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Different Modalities of Management of Liver Trauma (Operative and Nonoperative)

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ABSTRACT

Backgound: non operative management (NOM) of liver injury has generally become the most frequent treatment. Current rates of success for NOM for hepatic trauma of selected patients have been reported to be safe and efficient.

Objective: The purpose of this work is to study and evaluate different modalities in management of liver trauma regarding the available diagnostic modalities and current management options.

Patients and Methods: thirty patients with hepatic trauma were included in the study. They were classified according to their vital stability into 2 groups; conservative and operative groups. The conservative group was formed of 21 patients, while the operative group was formed of 9 patients.

Results: a higher rate of morbidity and mortality during the course of management was found among the patients of the operative group, while 4 patients (19%) in conservative group suffered from complications 6 patients (66.7%) in operative group suffered after the operative management. The only mortality case was found in operative group.

Conclusion: the operative management of liver trauma is associated with higher grade of injury, higher needs for blood transfusion, ICU admission and a higher rate of further management, morbidity, mortality and the presence of co-injuries.

Keywords: Liver Trauma, Operative and Nonoperative management

INTRODUCTION

Abdominal trauma is an emergency condition and, if not treated properly, is associated with significant morbidity and mortality. Today despite advancement in recognition, diagnosis, and management, the mortality remains high[(1)]. Trauma is the second largest cause of hospital admission with 16% of global burden of all health cost. As per the estimate of the World Health Organization, by 2020, trauma will be the first or second leading cause of years of productive life lost for the entire world population[(1)].

Hepatic trauma represents a significant management challenge that requires a high index of suspicion, rapid investigation, accurate classification and well-defined management protocols [(2)].

During the past decades, there has been an overall trend from operative towards conservative treatment in the management of liver trauma. Older studies have shown that almost half of the liver injuries actually had stopped to bleed at the time of operation [(3)].

The success of non-operative management of hepatic injuries in children in the early 1980s prompted the initiation of non-operative management in adults over 15 years ago [(4)].

The introduction and enhancement of the computed tomography (CT) scan has facilitated and improved selection and management of patients treated non-operatively [(3)].

Today non-operative management has become the first treatment of choice when possible in patients with blunt liver trauma. Non-operative management should only be considered in haemodynamically stable patients lacking signs of other laparotomy-demanding injuries [(5)].

Recently, a "multidisciplinary approach" concept has evolved as the standard of care in the treatment of complex hepatic trauma. In addition to prompt surgical intervention, when indicated, adjunctive interventional techniques have become a part of liver trauma management such ashepatic angiography, endoscopic retrograde cholangiopancreatography (ERCP), biliary stenting and percutaneous computed tomography (CT) scan–guided drainage [(6)].

AIM OF THE WORK

The purpose of this work is to study and evaluate different modalities in management of liver trauma regarding the available diagnostic modalities and current management options.

PATIENTS AND METHODS

This prospective study was conducted at Al-Zahraa University Hospital, National Liver Institute, Shebin Elkom Teaching Hospital, and El bagour Hospital. The study included 30 patients with hepatic trauma during two years; 2017 and 2018.

Ethical cosiderations:

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An approval of the study was obtained from Al-Azhar University Academic and Ethical Committee. Every patient signed an informed written consent for acceptance of the operation.

All patients were subjected to:

1) **Initial clinical evaluation:**

a) According to Advanced Trauma Life Support (ATLS) protocol with special emphasis to vital signs (pulse, blood pressure).

b) Resuscitation and anti-shock measures.

2) **History:**

Name, age, sex, mechanism of injury and past history of associated co-morbidity as diabetes, hypertension, heart disease, etc.

3) **Examination:** general and abdominal examination.

4) **Investigations:** a) Radiological. b) Laboratory.

5) **Management:**

On the basis of hemodynamic status of the patients, patients were classified into two groups:

I- Hemodynamic Stable Group

Patients in this group were managed conservatively:

- The criteria for non-operative management (NOM).
- The criteria for discontinuing NOM.
- The Conservative measures.

II- Hemodynamic Unstable Group

Patients in this group were managed Operatively.

- The criteria for immediate operation were:
- Surgical steps:
- Position of the patient.
- Anesthesia.
- Preparation and draping.
- Incision.
- Procedure.
- Postoperative Observation.
- Patients were admitted to ICU for the first 24 hours postoperative then according to their general condition; the patient might stay in ICU or transferred to the surgical ward.
- Postoperative follow-up include close monitoring

6) **Morbidity, mortality and hospital stay.**

7) **Follow-up:**

- Follow-up after discharge in out-patient clinic was done by clinical examination and imaging, if required, for 4-6 weeks to detect any complication as
- Abscess formation.
- Subhepatic collection.
- Biliary leakage.
- Biloma.
- Wound complications.

Statistical analysis:

Recorded data were analyzed using the statistical package for social sciences, version 20.0 (SPSS Inc., Chicago, Illinois, USA). Quantitative data were expressed as mean± standard deviation (SD). Qualitative data were expressed as frequency and percentage.

The following tests were done:

- Independent-samples t-test of significance was used when comparing between two means.
- Chi-square (x^2) test of significance was used in order to compare proportions between two qualitative parameters.
- The confidence interval was set to 95% and the margin of error accepted was set to 5%. The p-value was considered significant as the following:
- Probability (P-value):

- P-value <0.05 was considered significant.
- P-value <0.001 was considered as highly significant.
- P-value >0.05 was considered insignificant.

RESULTS

Thirty patients were included in this study and were classified according to their hemodynamic status after resuscitation into 2 main groups:

1. **Hemodynamic stable group including 21 patients (70%).**
2. **Hemodynamic unstable group including 9 patients (30%).**

Demographic distribution

Demographically, both groups were compared:

Regarding the gender, the hemodynamic stable group included 16 males (76.2%) and 5 females (23.8%), while hemodynamic unstable group included all males (100%) with no significant statistical correlation.

Regarding age, the mean age in hemodynamic stable group was 15 years while in hemodynamic unstable group was 28 years with no significant statistical correlation.

While in hemodynamic stable group children were 15 (71.4%) and adult were 6 (28.6%), in hemodynamic unstable group children were 2 (22.2%) and adult were 7(77.8%) with significant statistical differences (p-value 0.02).

Table (1): Demographic data of the studied patients

Variables	Hemodynamic stable		Hemodynamic unstable		Test of significance	
	Mean±SD		Mean±SD		t-test	P-value
Age	15.38±9.24		28.22±11.75		3.216	0.219
	No.	**%**	**No.**	**%**	**X^2**	**P-value**
Pediatric(<18 years)	15	(71.4%)	2	(22.2%)	6.4	0.02
Adult(>18 years)	6	(28.6%)	7	(77.8%)		
Gender	**No.**	**%**	**No.**	**%**	**X^2**	**P-value**
Male	16	76.2%	9	100.0%	2.571	0.109
Female	5	23.8%	0	0.0%		

Management

After the initial resuscitation, the patients were treated according to their hemodynamic status. The hemodynamic stable patients (21 patients) were treated conservatively (NOM) while the hemodynamic unstable patients (9 patients) were treated operatively (OM).

Table (2): Description of the studied sample as regards management

Variables	Hemodynamic stable		Hemodynamic unstable		X^2	P-value
	No.	%	No.	%		
Management	Conservative		Operative		30.000	0.001
	21	0%	9	30%		

In hemodynamic stable group only 7 patients recieved prehospital care while in hemodynamic unstable group only 3 patients received pre hospital care with no significant statistical difference.

Table (3): Pre-hospital care.

Variables	Hemodynamic stable		Hemodynamic unstable		X^2	P-value
	No.	%	No.	%		
Pre hospital care						
Yes	7	33.3%	3	33.3%	0.000	1.000
No	14	66.7%	6	66.7%		

In the hemodynamic stable group, all patients were managed by conservative management successfully except 2 patients developed hemodynamic instability and/or peritonitis during the first 48 hours of observation and conversion to operative management was needed.

Table (4): Conservative management

Variables	Hemodynamic stable	
	No.	%
Conservative		
Successful	19	90.5%
Failed	2	9.5%

In the hemodynamic unstable group, 5 patients required suture hepatorraphy for the repair of the liver injury while 3 patients required damage control therapy (liver packing) followed by non-anatomical resection in one patient and debridement in the other 2 patients and one patient died postoperatively from irreversible shock and DIC. Regarding both patients who were stable initially, Grade III liver injury in the right lobe was found in one case for which suture hepatorraphy was performed. The other patient showed signs of peritonitis in which perforation in the ileum was found and grade I liver injury in the right lobe. The perforation was repaired primarily while the liver injury responded only to compression and packing statistical significant difference between two groups was found (p-value 0.001).

Table (5): Distribution of surgical techniques among studied patient

Variables		Hemodynamic stable		Hemodynamic unstable		X^2	P-value
		No.	%	No.	%		
Operative	Compression	1	4.8%	0	0.0%		
	Damage control	0	0.0%	3	37.5%		
	Suture Hepatorraphy	1	4.8%	5	62.5%		
	No	19	90.5%	0	0.0%		

Regarding the further management of the co-injuries, the following was found:

In the hemodynamic stable group:

- Seventeen patients did not need further management 12 patients of them were found to have no co-injuries, 2 patients suffered from splenic injury successfully responded to the conservative measures, and 3 patients with fracture ribs and minimal hemothorax managed conservative with strict follow up.
- One patient suffered from traumatic pancreatitis managed by insertion of big tail and medical treatment.
- Chest tube for one patient that had sever hemopneumothorax
- Splint was done for one patient that had fracture humerus then an internal fixation was done later on.
- One of the 2 patients that were converted to operative management discovered to have a perforated viscus during the exploratory procedure a primary repair for a perforation in the ileum was done.

In the hemodynamic unstable group:

- 3 patients did not need further management 1 patient of them were found to have no co-injuries, and 2 patients with head trauma one died and the other improved with medical treatment
- 3 patients with splenic injury had splenectomy one of them also head trauma responded to medical treatment only.
- Chest tubes were inserted in 2 patients with hemopneumothorax.
- Primary repair for diaphragmatic tear and chest tube was inserted for one patient with stab wound with hemopneumothorax.

There is statistical difference between the two groups (p-value 0.03).

Table (6): Further management required in studied patients

Variables		Hemodynamic stable		Hemodynamic unstable		X^2	P-value
		No.	%	No.	%		
Further management	Yes	4	19.0%	6	66.7%		
	No	17	81.0%	3	33.3%		

The outcome findings

After the management, the outcome findings were gathered and analyzed statistically as follow:

In the study, all patients were assessed according to American Association of the surgery for trauma (AAST) either by CT scanning or intra-operatively.

Grade II was found to be the most in the stable group while grade IV then grade III were found to be the most in the unstable group with significant statistical correlation between them (p-value 0.003) .

Table (7): Different grades of liver trauma in studied patients

Variables		Hemodynamic stable		Hemodynamic unstable		X^2	P-value
		No.	%	No.	%		
Trauma grade	I	2	9.5%	0	0.0%		
	II	13	61.9%	1	11.1%		
	III	6	28.6%	3	33.3%		
	IV	0	0.0%	4	44.4%		
	V	0	0.0%	1	11.1%		

The conservative group:

a. One patient with subphrenic abscess resolved by antibiotics.
b. One patient with subhepatic collection resolved by ultrasound guided aspiration.

The operative group:

c. One patients with subphrenic abscess resolved by antibiotics and ultrasound guided aspiration.
d. One patient developed incisional hernia managed by hernioplasty.

Table (8): Percentage of follow up in both groups

Variables		Hemodynamic stable		Hemodynamic unstable		X^2	P-value
		No.	%	No.	%		
Follow up	No	5	23.8%	3	33.3%		
	yes	16	76.2%	6	66.7%		

Table (9): Follow up finding in studied patients

Follow up	Hemodynamic stable (N=16)		Hemodynamic unstable (N=6)		X^2	P-value
	No.	%	No.	%		
Sub-phrenic abscess	1	6.25%	1	16.7%	4.6	0.041
Sub-hepatic collection	1	6.25%	0	0.0%		
Incisional hernia	0	0.0%	1	16.7%		

DISCUSSION

Non-operative management (NOM) of liver injury has generally become the most frequent treatment. Current rates of success for NOM for hepatic trauma of selected patients have been reported to be safe and efficient [2].

In this study, 21(70%) patients were treated conservatively with only 9.5% (2 patients) had failed the conservation. This is lower than **Asfar *et al.*** [7] where 83% of the patients (98 patients) treated conservatively with 4.08% (4 patients) failed. The operative group formed 30% of the patients (9 patients) with death in 1 patient (11.1%) which near the study performed by **Bernardo *et al.*** [5] in which the operative group formed 39.2 % of the patients (56 patients) with death in 16 patients (28.57%) and the study performed by **Sreeramula *et al.*** [8] in which the operative group formed about 43.6 % of the patients (24 patients) with death in 5 patients (20.8%).

Regarding demographic distribution of the patients, it is usual that male and young adults are more susceptible to trauma as they are normally more involved in many hazardous activities so it is not surprisingly that male in our study represents 83% while female represents only 17% of the patients and the mean age was 15.38 ± 9.24 years in the conservative group and 28.22 ± 11.75 years in the operative group. These results match the results of a study performed by **Asfar *et al.*** [7] in which male to female ratio represents (4 male : 1 female) and the mean age was 29.02 ± 11.18 years.

In this study, the presence or absence of co-morbidities did not affect the method of management, morbidity or mortality of the patients. But a study held in China stated that the presence of renal failure or liver cirrhosis increased the mortality among liver trauma patients while diabetes and hypertension did not [9]. The difference could be due to that there were not such severe chronic diseases among patients included in our study. Regarding the mechanism of trauma, the most common mechanism of injury in the study was road traffic accident (21 patients; 70%) which higher than a study performed in Theodore Bilharz Research Institute, Cairo University by **Hamdy *et al.*** [2] 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 accidents in Egypt.

Blunt trauma was found to be the cause of liver injury in 93% of the patients (28 patients) with two thirds of them treated conservatively. On contrary, all penetrating trauma patients (2 patients 7%) were treated operatively. In the study of **Hamdy *et al.*** [2], three fourths of the patients (32 out of 42 patients; 76%) had blunt trauma with two thirds of them treated conservatively while 6 out of 10 patients with penetrating trauma treated operatively.

The high incidence of operative intervention among patients with penetrating liver trauma may be due to more aggressive nature of the penetrating trauma that cause more severe trauma.

Focused Assessment with Sonography for trauma (FAST) ultrasound scan was done for all patients in this study. It was positive in all patients so it is highly sensitive for detection of intra peritoneal haemorrhage, about 40% of the patients (12 patients) had moderate amount of intraperitoneal free fluid; 7 patients out 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.

In this study, the most common site of injury was the right lobe (60%) which is lower than **Sreeramula *et al.*** [8] study where the most common site of injury was also the right lobe (85%). The prevalence of right lobe injury may be due to its large size and proximity to the ribs.

The most common surgical technique used was suture hepatorraphy (6 cases); 5 cases in the operative group and one patient with failure of the conservative management in the conservative group. Damage control therapy was done for 3 patients followed by non-anatomical resection in one patient and debridement in

the other 2 patients, compression was enough in one patient, and one patient died postoperatively from severe shock and DIC.

In **Hamdy *et al.*[2]** study, 40% of the operative group underwent suture hepatorraphy compared to 62.5% of the operative group in our study. Also, 40% underwent damage control therapy by packing compared to 37.5% in our study.

In our study, the mean hospital stay in operative group was 18 day longer than mean hospital stay in conservative group about 9 days with no statistical significant difference that means that the method of management had no effect on the length of hospital stay. We found also that pre-hospital care did not affect the outcome.

16 patients (76.2%) from hemodynamic stable group and 6 patients from unstable group (66.7%) were followed up in the outpatient clinic for 1-3 months by clinical examination and imaging (U/S & CT). 82% of the patients (18 patients) showed satisfactory progress. Only 1patient required surgical intervention to repair incisional hernia by hernioplasty while the others got either intervention radiology or medical treatment to solve their problems. We found what actually affected the outcome was a number of factors including the vital status of the patients at the time of admission and the effect of resuscitation afterwards, the requirement of blood transfusion, AAST grading, the presence of co-injuries, the need for further management, the need for ICU admission and the presence of morbidity.

In this study, 9 patients (30%) required blood transfusion. It is different from **Asfar *et al.*[7]** study, in which, 70% of the patients (81 out of 117 patients) required blood transfusion but it is near to **Bernardo *et al.*[5]**study where only 54.5% of the patients (78 out of 143 patients) required blood transfusion.

Seven patients (77.8%) in the operative group and only 2 patients(9.5%) in the conservative group required blood transfusion while it was 91% (51 patients) and 31.1% (27 patients), respectively, in **Bernardo *et al.*[5]** study.

By AAST classification, 47% of the patients (14 patients) were found to have grade II liver injury. All of them were treated conservatively except one patient was treated operatively. 4 patients (44.4%) in the operative group were found to have grade IV and one patient (11.1%) grade V (complex liver trauma) ; no one of them could be treated conservatively as the majority of these patients presented in shock, sustained multiple associated injuries and significant blood losses making them more liable to operative management.

Also, a higher incidence of complications was found among the patients of unstable group with high grade trauma. In this study, 60% the patients who developed complications (6 out of 10 patients) had high grade liver injury were treated by operative management. This was lower than **Asensio *et al.*[10]** where 77% of patients who developed complications had either grade IV or grade V liver injuries.

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 [10]. The presence of co-injuries and the need for further management also affected the outcome. 56.6% of the patients (17 patients) proved to have co-injury, 9 patients (42.9%) in stable group 4 patients of them required further management and 8 patients (88.9%) in unstable group 6 patients of them required further management.(38.1%) 8 patients from stable group while (77.7%) 7 patients from unstable group required admission to ICU for more meticulous observation.

CONCLUSION

The operative management of liver trauma is associated with higher grade of injury, higher needs for blood transfusion, ICU admission and a higher rate of further management, morbidity, mortality and the presence of co-injuries.

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