A STUDY OF BLUNT INJURY ABDOMEN

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CERTIFICATE

This is to certify that this dissertation entitled **"A STUDY OF BLUNT INJURY ABDOMEN"** submitted by **Dr. B. SARAVANAN** to The Tamil Nadu Dr.M.G.R. Medical University, Chennai is in partial fulfillment of the requirement for the award of M.S. degree Branch I (General Surgery) and is a bonafide research work carried out by him under direct supervision and guidance.

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DECLARATION

I, Dr. B.SARAVANAN declare that I carried out this work on **"A STUDY OF BLUNT INJURY ABDOMEN"** at Department of General Surgery, Government Rajaji Hospital during the period of April 2005 – May 2006. I also declare this bonafide work or a part of this work was not submitted by me or any other for any award, degree, diploma to any university, board either in India or abroad.

This is submitted to the Tamilnadu Dr.M.G.R. Medical University, Chennai in partial fulfillment of the rules and regulation for the M.S. Degree examination in General Surgery.

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INTRODUCTION

Trauma is a major worldwide public health problem. It is one of the leading causes of death and disability in both industrialized and developing countries. Approximately ten percent of civilian injury that requires operation are the result of blunt abdominal trauma. Motorvehicle accidents account for 75 % of cases of blunt abdominal trauma. Explosive increase in population and increase mobility without increase in road surface area lead to increase in road traffic accidents. High speed vehicles, decivilization of human race, terrorism and sports are just few of the predisposing factors of trauma. Unrecognized intraabdominal injury remains distressingly frequent cause for preventable death in patient with Blunt injury abdomen.

Evaluation of a patient with abdominal trauma can be a most challenging task that a surgeon may be called upon to deal with.**Investigative modality can only supplement the clinical evaluation and cannot replace it in the diagnosis of blunt abdominal trauma.** Various mode of Blunt injury abdomen, varied mode of presentation and diagnostic challenges that blunt injury abdomen poses forms a fascinating subject to study.

THE AIM OF THE STUDY

The aim of the study is to evaluate the following aspects of blunt injury Abdomen .

1. The incidence of blunt injury abdomen.
2. Mode of injury.
3. Clinical Presentation.
4. Incidence of organ involvement.
5. Method of treatment
6. Incidence of negative laparotomies
7. Morbidity & Mortality

REVIEW OF ANATOMY

A revision of the surgical anatomy of the abdominal organs is necessary at this juncture to appreciate the various aspects of penetrating abdominal injuries. For evaluation purposes the abdomen is divided into four areas intrathoracic abdomen, true abdomen, pelvic abdomen, and retroperitoneal abdomen.

The intrathoracic abdomen is that portion of the upper abdomen that lies beneath the rib cage. The contents include the diaphragm, liver, spleen and stomach. Peritoneal lavage becomes useful in evaluating this area.

The pelvic abdomen lies in the hollow of the pelvis. It is surrounded on all sides by the bony pelvis and its contents include the rectum, bladder, urethra small bowel and in females the uterus, fallopian tubes and ovaries.

The retroperitoneal abdomen contains the kidneys, ureter, pancreas, second and third portion of the duodenum, the ascending and descending colon and the great vessels the aorta and vena cava. Evaluation of the retroperitoneal abdomen requires utilization of radiographic procedures including intravenous pyelography, angiography and CT.

The true abdomen contains the small and large intestines, the bladder when distended and uterus when gravid. Injuries to any of these organs are usually manifested by pain and peritonitis.

LIVER

The liver is the largest organ in the body weighs about 1500 gms and receives 1500 ml of blood per minute, developed from ventral mesogastrium Liver has two surfaces diaphragmatic and visceral surfaces. The diaphragmatic surface is subdivided into anterior, superior, posterior and right surfaces. The ligament which are attached to the liver are right and left triangular ligament, coronary ligament and lesser omentum. Liver is held in position by attachment of IVC and hepatic veins. The falciform ligamentum divides the anatomical left and Right lobes. Caudate Lobe lies back between Inferior venacava and the fissure for the ligamentum venosum. Quadrate Lobe lies between gall bladder fossa and the fissure for the ligamentum teres on the basis of blood supply and biliary drainage. Liver is divided into four anatomical segments in eight sectors. Blood supply is by hepatic artery 50% and portal vein supplying 25% and 75% of total blood supply by supplying oxygen each and drained by Right, middle and Left hepatic veins and also about 10 to 15 small veins drain directly into IVC. Hepatic artery, common bile duct and portal vein passes through the free border of lesser omentum.

Pringle's maneuver is the temporary application of vascular occlusion using finger, which has been extended to applying clamp to the free margin of lesser omentum upto a period of 20mts to 1 hour, indicated in major bleeding from hepatic injury so that bleeding points can be arrested.

SPLEEN

Spleen is the largest lymphoid organ in the body developed from dorsal mesoqastrium. It lies under diaphragm on the left side of the abdomen closely in contact with 9th, 10th, and 11th ribs. It measures 1x 3x5 inches weighs 7oz. Spleen is freely mobile organ and held in position by lienorenal ligament and gastrosplenic ligament, phrenocolic ligament gives additional support. Spleen is supplied by spleenic artery passes between the layers of lienorenal ligament. At the hilum it breaks up into four branches which enter hilum separately. Similar veins leave the hilum and unit to form the splenic vein. The hilum of spleen is closely related to the tail of pancreas. So concomitant pancreatic and splenic injuries are common.

Spleen act as an immunological filter. It produces opsonin, tuftsin – a tetra peptide that coats white cells to promote phagocytosis of particular matter, bacteria and aged red cells. It is also a source of properdin, a vital component of alternative pathway of complement activation.

STOMACH

Stomach is the most dilated part of the alimentary tract, interposed between the esophagus and duodenum in the upper part of abdominal cavity and Lying mainly in the left hypochondrial, epigastric and umbilical regions with much of it under cover of the lower ribs. It is loosely suspended in the abdomen by the gastro hepatic ligament superiorly, the gastrocolic ligament inferiorly and by its attachment to the spleen laterally. It is relatively fixed at the gastro esophageal junction and the retroperitoneal duodenum. The gastric wall consist of an external serosal layer followed by three layers of smooth muscle outer longitudinal layer, middle circular layer, and inner oblique layer. A strong sub mucosal layer is followed by a mucosal layer with a rich capillary network. This network is supplied by arterioles, which originate in the sub mucosa.

The stomach is supplied by four major nutrient arteries with extensive collateral circulation between the vascular beds. The left gastric artery most commonly arises from the celiac axis and usually splits into anterior and posterior trunks before it reaches the stomach. Branches from the left gastric artery supply the distal esophagus and cardiac portion of the stomach. The right gastric artery most commonly originates from the hepatic Artery and it

anastamoses with the left gastric circulation along the lesser curvature. The left gastroepiploic artery is a collateral of the splenic artery and supplies the greater curvature. It anastamoses with right gastroepiploicartery in about 75% of cases. The more maximal portion of greater curvature is supplied by the short gastric vessels which originate from the gastroepiploic artery as well as from the splenic artery. The right gastroepiploic artery arises from the gastro duodenal artery and supplies the pyloric area and distal greater curvature. Venous drainage from the lesser curvature is via the coronary vein to the portal vein. On the greater curvature drainage is via the short gastric vessels and right and left gastroepiploic veins to the splenic vein.

SMALL INTESTINE

The small intestine consists of the duodenum, jejunum and Ileum. The Duodenum extends from the pylorus, lies opposite to the right side of the spine at the level of the first lumbar vertebra to the duodenojejunal flexure. It is 'C' shaped tube and about 25cm Long. It is divided into four parts and properly called as superior, descending, horizontal and ascending but simply called first, second, third and fourth parts of duodenum. The blood supply to the duodenum is from the celiac and superior mesenteric vessels. The first portion of the duodenum is intraperitoneal and some what mobile. The remainder of the duodenum is retroperitoneal owing to the fusion of the

posterior peritoneum with the duodenum. The second and right half of the third portion of the duodenum may be easily mobilized through this blood less fusion plane, a Kocher's maneuver. An additional point of fixation occurs at the ligament of Treitz.

Jejunum is wider bored and thicker walled than ileum. Jejunum and Ileum together lie in the free margin of the mesentery. Total length varies greatly from about 4 to 6 metres. The jejunum constitutes two fifths and three fifths for the ileum. Fan shaped mesentery suspends the small bowel and extends from the left side of the second lumber vertebrae downward to the right sacroiliac joint, the traversing the transverse colon, duodenum, Aorta, Inferior venacava, right gonadal vessels and Right writer. The superior Mesentric Artery supplies the jejunum and Ileum arising from the aorta approximately 2 cm below the celiac trunk after crossing the uncinate process of the pancreas, it enters root of the mesentery giving off branches to pancreas right colic and numerous intestinal vessels before it terminates at the medial aspect of the caecum.

PANCREAS

The pancreas lies transversely across the upper part of the posterior abdominal wall and is about 15-20 cm in length, 3.1cm in width, 1-1.5 cm in thickness and weights about 80-90gms. Posterior the pancreas is the IVC,

Aorta, left Kidney, both renal vein and the right renal Artery. The pancreatic head lies with in the concave sweep of the duodenum. The splenic artery runs along the upper border of the pancreas and the splenic vein runs behind, Just superior to the lower edge. The superior mesenteric vein and artery lies just behind the neck of the pancreas and are also enclosed posteriorly by an extension of the head known as uncinate process. The uncinate process lies between the Inferior vena cava and portal vein.

The main pancreatic duct of wirsung usually traverses the entire length of the gland slightly above the line, halfway between the superior and inferior edges and normally ends by joining the common bileduct. The accessory duct of santorini branches out from the pancreatic duct in the neck of the pancreas and empties into the duodenum about 2.5 cm above the duodenal papillae. Sometimes the anomalous common hepatic artery and right hepatic artery may pass posterior to the portal vein awareness of this anomaly is useful for dissection of the portal triad to minimize inadvertent injury.

KIDNEYS

The kidney lies high up on the posterior abdominal wall behind the peritoneum, largely under cover of the costal margin. Each kidney lies obliquely, with its long axis parallel with the lateral border of psoas major. Normal kidney measures about 12x6x3 cms and weighs about 130 gms. The

hilum of the right kidney lies just below and the hilum of the left just above the transpyloric plane, 5cm from the midline. The relation of kidney posteriorly mostly the diaphragm and the quadratus lumborum muscles with overlaps medially on to psoas and laterally or to transversus abdominis. The right supra renal gland pyramidal inshape surmounts the upper pole of right kidney whereas the left supra renal is cresentric in shape and is applied to the medial border above the hilum. The anterior relation of the right kidney are duodenum, hepatic flexure, coils of jejunum and liver whereas the anterior relations of the left kidney include the tail of the pancreas, splenic flexure and stomach. The perinephric fat lies outside the renal capsule. At the hilum vein, artery and the pelvis lies in the order from anterior to posterior. The constant anatomy of the origin of the renal arteries on both sides, which is posterior to the point at which two left renal vein joints the inferiorvenacava. This is very important in controlling the renal pedicle initially before the Gerota's fascia is opened.

URETERS

The ureter is 25cm long. The ureter passes down on the psoas major under cover of the peritoneum and crosses the genitofemoral nerve being itself crossed superficially by the gonadal vessels. On the right the upper part is behind the duodenum, while lower down it is crossed by the root of the

mesentery and by the right colic, ileocolic and superior mesenteric vessels. On the left it is lateral to the inferior mesenteric vessels and is crossed by the left colic vessels and the sigmoid mesocolon. The blood supply is endangered if the ureter is stripped of the surrounding tissues.

COLON

The right colon is derived from the midgut and is supplied by the superior mesenteric artery, where as the left colon originates from the hind gut and is supplied by the Inferior mesenteric vessels. The Right colon has a thin wall and larger lumen and left colon is thicker and more muscular and has a smaller lumen. The right colon absorbs and dehydrates the small bowel contents whereas the left colon functions primarily for storage. Despite the fact that there are definite anatomical and physiological differences between the right and left colon both should be treated similarly.

RETROPERITIONEAL SPACE

The Area of the posterior abdominal wall behind the peritoneum that is not occupied by the major viscera and great vessels. Major structure lie on the posterior abdominal wall behind the peritoneum includes the aorta and inferior vene cava with a number of their branches and tributaries, the cysterna chyli, lymphnodes and nerves including the sympathetic trunk, the kidney's, ureters, pancreas and most of the duodenum and supra renal glands.

PATHO PHYSIOLOGY AND MANAGEMENT

LIVER INJURIES

Most of the liver injuries occurs following compressive type of injury. Compression is inbetween righ lower ribs and spines.Direct blow or shearing at fixed point secondary to deceleration produces liver injuries and is usually associated with lower chest or upper abdomen contusion or fracture of lower ribs. Right lobe is more commonly involved than left lobe because of larger size and lesser mobility. Because of its size, injuries sufficient to lacerate liver are associated with injuries to other organs in about 80% cases.

GRADING OF HEPATIC INJURIES[41]

(Liver injury scale 1994 revision)

Grade*	Type of Injury	Description of Injury
I	Haematoma Laceration	Sub capsular <10% surface area capsular tear <1cm parenchymal depth
II	Haematoma Laceration	Sub capsular, 10-50% surface area intraparenchymal <10 cm in diameter Capsular, tear, 1-3cm parenchymal depth <10cm in length.
III	Haematoma Laceration	Subcapsular >50% surface area of ruptured Subcapsular or parenchymal haematoma, Extraparenchymal haematoma >10cm or expanding 3cm parenchymal depth
IV	Laceration	Parenchymal disruption involving 25-

		75% hepatic lobe or 1-3 couinaud segments
V	Laceration Vascular	Parenchymal distribution involving >75% of hepatic lobe or > 3 couinaud segments with in single lobe Juxta hepatic venous injuries i.e. retrohepatic venacava/ central major hepatic veins
VI	Vascular	Hepatic avulsion

*advance one grade for multiple injuries upto grade III

DIAGNOSIS :

Hepatic injuries are suspected with location of trauma,profound hypotension that temporarily respond to infusion of blood and fluids.

After resuscitation the patients plain x-ray abdomen should be taken and shows altered liver border, hemoperitoneum and associated rib fractures.

Abdominal paracentesis is positive, if large amount of blood presents in the peritoneal cavity. DPL is diagnostic of minimal hemo peritoneum, but not specific for liver injury, CT is the investigation of choice in multiple injured patients provided patient is hemodynamically stable.

TREATMENT[41]

1. NON OPERATIVE MANAGEMENT

Indicated in

1. Hemodynamic stability
2. Normal mental status
3. Absence of a clear indication for laparotomy such as peritoneal signs
4. Low grade Liver injuries (grade 1to3)
5. Transfusion requirements of less than 2 units of blood.

These patients – followed by serial hematocrit and vital signs. During observation if the patient shows signs of bleeding angiography and selective embolisation can be done.

Indications for laparotomy during observations are

1. Continuing need for blood transfusion, increasing (or) deterioting vital signs.
2. Peritoneal signs.
3. Progressive expansion of haematoma.

II. OPERATIVE MANAGEMENT[41,47]

(A) Simple Techniques of repair

1. **Compression:** small cracks in the capsules can be treated by compression for 5 to 10 minutes to stop bleeding.

2. **Topical agents**: The application of gelfoam, microcrystalline collagen pad and fibrin glue is used for when avulsion of Glisson's capsule is present. After application of topical agent to the raw hepatic surface 5 minutes of compression with pads is applied. After removed electrocautery can be used for any bleeders.

3. **Suture hepatorrhaphy:** Horizontal mattress sutures with 1-0 vicryl or simple continuous suturing with 1/0 vicryl can be done with these measures most of the bleeding stops.

(B) Advanced Techniques Repair:

1. Extensive hepatorrhaphy:

If simple suturing fails to stop, multiple horizontal but bleeding from intralobar branches of hepatic artery, portal vein or hepatic vein are not controlled by this method.

2. Hepatotomy with selective vascular ligation:

It is indicated when bleeding vessels present deeply. Hepatotomy is done with finger fracture technique. Bleeding vessels and biliary radicals are identified and ligated.

3. Omental Pack

In 1975 stone and lamb first described the use of viable pedicle of omentum placed into deep lobar lacerations to control haemorrhage at the base. Viable omentum separated from transverse colon can be placed over liver laceration to control bleeding especially in bare area of liver.

4. Resectional debridement with selective vascular ligation

It is indicated whenever there is friable and partially devascularised hepatic tissue on the edge of liver or in a hepatic laceration or missile tract. It is used in preference to anatomic segmentation or lobectomy as these techniques frequently sacrifice larger amounts of normal hepatic tissue.

5. Resection

It is indicated in the case of total disruption of lobe or segment. In the form of lobectomy or segmentectomy.

6. Selective hepatic artery ligation

When selective vascular ligation fails, ligation of hepatic artery is an alternative. It may produce dramatic hemostasis without subsequent liver failure, but this should be done as close to liver as possible and only as a last resort.

7. Perihepatic packing

This technique involves the insertion of laparotomy pads or rolls of gauze around the injured liver not into hepatic laceration. Packs can be

removed 12 hrs after packing. Rebleeding and sepsis are common complications.

Complications:

Significant complications following liver injury includes

1. Haemobilia (commonest complication)
2. Coagulopathy
3. Hypoglycaemia
4. Jaundice
5. Biliary fistulas
6. Haemobilia
7. Subdiaphragmatic and intraparenchymal abscess formation

SPLENIC INJURIES

Spleen is the most commonly injured organ in blunt injury abdomen. The reason being its mobility and its attachment with

many of the structures in the left upper quadrant , its position and intimate contact with 9 to 11 ribs. The spleen is relatively free to continue movement in patient, who have suffered deceleration type of trauma which leads to capsular tear at the attachment to the named organs and possible fractures of ribs in

contact with spleen. The clinical picture of splenic injury includes left upper quadrant abdominal pain, signs of blood loss and pain in the left shoulder (Kehr's sign).

Grading of splenic injury[41]

Spleen injury scale (1994 revision).

Grade*	Type of Injury	Description of injury
I	Haematoma Laceration	Subcapsular, <10% surface area Capsular tear <1cm parenchymal depth
II	Haematoma Laceration	Subcapsular 10-50% surface area Intra parenchymal <5cm in diameter Capsular tear, 1 to 3 cm parenchymal depth that does not involve 9 trabecular vessel.
III	Laceration	Subcapsular >50% surface area or expanding, ruptured subcapsular or parenchymal haematoma.
IV	Laceration	Laceration involving segmental or hilar vessels producing major devascularsation (>25% of spleen)
V	Laceration Vascular	Completely shattered spleen Hilar vascular injury that devascularizes spleen

- - Advance one grade for multiple injuries upto Grade III

Management

The management of splenic injury has been subject of major re-examination over the past decade and the recognition of fatal pneumococcal septicemia in patients undergoing splenectomy has led to an interest in splenic salvage (D.B.Hyot and A.R. Moossa et al)[4].

Plain abdominal films may show

1. Enlargement of splenic shadow
2. Elevation of left hemidiaphragm
3. Medial displacement of splenic shadow or stomach
4. Irregular fundal air shadow
5. Fracture 9th & 10th rib on left side
6. Widening of the space between the splenic flexure and peritoneal pad

Peritoneal lavage should be performed when there is possibility of splenic injury, positive indicates laparotomy.

Ultrasound, CT scanning and radionuclide scan can reveal grade of significant splenic injury.

I Non operative management[41,47]

>70% of all stable splenic injuries are being treated nonoperative approach.

Criteria for non operative management of splenic injury.

1. Hemodynamic stability.
2. Negative abdominal examination.
3. Absence of contrast extravasation on CT.
4. Absence of other clear indications for explorative laparotomy or associated injuries requiring a surgical intervention.
5. Absence of associated health conditions that carry on increased risk of bleeding (coagulopathy, hepatic failure, use of anticoagulants) and grade 1 to 3 injuries.

The risk of non operative management are missed injury to other viscera and delayed rupture of subcapsular haematoma. Patient are usually admitted in ICU and serial abdominal examination and haematocrit are obtained during the initial 48 to 72 hrs. The patient should be followed sequentially with CT scan.

II Spleen conserving surgery[4,41,47]

During the course of laparatomy the spleen in evaluated for haemorrhage. The repair is not attempted.

1. If it is a multiple injury case
2. Patient is in shock (systolic pressure <90mmHg)
3. There are medical contraindications to prolonged surgery (bleeding disorder, cardiac, pulmonary or hepatic disease)

If the patient condition is favourable the decision to repair is based on the state of the spleen. Generally, Grade IV and Grade V injuries are not suitable for repair whereas it can be attempted in Grade I, II and III.

Splenorhaphy[4,41]

The following are the techniques for splenic repair.

1. Local hemostatic agents

Gelatin foam, surgical cellulose, microfibrillar collagens thrombin, cyanoaerylate, autologous fibrin glue can be used for superficial tears which are not bleeding actively. But often pressure alone may be sufficient. Non bleeding tears are best left alone.

2. Suture repair

Deep parenchyma, tears are managed by this technique. After removal of the clot and loose devitalized tissue, the wound is inspected, arterial bleeders are controlled and the parenchyma is approximated using deep mattress sutures. Vertical or horizontal including the fibrous capsule using absorble sutures.

3. Partial splenectomy

Polar injury which is grade IV can be managed by segmental devascularization and debridement by finger fracture technique at the line of

demarcation additional security to the suture line after suture repair or partial splenectomy can be achieved by omental wrap.

4. Heterotropic auto transplantation of the splenic tissue

If the patients condition permits, the splenic function can be preserved even after splenectomy by autotransplantation at sites like gastrocolic omentum, rectus sheath and anterior abdominal wall. To be effective in preserving adequate splenic function approximately one third of the original spleen must remain and be nourished by an adequate circulation.

III Splenectomy[4,41]

Indicated in

1. Shattered or avulsed spleen
2. Severely hypotensive patients
3. Associated with other severe injuries
4. Undue delay in attempting to repair the spleen

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 Splectomy Infection - OPSI)

RENAL INJURIES[32]

Blunt renal trauma is usually due to sudden deceleration type of injury. Motor vehicle accidents,fall from height or direc blow are the most common cause of deceleration type of renal injury. Ribs or upper lumbar transverse process

fracture may lacerate or contuse the renal parenchyma. Renal arterial intimal tear with subsequent thrombosis and disruption of uretero-pelvic junction are two unique renal injuries associated with deceleration.

Diagnosis

History is very important a high index of suspicion should be there, flank pain, haematoma warrants evaluation regardless of the apparent location of trauma. Ground glass density in the flank suggest urinary extravasation or

haematoma or preexisting mass such as hydronephrosis or tumor. Infusion pyelography identifies approximately 80% renal injuries.

Renal injury is suggested by the following radiological findings[31,32]

a. Decreased excretion of contrast
b. Obliteration of psoas shadow or renal outline
c. Scoliosis away from the injury
d. Extravasation of the contrast.

A normal IVU with haematuria in a trauma patient suggest minor renal contusion and rules out major renal injury. Incomplete or poor visualisation of a portion of kidney suggest major renal trauma, include deep laceration avulsion or vascular occlusion. Non visualisation of a kidney on pyelography require immediate arteriography whenever possible. CT is very useful investigation helpful in the non operative management.

Treatment[32]

Surgical exploration of all penetrating renal injuries is recommended because of the high incidence of associated intra abdominal injuries. Penetrating wounds causing small parenchymal injuries are generally treated with debridement, primary repair and drainage.

- More extensive wound may require a particular total nephrectomy.
- Injuries involving the hilum are seldom repaired primarily and in most circumstances a total nephrectomy is necessary.

- Renal vein laceration may be repaired by venorraphy. Renal arterial trauma may require a variety of repairs. Lateral arteriorrphy, arterial resection and repair by primary reanastomosis or autogenous repair.

URETERIC INJURIES[31,32]

The following classification of ureteral injury helps in organising the management of ureteral injury

1. Site; upper, middle and lower third
2. Time of recognition: immediate or delayed
3. Nature of injury: blunt trauma with laceration or avulsion, penetrating trauma
4. Presence of concomitant injuries

Injury to the ureter is an common and occurs mostly after penetrating trauma. The presence of haematuria in ureteral injury is the exception rather than the rule.

Diagnosis of ureteric injury

In the majority of cases, intra venous pyelography will confirm the diagnosis. In 15% to 20% of ureteral injuries a retrograde ureterography will be required to confirm the diagnosis. In hemodynamically unstable patients the diagnosis of ureteral injury may be made at the time of laparotomy by intravenously injecting 5ml of methylene blue. CT scan is more accurate in detecting the extravasation preoperatively.

Management[31,32]

The principles of ureteral repair are adequate debridement, tension free repair, spatulated anastomosis, watertight closure, ureteral stenting and drainage.

Ureteropelvic junction disruption

and major urethral injuries (greater than 2cm laceration) are best treated by nephrostomy and stent after repair with fine chromic catgut sutures. Drainage should be provided. Lower urethral injuries usually require tunneled reimplantation into the bladder, if this is not possible then a flap should be

turned cephaled for reconstruction (Boari and Ockerland) when major ureteral loss is present or when it is necessary not to have any ureteral leakage post operatively, one may ligate the ureter and perform nephrostomy either at the time or percutaneouly within 24 hrs.

then later doing a transuretero – ureterostomy. Alternatively one may choose substitution of a segment of tapered or nontapered ileum for the ureter. Nephrectomy may be the procedure of choice when there is simultaneous injury to the colon, ureter and iliac artery or aorta.

PANCREATIC INJURIES[31]

Pancreatic injuries are rare accounting for 10% to 12% of all abdominal injuries. Pancreatic injury occurs following blows or compressive type of injury involving upper abdomen. The injury varies from contusion to perenchymatic laceration. Difficulty in diagnosis are due to retroperitoneal position,tamponade effect of retroperitoneum, and DPL usually negative. Fistula, pseudocyst, pancreatitis, anastomotic leak and intraabdominal abscess occur in 1/3rd of the patients and account for the late mortality. Mortality rates ranges 10 to 25% mostly due to associated intra abdominal injuries.

GRADING OF PANCREATIC INJURY[41]

Grade*	Type of Injury	Description of injury
I	Haematoma Laceration	Minor contusion without duct injury Superficial laceration without duct injury
II	Haematoma Laceration	Major contusion without duct injury or tissue loss Major laceration without duct injury or tissue loss
III	Laceration	Distal transaction or parenchymal injury involving ampulla
IV	Laceration	Proximal transaction or parenchymal injury involving ampulla
V	Laceration	Massive disruption of pancreatic head

Diagnosis of pancreatic injuries

1. Increased level of serum and urinary amylase after blunt injury are not diagnostic, but a persistent elevation suggest pancreatic injury.
2. Contrast duodenography may reveal widening of the ‘C” loop.
3. Abdominal CT scan are currently reported as having a sensitivity and specificity in excess of 80% (Jefery KB et al, 1983)[19].
4. ERCP is the most useful in pre operative delineation of ductal anatomy in patients with delayed presentation or missed injuries (Whitwell et al, 1989).

Treatment

Pancreatic injuries are divided into proximal distal according to the location on the right or left of the superior mesenteric vessels.

1. injuries to the right of the superior mesenteric vein should be treated with debridement and direct suture ligation of areas of bleeding.
2. Extensive injuries to the pancreatic head or to the right of superior mesenteric vessels best treated by external drainage.
3. Severe trauma to the duodenum and head of pancrease may be treated with debridement of the pancreas, closure of the duodenal wound and pyloric exclusion with external drainage.
4. Most distal pancreatic injuries with suspected ductal injuries were treated by distal resection with or without splenectomy.

The most common complication after pancreatic trauma are pancreatic fistula and peripancreatic abscess.

GASTRIC INJURIES[25,41,47]

The stomach is intrathoracic, partially protected by rib cage and hence is well protected in blunt abdominal injury. Blunt gastric injuries most commonly occur after motor vehicle or motor-pedestrian accident.

Diagnosis :

After resuscitation, a nasogastric tube is placed that serves both diagnostic and therapeutic functions. The return of gross blood on nasogastric aspirate is suggestive of an upper gastrointestinal injury. The nasograstric tube also serves a therapeutic function by decompressing stomach. 50- 80 % presents with signs of irritation or shock.

OPERATIVE MANAGEMENT

The intra operative evaluation of stomach injury includes good visualisation of hiatus, evaluation of anterior portion of the stomach, division of gastrocolic ligament and complete visualization of the posterior aspect of the stomach. wounds are debrided and primary closure performed (Moossa A.R. et al)[1,31]. Injuries with major tissue loss may be best treated by gastric resection. Post operative complications include bleeding usually from the submucosal vessels, intrabadominal abscess and more rarely gastric fistula.

DUODENAL INJURES[25,31]

The majority 85 % of duodenum injuries are caused by penetrating trauma and only 15 % were due to blunt trauma. Most of duodenal injuries are accompanied by other intraabdominal injuries.

Grade*	Type of Injury	Description of injury
I	Haematoma Laceration	Involving single portion of duodenum Partial thickness, no perforation
II	Haematoma Laceration	Involving more than one portion Disruption <50% of circumference
III	Laceration	Disruption 50% to 75% of circumference of D_2. disruption of 50% to 100% of circumference of D_1, D_3, D_4
IV	Laceration	Disruption >75% of circumference of D_2 involving ampulla or distal common bile duct.
V	Laceration Vascular	Massive disruption of duodenopancreatic complex Devascularisation of duodenum

* - Advance one grade for multiple injuries upto Grade III.

DIAGNOSIS OF DUODENAL INJURIES

Serum amylase is sensitive but unfortunately not specific for duodenal injuries. Needle paracentesis or lavage will often be positive for blood, bile or bowel contents.

Plain films of the abdomen shows

1. Mild scoliosis
2. Obliteration of the right psoas shadow
3. Absence of air in the duodenal bulb

4. Air in the retropertitoneum outlining the kidney other investigation include gastrografin upper gastrointestinal series and CT of the abdomen.

Treatment[41,47]

Intra operative evaluation of the duodenum requires an adequate mobilization of the duodenum by means of a Kocher maneuver. 80 to 85% of duodenal wounds can be primarily repaired. The remaining 15 to 20% are severe

injuries that require more complex procedures.

Minor injuries **(Grade I + II)** diagnosed with in 6 hrs of injury, a simple primary repair is suitable. After 6 hrs, the risk of leak increases and any form of duodenal decompression like transpyloric nasogastric tube, tube jejunostomy, tube duodenostomy is advisable.

Grade III injuries are best treated by primary repair, pyloric exclusion and drainage or alternatively roux-en.Y deudenojejunostomy.

Grade IV injuries are treated by primary repair of the duodenum, repair of the common bile duct and placement of T-tube with a long transpapillary limb or choledochoenteric anastomosis can be performed.

Grade V injuries are best treated by pancreatico duodenectomy.

SMALL BOWEL INJURIES

In contrast to penetrating injuries, injury to the small bowel and mesentry is less common in blunt trauma. In blunt trauma a prepondarance of intestinal injuries results from motor vehicle accidents.

The widespread use of safety belt though has reduced incidence of serious head injuries but has increased in the incidence of hollow viscus injuries.

EVALUATION AND DIAGNOSIS[31,35]

Although history and physical examination are valuable in the diagnosis of small bowel injury following blunt trauma.

1. Plain films of the abdomen may reveal free air
2. Any patients who has peritoneal signs or hemodynamically unstable proceeds promptly to exploratory laparotomy. In equivocal cases peritoneal lavage is employed and look for indicators of hollow visceral injury like presence of bacteria, food fibres or bile and other criteria like amylase greater than 200, WBC >500/mm^3 and RBC>100,000/mm^3.

Treatment

At laparotomy a careful examination of the entire small bowel should be performed. Bleeding should be initially controlled and clamps or sutures

should be applied to prevent further leakage of intestinal contents into the peritoneal cavity.

Perforating injuries caused by blunt trauma should be debrided and usually small tears closed primarily. Extensive lacerations, devascularised segments or multiple lacerations in a short Segment of bowel are better treated by resection and reanastomosis.

Complications

Intra abdominal abscess, anastomatic leakage, enterocutaneous fistula and intestinal obstruction.

COLONIC INJURIES[25,31,35]

Management the following risk factors have been identified. They were thought to contribute to postoperative complications.

1. Shock : This may be factor in the development of anastomotic leak.

2. Faecal contamination : George et al classified contamination as mild (confined to immediate area around the injury), moderate (confined to single quadrant), major (more than one

quadrant).A significant increase in intaabdominal abscess occurs if there is moderate or major contamination.

3. Blood Transfusion :

George et al reported a 30% incidence of septic problem in patients receiving fewer than 4 units as compared to 69% in

those received 4 units or more.

4. Other Factors :

Associated injuries, age over 40 years, delay from injury to repair (6-8 hrs)

Treatment

General criteria for primary repair include

1. Early diagnosis (within 4 to 6 hrs)
2. Absence of prolonged shock or hypotension
3. Absence of gross contamination of the peritoneal cavity
4. Absence of associated colonic vascular injury
5. Less than 6 units of blood transfusion

6. No requirement for the use of mesh to permanently close the abdominal wall.

Injuries to the colon with minimal contamination and hemodynamic stability can be managed by primary repair.

High risk colon injuries or those associated with severe injuries will benefit from resection and colostomy.

Post operative complications

1. Abscess formation
2. Anastomotic leak
3. Peristomal hernia
4. Morbidity and mortality associated with colostomy closure

RETROPERITONEAL HEMATOMA[41,47]

Retroperitoneal haematoma in patients who have suffered blunt abdominal injuries is usually a

manifestation of a major vascular injury.

In general trauma surgeons recognize retroperitoneal haematoma in five locations.

1. Midline suprarenal.
2. Midline infra renal.
3. Lateral peri renal.
4. Lateral pelvic and portal.

Anemia and haematoma are constant findings in patients with retroperitoneal haematoma from pelvic fractures .

In contrast to the management of retroperitoneal haematoma with penetrating abdominal trauma, all five retroperitoneal hematomas previously listed are left as such in patients with blunt trauma.

MESENTERIC INJURIES

Mesenteric haematoma should be done to define the size, stability, i.e. is it expanding or nonexpanding, contained or it has ruptured the mesenteric folds. Exploration is required for large, expanding and uncontained haematoma. At exploration , the involved mesentry proximal to the haematoma should be examined and if possible site of vascular control defined.

Injuries to the base of mesentry associated with large haematoma may cause severe bowel ischaemia to the entire length of small bowel.

Missed injuries can be avoided if one carefully screens the whole intestine from ligament of trietz o ileocaecal junction.One should be careful towards the mesenteric border of the intestine where small perforation may be missed.

MATERIALS AND METHODS

This study was a prospective study of 30 cases of blunt injury abdomen admitted in the trauma ward of Government Rajaji Hospital, Madurai from April 2005 to May 2006. Once the patient is admitted the name, age, sex and mode of injury are noted. The time interval between injury and admission and time interval between admission and surgery are recorded. After resuscitating the patient, all patients were subjected to careful clinical evamination. Depending on the clinical findings,decision was taken for further investigations such as four-quadrant aspiration, Diagnostic peritoneal lavage, X-ray abdomen, ultrasound , CT abdomen and IVP.The decision foroperative & non-operative management depended upon the outcome of clinical examination & diagnostic tests.

Patients selected for conservative management were placed on strict bed rest,serial clinical examination which included hourly pulse rate, blood pressure, respiratory rate and repeated abdominal examination.

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

The total number of patients who had sustained blunt injuries to abdominal organs were 30.

In this study of the 30 patients 23 cases were male and 7 cases were females. This gives a male to female ratio of 3:1. The increase incidence of trauma in males may probably be due to the relatively high association of males in acts of violence and vehicular accidents.

Age Distribution

Table 1: Age Group Affected

Age group	Number	%
<10	Nil	Nil
11-20	6	20%
21-30	10	33.33%
31-40	8	26.66%
41-50	5	16.66%
51-60	1	3.33%
>60	0	0
Total	**30**	

Table 1 shows the age group involved in this study. In this, the majority of patients belonged to 21-30 years, followed by 30-40 years age group.

Sex Incidence

Table 2: Sex Incidence

Gender	No of patients	%
Male	23	76.66%
Female	7	23.33%
Total	**30**	

As given in the Table 2 out of 30 cases studied, 23 cases were males, with females accounting for about 7 cases .

Ratio Of Operative to Conservative Treatment

	No of Patients	%
Operated	22	73.33%
Conservative	8	26.66%

After a detailed clinical evaluation and suitable investigations, 22 patients with pneumoperitoneum or hemoperitoneum with hemodynamic instability underwent exploratory laparotomy. About 8 patients were selected for non-operative management because they have

no signs of peritonitis or they had hemoperitoneum without hemodynamic instability.

Mode Of Injury

Mode of Injury	NO. of Cases	%
RTA	20	66.66
Assault	4	13.33%
Fall	3	10%
Wall Collapse	1	3.33%
Bull Gore	2	6.66%

RTA constitutes about 66.66% of total blunt injury abdomen.

Symptoms & Signs

The following table shows the incidence of various symptoms & signs with which the 30 patients studied presented with

Symptoms & Signs	No.of Patients
Abdominal Pain	25
Vomiting	5
Distension	10
Haemetemesis	1
Guarding & Rigidity	20
Abdominal Tenderness	25
Pallor	15
Pulse >90/min	22
BP <90 mmHg systolic	16
Absent Bowel Sounds	13

Majority of patients presented with abdominal pain &

abdominal tenderness (83.3 %)

Latent Period

The analysis of the time interval between injury to the time of surgery

Time Interval	No. Of Cases	%
1-4 hours	1	4.54 %
4-8 hours	9	40.90 %
8-12 hours	5	22.72 %
12-24 hours	5	22.72 %
24-48 hours	2	9.09 %

The average latent period in thepresent study is between 8-12 hrs. Majority of patients (40.90 %) were taken for surgery between 4-8 hrs of latent period.

Associated Injuries

Table 3: Injury to other organs

Other injuries	No of patients	%
Head injuries	2	6.66 %
Thoracic injuries	4	13.33 %
Orthopaedic injuries	6	20.00 %
Soft tissue injuries	2	6.66 %
Combination	3	10

Associated extra abdominal injuries were found in 14 cases. The common Extra Abdominal injuries were chest injuries including Rib fractures, Extremity fractures, and Pelvic fractures.

INVESTIGATIONS

Plain X-ray Abdomen

Plain X-ray abdomen was done in all 30 cases. Gas under the diaphragm was found in only about 7 cases of 9 bowel perforations detected at laparotomy. The following table shows the abnormal findings detected in X-ray erect abdomen.

Feature	No. of Patients
Gas Under the Diaphragm	7
Enlarged soft tissue shadow	3
Ground glass appearance	5
Dilated loops	1

Four Quadrant Aspiration

Result	No of patients	Percentage
Positive	9	64.28 %
Negative	5	35.71 %
Total	14	

Total number of cases who underwent four quadrant aspiration was14. Among which 9 were true positive, and 5 were negative.

Diagnostic Peritoneal lavage

Diagnostic peritoneal lavage was done in 7 cases, out of which 6 were positive and 1 were negative. All positive detected cases had significant injury at laparotomy.

Ultrasound Examination

A total of 11 patients were subjected for ultrasound examination, out of which 5 patients had scan detected organ injuries or hemoperitoneum for which underwent laparotomy. 6 patients were treated conservatively because they had minor solid organ injury . 1 among the 6 patients treated conservatively later required a delayed laparotomy after 24 hours because of development of peritonitis.

Organ Wise Injury

Organ Injured	No. of Patients	Percentage
Spleen	4	13.33
Liver	6	20
Retroperitoneum	2	6.66
Kidney	1	3.33
Stomach	1	3.33
Small Bowel	8	26.66
Colon	2	6.66
Mesentry	5	16.66
Pancreas	Nil	Nil
Diaphragm	1	3.33
Bladder	Nil	Nil

In the present series, GIT is the most commonly involved .Small bowel was involved in about 26.66 % of cases. Liver(20 %) is the second most commonly injured organ in the present series. Negative laparotomy constitutes about 9.09 % of total laparotomies for blunt injury abdomen

Operative Procedures

The following table shows the various operative procedures carried out on 22 patients who underwent exploratory laparotomy.

Liver injuries were usually of grade 1 & 2. Hepatorraphies, where suturing with chromic catgut along with gelfoam packing was done in all cases. Splenic injuries ranged from grade 1 to 3 but all splenic injury patients underwent splenectomy.

Bowel perforations were usually treated by simple suturing, with 4 patients requiring resection & anastomosis. Mesenteric injuries were treated by simple suturing & ligating the bleeding points.

Procedure	Number of Patients
Bowel Perforation Closure	4
Repair of Mesentry	5
Splenectomy	4
Hepatorraphy	6
Resection & Anastomosis	4
Colostomy	1
Gastric Perforation Repair	1

Post Operative Complication

The following table shows the post operative complications in patients who Underwent exploratory laparotomy.

Complication	Number of patients
Wound dehiscence	1
Wound infection	2
Biliary leak	1
Respiratory complication	2
Intra abdominal sepsis	1

Morbidity & Mortality

The Mean range of stay of patients in the hospital ranged from 10-19 days. The range varied from 5 days to 46 days.

The following table shows duration of hospital stay of patients with blunt

Abdominal trauma including those who died.

Duration (days)	No. of Patients	Percentage
3-9	8	26.66
10-19	15	50
20-29	4	13.33
30-39	1	3.33
40-49	2	6.66

Mortality :

6 patients with blunt injury abdomen died in the present study. 4 patients belonged to operative group & died in the post operative period. Therefore the mortality rate in the present study is 20%. This is comparable with other series published in our country, Khanna et al. The mortality rate in Davis et al study is 13.3%., DiVincenti et al was 23 % .

DISCUSSION

Road traffic accident forms the single most important cause for blunt injury abdomen in our study which is in acceptance with **Oliver J. Mcanene** et al study. This assumes all the more significance because people involved in RTA are in their most active and productive phase of life. The follwing indication for laparotomy were included in our study.

1. Progressive shock not improved with resuscitative measures.
2. Peritonitis
3. Local tenderness
4. Haemoperitoneum
5. Pneumoperitoneum
6. Gastrointestinal Bleeding
7. London's Sign

For the convenience and ease of understanding each organ injury are Discussed individually.

LIVER INJURIES

There were totally 6 cases of liver injury which constitutes an incidence of 20 % which correlates well with **Feliciano DV** et al study who has reported an incidence of 15 to 20 %. Out of these 4 cases were due to RTA which in concordance with the findings of **Feliciano DV** et al. The remaining cause of liver injury were due to assault & fall. Application of gelfoams and suture hepatorrhaphy was done in 4 cases. In 1 case omental pack was kept in deep lobar laceration to control bleeding.Peri;hepatic packing was done in 1 case. Peritoneal lavage with normal saline and open drainage was done in all cases.

Hepatorraphy as a technique for management of liver injury was adopted in 66.66% of patients. **Feliciano** et al in his study adopted hepatorraphy as a method of treating liver injury in 64% of patients. 1 patient had right basal pneumonitis, 1 patient developed wound infection and another developed biliary leak which was managed conservatively. Mortality rate in our study was 16.66% which correlates with that of study conducted by **Cogbill TH** et al who had reported mortality rate of 10 to 15%. 100% of mortality occurred in the peri-operative period while in the series reported by the **Ben Taub General Hospital** in houston, Perioperative mortality occurred in only 78.1% of death.

In one interesting case of RTA, the patient presented with severe hypovolemic shock with multiple fracture right lower ribs. Clinically there was haemoperitoneum. Patient was taken for laparotomy. On laparotomy there was 2 litres of hemoperitoneum and had bilobar laceration of liver. Patient continued to bleed inspite of routine measures taken to achieve hemostasis. Hence perihepatic packing was done due to hemodynamic instability & coagulopathy. Patient died in the immediate post operative period.

SPLENIC INJURIES

There were totally 4 cases of splenic injury.The incidence is slightly alwer compared to study conducted at **Hermann Hospital** , Houston.Splenic injury constitutes about 13.33%. Road Traffic accidents was the major cause for splenic injury in our study.

Due to lack of supportive diagnostic facilities conservative line of management was not adopted in patients diagnosed to have splenic injury. Splenectomy was done in all 4 cases. Splenoraphy could not be done, because of the fact that blunt splenic injury tends to be more difficult to repair **(Steven R. Shackford)**

Mortality due to Splenic injury was 3.33%. In this study 1 case had died in the immediate post operative period due to hypovolemic shock and

multiple organ failure. 1 patient developed intra abdominal sepsis which was treated conservatively with antibiotics and antipyretics.

STOMACH INJURIES

There was only one case with stomach injury. Pre operatively the case were confirmed by the passage of bright red blood through the Rylestube and present of free air on an abdominal film. Then the stomach was closed in two layers utilizing an inner running row of absorble Vicryl 2/0 placed in full thickness fashion. This layer is then imbricated with a seromuscular of interrupted lembert sutures using 2/0 silk. Peritoneal irrigation was done with normal saline and open drainage was kept in this case.

SMALL BOWEL INJURIES

There were totally 8 cases of small bowel injuries which constitutes about 26.66%. This is in variance with the findings of **Dauterive AH** et al and **Divincenti** et al who have reported the incidence of 5% to 15%. Small bowel trauma tops the list in frequency of blunt injury abdomen. This finding does not correlate with that of Root HD et al who have ranked small bowel injury in the list after liver & spleen. RTA is the major cause for small bowel trauma which is in acceptance with findings of **Scott L.Steven** et al.

Even though several authors have opined that plain X-ray was not useful in small bowel injury, we have found that plain X-ray abdomen has been diagnostic in 77.77% of cases. All patients with small bowel injury were managed either by primary closure or by resection & anastomosis. One patient developed basal pneumonitis and another had anastomotic leak following resection anastomosis. Mortality due to small bowel injury was 6.66%. The cause of death in small bowel injury in our study was due to postoperative septicemia.

COLONIC INJURIES

These were 2 cases of colonic injuries. In this study one patient had tear in the transverse colon primary repair and defunctioning colostomy done and other patient had descending colon tear which was treated by primary closure in two layers. Wound infection rate was 50% which is high compared to that of George et al who have reported wound infection rate of 31%.

RENAL INJURIES

There was one case of renal injury. This was diagnosed in CT abdomen as left perinephric hematoma which was not expanding. Hence conservative line of management was adopted.

MESENTERIC INJURY

There were 5 cases of mesenteric injury in our study. In one patient there was non-expanding mesenteric hematoma size about 1.5cm and the corresponding bowel was viable. Hence the hematoma was not explored, as per the guidance of Christensen N et al, whose indication for exploration were hematoma larger than 2cm, expanding, uncontained or near the root of mesentry. In 2nd case there was a transverse tear size about 3cm with gangrene of corresponding ileum, hence resection anastomosis was done. In other 3 cases there was a tear in the mesentry with viable bowel, hence primary suture repair of the tear was done with 2/0 silk.

RETROPERITONEAL HAEMATOMA

There were 2 cases of mild retroperitoneal haematoma with non expanding which were associated with other injuries. Nothing specific was done for these hematomas. All patients had uneventful recovery.

DIAPHRAGMATIC INJURIES

We have come across one patient with diaphragmatic injury in our study. After diagnosis thoracotomy was done. There was stomach & loops of intestine in the thoracic cavity which was reduced into the peritoneal cavity and the rent was closed with horizontal mattress sutures with no.1 prolene . Thoracotomy closure was done after placing ICD tube.

NEGATIVE LAPAROTOMIES

In this study, there were 2 cases of negative laparotomies. Whereas in **Feliciano** et al, **Shorr** et al series, the negative laparotomy was from 5.8% to 7.4%. In this study , explorative laparotomy was done in all cases. There was no viscus or vascular injury and there was no missed injury in our study. All were discharged after an uneventful post operative period. Negative laparotomy rate in our study was 9.09% in referance with **Cox EF** et al who had reported 10.2% of negative laparotomies.

MORTALITY AND MORBIDITY

Morbidity rate in our study was 31.81%. The post operative complications were wound infection, lung infection in the form of basal pneumonia, and intra abdominal sepsis. Insignificant complications like stitch abscess, basal pneumonitis, were not included for the purpose of study.

These were totally 6 deaths in this study of 30 cases constituting a mortality rate of 20%. Morbidity in mild to severe forms occurred in all patients who survived.

The break up of the death cases is as follows:

Splenic injury	:	1
Small Bowel injury	:	2
Retrohepatic venous injury		

with severe liver laceration : 1

Others : 2

In liver injury peri hepatic packing was done to control the bleeding, this patient died due to coagulopathy & hemodynamic instability. Patients with small bowel injury died due to post operative septicemia. One case of splenic injury died in the immediate post operative period due to irreversible hypovolemic shock.

. In other case patient expired due to shock and haemorrhage autopsy revealed injuries to small bowel, mesentry , liver & pelvic fractures.

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CONCLUSION

- Road traffic accident is the commonest cause for blunt injury abdomen
- Predominance of male over female in blunt injury abdomen with the ratio of 3.3 : 1.
- People in the age group of 2nd & 3rd decade were commonly involved in Blunt injury abdomen constituting about 59.99%.
- Considering the involvement of solid & hollow viscus injury the incidence of solid organ injury is almost equal to hollow viscus injury. (solid organ –11 cases, hollow viscus –11 cases)
- Negative laparotomy rate 9.09%.
- Overall morbidity due to blunt injury abdomen was 31.81% .
- Overall mortality due to blunt injury abdomen was 20%.
- Hypovolemic shock due to bleeding and sepsis were the major causes of death.

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