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ORIGINAL ARTICLE

Blunt Liver Trauma: Non-Operative or Operative Management. A Retrospective Study

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ABSTRACT

Background: The liver is one of the most damaged organs and a common cause of death after blunt abdominal trauma. Conservative treatment becomes now the treatment of choice in hemodynamic stable patients. We aimed to assess the safety and efficacy of Non-Operative versus Operative Strategy in the management of patients with liver blunt trauma. **Methods:** This study was a prospective study that included 61 patients with blunt liver trauma admitted to the Emergency Department in Zagazig University Hospitals during the period from February 2017 to February 2019. Management options divided into two groups, group I (non-operative management "NOM") and group II (Operative management "OM"). All data were collected including age, sex, mechanism of injury, grades of hepatic trauma, treatment options, complications, and length of hospital stay. **Results**: 60% of the operative group vs 9.7% only in the conservative group had a high-grade injury. Conservative treatment was succeeded in all patients. The operative management group showed more post-operative complications comprised [bile leak 13.3%, pneumonia 20%, wound infection 13.3%, localized collection, and ascites in 6.7%] and mortality was 13.3% due to pulmonary embolism or shock**. Conclusion:** Conservative management is efficient in the management of patients with hemodynamic stability and high-grade liver injury with accepted morbidity. Operative management should be restricted in unstable patients with blunt liver trauma. **Keywords:** Liver, Blunt, Trauma, Conservative, Surgery.

INTRODUCTION

The liver is more prone to injury in blunt abdominal trauma due to its fixed position and its large size. Although the liver is the second organ suspect to be injured, it is the common reason for death following abdominal injury. Compared to splenic trauma, hepatic trauma management still a challenge in the high volumes' trauma centers [1], [2].

Most liver injuries, in the past, were managed surgically. However, evidence verifies that bleeding from liver injuries was stopped in 86% of patients at the time of surgical intervention. In the last years, Non-Operative Management for hepatic injury, show great success (82–100%)[3], [4], [5].

This NOM was firstly applied to pediatric patients and then has been widened to include adults. NOM is the treatment of choice in stable patients with no associated organ injuries that need OM [6].

We aimed to assess the safety and efficacy of Non-Operative versus Operative Strategy in the management of patients with liver blunt trauma.

METHODS

Technical design: This prospective randomized study was conducted on 61 patients admitted to the emergency department in Zagazig University Hospitals with blunt liver trauma during the period from February 2017 to February 2019. Complete history taking and physical examination were done for all patients. We followed ATLS protocols in the management of hepatic trauma patients for early detection of life-threatening injuries and prevention of lethal triad. Urgent laboratory investigations were done on all patients at admission. The FAST was used as rapid screening for the presence of hemoperitoneum. Abdominal CT was done on the stable patient with suspected blunt liver trauma or patient who developed hemodynamic stability after initial fluid resuscitation as shown in Figure (1**)**.

Patients selected for "NOM" (group I) or "OM" (group II) according to specific criteria. NOM criteria: hemodynamic stability or proper response to plasma volume expansion, blood transfusion related to hepatic injuries of less than 2-3 units of packed RBCs, no signs of peritonitis on clinical examination., mild to moderate hepatic injury on CT, and associated injuries not needing an OM.OM criteria: hemodynamic instability, physical signs of peritonitis, continuous decrease in hematocrit values, associated injuries requiring an OM, and failure of NOM. We depended on the American Association for the Surgery of Trauma (AAST) calcification for grading of liver injuries: Grade I (Subcapsular hematoma < 10 % surface, capsular tear <1 cm depth), Grade II (Subcapsular hematoma < 10-50 % surface, intraparenchymal < 10 cm diameter or capsular tear <1-3 cm depth, < 10 cm in length), Grade III (Subcapsular hematoma > 50 % surface, intraparenchymal >10 cm diameter or capsular tear > 3 cm depth), Grade IV (Parenchymal disruption 25–75 % of hepatic lobe), grade V (Parenchymal disruption involving > 75 % of hepatic lobe or vascular juxta hepatic venous injuries).

Patients that were managed by NOM needed to be admitted to the hospital, put on bed rest, and monitored continuously with repeated clinical, laboratory, and ultrasound assessment and ICU care if needed. Complications of conservative management included abscess, biloma, haemobilia, and bile leak managed by follow-up sonar, CT guided drainage, and ERCP. Failure of NOM was an indication for urgent intervention and is considered in patients who continued to bleed or developed delayed hemorrhage and/or hemodynamic instability even with ongoing blood transfusion. Urgent laparotomy was the standard treatment in the patients with hemodynamic instability or not responding to initial fluid resuscitation with a positive FAST scan or with CT findings showed massive hemoperitoneum and severe liver trauma with extravasations of intravenous contrast.

Operative technique:

Laparotomy was performed through a midline incision with adequate exposure of the upper abdomen. In case of severe right lobe or IVC lesion or referred patients a right extension of the incision may be necessary. Blood from the peritoneal cavity was aspirated. The liver was mobilized. The first management was to achieve hemostasis and control bile leak and contamination site through several approaches depending on the general condition of the patient (to prevent lethal triad) and extend of liver injury. Inflow vascular control was done (Pringle maneuver) in all patients before proceeding with liver parenchymal and vascular repair to decrease blood loss, hepatectomy with selective vascular ligation or resection debridement, and liver resection. In patients with physiological instability due to severe liver injuries, we initiated the strategy of Damage Control Surgery.

Post-operative management:

The patients were repeatedly monitored and followed up by complete blood picture, prothrombin concentration, INR, liver function, and ultrasound. Most of the patients needed postoperative ICU admission. Thromboprophylaxis was used in a stable patient with a liver injury who had a risk for thromboembolism. Early mobilization and enteral feeding encouraged also when there was no contraindication. Post-operative complications including abscess, biloma, and

bile leak, managed by follow-up, medical treatment, sonar, and CT guided drainage and ERCP. Some patients needed surgical debridement for sepsis and liver necrosis as demonstrated in Figure (2). After discharge, the patients in the 2 groups were followed up by liver function and CT after one, three, and six months from discharge in the outpatient clinic. Data collected according to age, sex, mechanism of injury, grades of hepatic trauma, ISS, and complications. Also, the method of operative intervention, blood transfusion requirement, and length of ICU stay, and hospital stay were documented.

Written informed consent was obtained from all participants and the study was approved by the research ethical committee of Faculty of Medicine, Zagazig University (Institutional Research Board IRB). The work has been carried out under The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

STATISTICAL ANALYSIS

The collected data were analyzed by computer using Statistical Package of Social Services version 24 (SPSS), Data were represented in tables and graphs, Continuous Quantitative variables were expressed as the mean ± SD & median (range), and categorical qualitative variables were expressed as absolute frequencies (number) & relative frequencies (percentage).

RESULTS

Our study included 31 patients managed conservative "NOM" (group I) and 30 patients managed operative (group II). Male sex was predominant in both groups. In the NOM group mean age was 14.73 ± 13.05 years, while was 21.6 ± 14.9 years in the operative group. In the NOM group, (77.4%) had a history of road traffic accidents. In the OM group, the history of road traffic accidents was presented in all patients. In 2 groups chest injury was included in almost all patients either alone or associated with renal, brain, spleen, or extremities as demonstrated in (table 1).

In the NOM group grade II liver injury presented in about half of the patients (51.6%), followed by grade III and grade IV in (38.7% & 9.7%) respectively. In the operative group patients, most of them (60%) had major liver trauma (grade IV, grade V) as also shown in (table 1).

There was a statistically significant difference between the operative and conservative groups. OM group needs a longer hospital stay 12.5 ± 7.9 days vs 6.97 ± 3.15 days in the NOM group. Also, 86.7% of the OM group need ICU to stay vs 22.6% of patients in the NOM group, and more times of blood transfusion for 4-5 times were found in 26.7% of the operative group. The number of blood transfusions increased in relation to the grading of liver injury as revealed in (table 2).

Table 3 clears that the complications in the NOM group represented 12.9% of all patients presented in patients with high-grade injury. All complicated patients including bile leak and abdominal collections managed by the US-guided drainage and follow-up. Our operative group including 30 patients. Four of them had a splenectomy, two of them had a cholecystectomy and right nephrectomy in one patient. Heaptotomy with intraparenchymal hemostasis and ligation of bile ducts in twelve patients. Non-anatomical resection was done in eight patients. Left lateral hepatectomy in two patients. In grade V trauma, right posterior sector resection was done in two patients; while damage control was done in four patients (succeeded in two patients that underwent further right hepatectomy) and (failed in two patients, died from uncontrolled bleeding).

Post-operative complications occurred in twelve (40%) patients. Bile leak through the external drain occurred in three patients, managed by follow-up for two weeks till stopped. The localized collection was presented in two patients managed by the US-guided pigtail insertion. Wound infection occurred in four patients, managed with repeated dressing; in the long-term follow-up, two of them developed an incisional hernia. In our operative group, mortality happened in four (13.3%) patients. Two patients died due to massive pulmonary embolism and the other

two patients with grade V liver trauma died from uncontrolled bleeding after damage control failure as cleared in (table 4).

Table (1): Comparison between the studied conservative and operative group.

variable		conservative group (N=31)		operative group(N=30)		p-value
		No.	%	No.	%	
Age	Mean ± SD	14.73 ± 13.05		21.6 ± 14.9		0.035*
	Median (Range)	12(2-65)		18(4-65)		
Sex	Male	20	64.5	30	100.0	0.000*
	Female	11	35.5	0	0.0	
ISC >15	No	21	67.7	2	6.7	0.000*
	yes	10	32.3	28	93.3	
Associated injury	No	12	38.7	6	20.0	0.000*
	Chest	11	35.5	20	66.67	
	Renal	3	9.7	2	6.7	
	Spleen	1	3.2	4	13.33	
	Brain	3	9.7	2	6.7	
	Extremities/facial	8	25.8	0	0.0	
liver grading	Grade I	0	0.0	2	6.7	0.000*
	Grade II	16	51.6	0	0.0	
	Grade III	12	38.7	10	33.3	
	Grade IV	3	9.7	12	40%	
	Grade V	0	0.0	6	20%	

Mann Whitney test, Chi-square test, *statistical significance.

Table (2): Comparison between the conservative and operative group regarding blood transfusion and hospital stay.

Variable		conservative group (N=31)		operative group (N=30)		p-value
		No.	%	No.	%	
Duration of hospital stay (days)	Mean ± SD	6.97 ± 3.15		12.5 ± 7.9		0.003*
	Median (Range)	6(3-18)		11(1-27)		
ICU stay	No	24	77.4	4	13.3	0.000*
	Yes	7	22.6	26	86.7	
Blood transfusion	No blood transfusion	15	48.4	0	0.0	0.000*
	Once	12	38.7	2	6.7	
	two times	2	6.5	12	40.0	
	Three times	2	6.5	8	26.7	
	Four times	0	0.0	2	6.7	
	Five times	0	0.0	6	20.0	

Mann Whitney test, Chi-square test, *statistical significance.

Table (3): Post-operative complications and outcome among the studied operative patients.

Items		Studied pts (N=30)	
		No.	%
Complications*	• Yes	12	40
	• Ascites	4	13.33
	• pleural effusion	8	26.67
	• Bile leak	3	10
	• Localized collection	2	6.67
	• Chest infection	4	13.33
	• Pulmonary embolism	2	6.67
	• Wound Infection	4	13.3
Mortality	• No	26	86.67
	• Yes	4	13.33
ICU stay	• No	4	13.33
	• Yes	26	86.67
Duration of hospital stay (days)	• Mean ± SD	12.5 ± 7.9	
	• Median (Range)	11(1-27)	

Qualitative data was represented as number and percentage. Quantitative data were described using range (minimum and maximum), mean, standard deviation, median.
*Multiple post-operative complications in one patient.

Table (4): Outcomes among the studied conservative patients.

Items		Studied pts (N=31)	
		No.	%
Complications	• **No**	27	87.1
	• **Bile leak**	3	9.7
	• **Localized collection**	1	3.2
ICU stay	• **No**	24	77.4
	• **Yes**	7	22.6
Duration of hospital stay (days)	• **Mean ± SD**	6.97 ± 3.15	
	• **Median (Range)**	6(3-18)	

Qualitative data was represented as number and percentage. Quantitative data were described using range (minimum and maximum), mean, standard deviation, median.
*Multiple post-operative complications in one patient.

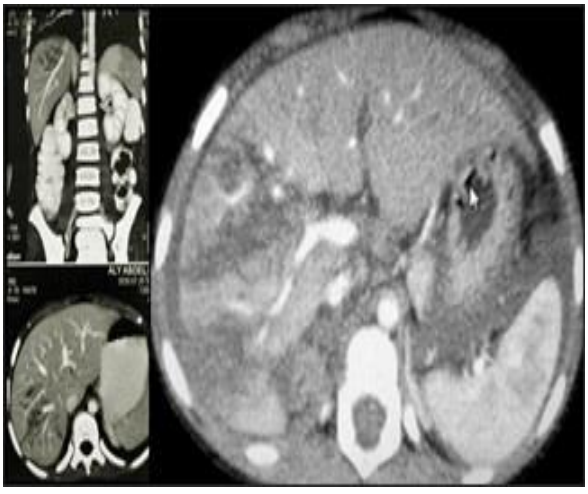

Figure (1): CT showed adifferent grade of liver injuries.

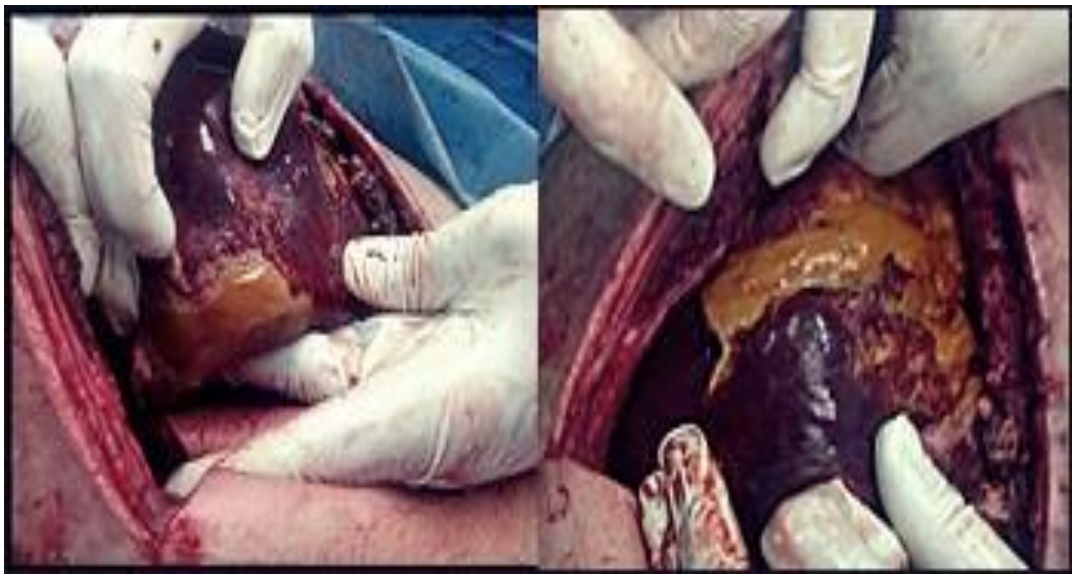

Figure (2): Debridement of liver and necrotic tissue.

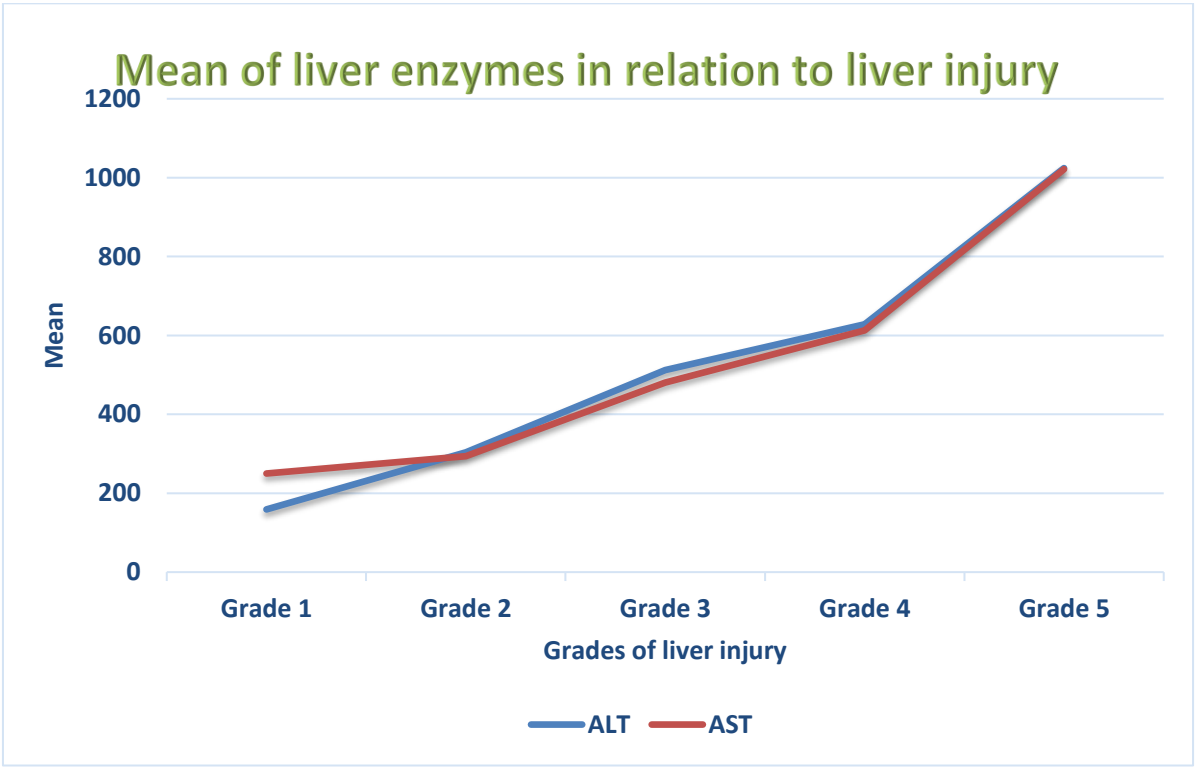

Figure 3: Mean of liver enzymes in relation to liver injury.

DISCUSSION

The average age of all patients in the current research was 9.17±3.47 years, there was 18 children,11 of them (61.1%) were males and 7(38.9%) females, which is similar to the study of **Desoky et al. [8]** which was conducted on 22 children, of them 15 males (68.2%) and 7 females (31.8%) with mean age 9.5 ± 3.2 years.

Bujons et al [9] found that in 33 patients who presented with renal calculi, 27 participants (81.8%) were boys, and six kids (18.2%) had a mean age of 7 years. While, **Gamal et al [10]** in a study included 27 children found that 21 children (77.7%) were males and 6 boys (23.3%) were females with a mean age of 6.8 years (range 2.5-12 years).

The current study showed that kidney stones, situated in the lower calyx in 27.8% of children , middle calyx in 22.2% and 11.1% of children stone located in upper calyx. Mean size of kidney stone was 26.1±2.9 (mm) ranged from 21-31(mm). Of the mini-PCNLs, 25 were left sided and 10 (28.6%) were right sided (71.4%). Mean stone density was1056±126.1 and ranged from (923-1340).

Bujons et al [9] discovered that 64% of patients had stones in the lower calyceal group and 50% had stones in the renal pelvis. With a range of 3–13.20 cm2, the average stone size was 4.46 cm2.

While **Gamal et al [10]** reported that by measuring the longest diameter of each stone or, in the event of numerous stones, the total of the longest diameters of all the stones we were able to determine the mean stone size, which was 32 mm (range 20-7 mm). In 17 instances, the stones had a right side, and in 10 instances, a left side.

The current study showed that modified biplanar 90° puncture technique was successful to remove kidney stone without residual in 66 % of patients and residual stones ≤ 4 mm without clinical symptoms in 16.7 % of patients and residual stone ≥0.4% mm with or with-out clinical symptoms. This was similar to the study of **Desoky et al [8]** who found that in 83.3% of patients, total stone removal was accomplished.

Desoky et al [8] found that with 20 patients having no stones or remaining fragments smaller than 4 mm, the success rate was 90.9%. A follow-up PCNL was required for one patient (4.5%) due to the appearance of 8 mm radiolucent debris on postoperative computed tomography. Another patient underwent SWL due to a remnant radiopaque piece that was 7 mm dislodged to the upper ureter.

The current study showed that complications occurred in 6 patients (33.3%), bleeding in 2 patients (11.1%) also fever in 2 patients, and 2 patients presented with infection.

Desoky et al [8] found that four patients (18.2%) experienced postoperative fever, which was treated conservatively. While postoperative urinoma affected two patients (9.1%) and was treated with a double-J stent and conservative methods, one patient required blood transfusion.

While **Gamal et al [10]** reported that there was two documented cases of intraoperative complications; the first required 300 ml blood transfusions (3.5%), while the second case (3.5%) resulted in a pelvicalyceal system perforation during tract dilatation, which was managed conservatively. Hypothermia during surgery wasn't observed in any patients. Two occurrences of postoperative fever (7%), which improved after receiving intravenous antibiotics for 72 hours, were the only postoperative problems. Urinary leakage, ureteral blockage, or postoperative bleeding were not observed as postoperative consequences.

This study had some limitations because it was conducted with a small sample size. It is still advisable to conduct similar studies with more participants and long-term follow-up to confirm the role of the modified biplanar (0–90) puncture technique in prone percutaneous nephrolithotomy in a pediatric age group in a large-scale population.

Declaration of interest

The authors report no conflicts of interest.

The authors along are responsible for the content and writing of the paper.

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None declared

CONCLUSION

In the paediatric age group, the 90°-puncture technique for prone percutaneous nephrolithotomy has been shown to be safe, efficacious, and less complicated for managing kidney stones measuring 2-3cm.

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