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Original Article

Role of Alanine Aminotransferase (ALT) and Aspartate Aminotransferase (AST) in Diagnosing Liver Injury in Blunt Abdominal Trauma (BAT) Patients in The Emergency Department

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ABSTRACT

Objective: To evaluate the role of the liver enzymes ALT and AST in aiding the diagnosis and severity of liver injury in blunt abdominal trauma patients (BAT) presenting to the emergency department.

Study Design: Quasi-experimental study.

Place and Duration of Study: Accident and Emergency Department of Pak-Emirates Military Hospital, Rawalpindi, Pakistan, from May to Dec 2022.

Methodology: Blunt abdominal trauma (BAT) patients were included in the study. Urgent blood samples were sent with values for Hb, WBC, ALT, and AST recorded subsequently. The primary outcome studied was the relationship between ALT and AST to diagnosis and severity of liver injury, and mean ICU stay as the secondary parameter.

Results: A total of 200 patients (n=100 in patients with liver injury and n=100 in patients without liver injury) were analyzed. The mean age of patients in the liver injury group was 27.22±4.60 years as compared to 27.41±4.55 years for the non-liver injury group. Both groups were still comparable (p=0.793). The primary parameters of liver enzymes (ALT and AST) showed a marked increase in the liver injury group with mean values of ALT and AST 686.59±775.42 U/L and 647.27±654.36 U/L versus 77.56±43.08 U/L and 78.95±43.69 U/L in the non-liver injury group (p<0.001).

Conclusion: The study concludes that liver enzymes ALT and AST show a progressive and marked increase during liver injury in blunt abdominal trauma patients and can be used as good adjunct markers for its diagnosis.

Keywords: ALT, AST, Blunt Abdominal Trauma (BAT), , Liver Injury.

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INTRODUCTION

Blunt abdominal trauma (BAT) remains one of the most widespread presentations requiring urgent resuscitation and treatment in the emergency departments worldwide.[1]. Among the most common causes, road traffic accidents remain one of the foremost reasons for patient presentation in the emergency room.[2]. Blunt abdominal trauma accounts for the third most common finding in these patients, preceded only by traumatic brain injury and extremity injuries and fractures.[3,4]. With other causes accounting for major blunt abdominal trauma, intra-abdominal injuries due to BAT account for approximately 13% of all injuries received at tertiary care centers.[5]

Among the findings in blunt abdominal trauma, the spleen is the organ most injured, followed by the liver.[6] However, it is the catastrophic liver injury that causes severe debility, requiring urgent resuscitation, emergency surgery, and subsequent ICU care.[7] Therefore, it remains a point of interest to diagnose liver injury swiftly and reliably in the emergency room setting. CT scan remains the gold standard for early and reliable diagnoses.[8] but this modality is not available readily in a major part of the developing world, where increasing costs and paucity of resources require other cheap, reliable, and sensitive modalities, which may help diagnose liver injury and its severity for better patient care[9].

While Focus assessment with Sonography for Trauma (FAST) scan is now increasingly being used in the trauma setting to diagnose abdominal organ injuries, its low yield and sensitivity to diagnose liver injury may be augmented by other methods to increase the chances of diagnosing and grading the severity of liver injury[10]. This is where the role of alanine aminotransferase (ALT) and aspartate aminotransferase (AST) is proposed. Both enzymes are essential components of the liver function test profile, a blood test easily available even at the primary care centers, providing a cheap, safe, and effective alternative when CT modalities are not available. This would not only add to the reliability of FAST scan

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findings but also help clinicians segregate patients requiring urgent intervention according to the severity. This study aims to assess the role of ALT and AST in diagnosing and identifying the severity of liver injury in blunt abdominal trauma patients.

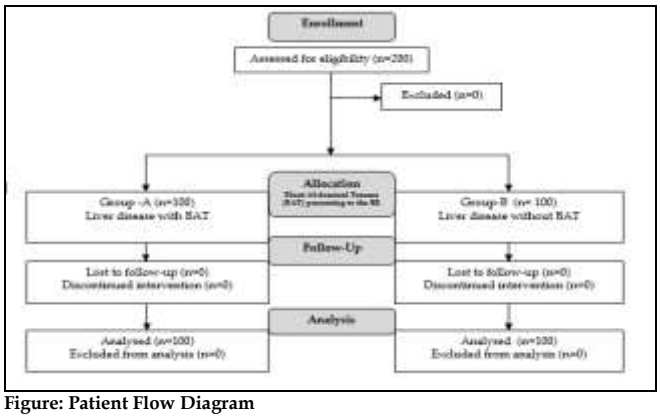

Figure: Patient Flow Diagram

METHODOLOGY

This Quasi-experimental study was carried out at the Department of Accident and Emergency, Pak-Emirates Military Hospital, Rawalpindi, Pakistan, from May to Dec 2022. Ethical permission was taken from the ERB of the institute vide letter no A/28/160(2) dated 05 May 2022. Minimum sample size was calculated using the WHO calculator, keeping the confidence interval at 95%, margin of error at 5%, and keeping the population proportion of blunt abdominal trauma (BAT) with liver injury at 5%[11] and those without liver injury at 95%[12] In our demographic area. The minimum sample size came out as 73 for each group. Two groups, including 100 patients in each group, were then made, keeping the minimum sample size as a reference, with one group comprising liver disease after blunt abdominal trauma (n=100) and one group without liver disease after blunt abdominal trauma (n=100), making the total study size 200 participants. The method of sampling used was non-probability consecutive sampling by the lottery method as per the inclusion criteria used. (Figur)

Inclusion Criteria: All patients of either gender, aged between 40 and 70 years, with a history of blunt abdominal trauma presenting in the accident and emergency department, further re-confirmed clinically by a surgical specialist and radiologically by FAST scan and CT abdomen.

Exclusion Criteria: It comprised all those patients with penetrating abdominal trauma, history of chronic liver disease (CLD), patients diagnosed with Hepatitis B and C previously or in the ER at the time of presentation, any history of previous elevated liver enzymes, or patients with a blunt trauma history of more than 3 days.

The study method included all patients as per the inclusion criteria furnished. All patients with blunt abdominal trauma (BAT) presenting to the ER were received by the emergency medicine resident in the triage area. A detailed history was taken, including age, gender, and mode of injury. Urgent blood samples were sent with values for Hb, WBC, ALT, and AST recorded subsequently. FAST scan was urgently advised for all patients, with the classified surgical specialist called for primary clinical assessment. Patients with liver and associated injuries developing hemodynamic instability were rushed for an emergency laparotomy, whereas the rest were sent for a CT abdomen. Those requiring subsequent surgery were also recorded and noted. The findings for liver injury on CT scan and during laparotomy were recorded. The patients were followed up till discharge, with secondary parameters of mean ICU or HDU stay and need for blood transfusion also recorded. The data were then compiled on a pro forma, and primary and secondary outcomes were studied. The primary outcome studied was the relationship between ALT and AST to diagnosis and severity of liver injury, whereas demographic factors and mean ICU stay were the secondary parameters.

Demographic data were statistically described in terms of mean and SD, frequencies, and percentages when appropriate. The t-test was used to compare the mean statistical differences between the two groups, including Hb, WBC, ALT, and AST. Chi-square test was used to compare the statistical difference for secondary variables. A p-value of <0.05 was considered statistically significant. All statistical calculations were performed using the Statistical Package for the Social Sciences 26.00

RESULTS

A total of 200 patients (n=100 in patients with liver injury and n=100 in patients without liver injury) were analyzed. The mean age of patients in the liver injury group was 27.22±4.60 years as compared to 27.41±4.55 years for the non-liver injury group. Both groups were still comparable (p=0.793). The gender distribution was predominantly male, comprising 97(97%) and 92(92%) of the total patients in both groups (n=200).

CT scan was performed in 89 (89%) of the patients in the liver injury group, and all patients subsequently diagnosed with non-liver injury have had their CT scan done 100(100%). Surgical laparotomy was performed in about half of the liver injury patients, 54(54%), whereas 30(30%) patients underwent laparotomy in the non-liver injury group (p<0.001). Road traffic accidents remained the single most leading cause of presentation in both groups (Table-I). Hemodynamic instability was observed in 45(45%) patients of the liver injury group versus 16 (16%) in the non-liver injury group (p<0.001).

Table-I: Demographic Variables of Patients with Liver Injury Vs Non-Liver Injury (n=200)

Variable	Patients with liver injury following blunt trauma (n=100)	Patients without liver injury following blunt trauma (n=100)
Mean age (years)	27.22±4.60	27.41±4.55
Gender n (%)		
Male	97 (97)	92 (92)
Female	03 (03)	08 (08)
Surgical laparotomy after blunt trauma n (%)		
Performed	54 (54)	30 (30)
Not performed	46 (46)	70 (70)
Ct scan after blunt trauma n (%)		
Ct scan done	89 (89)	100 (100)
Ct scan not done	11 (11)	0 (0)
Cause of injury n (%)		
Road traffic accident	78 (78)	83 (83)
History of fall	17 (17)	17 (17)
Others	05 (05)	0 (0)
Hemodynamic instability n (%)		
Yes	45 (45)	16 (16)
No	55 (55)	84 (84)

Blood panel analysis of both groups (Table-II) revealed mean Hb levels of 8.61±2.10 versus 10.45±1.34 g/dl between the groups (p<0.02). The primary parameters of liver enzymes (ALT and AST) showed a marked increase in the liver injury group with mean values of ALT and AST 686.59±775.42 U/L and 647.27±654.36 U/L versus 77.56±43.08 U/L and 78.95±43.69 U/L in the non-liver injury group (p<0.001).

Table-II: Blood Panel of Patients with Liver Vs Non-Liver Injury (n=200)

Blood Panel	Patient With Liver Injury (n=100) Mean (Range)	Patient Without Liver Injury (n=100) Mean (Range)	p-value
Hb (g/dl)	8.61±2.10 (5-14)	10.45±1.34 (8-13)	0.02
WBC (1000/L)	10.13±4.23 (4-18)	10.15±4.46 (4-18)	0.96
ALT (IU/L)	686.59±775.42 (98-3254)	77.56±43.08 (34-234)	<0.001
AST (IU/L)	647.27±654.36 (56-2890)	78.95±43.69 (34-234)	<0.001

**Hb – Hemoglobin, WBC – White Blood Cell Count, ALT – Alkaline Phosphatase, AST - Aspartate Aminotransferase*

Outcome parameters showed a mean ICU stay duration of 5.89±2.17 days versus 3.48±0.79 days between the two groups (p<0.0001) (Table-III).

Table-III: Outcome Parameters of Patients With Liver Injury Vs Non-Liver Injury (n=200)

OUTCOME PARAMETER	Patient With Liver Following Blunt Trauma (n=100)	Patient Without Liver Injury Following Blunt Trauma (n=100)	p-value
Mean ICU Stay Following Blunt Trauma (Days)	5.89±2.17	3.48±0.79	<0.001
ICUAdmission Following Blunt Trauma			
YES n (%)	87 (87)	75 (75)	
NO n (%)	13 (13)	25 (25)	

ICU=Intensive Care unit

DISCUSSSION

This study aimed to identify various sensitive parameters during BAT resulting in liver injury during our study. The main aim was to identify parameters that can give the clinician a clue towards suspecting and subsequently diagnosing liver injury in various allied setups where modalities like CT and FAST are not available.[7] It would also help as an adjunct to diagnosis, along with CT and FAST, to better identify underlying liver injury.[13]

Before the advent of CT scans, general surgeons were faced with the dilemma of directly performing an open laparotomy, resulting in considerable morbidity and mortality. With the advent of this technique, Morelle et al. discussed that many patients are managed conservatively, requiring less ICU care and decreasing the overall resource burden.[14] However, as outlined above, this is only applicable at larger centers, and now various studies are being done to find cheaper alternatives. Admission with a high-grade liver injury to a Level II trauma center is associated with increased in-hospital mortality. Level II trauma centers were less likely to use angiography or admit high-grade liver injuries to the ICU. This variation in practice may lead to the inability to rescue critically ill patients, as reported by Squires *et al*.[15] The role of liver enzymes after their release in blood stream secondary to Liver trauma is discussed by Anup *et al*,.[16] who reported that their titers have been shown to increase in the first hours of liver injury, making them a good tool to have a suspicion which can then be confirmed clinically and via other methods.[16]

A study carried out by Tarcholi et al. delineated the cut-off values for ALT and AST in liver injury at

>106 U/L and >80 U/L, respectively.[17] This is also in line with our findings, with mean values for liver injury falling in the bracket. The author aimed to find the mean ICU stay in patients with liver injury and found that patients with liver injury required a mean ICU stay of 5-9 days.[18] This corresponds to a mean ICU stay time of 5.89 days for these patients studied in this research. When accounting for blood loss, hematoma formation, and fall in Hb following liver injury, again, Tarchouli *et al.* deduced that mean Hb levels fell drastically for those with liver and splenic injury following BAT.[17] versus those without, and mean levels fell as much as 4 g/dl.

The mean blood loss and ICU time are also directly related to the grade of liver injury, as reported by Saqib *et al*.[19] and with Grade III liver injury being the most common in our demographic area, the corresponding increase in enzyme levels, as seen in this study with respect to grade of injury, can be helpful in early resuscitation and surgical rescue[20].

It is recommended that liver enzymes be included as part of an important metabolic panel for diagnosing early liver injury in the emergency room. This may raise the clinician's suspicion of liver injury and may also contribute to findings from the FAST and CT modalities, if available.

LIMITATION OF STUDY

The limitations are that the study is single-center only. A multi-center study would result in a wider demographic area with more confirmatory results.

CONCLUSION

The study concludes that liver enzymes ALT and AST show a progressive and marked increase during liver injury in blunt abdominal trauma patients, and can be used as good adjunct markers for its diagnosis.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

1 & 2: Data acquisition, data analysis, critical review, approval of the final version to be published.

3 & 4: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

5 & 6: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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