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Original Research Article

Prospective study of management and outcome of blunt abdominal trauma (solid organs and hollow viscus injuries)

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ABSTRACT

Background: Blunt abdominal trauma is a leading cause of morbidity and mortality among all age groups. Many injuries may not manifest during the initial assessment and treatment period. Injury to intra-abdominal structures can be classified into 2 primary mechanism of injury-compression forces and deceleration forces. Compression or concussive force may result from direct blows or external compression against a fixed object. Deceleration forces causes stretching and linear shearing between relatively fixed and free objects.
Methods: A prospective study of 48 patients admitted with blunt abdominal injuries in the department of surgery, B.R.D. Medical College Gorakhpur during a period of 1 year.
Results: Majority of patients of blunt abdominal injuries in present study were in 11-20 year of age group followed by 31-40 year of age group followed by 41-50 year of age group. Female to male ratio was 7:1. In the present study 41% of patients were subjected to non-operative management.
Conclusions: Males were pre-dominantly affected. Road traffic accident was the most common cause of injury. Though conservative management is successful in carefully selected patients, operative management remains the main stay of treatment.

Keywords: Blunt abdominal trauma, Liver injury, Perforation, Splenic injury

INTRODUCTION

Blunt abdominal trauma is a leading cause of morbidity and mortality among all age groups. Injury to intra-abdominal structures can be classified into 2 primary mechanism of injury-compression forces and deceleration forces. Compression forces may result from direct blows or external compression against a fixed object leading to tears and sub-capsular hematoma of solid viscera and may also deform hollow organs resulting in rupture. Deceleration forces cause stretching and linear shearing between relatively fixed and free objects.

Blunt abdominal trauma patients who are unstable and have intra-abdominal fluid identified on FAST (focused abdominal sonography for trauma) require an emergent laparotomy.[1] If FAST unavailable, aspiration of 10ml or more gross blood DPL (diagnostics peritoneal lavage) also suggest an intra-abdominal source of hemorrhage requiring urgent operation. Abdominal CT has become main stay of imaging for stable blunt trauma patients and has led to emergence of non-operative management of many solid organ abdominal injuries. Administration of oral contrast is not necessary and might increase the risk of vomiting with aspiration.[2] DPL may provide valuable information. Findings of lavage fluid evaluation, including more than 500 white blood cells/mm^3, amylase, bilirubin or particulate matters have been found to be indicative of a hollow visceral injury.

Nance et al, studied with 1180 patients over 10 years and reported that liver was the most commonly injured

organ.[3] Everard F cox et al from Maryland institute for emergency medical services systems, Baltimore, did a 5-year analysis of 870 patients requiring laparotomy for blunt abdominal trauma and concluded that spleen injury followed by liver injury followed by retroperitoneal hematoma followed by mesentery and bowel injury was the operative finding.[4]

Mackenzie EJ et al, demonstrated the benefit of care provided at a trauma centre versus non-trauma centre and concluded that trauma centre was associated with a reduction of in hospital mortality (7.6% versus 9.5%).[5]

Nathens AB et al, demonstrated the benefit of establishing a systematic method of managing trauma from the time of injury through the rehabilitation process.[6]

Rotondo MF et al. gave the concept of damage control, which has become the standard of care in managing multiple severe injuries.[7]

The objective of this study was to evaluate the impact of blunt abdominal trauma on solid organs like liver, spleen, kidney and hollow viscera like stomach, small intestine and large intestine. And to compare various preoperative investigations for detection of abdominal injuries and intra-operative findings. To study and compare the outcome of the treatment.

METHODS

The material for this prospective study were collected from 48 patients of blunt abdominal injury, admitted in the department of surgery, B.R.D. Medical College Gorakhpur, Uttar Pradesh during a period of 1 year from December 2015 to December 2016.

Study consists of following points

All patients with history of blunt abdominal injury are kept under monitoring of vitals

- Pulse rate
- B.P
- R.R
- PO2

General examination of all patients was done in following points

- Palor
- Icterus
- Clubbing
- Cyanosis
- Oedema

All patients were examined locally and systematically

All patients were subjected to detailed laboratory and radiological investigation.

Laboratory investigation consists of

- Hb, TLC, DLC, RBS, serum urea, serum creatinine, blood group, PT, PTT, INR

Radiological investigation consists of X-ray abdomen AP Erect

- X-Ray chest PA
- USG Abdomen
- CECT Abdomen.

For operative patient's operative procedure done as soon as possible.

Patients kept under conservative treatment were kept under close monitoring and if hemodynamic condition deteriorate, operative intervention done.

Inclusion criteria

- All the patients of blunt abdominal injury admitted in the department of surgery, B.R.D. Medical College Gorakhpur, Uttar Pradesh.

Exclusion criteria

- Patients with associated severe head injury
- Patients with associated sever orthopedic and bony injury.

RESULTS

Total numbers of patients admitted with blunt abdominal injuries in Nehru Hospital, BRD Medical College Gorakhpur, in one year (September 2010 to August 2011), was 48.

Age incidence

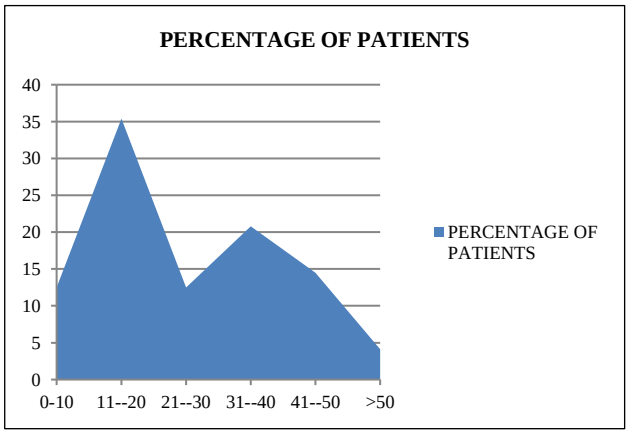

Figure 1: Age incidence.

In this series, majority of patients belong to, 11-20 years age group, followed by, 31-40 years age group. This shows that majority of patients belong to 10-30 years age group.

This age distribution of patients in blunt abdominal injuries is shown in Figure 1.

Sex incidence

In this series out of 48 patients of blunt abdominal injuries, 42 patients were Male and only 6 patients were Female.

So, majority of patients of blunt abdominal injuries were male.

This sex distribution of patients is shown in Figure 2.

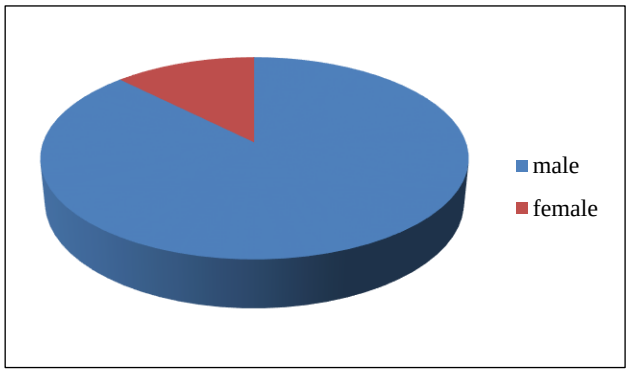

Figure 2: Sex incidence.

Mode of injury

Out of total 48 patients with abdominal injury 24 injuries were due to road traffic accident, 13 were due to fall from height, 7 were to assault and 2 were due to attack by animal and 2 by other mechanisms (eg.d/t fall of heavy object over abdomen, machinery injury).

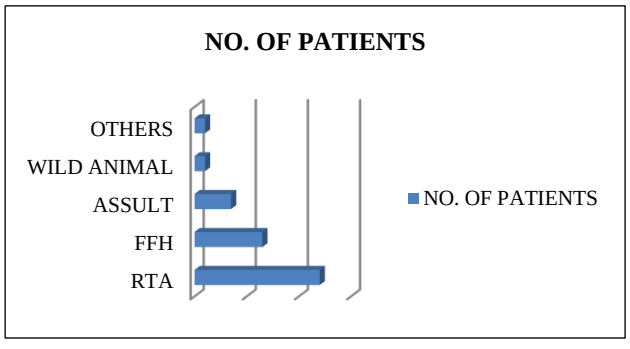

Figure 3: Mode of injury.

Associated injury

Out of total 48 patients 12 patients were associated with extra abdominal injury. Out of these 12 patients, 5 patients were associated with pelvic fracture, 2 were associated with chest injury, 1 patient with cervical injury, 2 patients with head injury and 2 patients with long bone fracture.

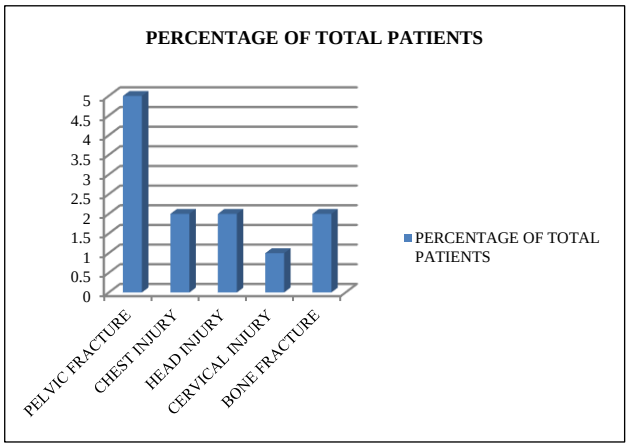

Figure 4: Associated injury.

Symptoms and signs of blunt trauma abdomen

Majority of patients with blunt trauma abdomen presents with pain and tenderness in abdomen. Second most common symptoms were distention of abdomen. Tenderness was present in all patients with blunt trauma abdomen.

On examination tenderness present in about 100 percent cases, guarding and rigidity present in 69 percent cases, and absent bowel sound present in about 64.5 percent cases.

Tachycardia was present in about 46 percent cases of total blunt trauma abdomen, and hypotension was present in about 31 percent cases of total blunt trauma abdomen patients.

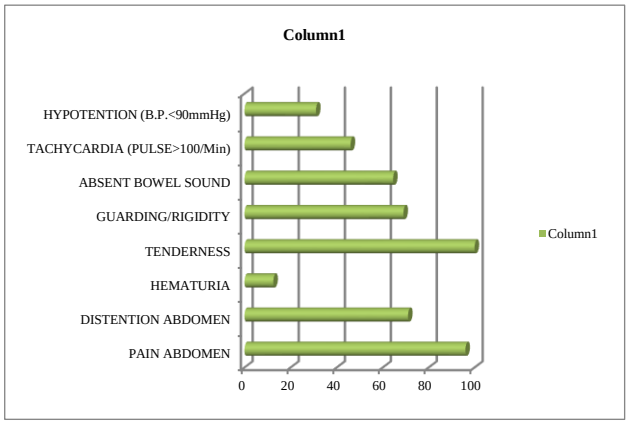

Figure 5: Symptoms and signs.

Investigations

Abdominal paracentesis

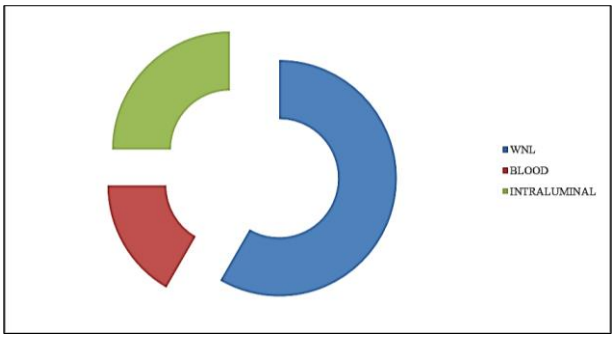

Figure 6: Abdominal paracentesis.

Abdominal paracentesis was carried out in every patient in which in 16.7% cases aspirate was blood, intraluminal contents in 25% and in 58% cases nothing could be aspirated.

X-ray abdomen

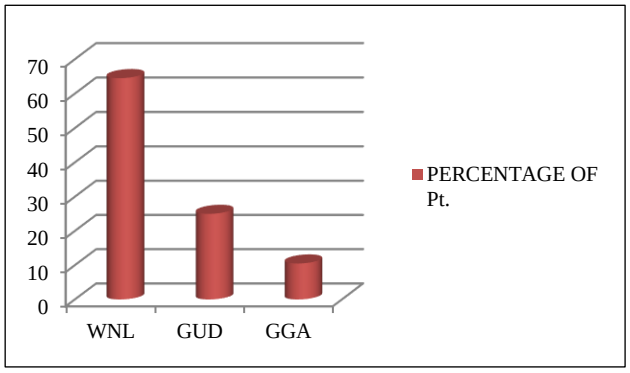

Figure 7: Percentage of Pt.

In blunt trauma abdomen patients, X-Ray abdomen shows normal findings in 64.5% cases, Gas under Rt. done of diaphragm was present in 25% cases, and ground glass appearance in 10.5% cases. X-Ray was done in all patients.

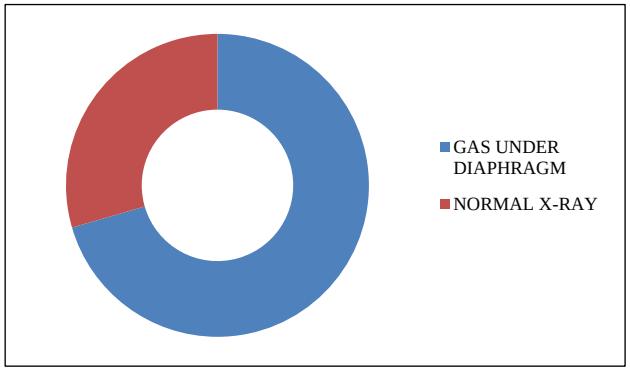

Figure 8: Hollow viscus perforation.

In case of blunt trauma abdomen in which hollow viscous perforation occurred 70.5% showed gas under Rt. Dome of diaphragm and 29.5% did not.

USG Abdomen

USG abdomen was done in about 48% cases of blunt trauma abdomen. In which most common finding in USG was intra peritoneal collection (52%), splenic injuries 17%. Liver injury was USG finding in 8.5% cases. Renal and urinary bladder injuries were rare USG findings. USG finding was within normal limit in 13% cases.

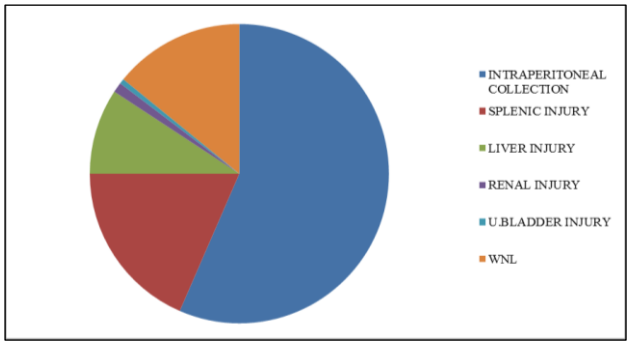

Figure 9: USG Abdomen.

CECT Abdomen

CECT Abdomen was done only in 5 patients in which there was Liver injury in 40%/ Hemoperitoneum in 40% Combined Liver and kidney injury in 20%.

Mode of treatment

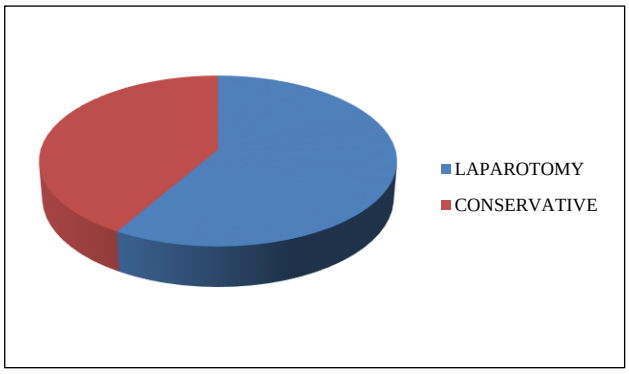

Figure 10: Blunt abdominal injury.

Out of total 48 patients of blunt abdominal injury, 28 patients were treated by laparotomy. 20 patients were treated by conservative method. That means ratio of conservative to operative method was nearly 1:1.4.

Organs involved

Out of total 48 patients of blunt trauma abdomen, 13 patients present with no organ injury. Jejunum was the most common organ injured in blunt trauma abdomen, comprising 9 patients. Ileal perforation was the second most common organ injured comprising 8 patients. Spleen and liver injuries were the third most common

organ injured in blunt trauma abdomen, comprising 7 patients each.

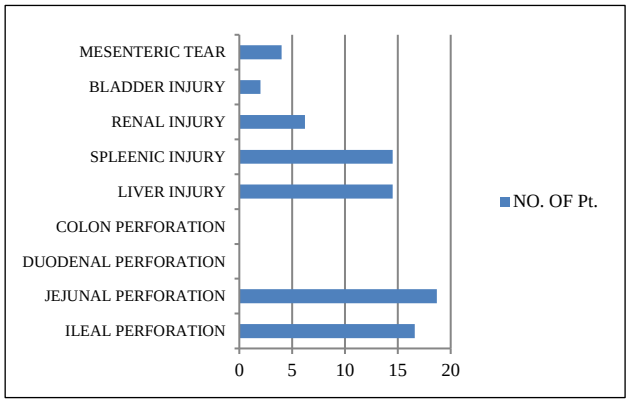

Figure 11: Number of patients during organs involved.

Operative procedure

Out of total 48 patients of Blunt abdominal injury, 28 patients were operated and 20 patients were treated conservatively. Out of these 28 operated patients, most common operative procedure was simple repair of mesenteric rent that was done in 11 patients. Second most common operative procedure was simple closure of jejuna perforation that was done in 10 patients. Third most common procedure was simple closure of ileal perforation and fourth most common was perforation taken as loop ileostomy.

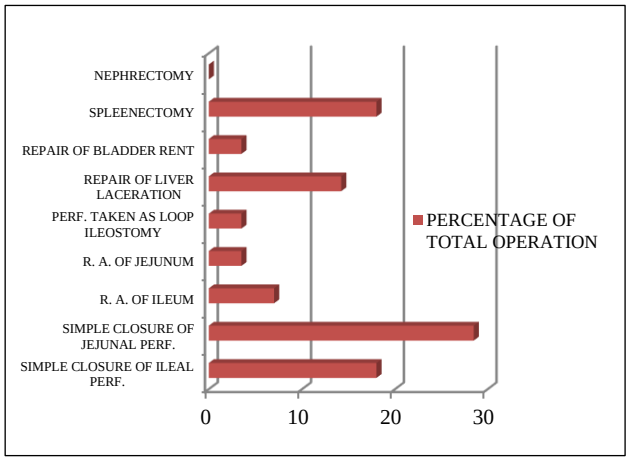

Figure 12: Percentage of total operation during Operative procedure.

Latent period

Latent period is the interval between the time of injury to the time of surgical intervention.

Majority of patients with abdominal injuries were operated between 11-20 hours of injury.

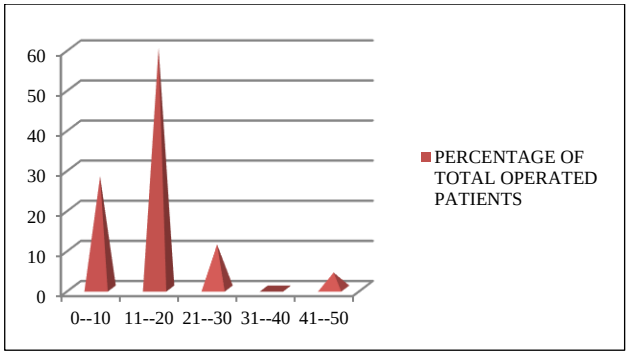

Figure 13: Latent period.

Post-operative complication

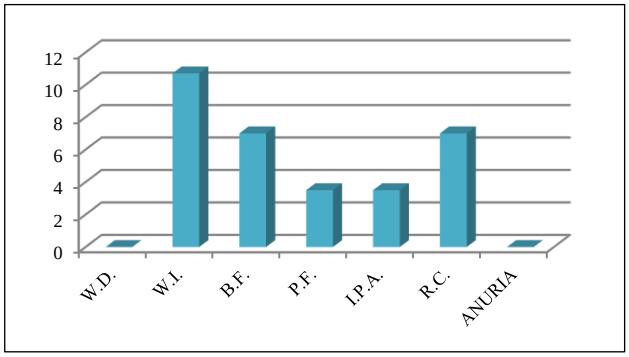

Figure 14: Percentage of total operated patients during post-operative complication.

Out of 28 patients operated for blunt abdominal injury, 19 patients had no any postoperative complication. Most common complication was wound infection found in 3 patients. Respiratory complications and biliary fistula occurred in 2 pt. ,1 pt. suffered from sub-diaphragmatic abscess and 1 pt. developed pancreatic fistula.

Hospital stays

Majority of patients with blunt abdominal injury stay in hospital from 11-15 days. Second most common hospital stay was from 0-5 and 5-10 days. Next most common hospital stay was from 16-20 days.

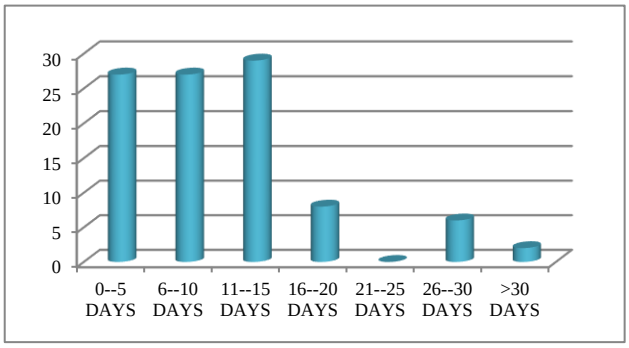

Figure 15: Hospital stays percentage of total patients.

Outcomes of abdominal injury

Out of 48 patients of abdominal injury, 38 patients were improved and discharged, 1 patients expired, 2 patients absconded and 6 DOPR.

Table 1: Outcomes of abdominal injury.

Outcome of abdominal injury	No. of patients	Percentage
Improved and discharged	39	81
Abscond	2	24
Expired	1	2
D.O.P.R.	6	13

DISCUSSION

Age incidence

The following table compares the incidence of blunt abdominal injury in various age groups in the present series to that of the Davis et al.

Table 2: Age incidence.

Age group (years)	Present series	Davis et al
0-10	12.5%	-
11-20	35.4%	19%
21-30	12.5%	24%
31-40	20.8%	15%
41-50	14.5%	13%
>50	4.1%	9%

From above Table, it is clear that majority of patients of blunt abdominal injury in present study were in 11-20 years age group, followed by 31-40 years age groups followed by 41-50 years age group. Whereas in study of Davis et al study the majority of patients belonged to 21-30 years age group. Therefore, it can be concluded that the young and the productive age group people were the usual victims of blunt abdominal trauma.

Table 3: Ratio of operative to conservative management.

Treatment	Present study (2011-12)	Davis et al (1976)	Khanna et al (1992-97)
Operative	58.3%	77%	58%
Conservative	41.7%	23%	42%

The above Table shows that there is an increasing trend towards conservative management, however the present study shows that 41% of patients were subjected for non-operative management. Davis et al showed 23% and Khanna et al showed 43% of pt. subjected to conservative management respectively.[8] Non-operative management is gaining increasing acceptance mainly because of easy availability of CT scan.

The disadvantages of non-operative management are those of missed injuries and delayed treatment resulting in excessive morbidity and even mortality.

Table 4: Mode of injury.

Mode of injury	Present series	Davis et al	Khanna et al (1992-97)
Road traffic accident (RTA)	50%	70%	57%
Fall from height (FFH)	27%	6%	10%
Asasult	14.5%	17%	33%
Attack by animal	4%	7%	
Others	4%	--	

In present study, most common mode of injury in BTA is road traffic accident followed by fall from height. Whereas in Davis et al, study most common mode of injury was road traffic accident followed by assault. Fall from height was least common mode of injury in Davis et al study. Fall from height was more common in present study because in these areas of Eastern UP, there is lack of boundary wall around roof. In present series, there was 4% cases of other injuries in which one was machinery and another one was d/t fall of heavy object on abdomen.

Table 5: Associated injury.

Associated injury	Present study	Davis et al	Khanna et al (1992-97)
Pelvic fracture	10.4%	9%	15%
Chest trauma	4%	27%	24%
Head injury	4%	9%	12%
Cervical injury	2%	5%	5%
Other bone fracture	4%	5%	7%

Associated extra abdominal injury present was 25% in present study as compared to Davis et al in which in total extra abdominal injury was 54%. Most common extra abdominal injury was Pelvic fracture followed by chest trauma and Head injury and other bone fractures.

Primary neurological injury was diagnosed in 5 cases. Lower extremities and upper limb injuries accounted for 59% and 26%.

Therefore, extra abdominal injuries were less common in our study.

Symptoms and signs of abdominal injury

In the present study, abdominal pain was the most common presenting complaint accounting for 96% and abdominal tenderness was the most common sign accounting for 100% of cases. Significant injuries to the retroperitoneal structures may not manifest signs and symptoms immediately and be totally missed even on

abdominal x-rays and DPL predisposing the patients to grave consequences of missed injuries. In Davis et al study, 43% of patients had no specific complaints and no signs or symptoms of intra-abdominal injury when they first presented to the emergency room. But 44% of those patients eventually required exploratory laparotomy and 34% of patients had an intra-abdominal injury.

Investigations

Abdominal paracentesis

Out of 48 pt. 8 pt. revealed hemoperitoneum and in 12 pt. intraluminal contents were aspirated where in study by Gupta S et al, out of 63 pt. 40 revealed hemoperitoneum which was subsequently confirmed on laparotomy.[9]

Plane X-ray abdomen

Out of total 48 patients of blunt trauma abdomen, X-Ray abdomen was done in all patients. X-Ray abdomen shows normal findings in 31 (64.5%) cases, GUD present in 12 (25%) cases and GGA present in 5 (10.5%) cases. Bowel perforation was found in 17 patients at laparotomy.

So, sensitivity of plane X-Ray abdomen in detecting pneumoperitoneum was about 70.5%. Davis et al reported that in their series, abdominal X-ray was abnormal in 21% of cases; pneumoperitoneum was detected in 6% of cases and dilated bowel loops in 6% of cases.[5]

X-ray abdomen is an important diagnostic for as about 80-90% of gastric, duodenal, colonic perforation is show free intra peritoneal gas under right dome of diaphragm (Love, Joseph and Anil).

Love et al, advocated the intravenous infusion of 300ml of urograffin contrast medium in order to produce a 'body gram' effect of the abdominal organs.[14]

Segalowisky and associates strongly recommended intra venous pyelography (IVP) in any patient in whom renal injury is suspected.

Ultrasonography (USG)

Out of total 48 patients of blunt trauma abdomen, USG done in 24 patients. Out of these 24 patients 3 patients shows USG within normal, 12 patients showed intra peritoneal collection, 2 patients showed liver injury, 4 patients showed spleen injury and 2 patients showed renal injury. Out of 12 patients with intra peritoneal collection, 4 patients showed bowel perforation at laparotomy.

In Yoshi H et al, study the sensitivity of ultrasound in detecting injuries in blunt abdominal injury patients was about 94.6%.[15]

In study of Gupta S et al, ultrasonography was done only in 7 patients and it revealed pathology like renal recreation and retroperitoneal hematoma in 6 cases.

Soto JA et al, studied in 32 patients, this Us examination was repeated 12 hours after admission, with the same equipment and technique as those used in the baseline study. One (3.1%) of 32 patients required surgery: Surgical findings were massive hemoperitoneum and an extensive hepatic laceration. Thirty-one (96.9%) patients were treated conservatively, without surgery, and remained asymptomatic during 28 days of clinical follow-up after discharge from the hospital. USG showed intraperitoneal abnormalities in 21 of these patients. In 11 patients, both method showed no evidence of visceral injury and none of these patients required surgery.

Branney SW et al, concluded that USG abdomen is initial investigation of choice to detect the intra-abdominal injury.[10]

Chiu WC et al, showed the importance of FAST in blunt trauma patients.[11] The FAST is now routinely performed for the initial assessment of abdominal trauma patients. A positive FAST examination is highly sensitive for hemoperitoneum and clinically significant abdominal organ injury. The FAST examination is an operator dependent technique with a sensitivity of 67% to detect *hemoperitoneum.*

CECT Abdomen

CECT Abdomen was done only in 5 patients in which there was Liver injury in 40% because in these areas of Eastern UP patients belong to low socioeconomic group and CECT facility was not available in 6 cases.

CECT abdomen is an excellent means to diagnose intra peritoneal hemorrhage. Marx JA, showed the limitation of CT abdomen in the evaluation of acute abdominal trauma.[12] CT scan is poor for the diagnosis of intraperitoneal hollow viscus injuries and early pancreatic injuries.

Goldstein AS et al, emphasized the role of CT abdomen in the diagnosis of blunt abdominal injury.[13]

Four groups of the patients are particularly suitable for CT abdomen.

- Patient with delayed (<12 hours) presentation who are hemodynamically stable
- Patients in whom DPL result are equivocal
- Patients In whom DPL is difficult to perform (eg: morbid obesity, pregnancy, multiple previous laparotomies.
- Patients at risk for retroperitoneal injuries in whom DPL is unremarkable.

Organs involved

Out of total 48 patients of blunt trauma abdomen in present study, 13 patients present with no organ injury. That means 27% patients of BTA present with no organ injury. Small intestine was most common organ involved in BTA comprising 35%. Liver and spleen was second most common organ involved comprising 15% each.

Table 6: Organs involved.

Organ injured	Present series	Cusheri	Davis et al	Cox et al	Khanna et al
Small bowel	35%	9%	8%	8%	56%
Spleen	14.5%	25%	25%	46%	26%
Liver	14.5%	15%	16%	33%	37%
Renal	6.2%				
Mesentry	4%	5%	4%	10%	47%
U. bladder	2%	6%	4%		

According to Davis et al, most common organ involved in BTA was spleen comprising 25%.[18] Second most common organ injured was liver comprising 16% and third most common organ involved was Small intestine comprising 8%. According to Cox et al, most common organ involved in BTA was spleen comprising 46%.[4] Second most common organ injured was Liver comprising 33% and third most common organ involved was Small intestine comprising 8%.

In present study, most common organ injured in BTA is small intestine as compared to the study of Davis et al and Cox et al, in which most common organ injured was Spleen.[4,18] This is so because in present study most of the BTA was due to low speed vehicular accident and fall from height and others were due to assault by iron rods and wooden rods (Lathi). In our study 13 (27%) patients present with no organ injury and this is again due to blunt trauma abdomen by low speed vehicular accident and fall from height.

Operative procedure

Out of total 48 patients of blunt abdominal injury, 28 patients were operated and 20 patients were treated conservatively. Out of these 28 operated patients, most common operative procedure was simple closure of jejunal and ileal (small intestine) perforation that was done in 13 (46.5%) patients. Second most common procedure was splenectomy in 5 (18%) patients. Third most common operative procedure was repair of liver laceration.

In Khanna et al study closure of bowel perforation was done in 13 patients, colostomy in 2 patients, repair of mesentery in 9 patients, splenectomy in 4 patients, splenorrhaphy in 1 patient and hepatorraphy in 6 patients.[20] From above it is clear that spleenectomy was done less frequently in present study as compared to Khanna et al study in which spleenectomy was done frequently.[20]

Latent period

Latent period is the interval between the time of injury to the time of surgical intervention. 60% of patients were taken for surgery between 11-20 hours and 28% of patients between 0-10 hours of injury. This time lag is the time taken to transport them to the hospital. 1patients was taken for surgery after 2 days of injury as they were initially put on conservative management. Since their condition deteriorated on repeated clinical examinations, they had to be taken up for delayed exploratory laparotomy.

Morbidity

Overall post-operative complications were reported in 32% pt. Wound infection was the most common post-operative complication present in 3 cases. Respiratory complication was present in 2 cases, biliary fistula in 2 cases, and pancreatic fistula in one case followed by splenectomy.

Nance and Cohn, reported complication rate of 27% in a series of 480 patients.[18] The commonest complications were found wound infection. Joseph and Anil, was found overall morbidity rate was 9.2%. The commonest complications were found infection and chest infection.[16]

In present study, the complication rate was 32%. The commonest complication was Wound Infection followed by Respiratory complication and biliary fistula formation.

Mortality

One patient died in the present study due to severe haemorrhage from lower limb compound fracture. Since out of total 48 patients one patients die, mortality rate was about 2%. This is much lower than other series published in our country Khanna et al.[20]

- The mortality rate in Davis et al study was 13.3%

- Di Vincenti et al study was 23%
- Cox et al study reports a mortality rate of 10%.[4,18]

Outcome of blunt abdominal injury

Out of total 48 patients of abdominal injury, 30 patients were improved and discharged, 1 patients expired, 2 patients absconded and 6 patients were discharged on personal request.

1 patients absconded while kept on conservative treatment and another in post-operative period.

Six patients were discharged on request. They were followed and improved while 2 absconded pt. could not be traced due to lack of communication.

CONCLUSION

This was a prospective study of 48 cases of blunt abdominal trauma in department of surgery, B.R.D. Medical College, Gorakhpur. From this study following conclusions can be made.

- Males are preabdominantly affected. It is mostly seen in the age group of 11-20 years which form the young and reproductive group
- Road traffic accident form the most common mode of injury. Though conservative management is successful in carefully selected patients, operative management remains the main stay of treatment
- Plain x-ray abdomen in erect posture is valuable investigation taken for gastrointestinal injuries
- Ultrasound examination give a clear picture of solid organ injury and free fluid
- The most common injured viscera in the present study is small bowel
- Spleen is the second most common injured organ and majority of patients were managed by splenectomy
- Liver injury equals to splenic injury and they are managed by repair
- Retroperitoneal hematoma was seen in small proportion of patients and managed conservatively
- Multiple organs were injured many patients rather than isolated organ injury
- Associated extra abdominal injuries were found in 12 cases in present study
- Post-operative complications like wound infections, respiratory complications are common in patients of blunt abdominal trauma
- The present study showed a mortality of 2%.

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Conflict of interest: None declared
Ethical approval: The study was approved by the institutional ethics committee

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