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RESEARCH ARTICLE
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BLUNT LIVER TRAUMA: THE EFFECTIVENESS AND EVOLUTION OF NON-OPERATIVE MANAGEMENT

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Abstract

Background: At present, patients who are hemodynamically stable and have experienced acute abdominal trauma are most effectively treated with nonoperative management (NOM) for small liver injury.

Aim: To analyze the effectiveness and evolution of non-operative management among patients with blunt liver trauma.

Patients and Methods: The study comprised 50 cases with blunt liver injuries treated at surgery department. Causes, locations and classifications of damage, clinical conditions, ultrasonographic and CT findings, concomitant injuries, laboratory results, treatment modalities (surgical or conservative), blood transfusions, complications and duration of hospitalization were documented and studied.

Results: The distribution of liver injury grades showed that lower-grade injuries were more commonly managed with non-operative management. However, the association between injury severity and the use of NOM wasn't statistically significant. A strong relationship was noted among hemodynamic stability and the choice of NOM. Patients managed non-operatively had significantly shorter hospital stays (10.95 ± 5.18 days). While those who required operative management had an extended hospital stay (16.37 ± 5.12 days). Persistent hemorrhage was the leading cause of NOM failure (38.4%). Bile peritonitis was responsible for 23.1% of failures, similar to missed hollow organ injuries.

Conclusion: Non-operative management of blunt liver injuries proved both safe and practicable in hemodynamically stable individuals. Hemodynamic instability and widespread peritonitis during resuscitation, or in conjunction with intra-abdominal organ damage, necessitate prompt surgical intervention.

Keywords: Blunt, liver trauma, blunt abdominal trauma, conservative management of liver trauma

Introduction

A relevant clinical issue, trauma is the leading reason for mortality and a major source of morbidity in those under the age of 40 in western countries. Although the spleen and liver are somewhat protected by the inferior ribs, they are among the most frequently damaged organs in cases of acute abdominal trauma, making up around two-thirds of all visceral injuries. The majority of patients who suffered acute trauma to their abdominal parenchymatous organs were treated surgically up until around 30 years ago. (1).

Gradually, the conservative approach became suggested and investigated, with positive outcomes thanks to improvements in critical care technology, more accurate diagnostic imaging, and more successful interventional radiology techniques (2). At present, nonoperative management (NOM) is the initial line of defense against severe splenic lesions (grades III–V) and the principal method for treating minor splenic injuries (grades I–II) according to the American Association for the Surgery of Trauma–AAST. NOM is also the gold standard for mild liver injuries.(3).
The AAST grading system categorizes liver injuries into Grades I to VI, guiding clinical management. Grades I & II represent minor injuries, while Grade III involves more extensive damage. Severe injuries are classified as Grades IV and V, with Grade IV involving parenchymal disruption of 25-75% of a lobe or major vascular injuries. Grade VI, the most severe, signifies hepatic avulsion, typically resulting in fatal outcomes. Grades I-II are managed nonoperatively in stable patients, while Grades III-V often require advanced interventions and damage control procedures. (4), (5)
The benefits of NOM include a reduced risk of intraabdominal complications, a decrease in the need for blood transfusions, an early release from the hospital, and less time spent on unnecessary investigation. (6). In addition, the mortality rate is lower with selective NOM than with surgical care. (7). When hemodynamic instability and severe injuries are present, surgical care may be necessary, either alone or in conjunction with other related problems.(8). At specialist trauma hospitals, conservative management is used for around 80% of adults and 97% of children nowadays. (9). Patient outcomes following non-operative treatment for blunt liver damage were therefore the focus of this study.

Patients and Methods
This retrospective study was conducted on 50 cases with blunt liver trauma between 2019 and 2022 treated in surgery department.

Methods
An analysis was conducted on all patients presented with liver injury as result of blunt truma, only patients received NOM were included in our study and their data were analyzed. The following patient-specific data: trauma type, site and extent of injury to the liver, clinical status, diagnostic procedures performed, presence and type of comorbid injuries, laboratory results, transfusion requirements, complications, survival rate, and duration of hospital stay. A CT scan or intraoperative results were used to diagnose and grade the damage. Prior to final database entry, the surgical and radiological teams verified all CTs for accuracy in relation to the liver segments affected and severity level. Injuries were categorized using standards set by the American Association for Trauma Surgery' Injury Scaling Committee. Analysis and monitoring of clinical circumstances and case progression were conducted for all patients. The rationale behind NOM and the possibility of undergoing surgical intervention were documented and evaluated. First, hemodynamic instability as defined by the Advanced Trauma Life Support/ATLS protocol; second, severe injuries to the spleen, bowel, or other organs that did not allow for non-invasive hemodynamic monitoring (NOM); and third, the presence of intra-abdominal free fluid as detected by CT or Focused Assessment with Sonography for Trauma (FAST) scans in conjunction with a worsening or deterioration of hemodynamic stability were enough to warrant surgical treatment. First, hemodynamic stability was required as a justification for NOM. Second, hepatic damage without additional lesions requiring surgical investigation as revealed by CT was an indication for NOM. After receiving counseling on potential symptoms caused by the unfavorable progression of their intrahepatic hematoma and completing a particular informed consent form, patients who had NOM treatment for this condition were discharged. Up until the point of ultrasonography healing, all cases were monitored in the outpatient clinic and underwent weekly ultrasounds.

Statistical Analysis: The recorded outcomes were analyzed utilizing SPSS version 22.0, a statistical software designed for social sciences by SPSS Inc. in Chicago, Illinois, USA. The quantitative data with normal distribution was revealed as mean ± SD. Furthermore, qualitative features were

expressed quantitatively by numerical values and percentages. The student t-tests were used to analyze the means of two parametric variables. The chi-square test was employed to contrast groups with categorical data. A p value < 0.05 was considered statistically significant.

Results

A total of 50 cases with blunt liver trauma were involved in the study. The average age was 28.6 ± 6.3 years, indicating a predominantly young population, which aligns with the common occurrence of trauma in younger individuals. Males constituted the majority of the cases, representing 66% of the cohort, while females comprised 34%(Table 1).

Table (1): Demographic data of the cases

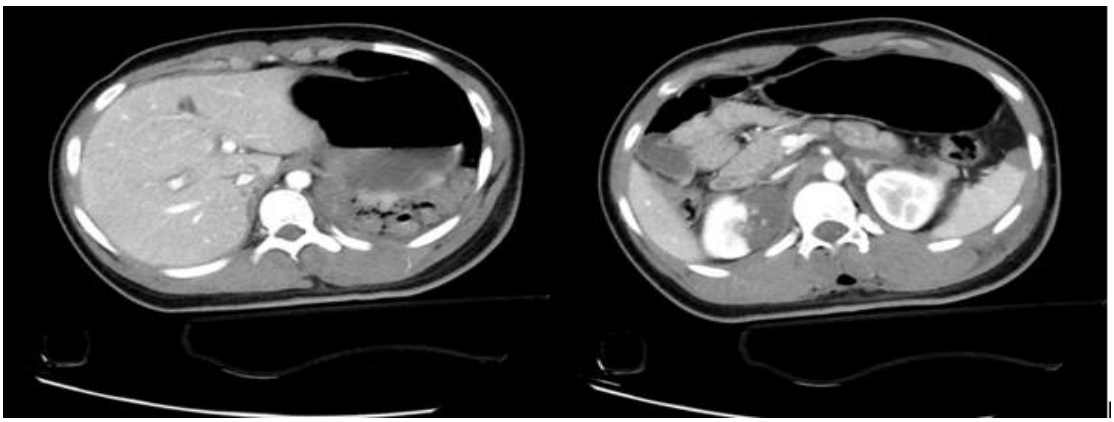
Age (Mean ± SD)	**28.6 ± 6.3**	
Gender (Mean ± SD)	**Male 33 (66%)**	
	Female 17 (34%)	
Mechanism of injury N (%)	Assault	8 (16%)
	Fall from Height	8 (16%)
	MVA	23 (46%)
	Pedestrian Struck	11 (22%)

Injuries sustained in motor vehicle accidents (MVAs) accounted for 46% of all cases. Other mechanisms included pedestrian strikes (22%), assaults (16%), and falls from height (16%) (Table 1).

Table (2): Liver Injury Grades and Management Approach

Grade	I	II	III	IV	V	p-value
No of patients (50)	10	20	10	7	3	
Non-Operative Management (NOM) (37)	9	17	6	5	0	**0.**086
Failure of Non-Operative Management (13)	1	3	4	2	3	

The distribution of liver injury grades showed that lower-grade injuries were more commonly managed with non-operative management (NOM). Specifically, 9 patients with Grade I injuries (Figure1), 17 with Grade II injuries, and 6 patients with grade III(Figure2) underwent NOM. In contrast, more severe injuries (Grades IV&V) were more likely to require operative intervention. However, the association between injury severity and the use of NOM was not statistically significant (p = 0.086). (Table 2).



(Figure1): Grade I liver injury at caudate lobe associated with partial right renal devascularization and grade I splenic injury.



(Figure2): case of grade III hepatic injury.

Out of 50 patients, 13 developed hemodynamic instability and were managed operatively. Hemodynamic stability demonstrated a strong positive correlation with the successful outcome of Non-Operative Management. This association was statistically significant ($p < 0.0001$). Vascular injury was present in 12 of the NOM cases and 5 of the operative cases, but no significant correlation was found between vascular injury and the management approach ($p = 0.602$). (Table 3)

Table (3): Hemodynamic Stability and Vascular Injury in Management Approach

	Non-Operative Management	Operative Management	p-value
Hemodynamic Stability	**37**	**0**	**<0.0001**
Hemodynamic Instability after stabilization	**0**	**13**	
Vascular Injury	**12**	**8**	**0.602**
No vascular injury	**25**	**0**	
Overall p-value			**<0.0001**

Table (4): Complications in Non-Operative Management

Complications	Frequency	Percent
Bleeding	**4**	**10.8 %**
Bile Leak	**5**	**13.5 %**
Abscess	**3**	**8.1 %**
Pseudoaneurysm	**3**	**8.1 %**
No Complications	**22**	**59.5 %**

The majority of patients managed with NOM (59.5%) had no complications. Among those who developed complications, bile leaks were the most common occurring in 13.5% of cases. Abscess formation and pseudoaneurysms were each observed in 8.1%, while bleeding occurred in 10.8% which treated with non surgical via insertion of ultrasound guided drains, either antibiotics or blood transfusion (Table 4)

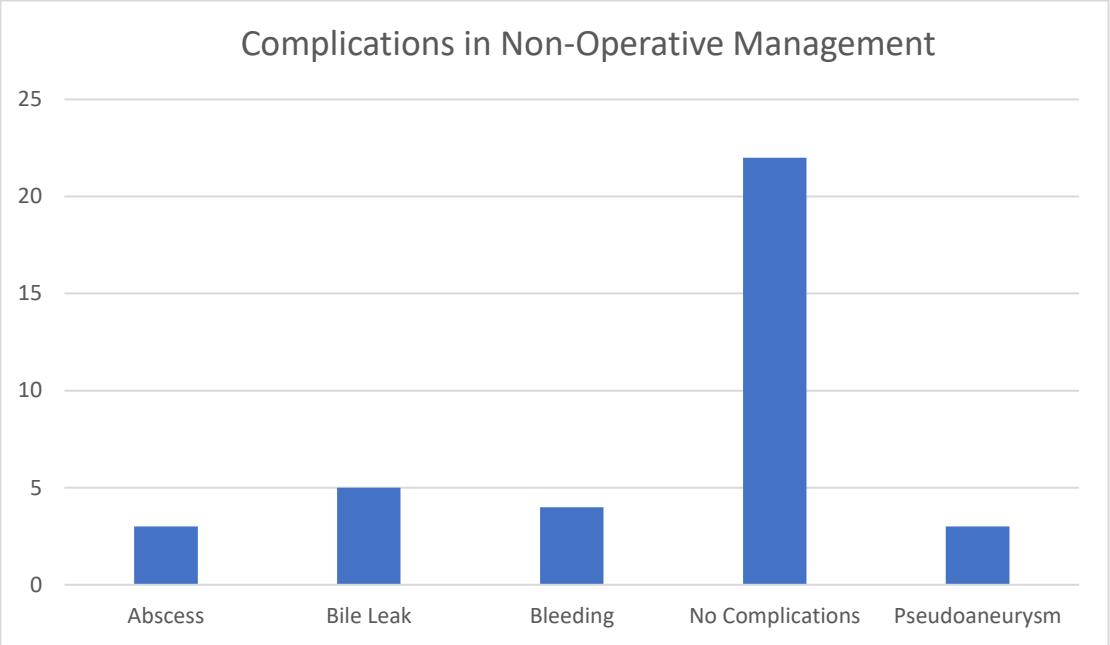


Table (5): Length of Hospital Stay

	Non-Operative Management without complications	Operative Management With complications	p-value
Length of Hospital Stay	**10.95 ± 5.18**	**16.37 ± 5.12**	**< 0.0001**

Patients managed and completed non-operative management without complications had a significantly shorter hospital stay, with a mean duration of 10.95 ± 5.18 days. In contrast, those who developed complications had an extended hospital stay, with a mean duration of 16.37 ± 5.12 days. This difference was statistically significant ($p < 0.0001$). (Table 5)

Persistent hemorrhage was the leading cause of NOM failure, occurring in 38.4% of the cases. Bile peritonitis was responsible for 23.1% of failures, similar to missed hollow organ injuries. Intra-abdominal hypertension contributed to 15.4% of NOM failures. (Table 6)

Table (6): Reasons for NOM Failure

Items	Frequency	Percent
Bile Peritonitis	3	23.1 %
Intra-abdominal Hypertension	2	15.4 %
Missed Hollow Organ Injury	3	23.1 %
Persistent Hemorrhage	5	38.4 %

Discussion

When it comes to solid organ trauma, the liver is the second most common. Because of the liver's anatomical position, severe bleeding is often the leading cause of mortality after damage to the liver. Bleeding from sharp objects is the leading cause of liver damage. One reason for the rise in liver trauma cases in Egypt over the past decade is the country's dangerously high rate of car accidents. (10).

According to our findings, 46% of all liver injuries occurred because of motor vehicle accidents (MVAs). The remaining causes were attacks (16%), falls from great heights (16%), and pedestrian strikes (22%).

Consistent with our results, Mansy et al. evaluated the efficacy and risk of complications or deaths associated with NOM and surgical treatment for patients suffering from blunt liver injuries.(11). According to their findings, injuries sustained in car accidents were the most common type of injury.

With 183 (or 55.96%) instances, men are the most common victims of trauma. Schembari et al. also looked at the results of the authors' method for treating blunt hepatic trauma in relation to the severity of the damage. The leading cause of death was vehicular accidents (95.2% of all cases), followed by falls (4.8%).(12).

The current study revealed that the distribution of liver injury grades showed that lower-grade injuries were more commonly managed with non-operative management (NOM). Specifically, 9 patients with Grade I injuries and 17 with Grade II injuries underwent NOM. In contrast, more severe injuries (Grades IV & V) were more likely to require operative intervention. However, the association between injury severity and the use of NOM was not statistically significant ($p = 0.086$).

In line with previous research by Brillantino et al., we found that the success rates did not differ significantly across patients with different grades of liver injuries. Specifically, the success rate ranged from 100% (63/63) in grade I patients to 90% (9/10) in grade V patients.(13).

According to the study by Schembari et al., a comparison of the recent decade with the preceding one revealed that, despite equal proportions of procedures for liver injuries and accompanying injuries, there was a general increase in the incidence of NOM. The increase in NOM utilization was likely attributable to a shift in the surgical team's mindset. The development over the past decade has shown a significant rise in the NOM rate from 37.2% to 74.4%, particularly in grade II (+38.1%), III (+39.4%), and IV (+45.3%) injuries. This variance was statistically significant in grade III and IV.(12).

This study reported that a strong connection was observed between hemodynamic stability and the choice of NOM. All hemodynamically stable patients (37 cases) were managed non-operatively, while all those who developed Hemodynamic Instability after stabilization (13 cases) required operative intervention. This association was statistically significant ($p < 0.0001$). Vascular injury was present in 12 of the NOM cases and 5 of the operative cases, but no significant correlation was found between vascular injury and the management approach ($p = 0.602$).

This study agrees with Moheb et al., who indicated that NOM of blunt liver injuries in hemodynamically stable individuals is both safe and possible. Hemodynamic instability and widespread peritonitis during resuscitation or in conjunction with intra-abdominal organ damage necessitate prompt surgical intervention. (14).

Consistent with Mansy et al., we found that NOM was the preferred therapy for individuals with stable hemodynamics, while surgery was necessary for patients with unstable hemodynamics or those showing symptoms of peritonitis.(11).

Another study from Turkey, carried out by Kaptanoglu et al., had 300 cases (63% stable and 37% unstable). Among them, 108 patients underwent surgery, while 192 patients utilized NOM. High liver damage grade & hemodynamic instability upon admission were the causes of death in 13% of cases.(15).

A new retrospective analysis, however, showed that even in patients with hemodynamic instability, favorable outcomes can be attained by following a well-established therapeutic plan for nonoperative care of severe hepatic lesions.

Our findings revealed that the majority of patients managed with NOM (59.5%) had no complications. Among those who developed complications, bile leaks were the most common, occurring in 13.5% of cases. Abscess formation and pseudoaneurysms were each observed in 8.1%, while bleeding occurred in 10.8%.

The current study reported that patients managed non-operatively had a significantly shorter hospital stay, with a mean duration of 10.95 ± 5.18 days. In contrast, those who developed complications during the NOM had an extended hospital stay, with a mean duration of 16.37 ± 5.12 days.

The current NOM success rate ranges from 80% to 100%. Based on their clinical experience with 86 NOM patients, Schembari et al. demonstrated a 100% success rate and zero occurrences of surgical conversion, proving that the team's original clinical and CT assessments were acceptable. In addition, 10.5% of patients had complications after receiving NOM, compared to 23.7% after receiving surgical therapy. When looking at the duration of hospitalization, it was clear that much more NOM was not associated with longer stays, even in patients with more severe injuries. The results show that

NOM is the way to go if you want to ensure the best possible patient selection. (12).
Although conservative treatment of blunt liver damage is a safe choice even for individuals with high-grade injuries (grades III-V), the risk of liver-related complications is moderate (10.5%).
Consistent with Moheb et al., we found that NOM significantly reduced hospital stays compared to surgical management. (14). On the other hand, Ghnnam et al. found no difference in hospital stay duration between NOM and OM. (4).
This study revealed that persistent hemorrhage was the leading cause of NOM failure, occurring in 38.4% of the cases. Bile peritonitis was responsible for 23.1% of failures, similar to missed hollow organ injuries. Intra-abdominal hypertension contributed to 15.4% of NOM failures.
Beardsley et al. found that around 25% of NOM patients failed, with the most common causes being rebleeding, bile leak, liver necrosis, or subsequent infection. Only 17 patients (7.46%) in our research were able to undergo NOM, and the majority of those patients had complications from other organ ailments unrelated to liver damage. (16).

Conclusion

Results showed that NOM was a safe and practical option for treating blunt liver injuries in patients with stable hemodynamics. Surgical intervention was necessary in cases of hemodynamic instability, widespread peritonitis during resuscitation, or related intra-abdominal organ damage.

No conflict of interest

REFERENCES

1. Dziubiński D, Abramczyk U, Ciechanowicz D, Kozłowski J, Pakulski C, Żyluk A. An analysis of causes of trauma, spectrum of injuries and treatment outcomes in patients treated at Multitrauma Centre of the University Teaching Hospital No 1 in Szczecin in 2015. Comparison of results from years 2015 and 2007. Polish J Surg. 2019;91(4):29–35.
2. Hommes M, Navsaria PH, Schipper IB, Krige JEJ, Kahn D, Nicol AJ. Management of blunt liver trauma in 134 severely injured patients. Injury. 2015;46(5):837–42.
3. Coccolini F, Montori G, Catena F, Kluger Y, Biffl W, Moore EE, et al. Splenic trauma: WSES classification and guidelines for adult and pediatric patients. World J Emerg Surg. 2017; 12:1–26.
4. Ghnnam WM, Almasry HN, Ghanem MAEF. Non-operative management of blunt liver trauma in a level II trauma hospital in Saudi Arabia. Int J Crit Illn Inj Sci. 2013;3(2):118–23.
5. Sartorelli KH, Frumiento C, Rogers FB, Osler TM. Nonoperative management of hepatic, splenic, and renal injuries in adults with multiple injuries. J Trauma Acute Care Surg. 2000;49(1):56–62.
6. Afifi I, Abayazeed S, El-Menyar A, Abdelrahman H, Peralta R, Al-Thani H. Blunt liver trauma: a descriptive analysis from a level I trauma center. BMC Surg. 2018; 18:1–9.
7. Sreeramula P, Venkatachalapathy T. Anantharaj, Blunt trauma liver-conservative or surgical management: A retrospective study. J trauma treat. 2012;1(8):146.
8. Rizoli SB, Brenneman FD, Hanna SS, Kahnamoui K. Classification of liver trauma. HPB Surg. 1996;9(4):235-8. doi: 10.1155/1996/58383. PMID: 8809585; PMCID: PMC2443777.
9. Moore EE, Cogbill TH, Jurkovich GJ, Shackford SR, Malangoni MA, Champion HR. Organ injury scaling: spleen and liver (1994 revision). J Trauma Acute Care Surg. 1995;38(3):323–4.
10. Pillai AS, Kumar G, Pillai AK. Hepatic trauma interventions. In: Seminars in interventional radiology. Thieme Medical Publishers, Inc.; 2021. p. 96–104.
11. Mansy W, El Henday E, Fouad A, Mohamed M. Nonoperative management in blunt liver trauma: a 10-year center experience. Egypt J Surg. 2021;40(2):438–46.
12. Schembari E, Sofia M, Latteri S, Pesce A, Palumbo V, Mannino M, et al. Blunt liver trauma: effectiveness and evolution of non-operative management (NOM) in 145 consecutive cases. Updates Surg. 2020; 72:1065–71.
13. Brillantino A, Iacobellis F, Festa P, Mottola A, Acampora C, Corvino F, et al. non-operative

management of blunt liver trauma: safety, efficacy and complications of a standardized treatment protocol. Bull Emerg Trauma. 2019;7(1):49.
14. Moheb SE, Mohamed H, Darwish A, MDv A. Operative and Non-Operative Management of Blunt Liver Trauma: Our Experience. Med J Cairo Univ. 2021;89(June):1111–7.
15. Kaptanoglu L, Kurt N, Sikar HE. Current approach to liver traumas. Int J Surg. 2017 Mar; 39:255-259. doi: 10.1016/j.ijsu.2017.02.015. Epub 2017 Feb 11. PMID: 28193544.
16. Beardsley C, Gananadha S. An overview of liver trauma. MSJA. 2011;3(3):5– 12.