO in initial phase, may consider TPN in prolonged fasting

- Blood tests include, CPR, L/RFT, amylase, lipid, x-match
- Urine analysis
- Imaging investigations, e.g. X-ray, CT scan, USG
Spleen Injury

- Isolated injury can be managed conservatively with resuscitation and close observation
  - Fluid resuscitation
  - Cross matching blood
  - Close monitoring
  - Bed rest till abdominal pain settles and limit physical activity for ~ 3 months
- Consider operation if unstable hemodynamics, or require large amount of blood transfusion during acute resuscitation
Liver Injury

- Conservative management if hemodynamic is stable
- Strict bed rest with close monitoring
- Look out for complications e.g. bile leakage
Injury To Pancreas

- Conservation management
- Pain management
- Withheld oral intake till resolution of symptoms and normalization of amylase and lipase
- Decompress GI tract by gastric drainage
- May consider TPN for nutrition
- May require operation if the pancreatic duct is transected
Injury To Intestine

• Usually associated with:
  - deceleration injuries, causing shear injuries at the DJ flexure, the terminal ileum, caecum or sigmoid colon
  - Abdominal crush injuries that involves lap seat belt
  - Penetrating injury

• Diagnosis is often delayed
  - Regular clinical evaluation including auscultation for bowel sounds, associated with repeat x-rays may be necessary to make the diagnosis

• Symptoms may appear days after injury if injury related to mesentery and devascularisation of the associated bowel, associated perforation
Injury To Duodenum

• Acute duodenal injury is suspected if:
  ✓ History of bruising in the epigastrium, severe epigastric tenderness or bilious vomiting
  ✓ Often associated with pancreatic injuries
  ✓ Associated with bicycle handlebar and seat belt injuries

• Injuries may in form of
  ✓ Intramural hematoma without perforation
  ✓ Rupture of duodenum

• May cause ongoing GI obstruction post trauma
Injury To Duodenum

- **Intramural hematoma**
  - May cause ongoing obstruction post trauma
  - Conservation management
  - NPO with gastric decompression
  - May consider TPN for nutrition

- **Acute duodenal perforation**
  - Can be detected by retroperitoneal free gas - - - > OT
  - May be delay in onset if related to devascularization with the trauma - - - > Managed conservatively with NGT, TPN and antibiotics
Kidney Injury

- Suspect injury from
  - History
  - Wounds or bruising in the renal area
  - Frank or microscopic hematuria

- Investigation
  - Urine analysis
  - Monitor urine output
  - Imaging including USG, CT with IV contrast
Kidney Injury

- **Management**
  - Most sharp and blunt renal injuries can be treated conservatively
  - Antibiotics
  - May consider surgery for renal trauma with on-going blood loss despite resuscitation
Bladder Injury

• Suspect injury from

  ➢ History of injury after deceleration injury or blow to lower abdomen when the bladder is full
  ➢ Bruising in the suprapubic region
  ➢ Evidence of urine extravasation (edema of scrotum, lower abdomen and upper thighs)
  ➢ Extraperitoneal extravasation or intraperitoneal rupture
  ➢ Failure to pass any urine
Bladder Injury

• Management
  ➢ Urinalysis
  ➢ Monitor urine output
  ➢ USG or CT scan with IV contrast for diagnosis
  ➢ Laparotomy should be reserved for intraperitoneal rupture
  ➢ Insertion of supra-pubic catheter if there is any evidence of damage to bladder neck
Urethral Injury

- Suspect injury from
  - Straddle injury
  - Pelvic fracture
  - Blood at meatus, or a high riding prostate in older boys

- May attempt for urethral catherization by specialist for splintage and drainage purpose

- Insert suprapubic catheter
External Genital Injury

• External genitalia damage has the same origins as urethral injuries

• Child abuse should also be kept in mind
Fracture Of Pelvis

- Elasticity of bone in children allows a greater level of energy absorption prior to the fracture

- Fracture may be stable or unstable

- Possibility of visceral, genito-urinary neurological injury

- The pelvis is in proximity to major blood vessels and organs, pelvic fractures may cause extensive bleeding and other injuries that require urgent treatment
Fracture Of Pelvis

- Examination for
  - anterior / posterior stability
    Testing by grasping the ASIS – Anterior Superior Iliac Spine regions bilaterally and performing an open book maneuver
  - vertical instability
    By checking for any discrepancy in heights of the ASIS and the legs lengths

- Treatment
  - May be conservative in low energy pelvic fracture: Pelvic binder
  - May require surgery to restore the stability and reconstruct the pelvis
Conclusion

- Children are susceptible to abdominal injury in trauma due to less muscle and subcutaneous tissue to protect the organ(s)

- Shock may be the presentation due to internal bleeding

- There may be delay in effect of injury especially in the injury of gut and mesentry due to devascularization