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Original Research Paper

Emergency Medicine

ENZYME LEVELS AS PREDICTORS OF HEPATIC INJURY SEVERITY IN BLUNT ABDOMINAL TRAUMA: A COMPARATIVE ANALYSIS WITH CT IMAGING

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ABSTRACT

Background: Blunt abdominal trauma (BAT) is a significant cause of morbidity and mortality globally, with liver injury being one of the most common consequences. Assessing liver injury severity in BAT patients is crucial for effective management. **Objective:** This study aimed to evaluate the role of liver enzymes, specifically AST and ALT, in predicting the severity of hepatic injury in cases of blunt abdominal trauma. **Methods:** A prospective observational study was conducted on 100 adult patients presenting with blunt abdominal trauma at Yashoda Hospital, Secunderabad, India, between January 2021 and June 2022. Demographic data, mode of injury, and clinical presentation were recorded. Liver enzymes (AST, ALT) were measured after initial resuscitation, and abdominal CT imaging was performed to assess liver injuries. Liver injury grades were determined based on imaging findings. Statistical analysis included chi-square tests, t-tests, and ROC curve analysis. **Results:** Liver was the most commonly injured organ (42%), followed by the spleen (33%). Most liver injury cases were grade II or III (73.8%). Mean AST and ALT levels were significantly higher in cases with liver injury compared to those without ($p<0.01$). Higher AST and ALT levels were associated with severe liver injury ($p<0.01$). ROC curve analysis demonstrated significant predictive ability of AST and ALT levels for diagnosing liver injury, with cut-off values of >42 U/L for AST and >33 U/L for ALT. **Conclusion:** Liver enzymes, particularly AST and ALT, serve as valuable markers for diagnosing and assessing the severity of liver injury in blunt abdominal trauma cases.

KEYWORDS :

INTRODUCTION

Blunt abdominal trauma (BAT) presents a significant global health concern, ranking as the third most prevalent form of trauma [1]. While road traffic accidents, falls, and assaults are common causes, rare occurrences include iatrogenic trauma during medical interventions [2].

BAT constitutes the majority of abdominal injuries seen in emergency departments, with motor vehicle collisions (MVCs) being the leading cause [28,29]. Despite its frequency, BAT diagnosis remains challenging, especially concerning occult cases [28]. The spleen and liver are commonly affected organs, with injury severity ranging from minor contusions to life-threatening lacerations [2].

Early diagnosis and resuscitation are pivotal for favorable outcomes. Although the Focus Assessment with Sonography for Trauma (FAST) is useful, computed tomography (CT) remains the gold standard for comprehensive assessment [6]. However, CT availability and cost limit its accessibility, particularly in developing regions [7].

Elevated liver enzymes, namely aspartate transaminase (AST) and alanine transaminase (ALT), have shown promise in indicating liver trauma severity [8-11]. Nonetheless, establishing definitive cut-off values for these enzymes remains contentious [12–20].

This study aims to evaluate the efficacy of AST and ALT levels within 24 hours of injury in predicting hepatic injury severity compared with CT imaging findings, in cases of blunt abdominal trauma.

MATERIAL AND METHODS

Study Population and Study Design

A prospective observational study was conducted on 100 patients with a history of blunt abdominal trauma who presented to the Emergency Medicine Department of Yashoda Hospital, Secunderabad, India, between January 1, 2021, and June 30, 2022, spanning 18 months.

Inclusion Criteria

All adult patients aged 18 years or older with blunt abdominal trauma who presented to the Emergency Medicine Department within 24 hours of injury were included.

Exclusion Criteria

1. Patients who expired during resuscitation in the emergency department.
2. Patients who presented beyond 24 hours after the trauma.
3. Patients with a known history of liver disease.
4. Patients positive for hepatitis B and hepatitis C surface antigen.

Methods

One hundred eligible patients who provided written informed consent were enrolled in the study. Upon admission, a comprehensive history was obtained, including demographic details, mode of injury, suspected injuries, and clinical presentation. Vital signs and hemodynamic status were assessed, and past medical history and comorbidities were documented. Blood samples were collected after initial resuscitation for estimation of liver enzymes (AST, ALT) as per hospital protocol. Subsequently, all patients underwent abdominal CT imaging to assess liver injuries, which were graded based on imaging findings. Correlation between imaging findings and liver enzyme levels in relation to injury severity was analyzed.

Statistical Analysis

Data were recorded using a pre-designed study proforma. Qualitative variables were expressed as frequency and percentage, and association between qualitative variables was assessed using the Chi-Square test. Quantitative data were presented as Mean ± SD, and comparison between groups was performed using unpaired t-tests. The diagnostic accuracy of liver enzymes for predicting injury severity and outcome was evaluated using standard formulae and ROC curve analysis to determine optimal cut-off values. A p-value

< 0.05 was considered statistically significant. Statistical analysis was performed using SPSS Version 21.0, and graphical representation was conducted using Microsoft Excel 2010 where appropriate.

RESULTS

The mean age of the study population was 32.7 years, with the most affected age group being 21-30 years (40%). Male predominance was observed, comprising 84% of cases, with no significant difference between cases with and without liver injury (p=0.87). Road traffic accidents were the most common mode of injury (90%), followed by falls (7%) and assaults (3%).

Liver was the most commonly injured organ in blunt abdominal trauma cases (42%), followed by the spleen (33%). Other organs involved included the kidney (12%) and pancreas (14%). Multiple organ injuries were observed in 11% of cases. (Table No. 1).

Table 1. Distribution Of Organ Injuries

Organs Involved in the Injury	N	%
Liver	36	36.0%
Spleen	25	25 25.0%
Kidney	12	12.0%
Pancreas	6	6.0%
Spleen & Pancreas	5	5. 0%
Liver & Pancreas	3	5. 0%
Spleen & Liver	3	3. 0%
None	9	9. 0%
Total	100	100%

Grading of Liver Injuries as per CT Findings

In liver injury cases, grade II or III injuries were most prevalent, accounting for 73.8% of cases, while grade IV and V injuries were seen in 19% and 7.1% of cases, respectively.

Table 2. Grading Of Liver Injuries

Grade of Liver Injury	N	%
II	17	40.5%
III	14	33.3%
IV	8	19.0%
V	3	7.1%
Total	42	100.0%

Mean Liver Enzyme Levels in Cases with and without Liver Injury

Mean liver enzyme values were significantly higher in cases with liver injury compared to those without. Specifically, mean ALT (57.8 vs 31.1 U/L) and AST (74.3 vs 37.3 U/L; p<0.01) levels were elevated in cases with liver injury. (Table 3)

Table 3: Mean Liver Enzyme Levels

Variables	Liver Injury	N	Mean	SD	p- value
ALT (U/L)	No	58	31.1	20.2	<0.01
	Yes	42	57.8	22.4	
AST (U/L)	No	58	37.3	11.4	<0.01
	Yes	42	74.3	34.7	

Association of Liver Enzymes with Liver Injury Severity

Furthermore, severe liver injury (grade >3) was associated with significantly higher mean AST (124.1 vs 56.5 U/L; p<0.01) and ALT (88.2 vs 47 U/L) levels compared to less severe injuries (grade ≤3). (Table 4)

Table 4. Association Of Severe Liver Injury With Mean Liver Enzymes

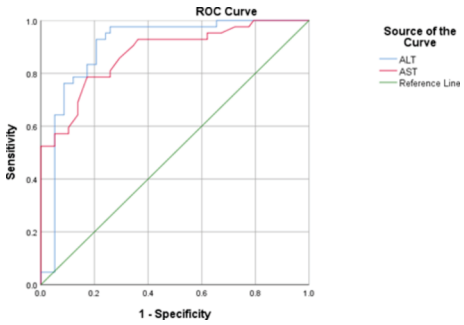
Variables	Severe Liver Injury (Grade >3)	N	Mean	SD	p- value
ALT (U/L)	No	31	47.0	11.1	<0.01
	Yes	11	88.2	17.5	
AST (U/L)	No	31	56.6	18.1	<0.01
	Yes	11	124.1	15.6	

Diagnostic Utility of Liver Enzymes

ROC curve analysis revealed that AST and ALT levels had significant predictive ability for diagnosing liver injury in blunt abdominal trauma cases. At cut-off values >42 U/L for AST and >33 U/L for ALT, sensitivity and specificity were determined. (Table 5 and Graph 1)

Table 5. Diagnostic Utility Of Liver Enzymes For Identification Of Liver Injury

Area Under the Curve: Diagnosis of Liver Injury					
Test Result Variable (s)	Area	SE	p- value	Asymptotic 95% Confidence Interval	
				Lower Bound	Upper Bound
ALT	0.901	0.033	<0.01	0.836	0.966
AST	0.875	0.035	<0.01	0.806	0.944
Cut-off	Sensitivity	Specificity	Accuracy		
ALT>33	90.5%	79.3%	84.9%		
AST>42	85.7%	70.7%	78.2%		



Graph-1

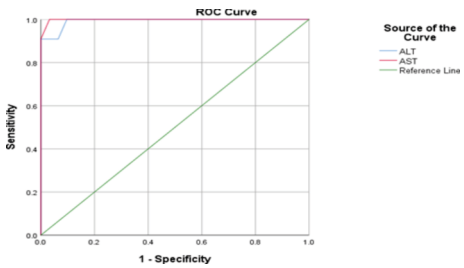
DISCUSSION

Diagnostic Utility Of Liver Enzymes For Identification Of Liver Injury

Similarly, for the diagnosis of severe liver injury (grade >3), AST and ALT levels demonstrated high sensitivity and specificity. At cut-off values >90 U/L for AST and >60 U/L for ALT, both enzymes exhibited excellent diagnostic accuracy. (Table 6 and Graph 2)

Table 6. Diagnosis Of Severe Liver Injury

Area Under the Curve: Diagnosis of Severe Liver Injury (Grade >3)					
Test Result Variable (s)	Area	SE	p- value	Asymptotic 95% Confidence Interval	
				Lower Bound	Upper Bound
ALT	0.993	0.009	<0.01	0.974	1
AST	0.999	0.003	<0.01	0.993	1
Cut-off	Sensitivity	Specificity	Accuracy		
ALT>60	100.0%	90.3%	95.2%		
AST>90	100.0%	96.8%	98.4%		



Graph - 2

DISCUSSION

The findings of our study highlight the utility of liver enzymes, specifically AST and ALT, as valuable markers for diagnosing hepatic injuries and assessing their severity in cases of blunt abdominal trauma. Consistent with previous research, we observed significantly elevated mean AST and ALT levels in patients with liver injuries compared to those without [17-20]. Moreover, there was a significant correlation between mean AST and ALT levels and the grade of liver injury, indicating their potential as indicators of injury severity [11-15].

The elevated levels of AST and ALT observed in cases of severe liver injury further emphasize their role as prognostic markers [11,13,14]. These findings are consistent with previous studies that have identified specific thresholds for AST and ALT levels to predict the presence and severity of liver injury [17,18,21-24]. Notably, our study identified cut-off values of >42 U/L for AST and >33 U/L for ALT as strongly indicative of liver injury, with higher thresholds (>90 U/L for AST and >60 U/L for ALT) suggesting severe liver injury.

The diagnostic utility of AST and ALT levels in identifying liver injury was further validated through ROC curve analysis, demonstrating high sensitivity and specificity at the identified cut-off values [7,10,21,22,24]. These findings support the inclusion of AST and ALT measurements in the initial trauma blood test panel to aid in early diagnosis and guide management decisions, particularly in settings with limited imaging facilities.

It is important to note that while AST and ALT levels showed diagnostic significance for liver injuries, they did not exhibit diagnostic or prognostic value for other visceral organ injuries. Therefore, their interpretation should be context-specific and integrated with clinical assessment and imaging studies.

CONCLUSION

In conclusion, our study underscores the clinical utility of AST and ALT as reliable markers for diagnosing and assessing the severity of hepatic injuries in cases of blunt abdominal trauma. Incorporating these markers into routine trauma evaluations can facilitate early detection, prognostication, and appropriate management, thereby improving patient outcomes. Further research in larger cohorts is warranted to validate these findings and optimize their clinical utility in diverse clinical settings.

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