International Surgery Journal
Panchal HA et al. Int Surg J. 2016 Aug;3(3):1392-1398
http://www.ijsurgery.com
pISSN 2349-3305 | eISSN 2349-2902

DOI: http://dx.doi.org/10.18203/2349-2902.isj20162717

Research Article

The study of abdominal trauma: patterns of injury, clinical presentation, organ involvement and associated injury

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Received: 30 March 2016
Accepted: 10 May 2016

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ABSTRACT

Background: The aim was to study the cases of abdominal trauma in context of: age/sex distribution, mode of injury (accidents, fall, assault etc.). Type of injury (blunt injury or penetrating injury), clinical presentation, role of investigations and organ involvement.
Methods: The study of 50 cases of abdominal trauma, including blunt as well as penetrating trauma was conducted prospectively during the period of 23 months (January 2010 to November 2011). Patients of all age and sex who were admitted in our department after abdominal trauma were potential candidate for enrolment in this study and study was done in context to fulfill our aim.
Results: In our study, the abdominal trauma is more common in age group 21-40 years (n = 30,60%) with male predominance (M:F: 7.3:1), blunt injury abdomen (n = 37, 74%) is more common than penetrating injury (n = 13, 26%) with RTA (n = 24, 48%) being the most common cause followed by fall (n = 16, 32%) and stab injury (n = 09, 18%), Abdominal pain (n = 49, 98%), tachycardia (n = 40, 80%) and abdominal distension (n = 25, 50%) are the most common clinical features in all abdominal trauma patients. In our study pattern of injury are: liver (n = 16, 32%), spleen (n = 15, 30%) and small bowel (n = 9, 24.32%). In polytrauma patients abdominal trauma is more commonly associated with thoracic injuries (n = 19, 38%) and orthopedic injuries (n = 7, 34%).
Conclusions: From our study we can conclude abdominal trauma can present differently and may injure organ depending upon pattern of injury and require clinical assessment, expedite investigations to set goal for prompt primary resuscitation and timely definitive treatment.

Keywords: Blunt injury abdomen, Trauma, Injury, Tachycardia

INTRODUCTION

Trauma or injury has been defined as damage to the body caused by an exchange with environmental energy that is beyond the body's resilience.[1]

Trauma remains the most common cause of death for all individuals between the ages of 1 and 44 years and is the third most common cause of death regardless of age.[1,2]

Globally, injury is the seventh leading cause of death, with 5.8 million deaths attributable to trauma in 2006. In the United States injuries constitute the third leading cause of death over all ages (accounting for 6 % of all deaths) and the leading cause of death among children, adolescent and adults aged 1 to 44 years.[2,5]

As per the report of NCRB, India 2001a, 2001b (The Crime Records Bureau), 27, 10, 019 accidental deaths reported in India. According to the survey of causes of death (SCD) under the sample registration system (SRS) of India, the rate of injury related deaths increased from 9% to 11% between 1994 and 1998.

The abdomen is a diagnostic black box. Abdominal injury is a significant cause of morbidity and mortality;

expedient diagnosis and treatment of intra-abdominal injuries are essential to avoid preventable morbidity and death.[1]

The objective of this study was to study the cases of abdominal trauma in context of:

- Age/sex distribution
- Mode of injury (accidents, fall, assault etc.)
- Type of injury (blunt injury or penetrating injury)
- Clinical presentation
- Role of investigations
- Organ involvement

METHODS

The study of 50 cases of abdominal trauma, including blunt as well as penetrating trauma was conducted prospectively during the period of last 23 months (January 2010 to November 2011) in civil hospital, Asarwa, Ahmedabad, Gujarat. Patients of all age and sex who were admitted in our department after abdominal trauma were potential candidate for enrolment in this study.

Inclusion criteria

Randomly selected patients with abdominal trauma (either blunt or penetrating) who were admitted in emergency department and required some definitive intervention or monitoring for evident abdominal organ injury or intra-abdominal hemorrhage or hematoma.

Exclusion criteria

- All deaths on arrival.
- Cases that were so severely injured that they did not survive attempts at resuscitation in emergency department.
- Patients with minor injuries and patients admitted with suspicion for major organ injury but found to have no major intra-abdominal injury after thorough assessment and evaluation.
- Patients who have taken discharged against medical advice and lost to follow ups.

After enrollment in our study, various clinical examinations, Trauma assessment done and various survey done as per requirement and management in term of investigating and imaging.

Clinical examination noted in our observation sheet

Symptoms[3,5]

- Pain in abdomen, abdominal distension, vomiting, hematuria or retention of urine, bleeding per rectum, breathlessness or chest pain.

Signs

- Level of consciousness
- Vital data
- Per abdominal examination

Inspection: discoloration, fullness in flanks, generalized distension, external marks of injury, absence of respiratory movements may indicate significant injury. External genitalia and back should be examined carefully.

Palpation: localized and generalized tenderness if associated with guarding or rigidity is suggestive of peritonitis.

Percussion: evidence of free fluid (fluid thrill, shifting dullness) suggests intra-abdominal haemorrhage.

Ascultation: absent peristalsis will suggest paralytic ileus or peritonitis.

- Per rectal or per-vaginal examination: Fullness in recto-vaginal or recto-vasical pouch will indicate pelvic collection. It will also show local rectal or vaginal injury.

Systemic examination

Abdominal injury is often associated with other injuries such as head injury, thoracic injury and musculoskeletal injury. So thorough systemic examination is needed to rule out any other associated systemic injury

Initial evaluation and resuscitation

Initial management of the critically injured patient demands simultaneous evaluation and treatment done as follow:

Primary survey[1,10]

The fundamental goal is to re-establish adequate oxygen supply to vital organs. Priorities are in the following order:

- Secure airway
- Optimize ventilation
- Circulation
- Disability
- Expose

Truama assessment[4,5]

- Glasgow coma score: the Glasgow coma score (GCS) is used now a days over the entire world to evaluate the trauma patients. Scored between 3 and 15. 3 being the worst and 15 being the best.

A coma score of 13 or higher correlates with a mild brain injury; 9 to 12 is a moderate injury and 8 or less a severe brain injury.

Secondary survey[1,6]

The second echelon of emergency department management encompasses detailed assessment of the overall condition of patient and identification of potential life-threatening injuries.

History

In blunt trauma, the type of impact, vehicular damage, use of restraining devices and conditions of the other victims are other helpful observations. If the patient is conscious then the patient himself or patient's relatives can be useful guide about the type of injuries patient sustained. For penetrating wounds description of the weapon and the amount of blood loss at the scene may be useful.

Physical examination-general

A rapid but systemic physical examination is essential to perform and document in the medical record.

Physical examination-abdomen

The abdomen is a diagnostic black box. Physical examination of the abdomen is unreliable in making this determination. For the majority of patients suffering blunt abdominal trauma serial examinations by the same surgeon can detect early peritoneal inflammation and the need for laparotomy can be worked out before serious complications occur

Tertiary survey[1,6]

The third echelon in the management of consist of a compulsive and systematic re-evaluation after all life threatening and limb threatening injuries have been cared for and toxic and metabolic derangements have been corrected. This process frequently occurs 12 to 24 hours after admission. Patients are systematically re-examined for occult injuries not evident on presentation owing to urgency other life threatening priorities.

Investigations

Laboratory investigations[1,4]

- Complete blood counts
- Liver function study
- Renal function tests
- Serum amylase
- Urine analysis
- Coagulation profile
- Blood type, screen and cross match
- Arterial blood gas analysis: ABG level may provide important information in major trauma victims. In addition to information about oxygenation and ventilation, this test provides valuable information regarding oxygen delivery by calculation of the A-a gradient.
- Drug and alcohol screen: perform drug and alcohol screen in trauma patients who have alterations in their level of consciousness.

Radiological investigation[1,4,7]

- Plain X-rays[7] plain X-rays of abdomen supine and standing for:
- Free gas under diaphragm suggesting perforation of hollow viscera
- Ground glass appearance suggests free fluid.

Plain X-ray of chest: it will show rib fracture, haemothorax, pneumothorax or both. It will also show an elevated diaphragm or with abdominal viscera in the chest cavity in case of rupture of diaphragm.

Ultrasound[3,5]

It detects intraperitoneal and retroperitoneal collection of fluid, solid organ injury with surrounding haematoma. It is very important investigation for observing the progress of the patient, particularly in conservative management.

FAST (focused assessment for sonography in trauma)[7]

It is done to assess patient with potential thoracoabdominal injuries. Test sequentially surveys for the presence or absence of blood in the pericardial sac and dependent abdominal regions including RUQ, LUQ and pelvis.

CT scan[7] It is most useful investigation for evaluation of retroperitoneal structures like kidneys and pancreas. CT is indicated primarily for hemodynamically stable patients who are candidates for non-operative therapy. CT is also indicated for hemodynamically stable patients who have unreliable physical examinations or other conditions (i.e., intracranial injury) that require CT evaluation. It quantitates free fluid and defines severity and staging of solid organ injury. Accuracy from 92 to 98%.

Diagnostic peritoneal lavage[1,4]

It is the most sensitive investigation in the case of blunt abdominal injury. Introducing peritoneal dialysis catheter through intra-umbilical incision and about 1 liter of normal saline is run into peritoneal cavity. Then patient is rolled into from side to side. Returning fluid is collected and sent for investigation. Statistical analysis revealed a sensitivity of 100% for peritoneal lavage, the accuracy was 99% and the predictive value was 97%. The advantage of peritoneal lavage is its high reliability,

simplicity of performance, the low rate of misinterpretation due to subcutaneous emphysema, ascites or meteorism, factors which plaque USG.

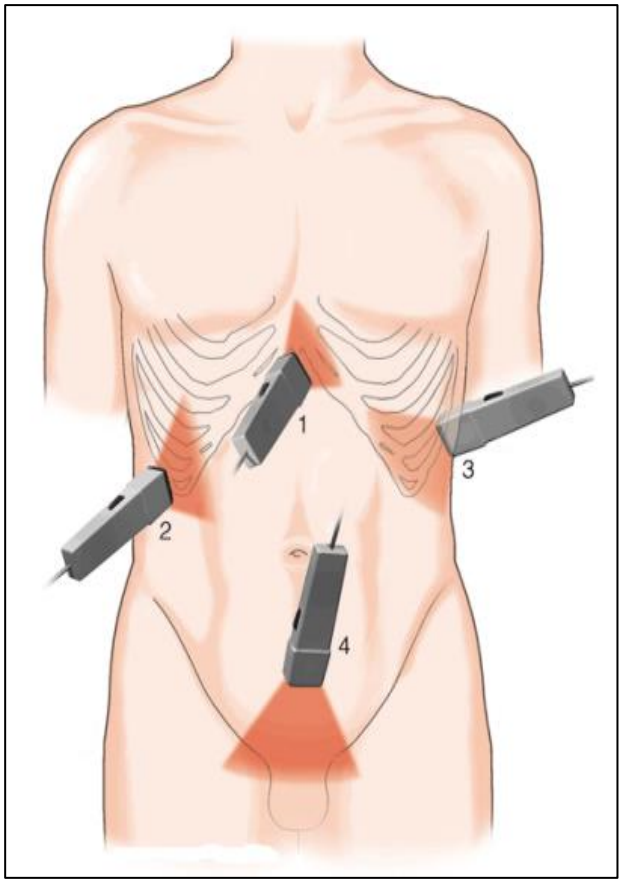

Figure 1: Fast (focused assessment for sonography in trauma).

It is positive if

- Blood in catheter
- Fluid studies revealing RBC more than 1,00,000/mm^3 indicate solid organ injury
- WBC more than 500/mm^3 indicates peritonitis - a late feature of trauma
- Amylase more than 175 IU/dl is suggestive of pancreatic injury
- Fluid should also be examined for presence of faecal material, bile etc.

Local wound exploration[4,5]

Local wound exploration requires a formal evaluation of a penetrating wound under local anesthesia. This procedure is performed in the operating room. The wound is extended under local anesthesia and track followed through tissue layers. Penetration of anterior fascia is considered a positive LWE, as penetration of peritoneum is difficult to identify. A positive LWE leads to either laparotomy or laparoscopy.

RESULTS

In present study 50 cases of abdominal trauma has been studied and following are the relevant observations and discussions.

Table 1: Age wise distribution.

Age (years)	Present study (%) (n = 50)	Davis J et al[8] (n = 437)	Musau P et al[9] (n = 80)
< 10	02 (04%)	81 (18.53%)	-
11-20	09 (18%)	84 (19.22%)	16.3%
21-30	18 (36%)	104 (23.79%)	53.8%
31-40	12 (24%)	65 (14.87%)	22.5%
41-50	05 (10%)	55 (12.58%)	3.7%
51-60	03 (06%)	25 (5.72%)	3.7%
>60	01 (02%)	23 (5.37%)	-
Total	**50 (100%)**	**437 (100%)**	

It is observed that 30 (60%) patients were from 21-40 years age group while mean age for the study is 31.48 years.

Musau P et al observed mean age of 28.2 years.[9] In a study by Smith J et al Mean age for abdominal trauma was 35.0 years (n = 1224).[10]

People from the age group 21 to 40 are economically productive people; they tend to travel more for the office, business or study purpose so they are more liable to RTA and other trauma.

Table 2: Sex wise distribution.

Sex	Present study (%) (n=50)	Smith J et al[10] (n=1224)	Musau P et al[9] (n=80)
Male	44 (88%)	865 (70.66%)	74 (92.5%)
Female	06 (12%)	359 (26.33%)	06 (7.5%)
Total	**50 (100%)**	**1224 (100%)**	**80 (100%)**
M:F ratio	7.3:1	2.4:1	12.3:1

In present study there were 44 (88%) male and 06 (12%) female with a ratio of 7.3:1. smith J et al observed similar pattern with 865 (70.66%) male and 359 (29.33%) females with a ratio of 2.4:1.[10]

Males are earning person in most of the family so he tend to travel more for this purpose and more liable to sustain injury.

In present study 37 (74%) patients suffered blunt abdominal trauma while 13 (26%) patients suffered penetrating abdominal trauma. J Smith et al observed similar pattern with 969 (79.16%) blunt trauma and 255 (20.83%) penetrating trauma.[10]

Table 3: Type of injury.

Type of injury	Present study (%) (n = 50)	Smith J et al[10] (n = 1224)
Blunt injury	37 (74%)	969 (79.16%)
Penetrating injury	13 (26%)	255 (20.83%)
Total	**50 (100%)**	**1224 (100%)**

Table 4: Mode of injury.

Mode of injury	Present study (%) (n=50)	Smith J et al[10] (n=1224)
Road traffic accident	24 (48%)	742 (60.62%)
Railway accidents	01 (02%)	-
Fall	16 (32%)	85 (6.94%)
Assault/stab injury	09 (18%)	201 (16.42%)
Assault/firearm injury	00 (00)	40 (3.26%)

In present study road traffic accidents accounted for 24 (48%) patients while fall accounted for 16 (32%) patients and stab injury accounted for 09 (18%) patients.

Study of Smith J et al showed 742 (60.62%) RTA, 85 (6.94%) falls and 40 (03.26%) stab injury.[10]

Due to rapid and unprecedented motorisation combined with the safety environment, RTA is more common day by day so it is the more common mode of injury in my study.

Table 5: Clinical presentation.

Presentation	Present study (%) (n=50)	Siddique et al[11] (n=50)
Abdominal pain	49 (98%)	46 (92%)
Abdominal distension	25 (50%)	14 (28%)
Vomiting	06 (12%)	11 (22%)
Hypotension (sys BP ≤100)	20 (40%)	20 (40%)
Tachycardia (pulse >90)	40 (80%)	24 (48%)
Haematuria	05 (10%)	02 (04%)
LOC	09 (18%)	02 (04%)
Bleeding	09 (18%)	14 (28%)
Breathlessness	17 (34%)	04 (08%)
Chest pain	17 (34%)	-
Evisceration of bowel	01 (02%)	03 (06%)
Evisceration of omentum	03 (06%)	07 (14%)

In my study 49 (98%) patients presented with abdominal pain and 25 (50%) patients presented with abdominal distension, 20 (40%) patients were in hypotension and 40 (80%) patients had tachycardia at the time of presentation. 17 (34%) patients had associated chest pain and breathlessness while 9 (18%) patients had history of unconsciousness and bleeding from external injuries.

Siddique et al observed abdominal pain in 92% (n = 46) and distension in 28% (n = 14) while tachycardia and hypotension were present in 48% (n = 24) and 40% (n = 20) respectively.[11]

When patient presents with abdominal pain with features of shock (tachycardia, hypotension), it should arouse the suspicion of intra-abdominal bleeding and immediate evaluation and treatment should be started. Hematuria in a patient with abdominal trauma suggests injury to kidney, ureter, bladder or urethra and should be managed accordingly. In a trauma patient with the complain of chest pain and breathlessness thorough evaluation should be done to rule out thoracic injury. Vomiting or history of LOC are indicators of probable head injury in the patient of trauma and should be managed accordingly.

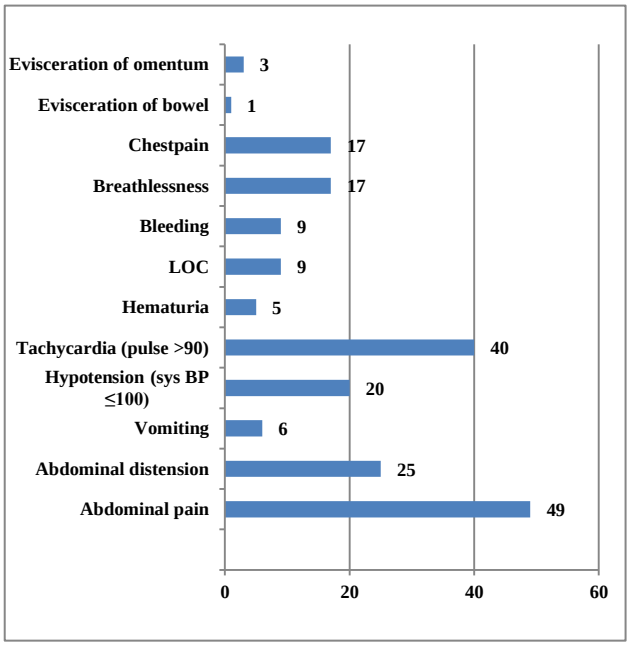

Figure 2: Clinical presentation.

Table 6: Organ involvement of single or multiple organ injury.

Organ involved	Present study N = (80)	Ayoade BA et al[12] (n = 77)	Ong CL et al[13] (n = 54)
Single organ injury	33 (66%)	55 (71.4%)	-
Multiple organ injury	15 (30%)	18 (23.3%)	10.5%
No organ injury	02 (8%)	04 (5.2%)	-

Table 7: Specific organ injury.

Organ involved	Present study (%) (n=50)			Smith J et al (n=1224)[10]	Davis J et al[8] (n=437)
	Blunt injury (n = 37)	Penetrating injury (n = 13)	Total (n = 50)		
Liver	13 (35.13%)	03 (23.07%)	16 (32%)	210 (17.50%)	72 (16.47%)
Spleen	15 (40.54%)	00 (00)	15 (30%)	195 (15.93%)	108 (24.71%)
Kidney	05 (13.51%)	00 (00)	05 (10%)	144 (11.76%)	30 (6.86%)
Pancreas	02 (05.40%)	00 (00)	02 (08%)	40 (3.26%)	08 (1.83%)
Stomach	00 (00)	01 (7.69%)	01 (04%)	23 (1.87%)	06 (1.37%)
Duodenum	00 (00)	00 (00)	00 (00)		07 (1.60%)
Small bowel (jejunum and ileum)	09 (24.32%)	03 (23.07%)	12 (24%)	160 (13.07%)	34 (7.78%)
Colon	00 (00)	00 (00)	00 (00)	104 (08.74%)	20 (4.57%)
Rectum	00 (00)	00 (00)	00 (00)	-	-
Ureter	00 (00)	00 (00)	00 (00)		-
Bladder	01 (2.70%)	00 (00)	01 (02%)	48 (03.92%)	-
Uterus	00 (00)	00 (00)	00 (00)		-
Diaphragm	00 (00)	03 (23.07%)	03 (06%)	-	06 (1.37%)
Retroperitoneum	11 (29.72%)	03 (23.97%)	14(28%)	59 (04.82%)	-
Gallbladder	00 (00)	01 (7.69%)	01 (02%)	04 (00.32%)	06 (1.37%)
Vascular injury	01 (2.70%)	00 (00)	01(02%)	168 (13.72%)	-

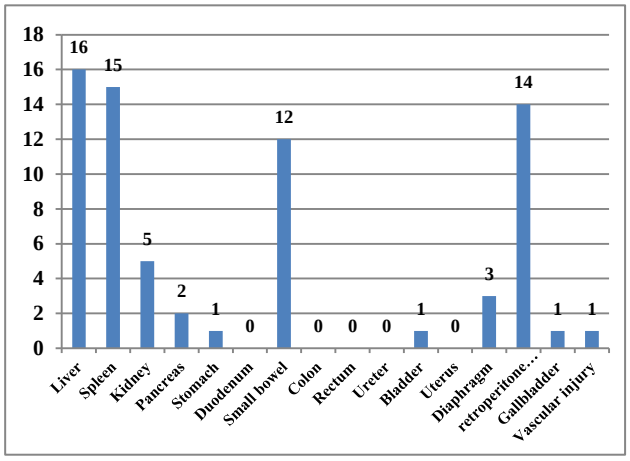

Figure 3: Specific organ injury.

In my study isolated organ injury is found in 66 % (n = 33) patients while 30% (n = 15) patients had multiple intra-abdominal organ injury and 8% (n = 02) had no organ injury.

Ayoade BA et al Observed 71.4% (n = 55) single organ injury including retroperitoneal hematoma and 23.3% (n = 18) patients had multiple organ injury and 5.2% (n = 4) showed no organ injury.[12]

In present study commonly involved organs are liver (16 patients, 32%) followed by spleen (15 patients, 30%), small bowel (12 patients, 24%) and retro-peritoneum (14 patients, 28 %).

In study of Smith J et al liver (210 patients, 17.15%) and spleen (195 patients, 15.93%) were commonly affected organs followed by vascular injury (168 patients, 13.72%) and small bowel (160 patients, 13.07%).[10]

Spleen and liver are the commonly involved due to their anatomical location and relative immobility. Their sub-diaphragmatic and subcostal location makes them more liable to injury due to compression or puncture by thoracic cage or broken rib during blunt trauma. Intestinal perforations are also common due to compression injury between vertebral column and injuring object.

Table 8: Associated injury.

Associated injury	Present study (%) (n=50)	Ayoade BA et al[12] (n=77)	Davis J et al[8] (n=437)
Thoracic	19 (38%)	06 (7.8%)	120 (27%)
Neurological (head injury)	4 (08%)	02 (2.6%)	41 (9.38)
Pelvic fracture	06 (12%)	14 (18.2%)	15 (03%)
Extremity fracture	08 (16%)	10 (18.2%)	51 (11%)
Spine fracture	03 (06%)	-	03 (0.68%)
Nil	23 (46%)	-	-

In a study by Davis J et al thoracic injury was associated with 27% (n = 120) abdominal trauma while orthopaedic injuries were associated with 14.68% (n = 69) cases of abdominal trauma.[8]

Isolated abdominal trauma without any other systemic trauma is found in 46% (n = 23) patients. I have observed that thoracic injury is associated with as much as 38% (n = 19) patients so it should be kept in mind that every abdominal trauma patient should be thoroughly evaluate for thoracic trauma whether there is any overt sign of thoracic trauma is present or not.

Orthopedic injury is also very common (n = 17.34%) so proper evaluation of each patient of abdominal trauma should be done to rule out any fracture or dislocation.

DISCUSSION

The abdominal trauma is more common in age group 21-40 years (n = 30, 60%) with male predominance (M:F:7.3:1) as they are economically productive and more liable to sustain injuries.

Blunt injury abdomen (n = 37, 74%) is more common than penetrating injury (n = 13, 26%) with RTA (n = 24, 48%) being the most common cause followed by fall (n = 16, 32%) and stab injury (n = 09, 18%).

Abdominal pain (n = 49, 98%), tachycardia (n = 40, 80%) and abdominal distension (n = 25, 50%) is the most common clinical feature in all abdominal trauma patients. Presence of these signs and symptoms warrants immediate attention (prompt primary resuscitation and timely definitive treatment) in abdominal trauma.

In my study following were the pattern of injury: liver (n = 16, 32%), spleen (n = 15, 30%) and small bowel (n = 9, 24.32%).

In polytrauma patients abdominal trauma is more commonly associated with thoracic injuries (n = 19, 38%) and orthopedic injuries (n = 7, 34%).

CONCLUSION

From our study we can conclude abdominal trauma can present differently and may injure organ depending upon pattern of injury and require clinical assessment, expedite investigations to set goal for prompt primary resuscitation and timely definitive treatment.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

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Cite this article as: Panchal HA, Ramanuj AM. The study of abdominal trauma: patterns of injury, clinical presentation, organ involvement and associated injury. Int Surg J 2016;3:1392-8.