Outcome of Management of Blunt Liver Trauma

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Abstract: Background: Liver is a solid organ with the highest injury rate in abdominal injury. Approximately 15% e 20% of abdominal injuries refer to hepatic trauma. Hepatic injury takes the third place in abdominal injury and 80% e 90% of hepatic injuries are blunt ones. In 2013, a study using ultra sonography to evaluate the intraperitoneal trauma showed that liver was the mostly affected organ and younger people were more vulnerable to hepatic and pancreatic injury. **Objective:** To assess the safety and efficacy as well as advantages and disadvantages in management of patients with liver blunt trauma so as to put conclusion and recommendation about what results arrive in management of patients with blunt liver trauma. **Patients and Methods:** The study was conducted at Emergency departments in Ain shams University Hospitals and Al-Ahrar Teaching Hospital in Al- zagazig and included 20 patients of both sexes with blunt liver trauma from May 2018 to May 2019. All patients presented to emergency department with blunt abdominal trauma and were diagnosed by focused abdominal Sonography for trauma (FAST) to have liver trauma. **Results:** This study was conducted on twenty patients with blunt liver trauma, their ages ranged from 18 to 60 years with Mean ± SD 38.13 ± 5.17, 4 patients (20%) were females, while 16 patients (80%) were males. There were two patients of grade IV liver injury one managed surgically and the other managed conservatively. **Conclusion:** The Patients who underwent conservative treatment with high-grade liver injuries should be closely monitored in the intensive care unit for the indication of failure of NOM which can be treated with operative management. NOM could be successful even in high graded injuries with low morbidity and mortality.

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1. Introduction

The liver is the largest gland in the body occupying 2.5% of total body weight and providing a host of functions necessary for maintaining normal physiological homeostasis. Despite the complexity of its functions, the liver has a homogenous appearance, making hepatic anatomy a challenging topic of discussion. To address this issue, scholars have devoted time to establishing a framework for describing hepatic anatomy to aid clinicians. Work by the anatomist Sir James Cantlie provided the first accurate division between the right and left liver in 1897. The French surgeon and anatomist Claude Couinaud provided additional insight by introducing the Couinaud segments on the basis of hepatic vasculature. These fundamental studies provided a framework for medical and surgical discussions of hepatic anatomy and were essential for the advancement of modern medicine [(1)].

The liver has fixed position and large size these make it more prone for injury in blunt trauma of the abdomen followed by spleen. Liver and spleen together, account for 75% of injuries in blunt abdominal trauma. Liver is the most common cause of death following abdominal injury. The management of blunt trauma abdomen is challenging. The liver is the second most commonly injured abdominal organ, despite its well-protected position, because of its size and position which makes it prone to injury [(2)].

Hepatic traumatic lesions can be classified as minor (grade I, II), moderate (grade III) or major/severe (grade IV, V) injuries. This classification is not well defined in the literature, but aims to define the type of management that can be adopted and the related outcome. Frequently low-grade American Association for the Surgery of Trauma (AAST) lesions (i.e., grade I-III) are considered as minor or moderate and treated with Non Operative Management. However some patients with high-grade lesions (i.e., grade IV-V laceration with paren-chymal disruption involving more than 75 % of the hepatic lobe or more than 3 Couinaud segments within a single lobe) may be hemo-dynamically stable and treated with NOM. This demonstrates that the classification of liver injuries as minor or major ones must consider not only the anatomic AAST classification but more importantly, the hemodynamic status of the patient and the associated injuries [(3)].

Non operative management of blunt hepatic trauma is now the standard of care for

hemodynamically patients with reported success rates ranging from 82% to 100 %. The advantages of NOM include: lower hospital cost, earlier discharge, avoiding non-therapeutic laparotomy and their associated cost and morbidity, unnecessary liver resection, fewer intra-abdominal complications and reduced number of transfusions [(4)].

The initial assessment of patients with suspected blunt abdominal trauma should focus on the patient's abdominal examination, vital signs, and response to resuscitation. General principles of advanced trauma life support should be instituted, and the response to resuscitation closely monitored. Peritonitis remains an indication for exploration after blunt abdominal trauma [(5)].

In a prospective case–control trial, reported that even higher grades of liver injury responded to NOM and that only a loss of haemodynamic stability or the development of complications determined the need for surgery [(6)].

Doctors should be experienced in order to closely observe the patients and prepare for emergent operation in time in the early stage, the doctors should accurately judge the severity of injury, monitor the patients' vital signs and ensure hemodynamic changes timely. Moreover, symptomatic treatment, nutritional support, and the maintenance of the patient's water and electrolyte balance are necessary to promote the healing of viscus organs, meanwhile the doctors should also pay attention to the protection of viscus function [(6)].

Aim of the Work

The aim is to assess the safety and efficacy as well as advantages and disadvantages in management of patients with liver blunt trauma so as to put conclusion and recommendation about what results arrive in management of patients with blunt liver trauma.

2. Patients and Methods

The study was conducted at ***Emergency departments in Ain shams University Hospitals and Al-Ahrar Teaching Hospital in Al- zagazig*** and included 20 patients of both sexes with blunt liver trauma from May 2018 to May 2019.

Inclusion criteria:

All patients presented to emergency department with blunt abdominal trauma and were diagnosed by focused abdominal Sonography for trauma (FAST) to have liver trauma.

Exclusion criteria:

Patients with hemodynamic instability. Patients with Clinical signs of peritonism. Patients with Continued reduction in hematocrit values. Patients with Associated injuries requiring an OM.

All patients were subjected to:

1) Initial clinical evaluation: I)

On admission patients were examined and resuscitated according to Advanced Trauma Life Support (ATLS) protocol as follows:

Resuscitation and anti-shock measures:

Large bore intravenous cannulas in both cubital fossa. Blood samples taken for cross matching and laboratory investigation. Crystalloid fluid infusion till ABO typing and cross matching done. Blood transfusion. Urinary Catheterization.

II) History:

Name, age, sex, mechanism of injury and past history of any chronic diseases as hypertension, diabetes, heart disease.

III) Clinical Examination:

General examination to determine the hemodynamic status and to exclude associated injuries. Abdominal examination.

V) Investigations:

Radiological. Chest and abdominal films were taken. Focused Assessment with Sonography for trauma (FAST) was done routinely for all cases to detect hemo-peritoneuum. Laboratory. Complete blood count, Prothrombin time and concentration were done.

CT Images

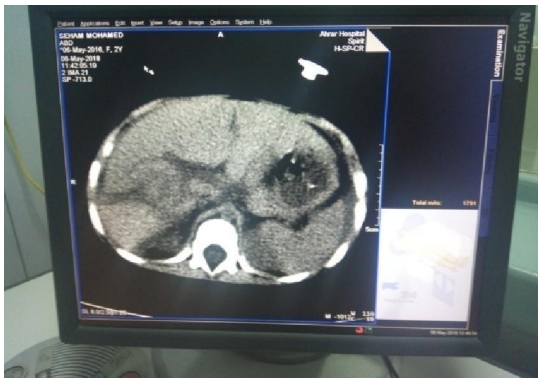

Fig. (1): Grade IV hepatic injury: A CT shows disruption more than 25% in a female patient

Operative Images:

See Fig. (2):

3. Results

See Tables.

4. Discussion

The management of the liver trauma still a challenge to the all surgeons. In the last decades, there was a constant debate regarding the most appropriate management of these often critically ill patients [(7)].

In the last 15 years, management of liver trauma has progressively evolved. At the beginning of the 1990's several articles reported the possibility of non-

surgical treatment in hemodynamically stable patients. The aim of this type of treatment is not only to decrease the number of non-therapeutic laparotomies but also to achieve in reduction of the values of morbidity and mortality [8].

Non operative management (NOM) of blunt liver trauma has generally become the most frequent treatment. Current rates of success for NOM for liver trauma of selected patients have been reported to be safe and efficient [9].

In this study, 20 patients with blunt liver trauma presented to **Emergency departments of Ain Shams Hospitals and Al-ahrar Teaching Hospital in Alzagazig** were included.

It is usual that male and young adults are more susceptible to trauma as they are normally more involved in many hazardous activities so that male in this study represents 80% (16 patients) while female 20% of the patients (4) and the mean age of the patients in this study was 38.13 ± 5.17 years.

The results of this study match with that performed by *Asfar et al.* [6] in which male to female ratio represents (4 male: 1 female) and the mean age was 29.02 ± 11.18 years.

Fig. (3): Male pt 33 years old with blunt abdominal trauma in RTA with active hemorrhage by FAST and liver injury grade II hepatic injury by ct scan

Table (1): Demographic and characteristics of the studied patients.

		No.=20
Sex	Female	4 (20.0%)
	Male	16 (80.0%)
Age (Y)	Mean±SD	38.13 ± 5.17
	Range	18– 60
Wt (kg)	Mean±SD	78.11 ± 11.97
	Range	50 – 100
Co-morbidities	+ve	2(10.0%)
	-ve	18(90%)
Interval from trauma to admission (in hours)	Mean±SD	6 ± 12.3
	Range	1-8

Table (2): The cause of injury and the treatment method of the studied patients.

		No.=20
Cause of injury	Traffic accident	12 (60.0%)
	Accidental fall	5 (25.0%)
	Hit by hard object	3(15.0%)
Grade of liver injury	Grade I	7(35.0%)
	Grade II	6(30.0%)
	Grade III	5(25.0%)
	Grade IV	2(10.0%)
	Grade V	00.00
Method of treatment	Surgical	3(15.0%)
	NOM	17 (85.0%)

Table (3): The results of initial evaluation of the studied patients.

		No.=20
Focused assessment with US for trauma (FAST)	No collection	1(5.0%)
	Minimal	4(20.0%)
	Mild	8(40.0%)
	Moderate	6(30%)
	Marked	1(5.0%)
Hemodynamic status	Stable	17(85.0%)
	Unstable	3(15.0%)
Site affected in the liver	Rt lobe	13(65%)
	Lt lobe	5(25.0%)
	Both	2(10.0%)

Table (4): A diagram showing groups who will go under conservative management and operative management.

		Surgical	NOM	P. value
Sex	**Male**	3	13	0.09
	Female	1	3	
Grade of liver injury	**Grade I**	0	7	0.002
	Grade II	1	5	0.002
	Grade III	1	4	0.002
	Grade IV	1	1	0.002
Extravasation of dye at CT scan		2	1	0.05
Mean N of packed RBC		7.2±8.1	0.4±2.2	0.001
Mortality (N)		1	1	0.002
Requirements for blood transfusion		3(75%)	4(25%)	0.05

Table (5): Findings according to hemodynamic stability.

	Surgical	NOM	P.value
Mean Hb at admission	10.9 ±2.6	11.9 ±2.1	0.05
Mean Hb after 4h from admission	10.2 ±1.3	10.9 ±1.3	0.05
Mean Aspartate Amino Transferase at admission	441.2 ±402.2	412.3 ±426	0.954
Mean Alanine Amino Transferase at admission	290 ±265.3	372 ±383.1	0.251
Mean heart rate at admission	100.8 ±22.2	98.7 ±18.5	0.05
Mean respiratory rate at admission	19.2 ±5.1	21.0 ±3.2	0.05
Mean systolic blood pressure at admission	96.2 ±34.1	122.19 ±21.28	0.001

Table (6): Hemodynamic stability according to the grade of liver injury.

	Low grade liver injury (grade I-II)	high grade liver injury (grade III-IV)	P.value
Mean Hb at admission	10.9±2.6	10.6±2.1	0.12
Mean Hb after 4h from admission	12.1±1.3	10.2±1.3	0.05
Mean heart rate at admission	96.8±21.2	98.9±28.5	0.15
Mean respiratory rate at admission	20.2±1.1	19.1±3.2	0.65
Mean systolic blood pressure at admission	97.3±3.2	96.3±1.2	0.22

Table (7): Heamodynamic stability between patients who failed in NOM and patient who successfully had NOM.

	Failed in NOM	Successfully had NOM	P.value
Mean Hb at admission	9.9±1.6	10.9±1.2	0.911
Mean Hb after 4h from Admission	10.0±1.1	11.9±1.7	0.10
Mean heart rate at admission	96.8±24.1	97.7±28.5	0.121
Mean respiratory rate at admission	18.8±9.1	20.9±3.2	0.005
Mean systolic blood pressure at admission	110.2±14.1	122.19±21.28	0.21

Table (8): Post-operative complications and morbidity (n=6 patients).

Post-operative complications	N	%
Pleural effusion	2	10.0%
Bronchopneumonia	1	5.0%
Hepatic abscess	1	5.0%
Biliary fistula	1	5.0%
Delayed hemorrhage	1	5.0%

This study pointed that the most common cause of the liver trauma is road traffic accidents (RTA) (12 patients; 60%) which is similar to a study performed in Theodore Bilharz Research Institute, Cairo University by *Hamdy et al.,* [9]**.** In which victims of road traffic accident compromised 57% of the mechanism of injury. These results, in both studies performed in Egypt, point to a major problem of motor vehicle collisions in Egypt.

In this study scan for all patients by Focused Assessment with Sonography for trauma (FAST) ultrasound scan was done. The FAST scan revealed that 30% of the patients (6 patients) had moderate amount of intraperitoneal free fluid; 5th of them had successful conservative management so the amount of intra-peritoneal free fluid detected by FAST scan cannot be depended upon to determine the method of management.

Patients in this study underwent into two groups according the vital status, hemodynamically stable group represented by 17 patients (85%) admitted vitally stable managed conservatively and hemodynamically unstable group represented by 3 patients (15%) admitted vitally unstable require urgent exploration. This is in agreement with the study done by *Asfar et al.* [6] who found 98 patients (83.8%) vitally stable and 19patients (16. 2%) vitally unstable.

In this study, 85% of the patients (17 patients) were treated conservatively with only 12.5% (2 patients) had failed the conservation. This is match with the study of *Asfar et al.* [6] where 83% of the patients (98 patients) treated conservatively with 4.08% (4 patients) failed.

As expected the magnitude of non-operative management of traumatic liver injury was higher considerably compared to operative management. This is most probably due to the new advancement in diagnostic tools and intensive care management [10]**.**

Most surgeons determine the treatment of traumatic liver injury according to a patient's hemodynamic status rather than the injury grade. The relationship between the liver injury grade and treatment choice remains controversial.

The percentage of low-grade liver injury was significantly greater in the NOM group (93.75% vs. 75%). This is in accordance with *Park et al., study* [11] where low-grade liver injury percentage was significantly greater in the NOM group (84.3% vs. 47.5%). In contrast, the percentage of high-grade (grade IV) liver injury was equal in both groups (n=1, 50%) but in *Park et al., study* [11] the percentage of high-grade (grade IV and V) liver injury was greater in the operative group (n=21, 52.5%) versus the NOM group (n=17, 15.7%)

There were some reasons why high-grade liver injuries were not well managed by NOM because of high-grade injury were associated with hemodynamic instability, patients with high-grade injury in the current study had a significantly lower mean systolic blood pressure at admission and reduced mean hemoglobin levels 4 hours after and patients with high-grade injury might have an associated co-injuries [11]**.**

There were no difference between both groups (OM_NOM) in the initial aspartate amino transferase and alanin amino transferase levels However, the mean hemoglobin at admission and 4 hours after were significantly lower in OM than in the NOM patients ($p < 0.05$). The change in hemoglobin level was also greater in the operative management. The mean number of transfused units on admission was greater in the operative group (7.2 vs. 0.4) this is in accordance with *Park et al., study* [11]**.**

Site of injuries were (65%) of patients in the right lobe (13 patients) while (25%) of patients in the left lobe (5 patients). (10%) of patients were affected in both lobes (2 patients). It is found that patients who failed in conservative treatment were injured one on each lobe (right and left). So, the site of injury has no effect on the outcome of the conservative management but the prevalence of right lobe injury may be due to its large size and proximity to the ribs [8]**.**

According to the grades of liver injury, there were no significant differences in the initial mean heart rate, mean respiratory rate, or mean hemoglobin. In the low-grade group, the mean systolic blood pressure at admission was higher than that of the high-grade group (97.3 mmHg vs. 96.3 mmHg). Furthermore, the mean hemoglobin after 4 hours was significantly higher in the low-grade group (12.1 g/dl

vs. 10.2 g/dl, $p < 0.05$) nearly the same results of *Park et al., study* [11].

Requirements of transfused blood was in 7 patients (one from conservative group and three patients of surgical group 25%) with average amount of 1-2 units of blood transfused. This was similar to *Parray and colleagues study* in [12] where 47 patients out of 152 patients included in that study (31%) required blood transfusion with an average of 2 units of blood transfused.

Patients in operative management were three (75%) required blood transfusion with average amount of 4.5 units of blood transfused like the studies of *Asfar and colleagues in 2014* [6], in which, 70% of the patients (81 out of 117 patients) required blood transfusion.

In this study one patient in the operative group with high grade liver (grade IV) injury died and one patient with high grade liver injury respond to the conservative management. In ***Park et al.*** *study* [11], most patients (80%) who died in operative group had grades IV and V liver injuries. Therefore, prompt resuscitation and appropriate surgical management are required to reduce mortality in patients with high-grade injury and significant blood loss.

In this study, the mean number of days for hospital stay in the conservative management was seven (7) days. on the other hand mean of the operative management was higher because one patient died 48 hours after admission and the others discharged 15 days thereafter. The difference was not significant. In *Slotta et al., study* [13] the mean length of hospital stay was also higher in the operative group than the conservative group without significant statistical difference.

Three authors noted that intensive care unit stay and mean length of hospitalization for patients underwent operative management were either comparable or exceeded that of patients in the conservative management (Boone and others, Sherman and others, and Meredith and others) [12].

The mortality rate was one patient (25%) in patients with OM and one patient in conservative management (6.25).

Park et al., [11] found the mortality rate significantly higher in the operative group than in the NOM group (25.0% vs. 2.8%).

The overall morbidity rate in surgical patients was 40%, with the most common post-operative complication was pleural effusion in two cases.

So, operative management was a predictor of a higher overall complication rate. The combination of non-favorable patient physiology, surgical hemostasis, and high-grade liver injury are also related to the higher number of complications [14].

Conclusion

The vast majority of hepatic injuries are mild (grade I-III) requiring conservative treatment, Therefore, non-operative management of liver injuries should be started and considered in hemodynamic stable patient.

The management of blunt liver trauma conservative or surgical will depend on some factors: stability of hemodynamic status; liver injury grading; amount of blood loss and extravasation of contrast dye and hemoperitoneum in FAST scan CT findings.

The Patients who underwent conservative treatment with high-grade liver injuries should be closely monitored in the intensive care unit for the indication of failure of NOM which can be treated with operative management.

NOM could be successful even in high graded injuries with low morbidity and mortality.

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