

Analysis of visceral injuries in blunt abdominal trauma

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Abstract

Aim: blunt abdominal trauma (bat) refers to road traffic injuries and injuries due to falls where impact or countercoup wounds enter the peritoneal cavity without breach in peritoneal cavity. We intend to study visceral injuries which are associated with blunt abdominal trauma in order to understand incidence of hepatosplenic injuries, and various other associated injuries with a etiology.

Material and methods: this is a cross sectional, prospective, observational study. Patients who sustained

blunt abdominal trauma and admitted in Department of Surgery at Chhatrapati Shivaji Subharti Hospital, Meerut Between October 2020 to October 2022.

Results: Total of 101 patients with bat were enrolled into the study. Almost half of the population (46%) presented with two or more intra-abdominal organs injured (most commonly liver and spleen), primarily due to road traffic accidents (70%). Isolated intra-abdominal organ injuries were reported in more than half 55 (54%) of the patients. Due to topographic anatomy and large surface area, most common solid organ injured was

found to be liver in 41 (40%) patients followed by spleen 33 (33%) and most common hollow viscus organ being intestine 31(31%) predominately jejunum in 12 (39%). Nearly 2/3rd of patients with bat had grade iii and above liver and/or spleen injury. Of these patients, ~40% faced post op complications, prolonged hospital stays of even more than a month (31-38days) and an unfortunate mortality rate of 1 in 5 (15-18%). E-fast being a sensitive modality was useful in diagnosing 83 patients (83%) with bat.

Results: in hemodynamically stable patients with solid organ injury, conservative management can be tried and is associated with less complication and morbidity.

Keywords: blunt abdominal trauma, road traffic accident, visceral injuries, hepatosplenic injuries, intra-abdominal injuries

Introduction

Trauma as a reason behind mortality and morbidity on a world scale is increasing, whether from large-scale disasters (both natural and man-made) or the day-after-day non-intentional injuries and intentional social violence. By 2030, road traffic injuries area unit expected to become the fifth leading reason behind death and also the third leading reason behind incapacity worldwide, with concerning 90% of this burden occurring in low- and middle-income countries, cost accounting us\$ 518 billion globally¹. Road-traffic accidents are increasing with an annual rate of 3%. Vehicular accident occurs every 2 minutes and a death every 8 minutes on Indian roads. In every 1.9 minutes, a trauma connected death happens on Indian roads².

India, ranks first in the number of road traffic accident deaths across the 199 countries reported in the world road statistics, 2018 followed by China and us. As per the who global report on road safety 2018 annually,

1.5lakh (0.15 million) lives are lost due to accidental injuries or road traffic accidents in India. Interestingly, with 1% of the world's vehicles, India accounts for 11 per cent of the accident-related death worldwide³. The estimated socio-economic costs of road accidents reported by India in 2018 with the mean monthly out of pocket expenditure on the accidental injuries-affected population has been estimated at inr 2672 .46 (us\$ 41.06) and inr 3041.64 (us\$ 47.09) in inpatient and outpatient care, respectively so India loses approximately 2-2.5% of its GDP only to road traffic injuries⁴.

Blunt abdominal trauma (bat) has proved to be the trauma surgeon's nemesis, due to multitude of its manifestations. Bat refers to road traffic injuries and injuries due to falls where impact or countercoup wounds enter the peritoneal cavity without breach in peritoneal cavity and are more common than penetrating abdominal trauma.

Given, the abdominal cavity comprises of both solid and hollow visceral organs, the most affected organs in bat are solid organ, and the treatment approach is conservative in these cases. Hollow visceral lesions are difficult to diagnose; incorrect diagnoses in patients with hollow visceral injuries occur in up to 45% of cases⁵.

Therefore, we intend to study visceral injuries which are associated with blunt abdominal trauma in order to understand further understand incidence of hepatosplenic injuries, and various other associated injuries with a etiology with age and sex distribution.

Methodology

This was a cross sectional, prospective, observational study. Patients who sustained blunt abdominal trauma and admitted in Subharti Medical College and Hospital, (Meerut, UP) between October 2020 to October 2022

and were will willing to participate in the study voluntarily were enrolled into the study. However, patients with any other cause of visceral injuries except blunt trauma (penetrating injuries, gunshot injuries, Figure 1. Summary of methodology and data collection

bomb blast injuries) were excluded from the study. The study was started after obtaining all the necessary approvals from the institutional ethics committee (fig.1).

Methodology	Patients/care givers suggesting a history of blunt trauma were analysed for primary survey
	After taking the informed consent, detailed patient history was taken as per the attached performa from either the patient or the care giver (in case the patient not fit for giving the history)
	Demographic data including the age , sex , occupation , the nature and time of accident leading to injury were attached in proforma
	Detailed physical examination including vitals (eg.BP, Pulse, saturation, respiratory rate etc), abdominal examination and other systemic examination was done and the findings were noted in the attached proforma
	All the basic blood investigations (CBC, LFT, KFT, PT/INR, Viral markers) were done
	Skiagrams (Xray erect abdome) and Ultra sonogram (F.A.S.T SCAN) were done for all cases and CT scan was done for selected cases.
	Based on clinical findings , hemodynamic stability and investigations(hematological/radiographic), cases were managed accordingly
	At laparotomy, systematic approach with examination of all intra abdominal organs were made.
	After surgery patients were managed with Nasogastric tube folley's catheterisation, IV fluids and antibiotics.
	Post operative complications were specifically looked for
Patients selected for non-operative or conservative management were placed on strict bed rest and were subjected to serial clinical examinations which include hourly pulse rate , blood pressure , respiratory rate and repeated examination of abdomen and other systems	

Statistical analysis

The data was compiled in a tabulated manner and necessary statistical tests (frequencies, proportions, percentages and chi – square test) were applied to study for significance of findings and their correlation with other parameters.

Results

The study enrolled 101 patients with bat aged between 5 years to 80 years with maximum patients falling in the age bracket of 25 to 34 years contributing to 26.73% of all cases. The mean age of patients was 35.43±16.27 years. Our study population comprised of 86 (85%) males and 15 (15%) females.

Table 1: Distribution of various mode of injuries resulting in bat

Mode of injury	%age of patients (n)
Road traffic accident	70 (71)
Fall from height	15 (15)
Fall of heavy object	6(6)
Assault	4(4)
Bull hit	3(3)
Industrial accidents	2(2)

Owing to the rise in use of automobiles and the location of our hospital on highway the most common mode of injury (table.1) was road traffic accident accounting for 71 cases (70%) which includes 62 (87%) males, 9 (13%) females followed by fall from height accounting for 15 cases (15%) with 11 (73%) males, 4 (27%) females. Fall of heavy object was reported in 6 (6%) cases with all males (100%), assault in 4 (4%) cases which includes 3 (75%) males, 1 (25%) female, bull hit in 3 (3%) cases with 2 (67%) males, 1 (33%) female, and industrial accident in 2(2%) cases with all males (100%).

Fast was positive in 83 (83%) patients, and negative in 18 (17%) patients. Ct scan was performed in 66 (65%) patients. Abdominal injuries were either isolated solid or hollow viscous organ injury or combination of both involving multiple intra-abdominal organs (fig.2).

Isolated organ injury was reported in 55 (54%) patients and more than one organ involvement were seen in 46 (46%) patients which categories into two organ injury in 35 (35%) patients, three organ injury in 5 (5%) patients and more than three organ injury in 6 (6%) patients. In isolated organ (fig.3) injury liver was involved in 17 patients which comprises of 1/3rd of the patients (31%) and spleen in 14 patients which constitutes about 1/4th (25%) of patients.

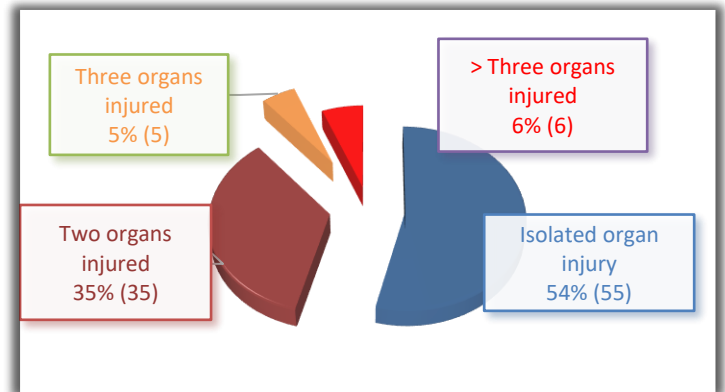


Figure 2: Combination of intra-abdominal organ injured in patients* (n) with bat

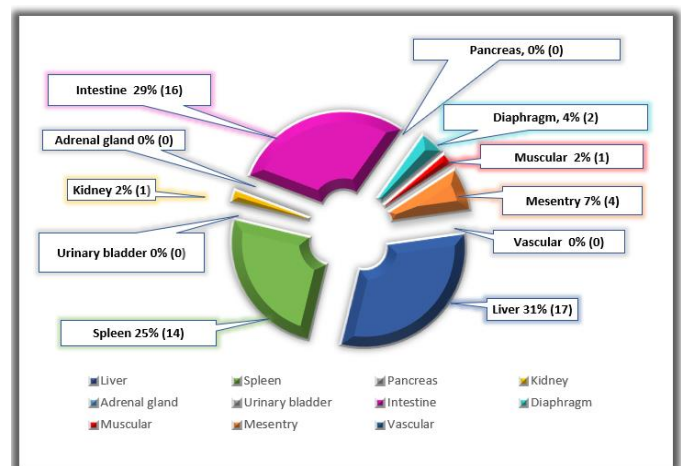


Figure 3: Distribution of single organ injury in patients* (n) with bat

Whereas in multiple organ injuries (fig.4) liver was found to be injured in half of patients which constitutes 24 (52%) patients and spleen in 19 (41%) patients followed by 15 patients of intestine trauma which constitute of about 1/3rd (33%) of patients having multiple intra-abdominal injuries.

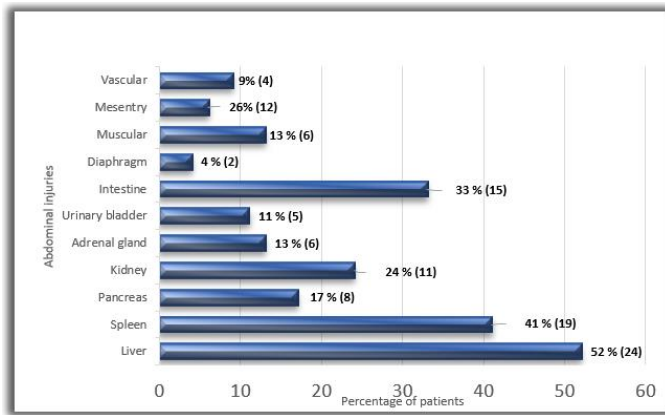


Figure 4: Involvement of specific abdominal injuries in patients* (n) with multiple organ injuries due to bat

In solid organ injuries, Liver was reported to be injured in majority of cases in road traffic accidents (30 cases) and in patients with fall from height (6 cases), followed by 23 cases of splenic trauma in road traffic accidents and 6 cases in fall from height patients. In hollow viscous injury, intestine was reported to be injured 20 cases of road traffic accidents.

In our study, fall of heavy object patients were predisposed more towards mesenteric (2 cases) and renal (2 cases) injury than other organs involved, however the majority of mesentery (12 cases) and renal (6 cases) trauma were associated with road traffic accidents.

Therefore, owing to the anatomy and largest surface area the most common organ overall involved was liver which was injured in 41 patients. Spleen was injured in 33 patients, intestine in 31 patients, mesentery in 16 patients, kidney in 12 patients, pancreas in 8 patients, muscular injury in 7 patients, adrenal gland involvement in 6 patients, urinary bladder injury in 5 patients, diaphragm injury in 4 patients, and vascular injury in 4 patients (fig.5).

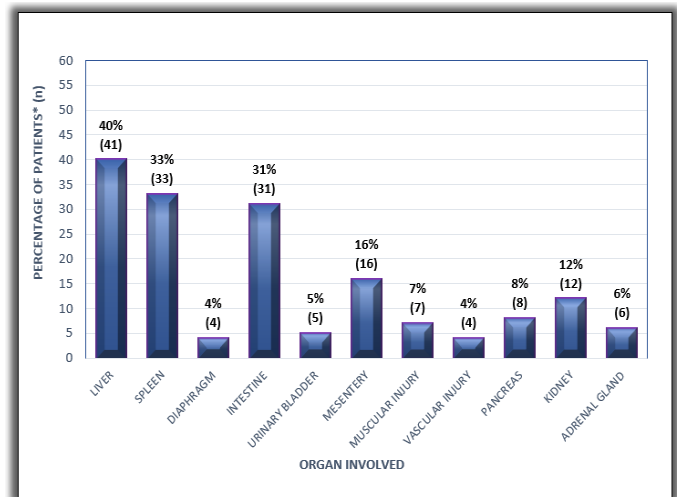


Figure 5: Overall distribution of abdominal injuries in patients* (n) with bat

In cases of intestinal involvement, most common part involved was jejunum in 12 patients, followed by ileum in 11 patients (fig.6).

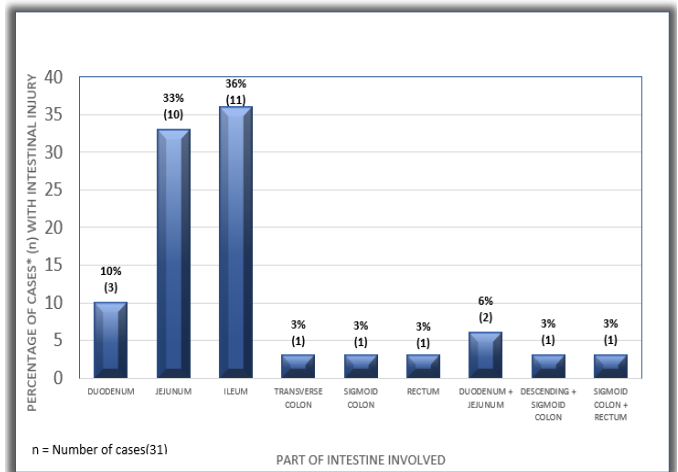


Figure 6: Distribution of patients*(n) with segment of intestine involved

The most common symptoms were abdominal pain (84.4%), abdominal distension (75.8%), chest pain (34.5%), and vomiting (38%). Abdominal tenderness (78.2%) was the most common sign followed by guarding-rigidity found in 50 patients (50%). Therefore, the signs of peritonitis were seen in 50(50%) patients and absent in 51(50%) patients.

In our study 34 (34%) patients were reported as cases of isolated abdominal trauma with involvement of only intra-abdominal organs and 67 patients (66%) were reported as poly trauma with involvement extra abdominal systems apart from abdominal organs. Frequencies of other associated injuries were as follows: chest injury in 36 patients, head injury in 26 patients, pelvis involvement in 19 patients, long bone injury in 17 patients, facial injury in 17 patients, and spine injury in 7 patients (fig.7).

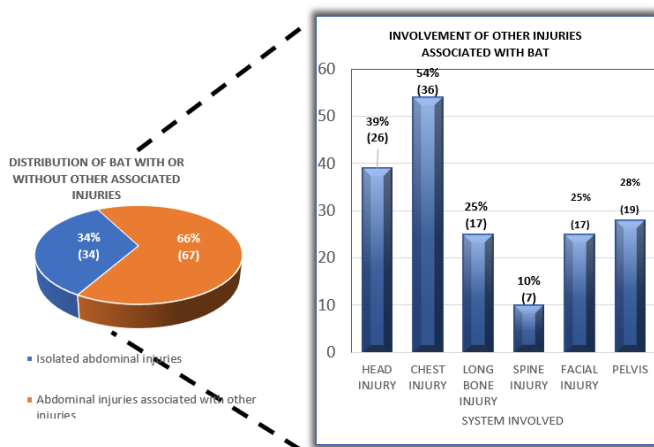


Figure 7: Involvement of extra abdominal injuries in patients* (n) with bat

Out of all the modes of injuries road traffic accidents accounts for the majority of poly trauma patients with involvement of intra-abdominal organs in which 26 patients were reported of chest injuries followed by 21 head injuries, 14 patients of long bone fractures with facial and pelvis injuries of equal predisposition of 13 patients each.

After road traffic accidents the chest trauma was reported second highest (6 patients) in patients with fall from height. In case of fall of heavy objects, the pelvis injuries (4 patients) had the strongest association followed by chest injuries (2 patients) compared to other organ systems involved however the majority of pelvis injury overall seen in road traffic accident.

Surgical intervention was required in 56 (55%) patients whereas 45 (45%) patients were managed conservatively. In our study (fig.8) out of 41 total liver injuries 38 (93%) patients were managed conservatively and 3 (7%) patients underwent hepatorrhaphy and out of 33 total spleen injuries 19 (58%) patients were managed conservatively, whereas 14 (42%) patients underwent splenectomy. Therefore, majority of hepatosplenic injuries in our study were managed conservatively. All the renal and adrenal gland trauma patients were managed conservatively. All 31 (31%) intestinal and 16 (16%) mesentery injury patients were repaired surgically. 50 (89%) operated patients had uneventful stay post operatively however re-exploratory surgeries was required in 6 (11%) patients. Complications were encountered in 35 (35%) patients.

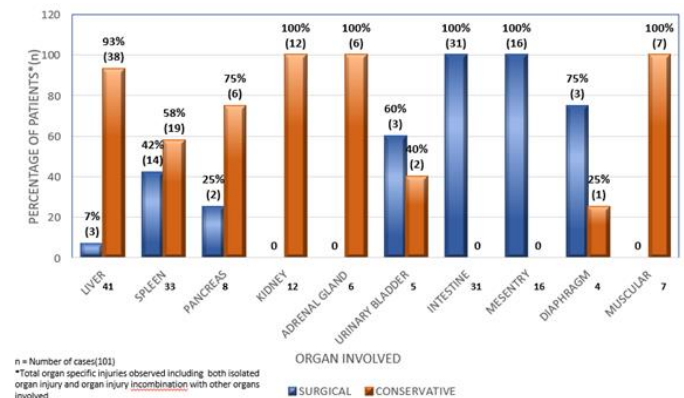


Figure 8: Organ specific management approach in patients* (n) with bat.

The duration of stay in hospital among the patients included in our study ranged from 1 day to 74 days with a mean duration of 12.77±12.04 days. Maximum number of patients required hospitalization between 1 to 10 days. 87 patients survived whereas 14 patients included in our study were expired.

Discussion

Owing to the increasing incidence of blunt abdominal trauma a study was undertaken at the NCSB medical

college, Meerut for analysis of visceral injuries in blunt abdominal trauma which comprised of a total 101 patients with BAT which demonstrated male predilection (85% males) impacted during productive and working life years (35.43 ± 16.27 years).

Almost half of the population (46%) present with two or more intra-abdominal organs injured (most commonly liver and spleen), primarily due to road traffic accidents (70%). Nearly 2/3rd of patients with BAT had Grade III and above liver and/or spleen injury. Of these patients, ~40% faced post op complications, prolonged hospital stays of even more than a month (31-38days) and an unfortunate mortality rate of 1 in 5 (15-18%). e-FAST being a sensitive modality was useful in diagnosing 83 patients (83%) with BAT. Isolated intra-abdominal organ injuries were reported in more than half 55 (54%) of the patients. Due to topographic anatomy and large surface area, most common solid organ injured was found to be liver in 41 (40%) patients followed by Spleen 33 (33%) and most common hollow viscus organ being intestine 31(31%) predominately jejunum in 12 (39%) followed by ileum 11 (36%) patients. Sign of peritonitis were evident in 50% patients.

We reported BAT results in injury of two or more intra-abdominal organs with liver and spleen most commonly affected. Some of the reasons for common involvement of liver and spleen can be the nature of force and location of these organs in the abdominal cavity. Considering, rapid deceleration results in differential movement of adjacent structures therefore shear forces are created which result in solid, hollow, visceral organs and vascular pedicles to tear, especially at relatively fixed points of attachment. Most commonly encountered deceleration injuries include intimal injuries to the renal arteries, and hepatic tear along the ligamentum teres. As

the bowel loops travels from their mesenteric attachments, thrombosis, mesenteric tears, with the resultant splanchnic vessel injuries, can result. The second mechanism involves crushing - intra-abdominal contents are crushed between anterior abdominal wall and vertebral column or between posterior thoracic cage. This produces a crushing effect, to which solid viscera like liver, spleen, and kidneys are especially vulnerable. The third mechanism is external compression, whether from direct blows or from external compression against a fixed object such as seat belt, spinal column. External compressive forces result in a sudden yet dramatic rise in intra-abdominal pressure which culminate in rupture of a hollow viscous organ. The liver and spleen are usually the most commonly injured organs, although inter-observer variability has been reported by different studies. The small and large intestines are next most commonly injured organs. Recent studies have shown an increased number of hepatic injuries, perhaps reflecting the increased use of CT scanning and concomitant identification of more injuries.

Our study demonstrated a significant association of age with mechanism of injury with road traffic accidents encountered more commonly in younger individuals. However, age was not found to be associated with duration of hospital stay or patient outcome. No association was observed between gender and mode of injury, organs involved, or outcome. Our study demonstrated a positive association of mode of injury with intestine involvement (occurring more commonly in road traffic accident), urinary bladder (more commonly involved in road traffic accidents), pelvis injury (occurring more commonly in fall of heavy object). It however did not show any significant association between mode of injury and involvement of

liver, spleen, pancreas, kidney, adrenal gland, diaphragm, mesentery, vascular system, muscular system, head, chest, long bone, spine or face. There was no association between mode of injury and occurrence of complications, duration of hospital stays or outcome.

In our study, since 50% of patients had Grade III and above liver and/or spleen injury and hence were managed operatively. Procedures performed included splenectomy, mesenteric tear suturing, hepatorrhaphy, primary closure of bowel injury, and stoma formation. Of these patients, more than 1/3rd (~40%) faced post-operative complications. Surgical intervention was more commonly required in patients having involvement of intestines, and mesentery; whereas, most cases of injury to liver, spleen, muscular system, head, and chest were managed conservatively. Patients having peritonitis required surgical intervention. No association was observed between type of management and involvement of pancreas, kidney, adrenal gland, diaphragm, urinary bladder, vascular system, long bone, spine, pelvis or face. Occurrence of complications, requirement of re-exploration or outcome of the patient also did not depend on the organs involved or other associated injuries. The duration of stay in the hospital was prolonged in case of involvement of mesentery, chest injury, and pelvis injury.

The results of our study were comparable to the study conducted by Surender Verma et al (2020)⁶ to evaluate pattern and management strategies of solid visceral injuries in blunt trauma abdomen patients on 100 consecutive patients admitted in Department of General Surgery at a tertiary care centre with an antecedent history of blunt abdominal injury. The study was in concordance with Road side accident as the most common mode of injury in these patients and was

responsible for 75% of the patients. Fall from height accounted for 8 percent and accidental trauma under unknown circumstances accounted for also 8 percent cases. Most common viscera injured is liver (48.2%) followed by spleen (36.7%), kidney (12.3%) and pancreas (2.8%). Study showed liver injury of grade I in 1 (2.22%) patient, grade II in 20 (44.44%) patients, grade III in 13 (28.89%) patients, grade IV in 10 (22.22%) patients, grade V in 1 (2.22%) patient, grade VI not in a single patient. Spleen injury of grade I in 0 patient, grade II in 14 (38.89%) patients, grade III in 15 (41.67%) patients, grade IV in 5 (13.89%), grade V in 2 (5.56%). Kidney injury of grade I in 0 patient, grade II in 2 (15.38%) patients, grade III in 5 (38.46%) patients, grade IV in 6 (46.15%) patients, grade V not even in a single patient. Pancreas of grade I in 1 (33.33%) patient, grade II in 1 (33.33%) patient, grade III in 1 (33.33%) patient, not even a single patient had a pancreatic injury of grade IV as well as grade V injury [6]. Out of 100 patients 84 patients (84%) were treated conservatively whereas 16 patients (16%) were managed by operation. In present study, among all cases in whom conservative and operative management was done, 4.8% patients and 12.5% patients were in shock respectively.

Summary

The present study analysed visceral injuries in blunt abdominal trauma in 101 patients

- Population comprised of 86 males and 15 females with a mean age of 35.43±16.27 years.
- Most common organ involved was liver which was injured in 41 cases followed by spleen which was in 33 cases, altogether in isolated and multiple abdominal organ involvement.
- Jejunal injury is the third most common injury seen

- Our study reports predisposition towards isolated abdominal visceral injury with polytrauma with involvement of extra abdominal injuries with chest followed by head injury.
- Our study demonstrated a significant association of age with mechanism of injury with road traffic accidents encountered more commonly in younger individuals.
- Surgical intervention was more commonly required in patients having involvement of intestines, and mesentery; whereas, most cases of injury to liver, spleen, muscular system, head, and chest were managed conservatively. Therefore, for hepatosplenic injuries conservative management can be tried.
- The duration of stay in the hospital was prolonged in case of involvement of mesentery, chest injury, and pelvis injury.

Conclusion

Blunt trauma to abdomen is on rise due to excessive use of motor vehicles. It poses a therapeutic and diagnostic dilemma for the attending surgeon due to wide range of clinical manifestations ranging from no early physical findings to progression to shock. Hence, the trauma surgeon should rely on his physical findings in association with the use of modalities such as X-ray abdomen, USG abdomen, and abdominal paracentesis. Hollow viscus perforations are relatively easy to pick on X-ray. However, solid organ injuries are sometimes difficult to diagnose due to restricted use of modern amenities such as CT scan in India. From our study, we conclude that in hemodynamically stable patients with solid organ injury, conservative management can be tried and non-operative management is associated with less complication and morbidity.

The most important principle in the management of blunt abdominal trauma is repeated examination by an experienced surgeon. The challenge in future will be to refine the diagnosis of abdominal trauma to allow swift recognition of those injuries that require surgical intervention. In order to improve the outcome in cases of blunt abdominal trauma following suggestions are made:

1. A detailed history should be taken from patients who present with blunt trauma abdomen in emergency to investigate mode of trauma.
2. There should be a high index of suspicion for visceral injuries even in cases of apparently trivial abdominal trauma. Effective transport facilities should be planned for timely.
3. Transfer of patient to appropriate place.
4. A fair policy should be devised regarding effective use of available investigations and criteria to decide about laparotomy so as to minimize the chances of missing an injury and doing a lion therapeutic laparotomy.

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