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Research Article

The study of abdominal trauma: non operative and operative intervention and their outcome

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ABSTRACT

Background: The aim was to study the cases of abdominal trauma in context of surgical intervention and criteria for non-operative and operative management, post-operative morbidity, mortality and final outcome.
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, 4 (8%) patients had undergone conservative management while 46 (92%) patients were managed by operative intervention. Amongst the surgical procedures drainage of haemoperitoneum and haemostasis (n = 20, 43.47%) is commonly done procedure for abdominal trauma involving solid organs especially liver. However some splenic injury may warrant removal of spleen (n = 10, 21.79%). In small bowel perforation primary repair (n = 8, 17.39%) is the choice of procedure however resection anastomosis (n = 4, 08.69%) is necessary if multiple perforations are present in small segment. Post-operative recovery in this study was generally good with rate of complication as 8% (n = 4) and most of the complications were wound related (n = 04, 08%). we have observed mortality rate of 8% (n = 04) and persistent shock and haemorrhage (n = 3, 75%) is the most common cause of death in our study. The reason was extensive polytrauma involving massive injuries of spleen, liver, pancreas and kidney associated with thoracic injuries, orthopaedic injuries and cranio-cerebral injuries. The average hospital stay in our study was 9.26 days. Out of 50 abdominal trauma patients 46 (92%) has survived and shown good prognosis on follow ups. These data suggests that good outcome can be achieved if proper evaluation done and timely definitive treatment is given to the trauma victims.
Conclusions: From our study we can conclude that for "optimum outcome" of abdominal trauma through timely definitive treatment is of prime importance. Establishment of dedicated and efficient trauma care system is mandatory to achieve these goals in abdominal trauma management.

Keywords: Surgical intervention, Patients

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]

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) 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 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 who were so severely injured that they did not survive
- Patients with minor injuries and patients admitted with suspicion for major organ injury but found to have no major intra-abdominal injury
- Patients who have taken discharged against medical advice and lost to follow ups.

Patients are classified according to management in two groups: conservative and surgical management as per criteria discussed in the management portion.

Standardized operative approach was followed and specific organ injury managed. A detailed analysis was done and various observations were derived, discussed and concluded.

After enrollment in our study, various clinical examinations, trauma assessment done and various survey done as per requirement and management in term of investigating, imaging and operating or non-operating plan set as follows.

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
- 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

Thorough systemic examination is done to rule out any other associated systemic injury apart from abdominal injury.

Initial evaluation and resuscitation

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

Primary survey[1,6]

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.

Tertiary survey[1,6]

The third echelons 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
- Drug and alcohol screen

Radiological investigation[1,4,7]

- 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.

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Ultrasound[3,5]

To see intraperitoneal and retroperitoneal collection of fluid, solid organ injury with surrounding hematoma.

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. 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.

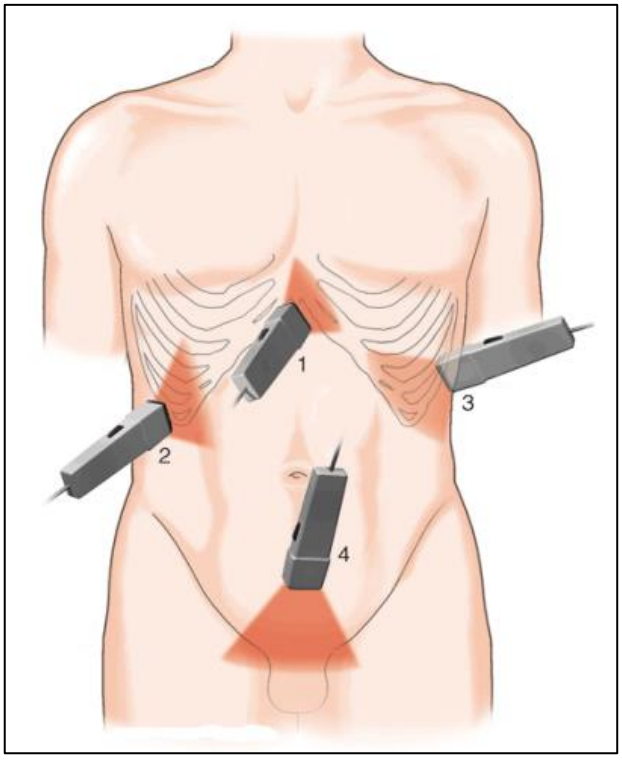

Figure 1: Fast (focused assessment for sonography in trauma).

It is positive if

- 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.

We have managed patient after proper resuscitation and clinical surveillance as follow and operative and non-operative plan kept on algorithm.

The optimal management for abdominal trauma remains controversial. The universally accepted practice is now selective management of abdominal trauma. Selective management of the patient depends on the hemodynamic status of the patient. The diagnostic and management approach to penetrating and blunt abdominal trauma differs substantially.[4,5]

Management of blunt abdominal injury[5]

Management of blunt abdominal trauma depends upon the hemodynamic stability of the patient and underlying organ injury.

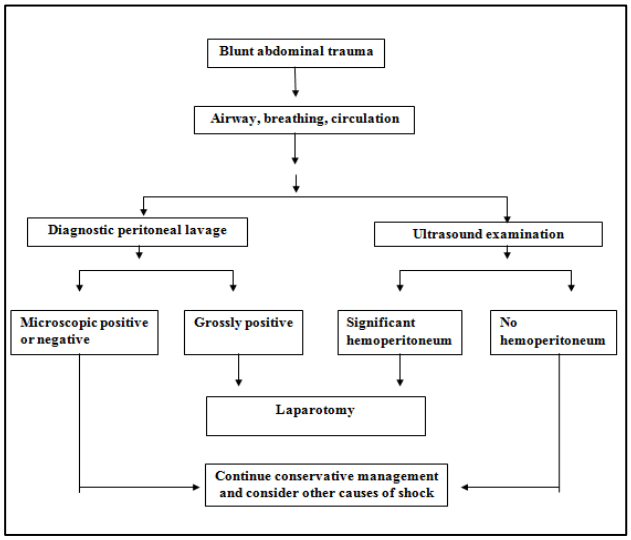

Figure 2: Management of blunt abdominal trauma in hemodynemically unstable patient.[5]

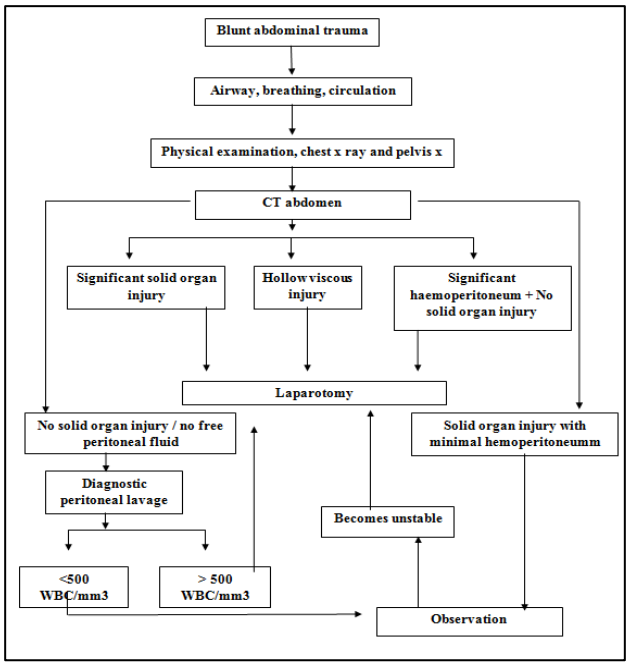

Figure 3: Management of blunt abdominal trauma in hemodynemically stable patient.[5]

Management of penetrating abdominal trauma[1]

Penetrating abdominal trauma is usually caused by a gunshot wound (GSW) or stab wound.

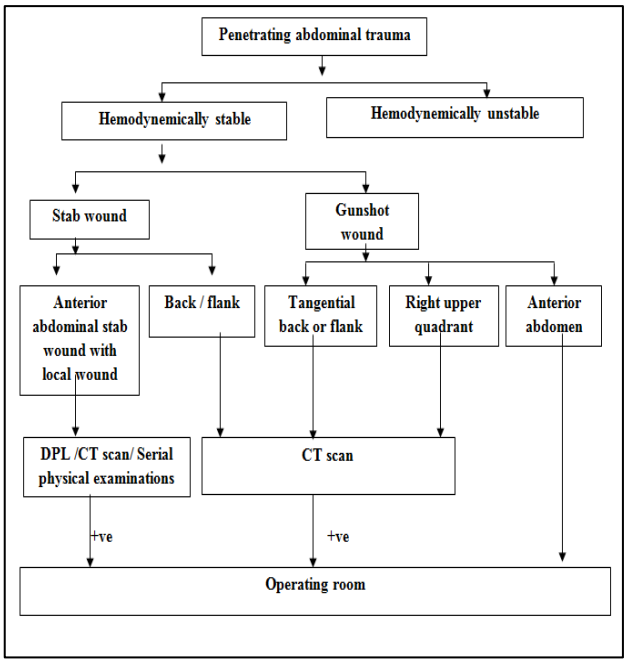

Figure 4: Penetrating abdominal trauma management.

Conservative management[1,4,5]

Prompt resuscitation with continuous monitoring is the key component for conservative management for abdominal trauma.

Serial physical examination (SPE)

The patient closely observed for 24 hours. During this time the patients checked regularly for hemodynamic status. The abdomen is examined routinely for signs of developing peritonitis. A suggested sequence of examination might be at 1, 4, 12 and 24 hours after the initial assessment.

SPE follow up

If the patient develops signs of hemodynamic instability or peritonitis during this period of observation, a laparotomy is performed.

Operative management[4,7]

If patient is haemodynemically unstable with overt signs of peritonitis or massive haemoperitoneum then immediate midline laparotomy should be performed after adequate initial resuscitation primary importance is damage control surgery.

Systematic exploration

Systematically explore the entire abdomen, giving priority to areas of ongoing hemorrhage to definitively control bleeding.

Solid organs such as liver and spleen are assessed for any ongoing hemorrhage, laceration or contusion.

The enteric viscera are then examined in an orderly fashion. The anterior aspect of stomach is inspected from the GE junction down to pylorus. The posterior aspect of stomach is examined by opening the gastrocolic omentum.

If the pancreatic-duodenal injury is suspected then kocher's maneuver done. The duodenojejunal junction is inspected and the intestine is inspected up to the ileocecal junction

Next the colon is examined from cecum to rectum. Once the peritoneal survey is complete, the retro peritoneum is inspected for potential injuries.

Abdominal closure

After abdominal tube drain kept abdomen is closed in monolayer with non-absorbable suture. Leave skin open with delayed secondary closure if there is contamination, or closed with non-absorbable suture. Dressings kept and close monitoring done and observed.

RESULTS

Table 1: Mode of management.

Mode of management	Present study (%) (n = 50)	Smith J et al[10] (n = 1224)	Costa G et al[13] (n = 79)
Conservative	04 (08%)	788 (64%)	38 (48.1%)
Operative	46 (92%)	436 (36%)	41 (51.9%)
Total	**50 (100%)**	**1224 (100%)**	**79 (100%)**

In my study 04 (08%) patients were treated conservatively and rest 46 (92%) patients were treated with operative management.

In Smith J et al study 64% patients were treated conservatively and in Costa G et al study 48.20% patients were treated by conservative management.[10,13]

Contrary to these studies we treated fewer patients conservatively. We have considered emergency laparotomy on the basis of clinical and radiological findings. Because of small sample size and absolute indications for laparotomy this contradiction is observed.

Table 2: Indications for laparotomy.

Indication	Present study (n = 50)	Ong CL et al[12] (n = 54)
Clinical	15 (32.67%)	07 (36.8%)
Plain X-ray	05 (10.86%)	02 (10.5%)
Clinical+USG	14 (30.43%)	-
Clinical+CT scan	12 (26.08%)	03 (15.8 %)

In present study operative management is done in 46 (92%) patients.

In 15 (32.67%) patients clinical assessment was the basis for operative patients.

Patients (n = 5, 10.86%) showing free gas under diaphragm in plain x-rays were straight forward considered for laparotomy and 14 (30.43%) patients were managed by laparotomy on the basis of USG findings along with the continuous clinical assessment.

In present study laparotomy was contemplated on the basis of CT scan and clinical assessment in 12 (26.08%) patients.

In the study by Ong CL et al basis for operative intervention were clinical assessment in 36.8% (n = 7) patients, plain X ray for 10.5% (n = 2) patients and CT scan in 15.8% (n = 3) patients which is quiet comparable with my study.[12]

Table 3: Surgical procedure.

Surgical procedure	Present study (%) (n = 46)	Costa G et al[13] (n = 41)
Drainage of hemoperitoneum and hemostasis	20 (43.47%)	16 (38.9%)
Splenectomy	10 (21.79%)	21 (51.2%)
Primary closure of small bowel or stomach perforation	08 (17.39%)	06 (14.5%)
Resection anastomosis of bowel	04 (08.69%)	03 (7.3%)
Diaphragm repair	03 (06.52%)	00 (00)
Cholecystectomy	01 (02.17%)	00 (00)
Bladder repair	01 (02.17%)	00 (00)
Hepatorrhaphy	01 (02.17%)	00 (00)
Intrabdominal packing	01 (02.17%)	02 (4.8%)
Nephrectomy	00 (00)	04 (9.7%)

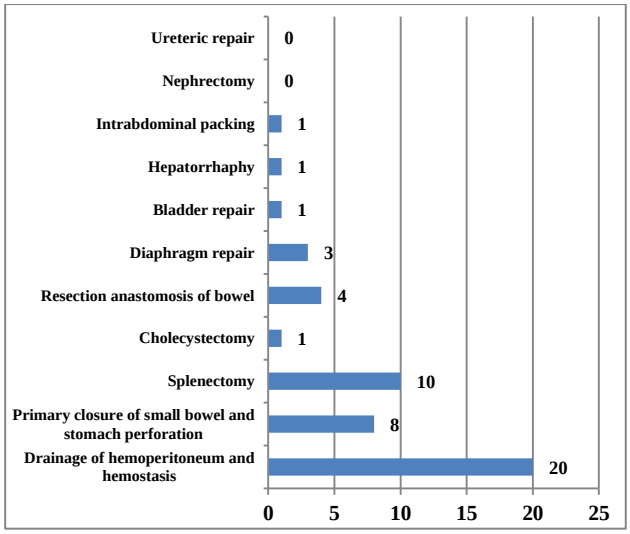

Figure 5: Surgical procedure wise distribution.

In this study 20 (43.47%) patients had undergone laparotomy with drainage of haemoperitoneum with hemostasis of culprit organ. It is followed by procedures for the stomach or bowel perforations (n = 12, 26.08%). Primary repair for the perforations was done in 8 (17.39%) patients and resection anastomosis of affected segment is done in 4 (08.69%) patients, splenectomy was performed in 10 (21.79%) patients.

Costa G et al observed emergency laparotomy and hemostasis in 16 (38.9%) patients, splenectomy in 21 (51.2%) patients and primary closure of perforations in 6 (14.5%) patients. These are comparable with my results.[13]

Table 4: Complications.

Complications	Present study (%) (n = 50)	Davis JJ et al[8] (n = 437)
wound related complications (SSI)	04 (08%)	23 (09%)
Fecal fistula and other intra-abdominal complications	01 (02%)	75 (17%)
Cardiovascular-pulmonary	01 (02%)	126 (29%)
Haemorrhage	01 (02%)	-
Urinary tract	00 (00%)	22 (05%)
Total	**07 (14%)**	

I have observed that 07 (14%) patients have developed complications rate.

Among which SSI is the Most common (n = 04, 08%) complication, which was managed by daily dressing and secondary suturing. Davis JJ et al observed 46% complication rate in which cardiovascular and pulmonary complication occurred in 29% and wound related complications were 9% which is comparable to present study.[8]

Musau P et al observed 12.5% complication rate.[9] Ayoade BA et al observed that wound infection was the most common complication in their study.

Table 5: Mortality rate.

Total no. of deaths	Total no. of patients	Mortality rate of present study	Musau P et al[9]	Davis JJ et al[8]	Ayoade BA et al[11]
04	50	08%	12.5%	13.3%	13%

Mortality rate i have observed in this study is 8% (n = 4). Mortality rate in Musau P et al, Davis JJ et al and Ayoade BA et al is 12.5%, 13.3% and 13% respectively.[8,9,11] Mortality rate of present study is comparable with the results of other study.

Table 6: Cause of death.

Cause of death	Present study	Mohmmed AA et al[14]
Shock and haemorrhage	03 (75%)	10 (27.8%)
ARDS	00 (00)	10 (27.8%)
Neurological injury and shock	01 (25%)s	8 (22.2%)
Total	**4 (8%) out of 50**	**36 (38.29%) out of 94**

In present study shock and haemorrhage is found to be most common cause of death (n = 3, 75%). Overall mortality in the study is 8% (n = 4).

In my study three patients died of irreversible shock and persistent haemorrhage, amongst which one patient also had associated head injury. The fourth patient had neurological trauma (SDH and SAH) and persistent shock. In a study by Mohhmmed AA et al hemorrhagic shock (n = 10, 27.8%) and ARDS (n = 10, 27.8%) was found to be most common cause of death followed by head trauma (n = 8, 22.2%).[14]

Table 7: Hospital stay.

Hospital stay	Present study (n=50)	Musau P et al[9] (n=70)
≤ 5 days	08 (16%)	32 (45.71%)
6-10 days	26 (52%)	30 (42.85%)
11-15 days	13 (26%)	05 (07.14%)
≥ 16 days	03 (06%)	03 (04.28%)

In present study 34 (68%) patients of abdominal trauma are discharged within 10 days. I have observed average hospitalisation period of 9.26 days. Hospitalisation ranged from 01 day to 46 days. The shortest hospitalisation in the survived patient is 04 days. The longest hospitalisation is 46 days. Musau P et al observed

6.4 days of average hospitalisation period and 62 (88.57%) patients were discharged within 10 days.[9]

Table 8: Outcome

Outcome	Present study	Davis JJ et al[8]	Ayoade BA et al[11]	Musau P et al[9]
Survival	46 (92%)	379 (86.7%)	67 (87%)	70 (87.5%)
Death	04 (08%)	58 (13.3%)	10 (13%)	10 (12.5%)
Total	**50 (100%)**	**437 (100%)**	**77 (100)**	**80 (100%)**

Mortality rate and discharged rate in Davis JJ et al was 13.3% (n = 58) and 86.7% (n = 379) respectively.[8] In Ayoade et al study it was 13% (n = 10) and 87% (n = 67) respectively.[11] In Masau P et al study it was 12.5% (n = 10) and 87.5% (n=70) respectively.[9] These are comparable with the present study.

In present study it is observed that if prompt primary resuscitation and timely definitive treatment is given to the abdominal trauma patients, favorable outcomes can be achieved. In this study mortality rate of 8% and morbidity rate in terms of complication rate is 14%, which is comparable with the other studies as described above.

DISCUSSION

The decision for operative intervention was taken on the basis of clinical assessment and radiological modalities such as plain x-rays, USG and CT scan. In my study 4 (8%) patients had undergone conservative management while 46 (92%) patients were managed by operative intervention.

Amongst the surgical procedures drainage of hemoperitoneum and hemostasis (n = 20, 43.47%) is commonly done procedure for abdominal trauma involving solid organs especially liver. However some splenic injury may warrant removal of spleen (n = 10, 21.79%). In small bowel perforation primary repair (n = 8, 17.39%) is the choice of procedure however resection anastomosis (n = 4, 08.69%) is necessary if multiple perforations are present in small segment.

Post-operative recovery in this study was generally good with rate of complication as 8% (n = 4) and most of the complications were wound related (n = 04, 08%) which can be reduced by minimizing the intra-operative contamination and use of antibiotics. We have observed mortality rate of 08% (n = 04) and Persistent shock and hemorrhage (n = 3, 75%) is the most common cause of death in my study. The average hospital stay in my study is 9.26 days.

Out of 50 abdominal trauma patients 46 (92%) has survived and shown good prognosis on follow ups. These data suggests that good outcome can be achieved if proper evaluation done and timely definitive treatment is given to the trauma victims.

CONCLUSION

From our study we can conclude that for "optimum outcome" of abdominal trauma thorough timely definitive treatment is of prime importance. Establishment of dedicated and efficient trauma care system is mandatory to achieve these goals in abdominal trauma management.

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