

A Study of Penetrating Injuries of Abdomen

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Abstract

Introduction: Major trauma does not respect and restrict itself to one organ or one system. Evaluation of a patient with abdominal trauma can be a most challenging task that a surgeon may be called on to deal with. Abdominal injuries may be parietal or visceral injuries. Visceral injuries may be intraperitoneal or retroperitoneal.

Aim: The aim of this study is to evaluate the various aspects of penetrating abdominal injuries excluding pelvic organs.

Materials and Methods: This study consists of all penetrating abdominal injuries admitted in the trauma ward of Mahatma Gandhi Memorial Hospital, from March 2015 to November 2016.

Results: A total of 2 stab injuries were the common penetrating trauma accounting for 67.5%. There were 10 cases of bull gore injury, 2 cases of gunshot, one case of road traffic accident, and one case of penetrating injury due to falling on to iron rods in a concrete centering work site. In this study, stab injury is the common mode of producing penetrating abdominal injuries. Liver, small bowel, and spleen are the three most frequently injured organs.

Conclusion: There was no appreciable delay in the management of majority of the patients because of the penetrating nature of injuries. Pancreatic and ureteric injuries had delayed presentations in this study.

Key words: Management, Morbidity, Penetrating injuries

INTRODUCTION

Trauma ranks along with atherosclerotic arterial diseases and malignancy as a major cause of morbidity and mortality. Injury continues to be the leading cause of death in the first four decades of life.^[1] High-speed vehicles, decivilization of human race, terrorism, and sports are just few of the predisposing factors of trauma. Major trauma does not respect and restrict itself to one organ or one system. Evaluation of a patient with abdominal trauma can be a most challenging task that a surgeon may be called on to deal with. Abdominal injuries may be parietal or visceral injuries. Visceral injuries may be intraperitoneal or retroperitoneal. The retroperitoneal structures enjoy the safety produced by the depth of domicile but nevertheless suffer from

the ominous potential for delayed presentations.^[2] Liver, spleen, stomach, small bowel, duodenum, large bowel, pancreas, kidney, ureter, and the retroperitoneal vascular are the organs included in this study and the pelvic organs are excluded. Multiorgan injuries, exsanguinating hemorrhages delayed presentations, and the ominous reputation for high mortality and morbidity are just few of the many reasons which make this topic of penetrating injuries a fascinating one.^[3] Although there is no debate that patients with peritonitis or hemodynamic instability should undergo urgent laparotomy (LAP) after penetrating injury to the abdomen, it is also clear that certain stable patients without peritonitis may be managed without operation. The practice of deciding which patients may not need surgery after penetrating abdominal wounds has been termed selective management. This practice has been readily accepted over the past few decades with regard to abdominal stab wounds, yet controversy persists regarding gunshot wounds.^[4] Indications for immediate LAP include hemodynamic instability, evisceration, peritonitis, or impalement. Selective non-operative management of stable, asymptomatic patients has been demonstrated to be safe. Adjunctive diagnostic testing-ultrasonography,

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www.ijss-sn.com

Month of Submission : 11-2017
Month of Peer Review : 12-2017
Month of Acceptance : 12-2017
Month of Publishing : 01-2018

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computed tomography, local wound exploration, diagnostic peritoneal lavage, and laparoscopy are often used in an attempt to identify significant injuries requiring operative management. However, prospective studies indicate that these tests frequently lead to non-therapeutic LAP and are not cost-effective.^[5]

Aim

The aim of the study is to evaluate the following aspects of penetrating abdominal injuries excluding pelvic organs.

MATERIALS AND METHODS

This study consists of all penetrating abdominal injuries admitted in the trauma ward of Mahatma Gandhi Memorial Hospital. Once the patient is admitted, the name, age, sex, and mode of injury are noted. The time interval between injury and admission and time interval between admission and surgery are recorded. After resuscitating the patients and if time permits, necessary investigations are carried out. In those who are operated, the operative findings and methods of management are recorded. Cases are followed up till their discharge from the hospital. If death occurs, the cause of death is evaluated. In those patients who died before surgery, the post-mortem findings are noted. The above facts are recorded in a pro forma prepared for this study.

RESULTS

The total number of patients who had sustained penetrating injuries to abdominal organs was 40. During this period, a total number of cases of abdominal trauma managed were 131. Thus, penetrating injuries to abdominal organs account for 30.53% of the abdominal trauma cases. In this study of the 40 patients, 33 were male and 7 cases were females. This gives a male-to-female ratio of 4.7:1. The high incidence of trauma in males may probably be due to the relatively high association of males in acts of violence and vehicular accidents.

Table 1 presents the age and sex incidence in this study. The youngest patient was an 11-year-old boy who had

sustained penetrating injuries by stabbing by his blood relative? Psychic. More than 50% of the patients belong to the age group between 21 and 40 years which is the most productive part of one's life. The oldest patient was an 80-year-old female who had sustained penetrating injuries by bull gore.

As given in Table 2, stab injury is the common penetrating trauma accounting for 67.5%. There were 10 cases of bull gore injury, 2 cases of gunshot, 1 case of road traffic accident, and one case of penetrating injury due to falling on to iron rods in a concrete centering work site.

Table 3 presents the associated injuries in penetrating injuries of the abdomen. Ten patients sustained associated thoracic injuries. Seven patients had long bone fractures. Six patients suffered from head injury and one patient sustained cut throat injury. A total of 24 patients had injuries involving other organs. This high incidence of polytrauma with penetrating injuries abdomen indicates the severity of injuries.

Admission and surgery are given in Table 4.

From the Table 4, it can be deduced that 32 cases took <6 h from the time of injury to admission. The fastest to arrive was within 30 min from the injury. The average time duration between admission and surgery was 4 h.

Table 5 presents the different organs injured in the study. Liver injury tops the list with 9 cases. This is followed by small bowel and spleen, accounting for 8 and 6 cases each. There were 5 cases of stomach and 4 cases of colonic injuries. There were 3 cases of duodenal injuries, 3 cases of retroperitoneal hematomas, and one case of ureteric injuries. There were 2 cases of kidney, 2 cases of pancreatic injuries, and also 3 cases of diaphragmatic injuries.

DISCUSSION

Liver Injuries

There were totally 9 cases of liver injury. In this, 7 cases were due to stab injury and 2 cases were due to bull gore. The most common cause of penetrating liver injury in 75 consecutive cases in a study done by Krige *et al.* was gunshot wounds accounting for 50.60% and stab injuries accounting for 33.90%.^[3,6] The incidence of associated organ injuries is a significant factor in patients sustaining liver injuries. In this study, only 2 cases were isolated liver injuries and remaining was associated with other organ injuries. The different ways in which the 9 cases of liver injuries were managed are as follows. Application of gel foam and suture hepatorrhaphy was done in 5 cases. In 2 cases, there was

Table 1: Age and sex incidence

Age group	Male	Female	Total
<10	Nil	Nil	Nil
11–20	5	Nil	5
21–30	11	2	13
31–40	8	1	9
41–50	4	2	6
51–60	4	1	5
>60	1	1	2
Total	33	7	40

no active bleeding, and hence, no repair was done. In other 2 cases, omental pack was kept in deep lobar laceration to control bleeding. Peritoneal lavage with normal saline was done in all cases and open drainage was kept in all cases.

In this study, 2 of the 9 cases died, giving a mortality rate of 22.22%. Mortality in one case was due to the severe associated injuries and one died of septicemia at the end of the 4th post-operative day. Two cases developed subphrenic abscess. The mortality rate of 75 consecutive cases in a study done by Krige *et al.* was 10–15%.^[3] The incidence of post-operative perihepatic abscess ranges from 3.5 to 22%.^[6]

Splenic Injury

There were totally 6 cases of splenic injury. Of these 6 cases, 4 cases were due to stab injury and 2 cases were due to bull gore injury, whereas the series from the 75 consecutive cases in a study done by Krige *et al.* has reported an incidence of gunshot splenic injuries as 7.6% and stab injuries as 7% among penetrating splenic injuries.^[3]

In this study, only one case had isolated splenic injuries. Three cases were associated with diaphragmatic injuries, and one case had associated pancreatic injury with retroperitoneal hematoma. One case was associated with stomach and small bowel injury, and one case had associated with transverse colonic injury.

In this study, all the injured spleen have undergone splenectomy, whereas the series from 75 consecutive cases in a study done by Krige *et al.* report 45–50% of injured spleen have undergone repair instead of splenectomy that too splenorrhaphy was accomplished in 51% of patients with a penetrating mechanism of injury. However, in only 36.7% with a blunt mechanism of injury would be expected to undergo splenorrhaphy.^[3,7] The grading of the splenic injury has a significant impact on treatment. In our study,

Table 2: Penetrating injuries: Abdomen

Stab injury	26
Bull gore	10
Gunshot	2
RTA	1
Others	1
Total	40

RTA: Road traffic accident

Table 3: Injury of the other organs

Thoracic injuries	10
Long bone injuries	7
Head injuries	6
Others	1
Total	24

of 6 patients, 3 patients were hemodynamically unstable and had associated intra-abdominal injuries, so we could not perform splenorrhaphy for these patients.

In this study, two cases had died in the immediate post-operative period due to hypovolemic shock and multiple organ failure.

Stomach Injuries

There were totally 5 cases of stomach injuries. In this, three cases were due to stab injuries, one case was due to bull gore injuries, and one case was due to accidental gunshot injury, whereas the series from 75 consecutive cases in a study done by Krige *et al.* reported an incidence of gunshot stomach injuries as 17.3% and stab stomach injuries as 12.6%.^[3,6]

In this study, isolated stomach injury was present in only two cases. All remaining cases were associated with other organ injuries. Of which, retroperitoneal hematoma was present in 3 cases, liver injury in 2 cases, splenic injury in 1 case, duodenal injury in 1 case and diaphragmatic, and small bowel injury in one case. In one patient after gastrorrhaphy, AGJ and JJ were done. That patient died on 4th post-operative day due to burst abdomen and septicemia. One more patient died of septicemia due to concomitant colonic injury. One patient developed consolidation of left lower lobe with left subphrenic abscess and two patients had wound infection post-operatively both of them were treated conservatively. The incidence of intra-abdominal abscess in patients with penetrating wounds of the stomach

Table 4: The analysis of the time interval between injury and surgery

Time interval (h)	Injury - admission	Admission - surgery
<2	15	10
2–4	10	15
4–6	7	7
6–8	3	1
8–10	2	1
10–12	2	2
>12	1	4

Table 5: Different structures affected

Liver	9
Small bowel	8
Spleen	6
Stomach	5
Duodenum	3
Colon	4
kidney	2
Ureter	1
Pancreas	2
Retroperitoneal injuries	3
Diaphragm	3

was 5–10 percent in the series of 75 consecutive cases in a study done by Krige *et al.*,^[3] which is in accordance with our study also.

Duodenal Injuries

There were totally 3 cases of duodenal injuries, of which two cases were due to stab injury and one case of bull gore injury. Whereas, Ivaturary *et al.* 1985^[8] and Levinson *et al.*^[9] give the following figures, gunshot (78%), stab injuries (16%), and shotgun (6%).

All patients were taken up for exploratory LAP. All patients underwent duodenorrhaphy in two layers. One patient underwent a gastrojejunostomy; in two patients, a serosal jejunal patch was kept. Como *et al.*^[4] also state that 80% of patients with duodenal injuries require simple duodenorrhaphy. Synder *et al.*^[10] could find no difference in the morbidity of simple closure with or without tube decompression. Levison *et al.*^[9] in a recent series report a mortality of 16.7% for blunt duodenal trauma and a mortality of 7.5% for penetrating duodenal trauma. The incidence of duodenal fistula in our study was 15% which is slightly more than that reported in other studies.^[8]

Pancreatic Injuries

There were totally two cases of pancreatic injuries. Of which, one case was due to stab injuries and one case was due to bull gore injury. Jurkovich *et al.*^[11] state that penetrating trauma accounts for two-third and blunt trauma accounts for one-third of pancreatic injuries. In this study, the mortality rate for pancreatic injury was 50%. The combined mortality from several large series of pancreatic trauma patients ranges from 10% to 25%. Our morbidity rate was 70%. In this study, the incidence of pancreatic fistula was 50% which healed with conservative management.

Small Bowel Injuries

There were totally 8 cases of small bowel injuries. Of which, 5 cases were due to stab injury, 2 cases were due to bull gore injury, and 1 case was due to accidental gunshot injury. Whereas, the incidence of small intestinal injury following penetrating trauma exceeds 80% with gunshot wound and 30% with stab injuries that penetrate the peritoneum.^[3,12] In this study, only three cases had isolated small bowel injury. In the remaining cases, two cases had associated mesenteric tears, one case was associated with colonic injuries, and other two cases were associated with liver, spleen, and stomach injuries separately. In one case with questionable viability of bowel, we have done resection and anastomoses in two-layers. In our study, two patients had wound infection and two had intra-abdominal abscess, both of them were treated with conservative management.

Colonic Injuries

There were totally 4 cases of colonic injuries, all the 4 cases were due to stab injuries. One patient was a diabetic who had sustained multiple stab injuries in the abdomen. There was injury to caecum, ascending colon, and ileum. The injuries were repaired and a tube cecostomy was done patient died on the 2nd day due to severe sepsis. One patient had injury to transverse colon, duodenum, and liver. All injuries were repaired and defunctioning colostomy was done, and patient expired on 4th post-operative day due to septicemia. One patient had injury at pelvirectal junction. Primary repair and pelvic colostomy were done. Remaining two patients had tear in transverse colon primary repair and defunctioning colostomy was done.

Renal Injuries

There were totally two cases of renal injuries. Both were due to stab injuries. Whereas, the most common cause of penetrating renal trauma in the Parkland memorial hospital study was gunshot wounds accounting for 79% and the remaining were due to stab injury.^[3]

The incidence of associated organ (non-renal) injuries is a significant factor in patients sustaining renal trauma. In this study, all penetrating renal trauma had associated organ injuries. Carlton^[13] reported an incidence of non-renal injuries of 81% in penetrating renal trauma. In one patient, the renal injury was made out only at autopsy because that patient sustained severe non-renal injury and succumbed mainly due to the severity of the associated non-renal injuries. In this study, one of the two patients died giving a mortality rate of 50%, due to the severe associated non-renal injuries.

Ureteric Injury

There was one case of ureter injury due to stab injury. In this case, the ureteric injury was made out at the initial LAP and hence repaired primarily after keeping a double “J” stent and drained the site of anastomosis externally. This type of management has also been recommended.^[14] In this study, there was no mortality in the ureteric injuries.

Retroperitoneal Hematoma

There were 3 cases of mild retroperitoneal hematoma which were associated with other injuries. Nothing specific was done for these hematomas. All patients had uneventful recovery.

Diaphragmatic Injuries

There were totally 3 cases of diaphragmatic injuries. Of which, 2 cases were due to stab injury and one case was due to bull gore injury. All cases were associated with intra-abdominal injuries, of which two cases were associated with splenic injuries, and one case was associated with combined

stomach and splenic injuries. In this study, after LAP only in one case, we had converted into thoracoabdominal incision, and in remaining cases, repair was done through abdominal approach only. The rent was closed with simple sutures with No. 1 silk or with other non-absorbable suture materials or with figure of eight sutures of the same material. In all cases, international classification of disease was done after closure.

Negative Celiotomies

In this study, there were 4 cases of negative celiotomies. Whereas, in Feliciano *et al.*^[6] and Shorr *et al.*^[12] series, the negative celiotomies were from 5.8% to 7.4%. In this study, after confirmation of peritoneal penetration by wound exploration, exploratory LAP was done in all cases. There was no viscus or vascular injury, and there was no missed injury in our study. All were discharged after an uneventful post-operative period.

Mortality and Morbidity

There were totally 6 deaths in this study of 40 cases, constituting a mortality rate of 13.7%. Morbidity in mild-to-severe forms occurred in all patients who survived. The severe degree of morbidity was occurred in the form of residual abscess, duodenal fistula, pancreatic fistula, post-operative lung infections, etc. The mild form of morbidity was due to wound infection. Feliciano^[6] and Krige *et al.*^[3] have reported in a series of 300 consecutive patients with penetrating abdominal injuries, an overall mortality rate of 15%. In our study, the mortality rate was 13.7% and it included only those patients arriving to the hospital alive. Hence, the pre-hospital mortality has been excluded and 13.7% mortality rate is comparable with literature.

CONCLUSION

Penetrating abdominal injuries constitute 30.53% of the abdominal injuries. In this study, stab injury is the common mode of producing penetrating abdominal injuries. Liver,

small bowel, and spleen are the three most frequently injured organs. There was no appreciable delay in the management of majority of the patients because of the penetrating nature of injuries. Pancreatic and ureteric injuries had delayed presentations in this study. Multiple organ injuries were the rule in retroperitoneal trauma. The overall mortality of penetrating abdominal injuries in this study was 13.7% and morbidity was 80%. Hypovolemic shock due to bleeding and sepsis was the major causes of death.

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How to cite this article: Rajendran G, Ramesh A, Anandan H. A Study of Penetrating Injuries of Abdomen. *Int J Sci Stud* 2017;5(10):105-109.
Source of Support: Nil, **Conflict of Interest:** None declared.