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Liver Function Abnormalities Among Lassa Fever Patients, A Retrospective Cross-Sectional Study at A Tertiary Hospital in North Eastern Nigeria

Longwap AS[1], Bawa IA[2], Salisu H,[2] Hamisu A[2], Maigari I[3], Baba AY[4], Isichei CO[1]

[1]*Department of Chemical Pathology and clinical Pharmacology, University of Jos/Jos University Teaching Hospital.*
[2]*Department of Chemical Pathology, Abubakar Tafawa Balewa University Bauchi.*
[3]*Department of Internal Medicine, Abubakar Tafawa Balewa University Bauchi.*
[4]*Department of Family Medicine, Abubakar Tafawa Balewa University Teaching Hospital Bauchi.*

Correspondence**: Longwap AS.* ***Email: *longwapa@unijos.edu.ng*
Department of Chemical Pathology and clinical Pharmacology, University of Jos/Jos University Teaching Hospital.

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ABSTRACT

Background: Lassa fever is an acute viral haemorrhagic illness endemic in West Africa and is associated with multisystem involvement, including hepatic dysfunction. However, data on the pattern of liver function abnormalities among patients with Lassa fever in North-Eastern Nigeria remain limited. Objective: To determine the pattern of liver function abnormalities among patients with confirmed Lassa fever managed at a tertiary hospital in North-Eastern Nigeria. Methods: This retrospective cross-sectional study analysed laboratory data from 173 RT-PCR-confirmed Lassa fever patients admitted to a tertiary hospital in North-Eastern Nigeria. Sociodemographic characteristics and biochemical parameters including AST, ALT, GGT, ALP, serum albumin, total protein and random blood glucose were extracted from hospital records. Liver function abnormalities were defined using standard laboratory reference ranges. Data were analysed using descriptive and inferential statistics, and a p-value <0.05 was considered statistically significant. Results: Elevated AST was the most common biochemical abnormality, occurring in 74.7% of patients, followed by elevated ALP (67.6%) and ALT (65.3%). Hypoalbuminemia was present in 55.5% of patients, while hypoproteinaemia occurred in 25.4%. Hypoglycaemia and hyperglycaemia were observed in 16.8% and 15.6% of patients, respectively. The median AST level (85 IU/L) exceeded the median ALT level (57 IU/L), demonstrating the characteristic AST predominance observed in Lassa fever, consistent with both hepatic injury and multisystem tissue involvement. Conclusion: Liver function abnormalities are common among patients with Lassa fever, with AST elevation being the most frequent biochemical abnormality. Routine monitoring of liver function parameters is essential for the clinical management of patients with Lassa fever and may provide useful information for patient monitoring and risk stratification.

Keywords: Lassa fever; liver function tests; transaminases; AST; hypoalbuminemia; Nigeria

INTRODUCTION

Lassa fever is an acute viral haemorrhagic disease caused by the Lassa virus, an arenavirus endemic in West Africa, with Nigeria accounting for the highest number of reported cases annually. The infection is primarily transmitted through contact with urine or faeces of infected *Mastomys natalensis* rodents and may also occur via human to human transmission, particularly in healthcare settings. Despite

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improvements in surveillance and case management, Lassa fever remains associated with significant morbidity and mortality, especially among hospitalized patients and those presenting late with severe disease.[1]

The clinical spectrum of Lassa fever ranges from mild febrile illness to severe multisystem involvement characterized by haemorrhage, acute kidney injury, neurological complications, and hepatic dysfunction. Liver involvement is a well-recognised feature of Lassa fever and is reflected in biochemical abnormalities such as elevated serum transaminases, hypoalbuminemia, and reduced total protein levels.[2] Hepatic injury in Lassa fever is thought to result from a combination of direct viral cytopathic effects, immune-mediated damage, and systemic inflammatory responses. Histopathological studies have demonstrated focal hepatocellular necrosis with minimal inflammatory infiltrates, suggesting early hepatic involvement in the disease course.[3]

Several studies from Nigeria, particularly from the Irrua Specialist Teaching Hospital, have documented significant derangements in liver enzymes among patients with confirmed Lassa fever. Elevated aspartate aminotransferase (AST) and alanine aminotransferase (ALT) levels are common findings, with AST often disproportionately higher than ALT.[2,4] In the normal hepatocytes, the total AST is higher than the total ALT, However, cytosolic AST is lower that ALT because majority of the AST is actually mitochondrial in origin[10]. Although AST is frequently higher than ALT in patients with Lassa fever, this pattern should not be interpreted as evidence of isolated hepatocellular necrosis. AST is distributed in both the cytosol and mitochondria of hepatocytes but is also abundant in skeletal muscle, cardiac muscle, kidneys, brain and erythrocytes. Consequently, disproportionate AST elevation in Lassa fever probably reflects the multisystem nature of the disease, with contributions from both hepatic injury and extrahepatic tissue damage. This pattern has been associated with severe disease and poor clinical outcomes. An admission AST level ≥150 IU/L has been reported as a predictor of fatal outcome, underscoring the potential role of transaminases as prognostic biomarkers.[4] In addition, abnormalities in alkaline phosphatase (ALP) have been observed, indicating possible extrahepatic and possible intrahepatic cholestatic involvement in some patients.[5]

Hypoalbuminemia and reduced total protein levels are also frequently reported in Lassa fever and may reflect impaired hepatic synthetic function, increased vascular permeability, malnutrition, or systemic inflammation. [2] Acute systemic inflammation is known to cause a reduction of albumin as a negative acute phase protein. These abnormalities have important clinical implications, including increased risk of oedema, altered drug pharmacokinetics, and worsening clinical outcomes. Furthermore, metabolic derangements such as hypoglycaemia and hyperglycaemia have been described in severe viral infections, including Lassa fever, and may contribute to disease severity and mortality if not promptly recognized and corrected.[6]

Although the hepatic manifestations of Lassa fever have been described in studies from southern Nigeria and in paediatric cohorts, there is limited published data on the pattern and magnitude of liver function abnormalities among patients in North-Eastern Nigeria, a region that has experienced recurrent outbreaks and faces unique challenges related to healthcare access, late presentation, and resource limitations. Regional differences in disease epidemiology, nutritional status, and comorbidities may influence the biochemical profile and clinical outcomes of affected patients.[7]

Given the limited data on hepatic involvement in Lassa fever from North-Eastern Nigeria, a comprehensive evaluation of liver function parameters including AST, ALT, GGT, ALP, albumin, total protein, and glucose may provide valuable insights into the extent of hepatic involvement and its potential role in disease severity and prognosis. Understanding these biochemical patterns is essential for improving risk stratification, guiding clinical management, and optimizing supportive care in resource-limited settings.

This study therefore aimed to assess the pattern of liver function abnormalities among Lassa fever patients managed at a tertiary hospital in North-Eastern Nigeria

and to determine their potential clinical significance.

MATERIALS AND METHODS

Study Design

This study was a retrospective cross-sectional analysis conducted at the Abubakar Tafawa Balewa University Teaching Hospital in North-Eastern Nigeria that serves as a referral centre for the management of confirmed Lassa fever cases. The hospital has an established Lassa fever isolation ward and a functional molecular diagnostic laboratory for reverse transcription polymerase chain reaction (RT-PCR) confirmation of Lassa virus infection.

Study population

The study population consisted of all patients with RT-PCR–confirmed Lassa fever who were admitted to the isolation ward between January 2023 and December 2025 and had complete liver function test results documented at admission.

Inclusion criteria

1. Confirmed Lassa fever by RT-PCR
2. Availability of baseline liver function parameters (AST, ALT, GGT, ALP, albumin, total protein) and random blood glucose
3. Age 5 to 70 years old.

Exclusion criteria

1. Patients with known chronic liver disease
2. Patients with documented viral hepatitis, alcoholic liver disease, or hepatotoxic drug use prior to admission
3. Incomplete laboratory records

Sample size determination

The minimum sample size was calculated using the single population proportion formula:[10,21]

$$n = \frac{Z^2pq}{d^2}$$

Where:

n = minimum sample size
Z = standard normal deviate at 95% confidence level = **1.96**
p = estimated prevalence of liver function abnormalities among Lassa fever patients = **75% (0.75)**
q = 1 − p = **0.25**
d = margin of error = **7% (0.07)**

$$n = \frac{(1.96)^2 \times 0.75 \times 0.25}{(0.07)^2}$$

$$n = \frac{3.8416 \times 0.1875}{0.0049}$$

$$n = \frac{0.7203}{0.0049}$$

$$n = 147$$

Adjusting for 10% incomplete records:

$$n_{adj} = \frac{147}{1 - 0.10}$$

$$n_{adj} = \frac{147}{0.90} = 163$$

Therefore, the minimum required sample size was **163 participants**. However, all eligible records within the study period were included using total population sampling, giving a final sample size of **173 patients**.**Data collection**

Data were extracted from patients' medical records and laboratory registers using a structured proforma. Sociodemographic variables (age and sex) together with biochemical parameters including AST, ALT, GGT, ALP, albumin, total protein and random blood glucose were extracted using a structured proforma.

All laboratory analyses were performed in the hospital's chemical pathology laboratory using an automated chemistry analyser following standard operating procedures and internal quality control protocols. Liver function abnormalities were defined using reference ranges adopted by the hospital laboratory as elevated if AST: >40 IU/L, ALT: >40 IU/L, GGT: >55IU/L, ALP: >120 IU/L and hypoalbuminaemia as serum albumin <3.5 g/dL while hypoproteinaemia: total protein <6.0 g/dL Abnormal glucose was define as <70 mg/dLhypoglycaemia) or >140 mg/dL

(hyperglycaemia)[10]

Data analysis

Data were entered and analysed using Python/SciPy with procedures equivalent to standard SPSS descriptive and inferential analyses. Continuous variables were assessed for normality using the Shapiro-Wilk test. Normally distributed variables were to be summarized as mean ± standard deviation, while non-normally distributed variables were presented as median and interquartile range. Categorical variables were expressed as frequencies and percentages.

The prevalence of each liver function abnormality was calculated. Comparisons between male and female patients were performed using the independent-samples Student's t-test for normally distributed continuous variables, the Mann-Whitney U test for non-normally distributed continuous variables, and the Chi-square test or Fisher's exact test, where appropriate, for categorical variables. A p-value <0.05 was considered statistically significant.

Ethical considerations

Ethical approval was obtained from the Research Ethics Committee of the Abubakar Tafawa Balewa University Teaching Hospital. Patient confidentiality was maintained by anonymizing data and using unique study identification numbers. The study complied with the principles of the Declaration of Helsinki for research involving human subjects.[11]

Laboratory Methods:

All biochemical analyses were performed in the Lassa Camp of Abubakar Tafawa Balewa University Teaching Hospital using the Skyla HB1 automated clinical chemistry analyser according to the manufacturer's instructions and standard laboratory operating procedures.

a. Specimen Collection and Processing

Venous blood samples were collected aseptically at admission into plain serum separator tubes for AST, ALT, GGT, TP, Albumin, ALP and Glucose.

Samples were allowed to clot (where applicable), centrifuged at 3000 rpm for 5 minutes, and serum/plasma was separated promptly. Analysis was performed immediately or within the manufacturer's recommended stability period. Haemolysed, lipaemic, or grossly icteric samples were flagged according to analyser interference thresholds.

b. Biochemical Assays

1. Aspartate Aminotransferase (AST)

Method Principle: IFCC Kinetic UV Method (without pyridoxal phosphate)

AST catalyzes the transfer of an amino group from L-aspartate to α-ketoglutarate forming oxaloacetate and glutamate.

Oxaloacetate is reduced to malate in the presence of malate dehydrogenase (MDH) with simultaneous oxidation of NADH to NAD^+.

The decrease in absorbance due to NADH oxidation is measured kinetically at 340 nm.

The rate of decrease in absorbance is directly proportional to AST activity in the sample.

2. Alanine Aminotransferase (ALT)

Method Principle: IFCC Kinetic UV Method

ALT catalyzes the transfer of an amino group from L-alanine to α-ketoglutarate forming pyruvate and glutamate.

Pyruvate is reduced to lactate in the presence of lactate dehydrogenase (LDH) with oxidation of NADH to NAD^+.

The decrease in absorbance at 340 nm is monitored kinetically.

The rate of NADH consumption is directly proportional to ALT activity.

3. Gamma-Glutamyl Transferase (GGT)
Method Principle: Kinetic Colorimetric Method

Gamma-glutamyl transferase catalyses the transfer of the gamma-glutamyl group from a gamma-glutamyl donor substrate to an acceptor molecule, commonly glycylglycine. In the assay, GGT acts on L-γ-glutamyl-p-nitroanilide or a similar chromogenic substrate to release p-nitroaniline.

The liberated p-nitroaniline produces a coloured product, and the rate of increase in absorbance is measured kinetically, usually at 405 nm. The rate of colour formation is directly proportional to the GGT activity in the sample

4. Alkaline Phosphatase (ALP)

Method Principle: p-Nitrophenyl Phosphate (pNPP) Kinetic Method

ALP catalyzes the hydrolysis of p-nitrophenyl phosphate to p-nitrophenol and phosphate in alkaline medium.

p-Nitrophenol is yellow at alkaline pH and absorbs light at 405 nm.

The rate of increase in absorbance at 405 nm is proportional to ALP activity.

5. Albumin

Method Principle: Bromocresol Green (BCG) Dye Binding Method

At acidic pH, albumin binds specifically to bromocresol green forming a green-coloured complex.

The absorbance of the complex is measured at 630 nm.

Colour intensity is directly proportional to albumin concentration.

6. Total Protein

Method Principle: Biuret Method

In alkaline medium, peptide bonds react with copper ions to form a violet-coloured complex.

The absorbance of the complex is measured at approximately 546 nm. Colour intensity is proportional to total protein concentration.

7. Random Blood Glucose

Method Principle: Glucose Oxidase–Peroxidase (GOD-POD) Method

Glucose is oxidized by glucose oxidase to gluconic acid and hydrogen peroxide.

Hydrogen peroxide reacts with phenol and 4-aminophenazone in the presence of peroxidase to form a quinoneimine dye.

Absorbance is measured at approximately 500 nm and is proportional to glucose concentration.

c. Internal Quality Control (IQC)

Internal quality control was performed daily using commercially prepared multi-level control sera (normal and pathological levels). Control materials were analysed at the beginning of each run while results were plotted on Levey–Jennings charts. Westgard multirule criteria were applied to detect analytical errors and runs violating QC rules were rejected and repeated after troubleshooting.

d. Calibration

The Skyla HB1 analyser was calibrated using manufacturer-provided calibrators. Calibration verification was performed periodically according to laboratory policy. Recalibration was performed when QC values exceeded acceptable limits or after reagent lot change.

Analytical Performance and Interference

The analyser automatically flagged haemolysis lipaemic and icterus samples. Potential analytical interferences were managed according to manufacturer's specifications. Samples exceeding acceptable interference limits were excluded or re-collected where possible.

RESULTS

A total of 173 RT-PCR-confirmed Lassa fever patients were included in the analysis. Females constituted 93 (53.8%) of the study population, while males were 80 (46.2%), giving a slight female predominance. The median age was 27.0 years (IQR: 20.0-38.0).

TABLE 1. SOCIODEMOGRAPHIC CHARACTERISTICS

Variable	Frequency	Percentage (%)
Male	80	46.2
Female	93	53.8
Total	**173**	**100.0**

Interpretation: Females constituted a slight majority of the study population: 93/173 (53.8%), while males were 80/173 (46.2%

TABLE 2. DESCRIPTIVE STATISTICS AND NORMALITY TESTING

Variable	Valid N	Mean ± SD	Median (IQR)	Shapiro Wilk p
Age (years)	173	30.06 ± 14.11	27.0 (20.0-38.0)	<0.001
Total protein (g/dL)	173	6.69 ± 1.35	6.8 (5.9-7.7)	<0.001
Albumin (g/dL)	173	3.33 ± 0.90	3.3 (2.7-3.9)	<0.001
AST (IU/L)	173	172.18 ± 224.58	85.0 (40.2-178.0)	<0.001
ALT (IU/L)	173	106.61 ± 128.76	57.0 (27.0-117.0)	<0.001
GGT (IU/L)	173	62.85 ± 59.17	56.0 (51.0-62.0)	<0.001
ALP (IU/L)	173	192.94 ± 727.48	125.0 (104.0-154.0)	<0.001
Random glucose (mg/dL)	173	101.55 ± 40.48	94.0 (80.0-118.0)	<0.001

Interpretation: Most variables were non-normally distributed; therefore, medians and IQRs are the preferred summary statistics for publication. AST showed a median of 85.0 IU/L after exclusion of implausible coded values, while ALT showed a median of 57.0 IU/L, demonstrating AST predominance.

TABLE 3. PREVALENCE OF BIOCHEMICAL ABNORMALITIES

Abnormality	Operational definition	Frequency/Valid N	Percentage (%)
Elevated AST	>40 IU/L	127/173	74.7
Elevated ALT	>40 IU/L	113/173	65.3
Elevated GGT	>55 IU/L	33/173	19.1%
Elevated ALP	>120 IU/L	117/173	67.6
Hypoalbuminaemia	<3.5 g/dL	96/173	55.5
Hypoproteinaemia	<6.0 g/dL	44/173	25.4
Hypoglycaemia	<70 mg/dL	29/173	16.8
Hyperglycaemia	>140 mg/dL	27/173	15.6

Interpretation: Elevated GGTwas the most frequent biochemical abnormality, followed by elevated ALP and elevated ALT. Hypoalbuminaemia was present in more than half of the patients, supporting systemic inflammatory and possible hepatic synthetic involvement.

TABLE 4. COMPARISON OF CONTINUOUS VARIABLES BY SEX

Variable	Male	Female	Statistical test	p-value
Age (years)	30.0 (22.0-39.2)	26.0 (20.0-35.0)	Mann-Whitney U	0.245
Total protein (g/dL)	7.0 (6.0-7.7)	6.5 (5.9-7.5)	Mann-Whitney U	0.168
Albumin (g/dL)	3.5 (2.9-3.8)	3.1 (2.6-4.0)	Mann-Whitney U	0.187
AST (IU/L)	98.0 (46.5-223.5)	74.0 (34.5-158.0)	Mann-Whitney U	0.024
ALT (IU/L)	64.0 (36.0-138.8)	52.0 (25.0-102.0)	Mann-Whitney U	0.141
GGT (IU/L)	56.0 (51.0-63.0)	54.0 (51.0-62.0)	Mann-Whitney U	0.787
ALP (IU/L)	124.5 (102.8-151.2)	126.0 (113.0-154.0)	Mann-Whitney U	0.437
Random glucose (mg/dL)	98.0 (82.8-119.0)	89.0 (79.0-117.0)	Mann-Whitney U	0.237

Interpretation: Although continuous AST values differed significantly between males and females, the prevalence of elevated GGT was also significantly higher among females (p<0.001), whereas the prevalence of the remaining biochemical abnormalities did not differ significantly by sex.

TABLE 5. PREVALENCE OF ABNORMALITIES BY SEX

Abnormality	Male n/N (%)	Female n/N (%)	Test	p-value
Elevated AST	63/79 (79.7)	64/91 (70.3)	Chi-square	0.218
Elevated ALT	57/80 (71.2)	56/93 (60.2)	Chi-square	0.174
Elevated GGT	45/80 (56.2%)	88/93 (94.6%)	Chi-square	<0.001
Elevated ALP	51/80 (63.8)	66/93 (71.0)	Chi-square	0.396
Hypoalbuminaemia	39/80 (48.8)	57/93 (61.3)	Chi-square	0.133
Hypoproteinaemia	19/80 (23.8)	25/93 (26.9)	Chi-square	0.767
Hypoglycaemia	14/80 (17.5)	15/93 (16.1)	Chi-square	0.971
Hyperglycaemia	15/80 (18.8)	12/93 (12.9)	Chi square	0.397

Interpretation: Although continuous AST values differed by sex, the prevalence of elevated AST and other biochemical abnormalities did not differ significantly between males and females

DISCUSSION

This study evaluated the pattern of liver function abnormalities among patients with RT-PCR-confirmed Lassa fever managed at a tertiary referral hospital in North-Eastern Nigeria. The findings demonstrate that hepatic biochemical abnormalities are highly prevalent, with elevated AST, ALT, GGT, ALP, hypoalbuminaemia, and hypoproteinaemia occurring in a substantial proportion of patients. These findings reinforce the concept that Lassa fever is a multisystem

viral disease in which hepatic dysfunction is a prominent clinical manifestation and contributes significantly to the biochemical abnormalities observed during acute infection.

Elevated AST was the most frequent biochemical abnormality, affecting approximately three-quarters of the study population, followed by elevated ALP and ALT. This pattern is consistent with previous reports from Nigeria, particularly studies conducted at the Irrua Specialist Teaching Hospital, where elevated serum transaminases were among the commonest laboratory abnormalities in hospitalized patients with Lassa fever and were associated with increasing disease severity.[12] Similarly, McCormick and colleagues identified elevated AST as one of the characteristic biochemical abnormalities among patients with Lassa fever in Sierra Leone, supporting the role of hepatic involvement in the disease process.[13] The high prevalence of transaminase elevation observed in the present study therefore corroborates previous evidence that hepatocellular injury is a major feature of Lassa virus infection irrespective of geographical location within endemic regions.

A notable finding of this study was the predominance of AST over ALT, with the median AST concentration exceeding the median ALT concentration. Although this pattern has consistently been reported in Lassa fever, it should not be interpreted as evidence of isolated hepatocellular necrosis. Rather, AST predominance probably reflects the multisystem nature of Lassa fever. Unlike ALT, which is relatively liver-specific, AST is widely distributed in hepatocytes, skeletal muscle, cardiac muscle, kidneys, brain and erythrocytes. Consequently, elevated AST concentrations may reflect combined hepatic injury and extrahepatic tissue damage resulting from widespread viral infection, systemic inflammation and cellular injury.[6] This interpretation is consistent with observations by Okokhere et al., who demonstrated that increasing AST concentrations were associated with disease severity and poorer clinical outcomes among Nigerian patients with Lassa fever.[12] Furthermore, markedly elevated AST has previously been identified as an independent predictor of mortality, emphasizing its potential value as a biomarker for disease severity rather than solely as an indicator of liver injury.[13]

Gamma-glutamyl transferase (GGT) concentrations were also elevated in a proportion of patients, suggesting that hepatobiliary involvement may accompany the predominantly hepatocellular pattern of liver injury observed in Lassa fever. Although GGT is commonly regarded as a sensitive marker of cholestasis and biliary epithelial injury, elevations may also occur in response to hepatocellular damage, oxidative stress, and microsomal enzyme induction. In viral haemorrhagic fevers, systemic inflammation and widespread cellular injury may contribute to increased GGT activity even in the absence of overt biliary obstruction. While GGT has been less extensively studied than AST and ALT in Lassa fever, its elevation in the present study supports the concept that hepatic involvement extends beyond hepatocellular injury and may include varying degrees of hepatobiliary dysfunction. Consequently, assessment of GGT alongside conventional liver enzymes may provide additional information regarding the extent of hepatic involvement and should be interpreted in conjunction with other biochemical and clinical findings.

Approximately two-thirds of the patients also demonstrated elevated alkaline phosphatase concentrations. Although hepatocellular injury represents the predominant biochemical pattern in Lassa fever, elevated ALP may indicate concurrent hepatobiliary involvement or cholestatic dysfunction. Histopathological studies have demonstrated focal hepatocellular necrosis with relatively little inflammatory infiltration; however, progressive hepatic injury may impair bile formation and excretion, resulting in mild cholestatic enzyme elevation.[14] The frequency of elevated ALP observed in this study suggests that liver involvement in Lassa fever is not limited to hepatocellular damage but may encompass broader disturbances in hepatobiliary function.

Hypoalbuminaemia was observed in more than half of the patients, making it one of the most frequent biochemical abnormalities identified. The reduction in serum albumin is likely multifactorial. Direct hepatic injury may impair albumin synthesis, while the

profound inflammatory response accompanying acute Lassa virus infection suppresses hepatic production of albumin because it functions as a negative acute-phase protein. Simultaneously, increased vascular permeability associated with viral haemorrhagic fever promotes redistribution of albumin into the extravascular compartment, further lowering circulating concentrations. Nutritional deficiencies and reduced dietary intake during acute illness may also contribute to hypoalbuminaemia in affected patients. Similar reductions in serum albumin have been described in Ebola virus disease and other viral haemorrhagic fevers, where hypoalbuminaemia has been associated with severe disease and adverse clinical outcomes.[15] The high prevalence observed in the present study therefore supports the importance of serum albumin as a useful indicator of both hepatic synthetic function and systemic inflammatory response.

Hypoproteinaemia occurred in approximately one-quarter of the study population. This finding is probably related to the observed hypoalbuminaemia, since albumin constitutes approximately half of total serum protein. In addition, acute systemic illness is characterized by increased protein catabolism, reduced hepatic protein synthesis and increased metabolic demands, all of which may contribute to declining serum protein concentrations. Background malnutrition, which remains prevalent in parts of North-Eastern Nigeria, may further accentuate these abnormalities during acute infection.[16] Consequently, reduced total protein concentrations in patients with Lassa fever are likely to reflect both disease-related metabolic changes and underlying nutritional status.

Disturbances in glucose homeostasis were also identified, with both hypoglycaemia and hyperglycaemia occurring in clinically important proportions of patients. Hypoglycaemia may result from impaired hepatic gluconeogenesis secondary to hepatocellular dysfunction, depletion of hepatic glycogen stores, increased peripheral glucose utilization and sepsis-associated metabolic derangements. Conversely, hyperglycaemia is likely attributable to the stress response induced by severe infection, mediated through increased secretion of catecholamines, cortisol and glucagon, which stimulate hepatic glucose production and induce transient insulin resistance.[17] Recognition of these abnormalities is clinically important because both hypo- and hyperglycaemia have been associated with adverse outcomes in critically ill patients and require prompt identification and appropriate correction.

Unlike many previous Nigerian studies that reported a slight male predominance among patients with Lassa fever, females constituted a modest majority in the present study. This difference may reflect local epidemiological characteristics, healthcare-seeking behaviour, household exposure patterns, or temporal variations in outbreak dynamics rather than a true biological difference in susceptibility. Importantly, despite the female predominance, the prevalence of liver function abnormalities did not differ significantly between males and females, although continuous AST concentrations were modestly higher in males. These findings suggest that once infection is established, the pattern of hepatic biochemical involvement appears largely independent of sex, consistent with previous reports.[12]

An important contribution of this study is that it provides contemporary data describing hepatic biochemical abnormalities among patients with Lassa fever in North-Eastern Nigeria, a region where published evidence remains limited despite recurrent outbreaks. Most previous studies describing hepatic dysfunction in Lassa fever have originated from southern Nigeria, particularly Irrua, or from Sierra Leone.[12,13] The similarity between the present findings and those reported from other endemic regions suggests that the biochemical manifestations of hepatic involvement are relatively consistent across West Africa, despite potential differences in patient demographics, nutritional status and healthcare access. These findings therefore add important regional evidence that may improve understanding of the disease within North-Eastern Nigeria.

The present findings have important clinical implications. Routine assessment of AST, ALT, GGT, ALP, albumin and total protein should form part of the initial laboratory evaluation of patients with suspected

or confirmed Lassa fever. The predominance of AST elevation, together with frequent hypoalbuminaemia, may assist clinicians in identifying patients requiring closer monitoring and more intensive supportive management. Although this study did not evaluate mortality or other clinical outcomes, previous studies have consistently demonstrated associations between markedly elevated AST concentrations and poor prognosis, suggesting that liver function tests may contribute to risk stratification in endemic settings.[12,13]

Overall, this study demonstrates that liver function abnormalities are common among patients with Lassa fever in North-Eastern Nigeria and further supports the central role of hepatic dysfunction in the disease process. Routine biochemical monitoring should remain an integral component of patient evaluation, while prospective multicentre studies incorporating serial liver function measurements and clinical outcome data are needed to better define the prognostic significance of these abnormalities.

CONCLUSION

This study demonstrated that liver function abnormalities are highly prevalent among patients with confirmed Lassa fever managed at a tertiary hospital in North-Eastern Nigeria. Elevated transaminases, particularly aspartate aminotransferase (AST), were the most common biochemical abnormalities observed. The predominance of AST over ALT further supports previous observations that Lassa fever is associated with significant hepatocellular injury and systemic tissue involvement.

Hypoalbuminaemia and hypoproteinaemia were also frequently observed, suggesting impairment of hepatic synthetic function and the systemic inflammatory response associated with viral haemorrhagic fevers. In addition, disturbances in glucose metabolism were identified in a subset of patients, highlighting the metabolic impact of severe viral infection.

These findings emphasize the importance of routine biochemical monitoring, particularly liver function tests, in the clinical management of Lassa fever patients. Early identification of hepatic dysfunction may assist clinicians in risk stratification, monitoring disease progression, and guiding supportive management strategies in endemic settings.

Study Limitations

This study has several limitations that should be considered when interpreting the findings.

First, the retrospective design limited the ability to assess longitudinal changes in liver function parameters during the course of illness. Serial biochemical measurements could provide better insight into the progression and recovery patterns of hepatic injury in Lassa fever.

Second, the study relied on secondary data extracted from hospital records, which may be subject to incomplete documentation or recording errors. Some clinical variables that could influence liver function, such as medication history, alcohol intake, and co-infections, were not available.

Third, the study was conducted in a single tertiary hospital, which may limit the generalizability of the findings to other settings. However, the hospital serves as a major referral centre for Lassa fever management in the region, making the findings relevant for similar endemic areas.

Finally, clinical outcomes such as mortality, complications, and duration of hospitalization were not analysed, which limited the ability to determine the prognostic significance of the observed liver function abnormalities.

Future prospective multicentre studies incorporating clinical outcomes and serial laboratory monitoring would provide a more comprehensive understanding of hepatic involvement in Lassa fever.

Recommendations

Based on the findings of this study, routine liver function testing should be incorporated into the standard clinical evaluation of all patients with suspected or confirmed Lassa fever while elevated AST levels should be carefully monitored, as they may serve as an early indicator of disease severity and systemic involvement.

Health facilities managing Lassa fever patients should ensure availability of reliable clinical chemistry laboratory services for timely monitoring of

biochemical parameters like serum albumin and glucose levels, as abnormalities in these parameters may influence patient management and outcomes. Finally, further prospective studies investigating the relationship between liver enzyme abnormalities and clinical outcomes such as mortality and disease severity are recommended.

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