A STUDY ON BLUNT INJURY ABDOMEN

SOLID ORGAN INJURIES

DISSERTATION SUBMITTED FOR

BRANCH - I M.S (GENERAL SURGERY)

APRIL 2013

THE TAMILNADU

DR.M.G.R.MEDICAL UNIVERSITY, CHENNAI

TAMIL NADU

CERTIFICATE

This is to certify that the dissertation entitled **"BLUNT INJURY ABDOMEN-SOLID ORGAN INJURIES"** is the bonafide work of **Dr.S.BALAMURALI** in partial fulfillment of the university regulations of the Tamil Nadu Dr. M.G.R. Medical University, Chennai, for M.S (Branch I) General Surgery examination to be held in April 2013.

Prof.S.SELVA CHIDAMBARAM, M.S.,
Professor of Surgery,
Madurai Medical College,
Madurai.

Prof.Dr.D.SOUNDARAJAN, M.S.,
Head of the Department,
Department of Surgery,
Madurai Medical College,
Madurai.

DECLARATION

I, **Dr.S.BALAMURALI** hereby declare that, I carried out this work on "**BLUNT INJURY ABDOMEN – SOLID ORGAN INJURIES"** at the department of surgery, Govt. Rajaji hospital, Madurai, under the guidance of Prof. Dr. S. Selva chidambaram, M.S., PROFESSOR OF SURGERY, during the period of April 2011 to May 2012. I also declare that this bonafide work has not been submitted in part or full by me or any others for any award, degree or diploma to any other university or board either in India or abroad.

This is submitted to the Tamilnadu DR. M.G.R. Medical University, Chennai in partial fulfilment of the rules and regulations for the M.S degree examination in general surgery (branch I) to be held in April 2013.

Place:

Date: (Dr.S.BALAMURALI)

ACKNOWLEDGEMENT

I wish to thank the **Dean,** Madurai Medical College for permitting me to utilize the clinical materials of the hospital to carry out this study.

I express my sincere gratitude to **Prof. Dr.D.Soundarajan.M.S.,** Professor and Head of the Department of Surgery, Madurai Medical College, Madurai, for his able guidance in doing this project.

I am extremely thankful to my **Unit Chief Prof.Dr. S. Selva Chidambaram,** for his excellent guidance in doing this study and for the inspiration and encouragement he rendered in every stage of this study.

With deep sense of gratitude, I remember my former Chief and Professor of Surgery, **Prof, Dr. M.Jebamani** for his valuable guidance in conducting this study.

I also thank my Assistant Professors **Dr. S.Kalirathinam,M.S., Dr.K.G.Subangi,M.S., Dr.M.ShenthilPrabhu,M.S.,** for their constant support and help.

I also wish to record my deep sense of appreciation and gratitude to the **patients** who have co operated and rendered themselves for this study.

CONTENTS

LIST OF ABBREVATIONS USED

ARDS	–	Acute respiratory distress syndrome
A –V	–	Arterio venous
BIA	–	Blunt injury abdomen
CBD	-	Common bile duct
CECT	–	Contrast enhanced computed tomography
CHD	-	Common hepatic duct
CPR	-	Cardiopulmonary resuscitation
CUSA	-	Cavitron ultrasonic surgical aspirator
CVP	-	Central venous pressure
DPL	-	Diagnostic peritoneal lavage
ERCP	-	Endoscopic retrograde cholangiopancreatography
FAST	–	Focused assessment by sonography for trauma
FQA	–	Four quadrant aspiration
GCS	-	Glasgow coma scale
ICD	–	Intercostal drainage
ICU	-	Intensive care unit
IVC	-	Inferior venacava
IVU	–	Intravenous Urography
KUB	-	Kidney, ureter, bladder x ray film
MRI	-	Magnetic resonance imaging
RTA	–	Road traffic accident
USG	-	Ultrasonography

INTRODUCTION

Blunt Abdominal trauma is most commonly caused by road traffic accidents.[1] The rapid increase in number of motor vehicles and its aftermath has caused rapid increase in number of victims to blunt abdominal trauma. Motor vehicle accidents account for 75 to 80 % of blunt abdominal trauma. [2] Blunt injury of abdomen is also a result of fall from height, assault with blunt objects, industrial mishaps, sport injuries, bomb blast and fall from riding bicycle. [2]

Blunt abdominal trauma is usually not obvious. Hence, often missed, unless, repeatedly looked for. Due to the delay in diagnosis and inadequate treatment of the abdominal injuries, most of the cases are fatal. Investigative modality can only supplement the clinical evaluation and cannot replace it in the diagnosis of blunt abdominal trauma. In spite of the best techniques and advances in diagnostic and supportive care, the morbidity and mortality remains at large.

The reason for this could be due to the interval between trauma and hospitalization, inadequate and lack of appropriate surgical treatment, delay in diagnosis, post operative complications and associated trauma especially to head, thorax.

In view of increasing number of vehicles and consequently road traffic accidents, this dissertation has been chosen to study the cases of blunt abdominal trauma.

AIM OF THE STUDY

The objectives of the study are:

1. To evaluate the incidence of blunt abdominal trauma on solid viscera.
2. To evaluate etiology and various modes of presentation.
3. To evaluate various available investigations for the detection of solid organ injuries.
4. To evaluate various modalities of treatment available with aim to reduce the mortality and morbidity.
5. To evaluate common complications of solid organ injury in blunt trauma abdomen.

REVIEW OF LITERATURE

Blunt injury as causes of intra abdominal injuries have been recognized since historical times. Aristotle was the first to record visceral injuries from blunt trauma. Hippocrates and Galen are said to have given apt description of the condition. [1] By 1500 BC distinct triage and surgical protocol had been developed in Babylonia under the rule of Hammurabi as said by Edwin Smith Papyru. The ancient Chinese used a sharp blow on the region of the spleen as a method of assassination. [3]

Trausse in 1827 presented fracture of body of pancreas in blunt trauma. In 1906 Solomen performed Peritoneal lavage for the first time. In 1934 Aenhium used puncture of abdominal wall as a diagnostic procedure in abdominal injuries. Branch in 1938 reported 2 cases of liver laceration treated by resection of left lobe. Synthetic grafts was first used by Voorhes in 1952 and widely employed by Hughes (1954) and Spencer (1955).

The development of emergency medical service is an important milestone in the history of clinical and surgical practice of trauma. Greeks required physicians to be present during the battle and Romans established the hospitals close to the battlefield. [1]

Cincinnati General Hospital first instituted the ambulance system in 1865.

In 1965 Root first described the flushing of sterile solution through the peritoneal cavity to obtain peritoneal contents. Advanced imaging techniques like spiral CT scan and MRI has made early detection of blunt abdominal injuries easier.

Anatomy of abdominal cavity:

Abdominal cavity extends just below xiphisternum to deep into the pelvis. It has number of organs, some solid and other hollow viscus. Abdominal organs are protected anteriorly only by muscles except those organs/parts lying under the lower ribs and in the pelvis. The abdominal cavity is bounded anteriorly by the rectus abdominis, laterally by external, internal and transverse abdominis and more inferiorly, the iliac muscles and posteriorly by the vertebral columns and psoas major, minor and quadratus lumborum.[3]

It is divided into nine regions for the descriptive purpose by two horizontal lines and two vertical arbitrary lines. The horizontal lines are transpyloric, at the level of pylorus of stomach or passes through the tip of the ninth costal cartilage and that passing through

the intertubercles of the ilium as transtubercular line. The two vertical lines are from midclavicle downwards. The resulting quadrants are right and left hypochondriac, middle epigastric, right and left lumbar, middle umbilical, right and left iliac, middle hypogastric.

Peritoneal cavity:

The peritoneum lines the wall of the abdominal cavity and it is a serous membrane. Developmentally abdominal and pelvic viscera invaginate into the abdominal cavity carrying the peritoneum before them. This results in covering over of the organs by the visceral peritoneum that is continuous with parietal peritoneum lining the abdominal walls. The layers of opposing peritoneum between viscera and body wall and between two organs form visceral ligaments of the abdominal cavity. The disappearance, fusion, shifting, shortening of these peritoneal folds during development divides the peritoneal cavity into two distinct parts, the greater and lesser sac. The lesser sac is situated posterior to the lesser omentum, stomach and gastro colic ligament. Right side, it communicates with the greater sac through the foramen of winslow [3,4]. In males peritoneal cavity is a closed cavity, whereas in females it communicates with the exterior through the openings of the fallopian tube at the fimbrial end.

Solid organs: Liver:

The liver is situated in the right upper quadrant of the body. It is wedge shaped; the base of the wedge is directed to the right. It is the largest gland in the body weighs about 1500gms and receives about 1500ml of blood per minute. The anterior surface is triangular and is related to the xiphoid process and the diaphragm on either side. The posterior surface is also triangular and is marked by the vertebral impression in the middle. The superior surface is quadrilateral and is marked by the cardiac impression in the middle. The diaphragm separates it from the pericardium and heart in the middle and from the pleura and lungs on each side. The inferior surface is also quadrilateral and has a sharp border. The liver has two lobes. Right lobe, which has two additional lobes, the caudate and quadrate lobes. [5] Left lobe on the inferior surface presents the omental tuberosity. It is held in position by attachment of IVC and hepatic veins. Liver receives 20% of its blood supply from the hepatic artery, and 80% from the portal vein. Before entering the liver, the hepatic artery and portal vein divide into right and left branches. Within the liver they redivide to form the segmental and then interlobular vessels which run in the portal canals. Venous

drainage is from the hepatic veins, which drain directly into the inferior vena cava. The bile is drained by the right and left hepatic ducts, which join to form the common hepatic duct. With the joining of cystic duct, it becomes common bile duct and drains into the second part of duodenum. [13].Pringles manovere is temporaray occlusion of free margin of lesser omentum upto a period of 20 min to 1 hour,indicated in majour hepatic injuries.

Pancreas:

Pancreas lies obliquely on the upper part of the posterior abdominal wall extending from the concavity of the duodenum to the spleen at the level of L1 and L2 vertebra. It is an elongated organ which has both exocrine and endocrine functions. Anteriorly, it is related to transverse colon and stomach. [3] Posteriorly, to the aorta, inferior venacava, superior mesenteric artery and the left crus of diaphragm. The tail of the pancreas is related to the hilum of spleen.The splenic artery runs along the upper border of spleen.The main pancreatic duct traverses along the entire length of the gland and joins common bile duct and empties into the duodenum about 2.5cm above the duodenal papillae.

Spleen:

Spleen lies in the left hypochondriac region of the abdomen, its long axis being parallel to that of 9th rib, behind the stomach and inferior to the diaphragm. It is the largest lymphatic organ. It is surrounded by the peritoneum and is suspended by the following ligaments. [3,4]

a) Gastro-splenic ligament from hilum to the greater curvature of stomach.

b) Lienorenal ligament from the hilum to the anterior surface of left kidney.splenic artery passes within this ligament

c) Phrenicocolic ligament supports the anterior end of the spleen.

Kidneys and suprarenal:

Kidneys are a pair of excretory organs situated on the posterior abdominal wall one on each side of the vertebral column behind the peritoneum. [14] The right kidney is slightly lower than the left, and the left kidney is a little nearer to the median plane than the right. Each kidney has got two poles, two borders and two surfaces. Upper pole is broad and is related to suprarenal gland, the lower pole is pointed. Lateral border is convex; the medial is concave, with hilus

in the middle. [3,4]

Anterior surface is irregular and posterior surface is flat. Right kidney is related to right suprarenal gland, second part of duodenum, hepatic flexure of colon and small intestine. The left kidney is related to left suprarenal gland, spleen, stomach, pancreas, splenic vessels, splenic flexure, descending colon and the jejunum. [15] Posterior surface of both the kidneys are related to diaphragm, medial and lateral arcuate ligaments, psoas major, quadratus lumborum, transverse abdominis, subcostal vessels and the subcostal, iliohypogastric, and ilioinguinal nerves. In addition, the right kidney is related to 12 rib, and the left kidney to 11 and 12

ribs. Renal fascia (fascia of Gerota) is the fibroareolar sheath surrounding the kidney and perirenal fat. Renal artery and vein supply kidneys. Renal artery is a direct branch of aorta; renal vein drains directly into the inferior venacava.

PATHOPHYSIOLOGY AND MANAGEMENT

Liver injuries: Incidence:

The liver is the second most commonly injured organ in all patients with blunt abdominal trauma. Incidence being 35-45% of patients with abdominal trauma, 40% of patients with stab injury to the abdomen and 30% of patients with gunshot wound to the abdomen.

Mechanism of injury: Blunt injury results from direct blows, compression between the lower ribs on the right and the spine or shearing at fixed points secondary to deceleration.

Classification of liver injuries (organ injury scaling system)

Grade I - Hematoma: subcapsular, <10% surface area Laceration: capsular tear, <1cm parenchymal depth

Grade II - Hematoma: subcapsular, 10-50% surface area Intraparenchymal, <10cm diameter.Laceration:1-3 cm parenchymal depth, <10cm long

Grade III - Hematoma: subcapsular, >50% or expanding; ruptured Subcapsular or parenchymal hematoma; intra- Parenchymal hematoma >10cm or expanding. Laceration: >3cm parenchymal depth.

Grade IV - Laceration: parenchymal disruption involving 25-75% of hepatic lobe or 1-3 couinaud's segments within a single lobe.

Grade V - Laceration: parenchymal disruption involving >75% of hepatic or >3 couinaud's segments within a single lobe.Vascular: juxtahepatic venous injuries: i.e., retrohepatic venacava/ central major hepatic veins.

Grade VI - Vascular: hepatic avulsion.

Clinical manifestations:

Major hepatic injuries are usually easy to detect because of the location of trauma, profound hypotension temporarily responsive

to the infusion of blood and fluids and marked abdominal distension. Small hepatic tears from blunt trauma or lacerations from stab wounds are usually more difficult to detect as hemorrhage from such injuries may be limited and might have stopped by the time the patient arrives in the emergence center for evaluation. For these reasons a variety of diagnostic agents have been utilized in recent years to evaluate possible hepatic injuries.

Management:

Resuscitation:

Approximately 80% of all patients who die of hepatic injuries do so in the perioperative period from hemorrhage and hypovolemic shock. Profound hypothermia is frequently present with severe hepatic trauma, particularly after repeated transfusions of non warmed blood. Maneuvers to prevent or decrease hypothermia in patients with major hepatic injuries are:

1. Resuscitation with warm (37 C) crystalloid solution.
2. Resuscitation with high flow blood warmers.
3. Covering of patient's head, placement of patients on heating blankets or covering of lower extremity with plastic bags or space blankets.

4. Irrigation of nasogastric tube with warm saline.
5. Irrigation of open body cavity with warm saline.
6. Using of heating cascade on anesthetic machine.

The most important resuscitative technique in the patient with a major hepatic injury includes insertion of large bore IV lines in the upper extremities, rapid transfusion with warm crystalloid solution and type specific blood and early operation for controlling of ongoing hemorrhage.

Indications of exploratory laparotomy are:

1. All patients of hepatic trauma whatever may be grade of injury; if they are hemodynamically unstable or become unstable after being stable initially.
2. Patients who are hemodynamically stable and detected to have hepatic injury on USG or CT scan but the facilities for non operative protocol do not exist.[3] Patients of hepatic trauma who have been put on non operative protocol and develop:

a) Deterioration in vital signs or continuing need of transfusion

b) Increased abdominal tenderness or development of new peritoneal signs.

c) Progressive expansion of the hematoma or laceration as documented by repeat CT scan and

d) An intrahepatic or subcapsular Management of actively bleeding liver:

First and foremost aim of exploration is to stop active bleeding from the liver. Various techniques are:

1. Manual compression.
2. Portal triad occlusion.
3. Placement of perihepatic packs.
4. Direct clamping of liver parenchyma.
5. Direct suture of the liver and
6. Application of liver tourniquet.

Manual compression: once the abdomen is entered and serious bleeding is encountered, manual compression is the first life saving maneuver the surgeon should attempt. It is applied from right and left margins of the liver towards the center. At the same tine, a posterior directional force may help tamponade bleeding in the retrohepatic surface and posterior perihepatic space.

Portal traid occlusion: the Pringles maneuver is usually the first step in attempting to stop hepatic bleeding particularly if there

appears to be arterial component, by means of artery occlusion/ interruption. The left thumb is placed on the anterior surface of the hepato-duodenal ligament and the middle and index finger inserted into the foramen of Winslow. hematoma thought to represent septic focus. The structures in the porta hepatis are compressed until a vascular clamp or a Rumel tourniquet can be placed across the porta hepatis. The results are observable in 10 minutes. The upper limit of normothermic occlusion of the liver is presently unknown, although it has been successfully been extended up to one hour. The wound is examined and the source of bleeding identified. Vessels and bile ducts that are visualized are occluded by clips, tie or ligature. Topical hemostatic agents like fibrin glue may be effective.

Selective hepatic artery ligation: Indicated when selective clamping of the extra lobar hepatic artery causes cessation of arterial bleeding in a hepatotomy site or parenchymal laceration and the injured vessel cannot be clearly visualized inside the liver. Either the right or the left hepatic artery is ligated. If the right hepatic artery is ligated, cholecystectomy is done to prevent gangrenous cholecystitis. [6]

Perihepatic packing: the technique involves the insertion of laparotomy pads or rolls of gauze around the injured liver, (not into hepatic lacerations) i.e. between the diaphragm and the liver, below the liver and laterally until sufficient pressure is generated to achieve hemostasis.

Indications:

1. Lack of facilities, blood or experience in dealing with hepatic trauma.

2. Transfusion induced coagulopathy.

3. Confined bleeding after the performance of routine measures for hepatic hemostasis in the patient who is not a suitable candidate for a major hepatic resection.

4. Bilobar injury

5. Subcapsular hematoma.

6. Need to terminate operation because of profound hypothermia associated with hemodynamic or cardiac instability. Excessive packing should be avoided because it may compromise cardiac inflow from the IVC. When packing is on a raw surface, a small steri-drape is placed between the packs and the liver. This prevents disruption of hemostasis when the pack pads are removed during

reexploration. Closed suction drains are placed and the patient is transferred to the intensive care unit where vigorous rewarming is instituted and attempts are made to treat the coagulopathy. It consists of the following:

• Maintenance of tissue perfusion by ensuring adequate blood and extracellular fluid volumes guided by appropriate monitoring.

• Rapid rewarming of the patient using thermal blankets, warm intravenous fluids and warm, humidified gases in the ventilator and

• The empirical use of fresh frozen plasma and platelets transfusion.

When hemodynamic instability, acidosis, hypothermia and coagulopathy have been corrected the patient may be returned to the operation theater for pack removal. This is usually at least 24 hours later and should be within 72 hours. Re operation serves not only to remove the packs, but also to debride nonviable hepatic tissue, suture, ligate specific bleeding point and lacerated bile ducts, irrigate the abdomen of clots and establish new drainage.

Surgical clamps:

The various surgical clamps for liver falls into two categories:[3,6.] 1.Occluding, noncrushing clamps and2. Crushing clamps. These clamps are large enough to encompass fully the

thickest part of the liver, both posteriorly and anteriorly. Successful placement of these clamps, which often requires previous dissection of the ligamentous attachments of the liver, stops the bleeding dramatically. This rapid cessation of bleeding permits further patient resuscitation and definitive ongoing treatment of the anatomic injury in a dry surgical field.

Liver suture: Direct suturing for the liver should be an adjunctive procedure, not a first step. In the liver suture one must avoid creating a dead space, which may lead to abscess formation or to hemobilia. Ideally liver sutures should be placed parallel to any laceration to control the bleeding by compression of the hepatic substance rather than apposition of cut edges. Parallel sutures control the hemorrhage and leave the wound open, permitting proper drainage of the wound without dead space. It is a heavy absorbable suture on a large, curved blunt tipped needle. This suture may be passed deeply into the hepatic substance several centimeters from the site of injury, passes deeply through the hepatic substance outside of the wound, and exits on the opposite site, as a figure of eight or simple suture. It should be tied lightly enough to oppose the edges of the fracture and to control hemorrhage. The suture may be tied over bolsters. This

suture can be effective in controlling hemorrhage from a grade III, grade IV or a grade V laceration unless there is a major venous injury.

Debridement: small fragments of amputated and devitalized hepatic substance should be removed. The resulting defect does not require closure. Occasionally, hepatic injury is of such severity as to require a major resection of devitalized tissue, resectional debridement. This usually is an avulsion injury (Grade IV) and will often involve the right lobe of the liver. Major injuries of the lateral segment of the left lobe of the liver (segment II and III) are usually treated by resection debridement. But major hepatic resections for trauma carry an excessive mortality.

Several techniques are used to divide the hepatic substance during the course of a resectional debridement. These are:

1. Finger fracture technique.
2. Cavitron ultrasonic surgical aspirator (CUSA).
3. Water jet knife.
4. Laser knife.
5. Suction knife.
6. Micro wave tissue coagulation.

Omental packs:

Stone and Lamb (1975) have recommended the use of omentum as a living pack. If additional length is desired, the omentum can be mobilized from the transverse colon from left to right. The wound is closed with sutures around the omentum. It eliminates dead space and compresses small vessels. Besides, the omentum is a rich source of macrophages and helps in combating sepsis.

Juxta hepatic venous injuries: If there is injury to major hepatic veins or the juxtahepatic venacava (Grade V and VI injuries) the surgeon must decide whether to proceed with definitive therapy or to attempt temporary control of hemorrhage with a pack. Definitive repair usually requires vascular isolation of the liver. There are three techniques for vascular isolation of the liver.

• Placement of atrial caval shunt through the right atrium.

• Placement of an intra caval shunt from below the liver and

• Use of multiple occlusive clamps.

When the liver has vein isolated, the rate of bleeding usually decreases to a point where it is possible to expose the hepatic venous or retrocaval injury and to proceed with its treatment. If one or more

hepatic veins have been avulsed from the vena cava or are divided, occlusion of the hepatic vein is indicated. A vascular clamp should be applied to the torn vein or vena cava and the vessel over sewn with a 5/0 or 6/0 vascular suture rather than to attempt a ligature that will tend to tear the vein. If there is a caval defect a satinsky clamp can be applied. If it is necessary to mobilize the right lobe of the liver, small venous tributaries from the liver to the vena cava are identified between ligatures. If a major hepatic vein is ligated, often it is necessary to resect the hepatic substance drained by them. If a major hepatic vein is ligated, often it is necessary to resect the hepatic substance drained by them.

Mesh hepatorraphy:

The goal of prosthetic encapsulation of the liver is to obtain sufficient compression of the liver parenchyma, and thus to achieve hemostasis. Absorbable mesh is wrapped around the liver in such a fashion as to compress the liver after freeing its peritoneal attachments. The use of mesh is best adopted to grade III and grade IV and lobar tears.

Drainage: Purpose is to monitor for bile and blood and to establish a tract for drainage of fragments of devitalized tissue. A closed drain is advocated. T tube of 10 or 12 Fr is inserted into the common bile duct only in patients where a major portion of the CHD is thought to be injured.

Postoperative course: In a case of major hepatic resection, there may be deficiency of coagulation factors, hypoglycemia and hypoalbuminemia. These are replaced by infusion of 10% glucose, coagulation factors and salt free albumin. Nutritional support is essential in all cases of severe liver injury. [5]

Post operative complications:

1. Haemobilia (commonest complication)

2. Coagulopathy

3. Hypoglycaemia

4. Jaundice

5. Biliary fistulas

6. Haemobilia

7. Subdiaphragmatic and intraparenchymal abcess formation

Non operative management of stable patients with hepatic injuries diagnosed on CT is now practiced in many centers.

CT criteria for non operative management are:

1. Simple hepatic parenchymal laceration or intra hepatic hematoma. Grade I to II injury (CT evaluation).
2. No evidence of active bleeding.
3. Intra peritoneal blood loss less than 250ml.
4. An absence of other intra peritoneal injuries requiring operation.
5. Ready access to CT scan and operation theater.
6. Availability of surgeon/ radiologist with extensive experience in interpreting the CT scans.

It is better to rely more on the clinical condition of the patient than on any arbitrary criteria based on CT in the selection of cases for non operative therapy. Once a decision is reached to use a non operative approach the patient is placed on strict bed rest and repeated physical examination by the same surgeon is performed. Blood count and hematocrit is done 12 hourly. USG is done daily. After second scan reveals no change in the injury or some worsening, the surgeon must decide whether further in hospital observation is warranted or immediate laparotomy.

If non operative care is chosen, the patient continues bed rest for a period of 5-7 days and then discharged to home for further bed rest for 4 weeks. After 4 weeks CT scan is repeated and by this time 95% of lesion would have healed. Individual is then permitted to return to his previous profession. Contact sports should be forbidden for 3 months.

Indications for laparotomy during the period of observation include:

1. Continuing need for transfusion or deterioration in vital signs.

2. Increasing abdominal tenderness or peritoneal signs.

3. Progressive expansion of the hematoma.4. Hematoma thought to represent a septic focus.

Splenic injuries:

It is the single commonest visceral organ to rupture following blunt trauma. Factors contributing to its increased susceptibility to injury in trauma are:

1. The soft consistency of the organ.

2. Its intimate contact with ninth to twelfth ribs and

3. Its tendency to enlarge becoming pulpier with variety of disease.

Pathology:

It is usually an avulsion from the pedicles, multiple fissure fractures, an enlarged spleen splitting on its outer aspect to produce either a tear or subcapsular hematoma. Less usually is a small tear in the anterior aspect of hilum, which may produce severe bleeding but will escape from detection.[2]

Splenic injury scale:

Grade I - Hematoma: Subcapsular, non-expanding<10% of surface area. Laceration: capsular tear, non bleeding, <1cm Parenchymal depth.

Grade II - Hematoma: Subcapsular, non-expanding, 10-50% of surface area, intraparencymal, non-expanding, <2cm in diameter.

Grade III-Hematoma: Subcapsular, >50% surface area, or, Expanding, ruptured Subcapsular hematoma, active Bleeding. Intraparenchymal hematoma >2cm or Expanding.Laceration: >3cm parenchymal depth or involving trabecular vessels.

Grade IV - Hematoma: ruptured intraparenchymal hematoma with active bleeding.

Laceration: involving segmental or hilar vessels producing major devascularization (>25% of spleen)

Grade V - Completely shattered spleen. Hilar vascular injury that devascularises the spleen.

Clinical presentation:

The 3 possible scenarios, a patient with splenic injury can present are:

1. Patient may succumb rapidly to trauma, without recovering from shock.
2. Initial shock followed by recovery with signs of rupture.
3. Delayed rupture after few days.

1. Rapid death: the spleen will be avulsed or severely mangled by blunt abdominal trauma. The patient dies before resuscitation or a laparotomy could be performed.

2. Shock: this is due to rupture. This is the largest group. Trauma to the abdomen or lower thorax is followed either by an absence of symptom for some hours or vague distress. Then suddenly with a matter of minutes patient symptoms are exaggerated. There is abdominal rigidity and circulation becomes apparent. The patient shows variable signs of hypovolemia and there

is evidence that points to serious intra abdominal pathology. The patient is pale. Abdomen may be slightly distended. Abdominal rigidity is variable ranging from generalized rigidity to that localized to left upper quadrant and extending towards the flank. Tenderness is likely to be variable. But commonly it is presented in the left upper quadrant and frequently pain is accentuated by deep breathing. In early cases, pulse may not rise above 90 and blood pressure is often unaltered for several hours. Referred pain to the left shoulder is a valuable symptom. In this group latent period is characteristic because a subcapsular hematoma forms and ruptures quickly.

3. Delayed rupture: when the trauma and acute events, which lead to surgery, are separated by days some times months.

The diagnosis can be made by four general methods.

- History of injury in the recent past with general signs of blood loss associated with local signs like bruising, tenderness, rigidity, fractured ribs, Balance's sign positive, Kehr's sign positive.
- Presence of palpable tender spleen.
- Radiography: plain x ray may show:

• Fractured lower ribs on left side.

• Elevation of left dome of diaphragm or pleural effusion.

• Diaphragmatic rupture.

• Increased density in the left upper quadrant.

• Displacement and indentation of greater curvature of stomach.

• Transverse colon displaced downwards.

• Radioisotope scanning is useful in diagnosis in about 90% of cases.

Other signs of splenic injury are:

1. Balance's sign: Fixed dullness in the left flanks and right flank. Changes of dullness on change of position.

2. Seagesser's sign: Pain produced in the neck by pressure over the phrenic nerve over the left supraclavicular region.

3. Hardi sign: Sternal saggital compression produces sharp pain below the left costal margin in splenic rupture.

4. Snow ball sign: Bulge in the pouch of Douglas due to hemoperitoneum.

Management:

Preoperative considerations:

Proper management of patients with blunt injury spleen begins with resuscitative regimes. Adults should receive a rapid infusion of 1 to 2 liters of lactated ringer solution. Children should receive lactated ringer solution on per weight basis (20 ml/kg). A naso

gastric or a oro gastric tube should be positioned to decompress the stomach., blood should be sent for blood typing and cross matching and blood transfusion to be started immediately, if possible, reserving further blood for intra operative period. Once in the operating room auto transfusion systems are available for recovery and reinfusion of blood vessels.

Once the decision has been made to proceed with operation, the surgeon should carefully consider the need for each of the following: additional intravenous access, peri-operative monitoring (i.e., central venous catheter, arterial catheter), peri-operative antibiotics, and blood transfusion.

Operative management:

The patient is positioned supine on the operating table and may be rotated 15 degrees toward the operating surgeon (standing on right side) so that there is greater exposure of the left upper quadrant. A midline incision, with adequate extension to the xiphoid, is preferably used to facilitate exposure and treat associated injuries.

Complete mobilization of spleen is the key to adequate assessment of injury and safe repair. With adequate retraction of the left upper quadrant, the splenic exploration begins by direct visualization and

careful palpation. Any blood should be evacuated from the area in order to optimize visual and palpatory examination. [6]

If splenic injury is apparent, spleen should be mobilized form its surrounding attachments, the lienorenal and phrenicolienal ligaments are avascular and can be sharply incised away from the lateral margin of the spleen. The vessels in the lienocolic ligament may need to be ligated and divided.

Complete removal of clot is necessary to assess the extent of splenic injury. Clot can be removed by gentle irrigation or grasping with forceps. Persistent massive bleeding from spleen usually can be controlled by manual compression of the splenic organ.

If this is not successful temporary control of the splenic artery at the superior pancreatic margin by grasping the splenic pedicle with thumb and fore finger is helpful when there is persistent active bleeding.

The decision to perform splenectomy or splenorrhaphy is based upon the condition of the patient and the condition of the spleen. Splenectomy is done without equivocation in patients who remain in shock after control of the splenic pedicle, and in patients who have other potentially life threatening problems, such as severe

head trauma or thoracic trauma with poor gas exchange or widened mediastinum.

Because attempts at splenorrhaphy can prolong the operation, splenectomy is strongly considered in patients with medical contraindications to prolonged surgery, such as coagulopathy, hypothermia and cardiac, pulmonary or hepatic disease. Age of the patient should also be considered especially in equivocal cases.

If the patient's condition does not contraindicate splenorrhaphy, especially in younger patients, the degree of splenic injury should dictate operative method.

Grade I injuries: Injuries consist of small subcapsular hematoma and laceration that involve splenic capsule and minimal amount of parenchyma. These require little or no treatment. Tamponade with a dry sponge for 5 minutes or topical hemostatic agent applied to the injury site is quite sufficient.

Grade II injuries: Include larger capsular hematomas, medium depth laceration of parenchyma or multiple grade I injuries. These can be treated with hemostatic agents (including microfibrillar collagen, gelfoam soaked in topical thrombin, or surgicel) with tamponade to control bleeding. Continued bleeding from grade II

injuries is treated by direct suture of the spleen (splenorrhaphy). The firm parenchyma is approximated using monofilament such as chromic catgut or polypropylene on a large needle. Mattress sutures are placed over a buttress of omentum, Teflon pledgets or a topical hemostatic can be used to minimize capsular tearing.

Grade III injuries: The principles involved in treating these injuries are:

• Removal of clot and devitalized tissue, complete reapproximation of parenchymal edges to the depth of the wound to avoid leaving dead space, and suture placement within the fibrous splenic capsule well away from the wound margin to prevent tearing.

• Expanding hematomas should be opened, the clot evacuated and a diligent search made for parenchyma arterial bleeding, which can be controlled with suture ligature.

• Another technique is to use polyglycolic acid mesh wrapping it around the spleen to partially approximate sections after local hemostasis has been performed with sutures.

Grade IV injuries: These often require partial splenectomy for segmental devascularization. Hemostasis in the hilum is attained by selective ligation of the appropriate segmental artery. Debridement is

accomplished by finger fracture or sharp resection at the line of demarcation. The resected splenic surface is treated with a combination of through and through capsular suture and hemostatic agents. An omental pedicle may also be used to seal the raw surface.

As described in grade II injuries, wrapping of absorbable mesh can also be used to tamponade grade IV injuries. Splenectomy should be done if, after a reasonable attempt, splenorrhaphy is unsuccessful.

Grade V injuries: Spleenectomy is advised for grade V injuries. It is now used in 40-60% of splenic injuries. In modern trauma centers, it is particularly advised when patient is in hypotension and with multiple associated intra abdominal injuries. In modern trauma centers, it is particularly advised when patient is in hypotension and with multiple associated intra abdominal injuries. The hand is passed around the outer surface of the spleen, the posterior layer at lenorenal ligament divided largely by blunt dissection and the spleen rotated medially into the incision. A large pack is inserted and short gastric vessels and those in the pedicles are ligated and divided. It is important to separate the tail of pancreas from the vessels in the hilum before ligation.

Complications of splenectomy

1. Early transient thrombocytosis, which resolved spontaneously over 1-3 months.
2. Acute dilatation of stomach
3. Delayed haemorrhage
4. Pancreatitis
5. Subphrenic abscess
6. Left lower lobe atelectasis and pleural effusion
7. Fatal pneumococcal septicemia (Over whelming Post Spleenctomy infection- OPSI)

Pancreas:

The incidence of pancreatic injury in severe abdominal trauma patients is about 3-12% with blunt trauma contributing about 1/3 of these patients. The spectrum of pancreatic injuries is broad, ranging from simple contusion to fracture/ laceration to complete disruption. The proximity of the pancreas to other vital structures and the high energy mechanisms typically involved make isolated pancreatic injuries uncommon. Wounds of the head of the pancreas are

commonly associated with blunt injuries to the liver, duodenum and major vascular structures. Injuries to the body are associated with blunt trauma to transverse colon. Injuries to the tail of the pancreas are associated with injuries to the spleen.

Associated organ injuries to pancreatic injuries are frequent in liver, stomach, vascular system, small bowel and colon, spleen, kidney, duodenum and biliary tract on descending order. [2]

Mechanism of injury: Blunt pancreatic injuries occur when high energy crushing force is applied to the upper abdomen. The majority of blunt pancreatic injuries result from motor vehicle accidents. The energy of impact is usually directed at the epigastrium or hypochondrium, resulting in a crushing of the retroperitoneal structures. At least 60% of blunt injuries to the pancreas are due to the impact of the steering wheel, although any high energy blow to the epigastric region can damage the pancreatic parenchyma. Epigastric pain out of proportion to the abdominal examination is often a clue to a retroperitoneal injury.

Following is the commonly used method of classification of pancreatic injuries.

GRADE 1 - Contusion and laceration without duct injury

GRADE 2 - Distal transection or parenchymal injury with duct injury

GRADE 3- Proximal transection or parenchymal injury with probable duct injury .

GRADE 4 - Combined pancreatic and duodenal injury Ampulla and blood supply intact .

GRADE 5 - Massive injury, ampulla destroyed devascularisation[2] .

Most patients with injuries to the retroperitoneal pancreas will have minimal clinical symptoms and signs when seen first after trauma; reason for this is the retroperitoneal location of the organ which masks the early development of peritonitis.

Secondly, tamponading effect of retroperitoneum may prevent significant blood loss from pancreatic injury. Thus symptoms may be absent for 12 hours. Severe epigastric pain out of proportion to the clinical features may indicate pancreatic injury.

Management:

General principles involved in the management of pancreatic injuries are:

1. Control hemorrhage and contain bacterial contamination.

2. Debride devitalized pancreatic tissue.

3. Preserve at least 20-50% of functional pancreatic tissue whenever possible.[4] Provide adequate internal or external drainage of pancreatic injuries or resections.

A management plan based on these principles requires that the surgeon ascertain the following:

1. The presence or absence of associated organ injuries, particularly the duodenum.

2. The degree of pancreatic parenchymal disruption.

3. The integrity of the main pancreatic duct and ampulla.

GRADE 1: Contusions and lacerations without duct injury. Minor pancreatic contusions and capsular lacerations account for 60% of all pancreatic injuries. Minor lacerations of the parenchyma without major ductal disruption account for an additional 20% of pancreatic injuries. These require only hemostasis and simple external drainage. Attempt to close or repair capsular laceration may result in

pancreatic pseudocyst, whereas a controlled pancreatic fistula is usually self limiting. Between 2-15% of the patients with grade I injuries will develop a pancreatic fistula, but most are low output (<500ml/day) minimally affected by oral intake and mostly close spontaneously within 2 weeks. [6]

GRADE II and III injuries:

Distal parenchymal transection or injury with duct disruption is best treated by distal pancreatic resection with or without spleenectomy. Spleenectomy makes distal pancreatectomy easier and more rapid because the splenic artery and vein as well as distal tip of the pancreas need not be dissected. The remaining proximal duct should be closed with a direct suture ligature either as U stitch or a figure of 8 with non absorbable suture. The parenchyma is controlled with mattress sutures placed through the full thickness of the pancreatic gland from anterior to posterior capsule to minimize leak from the transected parenchyma. A small omental patch can be used to buttress the surface and a drain should be left near the transection line.

Distal pancreatic resections are classified as extended, major or limited.

Extended resection are those to the right of the superior mesenteric vessels for a grade IV injury, major are those with transection between the superior mesenteric vessels and the inferior mesenteric vein and limited resection are those with transection to the left of the inferior mesenteric vein. The last two are performed for grade III injuries.

Approximately 80% of the pancreas can be resected before a patient is at risk of endocrine insufficiency and diabetes.

Grade IV and V injuries: Are defined as a ductal disruption to the right of the superior mesenteric vessels. These injuries have following spectrum.

1. There may be major injuries to the pancreatic head with or without ductal damage.
2. There may be injury to the pancreatic duct or the common bile duct in the juxta duodenal location or both.
3. There may be pancreatic injury with major duct disruption combined with a very severe duodenal injury.

Injuries to the head or neck, which do not involve the pancreatic duct, are simply drained. Severe damage to the head of the pancreas, even in the absence of duodenum injury is particularly

serious. Hemorrhage from the portal vein, vena cave, aorta or mesenteric vessel will often result in exsanguinations during or shortly after surgical attempts at control of the injuries. Presuming that such injuries either are not present or are adequately controlled, there are several options to deal with grade IV and V injuries but the treatment has to be tailored to the individual patient.

1) Extended pancreatectomy involving 80-90% of the gland will result in insufficiency. In order to avoid this after transecting the pancreas at the level of injury, closing the proximal pancreatic resection, an internal drainage from the distal fragment is accomplished by Roux-en-Y distal pancreato jejunostomy by end to end to side method.

2) Onlay Roux-en-Y: Major injuries to the pancreatic head without ductal damage is best treated conservatively by sump drainage. If the duct is damaged an onlay Roux-en-Y loop is probably the best procedure.

3) Duodenal diversion: these are more suited when the duodenal injuries are complex with pancreatic head injury. There are two ways of achieving this:

Pyloric exclusion: after repair of duodenal tear, a 4 cm gastrostomy is made along the distal greater curve. Through this the pylorus is approached and a polyglactin or chromic catgut suture is inserted to close the pylorus. A gastrojejunostomy is then constructed suing the same gastrostomy.

Duodenal diverticulization: this is a more extensive procedure requiring duodenal repair, vagotomy, antrectomy, gastrojejunostomy, pancreatic resection, T tube drainage of CBD and tube duodenostomy.

Pancreaticoduodenectomy: this carries an unacceptably high mortality rate in the acute situation. The overall mortality rate is 30-40%. A Whipple's procedure should therefore be performed only on the most severe injuries where the trauma has effectively performed the resection and the operation is essentially debridement of devitalized tissue. The incidence of such procedure is no more than 2%.

The most complication after pancreatic trauma are pancreatic fistula and pancreatic abcess.

Kidney and Suprarenal:

The most common sign in patients with traumatic injury to the genitourinary tract is hematuria. Since the degree of hematuria does not correlate with the severity of injury, radiographic evaluation has been recommended in all trauma patients who demonstrate hematuria. However, the majority of renal injuries is minor and is treated conservatively. Thus, significant expense and some morbidity from adverse reactions could be avoided if radiographic evaluation were restricted to a group of patients more likely to have significant injury, those with either gross hematuria or microscopic hematuria and shock. A renal contusion is seen as an area of poorly opacified renal parenchyma. Since a renal laceration extends to the surface of the kidney, a subcapsular or perinephric hematoma will also be present. If the renal contour is flattened by the compressive force of a hematoma contained by an intact renal capsule, a subcapsular hematoma can be diagnosed. If the capsule has been penetrated, the fluid runs away from the kidney producing a perinephric hematoma. Arterial injuries can be identified by CT if they cause renal infarction or if active extravasation is demonstrated. The infarcted portion of kidney does not enhance with intravenous contrast

injection. However, a thin rim of enhancing parenchyma may be detected if the renal capsular vessels remain intact.

Venous injury could result in either vessel laceration or thrombosis. Laceration often produces a large hematoma, but the source of the bleeding may not be apparent. The effect of renal vein thrombosis depends on the availability of collateral vessels. If good collaterals are present, the kidney is unaffected. If there is poor collateral flow, the affected kidney becomes swollen, edematous, and function deteriorates. Avulsion of the ureteropelvic junction is readily diagnosed on CT by the extravasation of excreted contrast material. An associated hematoma is invariably present and other abdominal injuries such as hepatic and splenic lacerations are common. [2,6]

Adrenal gland

The adrenal glands are injured infrequently by blunt trauma. They lie near the middle of the upper abdomen and are protected by the spine, ribs, and major organs. Nevertheless, adrenal injury has been reported in 28% of patients with significant abdominal trauma studied at autopsy. An adrenal hematoma is seen as a round to ovoid adrenal mass. Strands of high density material which also represent

hemorrhage may be seen in the perinephric fat. Initially the adrenal hematoma may demonstrate an increased density. Over time the density decreases as the blood clot lyses.

In most patients the hematoma will be reabsorbed, but occasionally it will persist as a seroma. This may be the most common etiology of adrenal pseudocysts. In most patients, adrenal injury has little clinical significance. The amount of blood loss is modest and more than 90% of functioning adrenal tissue must be lost before the patient will become adrenal insufficient. However, if bilateral adrenal hematomas occur, the potential for developing Addison's disease must be considered. [7]

Pathophysiology: As the kidney gets squeezed or crushed, there is varying degree of compression on the kidney tissue, causing pathological lesions. These may be classified into two broad types:

I. Minor injuries: (85%)

1. Contusion: there is bruising of renal tissue and macro or microscopic hematuria; no gross parenchymal damage.
2. Laceration: when there are radial lacerations across the kidney, up to the surface or up to the calyces, but no fragmentation.

II. Major injuries: (15%)

3. Rupture: when lacerations are through and through- thus causing fragmentation of the kidney; blood supply of the small fragments may be jeopardized.

4. Shattered kidney: when there are multiple fragments of the kidney, many of them devascularized.

5. Pedicle injury: injury to the major blood vessels of the renal pedicle, with or without parenchymatous injury.

Effects of injury can be:

• **Hemorrhage:** This is caused by rupture or pedicle injury: due to the tight gerota's fascia, there is a tendency to limit the size of expansion of the hematoma. Some blood would inevitably escape through the pelvicalyceal system appearing as hematuria. Expanding hematoma also devitalizes small segments of lacerated kidney and cause infection. Eventually hematoma may undergo encapsulation and fibrosis.

• **Urinary leakage:** Whenever there is a rupture of kidney, urine may escape outside the renal capsule and form either diffuse extravasation or a localized collection called urinoma. If renal

function is satisfactory, rupture is large or there is distal block then the urinoma keeps expanding.

• **Ischemic necrosis:** In pedicle injury, whole kidney may be ischemic; in rupture or shattered kidney, one or multiple segments may have blood supply compromised. Expanding hematoma also tends to jeopardize blood supply to the small fragments.

Management:

The pendulum of conception of ideal management of renal injury veers from early surgery (except in contusion) to ultra conservatism, where only pedicle injury is considered indication for surgery. Pathologically considering, minor injuries do not need surgery while major injuries may need surgery either immediately or subsequently. For blunt injury, the problem of early surgery is that on opening the gerota's fascia, often there is massive hemorrhage that necessitates nephrectomy. Hence whenever early surgery is indicated, anterior transperitoneal approach and preliminary control of vascular pedicle is mandatory, before opening the gerota's fascia.[2,6]

Renal contusions and lacerations (type I and II) make up 85% of blunt injuries and are to be treated conservatively. The remaining 15%, which contribute to major (type III and IV) renal injuries need surgical intervention. Vascular injuries make 2-5% of renal injuries and need immediate resuscitation and exploration in view of the deteriorating condition and hypovolemic shock.

Basically, management in minor injuries consists of conservative management with selective interventional surgery. It consists of bed rest, sedation, treatment of shock by infusion and transfusion, nasogastric suction (for paralytic ileus), serial excretory urogram and constant observation. Objective of treatment is to allow absorption of hematoma without infection; antibiotics should be given for 7-14 days.

Surgical management may be of the following types:

1. **Immediate:** In cases of blunt pedicle injury, because there may be uncontrollable hemorrhage, outside or inside, surgery should be done as soon as arteriography confirms renal pedicle injury. i.e. no intra renal vasculature seen.

2. **Interventional:** During the course of conservative management, surgical exploration may be indicated under following circumstances.

• Uncontrollable hematuria

• Deterioration of clinical status- indicates expanding hematoma

• Rapidly enlarging loin mass- hematoma or Urinoma

• Radiological evidence of extravasation

• Associated injury to other viscera e.g. bowel or spleen

3. **Late:** i.e. for the sequale e.g. hydronephrosis, para renal collection, infracted segment associated with hypertension.

Surgical technique: as applied to early or interventional surgery.

1. Approach: anterior trans peritoneal, either vertical (paramedian) or transverse incision.

2. Initial dissection of renal arteries: Bulldog clamp applied to renal artery and then vein. Only then the gerota's fascia is opened by making a paracolic incision.

3. Actual operative procedure will depend on pathological lesion found. Basically the objective is renal salvage.

Principles of repair would constitute the following essentials:

i. Debridement of all devitalized renal parenchyma

ii. Meticulous hemostasis

iii. Water tight closure of the collecting system

iv. Approximation of margins and obliteration of the dead space

For lacerations: Debridement, removal of necrotic tissue and packing with omentum or paranephric fat, along with hemostasis.

For rupture: If it is small polar segment, with blood supply doubtful, partial nephrectomy is best. In others, careful calyceorrhaphy, cortical hemostasis and nephrorrhaphy or omentum grafting is done. Veins have inter communications between segments and some may be divided, but arteries must be preserved.

Shattered kidney: If explored, needs nephrectomy. Nephrectomy is done by ligating and dividing the renal artery and vein individually and ureter as low as possible.

Pedicle injury: if operated very early, reconstruction is possible. But in most of the cases nephrectomy is done.

4. Local toilet is a must in all cases and a drain must be provided.

Complications:

1. Secondary hemorrhage occurs in a small percentage of the cases but poses potentially life threatening problem. Careful watch has to be made for 10-13 days.

2. Late hypertension known to occur following:

Renal artery damage resulting in stenosis. Excision of segment and reanastomosis of renal artery done using graft bypass.

Kidney is encased in fibrous tissue resulting from resolving perirenal hematoma. Excision and release of fibrous encasement is done.

3.Pseudocyst and Urinoma are common but pose dangerous complication. Urinoma may get infected or cause absorption from granulation tissue leading to hyperchloremic acidosis. Treatment is to dissect the cavity and also repair the renal and pelvic defects simultaneously.

4. A V fistula can sometimes occur after trauma. Angiography is used to establish the diagnosis. Renal artery is occluded first when attempt at closure or repair is made.

MANAGEMENT

Diagnostic methods

The following are the useful diagnostic methods in blunt abdominal trauma

1. Four quadrant abdominal tap.
2. Ultrasound of the abdomen.(F A S T)
3. Plain radiography and contrast studies.
4. Diagnostic peritoneal lavage.
5. Abdominal CT scan.
6. Angiographic studies.
7. Radionuclide imaging.
8. Laparoscopy

1. Four quadrant abdominal tap:

Simple needle aspiration has been used for a long time to diagnose abdominal injuries. Aspiration by a large bore needle (18G) is done in right and left hypochondrium and right and left iliac fossa. The accuracy is about 80% but it is argued to have inherent risk of causing visceral injuries. But this has been disproved at large. Aspiration of even a drop of blood that does not clot is diagnostic of

hemoperitoneum. But a negative tap does not rule out hemoperitoneum. [2]

2. Focused Abdominal Sonography for Trauma (FAST):

As quality ultrasound machines have become portable there is an increasing trend of their application in the initial evaluation of blunt abdominal trauma. Ultrasound can demonstrate the presence of free intraperitoneal fluid as well as the extent and precise location of solid organ hematomas.In recent years, focused abdominal sonography for trauma (FAST) has emerged as a useful diagnostic test in the evaluation of blunt injury abdomen. [21]

The advantages of the FAST examination have been clearly established. FAST is noninvasive, may be easily performed and can be done concurrently with resuscitation. In addition, the technology is portable and may be easily repeated if necessary. In most cases, FAST may be completed within 3 or 4 minutes. The test is especially useful for detecting intra-abdominal hemorrhage in the multiply injured or pregnant patient. [8]

A noted drawback to the FAST examination is the fact that a positive examination relies on the presence of free intraperitoneal fluid. In the hands of most operators, ultrasound will detect a

minimum of 200 mL of fluid. Injuries not associated with hemoperitoneum may not be detected by this modality.

In addition the FAST examination cannot be used to reliably grade solid organ injuries. Therefore, in the hemodynamically stable patient, a follow-up CT scan should be obtained if nonoperative management is contemplated. FAST compares favorably with more traditionally utilized diagnostic tests. In the hemodynamically stable patient with blunt injury abdomen, FAST offers a viable alternative to DPL.

Advantages: No use of radiation or contrast media.

Widely available.

Disadvantage: Immediate availability of an experienced Ultrasonographer.

Difficult to scan in presence of lower rib fracture, extensive skin lesions, soft tissue injuries and dressings.

3. **Plain radiography and contrast studies**:

Radiological procedures in a stable patient with blunt abdominal injury may be helpful especially when physical examination and lab investigations are inconclusive. Plain x ray abdomen should be done before other invasive tests such as

paracentesis, in order to avoid confusion in detection of free air in the peritoneal cavity. Chest radiograph will help in detecting thoracic and diaphragmatic injuries. Air under the diaphragm will be found in patients with gastric, duodenal, small intestine and colonic perforations. Presence of rib, pelvic, vertebral body and transeverse spinous process fractures can be made out.

General findings in case of blunt trauma would be:

a. Displaced bowel loops.

b. Enlargement or displacement of the viscera.

c. Presence of fluid where these should be made out.

d. Examination with water-soluble contrast reveals extravasation secondary to rupture,displacement and mucosal thickening due to edema and obstruction due to hematoma or incarceration.

e. Splenic outline can be made out.

f. Free intraperitoneal air is defined with horizontal beam films and is seen subdiaphragmatically on erect films and sub hepatic space on left lateral decubitus.

Retroperitoneal air remains more localized and is not altered greatly with the change in the position of the patient. It is commonly associated with retroperitoneal rupture of duodenum.

Also occurs with tears of retroperitoneal portion of the colon or rectum. The air has a streaky appearance over the psoas muscle and can extend to outline kidney and pancreas. [2,3]. At least 800ml of intraperitoneal blood is required to be evident on plain abdominal radiograph.

The following supporting signs may be observed.

The flank stripe sign: Is a fluid dense zone separating the ascending or descending colon from the distinctly outlined lateral peritoneal wall and the colon is displace medially.

The dog ear sign: Results from the accumulation of blood that gravitate between the pelvic viscera and the sidewalls of each side of the bladder.

The hepatic angle sign: Is loss of definition of the usually clearly defined inferior and right lateral borders of the liver as blood accumulates between the hepatic angle and the right peritoneal wall.

Hemoperitoneum causes small bowel to shift towards the centre of the abdomen with the production of ground-glass appearance. [20]

Diaphragmatic trauma: Plain x ray abdomen shows malposition of the nasogastric tube is often the first sign of a ruptured left diaphragm.

Mediastinal shift to the side opposite of the injury, bowel loops above the diaphragm are seen. In duodenal rupture both intra and retroperitoneal X ray studies are diagnostic. Free air or retroperitoneal air will be demonstrated as water soluble contrast will delineate the site. Intramural hematomas at the duodenum can be diagnosed by plain and contrast films.

In pancreatic injuries, enlargement of pancreas namely, widening of the duodenum sweep impression on the posterior aspect of the stomach, separation of the stomach from the transverse colon and depression of the transverse colon can be seen. Impression on splenic flexure gas shadow termed as colon cut off sign is also seen.

4. Diagnostic peritoneal lavage (DPL):

DPL was introduced by Root et al in 1965. it provides a rapid, inexpensive, accurate and relatively safe adjunctive diagnostic modality in the management of patients with blunt abdominal trauma. [6]

Reasons for performing a DPL:

- Signs those are equivocal or obscured by adjacent soft tissue injury.

- Unreliable signs owing to head injury, intoxication or paraplegia.

- Signs those are difficult to assess because the patient is undergoing lengthy radiological or extra abdominal surgical procedures.

- Unexplained hypotension or blood loss, even if abdominal examination is normal.

Relative contraindications of DPL:

- Only absolute contraindication to DPL is a clear indication for an immediate Laparotomy.

- Previous surgery.

- Gross obesity.

- Advanced pregnancy.

- Cirrhosis.

- Established coagulopathies.

There are three methods of doing DPL:

1. Closed method. 2. Open method. 3. Semi-open method.

Semi-open method is commonly used. Technique:

a) Insert a urinary catheter and a nasogastric tube.

b) Prepare the abdomen using antiseptic solution.

c) Inject local anesthetic in the midline below the umbilicus.

d) Make a 4 cm midline incision down to the fascia.

e) Incise the fascia and peritoneum and grasp the edge with clips.

f) Insert a peritoneal dialysis catheter or a soft infant feeding tube.

h) Contents are aspirated with a syringe looking for blood or bowel contents.

i) Instill 1 liter of warmed 0.9% sodium chloride (10ml/kg body weight) and distribute by gentle agitation of the abdomen if the condition of the patient permits.

j) Drain off after 5-10 mins depending on the degree of urgency. A minimum of 75% of lavage effluent is required for the test to be valued.

The fluid is analyzed in the laboratory by macroscopic, microscopic and biochemical examination. [8]

Positive result:

- >5ml blood on immediate aspiration.

- Obvious intestinal contents.

- >1,00,000 RBC's/cmm or 500 WBC/cmm in the drained lavage fluid.
- Elevated amylase level.

Visceral injuries are present in >95% of patients in whom the RBC count is >1,00,000/cumm and in less than 5% of patients in whom the count is less than 20.000/cmm. Patients in whom RBC count is between 20,000-1,00,000/cmm there is 15-25% risk of significant visceral injury and needs to be evaluated by other means, usually CT scan. [8]

5. Computarized tomography of abdomen (CT scan):

This can provide important diagnostic information on abdominal injuries. It plays an important role in the evaluation of blunt abdominal trauma when applied in appropriate setting. It plays a complementary role to diagnostic peritoneal lavage. When the lavage is positive but the patient is stable after resuscitation and continues to be even after 30 minutes or when lavage is indeterminate, CT has the potential to delineate specific viscus damage.

Four groups of patients are particularly suitable for CT scanning:

1. Patients with delayed (<12hours) presentation who are hemodynamically stable and do not have overt signs of peritonitis.

2. Patients in whom DPL results are equivocal and the results of repeated physical examination are unreliable or untenable.

3. Patients in whom DPL is difficult to perform (eg: morbid obesity, late term pregnancy or multiple previous laparotomies); peritoneal adhesions pose a technical problem to catheter placement.

4. Patients at risk for retroperitoneal injuries in whom the DPL is unremarkable.

Advantages:

It is an excellent means to diagnose intraperitoneal hemorrhage. It gives excellent views of spleen and liver permitting precise anatomic diagnosis of solid viscus injury.

It is also the best in diagnosis of retroperitoneal injury. Stomach, duodenum, pancreas can be diagnosed with high degree of accuracy. Intravenous contrast permits excellent imaging of the kidneys [8].

Disadvantages:

-The retroperitoneal colon injury is rarely delineated.

-CT scan is poor for the diagnosis of intraperitoneal hollow viscus injuries and early pancreatic injuries.

-Requires a proper set up and proper interpretation of films.

-Scanning abdomen takes a minimum of 45-60 minutes and it is difficult to monitor the patient during the investigation. In hemoperitoneum more than 100ml of blood in the cavity will be detected.

6. Radionuclide imaging:

This non-invasive nature of isotope studies makes them attractive as a screening procedure. The reduced radiation dosage permits repeat and follow up studies with safety.

But the obvious disadvantages are, they are not freely available in most centers and are dependent on the availability of an expert radiologist. [8]

7. Arteriography:

Arteriography was main tool prior to CT scan and ultrasound. Its use is now limited for the evaluation of solid intra abdominal and pelvic arterial bleeding in patients with pelvic fractures. Therapeutic

embolization can be carried when needed. Abdominal aortography or selective visceral arteriography is useful in the diagnosis and management of intra abdominal bleeding after laparotomy for trauma. Contraindications to do arteriography is obvious need for laparotomy, unstable patient or allergic to the contrast agent. The primary advantage is to prevent negative laparotomy. [6]

8. Laparoscopy or diagnostic laparotomy:

It is the final court of appeal in diagnosing blunt abdominal trauma. It has distinct advantage over a paracentesis because it provides visualization of the site and extent of bleeding. [2]

Enzymes studies: Amylase and alkaline phosphatase levels of the effluent from DPL when equal or greater than the serum level is suggestive of injury to bowel, liver or pancreas.

Routine investigations: Hemoglobin, hematocrit, blood grouping and Rh typing, serum amylase and alkaline phosphatase, urinalysis, blood urea, serum creatinine, blood sugar, chest x ray and ECG are to be done.

MATERIALS AND METHOD

Patients admitted in Governtment Rajaji hospital,Madurai from April 2011 to May 2012 and study includes 40 cases. This is a prospective study conducted over 1 year.

Methods of collection of data:

After admission data for my study was collected by:

1. Direct interview with the patient or patient relatives accompanying the patient and obtaining a detailed history.
2. Thorough clinical examination.
3. Clinical findings and relevant diagnostic investigations performed over the patient.

After initial resuscitation of the patients, thorough assessments for injuries were carried out in all the patients. Documentation of patients, which included, identification, history, clinical findings, diagnostic test, operative findings, operative procedures, complications during the stay in the hospital and during subsequent follow-up period, were all recorded on a Proforma specially prepared. Demographic data collected included the age, sex, occupation and nature and time of accident leading to the injury.

After initial resuscitation and hemodynamic stability, all patients were subjected to careful examination, depending on the clinical findings; decision was taken for further investigations such as four-quadrant aspiration, diagnostic peritoneal lavage, x ray abdomen and FAST.

The decision for operative or non operative management depended on the outcome of the clinical examination, hemodynamic stability and CECT abdomen.

Patients selected for non operative or conservative management were placed on strict bed rest, were subjected to serial clinical examination which included hourly pulse rate, blood pressure, respiratory rate and repeated examination of abdomen and other systems. Appropriate diagnostic tests especially ultrasound of abdomen was repeated as and when required

In those who are operated, the operative findings and methods of management are recorded. Cases are followed up till their discharge from the hospital. If patient expired postmortem findings are noted. Post operative morbidity and duration of hospital stay were recorded. The above facts are recorded in a proforma prepared for this study.

OBSERVATION AND RESULTS

Table – 1

Sex Incidence

Gender	No.of patients	Percentage
Male	34	85
Female	6	15
Total	40	100

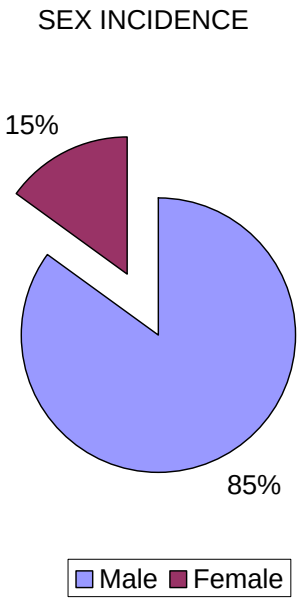


Table – 2

Age Incidence

Age Group	No.of patients	Percentage
11 – 20	10	25
21 – 30	11	27.5
31 – 40	9	22.5
41 – 50	4	10
51 – 60	6	15
Total	40	100

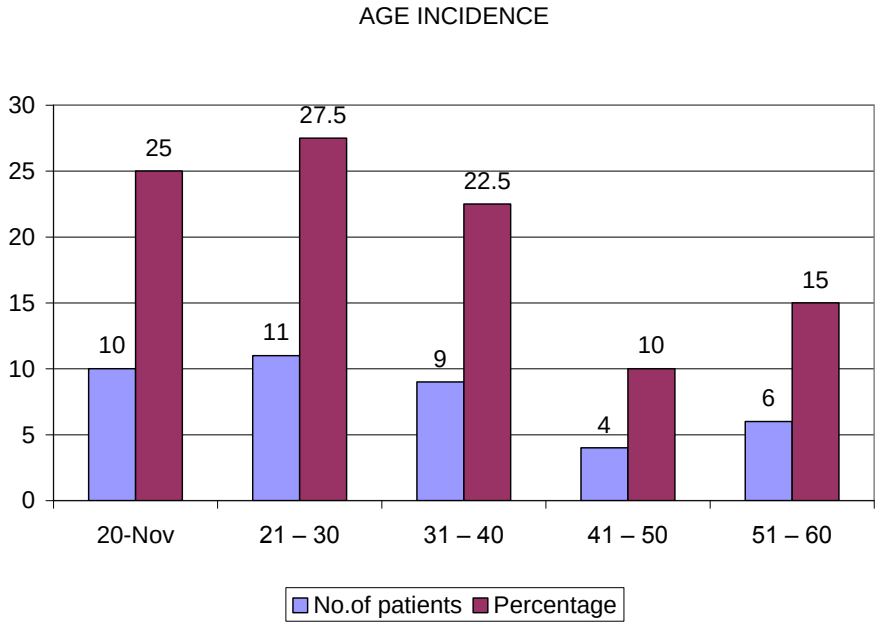


Table – 3

Mode of Injury

Mode of Injury	No.of patients	Percentage
RTA	27	67.5
Assault	5	12.5
Wall collapse	5	12.5
Bull gore	1	2.5
Accidental fall	2	5.0
Total	40	100

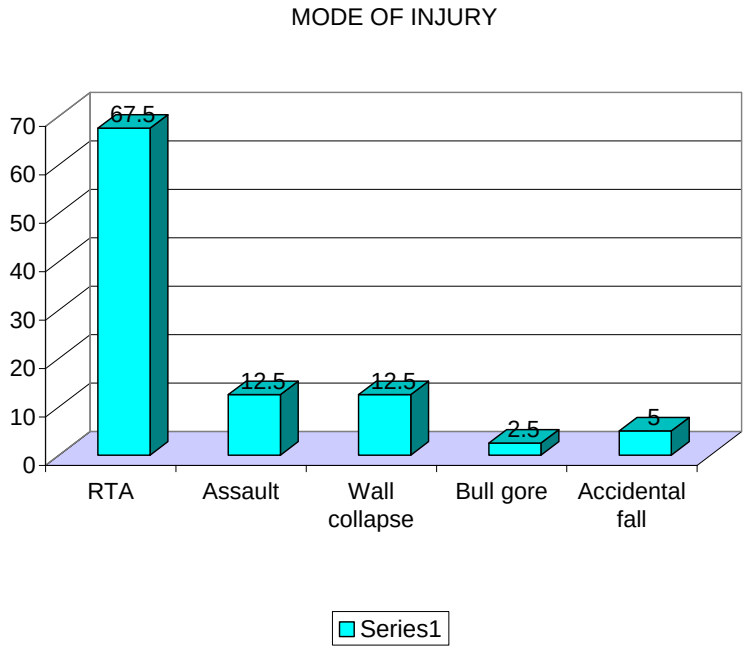


Table – 4

Clinical Presentation

Clinical Presentation	No.of patients	Percentage
Abdominal pain	36	90
Abdominal distension	15	37.5
Hematuria	3	7.5
Abdominal guarding and rigidity	33	82.5
Shock	18	45

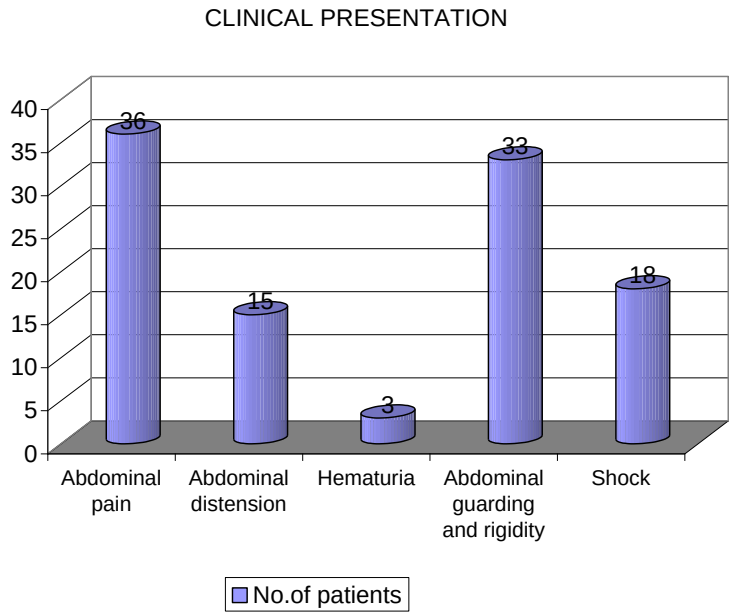


Table – 5

Latent period

Latent period	No.of patients	Percentage
0 – 6 hrs	15	37.5
7 – 12	17	42.5
13 – 18	5	12.5
19 – 24	1	2.5
> 24	1	2.5
Not known	1	2.5
Total	40	

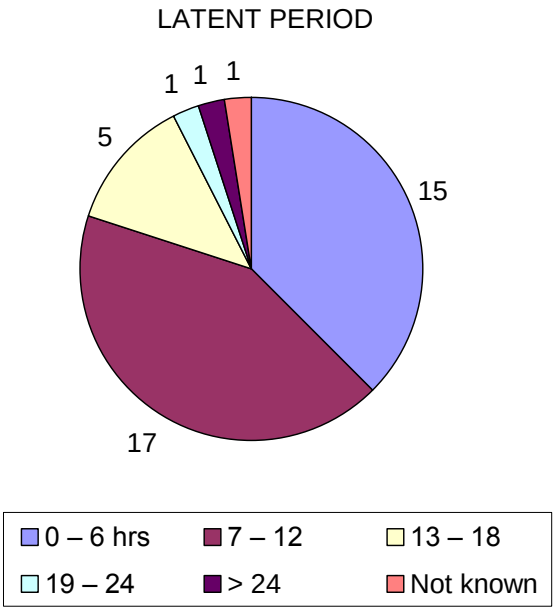


Table – 6

Associated Injury

Associated Injury	No.of patients	Percentage
Head	3	7.5
Thorax	4	10
Orthopaedic injuries	8	20
Soft tissue injuries	3	7.5
Combination	3	7.5

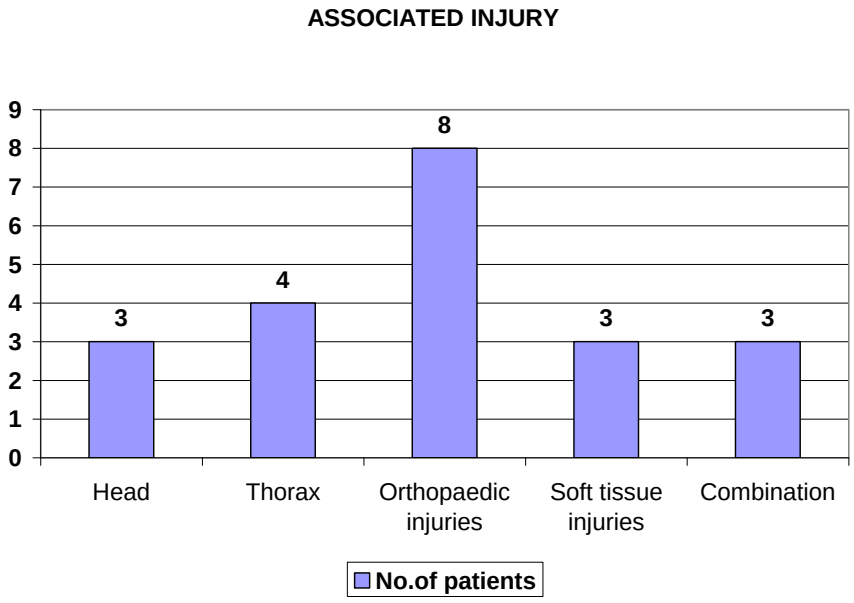


Table – 7

Investigations

Haemoglobin	No.of patients	Percentage
< 8 g%	8	20
8 – 10 g%	22	55
> 8 g%	10	25
Total	40	100

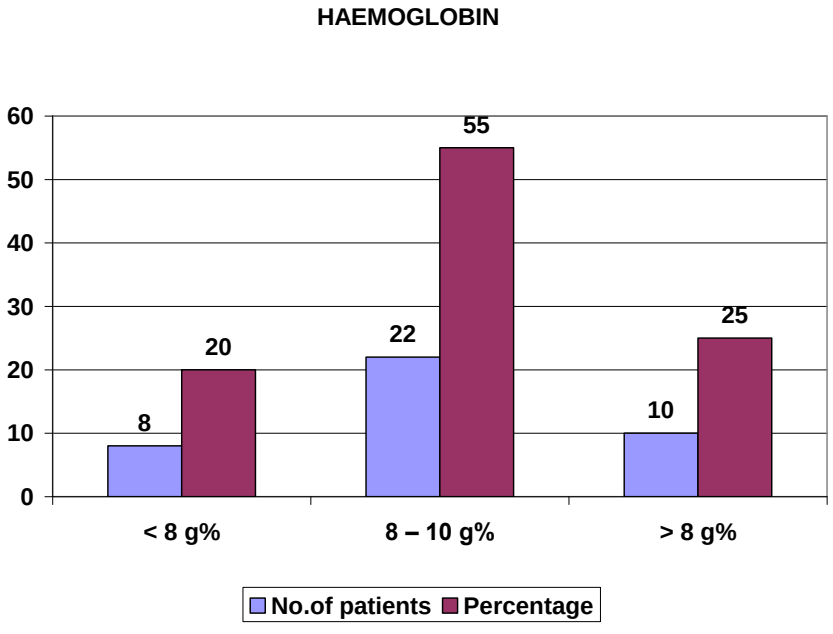


Table – 8

X ray Abdomen

X ray Abdomen	No.of patients	Percentage
Ground glass appearance	20	50
Gas under diaphragm	2	5
Enlarged soft tissue shadows	5	12.5
Dilated loops	5	12.5

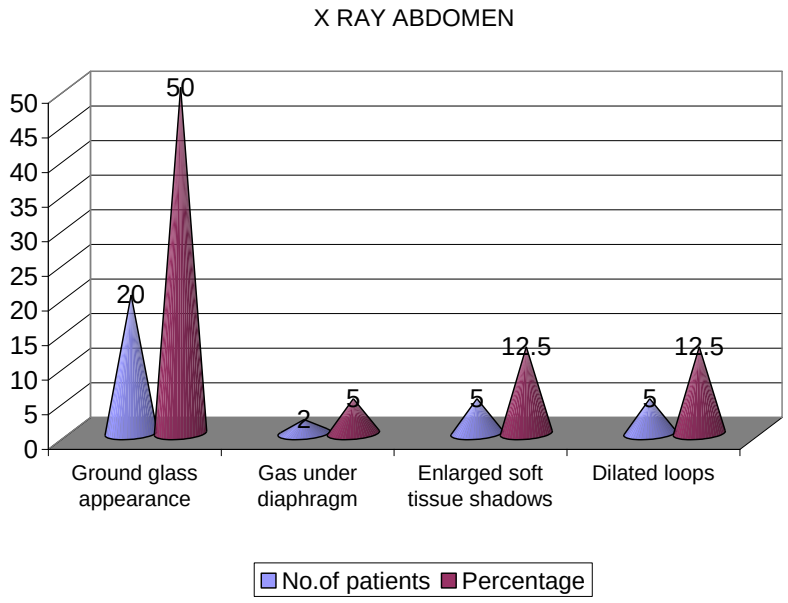


Table – 9

Four quadrant aspiration was done in 30 patients

Result	No.of patients	Percentage
Positive	20	50
Negative	10	25

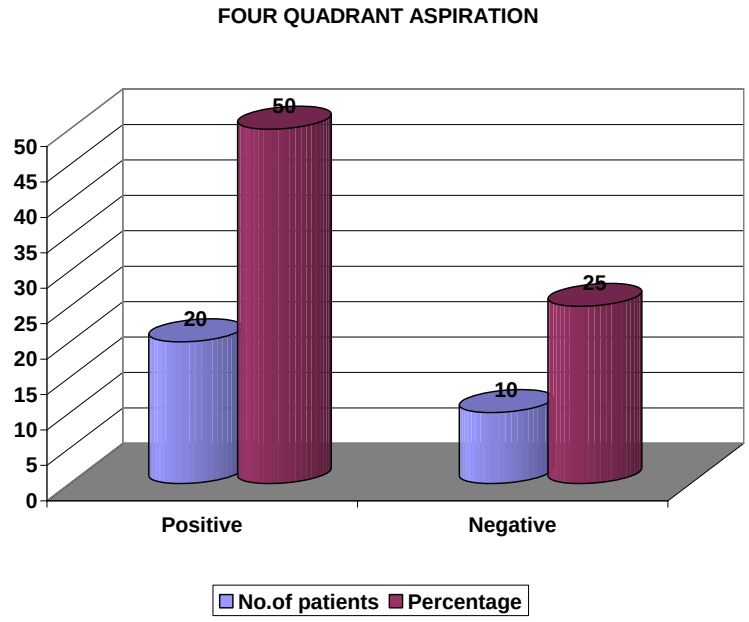


Table – 10

Four quadrant aspiration vs Laparotomy findings

Four quadrant aspiration	Laparotomy organ injury		Total
	Present	Absent	
Positive	16	4	20
Negative	4	6	10
Total	20	10	30

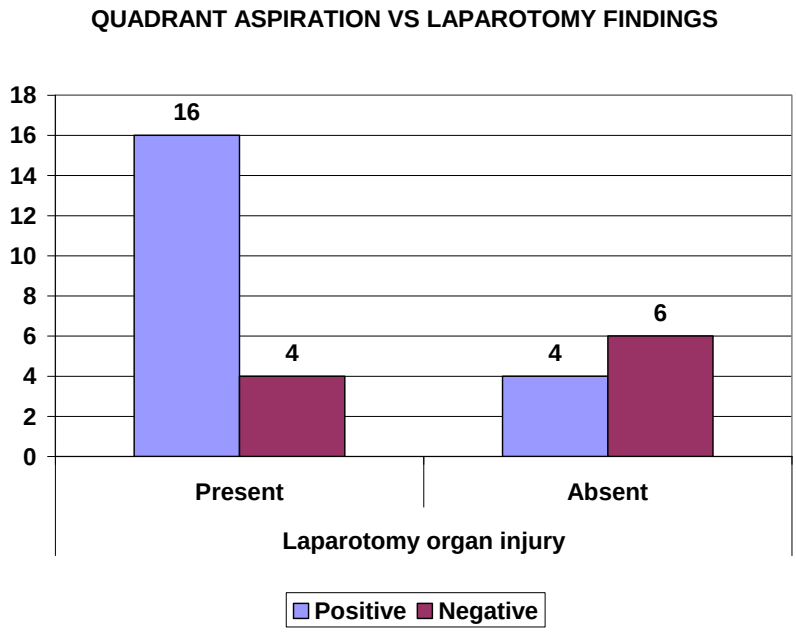


Table – 11

Ultrasound examination done in 25 patients

Organ injured	No.of patients	Percentage
Spleen	15	37.5
Liver	10	25
Kidney	2	5
Pancreas	1	2.5

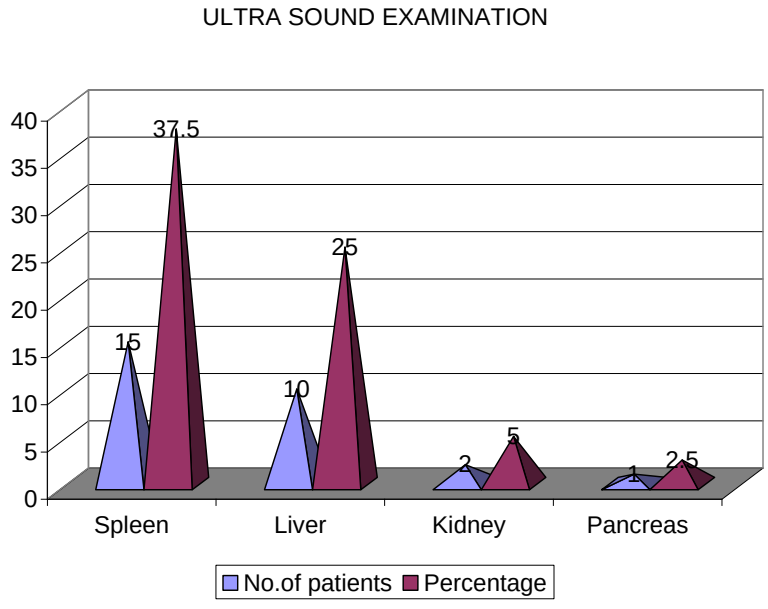


Table – 12

CT scan

Organ Injured	No.of patients	Percentage
Spleen	7	17.5
Liver	4	10
Pancreas	1	2.5
Renal	3	7.5
Not done	25	62.5
Total	40	100

CT abdomen was done in haemodynamically stable patients and about 15 patients underwent CT abdomen.

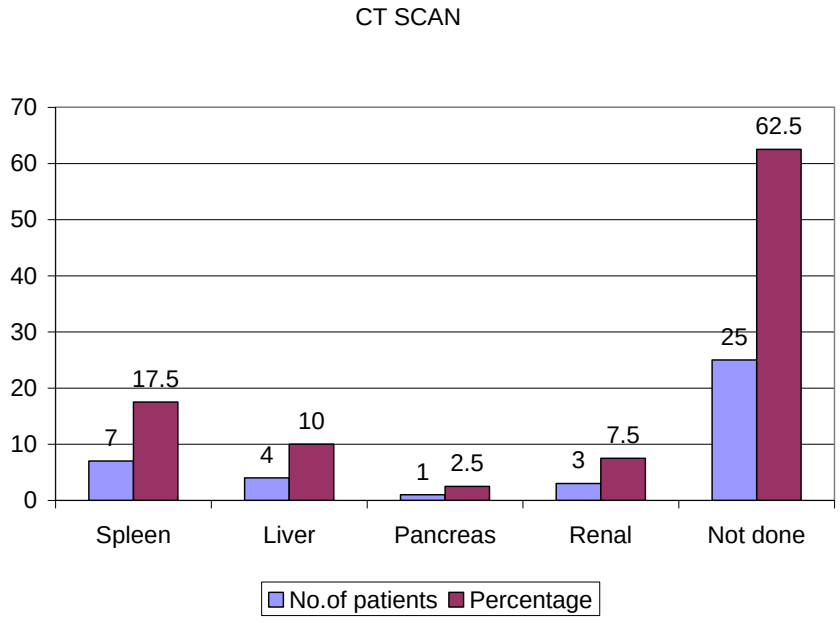


Table – 13

Ratio of operative to conservative treatment

Treatment	No.of patients	Percentage
Conservative	5	12.5
Operative	35	87.5
Total	40	100

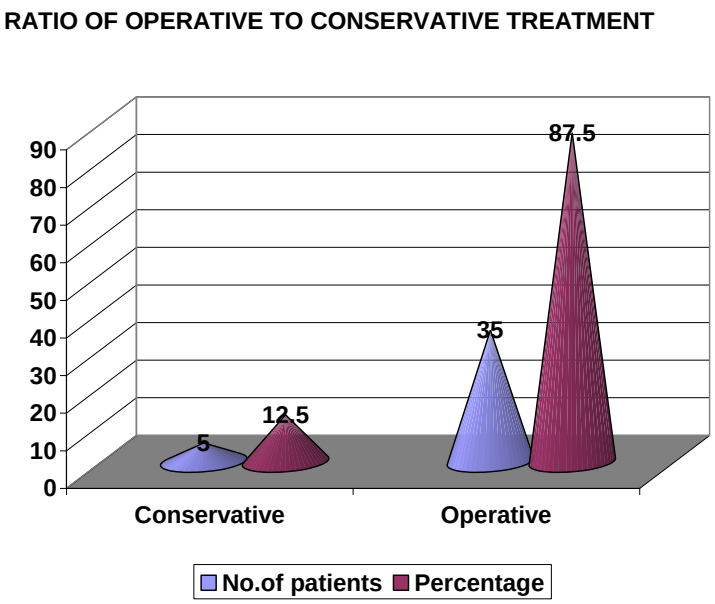


Table – 14

Organ wise Injury

Organ	No.of patients	Percentage
Spleen	20	50
Liver	13	32.5
Kidney	4	10
Bowel Injury	4	10
Pancreas	2	5
Mesentery	3	7.5
Bladder	1	2.5

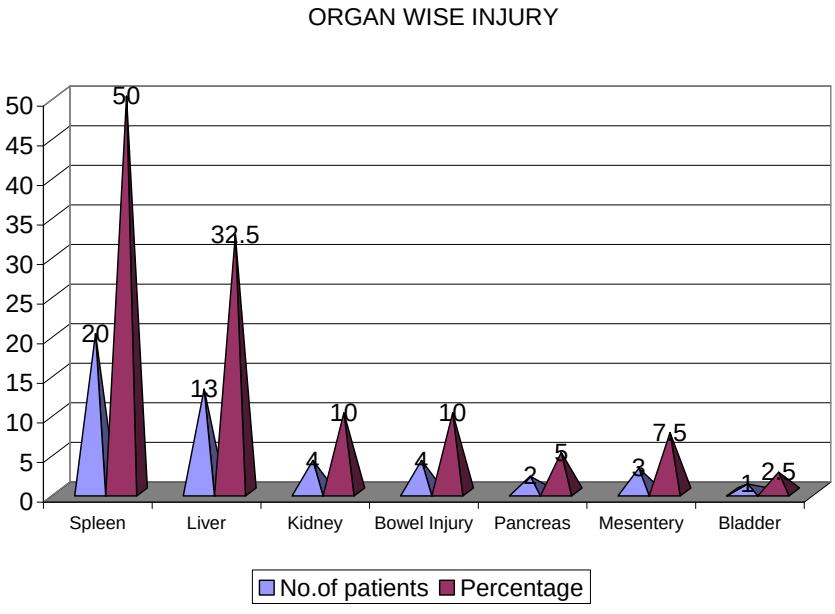


Table – 15

Type of Surgery

Type of Surgery	No.of patients	Percentage
Spleenectomy	15	37.5
Spleenoraphy	3	7.5
Hepatoraphy	5	12.5
Gel foam over liver laceration	8	20
Perforation closure	2	5

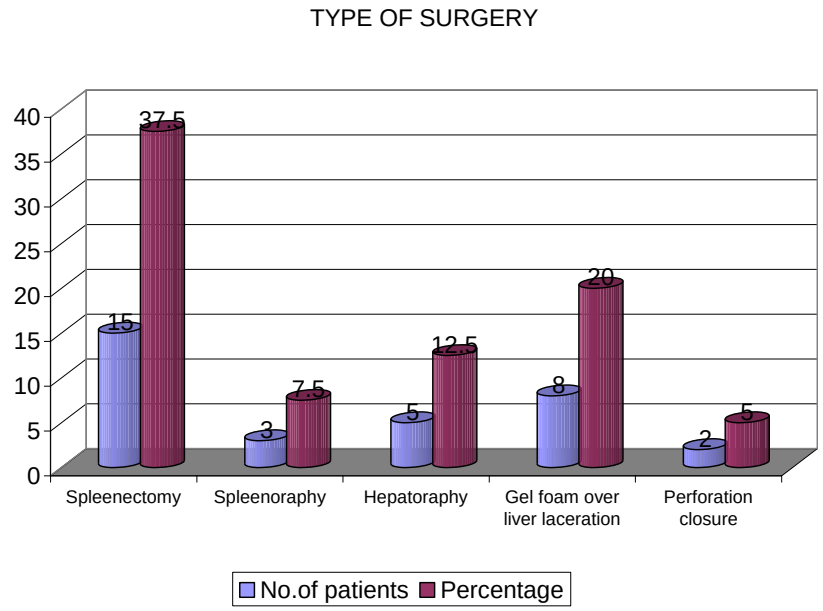


Table – 16

Post op complications

Post op complications	No.of patients	Percentage
Wound infection	3	7.5
Respiratory complications	4	10.0
Wound dehiscense	2	5.0
Intra abd abscess	1	2.5

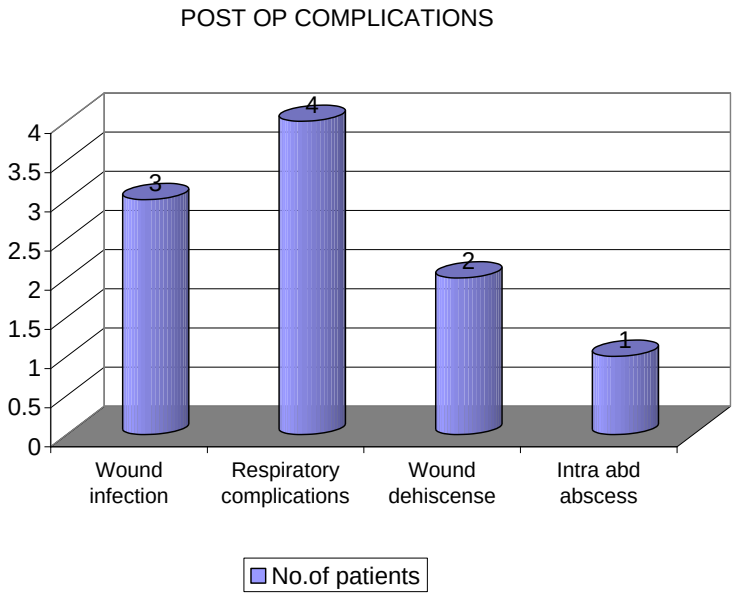
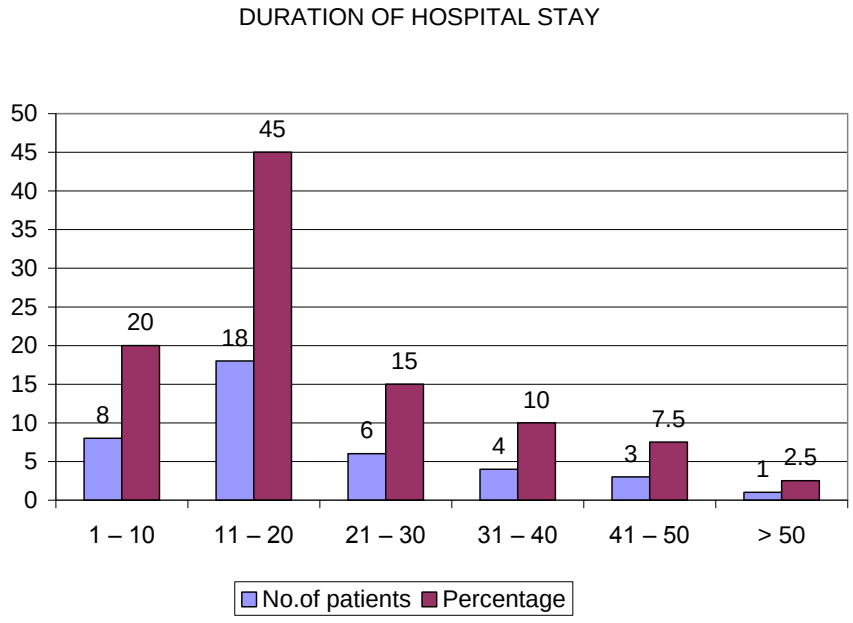


Table – 17

Duration of Hospital stay

Duration in days	No.of patients	Percentage
1 – 10	8	20
11 – 20	18	45
21 – 30	6	15
31 – 40	4	10
41 – 50	3	7.5
> 50	1	2.5
Total	40	100



Mortality :

6 patients with blunt injury died in the study. 5 patients belonged to operative group and died in the post operative period. Therefore the mortality rate in the present study is 15%.

This is comparable with other series published in our country, Khanna et al. The mortality rate in Davis et al study is 13.33%,Divincenti et al was 23%

DISCUSSION

Summarizing the findings of the study, details furnished here are in accordance with the renounced statistics. This is a prospective study of 40 cases of blunt abdominal trauma conducted in Govt Rajaji Hospital Madurai from April 2011 to May 2012.

Males (85%) outnumbered females (15%). The most common age group affected is of 21-30 years which forms the young and reproductive group. Road traffic accident forms the most common mode of injury (67.5%). Majority of our study population (90%) presented with pain abdomen .

The latent period in our study was < 18 hours in 90% of cases. Hemoglobin and hematocrit value becomes handy in treating BIA injury. X ray erect abdomen and chest X ray forms important investigational tools. Ultra sonography (FAST) has picked up solid organ injury or collection in 25 cases. So it becomes an important tool in emergency set up, more so in hemodynamically unstable patients. Four quadrant aspiration is a simple and non specific for diagnosis.

DPL was done in small number of patients since facility of high resolution ultrasonography (FAST) was available in our institution. CECT abdomen was performed in 37.5% of study population and had pivotal role in deciding operative or conservative management in hemodynamically stable patients.

The most common injured organ in the present study is spleen followed by liver, kidney, bowel and pancreas in the decreasing order.

For splenic injury, most common surgery performed was Splenectomy in 15 patients followed by splenorraphy in 3 patients. Rest was all managed conservatively. Liver injuries were managed conservatively most of the times with gel foam and hepatorraphy was done in 5 cases.

Retroperitoneal hematoma was seen in a small proportion of patients associated with renal injuries and were treated conservatively. Multiple intra abdominal organs were involved in our study accounting for 25%. Associated extra abdominal injuries like head, thoracic and orthopedic injuries were found in 21 cases in the present study and influenced the morbidity and mortality of the patients.

Post operative wound infections and respiratory complications were responsible for majority of long hospital stay in our study. The present study showed a mortality of 14.6%.

CONCLUSION

Following conclusions can be drawn from our study: Blunt injury abdomen with solid organ injury forms considerable load of patients in our society. Most common age group involved is 21-30 years. Predominantly males are affected in large proportions. Road traffic accident forms the most common mode of injury. So efforts should be made to bring road traffic regulations into strict action and traffic norms regulated. Well established trauma care centres should be established at every Taluk hospital. Measures for early transport of the patients from the accident site to the trauma centres should be undertaken. Significant number of cases will have associated injuries with blunt injury abdomen like head injury, thoracic injury, extremity fractures. Clinical presentation is varied, sometimes confusing.

Blunt injury abdomen is usually less obvious. Hence, repeated examination by multispecialty personnel in a specialized trauma centre is required. Erect abdomen X ray is a useful investigation to identify associated hollow viscus injury. Falling tires in serial hematocrit value indicates ongoing bleeding.

With the advent of high resolution ultrasonography (FAST), DPL and FQA investigations are becoming less opted. CECT forms the core investigation of choice in dealing with blunt injury abdomen patients, and becomes more important in deciding operative versus conservative management. Early diagnosis and repeated clinical examination and use of appropriate investigations forms the key in managing BIA injuries. Associated extra abdominal injuries like head, thoracic and orthopedic injuries influenced the morbidity and mortality of the patients.

BIBILIOGRAPHY

1. Cusheri A, Giles G. R., Moosa A. R: Essential Surgical Practice; Butterworth International Ed. 1998: p263-304..
2. Sabiston's Text book of surgery: 18th edition: vol 1: 2004: p483-531
3. Decker, G.A.G.,Lee McGregor's Synopsis of Surgical Anatomy, Bristol; John Wright and Sons LTD, 1986: p322-339
4. Hamilton Bailey's Emergency surgery: 13th edition: 2000: p446-471.
5. Feliciano DV. Diagnostic modalities in abdominal trauma. Peritoneal lavage, ultrasonography, computed tomography scanning, and arteriography. Surg Clin North Am 1991; 72: 241-56
6. Surgery of the liver and biliary tract: L.H. Blumgart: vol 1: 3rd edition: 2000: 1277-1318p.
7. Diagnosis and management of blunt small bowel injury: a survey of the membership of the American Association for the Surgery of Trauma. 2000 Mar: 48 (3): 402-7.
8. Donald D. Trunkey, Tom Shires, Robert McClelland; Management of Liver Trauma in 811 consecutive patients. Ann Surg. May 1974: vol 179: No 5; p722-728
9. Eddy H Carrillo, Christopher Wohltmann, J. David Richardson, Hiram C. Polk; Evolution in the treatment of complex blunt liver injuries; current problems in surgery. Mosby; vol 38 No 1, January 2001, p1-60.

10. Erwin R. Thal; Abdominal trauma, Surgical clinics of North America: vol,70/No 3: June 1990, W.B. Saunders Company.

11. Factors affecting the outcome of patients with splenic trauma. Am Surg. 2002 Mar: 68 (3): 232-239

12. Goins. A, Rodriguez, Brathwaite, Colin E.M et al; Retroperitoneal Hematoma after Blunt Trauma.

13. Gupta, Roshan Lall, Ed., Recent Advances in surgery (no. 6), New Delhi, Jaypee Brothers; 1998, p140-148

14. Blunt trauma to spleen: Aust N Z J Surg. 2000 May: 70 (5): 333-337.

15. Corriere Jn Jr and Sandler EN. Management of the ruptured bladder: 7 years of experience with 111 cases J Trauma. 1986: 26: 830.

16. Velmahos GC, Konstantinos G, et al. Nonoperative Treatment of Blunt Injury to Solid Abdominal Organs. Arch Surg 2003; 138: 844-851.

17. Knudson MM, Maull KI. Non-operative Management of solid organ injuries - Past, Present and Future. Surg Clin North Am 1999; 79: 1357-71.

18. McConnell DB, Trunkey DD. Non-operative management of abdominal trauma. Surg Clin North Am 1990; 70: 677-88

19. McAnena OJ, Moore EE, Marx JA. Initial evaluation of the patient with blunt abdominal trauma. Surg Clin North Am 1990; 70: 495-515

20.. Scalea TM, Rodriguez A, et al. Focussed Assessment with Sonography for Trauma (FAST): results from an international

consensus conference. J Trauma 1999; 46: 466-472.

21. Schwab CW. Selection of nonoperative management candidates. World J Surg 2001; 25:1389-1392

22. Stawicki SP. Trends in nonoperative management of traumatic injuries: A synopsis. OPUS 12 Scientist 2007; vol. 1, No. 1.

23. Gupta S, Talwar S, Sharma RK, Gupta P, Goyal A, Prasad P. Blunt Trauma Abdomen: A study of 63 cases. Indian J Med Sci 1996; 50: 272-6.

24. Maingot's abdominal operation, 11th edition, p:772-784 100

25. Joe Jack Davis, Isidore Cohn, Francis C. Nance; Diagnosis and management of Blunt abdominal trauma. Ann, Surg, June 1976: vol 183: No 6; p672-678.

26. R. Khanna, S Khanna, P Singh, Puneet and A K Khanna; Spectrum of blunt abdominal trauma in Varanasi; Quart J; vol 35, No 1&2, Mar&Jun 1999; p25-28.

27. Jurkovich GJ, Carrico CJ. Trauma: Management of the acutely injured patient. In: Sabiston DC Jr, et al., editor. Textbook of Surgery. NOIDA: Thomson Press (India) Ltd; 1997; pp. 296-337

28. Cox, Everard F; Blunt abdominal trauma: A 5 year Analysis of 870 patients requiring Celiotomy; Ann, Surg; April 1984 vol 199; p467-474.

29. DiVincenti FC, River JD, Laborde EJ, et al: Blunt abdominal trauma. J Trauma 8: 1004, 1968.

30. King H, Shumacker HB: Splenic studies, Ann surgery136-239, 1952.

31. Last RJ. Anatomy 9th edition.
32. Luna GK, Dellinger EP: Non operative observation therapy for splenic injuries: A safe therapeutic option? Am J Surg 153:462-468, 1987.
33. Maingot. R. In Maingot's Abdominal operation 10th edition.
34. Mcaninch JW, Carrol PR: Renal trauma. Kidney preservation through improved vascular control-A refined approach. J. Trauma. 22:285, 1982.
35. Moore EE : Resuscitation and evaluation of the injured patient. In zuidema GG, Ballinger W Rutherford : Management of Trauma. Philadelphia, WB Saunders, 1985, p1.
36. Moore EE, Shacford SR, Pachter HL, et al: Organ injury scaling: spleen, liver and kidney J. Trauma 29: 1664, 1989.
37. Oxford text book of surgery – 2nd Edition
38. Patel J, Williams JS, Shmigel B et al preservation of splenic functions by auto transplantation of spleen in man. Surg 90:683, 1981.
39. Peitzman AB, Makaroun MS, Slasky BS et al : Prospective study of CT in the initial management of blunt abdominal trauma J Trauma 26:585-592, 1986.
40. Powell DC, Bivins BA, Bell RM. Diagnostic peritoneal lavage. Surg Gynec obstet 155:257-262, 1982.
41. Sabiston Text book of surgery – 17th edition.
42. Sagalowsky I, and Paul C. Peters. Genito urinary trauma. Campbell's urology.
43. Schecter WP, turnkey DD: Abdominal trauma and indications for laparotomy. In Mattox KL, Moore EE, Feliciano DV: Trauma. Norwalk, CT, Appleton & Lange, 1988, P401.

44. Snyder WH III et al: The Surgical Management of duodenal trauma, Arch Surg: 115:422-429, 1980.
45. Shannon FL,Moore EE, Primary Colon repair – a sage alternative, surgery, 1985.
46. Sherman R: Management of trauma to spleen, Adv Surg 17:37-71, 1984.
47. Schwartz's – Principles of surgery – Eighth edition.
48. Soderstorm CA, Durriest RW, Cowley RA: Pitfalls of lavage in blunt abdominal trauma. Sur Gynec Obs 151:513-518,1988.
49. The new Aird's companion in surgical studies – 3rd edition.
50. Touloukiann R. Splenic preservation in children World. J Surg 9:214:1985.
51. Vaughu Gg, Frazier OH, Graham D, et al the use of pyloric Exclusion at the management of severe duodenal injuries AM J.Surgery 134,1977.

PROFORMA

BLUNT INJURY ABDOMEN - SOLID ORGAN INJURIES

Name : IP No.:

Age& Sex : Unit :

Date & Time of Admission :

Date of Discharge :

Date and Time of Injury :

Date and Time of surgery :

Latent Period :

Mode of Injury : RTA

Fall from height

Assault

Bull gore injury

Industrial accidents

Others

Presenting Complaints

1. Pain : Present / Absent

Site

Character

Duration

2. Vomiting : Present / Absent

3. Passed : Urine / Stools / Flatus

4. H/o : Hematuria / Hematochesia / Melena

5. Known H/o Jaundice : DM / TB/ Epilepsy / Previous surgery /

6. Personal R/o : Smoker / Alcoholic / Drug addiction

7. General Examination:

PR

BP

RR

Temp

Level of consciousness

8. Other symptoms

CVS

RS

Musculo skeletal system

9. Assessment of abdomen injuries:

Inspection	:	Abdominal wall Injury
		Discolouration of abdomen wall
Palpation	:	Distention
		Guarding / Rigidity
		Tenderness
		Renal angle tenderness
Percussion	:	Free fluid
		Liver dullness
		Splenic dullness
		Renal angle dullness
Auscultation	:	BS

10. Special Signs

Spleen

Liver

Kidney

Pancreas

11. Associated Injuries:

Head & Neck / ENT

spine and pelvis

Chest

External genitalia

Extremities

Others

12. Investigations

Urine	:	Albumin
		Sugar
		Deposits
Blood	:	Hb% Grouping and typing
		Sugar Urea
		çreatinine

E1ectrolyte

Amylase

Xray : Chest PA

Abd erect

USG Abdomen and Pelvis

CT Abdomen and pelvis

Diagnostic peritoneal lavage

13. Indication for Laparotomy
14. PreopDiagnosis
15. Operative procedure

Laparotomy findings

Surgical procedure

Blood transfusion

16. Post op. Complications

Fever

Jaundice

Wound infection / dehiscence

Intra peritoneal collections

Ileus

DVT

Others

17. Post mortem Findings if expired:
18. Follow up

S.NO	NAME	AGE	SEX	IP NO	NATURE OF INJURY	SOLID ORGAN INJURED	ASSOCIATED INJURIES	PROCEDURE	COMPLICATIONS	DEATH
1	SILAMBARASAN	25	M	70587	RTA	SPLEEN	RETROPERITONEAL HEMATOMA	SPLEENECTOMY		
2	DINESH	16	M	14032	RTA	PANCREAS	BLADDER CONTUSION	ROUX EN Y PJ,JJ, & FJ	WOUND INFECTION	
3	MUNIYATHEVAR	55	M	28189	ASSAULT	LIVER		GEL FOAM		
4	MUNIYANDI	55	M	41877	WALL COLLAPSE	SPLEEN		SPLEENECTOMY	ATELECTASIS	
5	SATISHKUMAR	19	M	74804	RTA	LIVER	DIAPHRAGM	GEL FOAM		
6	RAJAMANI	50	F	37148	RTA	SPLEEN		SPLEENECTOMY		
7	PALANIKANTH	25	M	43606	RTA	LIVER		GELFOAM		
8	PONNUTHAI	42	F	29579	WALL COLLAPSE	SLEEN		SPLEENECTOMY		
9	VAIRAMANI	55	M	70598	RTA	LIVER		GEL FOAM		
10	RAFIQUE	21	M	37280	ASSAULT	SPLEEN		SPLEENECTOMY		
11	SHANMUGAM	40	M	61542	RTA	LIVER		GELFOAM		
12	KANNAN	23	M	47793	RTA	SPLEEN		SPLEENECTOMY		
13	MANIKAM	60	M	55391	ASSAULT	SPLEEN		SPLEENECTOMY		
14	RAJA	18	M	71774	RTA	SPLEEN, LEFT KIDNEY		SPLEENECTOMY	WOUND INFECTION	
15	PALANIVEL	30	M	14520	RTA		RETROPERITONEAL HEMATOMA	CONSERVATIVE		
16	SANTHANAMARY	28	F	34082	RTA	SPLEEN		SPLEENECTOMY		
17	MUTHUPANDI	31	M	59026	RTA		RETROPERITONEAL HEMATOMA	NEGATIVE LAPAROTOMY		
18	NAVEEN	18	M	17851	RTA	LIVER		GELFOAM		
19	PRIYA	20	F	71786	WALL COLLAPSE	SPLEEN		SPLEENECTOMY	ATELECTASIS	
20	SEKAR	30	M	61586	ACCIDENTAL FALL	SPLEEN		SPLEENECTOMY		
21	MUNIYAMMAL	30	F	62674	RTA		RETROPERITONEAL HEMATOMA	NEGATIVE LAPAROTOMY		
22	NAGARAJ	28	M	56021	RTA	SPLEEN	MESENTRIC INJURY	SPLEENECTOMY	INTRAABD ABSCESS	DEATH
23	SURESH	31	M	48413	ASSAULT	KIDNEY	TRANSVERSE COLON CONTUSION	CONSERVATIVE	WOUND DEHISCENCE	DEATH
24	POOCHARAM	27	M	12701	RTA	SPLEEN	RIB FRACTURE- LFT 10,11	SPLEENECTOMY	ATELECTASIS	
25	RAJESH	19	M	70395	RTA	SPLEEN		SPLEENECTOMY		
26	GANESAN	38	M	37765	RTA	KIDNEY		CONSERVATIVE		
27	PAUL	51	M	74176	WALL COLLAPSE	LIVER	STOMACH	HEPATORAPHY	WOUND DEHISCENCE	DEATH
28	SUNIL	28	M	64746	RTA	LIVER	ASCENDING COLON	GELFOAM		
29	MURUGANANTHAN	19	M	15252	ACCIDENTAL FALL	SPLEEN		SPLEENECTOMY		
30	MUNIYANDI	50	M	19205	RTA	SPLEEN		SPLEENECTOMY		
31	PREM	16	M	32574	RTA	SPLEEN	MESENTRIC INJURY	SPLEENECTOMY		
32	PALANI	60	M	40377	BULLGORE		RETROPERITONEAL HEMATOMA	CONSERVATIVE		
33	KALA	38	F	49474	RTA	SPLEEN	RIB FRACTURE- LFT 10,11	SPLEENECTOMY	WOUND INFECTION	
34	MALAICHAMY	50	M	17833	RTA	SPLEEN		SPLEENECTOMY		
35	DURAIYAN	14	M	32054	RTA	SPLEEN, PANCREAS	SPLENIC FLEXURE CONTUSION	SPLEENECTOMY	ATELECTASIS	DEATH
36	SIKANDER	38	M	31461	ASSAULT	LIVER		HEPATORAPHY		
37	ARUMUGAM	40	M	50439	RTA	LIVER		GELFOAM		
38	NAVEEN KUMAR	20	M	60584	RTA	LIVER	MESENTRIC INJURY	GELFOAM		
39	SAKKARAI	40	M	60789	WALL COLLAPSE	LIVER		CONSERVATIVE		DEATH
40	MALAISAMY	36	M	69271	RTA	LIVER, KIDNEY	RETROPERITONEAL HEMATOMA	HEPATORAPHY		

A STUDY ON BLUNT INJURY ABDOMEN-

SOLID ORGAN INJURIES

DISSERTATION SUBMITTED FOR

BRANCH - I M.S (GENERAL SURGERY)

APRIL 2013

34

THE TAMILNADU

turnitin

Your digital receipt

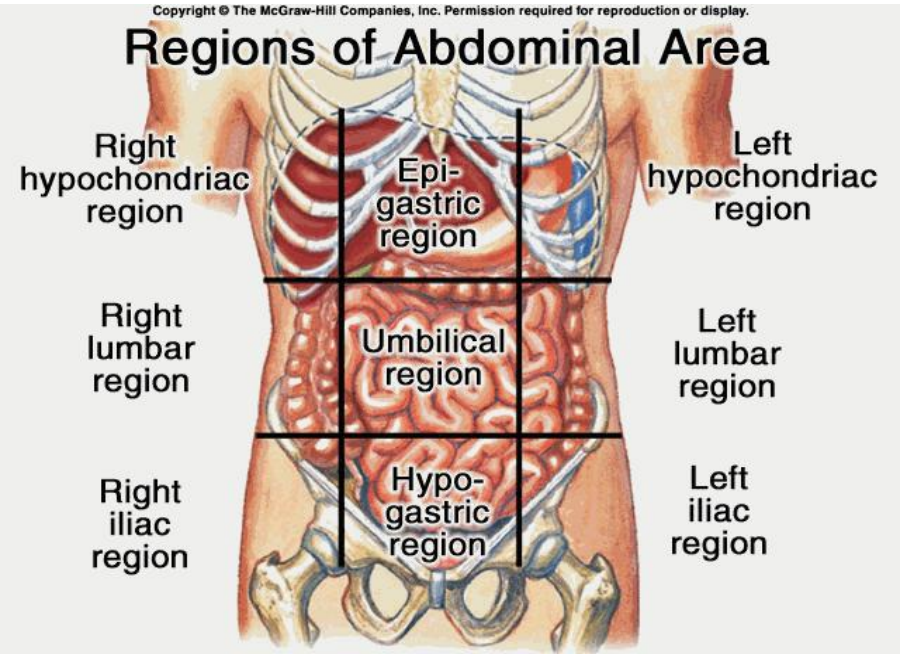
This receipt acknowledges that Turnitin received your paper. Below you will find the receipt information regarding your submission.

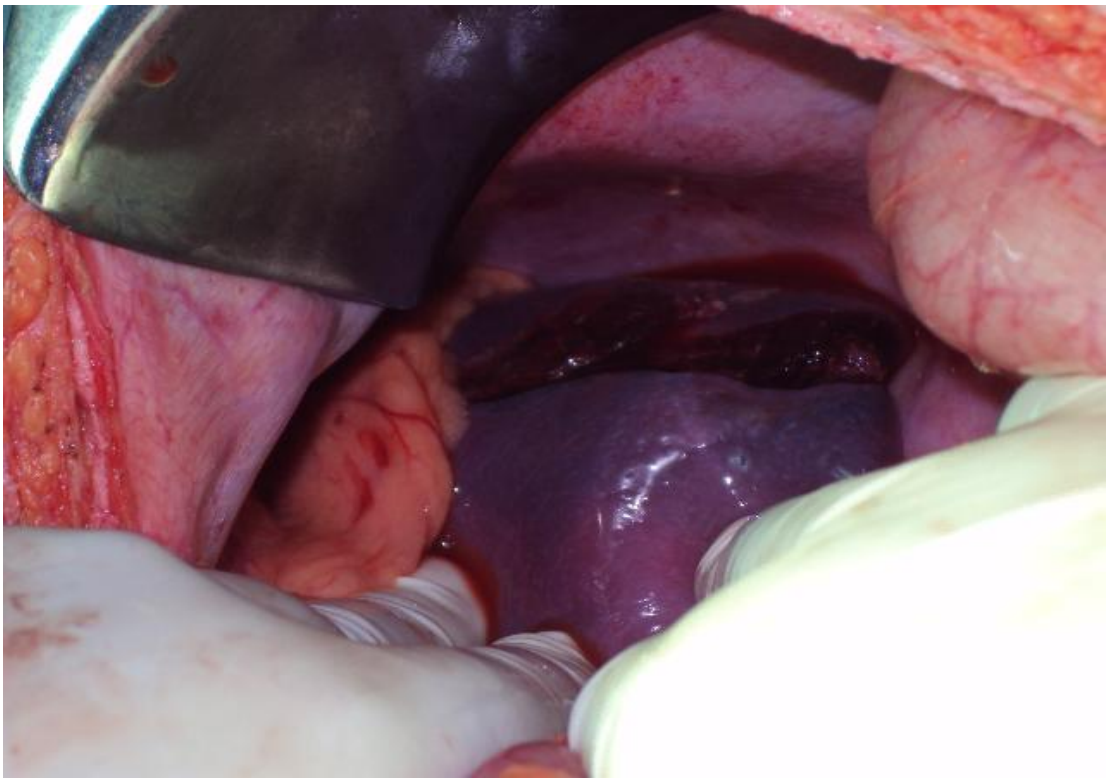
Paper ID	290020433
Paper title	A STUDY OF BLUNT INJURY ABDOMEN- SOLID ORGAN INJURIES
Assignment title	Medical
Author	Bala Murali 22101133 M.S. General Surgery
E-mail	muralidr2007@yahoo.co.in
Submission time	12-Dec-2012 06:24PM
Total words	13202

First 100 words of your submission

A STUDY ON BLUNT INJURY ABDOMEN- SOLID ORGAN INJURIES DISSERTATION SUBMITTED FOR BRANCH - I M.S (GENERAL SURGERY) APRIL 2013 THE TAMILNADU DR.M.G.R.MEDICAL UNIVERSITY CHENNAI CERTIFICATE This is to certify that the dissertation entitled "BLUNT INJURY ABDOMEN-SOLID ORGAN INJURIES" is the bonafide work of Dr.S.BALAMURALI in partial fulfillment of the university regulations of the Tamil Nadu Dr. M.G.R. Medical University, Chennai, for M.S (Branch I) General Surgery examination to be held in April 2013. Prof.S.S.ELVA CHIDAMBARAM, M.S., Professor of Surgery, Madurai Medical College, Madurai. Prof.Dr.D.SOUNDARAJAN, M.S., Head of the Department, Department of Surgery, Madurai Medical College,...

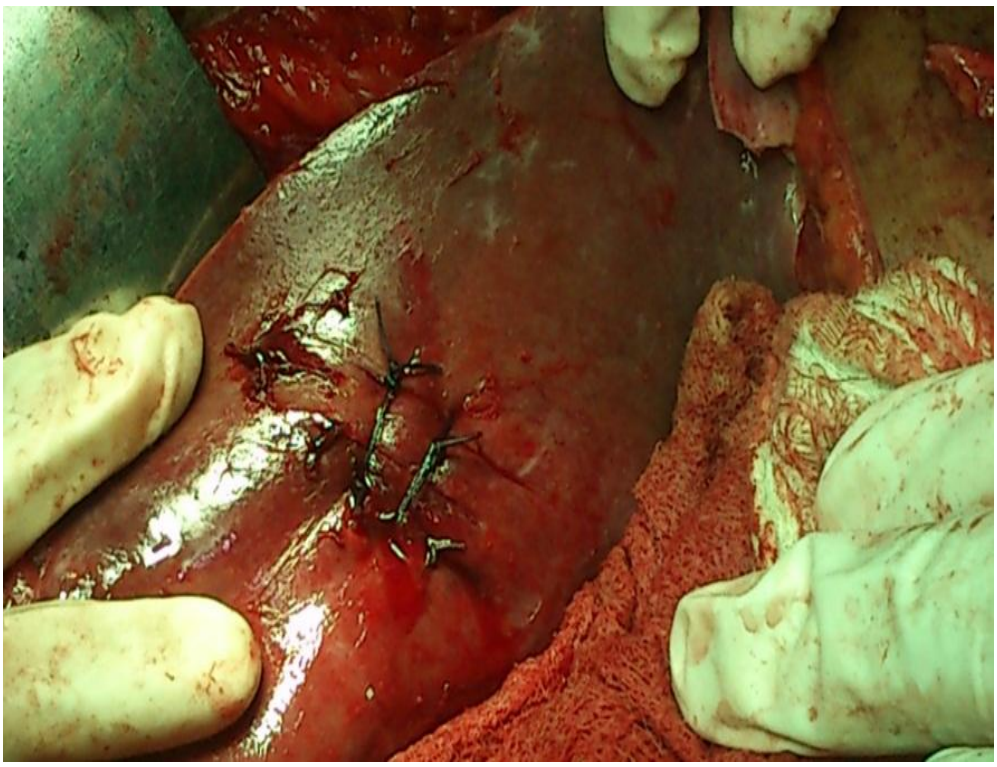
QUADRANTS OF ABDOMEN



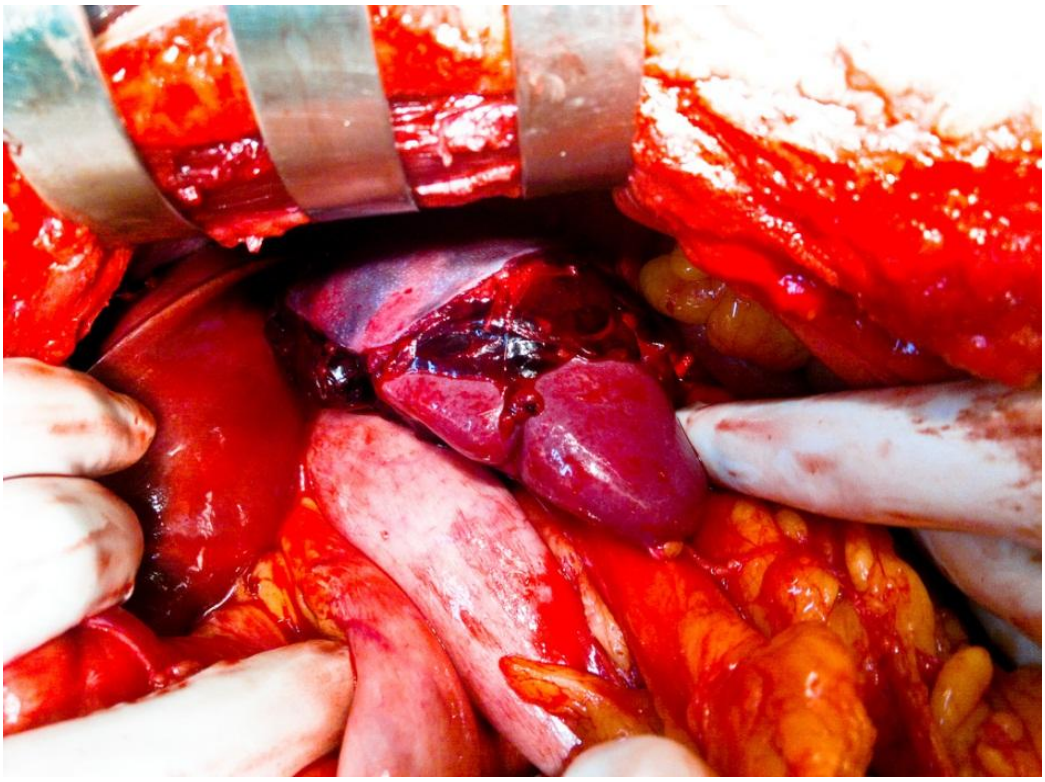


LIVER INJURY

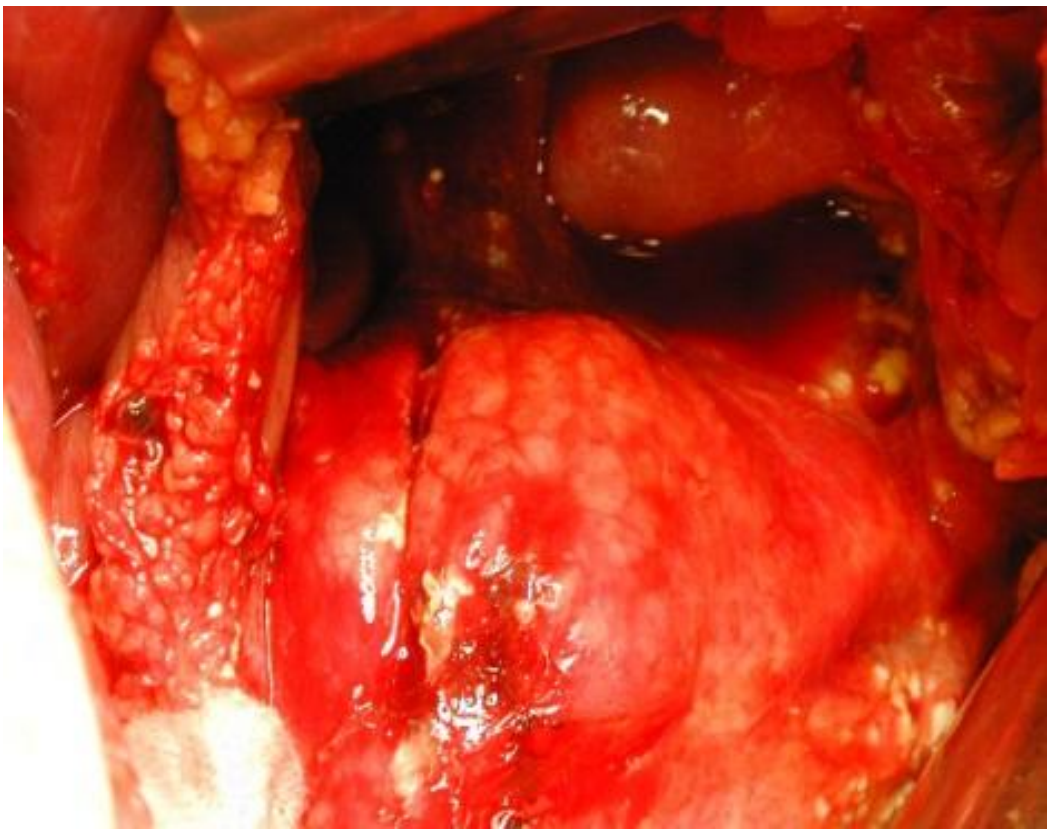
HEPATORAPHY



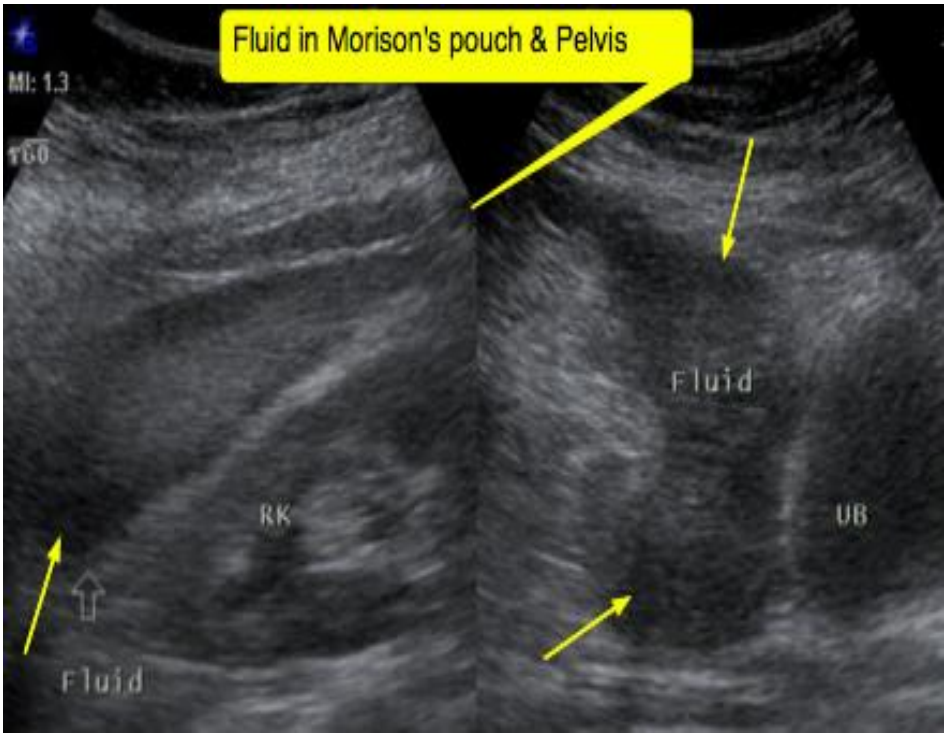
SPLENIC INJURY



PANCREATIC INJURY



ULTRASOUND ABDOMEN- FLUID IN MORRISONS POUCH AND PELVIS



CT ABDOMEN –SPLENIC INJURY

CT ABDOMEN-LIVER INJURY