ORIGINAL ARTICLE

MANAGEMENT OF HEPATIC TRAUMA IN PATIENTS WITH ABDOMINAL FIREARM INJURIES

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ABSTRACT

Background: Firearm injuries to the abdomen are increasing in frequency worldwide. The objectives of this study were to evaluate the different ways of managing hepatic injuries due to firearm injuries and to make recommendations as to how various grades of hepatic trauma may be managed locally.

Material & Methods: It was a descriptive study conducted in Surgical B Ward Lady Reading Hospital Peshawar from July 2007 to January 2008. Sampling technique was convenient. After taking informed consent, all patients above 14 years age who presented to emergency department with firearm injury of abdomen, were included in this study. Patients with other types of abdominal injuries like stab and blunt trauma were excluded. The data was collected and analyzed.

Results: Out of 70 patients having firearm injury of abdomen, 20(28.57%) had hepatic trauma. Mean age of patients was 27.5+12.15 years and male to female ratio 3:1. Twelve (60%) patients were in state of shock. Right lobe was involved in 13(65%) and left lobe in 7(35%) patients. Eleven (55%) patients had Grade-I and II liver injuries, 5(25%) Grade III and 4(20%) Grade-IV liver injury. Operative procedures performed were hepatorraphy+spongeston application in 8(40%) patients and temporary perihepatic packing in 4(20%) patients. Complications occurred in 10(50%) patients.

Conclusion: Hepatic injury is common with abdominal firearm injury. Many of these patients get complications with a significant mortality. Conservative approach like perihepatic packing is the mainstay of treatment in Grade III and IV hepatic injuries.

KEY WORDS: Firearm injury abdomen, Hepatic trauma, Perihepatic packing.

INTRODUCTION

Firearm injuries to the abdomen are increasing in frequency.[1,2] Treatment of hemodynamically stable patients with penetrating injuries to the abdomen without overt peritonitis remains controversial. Proponents of mandatory laparotomy base their belief on assertion that intra-abdominal injury cannot be diagnosed short of abdominal exploration. Clinical examination is often unreliable in patients with serious injuries and non-therapeutic laparotomy is rarely associated with morbidity a delay in diagnosis of these injuries results in unacceptably high morbidity and mortality.[3]

Liver is the largest solid intra-abdominal organ. Despite its relatively protected location it is the most frequently injured intra-abdominal organ.[4] Liver injury may be caused by an accident, assault or an iatrogenic intervention. Very rarely rupture may occur spontaneously. In Europe and Australia majority of liver injuries are caused by blunt abdominal trauma. Road traffic accidents account for most of these injuries. In USA majority of liver injuries are caused by penetrating trauma.[5,6] The incidence of liver injury in penetrating abdominal trauma is 40% and 20-45% in blunt abdominal trauma.[7] There is 8-10 fold difference in mortality rates associated with gunshot wounds when compared to stab wounds. Penetrating injuries are usually associated with gunshot or stab wounds, with the former usually resulting in more tissue damage due to the cavitation effect as the bullet traverses the liver substance.[4]

The right lobe of the liver is more commonly injured than the left because of its larger size and less mobility.[8] In 80% of cases liver injury is associated with other injuries.[3,9]

In penetrating injuries, liver trauma can be suspected from the site of entry and exit wounds. Any penetrating gunshot or stab wound below the right nipple or in the right upper quadrant of abdomen is likely to cause injury to the liver.[10] The entry and exit wounds do not indicate the damage that may have occurred to deeper structures.[9,11] Every penetrating and perforating missile wound of the abdomen should be explored by laparotomy.[12-14] In a stable patient in whom liver injury is suspected, imaging studies should be performed.[15]

The objectives of this study were to evaluate the different ways of managing hepatictrauma due to firearm injuries and to make recommendations as to how various grades of hepatic trauma may be managed locally.

MATERIAL AND METHODS

It was a descriptive study of 70 patients having firearm injury abdomen, from July 2007 to January 2008, in Surgical B Ward Lady Reading Hospital Peshawar. The sampling technique was convenient. After taking an informed consent, all patients above 14 years of age, who came to emergency department with firearm injury of abdomen, were included in this study. All these patients were clinically evaluated and resuscitated in the emergency surgical ward, which is attached to emergency operation theatre. In this study we recorded hemodynamic status, site of injury, age, sex, clinical findings, associated intra and extra-abdominal injuries, therapeutic procedure, grade of liver injury and the outcome (postoperative complications, mortality and cause of death). In this series, liver trauma was diagnosed by surgical exploration. The grade of hepatic injury was established according to the liver injury scale of the American Association for the Surgery of Trauma (AAST). Grade III to V were regarded as severe liver trauma.

The decision regarding laparotomy was made based on physical examination, the condition of the patient, laboratory studies and plain x-ray films. Abdominal ultrasongraphy and CT scan were done in stable patients. Two wide bore intravenous lines were established and crystalloid and colloid solutions were infused. In most of the patients blood was also infused preoperatively. Nasogastric tube and urinary catheter were inserted accordingly. Broad-spectrum antibiotic (ceftri-axone 1 gm) were given at the time of admission. All patients with abdominal and thoraco-abdominal firearm wounds underwent urgent laparotomy. In some patients resuscitation had to be completed in the operating room after opening the abdomen and controlling the bleeding.

Abdomen was explored by long midline incision in all cases. Amount of blood in the peritoneal cavity was noted and evacuated by suction and then by abdominal packs. The surgeon's primary goal was to stop haemorrhage. Upon opening abdomen in complex hepatic trauma all four quadrants were packed and then anesthesiologist was asked to transfuse fluids. Almost all venous haemorrhage in the liver could be controlled temporarily with packs. Simple liver injuries not bleeding at the time of exploration were left alone and those bleeding were sutured with chromic catgut size 1. In patients with severe hepatic trauma (Grade III-V) different operative methods were used. These included haemostatic agent like spongeston application, extensive hepatorraphy and temporary perihepatic packing.

Proforma was used for data collection. The data was entered in to SPSS version 10. Descriptive statistics was used to calculate mean and standard deviations for age and stay in the hospital.

RESULTS

Total number of patients with abdominal firearm injury was 70. Out of these 61 (87%) were males and 9 (13%) females.

Liver was injured in 20 (28.57%) patients. Out of these 15 (75%) were males and 5 (25%) females, with a male to female ratio of 3:1.

Age of the patients ranged from 15 to 70 years with the mean age of 27.5+12.15. (Table 1)

Table 1: Age distribution of hepatic trauma patients.

Age in years	Number	Percentage
15-29	16	80
30-49	3	15
50-70	1	5

The hospital stay ranged from 1 to 21 days with the mean stay of 8.3+5.23 days. (Table 2)

Table 2: Hospital stay in hepatic trauma patients (n=20).

Days in hospital	Number	Percentage
1-5	5	25
6-10	10	50
11-15	3	15
>15	2	10

The type of abdominal injuries is depicted in Table 3.

Table 3: Types of abdominal firearm injuries.

Type of injury	Homicidal	Suicidal	Accidental
Total abdominal firearm injury Patients (n=70)	44 (63%)	9 (13%)	17 (24%)
Hepatic trauma patients (n=20)	12 (60%)	4 (20%)	4 (20%)

The sites of entry wound associated with liver injury, in decreasing order were epigastrium 6 (30%), right upper quadrant 5 (25%), right lower chest 4 (20%), left lower chest 3 (15%) and right lumbar region 2 (10%).

Fourteen (70%) patients of hepatic trauma were in a state of shock at the time of presentation. The remaining 6 (30%) patients were stable.

Pain was the most common symptom present in (100%) of patients. Abdominal tenderness and rigidity were most common signs present in (90%) of patients.

Liver injury was confirmed at laparotomy. Liver injuries were stratified according to AAST classification of hepatic injuries after direct observation at exploration. Eleven (55%) patients had simple liver injuries (Grade I & II), 5 (25%) had Grade III injuries and 4 (20%) had Grade IV injuries. (Table 4)

Table 4: Grade of hepatic injury in abdominal firearm injuries (n=20).

Grade of Injury	Number of Patients	Percentage
Grade-I	4	20
Grade-II	7	35
Grade-III	5	25
Grade-IV	4	20
Grade-V	0	0

Right lobe was involved in 14 (60%) and left lobe in 6 (30%) patients. The organs more commonly injured in association to liver are given in Table 5.

Concomitant intra-abdominal injuries required 17 patients to undergo additional procedures that included right nephrectomy (n=2), left nephrectomy (n=1), splenectomy (n=1), right hemicolectomy (n=3), splenic salvage (n=3), cholecystectomy (n=1), repaired diaphragm (n = 5),repaired duodenum (n=3), small gut (n =6), kidney repair (n=3) and stomach repaired (n=9) patients.

Simple hepatorraphy was carried out in 3 (15%) patients, hepatorraphy along with application of spongeston in 8 (40%), hepatorraphy and temporary perihepatic packing in 2 (10%), temporary perihepatic packing only in 4 (20%) and only spongeston was applied to the hepatic laceration in 3 (15%) patients. (Table 7)

Table 5: Other organs injured in combination with hepatic trauma in abdominal firearm injuries (n=20).

Organ injured	Number of patients	Percentage
Diaphragm	5	25
Kidney	6	30
Stomach	9	45
Colon	7	35
Duodenum	2	10
Spleen	4	20
Pancreas	1	5
Small gut	6	30
Ribs	2	10
Extremities	1	5
Vertebra	1	5
Gall bladder	2	10

Table 7: Complications associated with hepatic trauma patients (n=20).

Complication	Number of patients	Percentage
Intra – Abdominal Sepsis	3	15
Wound Infection	4	20
Chest Infection	2	10
Biliary Leak	1	5
Re-exploration	3	15
Wound dehiscence	1	5
Bed Sores	2	10
Duodenal Fistula	1	5
Pleural Effusion	1	5
Acute Renal Failure	1	5
Paraplegia	1	5

One patient was referred to cardio-thoracic unit for management of chest trauma and One patient to psychiatric unit.

Complications occurred in 10 (50%) patients (Table 8) Wound infection was the most common complication occurring 4 (20%) patients. Ten patients recovered uneventfully from the injury and operation.

Four patients died with mortality rate of 20%. Two out of these died intra-operatively from grade IV hepatic trauma and multiple associated injuries to other organs. One patient died of multiple injuries and electrolyte imbalance due to duodenal fistula, which was explored thrice for repair but leaked again. One patient died from acute renal failure in ICU. Isolated liver injuries were not responsible for any death. All deaths occurred due to Grade IV liver injury and associated injury to other organs.

DISCUSSION

Trauma is the major cause of emergency admission in our setup. When operative intervention is required for bleeding, a variety of surgical procedures have been advocated. These include packing with omentum, hepatic artery ligation, absorbable mesh compressive wrap, hepatotomy with selected vascular ligation, perihepatic gauze packing, resectional debridement and partial hepatectomy.[16] Apart from hepatic artery ligation which is rarely useful, the other maneuvers, when applied appropriately in an individual patient, may be successful.[17]

The use of packing for hemorrhage control has seen the pendulum swing from its widespread use during World War II, followed abandonment and its more recent emergence as a method for salvaging a critical situation. Perihepatic packing can be used as a temporary measure to allow adequate resuscitation during which other intraabdominal injuries are assessed and possibly treated. It can be used as definitive treatment with multiple injuries beyond the surgeon's ability to manage, thereby gaining time to seek expert help or transfer the patient to a special unit.

Sixty percent of our patients were in shock on arrival. Khan et al showed 47%, whereas Cheema et al documented that 75% patients with liver injury were in shock.[18,19]

Urgent laparotomy was carried out in most of the patients, because such patients have 85% incidence of serious associated injuries.[20]

The diagnostic modalities most commonly used were x-ray abdomen and chest. Gas under the diaphragm and ground glass appearance of abdomen were the most common findings.

Majority of liver injuries 55% were Grade II. It is similar to other studies. Right lobe was involved in 65% and left in 35% of patients. In a study from Lahore right lobe was involved in 59.4% and left in 34.4% of cases.[19] Majority of the patients had associated organ injuries. Diaphragm, stomach, colon and kidney were most commonly injured organs.

Majority of liver injuries i.e. 45% were managed by simple suture with chromic catgut 1 and application of spongeston. Rajab et al used simple suture in 56% of cases[22] while Shah et al employed simple sutures in 72% of cases.[23]

Perihepatic packing as a sole procedure was employed in 10% of patients with 100% success rate. Cheema et al used perihepatic packing in 29% patients with complex hepatic injury.[18] Beal S used perihepatic packing in 29% patients with complex hepatic trauma including inferior vena caval and hepatic vein injuries, achieving 82% success rate. In 10% patients we used perihepatic packing as an adjunctive procedure to deal with the ooze from suture lines. In a multicentre review the packing as an adjunctive procedure was employed in 25% patients with complex liver injuries.[24]

We did not employ selective hepatic artery ligation in any patient. In a multicentre review hepatic artery ligation was carried out in 2% of patients with grade III liver injuries, 10% with grade IV injuries and 6.7% with grade V injuries.[24] In another study of 99 patients with liver injuries, selective hepatic artery ligation was carried out in 5% of cases with 80% success rate.[25] We did not perform major resection for complex hepatic injuries because of high mortality associated with it. In a series of 128 patients with complex liver injuries Patcher et al did not perform major resection in any case.[26]

Fifty percent patients developed post-operative complications. These were more common among patients with multiple injuries. Ninety percent patients had multiple organ injuries. Morbidity also increased with complexity of liver injury. Sixty percent patients with complex liver injury developed complications. Kudson et al documented 52% complication rate among patients with complex hepatic trauma.[16] Similarly 50% morbidity was documented by Cogbil et al in their multicentre review of severe liver injuries.[24]

Overall complication rate in our study is conforming to that recorded by Stain et al.[27] It is higher than that of 12.5% and 12.7% documented by Padre et al and Shah et al respectively but it is less than 59% observed by Khan et al.[19]

The overall mortality in our study was 20%. It is slightly higher than in other studies. Mortality in hepatic trauma is influenced by interplay of a

number of factors. These include grade of hepatic trauma, duration between injury and presentation, hemodynamic condition of the patient at the time of admission, age of the patient and other associated organ injuries.

In this study mortality among patients with grade I and II liver injuries was 5%. It was not related to liver injuries but due to associated injuries to multiple organs. However mortality among patients with complex liver injuries (grade IV) was 15%. John et al documented 6% mortality among patients with complex hepatic trauma.[21] one out of five patients with grade III liver injury died in this study. Watson noted 12.5% mortality among patients with grade III liver injuries.[28] Cogbil et al documented 25% mortality among patients with grade III liver injuries. One out of four patients with grade IV liver injury died in this study. Knudson et al observed 46% mortality among patients with grade IV liver injuries.[16] Moor et al observed 43% mortality rate among patients with grade IV liver injuries.[28]

In this study no patient had sustained grade V liver injury.

CONCLUSION

REFERENCES

1. Feliciano DV, Rozycki GS. The management of penetrating abdominal trauma. Adv Surg 1995; 28:1-39.
2. Schwab CW. Violence: American uncivil war-presidential address, sixth scientific assembly of the Eastern Association for the surgery of Trauma. J Trauma 1993;35:657-65.
3. Nance ML, Nance FC. It is time we told the emperor about his clothes. J Trauma 1996; 40: 185-6.
4. Urman MG, Subbotin AV. Surgical strategy for the liver injury and developed abdominal complications. Vestn Khir Im I I Grek 2009;168:72-5.
5. Frank M, Rademacher G, Schmucker U, David S, Ekkernkamp A. In the line of fire—21st-century approach to an ancient war injury. J Forensic Sci. 2009;54:408-10.
6. Smoliar AN, Abakumov MM, Barmina TG, Donova LV, Chernaia NR. Diagnostics and treatment of abdominal injuries with retroperitoneal organs involvement. Khirurgiia (Mosk). 2009; (1):8-13.
7. Badger SA, Barclay R, Campbell P, Mole DJ, Diamond T.Management of liver trauma. World J Surg. 2009;33:2522-37.
8. Feigin E, Aharonson-Daniel L, Savitsky B, Steinberg R, Kravarusic D, Stein M, Peleg K, Freud E.Conservative approach to the treatment of injured liver and spleen in children: association with reduced mortality. Pediatr Surg Int. 2009;25:583-6.
9. Ali U, Noor A, Shah MM, Alam WJ. Trauma management in a tertiary care hospital in Peshawar, Pakistan. Ayub Med Coll Abbottabad. 2008; 20:112-6.
10. Demetriades D, Hadjizacharia P, Constantinou C, Brown C, Inaba K, Rhee P, Salim A.Selective nonoperative management of penetrating abdominal solid organ injuries. Ann Surg. 2006;244:620-8.
11. Smaniotto B, Bahten LC, Nogueira Filho DC, Tano AL, Thomaz Junior L, Fayad O.Hepatic trauma: analysis of the treatment with intrahepatic balloon in a university hospital of Curitiba. Rev Col Bras Cir. 2009;36:217-22.
12. Sikhondze WL, Madiba TE, Naidoo NM, Muckart DJ. Predictors of outcome in patients requiring surgery for liver trauma. Injury 2007; 38:65-70.
13. Eryigit H, Oztas S, Urek S, Olgac G, Kurutepe M, Kutlu CA. Management of acquired bronchobiliary fistula: 3 case reports and a literature review. J Cardiothorac Surg 2007;2:52.
14. Tucker ON, Marriott P, Rela M, Heaton N. Emergency liver transplantation following severe liver trauma. Liver Transpl 2008;14:1204-10.
15. Demetriades D, Rabinowitz B. Indications for operation in abdominal stab wounds a prospective study of 651 patients. Ann Surg 1987; 203:129-32.
16. Feliciano DV. Surgery for liver trauma. Surg Clin North Am 1989; 69:273-84.
17. Cox EF, Flancbaum L, Dauterive AH, Paulson RL. Blunt trauma to the liver. Ann Surg 1988;207:126-34.
18. Cheema AM, Ayyaz M, Zafarullah Ch. Hepatic Trauma: Mayo Hospital Experience. J Surg 1998;10:20-2.
19. Khan AFA, Gondal KM, Ali IA. Management of hepatic trauma. Pak J Surg 1991;11:26-30.
20. Johns TG, Grieg JD, Johnston AJ, Garden O.J. Liver trauma: 10 years experience. Br J Surg 1992;79:1352-6.
21. Rajab AES, Abd EL, Baki S, Shamekh T, Adly M, Abdullah H. Management of Liver Injuries. Study of 100 consecutive cases. New Egyptian J Med 1993;9:804-9.
22. Shah PA, Kulkarni SS, Joshi N, Lakshmy MV, Dewoolkar VV. Hepatic Trauma: experience of 110 cases. Injury 1993;24:303-5.
23. Cogbill TH, Moore EE, Jurkovich J, Feliciano DV, Morris J.A and Mucha P. Severe Hepatic Trauma: a multicentre experience with 1335 Liver Injuries. J Trauma 1988;28:1433-8.

24. Pretre R, Mentha G, Huber O, Meyer P, Vogel J, Rohner A. Hepatic Trauma: Risk factors influencing outcome. Br J Surg 1988:75:520-4.

25. Patcher HI, Spencer FC, Hofstetter SR, Liang HG, Coppa GF. Significant Trends in the treat of Hepatic Trauma. Ann Surg 1992;215:492-500.

26. Fabian TC, Cross MA, Stanford GG, Payne L, Managiante EC, Voeller G.R, et al. Factors Affecting Morbidity Following Hepatic Trauma. Ann Surg 1991;213:540-8.

27. Watson CJE, Calne RY, Padhani AR, Dixon AK. Surgical restraint in management of liver trauma. Br J Surg 1991;78:1071-5.

28. Boone DC, Fedlerle M, Billiar TR, Volekwu AD, Peitzman AB, Evolution of management of major hepatic trauma: identification of patterns of injury. J Trauma 1995;39:344-50.

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