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Blunt abdominal trauma: A prospective analysis of surgical management and outcomes

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Abstract
Background: A major cause of morbidity and mortality for the working population of industrialized and developing nations is trauma, particularly blunt abdominal trauma.
Objective: To assess the outcome of surgery for Blunt abdominal trauma.
Methods: During the period of the study, 60 cases of blunt abdominal trauma were examined in a tertiary care hospital. Upon admission, the patient's medical history was reviewed, including the type of injury sustained and the time of the incident. In addition to a detailed physical examination, blood pressure, pulse rate, and respiratory rate were measured at the time of admission. A systemic examination of the chest, abdomen and central nervous system was also carried out. Injuries to the external, skeletal, and other parts of the body were noted. Likewise, the presence of hematuria was recorded.
Results: Younger populations (21-0 years) are more likely to suffer trauma, with men (7:1) being more likely to suffer. Most of the injuries were caused by motor vehicle accidents (48.33%). The blind abdominal tap was 55% sensitive to hemoperitoneum, while ultra-sonography was 80% sensitive. CT was almost 100% sensitive for abdominal injuries. Spleen (46.67%) and liver (21.67%) were the common organs injured. Patients who got delayed for hospital admission and whose operations lasted over an hour had a higher mortality rate.
Conclusion: Preventing abdominal trauma would prevent loss of productivity. It would be advantageous if trauma registries documented the care delivered, assessed the outcome, and implemented necessary changes as early as possible.

Keywords: Blunt abdominal trauma, surgery, outcomes, diagnosis

Introduction
Injury to the body ranks third on the list of causes of death leading to disability in the first four decades of life [1]. Physical or chemical agents impart energy that results in structural disturbances or physiological imbalances during trauma. Automobile accidents, railway accidents, and blunt abdominal trauma have become major causes of morbidity and mortality for working populations in developing and industrial nations worldwide [1]. The health care industry represents a significant economic resource diversion in all modern societies, particularly for those offering a comprehensive package of health benefits. The United States is the country with the highest number of road accidents, while India comes in fourth [2].
Anatomy is not a barrier to trauma and the patient may be affected in multiple regions at the same time, so treating the whole patient is essential. A blunt injury to the abdomen is common, while penetrative injury to the abdomen is rare and the often reason is a stab or gunshot. The most common organs injured are the small bowel (50%), large bowel (40%), liver (30%), and intra-abdominal vascular (25%) [3]. Permanent cavitation refers to the formation of a cavity caused by tissue destruction caused by penetration. As medium- and high-velocity projectiles enter the body, and damage the tissues they come into contact with, they pressure the tissues to move, which creates cavities. Cavitation has already caused considerable damage, however, since tissues return to their normal position, eliminating the cavity [3].
One of the most challenging aspects of blunt abdominal trauma treatment is the diagnosis since other injuries such as head injury and chest injury can mask it. The most common aetiologic agent of intestinal disruptions is blunt trauma [4, 5]. In many cases, the damage is internal, making a gross assessment difficult. Therefore, blunt abdominal trauma requires a high index of suspicion and active investigation to diagnose intraperitoneal injuries. X-rays, ultrasounds, and CT scans should be performed after a physical examination [6, 7]. Prior to an x-ray, a paper clip may be applied to the entrance and exit wounds.

If an abdominal injury penetrates the skin, the patient may present with shock, narrow pulse pressure, hypotension, oliguria, tachypnea as well as a trajectory and/or open wound. Depending on the type and hemodynamic status of the patient with penetrating abdominal trauma, the treatment will be different. The primary goal in the treatment of severe abdominal injury is to preserve life. The management is divided into four sequential phases, resuscitation, evaluation, initial management, and definitive treatment. The patient is treated with intravenous fluids and/or blood. Surgery is often required to secure impaled objects in place so that they do not move and they should only be removed in an operating room. Penetrating abdominal injuries often result in a variable prognosis, depending on the severity of the injury and when the patient presents to the emergency department. In the present study, we aimed to assess the surgical management and outcome of Blunt abdominal trauma.

Material and Methods

Study design

This was a prospective study where patients admitted for the complaint of blunt abdominal trauma were considered for analysis. Patients with blunt abdominal trauma cases were included of all age groups and irrespective of the reason of blunt abdominal trauma. All other patients not having blunt abdominal trauma cases were excluded from the study analysis.

Surgical Procedure

During the study period, 60 cases of blunt abdominal trauma were studied in a tertiary care hospital. A pertinent history including the nature of the accident, time of occurrence, and extent of injuries were obtained at the time of admission. An examination of the patient began with a general evaluation with an appropriate recording of vital signs such as blood pressure, pulse, and respiratory rate at the time of admission, followed by an examination of the chest, abdomen, and central nervous system. Details of external, skeletal, and other associated injuries were noted. A hematuria status was also recorded.

Airways were cleared, oxygen was administered, intubations and ventilation were administered, cervical spine immobilization and venous cannulas were placed or a cut was made to maintain breathing and circulation. Preoperative blood samples were sent for measurement of hemoglobin level, platelets count, blood grouping, serum electrolytes level, and sugar. Fluid resuscitation with Ringer Lactate, colloids, blood was started. Cathodization of the urinary tract (except when urethral injuries are suspected) and the presence or absence of hematuria were noted.

When there is suspected blunt abdominal trauma, patients were tapped in four quadrants to look for haemoperitoneum or feces. Likewise, examinations were conducted on unconscious patients when it was not possible to determine the cause of their accident, especially in patients exhibiting signs of shock.

Diagnosis procedure

An X-ray of the abdomen, chest, diaphragm domes and injuries were taken with the portable X-ray machine. An ultrasound sonography examination of the abdomen was carried out in stable hemodynamic cases when,

1. Organ injury suspected i.e. Pallor, reversed shock, local signs despite a negative abdominal tap,
2. In patients with no local signs of trauma where intraabdominal injury could not be ruled out.

The intravenous pyelogram was obtained in patients with genitourinary injuries who presented with hematuria, loin swelling, or an obvious retroperitoneal hematoma with abdominal sonography. CT scan was performed to evaluate stable patients with suspected of abdominal trauma or USG was done to detect injuries to grade and plan a conservative line of management.

Laparotomy was done as early as possible after a written valid and informed consent for following indications,

1. Positive abdominal tap
2. Local abdominal signs of peritonitis such as the presence of guarding and rigidity
3. USG detected organ injury which could not be conserved
4. Other radiological evidence of intraabdominal injury such as free gas under diaphragm.

Depending on the organ injured, the procedure varies. All cases were closed with monofilament following peritoneal wash with the monolayer. In all cases, drainage was left in the peritoneal cavity. Patient postoperative care included IV fluids, blood transfusions, antibiotics, and painkillers. Complications, if any were recorded and dealt with accordingly. On recovery, patients were discharged and followed up in the outpatient department. A post-mortem examination was conducted on all deceased cases in order to determine the cause of death.

Statistical methods

Excel was used to enter the data collection and preparation of Tables and graphs. The data was presented in percentage, mean, and standard deviation.

Results

Demographic characteristics

For analysis, all the patients with blunt abdominal injury admitted to the hospital were grouped according to age and gender. Blunt abdominal trauma was seen at all ages (Table 1). Higher percentage of these patients were found in the 21-30 years age group (41.67%). Infants and children (0-20 years) are protected from injuries, while the elderly is too sedentary to sustain injuries. The prevalence reported in this group is 16.67%. In elderly patients also incidents were reported very less (41-50 years, 11.67%; more than 50 years, 8.33%) compared to the young group.

The sex distribution has a male preponderance and the male: female ratio is 7:1. Because of their high working population, there is a preponderance of males.

Table 1: Basic Characteristics

Characteristics	No. of patients	%
Age Groups (Years)		
0-20	10	16.67
21-30	25	41.67
31-40	13	21.67
41-50	7	11.67
51 and above	5	8.33
Sex		
Male	52	86.67
Female	8	13.33

Distribution of Injury Related Parameters

Different types of injuries in the patients, reason of injuries,

management approach and time interval to reach to hospital is recorded (Table 2). Vehicular accidents have been the major cause of trauma. In our study, they contribute 48.33% (n=29 of 60) followed by railway accidents 26.67% (n=16). Chest injuries included fractured ribs, pneumothorax, and haemothorax. Only patients with significant head injury detected on CT scan were taken into consideration. Limb fractures, pelvic fractures, and significant soft tissue injuries were classified as other injuries.

3 out of 15 (33.33%) patients who died had been associated with head injuries. The pelvic fracture was seen in 1 out of 15 patients. One patient with associated pelvic fracture died due to septicemia following jejuna perforation.

In conservative and operative management, the mortality rate is 15.78% and 40.9% respectively. This is mainly due to associated injures.

The time interval between the events and definitive treatment showed that 21.66% of patients were taken up for surgery within one hour with mortality 0%. The mortality rate was 27.9% in those who operated between 1-24 hours and 50% in those who were operated after 24 hours.

Table 2: Distribution of Injury Related Parameters

Parameters	No. of Patients	%	Mortality	%
Mode of Injury				
Vehicular accidents	29	48.33	6	20.69
Railway accidents	16	26.67	6	37.5
Fall	9	15.00	3	33.33
Assaults	6	10.00	0 0	0
Associated injuries				
>2 injuries	10	16.67	1	10.00
Head injury	9	15.00	3	33.33
Chest injuries	6	10.00	2	33.33
Pelvic injuries	6	10.00	1	16.67
Spine fracture	7	11.67	4	57.14
Extremity fracture	4	6.67	2	50.00
Injury present	18	30.00	2	11.11
Management of injuries				
Conservative	38	63.33	6	15.78
Operative	22	36.66	9	40.9
Time interval				
<1 hour	13	21.66	0	0
1-24 hours	43	71.66	12	27.9
>24 hours	6	10.00	3	50

Evidence of organ Injury

Various type of organ injuries was recorded in patients (Table 3). The spleen was the commonest organ injured with 46.67% patients (n=28). The liver was the next common organ injured being found in 21.67% of patients, with mortality of 15%%. This was followed by kidney (11.67%), stomach and duodenum (10%) and bladded (6.67%) and then pancreas, small intestine, large intestine & Mesentry.

Table 3: Organ Injury

Organ	Injury	%
Spleen	28	46.67
Liver	13	21.67
Kidney	7	11.67
Stomach & Duodenum	6	10.00
Bladder	4	6.67
Pancreas	1	1.67
Small intestine, large intestine & Mesentry	1	1.67

Sensitivity of Investigations

26 patients (53%) were detected on positive abdominal tap while 9 out of 10 patients (90%) were detected on USG guided abdominal tap while 1 patient (10%) had a negative abdominal tap. Few initial negative Four QTAP turned positive on subsequent taps after fluid resuscitation.

Gas under diaphragm was seen on radiology suggestive of bowel perforation in 6 cases. One ileal perforation could not be diagnosed on the initial radiograph but USG guided tap was bilious.

Table 4: Sensitivity of Investigations

Tap	Total Cases	+ VE	-VE	Sensitivity
Blind Abd. Tap	45	25	20	55.55
USG guided tap	15	12	3	80

Discussion

In the present study, age incidence varied from 5 years to 80 years, and the highest incidence 41.67% was between 21-30 years compared to 32% in the study by Gurguis [8] and 44% by Kane and Dhandore, 2019 [9]. Traffic overcrowded suburban railroads and gang rivalry involving young adults are partly to blame for this. Similar age groups were also observed by other authors [10, 11]. As in the study, men were 7 times more likely to be injured (86.67% vs 13.33%). Mortality in the ratio of 5:1.

In the present study, vehicular accidents (48.33%) were the commonest mode of injury of blunt abdominal trauma compared to 80% reported previously [11]. Railway accidents caused 37.5% of deaths, while due to vehicular accidents 20.67%, and due to fall– 33.33%. Whereas, in another study, it was reported that road traffic accidents (61%) followed by railway accidents (28%), fall (26%), assault 14.28% [12]. In the present study, no seat belt injuries were reported.

Injury to admission interval was less than one hour in only 21.66% in contrast to Eastman, the goal for the prehospital time of fewer than 30 minutes in an urban environment [13]. No mortality was reported when patients were admitted within 1 hour of injury compared to 27.9% of those delayed beyond 24 hours for investigations. This emphasizes the importance of golden hour and silver day as previously reported [14]. Delay in prehospital in our country is due to the fact that resuscitation by paramedical squad is unknown and helicopter ambulance facility is not adapted even in urban regions and perhaps it's a future. Financial constraints also make it difficult in India. As a result, the "Golden Hour" concept suggests that most victims lose their first hour after trauma as 82% of our population resides in rural areas. Delay in the repair of small bowel injury leads to an increase in morbidity and mortality. A similar kind of explanation had been given in ileal perforation [15]. We observed that tachycardia and hypotension are associated with high mortality which is supported by earlier reports [16].

Associated injuries are also reported to be a cause for mortality and morbidity directly and indirectly. In patients who died in the present study, we have observed head injuries associated with pelvic fracture and septicemia. 21.67% liver injuries and 46.67% splenic injuries had associated rib fracture emphasizing the risk of abdominal organ injury in cases with a rib fracture.

Out of 60, 38 (63.33%) underwent surgery and 22 (36.66%) patients were managed conservatively. A preliminary CT abdomen and early resuscitation could identify minor injuries, allowing conservative methods to be employed [17].

The abdominal tap has been found to be a reliable and quick method of diagnosing blunt abdominal injury. While the abdominal tap was negative in 55.55% of cases, USG guided tap was positive in 80%. This shows the importance of portable sonography facility in the trauma ward, FAST (Focused

Assessment for Sonographic evaluation of Trauma patient) training. In retroperitoneum, bowel, and solid organ injuries without hemoperitoneum, USG is a false negative [18]. CT was done for USG positive and clinically suspected USG negative patients in the present study as reported previously [19]. In 1 case of blunt abdominal trauma, it is found that USG is normal but CT suggestive of liver laceration.

CT had a 100% sensitivity. The usefulness index of USG is 0.0069, so it is required for lesions of hollow viscus and solid organs. It can detect occult injuries that are not readily detected by USG [18]. After fluid resuscitation to target SBP of 90-100, a few initially negative Four Quadrant Tap tests became positive. A consideration of the phenomenon of increased blood loss as a result of overzealous infusions is given, as is the consideration of permissive hypotension and the dry management of injuries until definitive control of bleeding has been achieved.

Nine of the patients who died progressed to neurological problems, infection, septicemia, and multiple organ failure in another case. The jejuna perforation that was found on day 5 after the injury and sutured leaked after 5 days. The anastomosis was re-examined and resected. Septicemia and acute respiratory stress caused the patient's death which emphasizes the importance of DPL and CT scan in the early detection of bowel injuries. A geographic and monetary expansion of CT scan facilities should improve the ability to detect neurological deterioration, bowel injury and reduce mortality.

Conclusion

When there are no local signs, even in cases of polytrauma and vehicle accidents, blunt abdominal trauma should be considered. In order to avoid the loss of productive years from abdominal trauma, prevention and measures to decrease morbidity and mortality are essential. By enforcing traffic laws, educating the public and increasing safety, possible traffic accidents can be prevented.

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