

Non-Operative Management of Isolated Blunt Liver Trauma – A single institute based study

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ABSTRACT

Background: The solid organs of the abdomen such as liver and spleen although being protected by the inferior ribs, are the most commonly injured viscera during abdominal blunt trauma and represent about two-thirds of all visceral injuries. Trauma to liver is the most common abdominal emergency and carries high morbidity and mortality.

Aims and objective: To study the safety and effectiveness of NOM (non-operative management) of blunt trauma liver and to identify the factors predicting the failure of this treatment.

Methods: The study was conducted in the department of surgery Skims Medical college, Srinagar for period of two years from February 2019 to March 2021 and all the patients with USG and CT documented blunt trauma liver injury were included in the study. All the patients were subjected to detailed examination and baseline workup including ultrasonography and CT scan as soon as the patients were haemodynamically stable. All the data relevant including mode of injury, severity of hepatic injury, modality of management used (non-operative) and outcome were recorded and analysed using proper statistical methods.

Results: Total of 43 cases with diagnosis of isolated blunt hepatic injuries were included in the study. The mean age of the patients was 24.19±14.65 years, which included 30 (69.7%) males and 13 (30.3%) females. Non-operative management was adopted in 38 patients (88.3%), while as 5 (11.6%) patients needed an operative management. Out of 43 patients in our study, 20 (41.1%) had a grade 111 hepatic injury. The morbidity rate was significantly higher in patients with grade IV and V.

Conclusion: Non operative management of liver injuries is safe and effective in selected patients and reduces optimal length of stay without increasing morbidity or mortality. These patients may be safely discharged in presence of a normal abdominal examination and haemodynamic stability. More the severity of injury, higher is the morbidity and mortality rate and early surgical exploration is recommended in these patients.

Keywords: Liver trauma, Non-operative Management, Liver injury, CT scan

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INTRODUCTION

Non-operative management (NOM) of blunt liver injuries has become the standard of care in haemodynamically stable patients. In a blunt abdominal trauma, liver is the most commonly involved organ¹. The factors which make liver the most vulnerable organ to injury include its anterior location and presence of fragile parenchyma with easily disrupted Gilson's capsule. Injury to liver in association with injury to other organ, including hollow viscera, mesentery and diaphragm has been reported in 15–20% cases².

Management of liver trauma has undergone significant changes over the past three decades and nonsurgical management of liver trauma was first reported in

1972². Traditionally most of the cases of hepatic injury was managed by surgical intervention. However with improvement in interventional radiology techniques, availability of angioembolization and better intensive care facility, non-operative line of management is being practised with good results¹. Widespread utilization of computed tomography, ultrasonography, angiography, enhanced critical care monitoring and damage control surgery have revolutionized the management of liver trauma^{2,3}. A contrast enhanced CT is considered as the gold standard in blunt abdominal trauma with a specificity and sensitivity approaching 96 - 100%^{3,4,5}. Immediate angiography if available should be considered in patients

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who are haemodynamically stable and have free intraperitoneal extravasation. Angioembolization can be utilized in many of these patients with excellent results, thereby avoiding surgical intervention⁴. Several studies have proven the safety and effectiveness of Non-operative management of both minor and severe liver injuries. The success rate has been high and morbidity rate has been acceptable^{5,6}. The non-operative management of blunt liver trauma in haemodynamically stable patients has got a success rate of 80 and 98 % and failure rate of 10 and 25 % based on the results of different studies^{5,6,7,8}.

The aim of present study was conducted to know the incidence, severity, etiology and management of isolated blunt liver trauma patients admitted to the department of general and minimal invasive surgery Skims medical college hospital.

MATERIALS AND METHODS

Study design: It was a prospective observational study conducted over a period of two years between February 2019 and March 2021 in the Department of Surgery, Skims Medical College Srinagar to study the safety and effectiveness of NOM in blunt liver trauma.

Patient selection: All the patients who reported to accident and emergency department of the hospital with history of blunt trauma abdomen were admitted and resuscitative measures initiated which included securing an intravenous line, blood sampling and infusion of crystalloid fluid. Brief history was taken and general physical examination carried out. All these patients underwent initial evaluation with ultrasonography and X-ray chest and X-ray pelvis. Those patients who were haemodynamically stable (systolic blood pressure $\geq$ 90 mmHg, heart rate $<$ 100 bpm) or got haemodynamically stabilized after infusion of 1000 ml of crystalloid solution, were subjected to total body computed

tomography examination. Haemodynamically stable patients with CT documented hemoperitoneum with grade 1 to grade IV liver injury according to AAST organ injury scale were included in the study. Any associated injury was ruled out in these patients with the help of X-ray chest, X-ray pelvis and X-ray long bones. CT brain was done only in those patients who had low GCS. All the relevant data including demographics, mechanism of injury, initial management, diagnostic tests, associated injuries, grade of liver injury, quantity of hemoperitoneum, treatment, blood products received, total length of stay (LOS), complications and mortality, and outcome were recorded in the already prepared proforma. The data was later, tabulated and analysed using proper statistical methods. Stable patients were observed in the ICU, or regular surgical ward, depending on clinical condition and degree of injury on CT scan.

Inclusion criteria: The patients who were haemodynamically stable or those who showed rapid response to 1000 ml of crystalloid fluid prompt infusion, patients with isolated grade 1-IV hepatic injury and patients without peritonitis were included in the study.

Exclusion criteria: All those patients who were haemodynamically unstable, patients with any other associated injuries requiring surgical intervention, those with Continuous reduction in haematocrit value and Patients with clinical signs of peritonitis were excluded from the study.

All the haemodynamically unstable patients with the presence of intraperitoneal fluid were immediately shifted to theatre for laparotomy. Similarly if a patient became haemodynamically unstable, or if there was sudden fall in haematocrit and haemoglobin concentration, non operative management was discontinued. Liver injuries were graded

Table 1: AAST Liver Trauma Classification

Grade	Injury type	Injury description
I	Haematoma	Sub capsular $<$ 10% surface
	Laceration	Capsular tear $<$ 1 cm parenchymal depth
II	Haematoma	Sub capsular 10-50% surface area; intra-parenchymal, $<$ 10 cm diameter
	Laceration	1-3 cm parenchymal depth, $<$ 10 cm in length
III	Haematoma	Subcapsular $>$ 50% surface area or expanding, ruptured subcapsular or parenchymal haematoma. Intra parenchymal haematoma $>$ 10 cm
	Laceration	$>$ 3 cm parenchymal depth
IV	Laceration	Parenchymal disruption 25-75% of hepatic lobe
	Vascular	Juxta venous hepatic injuries i.e. retro hepatic vena cava/central major hepatic veins
V	Vascular	Hepatic avulsion

following the standard protocol of American Association for the surgery of trauma (AAST) grading scale⁹⁻¹². Grade VI injuries are lethal injuries as these patients mostly die at the site of accident and their diagnosis is confirmed by autopsy.

Study protocol

An informed consent was taken from all the study patients. During the stay in hospital, patients were closely observed and monitored. Arterial blood gas analysis was done every 12 hours while as complete blood cell counts was repeated every 8 hours (until two stable haemoglobin examinations were obtained). On the other hand, liver function and kidney function tests were repeated every 24 hours. Follow up CT or Contrast enhanced ultrasound (CEUS) was done 48-72 hours after injury. NOM was abandoned and patients were taken for laparotomy if there was an active bleeding at follow-up CEUS or CT or a persistent fall in haemoglobin level or haemodynamic instability. NOM was also abandoned in patients with clinical signs of diffuse peritonitis or missed abdominal injuries requiring surgery on follow up CEUS or CT. Angioembolization was not attempted in our study in any of the patients as there were no signs of vascular injury on CT abdomen neither at admission nor at follow up. NOM was considered successful when the patient was discharged without undergoing any abdominal surgical procedure.

Statistical analysis

Statistical analysis was carried out using appropriate statistical methods. Based on the distribution of data, values were expressed as means $\pm$ standard deviation (SD) or medians (range). Comparison of continuous data between

the groups was done using the Mann-Whitney U-test. On the other hand Fisher's exact test was utilized to compare the prevalence data between groups. A P- value of less than 0.05 was considered significant.

Follow Up of Patients

After discharge from the hospital, patients were followed initially weekly for 4 weeks, followed by fortnightly for 3 months and then monthly for one year. On follow up, general physical examination and abdominal examination was done along with basic investigation such as haemoglobin, haematocrit and ultrasonography. Patients were allowed to resume routine work according to grade of liver injury; patients with Grade I (mild physical activity 4 - 6 weeks; labourer 6 weeks), Grade II / III (mild physical activity 6 weeks, labourer 8 weeks), Grade IV (mild physical activity 16 - 20 weeks, labourer 24 weeks).

RESULTS

Total number of patients studied was 43, which included 30 (69.7%) males and 13(30.2%) females. Fifteen patients were in the age group of 30-40 years, while as only 4 patients were above 60 years (table 1). The mean age of the patients was 24.19 $\pm$ 14.65 years (min=10, max=69), indicating that age is not a risk factor for failure of NOM in isolated blunt liver trauma is safe in all age groups.

In our study ,according to AAST organ injury scale, 8 (18.6%) patients had grade I (Fig.1), 10 (23.25%) patients had grade II (Fig.2), 20 (46.51%) patients had grade III (Fig.3) and 5(11.62%) patients had grade IV (Fig.4) liver injury. Grade V injury or vascular injury was not seen in any of our patients on admission CT.

Table No.1: Age distribution of patients.

Age group (years)	No. Of patients	%
10-20	3	6.97
20-30	5	11.62
30-40	15	34.88
40-50	6	13.95
50-60	10	23.25
>60	4	9.3

Table 2: Grades of liver injury in study cases.

Grade of liver injury	Number of patients. (n=43)	
	No	%
Grade I	8	18%
Grade II	10	23%
Grade III	20	46%
Grade IV	5	11%
Grade V	0	0%

Table 3: Complications in the non-operative group

Type of complication	Number of patients (n=43)	Percentage (% age)
Failure of the non -operative management	04	9.3
liver abscess	01	2.3
Peri-hepatic collection	01	2.3
Pleural effusion	02	2.3

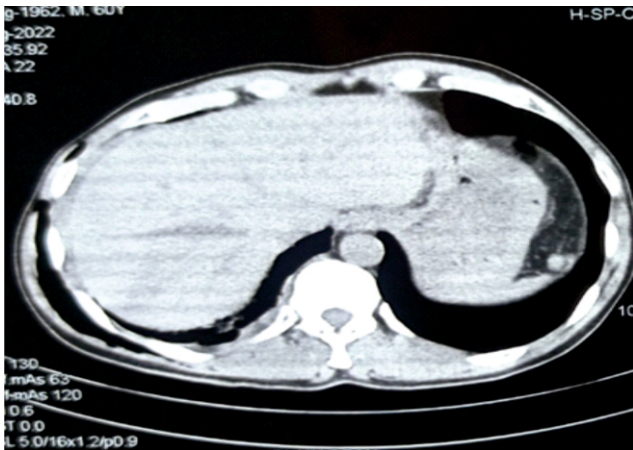


Fig. 1: Grade 1 liver injury

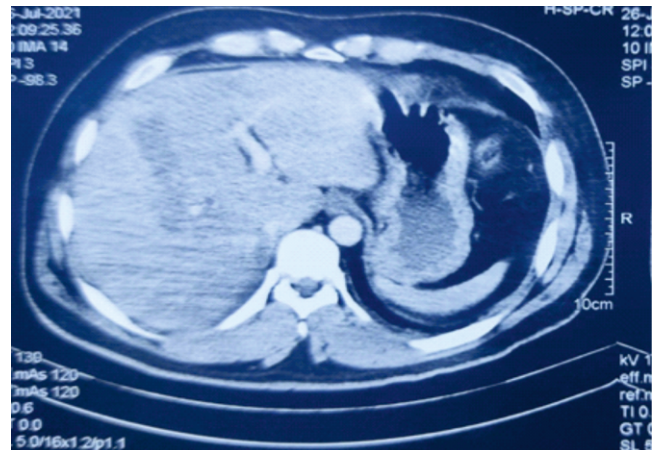


Fig. 2-: Grade 2 liver injury

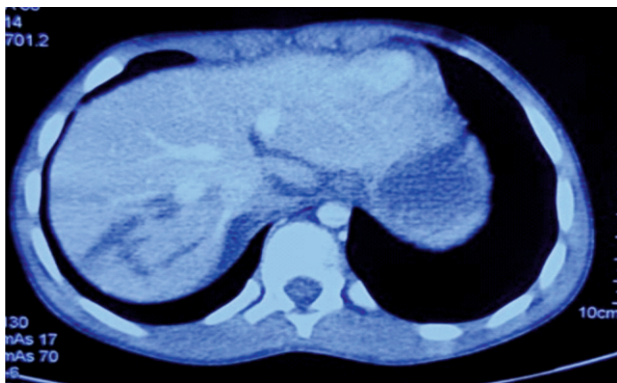


Fig. 3: Grade 3 liver injury

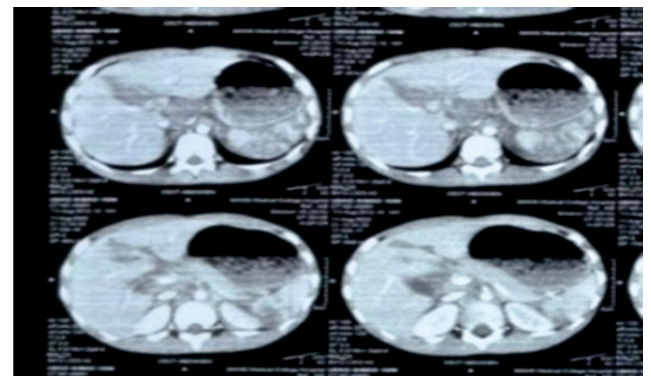


Fig. 4: Grade 4 liver injury

There was a statistically significant difference in the number of blood transfusions required among patients with minor and severe liver injury ($P < 0.0001$). In our study 22 (51.1 %) patients needed 1 unit of blood, 10 (23.2 %) required 2 units of blood, 3 (6.9 %) required 3 units of blood and 4 (9.3 %) patients required more than 3 units of blood.

Duration of hospital stay varied from 12 to 15 days and there was no mortality in our study. However complications were seen in four patients, which included biloma in one case, liver hematoma in one case and pleural effusion in two cases (table 3). These complications resolved spontaneously within 7-8 days without any intervention except for pleural effusion. Both the patients with pleural effusion had to be managed with intercostal tube drainage .NOM was not successful in 4 patients (9.30 %) due to unstable haemodynamic parameters with grade 1V liver injury and required urgent surgical intervention. NOM was successful in as many as 88.3% patients.

In these patients where NOM was not successful, perihepatic packing was done in one patient, while as

suturing of the liver laceration was done in three patients. Operated patients had increased transfusion requirements ($P < 0.001$), longer hospital ($P = 0.011$) and longer stay in the intensive care unit (ICU) unit ($P < 0.001$) as compared with NOM.

DISCUSSION

NOM (Non-operative management) is the first line of treatment for liver trauma, if the patient is haemodynamically stable^{1-3, 10}. Over a period of several decades, approach to liver trauma has changed from mandatory operation to selective NOM^{1-5,11}. This shift from surgical approach to NOM has been attributed to several factors which include the recognition of the fact that 50-80% of liver injuries stop bleeding spontaneously, the high success rate of NOM in children, the significant development of CT scanning, utilization of interventional radiology and better critical care facilities¹¹⁻¹³. Failure of NOM is said to be there when a patient needed abdominal exploration for hemodynamic instability, if there is a progressive fall of haemoglobin level, in patients with

clinical signs of diffuse peritonitis and those with missed abdominal injuries requiring surgery¹²⁻¹⁴ on follow up CUES or CT abdomen. NOM is considered successful when the patient is discharged without undergoing any surgical intervention^{3,5,9,11}. Advances in CT imaging have allowed non-operative management to be used as alternative to surgery. Gender has been explored as one of the risk factors for failure of non - operative management. However in our study gender was not a risk factor. This is in agreement to the results of the study conducted by Tinkoff et al., and Scolay et al.,^{10,11}.

In our study out of 43 cases, 30 (69.7%) patients were males and 13(30.2%) were females. The mean age of the patients was 24.19+14.65 years (min=10, max=69). In a study conducted by Brilliantino, A. et al, over a period of seven years, out of 181 patients with blunt liver trauma, 55 (30.4%) patients were women and 126 (69.6%) were men, with a median age of 39 (range 14–71)]. As per the results of their study, grade I liver injury was seen in 63 (34.8%) , grade II in 48 (26.5%) , grade III in 39 (21.5%), grade IV in 21 (11.6%) in and grade IV in 10 (5.5%) patients. In our study, Grade III liver injury was the most common and was seen in around 46% patients. On the other hand, in a study conducted by Schweizer et al., grade IV liver injury constituted the major portion of patients followed by grade I and grade II to III¹⁵.

In our study, the haemodynamic status was the main criteria in determining the therapeutic approach. Non-operative approach was 100% successful in the patients with grade I-III liver trauma. We found that there are no definite risk factors other than haemodynamic un-stability that will predict the failure of NOM in isolated blunt hepatic injury. Our results are in agreement to the results of study conducted by Gustav Norman et al¹⁶. However in a study conducted by Brilliantino, A. et al,¹ indication for surgical intervention was biliary peritonitis in 2 patients , associated small bowel injury in 1 patient, intra-abdominal hypertension in 1 patient and an associated splenic injuries with delayed surgery in 2 patients.

In a study conducted by Gustav Norman et al¹⁶, out of forty six patients of liver trauma, thirty-five (76%) were initially treated non-operatively while as 11 (24%) patients had to be taken for immediate surgery. Out of 35 patients, NOM failed in four (11%) patients and were taken for surgery

within 8–72 h after admission. Patients failing non-operative management had a significantly lower systolic blood pressure on admission as compared with patients with successful NOM ($P = 0.001$), which is in agreement to our observations. Patients operated immediately were haemodynamically unstable to a greater extent ($P < 0.001$) as compared with patients initially considered for NOM.

Although angioembolization is being widely practised in patients who are haemodynamically stable with a success rate of 87% , but to date, there are no consensus guidelines on appropriate patient selection criteria for those who would benefit from angiography and angioembolization (AE)¹⁷. In a study conducted by Brilliantino A. et al,¹ NOM was successful in one hundred and seventy seven patients. During hospital stay, one patient (0.56%) with grade IV injuries had progressive fall in haemoglobin level and active bleeding of liver at follow-up USG. The patient was successfully taken for selective embolization of hepatic artery branches. In eleven patients, follow-up Sonographic or CT revealed a contained vascular injuries in the form of an isolated peripheral hepatic artery pseudo aneurysms in 7 patients and pseudo aneurysms associated with arteriovenous fistulas in 4 patients¹⁷. Angiography followed by embolization was done in all these patients. However angiography and embolization was not done in any of our patients as there were no signs of vascular injury on CT abdomen neither at admission nor at follow up

In our study NOM was successful in all the 41(100%) patients with grade I-III liver trauma in comparison to 96.7% success rate in a study conducted by Brilliantino A., et al¹. There was no significant difference in the success rate among various grades of liver injuries in their study patients. The success rate was 100% (63/63) in patients with grade I and 90% (9/10) in patients with grade V liver injuries ($p > 0.05$).

In our study, there was a statistically significant difference with respect to number of blood transfusions required among patients with grade I-II and grade III-V liver injury ($P < 0.0001$) which is in agreement to the results of Brilliantino A. et al¹.

In our study, the complications were seen in 9.30% of patients, which is in agreement with the results of Brilliantino et al,¹ who reported complications in 7.4% patients which included biloma in 2 , liver hematoma in 1

and liver abscesses in 2 patients.

CONCLUSION

We conclude that the non-operative management of blunt liver trauma is a safe and effective therapeutic modality for both minor and severe liver injuries. The success rate is very high even in cases of high-grade liver injuries with overall low mortality rate and acceptable morbidity.

Add: conflict of Interest: None

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Written Informed consent: Taken

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