RESEARCH ARTICLE

Non-operative treatment of hepatic trauma: A changing paradigm. A Six year review of liver trauma patient in a single institute.

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Abstract

Objective: To review the managing strategies of adult patients with liver trauma in a tertiary care hospital during a six years period.

Methods: The medical records of all patients admitted with a diagnosis of liver trauma from January 2012 to December 2017 in the Aga Khan University Hospital were retrospectively reviewed. The details of demographic, clinical, and outcome variables including morbidity and mortality rates were noted.

Results: A total of 182 patients were admitted at AKUH with liver trauma between January 2012 and December 2017. Twenty-two patients were excluded according to our study criteria. Of 160 patients, 139 were male and 21 were female. One hundred twenty seven (79.4%) patients were less than 45 years of age. Most patients (89.4%) had no comorbids and 48 (44%) arrived at the hospital within 4 hours of injury. Majority, 101 (63.1%) of the patients had blunt trauma and 142 (89%) met with road accidents. A total of 109 (68.1%) patients were stable at arrival and 77 (48.1%) had abdominal signs present on examination. FAST ultrasound was done on 75 (46.9%) patients and CT scan abdomen on 145 (90.6 %) patients. Liver injuries were associated with other abdominal or systemic injuries in 139 (86.6%) patients. Low grade (Grade I & II) liver injuries were found in only 41 (25.6%) patients, with the remainder being high grade (Grade III- 41 patients, Grade IV-42 patients and Grade V-2 patients). Conservative treatment was offered to 68 (41.9%) patients, of which 57 (85.1%) remained stable and were eventually discharged. Of these, 2 expired and 3 required intervention. There were a total of 92 (57.2%) interventions done of which 60 patients were cured, 14 expired and 18 readmitted. Interventions included perihepatic packing (n=18), hepatorraphy (n=3), angioembolization (n=12) and hepatectomy (n=1). There were 16(10%) deaths in which liver haemorrhage and sepsis were the most common cause of mortality. Mean hospital stay in our study population was 8.9 days. Second admission was observed in 28 (17.5%) patients (n=28). Morbidity rate in our patients was 17.5% (n=28). The most common complication noted was that of a liver abscess, developing in 2 (1.3%) patients. Other significant problems were intra-abdominal collections (n=2) and biliary complications (n=3). Unstable haemodynamic status at arrival and prolonged stay in high dependency unit were noted to be independent risk factors for mortality.

Conclusion: Conservative treatment was found successful in most of our patients with an intervention rate of 57.5% and overall mortality rate of 10%. So, NOMLI can be safely offered to liver trauma patients, even in high grade injuries.

Keywords: Liver trauma, non-operative treatment, angioembolization. (JPMA 70: S-27 (Suppl. 1); 2020)

Introduction

Despite being well nested within the confines of the protective rib cage, the liver is the most commonly injured organ in trauma, irrespective of the mode of injury.[1,2] With recent advances in diagnostic investigations, and resuscitation techniques, there has been a global trend away from more traditional surgical exploration of hepatic injuries, towards more conservative management option. That being said, the management of such injuries, over the last 20 years has begun to favour the Non-Operative Management of Liver Injuries (NOMLI).[3]

The application of such non-operative treatment protocols have shown to be vastly reliable and successful, and contributing to lower morbidity. With more specialized interventions, like angiography being reserved for only selected cases.[4,5] In fact, authors attribute success rates of NOMLI to 80-90%.[5] Works by authors like Cerit et al, have also shown the effectiveness of this modus operandum in the paediatric population as well[6]. This has led to the notion of considering conservative management options as the current standard of care.[3,7]

In our 'third world metropolis', we are encountering more and more patients suffering from liver injuries each year. The objective of this study was to review our institutional experience in managing liver trauma patients and to identify factors which predict mortality in these patients.

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Materials and Methods

The study was approved by the Hospital ethics review committee. A retrospective review of medical records of all adult patients admitted with liver injury in surgical unit of Aga Khan University Hospital, Karachi between January 2012 and December 2017 was done. All patients admitted with liver injury were included. Medical records of all identified patients were reviewed and information on demographic, clinical and outcome variables, including morbidity and mortality rates were recorded on a performa. Patients with missing and/or incomplete records, iatrogenic liver trauma, and those who came to the hospital after being operated upon at another health facility were excluded from the study. Telephone contacts were made with patients (75% of all patients could be successfully contacted) to reveal any undocumented complications related to liver injuries.

A Total of 182 patients were admitted with liver injuries during the study period. Twenty-two patients were excluded as per our exclusion criteria leaving a final study population of 160 patients.

Data was analyzed using SPSS version 18. All continuous variables were analyzed as a proportion of mean or median. Factors predicting mortality in liver trauma patients were analyzed using univariate analysis initially and those variables who were found statistically significant or p value of less than 0.2 were included in the cox regression analysis to predict the independent risk factors for mortality in patients suffering from liver injury. Hazard ratios were calculated and p value of less than 0.05 was considered statistically significant.

Results

Of the 160 patients, 139 (86.9%) were males. Mean age at presentation was 30.2 ± 14 years. The basic demographic, clinical, treatment and outcome details of our study population are shown in Table-1.

Blunt trauma was the main mechanism of injury (63.1%) and within this group road traffic accidents were the predominant cause (55.6%). One hundred and nine (68.1%) patients were haemodynamically stable at presentation. Forty eight patients (44%) reached the hospital within 4 hours of injury.

After complete evaluation 21 (13.1%) patients were found to have isolated liver injuries, the rest had associated abdominal and/or systemic injuries (Table-1). Mean haemoglobin at presentation was 11.6 ± 2.9

Table-1: Table showing basic demographic, investigations, treatment, complications, readmission and mortality details of study population.

Variables	Frequency (Percentages)
Mean age of study population	30.2 years (SD ±14)
Gender	
Males	139 (86.9)
Females	21 (13.1)
Mode of injury	
Blunt	101 (63.1)
penetrating	59 (36.9)
Status at arrival	
Stable	109 (68.1)
unstable	44 (27.5)
Delay in arrival	
Within 1 hour	21 (19.1)
Between 1 to 4 hour	27 (24.5)
After 4 hours	62 (56.4)
Ultrasound FAST	
Done	75 (46.9)
Not done	85 (53.1)
CT scan	
Done	145 (90.6)
Not done	15 (9.4)
Injury Burden	
Isolated liver injury	21 (13.1)
Liver plus abdominal injury	65 (40.6)
Liver plus other systemic injuries	74 (46.2)
Mean hemoglobin at presentation	11.6 mg/dl (SD ±2.9)
Grades of liver injury	
Grade I	16 (10.0)
Grade II	25 (15.6)
Grade III	53 (33.1)
Grade IV	42 (26.3)
Grade V	02 (1.30)
Segments of liver involved	
Single	40 (25.0)
Multiple	90 (56.3)
Total Intervention	101
Angiography / embolization	12
Perihepatic packing	18
Hepatorraphy	3
Hepatectomy	1
For causes other than liver injury	67
Complication	28 (17.5)
Liver abscess	2
Abdominal collection	2
Biliary complication (biloma, pancreatitis)	3
Others (incisional hernia, chronic backache etc.)	21
Mean hospital stay in days (range in days)	8.94 (1-48)
Mean stay in high dependency unit in days (n=140)	3.24
Mean stay in Intensive care unit in days (n=61)	1.13
Mean follow up in days (range in days)	156 (14-700)
Readmission	28 (17.5)
Admission due to liver problem	1
Admission due to other problem	27
Mortality	16 (10)
Haemorrhage from liver	3 (1.9)
Sepsis	5 (3.1)
Other causes	8 (5.1)

Table-2: Table showing univariate analysis for the predictors of mortality in liver trauma patients. Only variables with p value of less than 0.2 are shown in this table and were included in cox regression analysis.

Variables	Categories	P value	Crude Hazard ratio	95.0% CI	
				Lower	Upper
Mode of injury	Penetrating	.115	2.215	.824	5.951
	Blunt(ref)		1		
Status At Arrival	Stable (ref)	.002	1		
	Unstable	.000	36.518	4.822	276.533
CT Scan	No	.029	3.546	1.139	11.039
	Yes(ref)		1		
Need for Blood Transfusion	No (ref)		1		
	Yes	.05	5.564	.733	42.258
Hemoglobin Trend in initial 24 Hours	Increasing (ref)	.09	1		
	Decreasing	.03	2.244	.484	10.390
	Stable	.987	.000	0.000	
Grade of liver injury	I (ref)	.093	1		
	II	.221	3.747	.451	31.153
	III	.860	.816	.085	7.855
	IV	.762	.690	.063	7.623
	V	.141	8.030	.501	128.757
Reasons For Intervention	No intervention (ref)	.163			
	For Liver Inury	.666	1.594	.192	13.247
	For Injury Other Than Liver	.379	2.563	.315	20.844
	Liver + Other Injuries	.500	.438	.040	4.832
Prolong Stay In high dependency unit	no		1		
	Yes (ref)	.000	19.813	6.235	62.963

Table-3: Table showing cox regression analysis and adjusted hazard ratio for the independent predictors of mortality in liver trauma patients.

Variable	Categories	P value	Adjusted Hazard ratio	95.0% CI	
				Lower	Upper
Status At Arrival	Stable (ref)	.001	1		
	Unstable	.000	57.202	6.859	477.032
Prolong Stay In high dependency unit	no		1		
	Yes (ref)	.000	42.191	9.849	180.740

gm/dl. Ultrasound FAST was done in 75 (46.9%) patients. Abdominal CT scan was done in 145 (90.6%) patients. Based on CT scan and per operative findings, 94 (58.8%) patients had low grade hepatic trauma (liver injury grade I - III). Grade IV liver injuries were seen in 42 (26.3%) and grade V injuries in 2 (1.3%) of patients.

Depending on the haemodynamic status and nature of injuries, patients were either treated non-operatively (NOMLI) or required an intervention. Sixty-eight patients (42.5%) were initially offered conservative treatment, which includes admission in high dependency unit, serial pulse, blood pressure, and haemoglobin monitoring. Of the NOMLI group, 57(83.8%) patients remained stable and were eventually discharged, while 11 patients did not improve with conservative management. Of these 11 patients two patients expired while the remaining nine patients required intervention and were shifted to the intervention group (Figure-1).

After the initial assessment, 92 (57.2%) patients were offered primary intervention. Of these, 78 (84.6 %) improved and were discharged, while 14 (15.4%) patients expired. In total, 101(57.5%) patients needed intervention (92 primary interventions and 9 patients were shifted from the NOMLI group). Figure-1 explains the treatment algorithm and details along with the outcomes for both groups.

Of the 101 patients who required interventions, the cause for majority were injuries other than liver disorders while only 34 patients had sustained liver injuries. The interventions included perihepatic packing

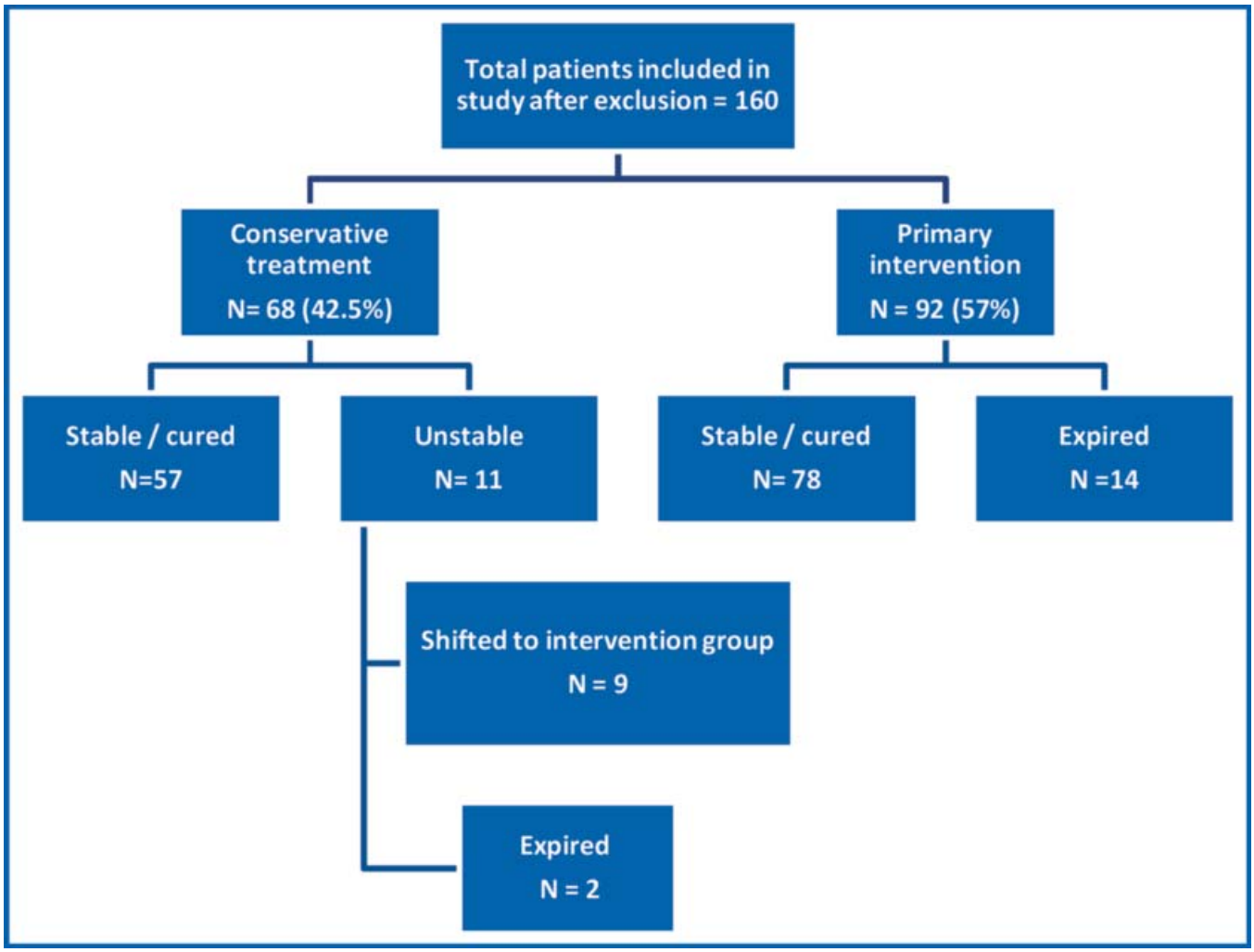

Figure-1: Figure showing algorithm of treatment provided at initial presentation and their outcomes.

(n=18), hepatorraphy (n=3), angioembolization (n=12) and hepatectomy (n=1). In the remaining 67 (66.8%) patients, the main indication for surgery was injury other then liver. (Table-1).

Overall morbidity rate was 17.5% (n=28). The most common complication related to liver injury was liver abscess in 2 patients (1.3%), intra-abdominal collections (n=2) and biliary complications (n=3). Rest of the complications were related to medical problems including incisional hernia and chronic backache (n=21). The overall mortality rate was 10% (n=16). Fifteen of these expired patients had been haemodynamically unstable at presentation. Uncontrolled haemorrhage from liver (n=3) and delayed sepsis (n=5) were the most common causes of deaths related to liver injury. Twenty-eight patients required a second hospital admission and the reason of admission related to liver injury was seen in only one of those 28 patients.

To identify the predictors of mortality, on univariate analysis status at arrival ($p< 0.002$), need for blood transfusion ($p< 0.05$), decreasing haemoglobin trends ($p< 0.003$) and prolonged stay in high dependency unit ($p< 0.001$) were found to be statistically significant (Table-2). To determine the independent association for mortality, Cox regression analysis and adjusted hazard ratio were calculated and unstable condition at arrival ($p<0.001$) and prolonged stay in high dependency unit ($p < 0.001$) were found to be independent risk factors to predict fatal outcomes in liver trauma patients (Table-3).

Discussion

Due to the availability of better treatment modalities and more specialized care and monitoring facilities,

NOMLI has become of a mainstay of practice while addressing haemodynamically stable patients with liver trauma.[2] Recent literature supports NOMLI, considering its safety and an acceptable organ related morbidity and mortality, in comparison to more traditional operative strategies.[2,3,5]

Grade of liver injury has significant impact on the final outcome of the patient. High grade liver injuries are associated with greater mortality as well as organ related morbidities. Similarly patients with multiple organ injuries as indicated by high Injury Severity Score (ISS) are also directly related to higher deaths and complications. Though in our study, we see that many high grade injuries (grades III-IV) were managed conservatively, however majority of mortalities fell in this group (grade V). Our study has highlighted the importance of assessing the liver injury grade as well as the ISS at the time of presentation, as both factors were statistically significant and linked to the mortality rates of the patients.

Low haemoglobin levels on admission could also be related to higher mortality rates, as it signifies the need for multiple transfusions due to haemorrhage, thereby implying greater instability amongst this group. Our study did prove that in expired patients the haemoglobin values were significantly low compared to those who were salvaged. Similarly, time from the event to presentation at a health care facility is not only related to the final fate of the patient but is also an indicator of how developed is the health system of that particular area. This factor is more relevant in this part of the world due to lack of standard pre-hospital emergency service systems. A study by Fraz Fahim et al.[8] in Lahore did show that delay in arrival to the hospital was associated with poor prognosis. Our study failed to show such an association.

The spectrum of complications are different between those who are offered NOMLI and those who primarily required surgical intervention. Liver related complications like biloma, biliary leaks etc. are more common in those patients who are selected for NOMLI.[7,9] Likewise delayed problems like incisional hernia are more frequent in the latter. In our study, we found a lower number of liver related morbidities when compared to literature, with most of them arising in patients with high grade liver injuries. Amongst our complications, the majority were the result of surgical intervention, e.g. incisional hernia. Similar findings have been reported in literature. Kozar et al,[7] observed that 63% patients with grade 5 injury developed hepatic-related complications. A strong association between intervention and complication rate was also seen in this study. Similarly, in the Western Trauma Association's Multicenter Trial of 210 patients with complex hepatic injuries, which included both blunt and penetrating trauma, all patients underwent initial operative intervention.[10] They defined complex injuries as grades 3 to 5, which represented only 16% of all hepatic traumas in their study. These patients had a high overall (46%) and liver-related (30%) mortality, as well as significant liver-related morbidity, including prolonged biliary leak (8%), intra-abdominal abscess (9%), coagulopathy (16%), and late haemorrhage (7%). This large trial signifies the high morbidity and mortality rates in patients having high grade liver injuries, yet was not offered NOMLI.

Mortality rates at our institution were remarkably low (13%) compared to other trauma centers. Taking the example from another hospital in Pakistan, a study by Fraz Fahim et al,[8] shows the mortality rate was 18% after intervention, which was carried out on most of the patients in their study. Furthermore, our results were also in tandem with similar international studies.[4,11,12]

While our study has demonstrated the need for conservative management in grade 1 and 2 injuries and the use of intervention for grades 4 and 5 injuries, it is important for other researchers to do further projects on patients with grade 3 injuries, as highly varied results have been noted amongst this group. If feasible, trauma centers could perform prospective studies on such groups to evaluate their follow-up status, this would help delineate the need for NOMLI versus the need for an intervention.

Conclusion

NOMLI is an effective and safe method of managing liver trauma patients at our institute, despite the majority of high-grade injuries in our study population. Most patients who expired had high grade liver injuries and the most frequent causes of death were liver haemorrhage and sepsis. Unstable haemodynamic status at presentation and prolonged stay in high dependency unit predicts high mortality in liver trauma patients at our institute.

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