

## SELECTIVE NON-OPERATIVE MANAGEMENT OF TRAUMATIC LIVER INJURY

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### ABSTRACT:

**Objective:** To assess the feasibility and safety of selective non-operative management in traumatic liver injuries.

**Patients and Methods:** The study included 20 patients underwent non-operative management of liver trauma from January 2007 to December 2011), at the Department of General Surgery, Minia University Hospital. The selective criteria included: (1) haemodynamic stability after resuscitation, and (2) absence of signs of other visceral or retroperitoneal injuries that require surgery. The liver injury was proved by surgical exploration or defined by computed tomography (CT) scan. The severity of liver injuries was assessed using American Association for the Surgery of Trauma (AAST). If a patient's condition was worsening with unstable general vital signs and/or an abdominal lavage for blood was positive, an urgent laparotomy was decided on.

**Results:** The AAST Liver Injury Scale results were as follows: grade I in 9 patients; grade II, 6 patients; grade III, 3 patients; grade IV, 2 patients; grade V, no patient. Associated intraabdominal or extraabdominal injuries, or both, were found in 14 (70%) patients. The percentage of failure of nonoperative management was 15% (3/20). The percentage of patients had successful nonoperative management decreased as the grade of liver injury increased. Among the three patients who had failure of non-operative management, the main cause of operative management was associated splenic injuries in 2 patients and delayed liver bleeding in one patient. Three (17.6%) of the 17 patients who successfully managed non-operatively required adjunctive treatment, and all had a high degree of success.

**Conclusion:** In the appropriate environment, selective non-operative management of traumatic liver injuries has a high success rate. Severity of injury affects decision and failure of management.

### KEYWORDS:

Liver

Conservative

Trauma

Non-operative

### INTRODUCTION:

The liver is the most frequently injured abdominal organ, despite its relatively protected location<sup>1,2</sup>. The management of hepatic trauma has undergone a paradigm shift over the past several decades with significant improvement in outcomes, shifting from mandatory operation to selective nonoperative treatment, and, presently,

to nonoperative treatment with selective operation<sup>3</sup>.

Nonoperative therapy of liver injuries has become an acceptable approach to management of hemodynamically stable patients without associated injury requiring laparotomy, and the indication is extended<sup>4-6</sup>. However, some surgeons recommend

that nonoperative management should be initiated only for injuries below grade III in patients with stable hemodynamics; grade III to grade V injuries usually require surgical intervention<sup>7</sup>. The present prospective study evaluated the safety and success rate of non-operative management of traumatic liver injuries.

#### **PATIENTS AND METHODS:**

The study included 20 patients with liver trauma in a 4-year period (January 2007-December 2011), at the Department of General Surgery, Minia University Hospital, Egypt, who underwent non-operative management. The inclusion clinical criteria for nonoperative management included: (1) haemodynamic stability after resuscitation, and (2) absence of signs of other visceral or retroperitoneal injuries that require surgery.

The medical records were reviewed for information regarding patients' sex, age, mechanism and side of injury, physical findings, laboratory findings, radiologic imaging, and operative or nonoperative management.

In addition, the recorded data included: shock state on admission, amount of blood transfusion, severity of hepatic injuries (including grade of hepatic injury and Injury Severity Score [ISS] value), associated intra-abdominal and extraabdominal injuries, method of diagnosis, therapeutic procedures, and the outcome (uneventful recovery, postoperative complications, mortality and cause of the death).

The liver injury was proved by surgical exploration or defined by computed tomography (CT) scan. The severity of liver injuries was assessed

using American Association for the Surgery of Trauma (AAST), (Table 1)<sup>8</sup>.

In cases where the hepatic injury was defined by CT and patients were hemodynamically stable, treatment was decided to be conservative. If a patient's condition was worsening with unstable general vital signs and/or an abdominal lavage for blood was positive, an urgent laparotomy was decided on. Hemo-dynamic stability was defined as those patients who initially presented with, or regained, a systolic blood pressure greater than 90 mmHg and a heart rate less than 100 beats/min after initial resuscitation with 2 L of crystalloids.

#### **RESULTS:**

There were 15 male (75%) and 5 female (25%) patients, with an age range of 18 to 64 years (median age, 32 years). Injury was defined as blunt trauma in 16 patients (80%) and penetrating trauma in 4 patients (20%). The AAST Liver Injury Scale results were as follows: grade I in 9 patients; grade II, 6 patients; grade III, 3 patients; grade IV, 2 patients; grade V, no patient (Table 2). Associated intraabdominal or extraabdominal injuries, or both, in 14 (70%) patients are shown in Table 3. Bone and joint injuries, head injuries and chest injuries were most often observed. The major associated intraabdominal injuries were observed in 4 patients (20%), 2 had Splenic injury, one had diaphragmatic tear, and another one had mesenteric contusion.

The studied 20 patients with stable hemodynamics at admission were treated nonoperatively in the first instance. Of these 20 cases, 17 were cured including grade I (9), grade II (5), grade III (2), and grade IV (1). The remaining 3 patients (15%)

required a subsequent laparotomy within 8–24 hours because hemodynamic status worsened. During the operation, one patient (3.3%) with grade III–IV injury died of excessive blood loss because of the delay. The percentage of failure of nonoperative management was 15% (3/20); and it was 40% (2/5) in grade III–IV injuries. The percentage of patients had successful nonoperative management decreased as the grade of liver injury increased (Figure 1).

Among the three patients who had failure of nonoperative mana-

gement, the main cause of operative management was associated splenic injuries in 2 patients and delayed liver bleeding in one patient.

Three (17.6%) of the 17 patients who successfully managed nonoperatively required adjunctive treatment, and all had a high degree of success. A percutaneous drainage of biloma or hematoma was done in 2, while endoscopic retrograde cholangiopancreatography (ERCP) was performed in 1 patient and biliary leakage was successfully treated with stenting.

**Table (1):** American Association for the Surgery of Trauma (AAST) liver injury scale [8]

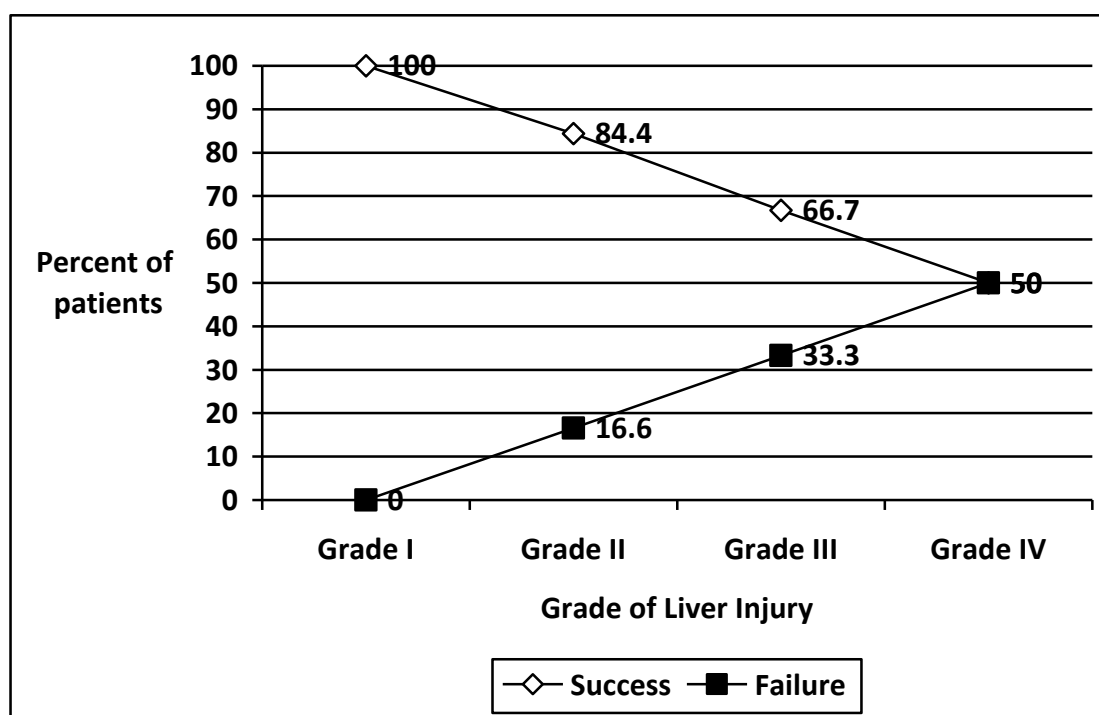
Grade	Description of injury
I	Haematoma: Subcapsular, nonexpanding, <10% surface area Laceration: Capsular tear, nonbleeding, <1 cm in parenchymal depth
II	Haematoma: Subcapsular, 10–50% surface area; intraparenchymal, <10 cm in diameter Laceration: 1–3 cm in parenchymal depth, <10 cm in length
III	Haematoma: Subcapsular, >50% surface area or expanding. Ruptured subcapsular or parenchymal haematoma. Intraparenchymal >10 cm or expanding Laceration: >3 cm in parenchymal depth
IV	Haematoma: Ruptured intraparenchymal haematoma with active bleeding Laceration: Parenchymal disruption involving 25–75% of a hepatic lobe or one to three Couinaud segments within a single lobe
V	Laceration: Parenchymal disruption involving >75% of a hepatic lobe or more than three Couinaud segments within a single lobe Vascular: Juxtahepatic venous injuries (i.e., retrohepatic vena cava or central major hepatic veins)
VI	Vascular: Hepatic avulsion

**Table (2):** Demographic data, mechanism of traumatic injury, and AAST Liver Injury Scale in 20 patients.

Associated injuries	No. of patients
Age; years, median (range)	32 (18-64)
Sex; M/F	15/5
Mechanism of injury	
Blunt trauma	16
Penetrating trauma	4
AAST Liver Injury Scale:	
Grade I	9
Grade II	6
Grade III	3
Grade IV	2

**Table (3):** Associated injuries in 20 patients.

Associated injuries	No. of patients
Bone and Joint	11
Head	7
Abdomen (other than liver)	4
Chest	2

**Fig. (1):** The percentage of patients with success and failure after nonoperative management of liver trauma as the grade of liver injury.

**DISCUSSION:**

Nonoperative management was first reported in 1972 and has been one of the most significant changes in the treatment of liver injuries over the last two decades<sup>9-12</sup>. This paradigm shift developed as a result of several factors: (1) the recognition that 50–80% of liver injuries stop bleeding spontaneously, (2) the precedent of successful nonoperative management in children, and (3) the significant development of liver imaging with CT scanning<sup>13,14</sup>.

The current study agreed with literature in that important assessment criteria for nonoperative management include (1) haemodynamic stability after resuscitation, (2) absence of signs of other visceral or retroperitoneal injuries that require surgery, and (3) the availability of an effective multidisciplinary team providing good-quality CT imaging, intensive care facilities, and suitably experienced surgeons<sup>15,16</sup>.

In the current study, patients with stable hemodynamics at admission were treated nonoperatively in the first instance. It is generally accepted that the ultimate decisive factor in favour of nonoperative management is the haemodynamic stability of the patient, irrespective of the grade of injury or the volume of haemoperitoneum. It is also essential that appropriate clinical and radiological follow-up is arranged<sup>17-20</sup>.

In the current study, nonoperative management was carried in 16 patients (80%) with blunt trauma and 4 patients (20%) with penetrating trauma. In literature, nonoperative management has become the standard of care in patients with blunt liver trauma, with a 23.5% reduction in mortality in grade III and grade IV

patients<sup>21,22</sup>, and it is considered standard treatment for 80% of blunt hepatic trauma<sup>23</sup>. The same technique has also emerged as effective management in appropriately selected patients with liver penetrating injuries<sup>24,25</sup>.

In the current study, the failure of nonoperative management was 15% and thus the success rate was 85%. Evidence for the efficacy of nonoperative management of liver trauma accumulated throughout the 1990 s, with success rates ranging from 80 to 100% and documentation of significant reduction in blood transfusion requirements and reduced hospital stay<sup>5,26-28</sup>. As proved in the current study, the failure rate of nonoperative management leading to the necessity to resort to open surgery is significantly higher in grade IV and V injuries compared to grade I–III injuries<sup>29</sup>. In the current study, among the three patients who had failure of nonoperative management, the main cause of operative management was associated splenic injuries in 2 patients and delayed liver bleeding in one patient. The necessity to resort to surgical intervention is rarely due to liver-related complications<sup>5</sup>. The most common reason for surgical intervention in patients initially managed nonoperatively is coexisting abdominal injury such as delayed bleeding from the spleen or kidney<sup>30</sup>. Failure of nonoperative management due to delayed liver bleeding is rare (0–3.5%)<sup>31,32</sup>.

In the current study, 3(17.6%) of the 17 patients who successfully managed nonoperatively required adjunctive treatment. Similarly, Carrillo and colleagues<sup>33</sup> showed that 24% of patients managed nonoperatively required additional treatment secondary to complications,

and in the study by Gourgiotis and colleagues<sup>34</sup>, 13.5% of those managed nonoperatively required adjunctive treatment procedures.

In conclusion, selective nonoperative management of traumatic liver injuries is safe when the decision is based on careful initial evaluation, aggressive resuscitation, and close observation of their hemodynamic stability. Also, hepatic injuries can be managed nonoperatively in hospitals where CT is available. Low-grade injuries can be managed nonoperatively with excellent results, while severe hepatic injuries require surgical intervention due to hemodynamic instability.

#### REFERENCES:

- 1- Ochiai T, Igari K, Yagi M, Ito H, Kumagai Y, Iida M, Matsumoto A, Kumada Y, Shinohara K, Yamazaki S. Treatment strategy for blunt hepatic trauma: analysis of 183 consecutive cases. *Hepatogastroenterology* 2011; 58(109): 1312–1315.
- 2- Morrison JJ, Bramley KE, Rizzo AG. Liver trauma—operative management. *J R Army Med Corps* 2011; 157(2): 136–144.
- 3- Kozar RA, Feliciano DV, Moore EE, Moore FA, Cocanour CS, West MA, Davis JW, McIntyre RC Jr. Western Trauma Association/critical decisions in trauma: operative management of adult blunt hepatic trauma. *J Trauma* 2011; 71(1): 1–5.
- 4- Davis KA, Reed RL, Santaniello J, et al. Predictors of the need for nephrectomy after renal trauma. *J Trauma*. 2000;60:164–170.
- 5- Velmahos G, Toutouzas K, Radin R, et al. High success with non-operative management of blunt hepatic trauma: the liver is a sturdy organ. *Arch Surg*. 2003;138:475–480.
- 6- Santucci RA, Fisher MB. The literature increasingly supports expectant (conservative) management of renal trauma: a systematic review. *J Trauma*. 2005;59:493–503.
- 7- Parks RW, Chryso E, Diamond T. Management of liver trauma. *Br. J. Surg*. 1999;86: 1121-1135.
- 8- Moore EE, Cogbill TH, Jurkovich GJ. Organ injury scaling: spleen and liver (1994 revision). *J Trauma*. 1995; 38:323–324.
- 9- Ritchie JP, Fonkalsrud EW. Subcapsular haematoma of the liver: nonoperative management. *Arch Surg*. 1972;104:781–784.
- 10- Velmahos GC, Toutouzas KG, Radin R. Nonoperative treatment of blunt injury to solid abdominal organs: a prospective study. *Arch Surg*. 2003;138:844–851.
- 11- Haan JM, Bocchicchio GV, Kramer N. Nonoperative management of blunt splenic injury: a 5-year experience. *J Trauma*. 2005;58:492–498.
- 12- Stein DM, Scalea TM. Nonoperative management of spleen and liver injuries. *J Intensive Care Med*. 2006;21:296–304.
- 13- Losty PD, Okoye BO, Walter DP. Management of blunt liver trauma in children. *Br J Surg*. 1997;84:1006–1008.
- 14- Stylianos S. Evidence-based guidelines for resource utilisation in children with isolated spleen or liver injury. The APSA Trauma Committee. *J Pediatr Surg*. 2000;35:164–167.
- 15- Pachter HL, Knudson MM, Esrig B. Status of non-operative management of blunt hepatic injuries in 1995: a multicenter experience in 404 patients. *J Trauma*. 1996;40:31–38.
- 16- Brammer RD, Bramhall SR, Mirza DF. A 10-year experience of complex liver trauma. *Br J Surg*. 2002;89:1532–1537.
- 17- Demetriades D, Gomez H, Chahwan S. Gunshot injuries to the liver: the role of selective nonoperative management. *J Am Coll Surg*. 1999; 188:343–348.

- 18-Beckingham IJ, Krige JE. ABC of diseases of liver, pancreas and biliary system. Liver and pancreatic trauma. *BMJ*. 2001;322:783–785.
- 19-Yaman I, Nazli O, Tugrul T. Surgical treatment of hepatic injury: morbidity and mortality analysis of 109 cases. *Hepatogastroenterology*. 2007; 54:1507–1511.
- 20-Sikhondze WL, Madiba TE, Naidoo NM. Predictors of outcome in patients requiring surgery for liver trauma. *Injury*. 2007;38:65–70.
- 21-Demetriades D, Hadkizacharia P, Constantinou C. Selective nonoperative management of penetrating abdominal solid organ injuries. *Ann Surg*. 2006;244:620–628.
- 22-Coimbra R, Hoyt DB, Engelhart S. Nonoperative management reduces the overall mortality of grades 3 and 4 blunt liver injuries. *Int Surg*. 2006; 91:251–257.
- 23-Letoublon C, Chen Y, Arvieux C, Voirin D, Morra I, Broux C, Risse O. Delayed celiotomy or laparoscopy as part of the nonoperative management of blunt hepatic trauma. *World J Surg*. 2008;32(6):1189-93.
- 24-Omoshoro-Jones JAO, Nicol AJ, Navsaria PH. Selective nonoperative management of liver gunshot injuries. *Br J Surg*. 2005;92:890–895.
- 25-DuBose J, Inaba K, Teixeira PG. Selective non-operative management of solid organ injury following abdominal gunshot wounds. *Injury*. 2007;38:1084–1090.
- 26- Sherman HF, Savage BA, Jones LM. Nonoperative management of blunt hepatic injuries: safe at any grade? *J Trauma*. 1994;37:616–621.
- 27- Ochsner MG. Factors of failure for nonoperative management of blunt liver and splenic injuries. *World J Surg*. 2001;25:1393–1396.
- 28- Coughlin PA, Stringer MD, Lodge JP. Management of blunt liver trauma in a tertiary referral centre. *Br J Surg*. 2004;91:317–321.
- 29- Leppaniemi AK, Mentula PJ, Streng MH, Koivikko MP, Handolin LE. Severe hepatic trauma: nonoperative management, definitive repair, or damage control surgery? *World J Surg*. 2011;35(12):2643-9.
- 30-Markogiannakis H, Sanidas E, Michalakis I, Manouras A, Melissas J, Tsiftsis D. Predictive factors of operative or nonoperative management of blunt hepatic trauma. *Minerva Chir*. 2008;63(3):223-8.
- 33- Carrillo EH, Spain DA, Wohltmann CD, Schmiege RE, Boaz PW, Miller FB, Richardson JD. Interventional techniques are useful adjuncts in nonoperative management of hepatic injuries. *J Trauma* 1999;46:619–22.
- 34- Gourgiotis S, Vougas V, Germanos S, Dimopoulos N, Bolanis I, Drakopoulos S, Alfaras P, Baratsis S. Operative and nonoperative management of blunt hepatic trauma in adults: a single-center report. *J Hepatobiliary Pancreat Surg*. 2007;14(4):387-91.