Specific Organ Trauma

With all courtesy to our colleagues, Raslan and his team, a lot of our work is based on their Manual to Surgery Booklet.

- **Important**
- Mentioned by doctors but not in slides
- Additional notes from Surgical Recall 6th edition or Raslan's booklet
- Not mentioned by the doctor

431 SURGERY TEAM

Done By:

Sara Alkhelb

Revised By:

Musab Almoshaigeh

Leaders

Abeer Al-Suwailem

Mohammed Alshammari

Overview:

- Trauma is a major cause of death after IHD and malignancies.
- Trauma is considered the leading cause of death in the young population with ages that vary between 1 and 35 years.
- If trauma didn't cause death, it can cause any type of disability for a large group of people per minute.
- Trauma care account up to 7% of all hospital care which is a big budget.
- There is no specific organ trauma, so abdominal trauma comes with multiple traumas.

ROAD TRAFFIC ACCIDENTS:

* Road traffic accident (RTA) is one of the good examples of trauma and it is the most common trauma.

* RTA is the third leading cause of death after IHD and cancer.

* How to reduce trauma due to RTA?

- Roads should be in a good shape.

- Every person should make a complete check up for his car every once in a while, such as: breaks, water the car, wheels... etc.

-Drivers should follow the rules which include: wearing the seat belt,

not to drive while person is drunk or on drugs, follow the road signs,

not to exceed the assigned speed and so on.

- Medical care: there should be very good equipment/machines at the ERs with qualified staff.

TYPES OF TRAUMA

- There are different types of traumas; the types are classified according to the Mechanism of trauma.
- A patient can either get one of these types or a combination of them.
- Types of trauma:
  - Blunt trauma: Road traffic accident is the major cause of blunt trauma.
  - Penetrating
  - Burns
  - Blast

Blunt trauma: injury incurred when the human body hits or is hit by a large outside object (as a car).

Blast trauma: injury caused by the explosion of a bomb (especially in enclosed spaces)

ABDOMINAL TRAUMA

The majority of abdominal injuries are due to blunt abdominal trauma (90%) secondary to high speed automobile accidents.

-ANATOMICAL REGIONS OF THE ABDOMEN:

- Peritoneum:
  - Intra thoracic abdomen:

It is under the costal margin. Contains the liver, spleen, stomach, and pancreas.It is hard to examine it.

  - True abdomen:

It can be clinically examined.

- Retroperitoneal:
  - Pancreas & Duodenum
  - Bowel
  - Vascular(IVC , aorta)
  - Kidneys, ureter
  - Pelvic abdomen: bladder, female genital system
  - It is not accessible during physical examination, investigations are needed.

-TYPES OF THE ABDOMINAL TRAUMA:

- Blunt abdominal trauma: (take about 90 % of trauma) Sometimes doctors miss such cases because a patient with a blunt abdominal trauma can come walking to the ER. Some doctors take superficial history and physical examination and let the patient go home without admitting him. At the mean time, the patient would be bleeding slowly from the inside and in an hour he would collapse. Patients who come to the ER because of trauma should be examined from head to toe whether they came walking and conscious or not.

- Penetrating abdominal trauma: It is to diagnose and manage.

- MANAGEMENT OF TRAUMA PATIENTS:

- The primary management of abdominal trauma is determination that an intra abdominal injury exists and operative intervention is required.

- Many deaths would have been preventable if there wasn't a failure in managing the abdominal injuries.

- Causes of the failure of management includes:

1- Delay in ambulance to arrive, traffic jam, wrong place of hospitals, no good qualified hospital, and non well equipped hospitals.
2- Many patients die because doctors don't do ABC

- When you receive a trauma case always assume that there is injury even if the patient came walking to you until proven otherwise by history clinical presentation and investigations.

* PRIMARY SURVEY:

The resuscitation & Management priorities of patient with major abdominal trauma are:

1) ABCDE of emergencies (must be done to all trauma patients):
   - Airway: intubation if the airway is damaged.
   - Breathing: if breath sounds were absent, insert a chest tube immediately. No O2 for 15 minutes will cause a disability.
   - Circulation: If there was bleeding (hemorrhage), control should be initiated. Give IV fluids (usually crystalloids and normal saline) and control the bleeding.

- Disabilities
- Exposure: cut the clothes.

2) Usage of Nasogastric tube. It is contraindicated if there was bleeding from the nose or mouth.

3) Usage of urinary catheter to monitor the output and input. It is contraindicated If there was bleeding from the urethra.

* SECONDARY SURVEY:

- History: History is taken from the patient himself, if he was conscious, if not it is taken from the person who attended or the paramedic.
  - Blunt trauma
  - Penetrating trauma→ immediately to surgery
- Physical examination: General and abdominal examination
- Sometimes there is no time for Secondary survey.
- Abdominal Examination: Inspection, Palpation, Percussion, Auscultation, Rectal Examination, and Vaginal Examination.

* INVESTIGATIONS:

- Blood Tests (CBC, U/E, blood glucose , matching)
- Radiological Studies (Plain abdominal X-ray , CXR)
- Diagnostic Peritoneal Lavage (DPL):
  - Indicated when the patient is in a shock or suffering from abdominal distention.
  - It is extremely reliable; it can determine the presence of blood in the peritoneal cavity up to 98% of the cases.
  - When positive take the patient to the OR immediately.
  - If the results weren't so accurate and clear, insert a liter of saline and if fresh blood appears then it is positive.
- If the patient is stable you do:
  - USG abdomen
  - CT abdomen
  - Peritoneoscopy (diagnostic laparoscopy) *PATIENT SHUOLD BE STABLE

*INDICATIONS FOR SURGERY- LAPROTOMY:

1) If there were any signs of peritoneal injury such as tenderness, distention, guarding, bruising and so.

2) Unexplained shock (If you give a lot of fluid but your patient is still in a shock).

3) Evisceration of viscus (If the bowel was out).

4) Positive DPL – diagnostic peritoneal lavage.

5) Determination of finding: During routine follow up on investigations.

a. Sometimes you need to admit the patient for observation or admit them to the ER for 6 hours then signs will start to appear.
b. Ex: Patient came conscious with injury for conservative therapy to the ER and got admitted, after

4-6 hours he went into a shock.

SPECIFIC ORGAN TRAUMA

-Peritoneal:
- Liver: protected by ribs.
- Spleen: it is a mobile organ.
- Kidneys: in the retroperitoneal, it is not easy to injure so if it was injured it will be a severe trauma.
- Bowel

-Retroperitoneal:
- Pancreas & Duodenum
- Bowel
- Vascular(IVC , aorta)
- Kidneys, ureter

-Gento-urinary system:
- Urinary bladder, urethra (it is easy to diagnose if there was a fracture in the pelvis)
- Female reproductive system

1) LIVER TRAUMA :

-Liver is the largest organ in the abdominal cavity "5th intercostal space"
- Any trauma under the nipple we expect liver; it means the liver is injured.
-Most commonly injured organs in all patients with abdominal Trauma.
-Commonest organ injured in case of penetrating trauma.

If you found a gunshot or a stab in the fifth intercostal space, assume that the liver is injured.

- MECHANISM OF INJURY:
  - ▪Hepatic injuries result from direct blows
  - ▪compression between the lower ribs on right side and the spine
  - ▪Shearing at fixed points secondary to deceleration.
  - ▪Any penetrating gunshot, stab or shotgun wound below the right nipple on right upper quadrant of the abdomen is also likely to cause a hepatic injury.

- DIAGNOSIS AND INVESTIGATIONS:
  - Clinical manifestations:
    - Often made at laparotomy in patients presenting with penetrating injuries requiring immediate Surgery or in shock.
    - Blunt Trauma: patients who remain in a shock or present with abdominal rigidity, you do no further investigation and you take him to the OR immediately.
  - Investigations:
    - Diagnostic peritoneal lavage (DPL) (if the patient unstable)
    - CT Scan abdomen: used to diagnose intra peritoneal injuries in stable patients after blunt trauma.

    - mostly diagnosed by laparotomy

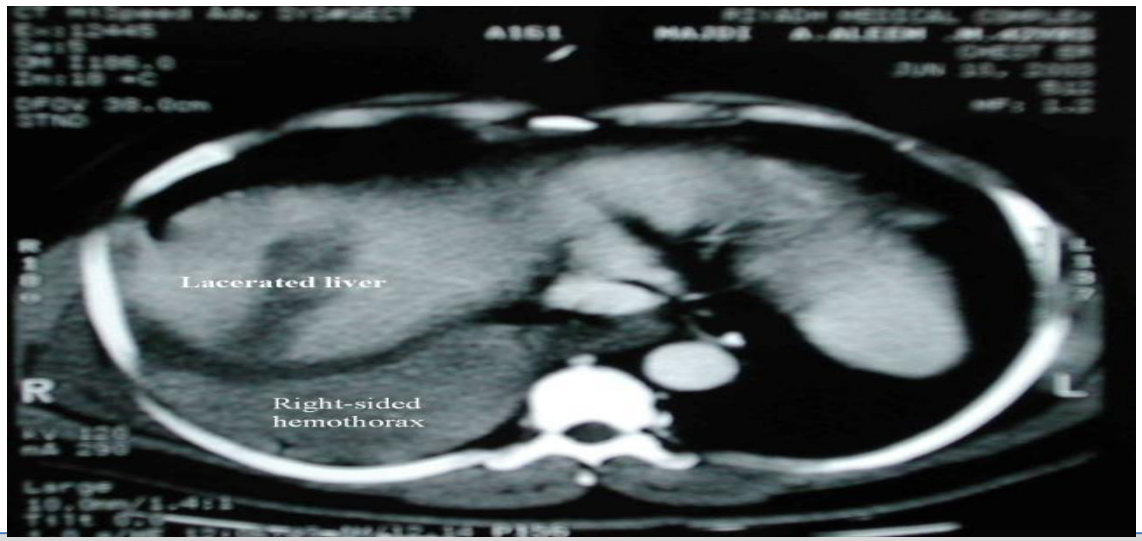


Figure: Gunshot below the nipple, Right side hemothorax, grade 3. The patient is stable; there is no blood in the peritoneal cavity. In this case the patient will go with conservative management, if he bleeds, he must be taken to the OR and if there was another injury take him to the OR and deal with all the injuries.

- MANAGEMENT:

–When the patient comes to ER, the initiate management should be uniform:

–ABCDE: regardless what injury you have.

–Non-operative approach:

○ Not all patients with liver injury need operation. It is determined by CT scan.

○ The criteria for non-operative approach is:
- Simple hepatic laceration Or intra hepatic hematoma
- No evidence of active bleeding
- Intra peritoneal blood loss less than 250 ml
- Absence of other Intra peritoneal injuries " spleen , bladder,.." that requires surgery

– Operative approach:

○ Persistent hypotension, despite adequate volume replacement, suggests ongoing blood loss and mandates immediate operative intervention

The Pringle maneuver is a surgical maneuver used in some abdominal operations. A large hemostat is used to clamp the hepato-duodenal ligament interrupting the flow of blood through the hepatic artery and the portal vein and thus helping to control bleeding from the liver.

○ Classification: This classification is based on operative findings and management. So hepatic injury is classified into:

-Grade 1: Simple injuries – non bleeding. Conservative treatment if there is no bleeding or other injuries.
- Grade 2: Simple injuries managed by superficial suture alone if you opened the patient. Conservative treatment if there is no bleeding or other injury.
- Grade 3: Major Intra parenchymal with active bleeding but not requiring inflow occlusion (Pringle maneuver) to control hemorrhage. Some of the patients go for conservative treatment others go for OR.
-Grade 4: Extensive Intra parenchymal injury with major active bleeding requiring inflow occlusion for homeostatic control. Needs operation and do Pringle maneuver.

Grade 5: Juxtahepatic venous injury (injuries to retrohepatic cava or main hepatic veins) portal vein injury. Patients in this grade are less likely to survive

- All patients undergoing laparotomy for trauma should be explored through midline incision (from xiphisternum to pubic" around the umbilicus go up or down) because you do not know where is the lesion.

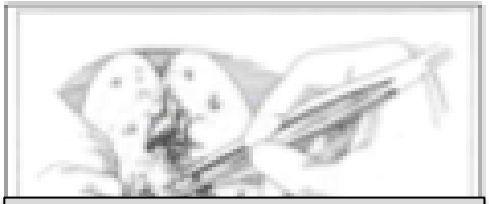


Figure:

Finger fraction: the injury in the liver is small, you will open the liver according to the injury, start ligating the blood vessels then ligating the ducts. Then omental packing: put omentum in between and suture it because it will cause hemostasis.

- Management according to classification:

- Grades 1 & 2: Simple injuries can be managed by any one of variety of methods: if we open it simple suture, electrocautery, tropical hemostatic agents, etc. Does not require drainage.

- Grade 3: Major intra-parenchymal injuries with active bleeding can be managed best by Finger Fracturing the hepatic parenchyma and ligating or repairing lacerated blood vessels & bile ducts under direct vision

- Grade 4: Extensive intraparenchynal injuries with major rapid blood loss require occlusion of portal trial to control hemorrhage. It might need liver resection, lobe resection, and ligation of intrahepatic artery. It is rarely saved.

Summary: (IMPORTANT)

-Simple techniques: Simple techniques include drainage only of non-bleeding injuries, application of fibrin glue, sutures “hepatorrhaphy” and application of surgical (I & II).

-Advanced techniques: Advanced Techniques of Repair (III & IV) all performed with Pringle Maneuver in place

-Types of repair:

1) Extensive hepatorrhaply
2) Hepatotomy with selective vascular ligation
3) Omental pack
4) Resectional debridement with selective vascular ligation
5) Resection
6) Selective Hepatic Artery Ligation “remember liver is regenerate”
7) Peri-hepatic packing: If you can’t deal with a patient, just pack the patient and send him to a center where he will be treated. Also, if you did what you have to do but the bleeding didn’t stop, pack your patient and send him to another hospital.

COMPLICATIONS AND MORTALITY:

-Recurrent bleeding
-Hematobilia: blood will go to the bile duct and the patient will bleed per rectum.
-Perihepatic abscess then Biliary Fistula later on.
-Biliary Fistula (missing one duct)
-Intrahepatic Hematoma
-Pulmonary Complications (bronchostasis)
-Coagulopathy: because of a lot of blood transfusion.

2) SPLENIC TRAUMA

GENERAL CONSIDERATIONS:

-The spleen remains the most commonly injured organ in patients who have suffered blunt abdominal trauma
- Involved frequently in penetrating wounds of the left lower chest and upper abdomen.
-Management of the injured spleen has changed radically over the past decade.
- The spleen is now recognized as an important immunological factory as well as a reticuloendothelial filter. The problem is when spleen has a disease; splenomegaly;- malaria, portal hypertension makes it more susceptible to be damaged from simple trauma and you will find the patient collapsed.
- Although the risk of over whelming post- splenctomy sepsis (OPSS) is greatest in children less than 2 years, recognition of OPSS has stimulated efforts to (Conserve spleen) by splenorrhaphy (either by repair or leave according to grade).

MECHANISM OF INJURY:

- Commonly injured in patients with blunt abdominal trauma because of its mobility.
- Most civilian stab wounds and gunshot wounds cause simple lacerations through injuries.
- It is of interest that 2% of patients who are undergoing a surgery in the LUQ of the abdomen can get injured in the spleen by the surgeon causing a small injury by any of the surgical equipment being used by the doctor using or the assistant.

CLASSIFICATIONS:

- The Magnitude of splenic disruption depends on the patient's age, injury mechanism and presence of underlying disease.

- Splenic injury has been classified according to its pathological anatomy into:
  - Grade I: Sub capsular hematoma.
  - Grade II: Sub segmental parenchymal injury.
  - Grade III: Segmental devitalization (part of it)
  - Grade IV: Polar disruption (complete pole)
  - Grade V: Shattered or devascularized organ (autosplenectomy). (don't wait, take the patient to OR immediately)

Patient is in a shock but he can survive because of the blood supply.

DIAGNOSIS AND INVESTIGATIONS:

-History

- Physical examination:

–Sign & symptom: if you find any of these, you presume spleen and kidney injury:

- LUQ bruising or abrasion
- Left lower ribs fracture on CXR
- Kehri's sign: shoulder tip pain (L shoulder)
- Balance's sign: LUQ mass (hematoma)

Kehri's sign is the occurrence of acute pain in the tip of the shoulder due to the presence of blood or other irritants in the peritoneal cavity when a person is lying down and the legs are elevated.

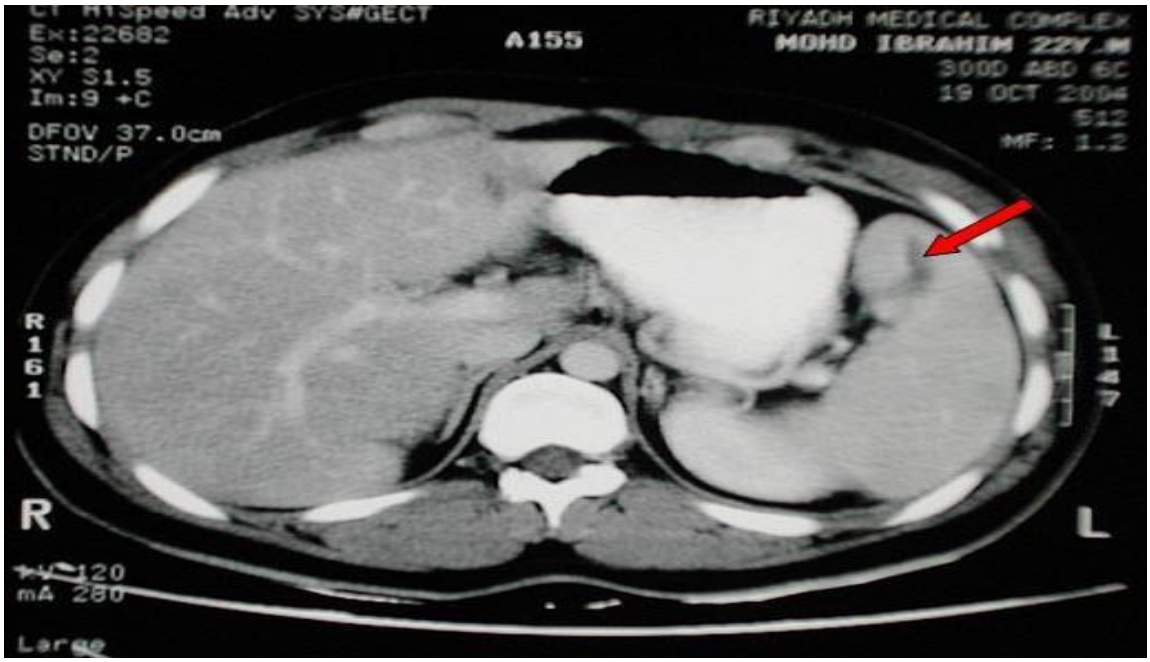
- Splenomegaly is a risk for spleen laceration.

- Radiological:

  - CXR "very important in case of spleen injury"
  - Plain abdominal X-Ray
  - CT Scan: it is the most important investigation in spleen injury.(Done if the patient is stable)
  - Angiography: it is very important for grading. It can be

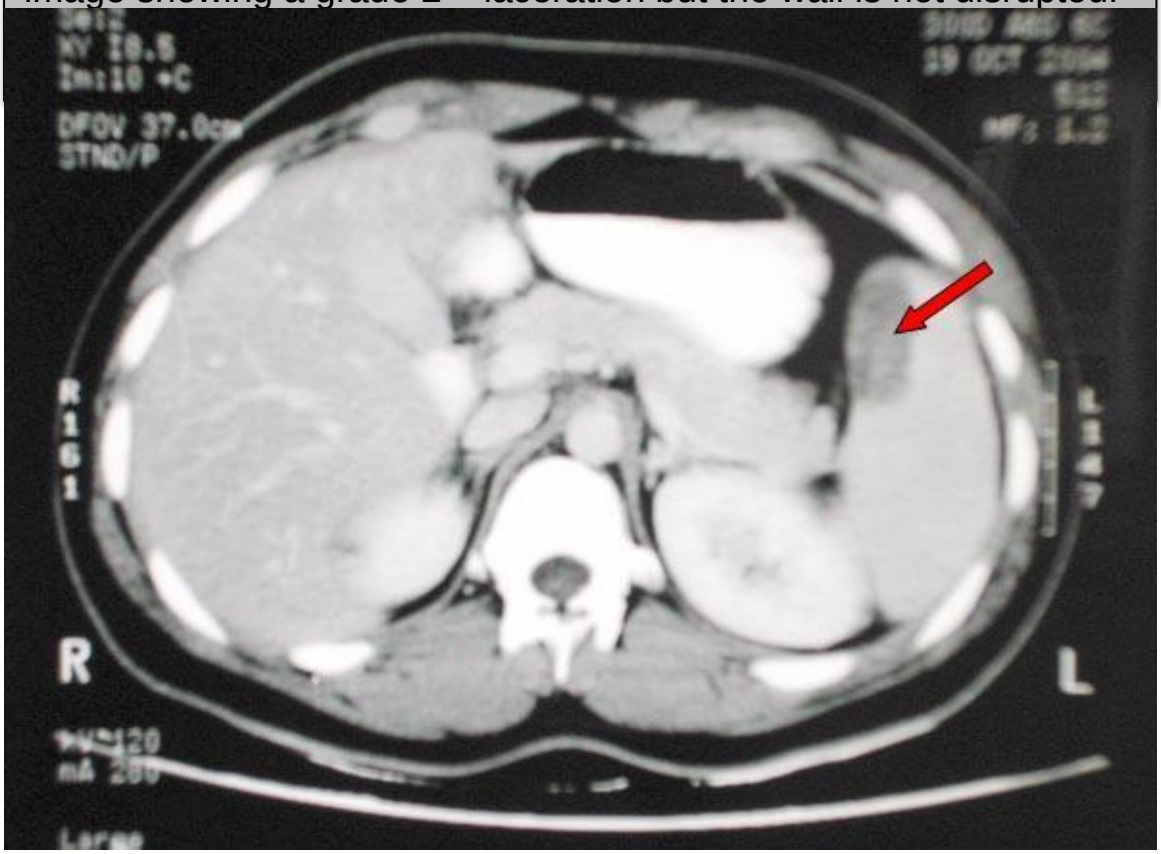
used for diagnosis and a therapeutically. Done if the patient is stable.

- Picture -1-: it shows grade 1 hematoma – patient is



stable so go with conservative therapy.

image showing a grade 2 – laceration but the wall is not disrupted.



TREATMENT:

- ABCDE

- Non-operative approach:
  - Widely practiced in pediatric trauma
  - criteria for non-operative approach :
  - Haemodynamically stable children / adult (not in a shock)
  - Those patients who do not have any peritoneal findings at any time (no rigidity, no tenderness, just bruising).
  - Those who did not need more than two units of blood (more than 2 go to OR)

- Operative approach:
  - Decision to perform splenctomy or splenorraphy is usually made after assessment & grading the splenic injury
  - Contra indication for splenic salvage: (perform splenoctomy)
  - The patient has protracted hypotension (Everything is done but there is no response and the patient is still bleeding)
  - Undue delay is anticipated in attempting repair the spleen (if we put a needle patient will bleed)
  - The patient has other severe injuries (in the liver, bowel, or bladder)

COMPLICATIONS OF SURGERY:

- Early complications occur such as:
  - Bleeding.
  - Acute gastric distention.
  - Gastric necrosis (short gastric vessels are close to each other so when you ligate them, it might lead to necrosis.)
  - Recurrent splenic bed bleeding.
  - Pancreatitis (remember the tail of pancreas ends at the pelvis of the spleen)
  - Subpherinic abscess

-Late complications occur such as:
  - Thrombocytosis
  - OPSS(1–6Week)
  - DVT

3) RENAL TRAUMA

GENERAL CONSIDERATIONS:

- The commonest organ prone to injury in the urinary system.
-If contusion occurs, it can be treated by conservative therapy.
If hematuria is present, it means there is a poor indicator of severe renal injury (complete or partial kidney damage)

DIAGNOSIS:

MEASUREMENT OF MEAN ARTERIAL PRESSURE

-Symptoms and signs (3 Fs) :
- Flankabrasion
- Fracture of the ribs
- Fracture vertebral transverse process

-Investigation:
Intravenous urography (IVU) + CT scan.

MANAGEMENT:

- For minor injuries such as hematoma: US scan, percutanous drainage, antibiotic usage.
- For severe injuries: partial nephroctomy or total nephroctomy.

4) BOWEL INJURY : small bowel are very mobile, so less likely to injured, the problem is in : duodenum and some parts of colon .
- There will be signs of peritonitis
- do laparotomy.

5) PANCERIAS: if it is injured it indicate sever injury, and it usually present with other injures.
- Diagnosis is by laparotomy.
-if the injury was just in the tail, we can take it out, but it was in the head the patient should undergo major surgery.

6) Aorta and IVC: patient usually dies before reching the hospital because of sever bleeding.

MCQS

1. In abdominal injuries, the most informative initial investigation is:

A. CT

B. Ultrasound

C. Diagnostic peritoneal lavage

D. Abdominal x-ray Answer: C

2.Blunt trauma to the abdomen most commonly injures which of the following organs?

A. Liver

B. Kidney

C. Spleen

D. Intestine

E. Pancreas Answer: C

- Explanation: The diagnosis of injuries resulting from blunt abdominal trauma is difficult; injuries are often masked by associated injuries. Thus, trauma to the head or chest, together with fractures, frequently conceals intraabdominal injury. Apparently trivial injuries may rupture abdominal viscera in spite of the protection offered by the rib cage. The structures most likely to be damaged in blunt abdominal trauma are, in order of frequency, the spleen, kidney, intestine, liver, abdominal wall, mesentery, pancreas, and diaphragm. Abdominal paracentesis is a rapid, sensitive diagnostic test for patients with suspected intraabdominal injury and may be extremely helpful in the management of patients with

associated head, thoracic, or pelvic trauma in whom signs and symptoms of the abdominal injuries may be masked or overlooked. Abdominal CT scans, which should be done promptly and rapidly, are being used more frequently to evaluate these injuries.

3.Which of the following conditions is most likely to follow a compression- type abdominal injury?

A) Renal vascular injury

B) Superior mesenteric thrombosis

C) Mesenteric vascular injury

D) Avulsion of the splenic pedicle

E) Diaphragmatic hernia Answer: E

Explanation: In the rapid deceleration injury associated with automobile crashes, the abdominal viscera tend to continue moving anteriorly after the body wall has been stopped. These organs exert great stress upon the structures anchoring them to the retroperitoneum. Intestinal loops stretch and may tear their mesenteric attachments, injuring and thrombosing the superior mesenteric artery; kidneys and spleen may similarly shear their vascular pedicles. In these injuries, however, ordinarily the intraabdominal pressure does not rise excessively and diaphragmatic hernia is not likely. Diaphragmatic hernia is primarily associated with compression-type abdominal or thoracic injuries that increase intraabdominal or intrathoracic pressure sufficiently to tear the central portion of the diaphragm.

4.In hemodynamically stable trauma patient, intra-abdominal injury is best assessed by:

A)Clinical abdominal examination

B)CT scan

C)Diagnostic peritoneal lavage (DPL)

D)Four quadrants peritoneal tapping

E)Ultrasound Answer: B

5. Mortality from trauma occurs mostly:

A) Immediately at the scene

B) During the first hour from the accident

C) After admission to the hospital

D) In the intensive care unit (ICU)

E)Just before discharge from the hospital Answer: B

SURGICAL RECALL

-What are the three main elements of the ATLS (Advanced Trauma Life Support**) protocol?**

1. Primary survey/resuscitation

2. Secondary survey

3. Definitive care

-How and when should the patient history be obtained?

It should be obtained while completing the primary survey; often the rescue squad, witnesses, and family members must be relied upon

-What are the five steps of the primary survey?

Think: **"ABCDEs":**

- **A**irway (and C-spine stabilization)
- **B**reathing
- **C**irculation
- **D**isability
- **E**xposure and **E**nvironment

-What principle is followed in completing the secondary survey?

Complete physical exam, including all orifices: ears, nose, mouth, vagina, rectum

-What is the best way to diagnose or rule out aortic injury?

CT angiogram

-What must be considered in every penetrating injury of the thorax at or below the level of the nipple?

Concomitant injury to the abdomen: Remember, the diaphragm extends to the level of the nipples in the male on full expiration

-What physical signs may indicate intra-abdominal injury?

Tenderness; guarding; peritoneal signs; progressive distention (always use a gastric tube for decompression of air); seatbelt sign

-What is the seatbelt sign?

Ecchymosis on lower abdomen from wearing a seatbelt (□10% of patients with this sign have a small bowel perforation!)

-What must be documented from the rectal exam?

Sphincter tone (as an indication of spinal cord function); presence of blood (as an indication of colon or rectal injury); prostate position (as an indication of urethral injury)

-What physical signs indicate possible urethral injury, thus contraindicating placement of a Foley catheter?

High-riding ballotable prostate on rectal exam; presence of blood at the meatus; scrotal or perineal ecchymosis

-What are the common trauma labs?

Blood for complete blood count, chemistries, amylase, liver function tests, lactic acid, coagulation studies, and **type and crossmatch;** urine for urinalysis

-What studies are available to evaluate for intra-abdominal injury?

FAST, CT scan, DPL

-What is a FAST exam?

Ultrasound: **F**ocused **A**ssessment with **S**onography for **T**rauma

-What does the FAST exam look for?

Blood in the peritoneal cavity looking at Morison's pouch, bladder, spleen, and pericardial sac

-What does DPL stand for?

Diagnostic **P**eritoneal **L**avage

-What diagnostic test is the test of choice for evaluation of the unstable patient with blunt abdominal trauma?

FAST

-What is the indication for abdominal CT scan in blunt trauma?

Normal vital signs with abdominal pain/tenderness/mechanism

-What is the indication for DPL or FAST in blunt trauma?

Unstable vital signs (hypotension)

-How is a DPL performed?

Place a catheter below the umbilicus (in patients without a pelvic fracture) into the peritoneal cavity

Aspirate for blood and if 10 cc are aspirated, infuse 1 L of saline or LR Drain the fluid (by gravity) and analyze

-What is a "grossly positive" DPL?

>10 cc blood aspirated

-What injuries does CT scan miss?

Small bowel injuries and diaphragm injuries

-What injuries does DPL miss?

Retroperitoneal injuries

-What study is used to evaluate the urethra in cases of possible disruption due to blunt trauma?

Retrograde urethrogram (RUG)

-What findings would require a celiotomy in a blunt trauma victim?

Peritoneal signs, free air on CXR/CT scan, unstable patient with positive FAST exam or positive DPL results

-What is the treatment of a gunshot wound to the belly?

Exploratory laparotomy

-What is the evaluation of a stab wound to the belly?

If there are peritoneal signs, heavy bleeding, shock, perform exploratory laparotomy; otherwise, many surgeons either observe the asymptomatic stab wound patient closely, use local wound exploration to rule out fascial penetration, or use DPL