LIVER INJURIES
Grades and Management

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ABSTRACT

Background: Liver injuries could be caused by trauma to the abdomen or lower thorax, blunt or penetrating, and may be associated with high morbidity and mortality, depending on mechanism of injury and associated injuries. **Patients And Methods:** this is a prospective study included 125 patients within one year period with hepatic injury**Results:** 78.4% of patient were males ,most of the injured were young. Penetrating injury was the cause in majority of collected patients (97.6%), and all were due to bullet injuries or massive explosions. Grades **I**, **II**, and **III** were more common (forming 77% of patients), while the remainder were in grades **IV**, **V** and **VI.** Injuries to the diaphragm, lung and chest wall were the most common associated injuries. The mortality rate was 19.2% (24 patients), Wound infection was the commonest complication and occurs in 19 (15.2%) patients **Conclusions:**. Most gunshot injuries of the liver required no treatment at laparotomy or could be managed successfully with minimal surgical intervention.. High mortality rate occur in high grade injuries, while the deaths occurred in low grade injuries were mainly due to associated injuries.

Introduction:

Trauma is the leading cause of death, hospitalization , short and long term disability for all ages. Liver is the largest organ in the abdominal cavity and is commonly damaged in blunt or penetrating abdominal trauma as well as in thoracoabdominal injuries [1]. The principal objectives in the treatment of liver trauma are early and effective control of Bleeding, with preservation of hepatic function and prevention of septic and ischaemic complications.[2]

Classification

Currently, hepatic injury is best described using the classif- ication of the Organ Injury Scaling Committee of the American Association for the Surgery of Trauma (AAST). This was first outlined in 1989 [3] and revised in 1994 [4].

American Association for the Surgery of Trauma Organ Injury Scale: liver

Grade*		Description of injury†
I	Haematoma	Subcapsular, non-expanding, less than 10 per cent of surface area
	Laceration	Capsular tear, non-bleeding, less than 1 cm parenchymal depth
II	Haematoma	Subcapsular, non-expanding, 10–50 per cent of surface; or intraparenchymal, non-expanding, less than 2 cm in diameter
	Laceration	Capsular tear, active bleeding, 1–3 cm parenchymal depth, less than 10 cm in length
III	Haematoma	Subcapsular, greater than 50 per cent surface area or expanding; ruptured subcapsular haematoma with active bleeding; intraparenchymal haematoma greater than 2 cm or expanding
	Laceration	Greater than 3 cm parenchymal depth
IV	Haematoma	Ruptured intraparenchymal haematoma with active bleeding
	Laceration	Parenchymal disruption involving 25–50 per cent of hepatic lobe
V	Laceration	Parenchymal disruption involving more than 50 per cent of hepatic lobe
	Vascular	Juxtahepatic venous injuries (i.e. retrohepatic vena cava/major hepatic veins)
VI	Vascular	Hepatic avulsion

*Advance one grade for multiple injuries to the same organ.†
Based on most accurate assessment at autopsy, laparotomy or radiological study.
The measures of liver lacerations were made depending on approximate measure by the eyes of the surgeons.

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Types Of Surgical Management

If a major liver injury is encountered, initial control of bleeding can be achieved with temporary tamponade of the right upper quadrant using packs, portal triad occlusion (Pringle mano- euvre), bimanual compression of the liver or even manual compression of the abdominal aorta above the celiac trunk [5,6]. After resuscitation and assessment of the injury, liver can be managed by one of the following ways

:1. Hepatorrhaphy (simple suture): [7,8]
)2. Hepatotomy with direct suture ligation: [7,9,)]
3. Resectional debridement: [7]
4. Anatomical resection: [5, 10]
5.Selctive hepatic artery ligation: [7, 10]
6. Perihepatic packing: [5, 10]
7. Mesh wrapping: [7, 11,)]
8. Omental packing: [5, 7, 11]
9. Tamponade with Penrose drain: [7,12]
10. Adjunctive techniques: [13, 14,)]

Patients And Methods:

This is a prospective study, included 125 patients admitted with liver injury from 1\1\2009 to 1\12\2009 in AlYarmouk Teaching hospital ,they were analyzed regarding their, age, gender, mechanism of injury, site of trauma, time from injury to admission to hospital, physical examination, investigations, details of management, which include conservative or operative management, grades of liver injury according to classification of the Organ Injury Scaling Committee of the American Association for the Surgery of Trauma (AAST), and management of liver injuries, associated injuries, and follow up for development of complications (until discharge from hospital and including readmission for development of liver related complications), and mortality. Different types of surgical management were done including suturing techniques, which was done through a deep transverse mattress sutures in most of the cases or under running sutures for simple injuries. Other methods of surgical repair were done and include packing, hepatotomy, resection of devitalized hepatic tissue and debridement, and vascular repair of retrohepatic inferior vena cava; all of these methods were done by surgeons by their judgment and according to standards.

Results:

Ninety eight of the 125 patients (78.4%) were males, with a mean age of the entire group 34.25 ranging from 1.5 to 67 y One hundred and twenty two (97.6%) patients injured by penetrating trauma, and 3 (2.4%) by blunt trauma . Of the penetrating injuries, 77 (63.11%) patients were due to bullet injuries, and 45 (36.89%) due to shell injuries, with no stabbing injuries. All blunt trauma patients (3 patients) were due to road traffic accidents Regarding the grading of liver injury, 46 (37.7%) patients had grade **III**, followed by grade **II** and **IV** which included 31 (25.41%) patients and 22 (18.3%) patients respectively The diaphragm was the commonest organ injured in assoc- iation with liver injury, 44 (36.07%). The chest wall, lung parenchyma and pleura were the second common associated injury; 42 (34.43%) patients. Of the abdominal organs, large bowel injured in 40 (32.79%) patients, followed by the stomach in 31 (25.41%). Injury to the kidneys was present in 29 (23.77%) patients. The small bowel was injured in 25 (20.49%). Injuries rarely associated with liver injury were the urinary bladder and spinal cord in 2 patients for each, the ovary and uterus are injured in 1 patient only for each organ. While isolated liver injury occur in 13 (10.6%) patients. The overall mortality rate was 19.2% (24 patients), of which 17 (13.6%) patients were due to bullet injury, and 7 (5.6%) patients were due to shell injuries with no death among the blunt trauma patients. Severe massive liver injury was the cause of death in 9 (7.2%) patients, 3 of which were in grade **V,** 5 in grade **IV,** and 1 in grade **III.** Massive intraabdominal vascular injury was the cause of death in 7 (5.6%) patients, 3 of them were in grade **I**, 3 in grade **III**, and 1 in grade **IV** Relaparotomy was done in 4 patients for removal of packs successfully, of which one patient developed bile leak and was referred to the GIT centre , while 3 patients for whom packing was done, died shortly after the operation.

Table 1:Age Distribution

Age group	No.	Percentage
0-9 yr.	13	(10.4%)
10-19 yr.	27	(21.6%)
20-29 yr.	39	(31.2%)
30-39 yr.	18	(14.4%)
40-49 yr.	18	(14.4%)
50-59 yr.	7	(5.6%)
60-69 yr.	3	(2.4%)
Total	125	100%

Table 2 ; Types of Injuries

Type of injury	No.	Percentage
Bullet injury	77	(61.6%)
Shell injury	45	(36%)
RTA	3	(2.4%)
Total	(125)	100%

Table 3 Grading and Management

Grades	No. & %	None	Suturing	Packing	Hepatotomy	Resection & debridement	Vascular repair
Grade I	17 (13.93%)	13 (76.47%)	4 (23.53%)	–	–	–	–
Grade II	31 (25.4%)	12 (38.71%)	19 (61.29%)	–	–	–	–
Grade III	46 (37.7%)	–	44 (95.65%)	2 (4.35%)	–	–	–
Grade IV	22 (18.0%)	–	15 (68.18%)	4 (18.18%)	2 (9.09%)	1 (4.55%)	–
Grade V	5 (4.1%)	–	–	1 (20%)	–	4 (80%)	–
Grade VI	1 (0.9%)	–	–	–	–	–	1 (100%)

Table 4 Associated injuries

Organs	No.	Percentage
Diaphragm	44	(36.07%)
Lung and chest wall	42	(34.43%)
Colon	40	(32.79%)
Stomach	31	(25.41%)
Kidneys	29	(23.77%)
Small bowel	25	(20.49%)
Spleen	12	(9.84%)
Vascular injury	10	(8.2%)
Duodenum	10	(8.2%)
Gallbladder	9	(7.38%)
Pancreas	6	(4.92%)
Urinary bladder	2	(1.64%)
Spinal cord	2	(1.64%)
Oesophagus	1	(0.82%)
Ovary	1	(0.82%)
Uterus	1	(0.82%)
Total	122	100%

Table 5 Death in relation to liver injury grades.

Cause of death	No. of cases	Percentage	Grades of liver injury
Severe liver injury	9	7.2%	3 in **G V** 5 in **G IV** 1 in **G III**
Massive intraabdominal vascular injury	7	5.6%	3 in **G I** 3 in **G III** 1 in **G IV**
Septicemia & MOF syndrome	8	6.4%	5 in **G II** 3 in **G III**
Total	24	19.2%	

Table 7: Complications

Complication	No.	Percentage
Wound infection	19	(15.2%)
Chest infection	10	(8%)
Bile leak	5	(4%)
Total	34	27.2%

Discussion:

In most studies, liver injuries caused by blunt trauma are more common than that produced by penetrating injuries. In studies from Europe, the blunt trauma accounted for (80%--90%) of liver injuries [15, 16, 17,]. While in a study from South Africa, penetrating injury was commoner than the blunt trauma in causing liver injury & constitutes 66% of 446 patients [18]. In other studies from North America, Penetrating injury accounts up to 88% of cases [19]. In our collection, penetrating injury was the cause in 97.6% of patients. This is due to the current situation in Baghdad city during the period of the study. Most of patients in our collection were males. This is usual in most studies [20, 21, 22]. In our collection, males constitute 78.6% of cases. This is due to the outdoor activity of males in our society making them more vulnerable to violent activities. In our series, most of patients (77%) had grades **I**, **II** & **III** liver injury according to AAST, while the rest had grades **IV**, **V** & **VI**.

Any abdominal organ can be injured by either blunt or penet- rating trauma; however, certain organs are injured more often depending on the mechanism. In blunt trauma, organs which cannot yield to impact by elastic deformation are most likely to be injured. The solid organs, liver, spleen, and kidneys, are repr- esentative of this group. For penetrating trauma organs with the largest surface area when viewed from the front are most prone to injury (i.e., the small bowel, liver, and colon). Because bullets usually follow straight lines, adjacent structures are commonly injured (e.g., the pancreas and duodenum) [1].

In our collection, isolated liver injury constituted only 10.6% of cases. Associated injuries affected were; the diaphragm, pulmonary and chest, large bowel, stomach and the small bowel in that order of frequency. Post operative complications occur in 34 patients (27.2%), and these were; wound infection (15.2%), chest infection (8%) and bile leak and fistulae (4%). Uncontrolled haemorrhage occurred in 4 patients who died in the immediate post-operative period.

Wound infection and biliary fistulae and leak were man- aged conservatively. In a study from South Africa, Compl- ications occurred in 151 of 392 survivors (38.5%) and correlated with type and severity of the liver injury (31% in stab wounds, 43% in gunshot wounds, and 57% in blunt injuries [31].In a study from Malaysia,the major post-operative complications (biloma and biliary fistula) were noted in 11 out of 175 patients with liver trauma requiring hepatorrhaphy. All were managed by CT-guided percutaneous drainage. No patient required further operative intervention and all fistula closed spontaneously without complication [23].

The overall mortality in this series was 19.2%(24 patients). The liver related mortality occurs in 9 patients (7.2%) due to massive liver injury. The other 15 patients (12%) died due to massive associated injuries (multiple abdominal injuries and major vascular injury)..In a study from Berlin, The overall mortality was 23.3% and was significantly related to concomitant injuries [15]. The overall mortality rate was 9% and liver related mortality 7% in a collection of 43 patients with liver injury [24].. Hepatic mortality rates of 30% in grade **IV** and 66% in grade **V** patients was mentioned in a multicentre study. [25]

Conclusion:

* Most gunshot injuries of the liver required no treatment at laparotomy or could be managed successfully with minimal sur- gical intervention.
* Grading system is useful to know the severity of liver injury and is of importance in communication and comparison with other studies.

Recommendatuons::

*Improvement in facilities and supplies in our hospital and specially in the emergency room and operating theatre

*Improvement in documentation of injured organs according to OIS (organ injury scale).

*Establishment of trauma centers to be specialized in treating trauma patients.

References:

1. Jon M. Burch, Reginald J.Franciose, Ernest E. Moore; Trauma. In Charles Brunicardi, Dana K. Andersen, Timothy R. Billiar, David L. Dunn, John G. Hunter, Raphael E. Pollock; Schwartz's manual of Surgery, 8th ed., McGraw-Hill, New York, 122-162.
2. Feliciano DV, Burch JM, Spjut-Patrinely V, Mattox KL, Jordan GLJr. Abdominal gunshot wounds. An urban trauma center's experience with 300 consecutive patients. Ann Surg1988; 208: 362-70.
3. Moore EE, Shackford SR, Pachter HL, McAninch JW, Browner BD, Champion HR *et al.* Organ injury scaling: spleen, liver, and kidney. *J Trauma* 1989; **29:** 16646.
4. Moore EE, Cogbill TH, Jurkovich GJ, Shackford SR, Malangoni MA, Champion HR. Organ injury scaling: spleen and liver (1994 revision). *J Trauma* 1995; **38:** 3234.
5. Feliciano DV, Pachter HL. Hepatic trauma revisited. Curr ProblSurg 1989; 26:453-524.
6. Canizaro PC, Pessa ME. Management of massive hemorrhage associated with abdominal trauma. Surg Clin North Am 1990; 70: 621-34.
7. Ochsner MG, JaffinJH, Golocovsky M, Jones RC. Major hepatic trauma. Surg Glin North Am 1993; 73: 337-52.
8. Pachter HL, Spencer FC, Hofstetter SR, Liang HG, Coppa GF. Significant trends in the treatment of hepatic trauma. Experience with 411 injuries. Ann Surg 1992; 215: 492-502.
9. Pachter HL, Feliciano DV. Complex hepatic injuries. Surg GlinNorthAm 1996; 76: 763-82.
10. Beal SL. Fatal hepatic hemorrhage: an unresolved problem in the management of complex liver injuries. J Trauma 1990; 30: 163-9.
11. Shuman WP. CT of blunt abdominal trauma in adults. Radiology 1997; 205: 297-306.
12. Jacobson LE, Kirton OC, Gomez GA. The use of an absorbable mesh wrap in the management of major liver injuries. Surgery 1992; 111:455-61.
13. Geis WP, Schulz KA, GiacchinoJL, Freeark RJ. The fate of unruptured intrahepatic hematomas. Surgery 1981; 90: 689-97.
14. Kram HB, Reuben BI, Fleming AW. Use of fibrin glue in hepatic trauma.J Trauma 1988; 28: 1195-1201.
15. Langrehr-JM; Buchen-S; von-Fournier-C; Tempka-A; Keck-H; Neuhaus-PJ; Outcome of primary surgical management of liver trauma, Langenbecks-Arch-Chir-Suppl-Kongressbd. 1997; 114: 1247-8
16. Gackowski-W; Najnigier-B; Otto-W; Paczkowski-PM; Krawczyk-M; Karwowski-A; Treatment of liver injuries in personal clinical material from 1990-1996. Wiad-Lek. 1997; 50 Su 1 Pt 2: 223-7.
17. Struckmann-JR; Pedersen-IK; Burcharth-F; Liver trauma, Ugeskr-Laeger. 1997 Aug 18; 159(34): 5098-102.
18. Krige-JE; Bornman-PC; Terblanche-J; Liver trauma in 446 patients. S-Afr-J-Surg. 1997 Feb; 35(1): 10-5.
19. Cogbill TH, Moore EE, Jurkovich GJ, Feliciano DV, Morris JA, Mucha P. Severe hepatic trauma: a multicenter experience with 1335 liver injuries.J Trauma 1988; 28: 1433-8.
20. Salzano,-A; Nocera,-V; De-Rosa,-A; Rossi,-E; Carbone,-M; Gatta,-G; Vitale,-L; Vigliotti,-A; Liver trauma due to penetrating lesions: miscellanea, personal case series, clinical and CT findings. Radiol-Med-(Torino). 2000 Dec; 100(6): 465-9.
21. Rizoli-SB; Brenneman-FD; Hanna-SS; Kahnamoui-K; Classification of liver trauma. HPB-Surg. 1996; 9(4): 235-8
22. Wakeman,-C; Beasley,-S; Pearson,-S; Frizelle,-F; Gooding,-A; Sharr,-J; Dobbs,-B; Liver injury in children: causes, patterns and outcomes. N-Z-Med-J. 2003 Jul 25; 116(1178): 515
23. Shahrudin-MD; Noori-SM ; Biloma and biliary fistula associated with hepatorrhaphy for liver injury. Hepato-gastroenterology. 1997 Mar-Apr; 44(14): 519-21.
24. Wilson RH, Moorehead RJ. Hepatic trauma and its management. Injury 1991; 22: 439-45.
25. Cogbill TH, Moore EE, Jurkovich GJ, et al. Severe hepatic trauma; a multicentre experience with 1335 liver injuries. J trauma, 1988;28:1433.