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A Prospective Study on Non-Operative Management of Solid Organ Injuries in Blunt Abdominal Trauma Patients

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Introduction: Following injury to the extremities and head, abdomen is the third most commonly injured part of the body. Blunt abdominal trauma (BAT) is particularly deceptive because of the delay in clinical manifestations for hours or even days, even though the damage to the internal organs might be serious and lethal. The road traffic accident (RTA) is the most common mode of injury to cause blunt abdominal trauma. Diagnostic modalities like FAST and CT scans have caused a significant change in trends regarding management from surgical to a more conservative approach. Our current research aimed at examining the pattern of blunt injury to the abdomen, the mode of injury, and the involvement of various abdominal solid organs, investigating various

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investigational modalities and their use in the management of blunt abdominal trauma, and examining post-traumatic management with regard to non-operative treatment modality.

Materials and Methods: This prospective study is based on 100 cases of Blunt abdomen trauma who presented in P.D.U. Medical College & Hospital, Rajkot with respect to clinical presentation, investigations, management and outcome. Results and outcomes are depicted in various tables and figures.

Results: In the present study, demographic data like age and sex, the mode of injury, commonly injured solid organs, management done and the associated other treatment parameters was observed and compared. It was found that Blunt abdominal trauma commonly involves young males in the age group of 20 - 30 years. RTA is found to be the most common mode of injury. Liver was the most commonly injured solid organ followed by spleen. Around 27% of total cases have associated other organ system injuries in addition to blunt trauma to abdomen. Non-operative management was successful in 92 out of 100 patients with an average length of the hospital stay around 6 days.

Conclusion: Peak incidence of Blunt trauma abdomen is in young males and productive age population. All abdominal solid organ injuries can be given a trail of non-operative management whenever the patient is stable. Liver and spleen have favorable outcome when managed conservatively. Non-operative management is widely accepted in hemodynamically stable blunt abdominal trauma patients. The basic principle of non-operative management is close clinical follow-up of the patient. The non-operative treatment efficacy in well in this study regardless of the type of injury. Early diagnosis, aggressive resuscitation and timely surgical intervention may improve the outcomes for trauma patients.

Keywords: Organ injuries; abdominal trauma; road traffic accident; abdominal injuries; haemorrhage.

1. INTRODUCTION

“Despite its close relationship with humans, trauma has been dubbed the overlooked disease of modern society. In poor nations, trauma is the greatest cause of mortality and disability as well as the top cause of death for those under the age of 45” [1].

“Worldwide, there has been a significant increase in urbanization, motorization, industrialization, and changes to socioeconomic ideals. India isn't an exception to this evolving trend. Road traffic accidents are now the most significant public health risk in the world, posing one of the biggest hazards to human life and safety as a result of these changes. India is the leading country in the number of deaths due to Road traffic accidents” [2].

“The abdomen is the third most frequently damaged bodily part, behind the extremities and the head. Two major categories can be used to classify abdominal trauma -- 1) Penetrating trauma to the abdomen 2) Blunt trauma to the abdomen. Blunt trauma to the abdomen is the more frequent type of damage amongst the two. Among the many factors that might lead to blunt abdominal trauma, common scenarios include car accidents, wounds sustained during combat, assaults, falls from great heights, sports accidents, athletic endeavors, and mountaineering. The road traffic accident is the most common cause of blunt trauma abdomen” [1].

“Blunt trauma abdomen can result from deceleration, crushing or external compression mechanism. Blunt trauma to the abdomen needs to be carefully evaluated to increase the chances of patient survival. The swift use of diagnostic modalities and vigorous resuscitation to attend immediate life-threatening problems should be administered. Focused assessment with sonography for trauma or FAST has emerged as a useful tool in the evaluation of blunt injury abdomen” [3-6].

“After blunt abdominal trauma, concealed bleeding is the second most prevalent cause of death, and undetected abdominal injuries are frequently responsible for morbidity and late mortality in patients who survive the initial stage of damage. A close eye and prompt implementation of the right therapy reduce morbidity and mortality” [7].

“Haemorrhage and infection are the two main adverse consequences of abdominal injuries. Early death after abdominal injuries is mainly due to hemorrhage. The most frequent cause of death happening more than 48 hours following

an accident is sepsis. Intraabdominal sepsis after trauma typically results from hollow viscus injury which causes the leakage of gut contents, and it frequently happens with penetrating trauma" [1].

"In stab wounds it is easier to predict the injured organs as the injuries are usually confined to the tract. The management of blunt trauma abdomen has undergone a paradigm shift from immediate explorations, as was the norm, to a conservative and more selective management today because of better intensive monitoring of patients aided by noninvasive technology. The development of newer therapeutic modalities - such as embolization of bleeding vessels, ultrasound or CT guided drainage and advances in critical care management have increased the chances of nonsurgical management. The availability of intensive monitoring is also important. The patient is strictly observed by serial physical, radiological and laboratory examinations like Hb, CBC or Sr. Lactate. Operative interventions need to occur expeditiously in hemodynamically unstable patients defined by with low systolic BP (<90 mm Hg), tachycardia, low hematocrit and higher blood transfusion requirement" [8].

With the goals of examining the pattern of blunt injury to the abdomen, the mode of injury, and the involvement of various abdominal organs, investigating various investigational modalities and their use in the management of blunt abdominal trauma, and examining post-traumatic management with regard to non-operative and operative modalities in patients, current research sought to examine the blunt trauma abdomen with respect to management and outcome in a tertiary care hospital.

2. MATERIALS AND METHODS

It was a prospective study of 100 patients presented to the Department of General Surgery Pandit Dindayal Medical College and hospital, Rajkot with a history and presentation of blunt trauma abdomen and filtered through the pre determined inclusion and exclusion criteria. Et We included patients with blunt abdominal trauma who were hemodynamically stable at the time of presentation or became hemodynamically stable after proper resuscitation.

We applied the ATLS protocol of management to unstable poly-traumatized patients in the form of; securing the airway, control of breathing and ventilation, control of circulation, assessment of neurological status and proper exposure. On admission, blood sample was sent for complete blood count (CBC), liver profile (SGOT, SGPT), kidney profile (creatinine, BUN), blood grouping and cross matching, patients were examined by focused abdominal sonography for trauma (FAST). Patients with positive FAST then further investigated by abdominal-pelvic CT scan with IV and oral contrasts.

Documentation of the patient's data which included identification, history, clinical findings, diagnostic test, operative findings, operative procedures, complications during the stay in the hospital and during subsequent follow up period, were all recorded on a proforma specially prepared. Demographic data collected included the age, sex, occupation and nature and time of accident leading to the injury. Non-operative management included IV fluids resuscitation, close observation of the vital signs, monitoring urine output, and blood transfusion and if needed. Urgent laparotomy was done to patients with failed non-operative management which was defined as any rapid drop in the vital signs (pulse and blood pressure), drop in the hemoglobin % or significant increase in the volume of hemoperitoneum in repeated FAST (if needed).

Patients with succeeded non-operative management were instructed before discharge to visit the hospital if they had any disturbed level of consciousness, vomiting or abdominal pain. Patients were followed up once per week in the out-patient's clinic for 1 month.

3. RESULTS

A total of 100 patients were observed in our study and the observations were interpreted in the form of figures and tables.

3.1 Age and Sex Distribution

About one third of the patients were of 21-30 years age (39%) followed by 31-40 (19%). (Table 1).

Overall, 72 males and 28 females were observed in our study with male: female ratio of 2.6:1. (Fig. 1).

3.2 Mode of Injury

About half of the patients had RTA (48%) followed by fall from height (38%) and assault (10%) as the mode of injury (Fig. 2).

Table 1. Age Distribution

Age Groups (Years)	Total Numbers	Percentage (%)
0-10	9	9
11-20	15	15
21-30	39	39
31-40	19	19
41-50	10	10
51-60	5	5
>60	3	3

The mean age group of study is around 30 years of age

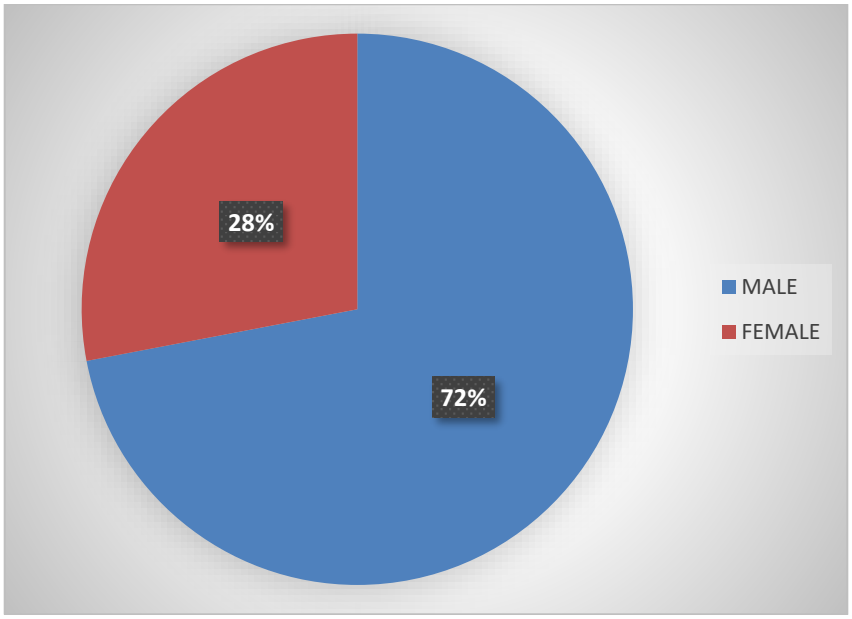

Fig. 1. Sex Distribution

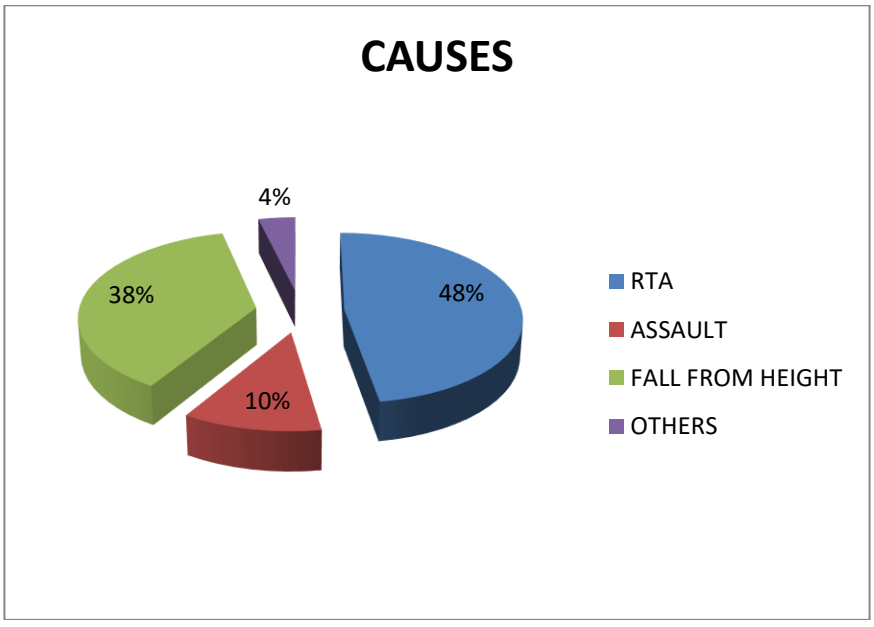

Fig. 2. The Mode of Injuries

Table 2. Organs Involved

Organs Involved	Numbers	Percentage
Isolated Liver injury	44	44%
Isolated Spleen injury	20	20%
Isolated Kidney injury	9	9%
Pancreatic injury	6	6%
Liver/Spleen	12	12%
Liver/Spleen/Kidney	4	4%
Bilateral Kidney injury	2	2%
Urinary Bladder injury	3	3%

3.3 Organs Involved

Liver was the most common organ injured in 60 (60%) cases among which 44 cases are of isolated liver injuries. This is followed by spleen in 36 (36%) cases of which isolated splenic injuries comprises of 20 cases. Renal injuries, pancreatic injuries or bladder injuries comprised the rest. (Table 2).

3.4 Line of Management an Outcome

In our study, out of 100 cases, non-operative management was successful in 92(92%) cases. Three cases were taken for the operative intervention due to massive hemoperitoneum and five cases which initially kept for non-operative management was taken for operative management because of hemodynamic instability.

Among those five patients on the non-operative management failure group, two patients had delayed splenic bleed presenting 48 hours after admission. Two patients presented with a serial and rapid fall on hematocrit over 48 hours and one patient developed features of peritonitis, for which operative interventions was considered.

Among all the patients, there were two deaths among the non-operative group whereas only one death in eight patients we have operated in total. (Table 3) The single death in the operative group owes to cardio-respiratory arrest and two deaths in the non-operative group owes to hemorrhagic shock in patients with poly-trauma cases.

3.5 Associated Trauma along with Blunt Abdominal Injuries

Along with blunt abdominal injuries, many patients were discovered with other organ involvements. Isolated blunt trauma to abdomen was present in 73(73%) cases. Among the rest, CT Confirmatory brain injuries were present in 12(12%) cases, whereas blunt injuries to chest in the form of haemothorax comprises of 10(10%) cases and various forms of upper and lower extremities fractures comprises 18(18%) of cases.

Table 3. Overall line ofmanagement

Line of Management	Number of Cases	Percentage (%)
Non-operative mangement	92	92
Non-operative Converted to Operative	8	8
death:		
Non-operative group	2	2.17
Operative group	1	12.5

Table 4. Organ system involved

Associated Other Organ Systems Involved	Number of Cases	Percentage (%)
Only Blunt Abdomen	73	73
Associated Brain Injury	12	12
Associated Blunt Chest Injury	10	10
Associated Limb Injury	18	18

Table 5. Individual Major organs injury: Grade

Organs	Grade	Numbers
Liver (60)	1	24
	2	21
	3	11
	4	4
	5	0
Spleen (36)	1	16
	2	12
	3	6
	4	2
	5	0
Kidney (15)	1	9
	2	3
	3	2
	4	1
	5	0

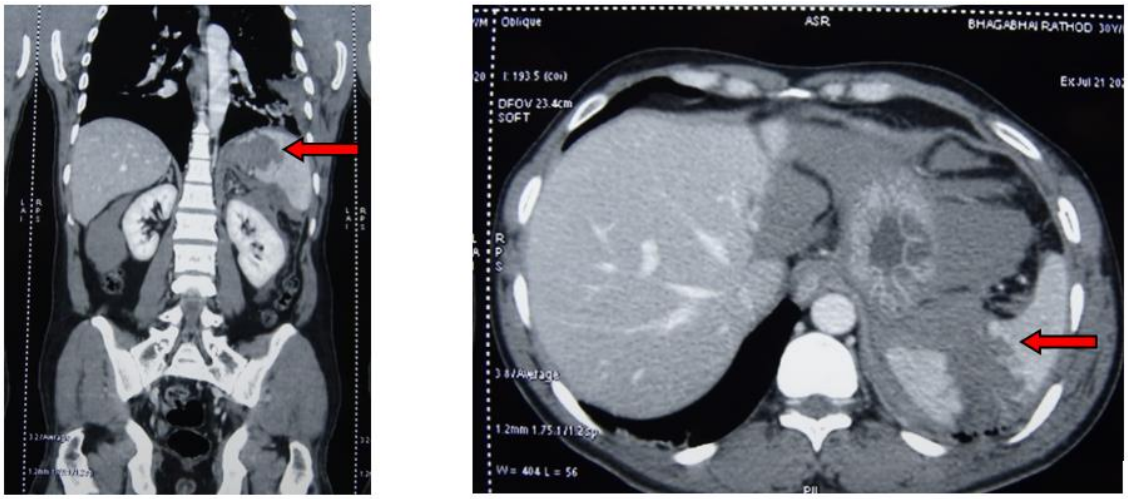

Image 1. CECT (A+P)-Splenic Contusion with Laceration –Grade II

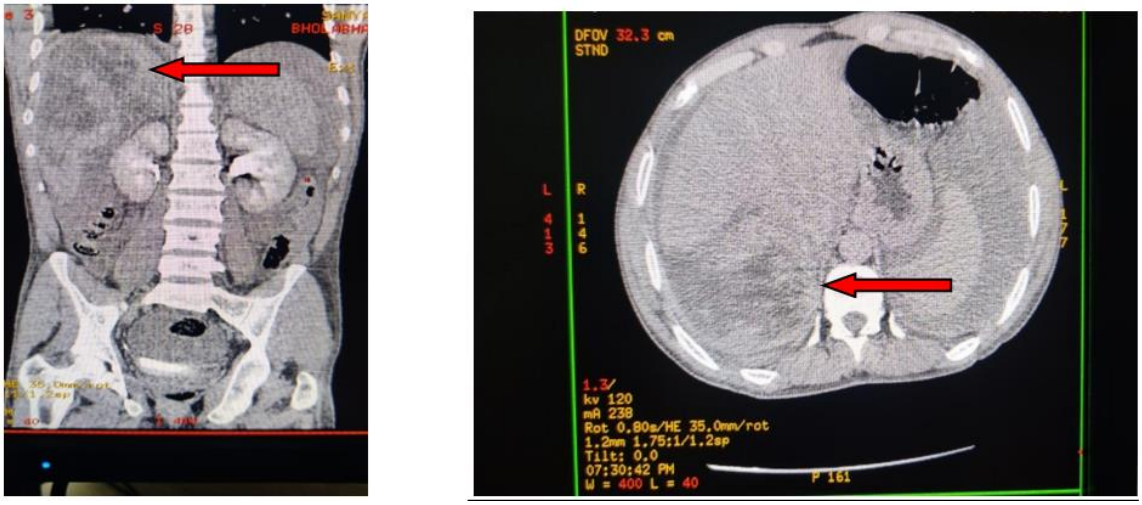

Image 2. CECT (A+P): Liver contusion + Hemoperitoneum

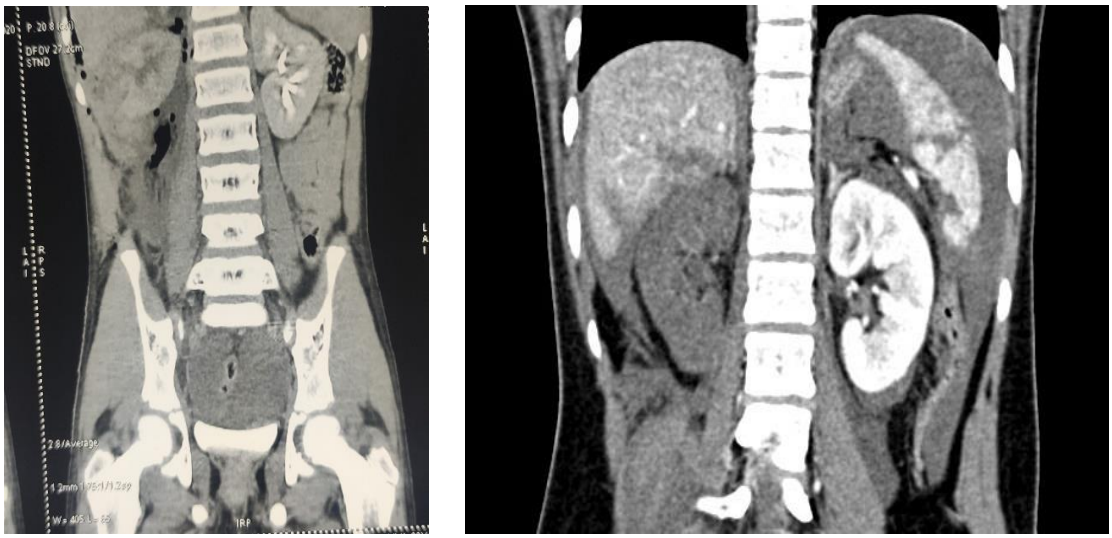

Image 3. CECT (A+P): Grade IV Right Renal Injury

Among all the injuries, multi-organs abdominal injury was found in total 16 n0. of patients out of which 2 patients having grade 4 liver injury and 2 patients having grade 4 and one patient with grade 3 splenic injury undergone surgical intervention.

Majority of solid organ injury cases belonged to Grade 1, 2 or 3 of blunt trauma respective classification. Among grade 4 injuries, two cases of grade 4 liver injury and also one grade 4 renal injury have successfully been treated non-operatively.

3.6 Requirements for Blood Products

Out of 93 patients who form the non-operative group in our study, 32(32%) cases required the need for RBC transfusion whereas 15(15%) cases required FFP transfusion for hemodynamic stability in the course of conservative management.

3.7 Average Duration Patient Kept NBM

In the conservative group, the average number of days the patient at the initial course kept nil by mouth is around 2.2days.

3.8 Average Hospital Stay

Hospital stay was less in the non-operative group. The average stay in the hospital for patients managed conservatively was about 6 days in comparison to 15 days in operative group.

4. DISCUSSION

One of the leading causes of morbidity and mortality is trauma. After injuries to the head and extremities, blunt trauma to the abdomen is the third most frequent injury reported. The associated injuries, alcohol and drugs may mask abdominal signs and symptoms. Patients with short pre-hospital transport time have initial subtle clinical features affecting early diagnosis. Due to the lack of any obvious symptoms and the inability to assess any clinical signs, blunt abdominal trauma is frequently exceedingly challenging to identify and diagnose. Therefore, in order to early detect and avoid morbidity and death from occurring, we need an accurate way of diagnostic modality to screen the patients of blunt trauma abdomen. All prior diagnostic techniques have mostly been supplanted by USG and CT scans today. The fundamental benefit of ultrasonography is that it may be done at the patient's bedside, allowing for fast assessment of the severity of the reproducible damage and highly sensitive for detection of free peritoneal fluid and identifying probable organ injury [7].

The prevalence of intra-abdominal damage following blunt abdominal trauma has been estimated to be as high as 12–15%. The third most often injured body part, requiring surgical intervention in 25% of instances, is the abdomen. There are two types of abdominal trauma: blunt and penetrating. While problems from blunt trauma can go undiagnosed if the clinical indications are not obvious, penetrating abdominal trauma is simple to identify. The

requirement for an accurate and quick imaging technique to evaluate related abdominal visceral injuries is explained by hemodynamic instability, disturbed level of awareness, and the occurrence of concomitant injuries to the pelvic bones, cranium, chest, or limbs [1].

"The management of abdominal injuries has changed significantly when compared with the management prior to 1990. The rate of unnecessary laparotomy has also reduced significantly due to non-operative management, particularly of blunt abdominal injuries" [8]. "Regardless of the severity of the injury, patients who are hemodynamically stable can be followed up without surgery. Imaging techniques and thorough clinical observation are used to monitor these patients. When hemodynamic instability and/or symptoms of peritonitis are found, the proper settings must be prepared in order to immediately operate on the patient. Shock, acidosis, the need for transfusions, the existence of multiple organ injury, treatment delays, the presence of co-morbid conditions, and high trauma scores are factors that raise mortality in these injuries" [9].

Present study involving 100 patients was aimed to study the most common visceral solid organ involved, the most common mode of injury and course of illness during the non-operative management of BTA and to evaluate the outcome of non-operative management in terms of hospital stay, blood utilization, and morbidity and conversion rate into operative management.

Till date, the largest study documented on non-operative management for blunt abdominal trauma within a span of 10years with around 5400 subjects is by Raza et al. Comparing our results to their large study we conclude the followings.

In the study by Raza et al, Male (71%) outnumbered female (29%) as BTA victims. Male to female ratio was 2.47:1 [10]. This is nearly same to our study which shows male: female ratio of 2.6:1.

In the study by Umare et al., "the most cases of blunt abdominal trauma were between the age group of 11-40 years (76%)" [11]. Rahman and Das found that "the commonest age group was 21 to 30 years comprised about 39% of BAT patients. The average age was 30.82 years" [12]. This is consistent with our findings of the most common age group of 21-30 years with average age being 30 years.

About half of the patients sustained RTA (48%) followed by fall from height (38%) and assault (10%) as the mode of injury in the present study. Anarase and Anarase also found that "road traffic accidents were the predominant cause of trauma" [13]. In the study by Rahman and Das [12], "the most common cause of BAT was found to be road traffic accidents (67%) which were slightly higher than the present study". Also in the study by Raza et al [10] the most common cause of blunt abdominal trauma was RTA accounting for nearly 90%.

Ultrasound is non-invasive, portable investigation using non ionizing radiation, repeatable, and easily performed in the emergency unit, at the same time with resuscitation methods. Fast examination techniques like focused abdominal sonography for trauma (FAST) may show intraperitoneal fluid. This approach was reported to be sensitive (79-100%) and specific (95.6-100%) in several investigations, especially in individuals with hemodynamic instability. According to reports, the CT scan can distinguish between various types of solid organ injuries in stable individuals who have sustained acute abdominal trauma [1].

In our study most common organ injured was liver (60%) followed by spleen (36%) which is comparable to study by Cox EF [14]. The study by Raza et al. [10] also showed the most common organ to be injured as the liver with an incidence rate of around 35% followed by the spleen accounting for 29% of cases. The management of Blunt abdominal trauma were successfully managed by Non operative management. Around 8% cases of Blunt trauma abdomen ended up in surgical procedure after initial conservative approach due to deterioration of their condition where as 92% cases were managed successfully by conservative management. Our study is comparable to study done by Tripathi et al. [15] Similar findings were present in the study by Raza et al. [10] which shows successful non-operative management in around 89.91% cases. In our study mean stay in hospital was 6 days in conservative group as compared to 15 days in surgical group. Gopalswamy S reported median length of hospital stay in conservative cases as 6.5 days [16].

In our study out of 92 patients who form the non operative group in our study, 32(32%) cases required the need for RBC transfusion whereas 15(15%) cases required FFP transfusion for hemodynamic stability in the course of conservative management. This indicates that even in high grade injuries, if proper monitoring is done and the need for blood products are provided at the required time non-operative management yields satisfactory results.

Now-a-days a 24-point Blunt Abdominal Trauma Severity Scoring System has been developed based on factors like abdominal pain, abdominal tenderness, systolic blood pressure, pulse rate, chest wall sign, pelvic fracture, and FAST to categories patients in severity groups and addressing the need for operative intervention [17].

Liver due to its firm texture is more confidently treated by non-operative management. In our analysis non-operative management succeeded in all stable isolated liver injuries but failed in two cases of isolated splenic trauma where delayed bleeding becomes the reason for operative intervention. We face many cases of higher grades of liver and splenic injuries, where patients were hemodynamically stable and with resuscitation protocols they improved by non-operative management.

5. CONCLUSIONS

The frequency of blunt abdominal trauma is highest in young males and the working-age population. All abdominal solid organ injuries can be managed with non-operative interventions. Conservative management results in favorable outcomes for the liver and spleen. In the treatment of severe trauma patients, diagnostic tests like FAST, X-rays of the abdomen in the erect position, and CT scans are crucial tools. In patients with blunt abdominal trauma who have hemodynamic stability, non-operative therapy is universally recognized. Abdominal injuries can be managed safely and effectively without surgery. Even patients with multiple abdominal injuries can be successfully managed by Non operative management provided they are closely monitored. The non operative group has a significant decrease in length of hospital stay and morbidity compared to patients who undergo surgery.

No practices are free from risk. Close clinical follow-up of the patient is the fundamental tenet of non-operative management. Regardless of the kind of damage, the efficacy of non-operative treatment performed well in this study. Early diagnosis, aggressive resuscitation and timely surgical intervention may improve the outcome for trauma patients.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

1. Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

CONSENT

Informed consent was obtained from all the participants.

ETHICAL APPROVAL

Ethical approval for the study was obtained from the Institutional Ethical Committee.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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