High velocity missile injuries of the liver

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A prospective study of 15 consecutive patients admitted with high velocity missile liver injuries of the liver was done at Lacor hospital between November 1996 and May 1997. Operative findings, treatment offered and factors influencing morbidity and mortality were noted. All patients were followed up for two months postoperatively.

Fourteen patients sustained gun shot wounds while one was injured by a bomb blast fragment. Ages ranged from 2 to 33 years (mean 24.4 years). Two patients sustained liver injury alone while the rest had other associated visceral injuries as well. Grade I, II and III liver injuries were seen in 7, 5 and 2 patients respectively. One patient had a bullet perforation of the liver and could not be classified on this scale. Six patients received blood transfusion.

Four patients (27%) developed complications. One had a sub-hepatic abscess while the other three had wound infections. Two patients died, one of exsanguination and the other of septic shock.

High velocity missile injuries of the liver are associated with high transfusion needs and morbidity both of which can be minimised by a policy of conservative surgery.

Introduction.

High velocity missile injuries of the liver present a major challenge in management, especially in an up-country hospital where resources, both human and material, are often lacking. The situation is further worsened by the civil strife occurring in this sub region. In this situation the surgeon approaches these patients cautiously and with a lot of anxiety, knowing very well that referral to another centre is out of the question. With this in mind a study was carried out to determine the pattern of injury and outcome of treatment of patients who sustained high velocity missile injuries of the liver.

Patients and methods

A prospective study was carried out on patients presenting with high velocity missile injury to the liver between 1st November 1996 and 31st May 1997 at Lacor hospital. Lacor Hospital has 450 beds. Situated in northern Uganda, it also receives patients from southern Sudan.

For each patient a standard questionnaire was filled in by the surgeon. Patients were considered to have high velocity missile injury if they gave a history of having been shot with an assault rifle fired from nearby, or if there was evidence of both entry and large exit wounds or evidence of cavitating injury to the liver or all of the above. Bomb blast fragment injury with marked tissue destruction with burns of the surrounding tissue was also considered as high velocity missile injury. Demographic data and mechanisms of injury were noted. A policy of mandatory laparotomy was adopted and operative findings were recorded. The liver injuries were classified using the Liver Injury Scale (Table I) from grade I to VI[1,2].

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Conservative surgery, with the aim of stopping bleeding and debridement of devitalized liver tissue using the finger fracture technique, was performed. Most often ligature of bleeders and deep sutures were used to control bleeding. Cavities or dead space left after debridement were packed with viable omentum. Soft tubular drains were left in the vicinity of the injury.

A combination of crystalline penicillin and chloramphenicol was given to all patients starting before surgery and continued until the second to third postoperative day. Where infection occurred antibiotic administration was prolonged. Tetanus toxoid was administered to all patients.

Associated morbid factors were looked for and patients were followed up for three months after surgery by physical examination and abdominal ultrasound examination.

Results

There were 15 male patients, of whom 13 were combatants. Their ages ranged from 2 to 33 years (mean 24.4 years). Fourteen patients had gun shot wounds while one was injured by a bomb blast fragment. Two patients had liver injury only, while the rest had other associated visceral or organ injury.

Grade I liver injury was noted in seven patients, one of whom had insignificant oozing of blood from the liver laceration which was easily controlled by placing a few deep sutures. Five patients sustained grade II liver laceration, four of whom were actively bleeding at laparotomy. These needed the Pringle manoeuvre to allow full evaluation, removal of devitalized tissues and ligation of bleeders. Deeply placed sutures were used to approximate the wound edges. Two patients sustained grade III injuries and required packing with viable omentum to obliterate the resultant cavity after debridement and haemostasis had been achieved.

One patient had a through and through liver injury involving both lobes with the bullet found lying within the peritoneal cavity in the left sub hepatic space. This particular patient was difficult to grade on the liver injury scale (Table I). Other grades of liver injury were not seen.

Bleeding had stopped in eight of the patients. The other six patients had active bleeding and were given blood transfusions of two or three units.

The transverse colon was the commonest other viscus injured (seven patients) followed by the caecum (Table II).

TABLE I *The pattern of liver injuries*

GRADE	LIVER INJURY	FREQUENCY	PATIENTS TRANSFUSED
I	Subcapsular haematoma, non expanding, <10% surface of liver. or capsular tear 1cm deep intraparenchyma.	7 (46.7%)	1
II	Capsular tear, active bleeding. 1-3 cm deep into parenchyma, < 10 cm long.	5 (33.3%)	4
III	Laceration > 3 cm deep into parenchyma	2 (13.3%)	2
IV	Parenchymal disruption involving < 50 % of hepatic lobe	0	
V	Parenchymal disruption involving > 50% of hepatic lobe or juxta hepatic venous injuries e.g. vena cava or hepatic veins	0	
VI	Vascular hepatic avulsion.	0	0
***	Through and through injury perforating both hepatic lobes.	1 (6.7%)	0
TOTAL		15 (100%)	6

*** Difficult to classify.

TABLE II *Other visceral trauma associated with liver injuries (n=15).*

ORGAN . VISCERA	FREQUENCY	PERCENTAGE
Transverse colon	7	46.7%
Caecum	4	26.7%
Thorax and lungs	3	20%
Diaphragm	3	20%
Kidney- right	3	20%
Stomach	1	6.7%
Ileum	1	6.7%
Gall bladder	1	6.7%
None (liver only)	2	13.3%

Four patients developed complications. Three had wound infections and one developed a sub hepatic abscess which required re-laparotomy for drainage. All these patients had sustained colonic injury (Table III).

There were two deaths. One patient died of exsanguination six hours after surgery. The second patient died of septicaemia on the fifth postoperative day (Table III).

TABLE III *Outcome of treatment of patients with high velocity missile injuries of the liver.*

OUTCOME	FREQUENCY	PERCENTAGE
No complication	9	60%
Wound infection	3	20%
Intra abdominal abscess	1	6.7%
Mortality	2	13.3%
TOTAL	15	100%

Discussion

The diagnosis of penetrating abdominal injury is usually straightforward. Injury to the liver may be suspected by the presence of haemodynamic instability and anaemia, as well as by the anatomical site of entry and exit wounds with some consideration to the trajectory followed by the missile.

All patients who sustained high velocity missile liver injuries in this study were males most of whom were in their third decade of life. Most combatants are male and males indulge in more risky ventures compared to their female counterparts during periods of civil strife. These findings have been noted elsewhere[2,3,4].

The majority of patients sustained grade I and II liver injuries and the control of bleeding after debridement was easily accomplished by ligating bleeders and placement of deep sutures to approximate wound edges. This procedure was made easy by application of the Pringle manoeuvre. Since its introduction by Pringle in the beginning of this century this manoeuvre has gained much popularity and wide usage[4,5]. In this study, it was found to be an invaluable method, allowing wound assessment as well as the identification of bleeding vessels. The two patients with grade III injuries required viable omental packs to obliterate the resultant cavity after debridement and ligature of bleeders and bile ducts. Stone et al[6] found omental pack a safe method for filling the liver dead space as well as promoting haemostasis[2,7].

One patient who sustained perforation of both lobes of the liver was difficult to grade on the liver injury scale as well as on the Calne classification[1,8]. It is suggested that this be classified as a grade III injury considering the impact the travelling missile would have on the surrounding liver tissue. The more severe forms of liver injury (Grades IV-VI) were not encountered and it is assumed that these patients died from exsanguination before reaching the hospital.

Most patients were found to have stopped bleeding at time of laparotomy, a common finding in other

studies[1]. Seven patients needed blood transfusion, however, which in this study was used sparingly due to the fact the hospital did not have a big blood reserve in its blood bank. The strict policy against unnecessary blood transfusion is followed to minimise the risk of HIV transmission. We know that a small number of donors may be in the window period and hence pass the antibody screening tests.

Thirteen patients (87%) had other visceral injuries. This justifies the policy of mandatory laparotomy used in this study. Other workers tend to agree with this policy[9,10,11]. The commonly injured viscera were all anatomically related to the liver.

Wound infection and sub hepatic abscess formation were the two morbid factors found. All patients with these complications had associated perforation of the transverse colon and massive peritoneal faecal soiling. Demetriades et al[12] found that colonic injury was the most important risk factor for the development of septic complications in patients with penetrating abdominal injuries. It should be noted, however, that both sepsis and sub hepatic abscess can occur with liver injury alone, hence the need for antibiotic prophylaxis in patients with hepatic injuries[13,14]. The need for constant monitoring of patients to detect the onset of these complications with the aim of early intervention is necessary. Olsen[15] re-operated on 6.5% of his patients while Calne[8] performed eight re-operations out of 26. In this series the patient with sub hepatic abscess formation required a re-laparotomy. The overall morbidity in this study was (27%), a figure which is similar to that of other studies[3].

The mortality rate was (13%) with one patient dying of exsanguination and the other of septicaemia. Both complications are known to be the major cause of deaths in patients with liver injuries[16]. The rather low mortality rate was probably due to the low grades of liver injuries in those who survived to be admitted to this centre but it was possibly helped by our use of conservative surgery.

In conclusion, high velocity missile injury of the liver is often life threatening and exerts considerable demands upon surgeons and upon the available resources, especially the blood bank and reserves of intravenous fluids. A policy of mandatory laparotomy is recommended and established methods of conservative surgery should be followed, especially in the up-country setting where resources are limited.

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