

# Surgical Management of Liver Trauma

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## ABSTRACT

**Objective** To compare the results of operative management of hepatic trauma treated with suture hepatorrhaphy alone and with suture hepatorrhaphy in combination with hepatotomy (resectional debridement with individual vessel suture ligation) spongston, and omental packing.

**Study design** Cross-sectional comparative study.

**Place & Duration of study** The study was conducted at Bahawal Victoria Hospital Quaid-e-Azam Medical College Bahawalpur, from January 2007 to December 2010.

**Methodology** A total of fifty patients were divided into two groups. Group A comprising 25 patients (50%), was treated with suture hepatorrhaphy alone while the Group B was treated with suture hepatorrhaphy in combination with hepatotomy, omental packing and spongston.

**Results** Of the 50 patients of liver trauma mean age was 28.14 years (SD  $\pm$  12.12y) and 94% were males. Sixty percent injuries were blunt in nature and 40% penetrating. Of penetrating trauma 75% were firearm injuries and 25% stab wounds. Right lobe was the site of injury in 56% of patients. Severity of injury was grade I in 14%, grade II in 40%, grade III in 36% and grade IV in 10%. Postoperative complications were sepsis in 24%, bile leak in 16% and recurrent hemorrhage in 24% of group A patients, whereas, in group B patients the sepsis was 8%, bile leak 8% and recurrent hemorrhage 4%. Mean hospital stay in group A was 26.44 days (SD  $\pm$  13.56) while in group B it was 20.20 days (SD  $\pm$  11.06). In group A patients, the survival rate was 96% while it was 100% in group B.

**Conclusions** Once decided for Surgical management for blunt and penetrating liver trauma, suture hepatorrhaphy in combination with hepatotomy, omental packing and use of spongston for hemostasis had marginally better survival rate, reduced hospital stay and significantly fewer postoperative complications as compared to simple suture hepatorrhaphy.

**Key words** Blunt hepatic trauma, Penetrating hepatic trauma, Suture hepatorrhaphy.

## INTRODUCTION:

The liver is the largest solid abdominal organ with a relatively fixed position, which makes it prone to injury. Liver trauma is the second most frequent event during an abdominal trauma and is the leading cause of death (20-40%) in these cases.<sup>1</sup>

Major causes of blunt abdominal trauma are road traffic accidents, street violence, industrial accidents and fall from height. Penetrating injuries

are associated mainly with gunshots and stabs.<sup>2</sup> Firearm injuries are more lethal as compared to stab injuries, because of their blast and cavitation effects.<sup>3</sup>

Patients of liver trauma are managed according to grade of the injury. The commonly performed procedures are horizontal mattress suturing, omental packing, intrahepatic roll gauze packing, perihepatic packing with abdominal packs, resectional debridement with individual vascular ligation and segmentectomy.<sup>5-7</sup> Mortality has decreased from 66% in world war I to 25% in world war II and now is less than 20% due to better intensive care, good resuscitation, antibiotics, advanced surgical techniques and planned re-operation.

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This study was conducted to compare the results of suture hepatorrhaphy alone versus suture hepatorrhaphy in combination with spongston, omental packing and hepatotomy in the management of penetrating and blunt liver trauma with reference to post operative complications, duration of hospital stay and patient survival.

#### METHODOLOGY:

It is a cross-sectional comparative study conducted in Department of surgery Bahawal Victoria Hospital Quaid-e-Azam Medical College, Bahawalpur Pakistan. Consecutive 50 patients with liver trauma of grade I-IV presenting in the Emergency Department under going operative surgical management during the period from January 2007 to December 2010 were included in the study. Exclusion criteria were patients with iatrogenic liver injuries, injuries due to interventional radiology procedures and liver trauma patients managed conservatively.

The decision to implement surgical intervention was based on clinical findings supported with laboratory investigations and radiological findings. Following criteria was followed: Patients presenting with highly unstable clinical findings like rapidly expanding abdomen or increasing rigidity, an evidence of massive hemorrhage or persistent hypotension despite active resuscitation (unexplained shock), gunshot to the abdomen in right upper quadrant or to the right lower chest, grossly positive diagnostic peritoneal lavage, blood transfusion requirements more than half of their blood volume (40 ml/Kg body weight), associated hollow abdominal viscus injury (signs of peritonitis), intraperitoneal and intrahepatic hemorrhage detected by various radiological findings (hemoperitoneum of more than 500ml on CT scan).

A roof top or midline incision was used for exploration. Right lobe visualization was enhanced with the use of large Richardson retractor by elevating the right costal margin. Mobilization of the liver was carried out by dividing the falciform ligament and lateral triangular ligaments, and then rotating the liver medially into the surgical field. Initially temporary hemostasis was carried out by Pringle's maneuver or by manual compression applied on the surface of the liver or both. Any associated injury during initial process of hemostasis was inspected and dealt accordingly afterwards. Finally definitive management to control bleeding and repair was carried. Suture hepatorrhaphy alone or suture hepatorrhaphy in combination with spongston, omental packing and hepatotomy was done; chromic catgut No. 1 or 0 was used on liver

needle. The patient was kept in ICU post-operatively and shifted to the ward when got stabilized. Blood transfusion, PCV, FFPs and platelets factors, broad spectrum antibiotics and ultrasound or CT guided aspiration were used as and when needed. On stabilization, the patients were sent home and regular follow-up was advised in the surgical out door department. The patient's record was analyzed for postoperative complications, hospital stay and immediate outcome (till discharge).

#### RESULTS:

This study comprised of 50 patients with hepatic injuries. The age ranged between 3 to 62 years with a mean of 28.14 years  $\pm$  12.12 years. Most of the patients (44%) belonged to age group of 21 to 30 years (n 22), followed by 22% patients (n 11) in the 21 to 40 years age group. Out of 50 patients, 94% (n 47) were males and 6% (n 3) females.

Sixty percent (n 30) of injuries were blunt in nature and 40% (n 20) penetrating (table I). Out of the 20 cases of penetrating trauma 75% (n 15) were due to firearm injuries and 25% (n 5) were due to stab wounds.

**Table I: Type of Blunt Injuries**

Blunt Injury	No. of Patients	Percentage
RTA	24	80
Fall from height	03	10
Street Fighting	03	10
Total	30	100

Right lobe was involved in 56% of patients (n 28), left lobe in 28% (n 14) while bilateral injuries were present in 16% (n 8). Severity of the injuries on the basis of Moore's liver injury scale (revised in 1994) were as follows: Grade I 14% (n 7), Grade II 40% (n 20), Grade III 36% (n 18) and Grade IV 10% (n 5).<sup>8</sup>

Associated abdominal injuries were present in 22% (n 11) of the patients. In 18% (n 9) cases, one associated organ injury was present while 4% (n 2) of patients had 2 associated organ injuries. Clinical features and investigation performed and postoperative complications are given in table II, III and IV.

In group A patients mean value of hospital stay was 26.44  $\pm$ 13.56 days while in group B patients 20.20  $\pm$ 11.06 days. The t test value was 0.192 i.e < 1.943.

**Table II: Clinical Features**

Feature	No. of Patients	Percentage
Tachycardia	45	90
Hypotension	40	80
Pallor	35	70
Unconsciousness	01	02
Right Shoulder tip pain	15	30
Local bruising and ecchymosis	13	26
Right hypochondrium tenderness	40	80
Abdominal rigidity	25	50
Abdominal distention	10	20

**Table III: Investigations**

Investigation	No. of Patients	Percentage
FBC, Electrolytes, Urea and Creatinine	48	96
LFTs	40	80
Serum Amylase	30	60
Clotting Screen	25	50
Plain Radiographs Abdomen and Chest	46	92
Diagnostic Peritoneal Tap	44	88
Diagnostic Peritoneal Lavage	10	20
Laparoscopy	02	04
Ultrasonography	45	90
CT Scan	10	20
Angiography	05	10

**Table IV: Post-operative Complications**

Complications	Group	No. of Patients	Percentage	t test
Sepsis	A	06	24	4.92 i.e > 2.132
	B	02	08	
Bile leak	A	04	16	
	B	02	08	
Recurrent hemorrhage	A	06	24	
	B	01	04	

Group A patients had 96% (n 24) survival rate while it was 100% in group B. Mortality was 4% in group A. Chi square test value was  $1.020 < 3.84$ .

For complications and hospital stay student t test

value were 4.92 and 0.192 at 95% confidence level (p 0.05) which is more than 2.132 and less than 0.943 correspondingly at degree of freedom of 4 and 6 respectively. Statistically significant decrease in complications but marginal decrease in hospital

stay noted in group B. Pearson Chi square test value was 1.020 for mortality of patient at degree of freedom of 1 so mortality differences was not significant because Chi square test value at 95% confidence level fell in insignificant area.

#### DISCUSSION:

Any physiological instability after initial resuscitation in liver trauma patient mandates laparotomy.<sup>9</sup> Sole clinical criteria is basis for conversion of non operative management to an operative one. Two third of high grade injuries require operative management.<sup>10</sup> Literature shows that for patients in whom non operative management was decided initially need surgery in 6% of the cases.<sup>11</sup> A guideline recommends that if the patient requires replacement of more than half of his blood volume then laparotomy is mandatory.<sup>9</sup>

Incidence of liver injury is on increase.<sup>5,12-15</sup> Young patients are more prone to hepatic injuries, because they are the ones who drive motor vehicles more often and get themselves engaged in street fighting as well.<sup>2,3,7</sup> In this study, the range of age was from 3 to 62 years. The mean value of age was 28.14 ±12.12 years. Most of the patients belonged to age group of 21 to 30 years. These findings are similar to the results of some other studies conducted on hepatic trauma.<sup>12</sup>

Male patients are more affected by liver trauma.<sup>2,3,16</sup> In the present study male patients were affected in 94% (n 47) cases. This is similar to the results of some other studies.<sup>2,3,5,16</sup> In one study women were affected in a significant number.<sup>17</sup>

Firearm injuries are more common than stab wounds. The penetrating hepatic injuries are due to increased civilian violence and easy availability of firearms.<sup>3,5</sup> The above mentioned facts are consistent with the present study's findings as blunt injuries were found to be present in 60% of cases of hepatic trauma and penetrating injuries in 40%. Out of 20 cases of penetrating trauma 75% were caused by firearm injuries and 25% due to stab wounds.

As a result of its larger size and proximity to the ribs, right lobe of the liver is injured more commonly than the left.<sup>3</sup> In this study right lobe as the site of injury was involved in 56% of the cases, which coincides with the findings of studies conducted by Khan and Ahmad.<sup>3</sup> In 90% (n 45) of the total patients of this study grade I-III liver injuries were found which is consistent with the findings of other studies.<sup>2,3,16</sup>

Tachycardia, hypotension and pallor are the principal

signs present in any hepatic trauma patient with hypovolemic shock due to acute blood loss.<sup>2,12,13</sup> Same findings were noted in present study.

Several studies have shown that ultrasound and CT scan help the surgeon in detecting the site and severity of hepatic injury and to determine the different options of surgical treatment.<sup>16,18-22</sup> In this study ultrasonography was the prime radiology tool used for the detection of site and severity of hepatic injury. CT Scan was done in only ten cases.

Per-operatively Pringle's maneuver and bimanual compression of liver helps the surgeon to combat the bleeding temporarily and definitive surgical control of bleeding can be achieved later on, with reduced bleeding and clear visualization of the site of hepatic injury.<sup>3,6,7,12,23</sup> If bleeding continues after Pringle Maneuver then retrohepatic, caval or hepatic vein injury are suspected.<sup>24</sup> Operative treatment of grade I-IV blunt and penetrating trauma patients ranges from topical agents to suture hepatorrhaphy, resectional debridement with individual vessel ligation, omental packing, perihepatic packing and segmentectomy, as needed.<sup>2,3,5,7</sup> The need for re-operation in literature is reported as 19%.<sup>25</sup>

In this study group B patients had significantly better results on the basis of less development of post operative complications, reduced duration of hospital stay and better, but insignificant statistically, survival rate. Post-operative complications were present in less number of patients of the group B as compares to group A. This was statistically insignificant.

#### CONCLUSIONS:

Once decided for surgical management, for blunt and penetrating liver trauma, suture hepatorrhaphy in combination with hepatotomy (resectional debridement with individual vessel suture ligation), omental packing and use of spongston for hemostasis had marginally better survival rate, reduced hospital stay and significantly decreased chances of development of postoperative complications as compared to simple suture hepatorrhaphy.

#### REFERENCES:

1. Gourgiotis S, Vougas V, Germanos S. Operative and non-operative management of blunt hepatic trauma in adults. *J Heptobiliary Pancreatic Surg* 2007; 14:387-91.
2. Iqbal P, Sial K, Iqbal SA. Liver injuries: Management and outcome. *Med Channel* 2000; 6:27-32.

3. Ahmad N, Abid KJ, Khan AZ, Shah ST. Management of penetrating liver injuries. *Ann Surg* 2001;07:293-5.
4. Gao JM, Du DY, Zhaq XJ, Liu GL, Yang J, Zhao SH, et al. Liver trauma: Experience in 348 cases. *World J Surg* 2003;27:703-8.
5. Richardson JD, Franklin GA, Lukan JK, Carrillo Eh, Spain DA, Miller FB, et al. Evolution in the management of hepatic trauma: 25 year perspective study. *Ann Surg* 2000; 2:324-8.
6. Parks RW, Chrysos E, Diamond T. Management of liver trauma. *Br J Surg* 1999; 86:1121-35.
7. Asensio JA, Demetriades D, Chawan S, Gomez H, Hanpeter D, Velmahos G, et al. Approach to the management of complex hepatic injuries. *J Trauma* 2000;48:66-9.
8. Moore EE, Cogbill TH, Jurkovich TG. Organ injury scaling: spleen and liver. *J Trauma* 1995;38:931-40.
9. Fang JF, Chen RJ, Lin BC, Hsu YB, Kao JL, Chen MF. Blunt hepatic injury: Minimal intervention is the policy of treatment. *J Trauma* 2000; 49:722-8.
10. Piper GL, Pietzman AB. Current management of hepatic trauma. *Surg Clin North Am* 2010;90:775-85.
11. Parks, Nancy A, Davis, James WI. Observation for non-operative management of blunt liver injuries. *J Trauma Crit Care*. 2011;70:626-9.
12. Beckingham JJ, Krige JE. Liver and pancreatic trauma. *Br Med J* 2001; 322: 783-5.
13. Chaudhry AK, Azam M, Maqsood R. Repair of retrohepatic inferior vena cava. *J Coll Physicians Surg Pakistan* 2003;13:22-35.
14. Pachter HL, Feliciano DV. Complex hepatic injuries. *Surg Clin North Am* 1996; 76: 763-82.
15. Al-Mulhim SA, Muhammad HA. Non operative management of blunt hepatic injury in multiply injured adult patients. *J R Coll Surg* 2003; 4: 81-5.
16. Saeed Y. Yousaf H, Syed HS. Management of severe hepatic injuries. *Pak J Gastroenterol* 1993;7:27-33.
17. Zargar M. Liver trauma operative and non-operative management. *Inter J Collaborative Research* 2010;2:96-107.
18. Poletti PA, Mirvis SE, Shanmuganathan K, Killen KL, Coldwell D. CT criteria for management of blunt liver trauma: correlation with angiographic and surgical findings. *Radiology* 2000;216:418-27.
19. Ma OJ, Kefer MP. Ultrasound detection of free intraperitoneal fluid associated with hepatic and splenic injuries. *South Med J* 2001;94:54-7.
20. Dinkel HP, Moll R, Gassel HJ, Knupffer J, Timmermann W, Fieger M, et al. Helical CT cholangiography for the detection and localization of bile duct leakage. *Am J Roentgenol* 1999;173:613-7.
21. Cuff RF, Cogbill TH, Lambert PJ. Non-operative management of blunt liver trauma: The value of follow up abdominal computed tomography scans. *Am J Surg* 2000; 66: 332-6.
22. Richards JR, McGahan JP, Pali MJ, Bohnen PA. Sonographic detection of blunt hepatic trauma: hemoperitoneum and parenchymal patterns of injury. *J Trauma* 1999;166: 903-7.
23. Mullins RJ, Huckfeldt R, Trunkey DD. Abdominal vascular injuries. *Surg Clin North Am* 1996;76:813-32.
24. Ahmed N, Vernick JJ. Management of liver Trauma In adults. *J Emerg Trauma Shock* 2011;4:114-9.
25. Yazman I, Nazlio, Tugrul TI. Surgical treatment of hepatic injury morbidity and mortality analysis of 109 cases. *J Hepato-gastro-enterology* 2007;54:1507-11.