Non-Operative Management of Isolated Blunt Hepatic Trauma - An Observational Study

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ABSTRACT

BACKGROUND

Blunt trauma is one of the most serious and most common causes of death in youth. Specifically, liver is one of the most frequently injured organs during abdominal trauma. During the last two decades, management of blunt trauma to the liver has changed from mainly operative intervention, to the current practice of selective operative and non-operative management (NOM). Avoidance of a laparotomy with its short- and long-term risks is of great benefit to the patient. Majority of patients admitted for liver injury have grade I, II and III injuries and are successfully treated with non-operative management.

METHODS

We conducted a prospective observational study over a period of 24 months between August 2017 and August 2019 among a total of 48 patients, in the Department of General Surgery, Government Medical College, Srinagar, and associated hospitals who were haemodynamically stable with isolated blunt hepatic trauma.

RESULTS

As liver trauma occurs more frequently in men, we found that male to female ratio was 3 : 1. In our study, 97 % of patients with isolated blunt hepatic trauma were haemodynamically stable, rest 3 % patients stabilized after initial resuscitation. Most of the complications 14.58 % occurred in higher grade injuries (grade IV and V). The complication rate in our study group was 18.75 %.

CONCLUSIONS

About 90 % of haemodynamically stable patients with isolated blunt hepatic injury can be managed successfully by non-operative management and non-operative management is the treatment of choice irrespective of the grade of injury, mode of blunt trauma, age, and gender.

KEYWORDS

Non Operative Management, Hepatic Trauma

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DOI: 10.18410/jebmh/2020/510

How to Cite This Article:
Dar WA, Jeelani S, Mushtaq U et al. Non operative management of isolated blunt hepatic trauma - an observational study. J Evid Based Med Healthc 2020; 7(43), 2463-2469. DOI: 10.18410/jebmh/2020/510

Submission 06-05-2020,
Peer Review 14-05-2020,
Acceptance 21-06-2020,
Published 26-10-2020.

BACKGROUND

Blunt trauma is one of the most serious and most common causes of death in youth.[1] Specifically, liver is one of the most frequently injured organ during abdominal trauma.[2] Advances in imaging modalities such as ultrasonography and computed tomography, interventional radiology, critical care and the introduction of damage control surgery during the past two decades have greatly influenced the diagnosis and treatment algorithm in trauma surgery.[3] During the last two decades, the management of blunt trauma to the liver has changed from mainly operative intervention, to the current practice of selective operative and non-operative management (NOM).[4] Non-operative management of blunt liver injuries has become the standard of care for patients with stable haemodynamics, which account for approximately 85 % of all those with blunt hepatic trauma.[5] The workup has shifted largely from the use of physical examination, plain x-ray, laboratory findings, and diagnostic peritoneal lavage to the extensive use of Ultrasonography and Computed Tomography. Management of the trauma patients at level I trauma centers with state-of-the-art techniques has now conclusively shown significantly improved patient outcome and survival.[6]

Avoidance, if at all costs, of a laparotomy with its short and long term risks is of great benefit to the patient.[7] Operative management of these patients often results in a non - therapeutic exploration because the liver usually has stopped bleeding. Operative management of the more severe liver injuries, however, is associated with significant morbidity and mortality.

Over the past decade, a number of retrospective reports have demonstrated that non-operative management of stable patients with minor hepatic injuries is safe.[8-17] The success of non - operative management of blunt liver trauma in haemodynamically stable patients is between 80 and 98 % and failure rate is between 10 and 25 %.[18] However, relatively few major hepatic injuries were included in these reports. It had been thought that spontaneous haemostasis after parenchymal disruption occurred infrequently with significant liver injuries.[19] This continued haemorrhage could contribute to prolonged non resuscitated haemorrhagic shock, increased transfusion requirements, and ultimately, death from sepsis and multiple-organ failure. The current non-operative paradigm in adults was stimulated by the success of non-operative management of solid organ injuries in haemodynamically stable children. The advantages of non-operative management include lower hospital stay, early discharge, avoiding non - therapeutic laparotomies and their associated cost and morbidity, fewer intra-abdominal complications, and reduced transfusion rates. Selective non operative management of blunt hepatic injuries is associated with an improvement in mortality when compared with operative therapy.[20,21,22]

The majority of patients admitted for liver injury have grade I, II and III injuries and are successfully treated with non-operative management. In contrast, two third of grade IV or V injuries require operative management.[23] However in many cases there is no correlation between AAST grade and patient physiological status. In determining the optimal treatment strategy, the AAST classification should be supplemented by haemodynamic status and associated injuries. In fact, in clinical practice the decision whether patients need to be managed operatively or conservatively is based mainly on the clinical condition and the associated injuries, and less on the AAST liver grade injury. Moreover in some situations patients conditions lead to an emergent transfer to the operating room without the opportunity to define the grade of liver lesions before the surgical exploration, thus confirming the primary importance of the patients overall clinical condition. Ultimately the management of trauma requires an assessment of the anatomical injury and its physiological effects. Factors previously thought to completely preclude non - operative management of hepatic injuries include hepatic injury grade, Head injury, Injury Severity Score, degree of haemoperitoneum, age greater than 55, number of transfusions, pooling of contrast/ blush on CT scan.[24,25] More recent literature has challenged these findings and severity of hepatic injury (as suggested by CT grade or degree of hemoperitoneum), neurologic status, presence of blush on CT scan, age greater than 55, and or the presence of associated injuries are no longer considered absolute contraindications to a trial of no operative management in the haemodynamic ally stable patient.[26-30]

Objectives

1. To assess the feasibility of Non-operative management of isolated blunt hepatic trauma in our setup.
2. To ascertain additional steps needed to be taken to ensure reliable, successful and reproducible outcome of Non - operative management of blunt hepatic trauma.
3. To identify the factors which predict the failure of Non-operative management of blunt hepatic trauma.

METHODS

We conducted a prospective observational study over a period of 24 months between August 2017 and August 2019 among a total of 48 patients, in the Department of General Surgery, Government Medical College, Srinagar, and associated hospitals after taking clearance from ethical committee of the institution. We included all patients with blunt abdominal trauma who arrived in the emergency department of general surgery at GMC Srinagar under different admitting surgical units.

Inclusion Criteria

1. Haemodynamically stable patients with isolated blunt hepatic trauma.

Exclusion Criteria

1. Haemodynamically unstable patients.
2. Hepatic trauma associated with other visceral injuries.
3. Penetrating hepatic injuries.

4. Patients with bleeding diathesis.
5. Patients on anticoagulant drugs.

Baseline characteristics of patients with blunt hepatic trauma such as age, gender, heart rate, systolic blood pressure, diastolic blood pressure, mode of injury, time since injury, history of any medical illness especially bleeding diathesis, anticoagulant therapy were recorded.

Patients were resuscitated according to Advanced Trauma Life Support (ATLS) guidelines. Multidisciplinary approach in resuscitation and stabilization alongside the attempt to screen for intra-abdominal solid visceral injury was adopted in collaboration with anaesthetists and radiologists. Patient who became haemodynamically stable after initial fluid resuscitation or presented with normal haemodynamics were accompanied to radiology suit for FAST scan. FAST was followed by CECT abdomen for further characterization and grading of liver injury. Liver injury was categorized using the organ injury scale of the American Association for the Surgery of Trauma (AAST).

Blood samples were drawn at admission such as Haemoglobin, Haematocrit, Platelet count, urea, creatinine, blood sugar, Na+/k+, ABG, ALP, AST, ALT, PT / INR and Blood grouping. Haemodynamic ally stable patients with isolated hepatic injury were put on non - operative management. Haemodynamic ally unstable non responders and with concomitant visceral injuries were excluded from the study and were taken for immediate operative management. Non-operative management consisted of closely monitoring with repeated clinical assessment including the evaluation of vital signs such as heart rate, blood pressure, temperature, respiratory rate and fluid balance with estimating input and output of fluids in the body, number of red cell packs transfused, measurement of Haemoglobin and haematocrit 6 hourly for first 48 hours and later twice a day during hospital stay, PT / INR, AST, ALT, ALP and frequent abdominal examination to look for signs of peritonism. Serial ultrasonography were done to look for improvement in liver injury, to quantify hemoperitoneum and any fluid collections in relation to liver like biloma in grade I, II and III liver injuries. In grade IV and V liver injuries repeat CT scans were done in addition to ultrasonography. The evaluated outcomes were indications of immediate surgical treatment and failure of non-operative management was defined by surgical treatment 24 hrs. after admission to hospital or haemodynamic unstability after initial resuscitation. Patients with grades I, II and III were monitored in respective wards while as in patients with high grade liver injuries grades IV and V immediate. Patients were catheterized, advised strict bed rest, kept off oral feeding for variable times depending on the clinical condition and grade of liver injury. Patients with lower grade injuries i-e I, II and III without lower limb fractures were mobilized and catheter was removed within first week. However in grade IV and V injuries catheter removal and mobilization were delayed. Patients with grade I, II and III were discharged from hospital within first 10 days of admission with lowest hospital stay of 3 days in one patient with grade I and one patient with grade III injury. However, patients with grades IV and V were hospitalized for longer duration with longest duration of hospital stay of 35 days in one patient with grade V liver injury. Thromboprophylaxis was not instituted in any of our patients. We evaluated several parameters such as age, gender, mode of liver trauma, hemoperitoneum in more than two quadrants on initial FAST scan, grade of liver injury on CT scan, number of blood transfusions more than two within first six hours of admission, initial haemoglobin, initial haematocrit, initial heart rate, initial systolic blood pressure, initial diastolic blood pressure, AST, ALT, ALP and coagulogram (PT / INR) as risk factors for failure of non-operative management of isolated blunt hepatic trauma.

Follow Up of Patients

Patients were followed weekly for 4 weeks thereafter fortnightly for 3 months then monthly. On follow up general physical examination was done with main focus on abdominal examination. Haemoglobin, haematocrit and ultrasonography was done. Patients were allowed to resume routine work according to grade of liver injury as follows: Grade I (mild physical activity 4 - 6 weeks; labourer 6 weeks), Grade II / III (mild physical activity 6 weeks, labourer 8 weeks), Grade IV / V (mild physical activity 16 - 20 weeks, labourer 24 weeks).

Statistical Analysis

Statistical package for social sciences software (SPSS 20.0) was used for statistical analysis. Continuous variables were expressed as mean + / _ standard deviation values, whereas categorical variables were presented as percentages. The difference between normally distributed numeric variables were evaluated by Student's t-test or one way analysis of variance. Chi-square test was employed for the comparison of categorical variables. Statistical significance was assumed for $p<0.05$.

RESULTS

48 patients were included in the study. Of the cases studied, 36 (75 %) were male and 12 (25 %) were female. Male to female ratio was 3:1.

			Conservative Management Successful	Conservative Management Unsuccessful	Total
Gender	F	Count	12	0	12
		% of Total	25.0 %	0.0 %	25.0 %
	M	Count	30	6	36
		% of Total	62.5 %	12.5 %	75.0 %
Total		Count	42	6	48
		% of Total	**87.5 %**	**12.5 %**	**100.0 %**

Table 1. Gender Distribution of Study Patients

Chi-Square = 0.131

Gender is not a risk factor for failure of non-operative management of isolated blunt liver trauma.

2- The mean age was 28.79 +_14.768 years (min=4, max=69)

Sl. No.	Group	No. of Patients	Percentage
1	0 - 20	9	18.75 %
2	21 - 40	32	66.66 %
3	41 - 60	4	8.33 %
4	61 - 80	3	6.25 %
5	> 80	0	0 %

Table 2. Age Distribution of Study Patients

Fischer's exact=0.095

Age is not a risk factor for failure of non - operative management of isolated blunt liver trauma.

			Conservative Management Successful	Conservative Management Unsuccessful	Total
Mode of Injury	Abdominal Blow	Count	8	1	9
		% of Total	16.66%	2.08%	18.8%
	FFH	Count	18	0	18
		% of Total	37.5%	0%	37.5%
	RTA	Count	18	3	21
		% of Total	37.5%	6.25%	43.8%
Total		Count	44	4	48
		% of Total	**91.66%**	**8.33%**	**100.0%**

Table 3. Mode of Blunt Liver Trauma is not a Risk Factor for the Failure of Non-Operative Management of Isolated Blunt Liver Trauma

Fisher Exact = 0.631

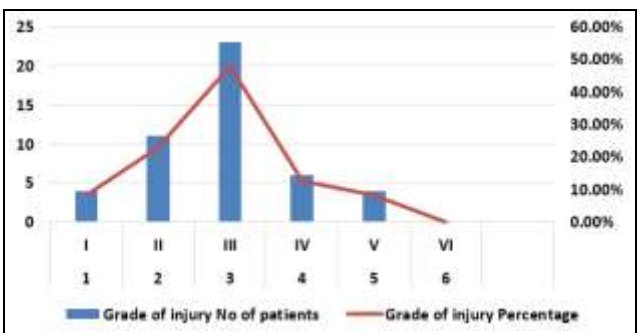

Figure 1. Grade of Liver Injury of Study Patients as per CT Based AAST Classification

			Conservative Management Successful	Conservative Management Unsuccessful	Total
Grade of Injury	I	Count	4	0	4
		% of Total	8.3 %	0.0 %	8.3 %
	II	Count	11	0	11
		% of Total	22.9 %	0.0 %	22.9 %
	III	Count	22	1	23
		% of Total	45.8 %	2.1 %	47.9 %
	IV	Count	4	2	6
		% of Total	8.3 %	4.2 %	12.5 %
	V	Count	3	1	4
		% of Total	6.2 %	2.1 %	8.3 %
Total		Count	44	4	48
		% of Total	91.7 %	8.3 %	100.0 %

Table 4. Grade of Liver Injury is not a Risk Factor for Failure of Non-Operative Management of Isolated Blunt Liver Trauma

Fisher's Exact = 0.097

Blood Transfusion Required in the Study Group

In our study 22 patients (45.83 %) were transfused 1 unit of blood, 10 patients (20.83 %) were transfused 2 units of blood, 3 patients (6.25 %) were transfused 3 units of blood and 4 patients (8.33 %) were transfused more than 3 units of blood.

Non-Operative Management Success in Study Patients According to AAST Grade

Out of 48 haemodynamically stable patients. conservative management was successful in 44 (91.66%). Conservative management failed in 4 (8.3%) patients which included grade III; 1 (2 %), grade IV; 2 (4.1 %) and grade V; 1 (2 %) of patients. All of the 4 patients who failed conservative management became haemodynamically unstable after initial trial of conservative management.

Variable	Conservative Management	No. of Patients	Mean	S.D.	P Value
Age (Yrs.)	Successful	44	28.30	13.973	0.446
	Unsuccessful	4	34.25	23.977	
No. of Blood transfusions within 6 hours	Successful	44	0.45	0.548	0.000
	Unsuccessful	4	2.00	0.000	
Initial Hb (g/dl)	Successful	44	11.379545	1.7008315	0.662
	Unsuccessful	4	11.000000	.5163978	
Initial HCT (%)	Successful	44	35.64	3.557	0.301
	Unsuccessful	4	33.75	1.258	
WBC count/mm^3	Successful	44	11697.73	4813.57	0.528
	Unsuccessful	4	13250.00	1500.00	
Platelet count/ mm^3	Successful	44	259238.64	191938.565	0.227
	Unsuccessful	4	140500.00	13916.417	
Systolic Blood Pressure (mmHg)	Successful	44	114.64	9.063	0.000
	Unsuccessful	4	96.50	5.000	
Diastolic Blood Pressure (mmHg)	Successful	44	73.23	7.424	0.002
	Unsuccessful	4	61.00	2.582	
PT (Sec)	Successful	44	13.851818	2.6188843	0.082
	Unsuccessful	4	16.250000	1.9278658	
INR	Successful	44	1.288523	0.3879642	0.043
	Unsuccessful	4	1.727500	0.5802514	
AST (IU)	Successful	44	326.43	203.603	0.003
	Unsuccessful	4	650.00	91.287	
ALT (IU)	Successful	44	300.75	188.586	0.001
	Unsuccessful	4	647.50	100.457	
ALP (IU)	Successful	44	215.64	128.286	0.239
	Unsuccessful	4	295.00	114.455	
Pulse rate/ min	Successful	44	96.11	14.260	0.001
	Unsuccessful	4	121.50	8.386	
Hospital stay(days)	Successful	44	8.95	5.229	0.002
	Unsuccessful	3	19.00	2.646	

Table 5. Correlation of Different Variables with Non-Operative Treatment of Blunt Hepatic Injury

DISCUSSION

Management of blunt liver trauma has changed over the past two decades. Advances in CT imaging have allowed non - operative management to be used as alternative to surgery. Studies report that the efficacy of non - operative management in blunt liver trauma is between 87 and 95 %.[18,31] In agreement with the previous findings, we achieved successful non-operative management in 91.66 % of our patients. As liver trauma occurs more frequently in men, we found that male to female ratio was 3 : 1. Beel et al found that male to female ratio varies from 15:1.[32] Gender has been explored as a risk factor for non - operative management failure, however in our study gender was not a risk factor as found by Tinkoff et al and Scollay et al.[33,34] In our study, the haemodynamic status was the main

criterion in determining the therapeutic approach. Approximately 85% of patients with blunt liver trauma are haemodynamically stable or stabilize after receiving bolus intravenous fluids.[35] In our study 97 % of patients with isolated blunt hepatic trauma were haemodynamically stable, rest of 3 % patients stabilized after initial resuscitation. Traditionally, non - operative management has been prescribed for lower grade liver injuries (Grades I, II, and III).[36] The severity of the liver injury is an independent risk factor for the failure of non - operative management.[37] However recent studies have shown successful non-operative management in patients with more severe liver injuries.[36] Even observations in paediatric liver injuries suggest that haemodynamic instability rather than the grade of injury, should guide decisions regarding non-operative management. In our study grade of injury was not a risk factor for failure of Non - operative management. One patient with grade III liver failed non - operative management, he was haemodynamically stable initially but had a contrast blush on CT scan. In view of haemodynamic stability and maintained haemoglobin and haematocrit patient was put on Non-operative management, after 24 hours patient became haemodynamically unstable, CT was done which showed moderate haemoperitoneum with contrast blush. Patient underwent laparotomy. In grade IV injury two patients out of total six failed non - operative management. One patient became haemodynamically unstable after 24 hours, had persistent fall in haemoglobin and haematocrit, resuscitation with massive blood transfusion and blood products was done followed by laparotomy, massive haemoperitoneum was present with active extravasation from liver, patient died on second post-op day. Another patient with grade IV injury put on Non-operative management, was discharged from hospital after two weeks. After two weeks of discharge from hospital he presented in the emergency department with abdominal pain, distension, tachycardia and hypotension. Patient was operated, massive haemoperitoneum was present because of rupture of subcapsular haematoma, packing was done, and patient was shifted to surgical intensive care unit. After 24 hours re-exploration was done, packs were removed bleeding had stopped and abdomen was closed. Next day CT scan of the patient showed pseudo aneurysm of left hepatic artery, patient was referred for angioembolization. Because the intrahepatic arterial injuries are not definitely addressed with non - operative management, a small number of patients with arterial injuries will develop hepatic artery pseudo aneurysms.[38] Computed tomography can identify these lesions before development of a large intrahepatic cavity so that they are amenable to embolization, and the patient will avoid a major hepatic resection. Another patient with grade V live injury failed non - operative management when he developed peritonism after 48 hours of admission and was operated after a rescan to found pneumoperitoneum and jejunal perforation which had been missed on earlier scan. The complication rate in our study group was 18.75 % as shown in table 8. Most of the complications 14.58 % occurred in higher grade injuries (grade IV and V). In one patient biloma resolved spontaneously, while in another patient biloma was percutaneously aspirated. Subphrenic and hepatic abscess in one patient each resolved spontaneously with antibiotic therapy. The failure of the conservative management was often attributed to the deterioration of haemodynamic parameters, bile leak and the overlapping septic complications. Durham et al. and Hammond et al. have reported that secondary haemorrhage occurs in less than 5 % of cases treated conservatively. We observed that the failure of conservative treatment due to secondary haemorrhage occurred in 4 % of cases. Buckman et al. showed that bile leak can occur in 3 – 20 % of patients who are managed conservatively.[39] We observed similar rate of bile leak as 2 % in our study. Most of the liver injuries healed within 3 to 4 months and the longest interval was 7 months. Follow up ultrasonography was used to quantitate liver healing in our study similar healing rates were found by Martin A Croce et al.

In our study we found that patients who ultimately fail non - operative management of blunt liver trauma have high initial heart rates, low initial systolic and diastolic blood pressures, high INR levels, high AST,ALT levels and require more number of blood transfusions and have longer duration of hospital stay, similar results were found by Levent Kaptanoglu and others. Haemoperitoneum in more than two quadrants of abdomen on initial FAST scan was not associated with failure of conservative management in our study, similar results were found by C. Morales et al. in their study. Mortality rate in non-operatively managed blunt liver injury patients in our study was 2.08 % which is in agreement with Ibrahim Afifi et al. and others who observed mortality of 3 – 7 %.

CONCLUSIONS

About 90 % of the haemodynamically stable patients with isolated blunt hepatic injury can be managed successfully by non-operative management and non-operative management is the treatment of choice irrespective of grade of injury, mode of blunt trauma, age, and gender. There are no definite risk factors other than haemodynamic un-stability that predict the failure of Non - operative management in isolated blunt hepatic injury. Non - operative management of isolated blunt liver trauma is associated with a low overall morbidity and mortality when applied to an appropriate patient. Non - operative management of blunt hepatic injuries should only be considered in an environment that provides capabilities for monitoring, serial clinical evaluations, and an emergency operating room available for urgent laparotomy. Intra -venous contrast enhanced CT scan is the diagnostic modality of choice for evaluating blunt hepatic injuries. Repeated imaging should be guided by the patient's clinical status.

Limitations

The sample size in higher grade injury groups grade IV (n=6) and grade V (n=4) was small for reliable comparison.

In haemodynamically stable patients with contrast blush on CT and pseudoaneurysm, angioembolization is a well-accepted adjuvant. But in our facility, we lacked facility of angioembolization, the availability of which could possibly obviate operative intervention in all those patients who have major arterial bleed / vascular injury. Future lies with conservative management with minimal intervention with multidisciplinary team efforts encompassing trauma surgeons, anesthetists, surgical gastroenterologists, radiologists and competent blood bank facility. Availability of high dependency units for close monitoring and diligent decision making as to when to terminate the protocol of non-operative management was another limiting factor.

Data sharing statement provided by the authors is available with the full text of this article at jebmh.com.
Financial or other competing interests: None.
Disclosure forms provided by the authors are available with the full text of this article at jebmh.com.

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