Case report

# Low Cycle Threshold Values and Favorable Outcomes in Pediatric Lassa Fever Managed at FMC Owo Isolation Centre: A Case Series

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## ABSTRACT

**Background:** Lassa fever, a zoonotic viral hemorrhagic disease endemic to West Africa, poses a major public health threat, with Nigeria accounting for a large proportion of annual cases. Cycle threshold (CT) values from RT-PCR serve as indirect markers of viral load in Lassa fever. In adults, very low CT values are strongly associated with severe disease and mortality. However, the prognostic value of CT measurements in children is not well established. Pediatric patients may exhibit different immune responses and disease trajectories compared to adults, and data on how CT values correlate with clinical outcomes in this population remain limited. Understanding these dynamics could inform risk stratification, guide clinical management, and optimize resource allocation in endemic settings. This series highlights an unusual clinical pattern that has been noticed among pediatric Lassa fever cases. Unlike in adult cohorts, children with very low CT values survived when provided with comprehensive care. These findings suggest CT values in pediatrics should inform but not solely determine patient outcomes.

**Methods:** This is a case series of three pediatric patients with laboratoryconfirmed Lassa fever, managed at the FMC Owo Isolation Centre. All cases were comanaged with the Pediatricians throughout admission, and received IV ribavirin in line with NCDC protocols, together with supportive care (transfusions, antimicrobials, anticonvulsants, oxygen therapy and targeted organ support as required). RTPCR CT values (reported here as G and L genes where available) were recorded at baseline and during followup as part of routine clinical monitoring. Clinical data, laboratory values and documented interventions were extracted from inpatient records.

**Results:** We report three pediatric cases of laboratory-confirmed Lassa fever managed at FMC Owo Isolation Centre, Nigeria. A 1-year-old female (baseline G18.89 and L23.37) developed seizures, anemia, and multi-organ dysfunction but recovered and discharged 31 days later following ribavirin administration, blood transfusion, and other supportive care. An 8-year-old male (baseline G-14.99 and L-19.23), experienced seizures, bleeding from puncture sites, and prolonged illness, yet was discharged after 23 days of intensive management. A 10-year-old male (baseline G-23.99 and L-27.56), had a comparatively mild course with anemia and hematuria, achieving full recovery within 16 days. In all cases, rising CT values during treatment paralleled clinical improvement.

**Conclusion:** This is one of the first Pediatric-focused Lassa fever case series linking CT values with outcomes. CT monitoring shows promise both as a baseline prognostic marker and as a dynamic indicator of treatment response. Larger studies are needed to validate Pediatric-specific cut-offs and inform triage and resource allocation in endemic settings.

## Introduction

Lassa fever is a zoonotic viral hemorrhagic disease caused by the Lassa virus, a member of the Arenaviridae family.[1] It remains a major public health problem in West Africa, with Nigeria reporting the highest annual caseloads and frequent outbreaks.[1,2,3] The disease is transmitted primarily through exposure to rodent excreta, but human-to-human transmission also occurs, particularly in healthcare settings.[2,3] Clinical presentation is highly variable, ranging from mild febrile illness to severe multi-organ dysfunction and death.[1,2]

The diagnosis of Lassa fever has been significantly advanced by reverse transcriptase polymerase chain reaction (RT-PCR), which not only confirms infection but also provides cycle threshold (CT) values.[4] These values serve as indirect measures of viral load, as demonstrated in viral infections such as SARS-CoV-2, with lower CT values indicating higher viral burden.[4] Several studies in adult populations have shown that very low CT values are strongly associated with severe disease, complications, and increased mortality.[5,6] Consequently, CT has been proposed as a prognostic marker to guide risk stratification and clinical management.[5,6]

However, in pediatric patients, the relationship between CT values and outcomes is less clear. Children often display unique immune responses and disease trajectories compared with adults, and evidence from other viral infections, such as SARS-CoV-2, has shown differing patterns of CT– outcome associations.[7] This knowledge gap poses a challenge in clinical decision-making, as children may present with high viral loads yet experience outcomes that diverge from those observed in adults.

In this context, we present a descriptive case series of three pediatric patients with confirmed Lassa fever managed at the Federal Medical Centre (FMC) Owo Isolation Centre. Despite very low baseline CT values suggestive of high viral load, all three children survived following timely ribavirin therapy and comprehensive supportive care. This report highlights the potential differences in the prognostic implications of CT values in pediatric populations and underscores the importance of cautious interpretation when managing children with Lassa fever.

## CASE PRESENTATION

### CASE ONE

A 1-year-old female was referred from the Children's Emergency Room (CHER) with a confirmed diagnosis of Lassa fever, following a positive Lassa virus PCR. The patient's clinical course was marked by significant complications, including encephalitis, anemia, and disseminated intravascular coagulation (DIC).

The patient's illness began two weeks prior to admission with a persistent fever, followed by a week history of cough with associated dyspnea and two episodes of generalized tonic-clonic seizures at CHER. A notable history of household rodent exposure was reported, but no known contact with sick individuals. She had initially received supportive care at a peripheral facility without improvement. Her initial Lassa virus PCR cycle threshold (CT) values were G-18.89 and L-23.37, indicating a high viral load.

On admission, she was febrile (38.1OC), pale (++), had active bleeding from venipuncture sites, and an oxygen saturation (SpO□) of 91% in room air. Other systemic findings were normal. A presumptive diagnosis of Lassa fever with multi-organ complications, including anemia, encephalitis, and DIC, was established. She was started on IV ribavirin, IV Vitamin K, IV antibiotics (ceftriaxone), intranasal oxygen at 2L/min (saturation improved to 96%) and samples for baseline laboratory investigations including a full blood count (FBC), electrolytes/urea/creatinine (E/U/Cr), liver function tests (LFT), and serology were collected, the pediatricians were invited to co-manage the patient.

The fever persisted on the second day of hospitalization; The patient was noticed to have altered sensorium. Laboratory results revealed a hematocrit (HCT) of 23% and a white blood cell (WBC) count of 29.35 × 109/L, BUN of 9.9mmol/l, CRE of 287umol/l, ALP-609 I.U/L, ALT-256 I.U/L AST-701I.U/L, ALB-23g/L TP-50g/dL serology (RVS, HBsAg,) and VDRL were negative.

A subsequent seizure episode on the third day was aborted with IV diazepam, and she received a transfusion of 220 mL of fresh unbanked whole blood. By the fourth day, saturation improved to 97% in room air, she was then weaned off oxygen. Given the clinical context in an endemic region, she

was also started on oral artemisinin-based combination therapy (ACT) for presumptive malaria following persistent fever. Her post-transfusion hematocrit on the fifth day was 36.8%, with a platelet count of 98 × 103/UL and a WBC count of 16.56 × 109/L, BUN 7.3mmol/l, CRE 89umol/l, ALB 26gldl, TP 65g/dl, AST 1181I.U/l. A drastic drop in hematocrit to 11% on the seventh day necessitated a second transfusion of 220 mL of fresh unbanked whole blood.

The patient had two additional episodes of generalized seizures on the ninth day, which were again aborted with IV diazepam. IV phenobarbitone was initiated at a maintenance dose to prevent further episodes. She received another 220 mL of fresh unbanked whole blood. The following day, she was transfused with 198 mL of fresh unbanked blood. She remained febrile (37.8□C) and developed loose, bloody stools, prompting a switch in antibiotics to IV ciprofloxacin. Oral zinc and Vitamin A were also commenced.

On the twelfth day, the patient's condition worsened with the development of cough and multiple seizures. Her oxygen saturation dropped to 83% in room air. She was recommenced on intranasal oxygen at 4L/min oxygen saturation improved to 96%. IV ribavirin was extended for five days.

A positive malaria rapid diagnostic test (RDT) on the fifteenth day led to the initiation of oral Piperaquine-dihydroartemisinin.

A follow-up PCR on the seventeenth day showed a decrease in viral load (CT values of 31.92 and 35.11 following five days of IV ribavirin extension). Her ribavirin treatment was further extended for an additional 5 days. She remained thrombocytopenic (PLT 24 x 103/ul) for which she was transfused with platelet concentrate to address the critical platelet count.

On the nineteenth day, her platelet count was noticed to be critically low at 9 × 103/UL for which she was transfused with fresh plasma. By the twenty-first day, her platelet count had recovered to 194 × 103/UL, HCT was 29% and the fever had finally subsided. She received a final transfusion of 220mls of fresh whole blood.

A repeat Lassa virus PCR on the twenty second day showed a CT value of 36.9 (Single L gene), indicating a significant reduction in viral load she then commenced oral ribavirin for five days. A post-transfusion HCT on the twenty-third day was 50% PLT of 240 x 103/ul. A left gluteal abscess was noted; the plastic surgery team was consulted for co-management.

A repeat Lassa PCR on the 31st day was negative, confirming viral clearance. She was transferred to the pediatric ward for incision and drainage (I&D) of the abscess and was subsequently discharged with a scheduled follow-up at the Viral Hemorrhagic Fever (VHF) clinic.

## CASE TWO

An 8-year-old male who was transferred from the Infectious Disease Hospital (IDH) Akure to the Infection Control and Research Centre (ICRC) Owo after a positive Lassa virus PCR result with cycle threshold (CT) values (G-14.99 and L-19.23). He presented with a two-week history of fever, reduced urine output, and bleeding from puncture sites. He also reported a cough and loose stools. A history of frequent rodent sightings at home suggested a probable source of infection. There was no known contact with sick individuals.

On admission, the patient was febrile (38.8°C), tachycardic (pulse rate of 127 bpm), and tachypneic (respiratory rate of 50 breaths/min), with signs of respiratory distress. He had an oxygen saturation (SpO2 ) of 97% on intranasal oxygen at 2 L/min. A working diagnosis of Lassa fever with complications of acute kidney injury (AKI) and disseminated intravascular coagulation (DIC) was made.

Intravenous Ribavirin, broad-spectrum antibiotics (intravenous ceftriaxone), vitamin K, tranexamic acid, and Intravenous fluids were commenced immediately. Sample for baseline investigations were obtained. Pediatricians were invited to co-manage the patient.

By Day 2, laboratory results revealed marked leukocytosis (51.8×109/L), His hematocrit was 32.1%, he had deranged liver function tests; ALP-1330I.U/l, AST-314I.U/l, AST-615 I.U/l, TBIL- 3.5umol/ l, ALB-20g/l; he also had an elevated serum creatinine of 204µmol/L, BUN of 8.0mmol/l, serum potassium of 3.2mmol/l, Bicarbonate of 18mmol/l.

By Day 3, the patient's condition worsened with a drop in hematocrit to 25%, necessitating a fresh whole blood transfusion. Other repeat FBC result revealed a WBC of 23.08 x 103 Ul/109/l, PLT of 229 x 103/ul, E/U/CR revealed

a CRE 238umol/l, BUN 9.4mmol/l, bicarbonates of 18mmol/l, potassium of 3.18mmol/l, sodium of 130mmol/l.

On the fifth day, there was noticed to be a drop in WBC to 15.7 x 103/ul/109/l, hematocrit was 27%, PLT remained within normal range of 273 x 103/ul, potassium improved to 4mmol/l, sodium-138mmol/l, bicarbonates-21mmol/l, CRE-146umol/l, BUN-9.2mmol/l. ALP-277I.U/l, ALT-207 I.U/l, AST-471iu/l, ALB-21 g/l, TP-44g/dl. He was transfused with whole blood. The post transfusion hematocrit being 37%.

Persistent fever and poor clinical state prompted the addition of IV dexamethasone to his regimen on Day 7.

On the 12th day, he was noticed to be pale, had several episodes of seizure, a repeat hematocrit was 25% and low serum albumin (24g/L). He had a repeat blood transfusion, and IV ribavirin was extended for an additional five days. Nutritional support was optimized, while seizures were controlled by the administration of parenteral phenobarbitone.

The patient's condition gradually improved over the following days. On Day 17, a repeat Lassa virus PCR showed a significant increase in CT values (35.35 and 36.29), indicating a substantial reduction in viral load. He then had a second extension of IV ribavirin for additional five days. On Day 20, he had been seizure-free for five days, and his vital signs were stable, he was weaned off oxygen, intravenous fluids were discontinued, and oral fluid intake was encouraged.

By Day 23, he was clinically stable. A repeat PCR revealed a CT value of 37.00. He was discharged on oral ribavirin and scheduled for a follow-up at the Viral Hemorrhagic Fever (VHF) clinic. A subsequent PCR test two weeks later was negative, confirming viral clearance.

Due to the multiple seizure episodes and the potential for neurological sequelae, he was referred to a pediatric neurologist for ongoing care and monitoring.

## CASE THREE:

A 10-year-old male who was referred from a primary health care (MCHC) to the Infection Control and Research Centre (ICRC) with a confirmed positive Lassa virus PCR test (cycle threshold (CT) value of G23.99 and L27.56). His illness began with a 9-day history of intermittent high-grade fever, followed by a 3-day history of generalized body weakness, abdominal pain, and passage of dark, coke-colored urine. There was no history of vomiting, diarrhea, or bleeding from any orifices. His past medical history was unremarkable, and while there was no known contact with sick individuals, there was a history of rodent infestation at his home.

On admission, the patient was febrile (38.4□C) and pale. The systemic examination was otherwise normal. A provisional diagnosis of Lassa fever complicated by anemia was made. Samples for baseline laboratory investigations, including a full blood count, electrolytes, urea and creatinine, and liver function were obtained. Consult was sent to the pediatricians who comanaged the patient.

Base line investigation results revealed a HCT of 28.8%, prompting a transfusion of 250 mL of fresh whole blood. His platelet count was 161×103/UL and white blood cell count was 15.46×103/ UL, while kidney function tests revealed Cr- 115umol/l, BUN 7.6mmol/l, electrolytes revealed sodium of 138mmol/l, potassium of 3.6mmol/l, bicarbonates of 22mmol/l. liver function tests revealed ALP 167I.U/L, ALT 203i.u/l, AST 561i.u/l, ALB 40.1 g/l He was immediately started on intravenous ribavirin and supportive treatment including intravenous 4.3% dextrose in saline (500 mL 12-hourly), oral zinc (20 mg daily), and oral vitamin K (5 mg daily).

On Day 2, the patient remained febrile with no new complaints. His urine remained coke- colored, and a dipstick test confirmed the presence of hematuria and proteinuria. On Day 3, the patient became afebrile, and hematuria was improving although urinalysis still showed microscopic hematuria. A post-transfusion HCT was 33%. He was stable and maintained on the same treatment.

Sixth day into admission, he developed new symptoms of vomiting and mild abdominal pain. Intravenous antiemetics and oral omeprazole (20 mg daily) were added to his regimen. His temperature remained normal. On Day 9, he was noticed to be pale, and a repeat PCV was 23.5%, necessitating a second transfusion of fresh whole blood at 20 ml/kg.

Post-transfusion HCT on Day 10 was 33%, and intravenous fluids were discontinued. His urine became clearer by Day

11. A repeat Lassa virus PCR showed improved CT values of 34.55 and 34.76, indicating a lower viral load. IV ribavirin was then extended for additional five days. The patient's clinical condition improved significantly. Intravenous tranexamic acid was discontinued on the 14th day when urinalysis revealed a normal result. A final PCR test was performed on Day 16 and revealed a negative result for the Lassa virus. The patient was stable with no further symptoms.

The patient was discharged on Day 17 to continue follow-up care at a Viral Hemorrhagic Fever (VHF) clinic. An appointment was scheduled for one-week post-discharge.

## Discussion

This case series highlights the prognostic relevance of CT values in pediatric Lassa fever. A consistent pattern emerged: lower baseline CT values were linked with more severe complications and prolonged convalescence, while higher CT values correlated with milder disease. Progressive increases in CT values during treatment paralleled clinical recovery, underscoring their utility as a real-time marker of viral clearance.

Although adult-focused studies have linked baseline CT values below 20 with poor outcomes and high mortality,[5,6] our findings suggest that in children, such values are not invariably fatal. Two patients with baseline CT values <20 developed life-threatening complications, yet survived with timely IV ribavirin and intensive supportive care. This underscores that CT values should be interpreted as part of a broader risk stratification framework, rather than as stand-alone predictors. Factors such as host immunity, nutritional status, co-infections, and access to high-quality supportive care critically modify outcomes.[2,6] Furthermore, pediatric immune responses and recovery potential may differ from adults, which may explain the observed divergence.

Clinically, CT values could serve as a vital triage tool in resource-limited endemic settings. They can enable healthcare providers to swiftly identify high-risk pediatric patients, prioritize intensive monitoring, and strategically allocate scarce resources such as antivirals, transfusions, and advanced supportive care.

This study has limitations. It is a small descriptive series, limiting the generalizability of our findings. Additionally, CT values may vary across laboratories due to differences in assay protocols and reagents.[6] Finally, as a descriptive study, it does not allow for statistical inference.

## Conclusion

In this pediatric Lassa fever case series, low baseline CT values were associated with greater severity, while higher values corresponded with milder disease. Importantly, despite adult data linking CT <20 with high mortality, all patients in this series survived, indicating that in children, CT may be a marker of severity but not an absolute determinant of outcome. Rising CT values during treatment reliably tracked clinical recovery, reinforcing their value as a dynamic prognostic tool. These findings suggest that favorable outcomes are achievable even in children with high viral load when comprehensive, multidisciplinary care is provided. CT monitoring may therefore provide a pragmatic framework for risk stratification in endemic settings, though validation in larger pediatric cohorts remains essential.[2,5,6]

Beyond clinical management, preventive strategies remain critical. Regular community-wide deratization and sensitization campaigns focusing on environmental sanitation, safe food storage, and household hygiene are strongly recommended to reduce rodent-to-human transmission and mitigate recurrent outbreaks.

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