

Diphtheria with Measles Co-Infection in a Severely Malnourished, Unvaccinated Child: A Case Report from a Resource-Limited Setting

Kadra Hassan Mohamud¹, Fartun Abdullahi Hassan¹, Abdiwali Mohamed Hussein², Nasteaho Mohamud Mudei², Rayan Abdirahman Hassan¹, Amal Abdullahi Abdi³, Safia Mohamed Muhumed³

¹Department of Pediatrics, Dr. Sumait Hospital, SIMAD University, Mogadishu, Somalia; ²Dr. Sumait Hospital, SIMAD University, Mogadishu, Somalia;

³Department of Nursing, Dr. Sumait Hospital, SIMAD University, Mogadishu, Somalia

Correspondence: Kadra Hassan Mohamud, Email kadrahassanm@simad.edu.so

Background: Diphtheria and measles persist in regions with low vaccination coverage, where co-infection can lead to severe disease, especially in malnourished children. Diphtheria antitoxin shortages and limited diagnostic capacity further complicate timely management in low-resource settings. This report describes clinically evident diphtheria and measles co-infection in an unvaccinated, severely malnourished child.

Case Presentation: A 12-year-old unvaccinated girl from rural Somalia presented with a four-week history of high fever, sore throat, dysphagia, nasal regurgitation, cough, and progressive neck swelling. She was severely malnourished. Examination revealed cervical lymphadenopathy, severe pharyngeal inflammation, oral thrush, and later Koplik spots and a generalized rash consistent with measles. Laboratory confirmation for both infections was unavailable, and diphtheria antitoxin was not accessible. She received oxygen, intravenous ampicillin and gentamicin, vitamin A, nasogastric feeding, and nutritional rehabilitation, leading to clinical improvement. At follow-up, she had gained weight, resumed full oral intake, and demonstrated near-complete respiratory recovery.

Conclusion: This case highlights the interaction of vaccine-preventable infections and severe malnutrition in a low-resource setting. Early syndromic recognition of diphtheria and integration of nutritional rehabilitation are critical where diagnostic and therapeutic options are limited. Strengthening immunization and improving access to diphtheria antitoxin remain essential.

Keywords: diphtheria, measles co-infection, severe malnutrition, low-resource settings, pediatrics, Somalia

Introduction

Diphtheria is a toxin-mediated infection caused by *Corynebacterium diphtheriae*, characterized by upper respiratory tract involvement, pseudomembrane formation, and systemic complications including myocarditis and neuropathy.^{1,2} Despite the availability of effective vaccines, diphtheria has re-emerged in several regions, particularly in settings affected by conflict, population displacement, and disruptions to routine immunization services.^{3,4}

Measles is a highly contagious viral disease presenting with fever, cough, coryza, conjunctivitis, and pathognomonic Koplik spots, followed by a generalized maculopapular rash.² Measles infection induces profound immune suppression, predisposing affected individuals to secondary bacterial and viral infections.⁵

Severe acute malnutrition (SAM) further compromises both innate and adaptive immunity, increasing susceptibility to severe infections and adverse outcomes.^{6,7} In Somalia, persistent gaps in immunization coverage and recurrent outbreaks of vaccine-preventable diseases reflect ongoing health system challenges.^{4,8} Co-infection with diphtheria and measles is rarely reported but represents a critical clinical scenario in low-resource and fragile settings. Limited diagnostic capacity and constrained access to diphtheria antitoxin (DAT)—the only therapy capable of neutralizing circulating toxin—further

complicate case management.^{9,10} This case highlights the intersection of malnutrition, immunization gaps, and health system limitations in a resource-constrained setting.

Case Presentation

A 12-year-old girl from rural Somalia, unvaccinated due to lack of access to immunization services, presented with a four-week history of high fever, sore throat, productive cough, dysphagia, nasal regurgitation, and progressive neck swelling. She had no significant past medical history. On admission, she appeared severely wasted (weight 23 kg).

Vital signs: temperature 40.0 °C, heart rate 153 bpm, respiratory rate 35/min, blood pressure 100/60 mmHg, and SpO₂ 80% on room air.

She had marked cervical swelling with tender lymphadenopathy and severe pharyngeal inflammation. Koplik spots and a generalized maculopapular rash were present. Chest auscultation revealed bilateral upper-zone crackles. Neurological examination revealed no focal deficits.

Initial laboratory results showed leukocytosis (Table 1) with elevated C-reactive protein (76.8 mg/L), erythrocyte sedimentation rate (60 mm/hr), and antistreptolysin O titers (312.9 IU/mL) (Tables 1 and 2). Liver enzymes showed mild transaminitis with elevated aspartate aminotransferase (62.8 U/L) and normal alanine aminotransferase (22 U/L) (Table 3). No hematological abnormalities other than leukocytosis were identified. Microbiological confirmation for specific infectious etiologies was not available at the time of evaluation. Cardiac imaging and advanced serological or molecular diagnostic tests were not performed due to limited resource availability.

She was started on oxygen (5 L/min), intravenous ampicillin (1 g three times daily), intravenous gentamicin (80 mg daily), vitamin A (200,000 IU on days 1 and 2), miconazole for oral candidiasis, and paracetamol. Due to severe dysphagia and aspiration risk, a nasogastric tube was inserted for feeding. Diphtheria antitoxin was not accessible.

Table 1 Complete Blood Count (CBC) Findings

Parameter	Result	Unit	Reference Range
White Blood Cells (WBC)	7.96	$\times 10^9/L$	4.0–11.0
Hemoglobin (Hb)	12.8	g/dL	12.0–15.0
Red Blood Cells (RBC)	4.25	$\times 10^{12}/L$	3.8–5.2
Hematocrit (HCT)	37.8	%	36–46
Mean Corpuscular Volume (MCV)	88.8	fL	80–96
Platelets	262	$\times 10^9/L$	150–400
Neutrophils	89.6	%	40–75
Lymphocytes	6.3	%	20–45
Monocytes	3.6	%	2–10
Eosinophils	0.4	%	1–6

Table 2 Inflammatory and Serological Investigations

Parameter	Result	Unit	Reference Range	Interpretation
C-reactive protein (CRP)	76.8	mg/L	2–10	Markedly elevated
Erythrocyte sedimentation rate (ESR)	60	mm/hr	≤ 20	Elevated
Anti-streptolysin O (ASO)	312.9	IU/mL	25–200	Elevated

Table 3 Liver Function Test Results

Parameter	Result	Unit	Reference Range
Aspartate aminotransferase (AST)	62.8	U/L	≤ 40
Alanine aminotransferase (ALT)	22	U/L	≤ 40

After 3 days of admission, fever subsided, oxygen requirements decreased, and feeding tolerance improved. She was discharged on day 5 on oral antibiotics and nutritional supplements.

At follow-up, she had gained weight (26 kg), was tolerating solid food, had no respiratory distress, and showed near-complete resolution of symptoms.

Discussion

Global surveillance data indicate a resurgence of diphtheria, particularly in fragile and conflict-affected settings, with outbreaks increasingly reported in regions with declining immunization coverage.^{1,3,11} Measles continues to pose a major public health threat due to its high transmissibility and ability to exploit immunity gaps, particularly among unvaccinated populations.^{2,4,8}

Malnutrition remains a critical determinant of infectious disease severity. Severe acute malnutrition disrupts immune function through impaired barrier integrity, reduced phagocytic activity, and diminished cell-mediated immunity, thereby increasing susceptibility to severe infections.^{6,7} Additionally, measles induces prolonged immune suppression—termed immune “amnesia”—which erases pre-existing immune memory and increases vulnerability to secondary infections.¹²

Definitive diagnosis of diphtheria requires microbiological confirmation and toxin detection, while measles diagnosis is typically confirmed by serological or molecular assays.^{13,14} However, in low-resource settings such as Somalia, access to these diagnostic tools remains limited, necessitating reliance on clinical case definitions.^{11,14} This diagnostic gap underscores broader systemic challenges in surveillance and laboratory capacity.

The cornerstone of diphtheria management is early administration of diphtheria antitoxin, which neutralizes circulating toxin and reduces mortality.¹¹ However, global shortages of DAT and logistical barriers to procurement limit its availability in many low-income settings.^{9,15} In this case, the absence of DAT represents a significant constraint in optimal management.

Supportive care, including antibiotic therapy, oxygen supplementation, nutritional rehabilitation, and vitamin A administration, remains essential—particularly in cases complicated by measles and malnutrition.^{4,8} While the antibiotic regimen used in this case was not standard for diphtheria, it likely provided coverage for secondary bacterial infections, which are common contributors to morbidity in measles.

Reports of diphtheria–measles co-infection are limited, highlighting the rarity of this clinical presentation. Existing literature more commonly describes diphtheria occurring alongside other viral infections or complicated by severe systemic manifestations such as myocarditis and neuropathy.^{16–18}

This case underscores critical gaps in immunization coverage, surveillance systems, and access to essential therapeutics in Somalia. Addressing these challenges requires strengthening routine immunization programs, improving outbreak detection and response, and ensuring equitable access to lifesaving interventions such as diphtheria antitoxin.^{8,11}

Conclusion

Co-infection with diphtheria and measles, compounded by severe acute malnutrition, can result in severe illness in settings with persistently low immunization coverage. Limited diagnostic capacity prevented etiologic confirmation, and unavailability of diphtheria antitoxin restricted definitive management. Despite these constraints, early syndromic recognition, broad-spectrum antibiotics for severe pneumonia, vitamin A supplementation, careful airway and feeding support, and timely nutritional rehabilitation contributed to recovery.

This case underscores priorities for the Somali health system: strengthening routine immunization services; improving access to diphtheria antitoxin and appropriate antibiotics; building frontline clinicians’ capacity to use syndromic case definitions when diagnostics are limited; and integrating targeted nutritional support into pediatric infectious disease care. Beyond the classical diphtheria toxin gene, *Corynebacterium diphtheriae* possesses multiple pathogenicity islands acquired through horizontal gene transfer, which enhance virulence and adaptability. The potential for emergence of new pathogenic strains, particularly in settings with suboptimal vaccine coverage and antibiotic pressure, underscores the need for robust genomic surveillance and ongoing epidemiologic vigilance for both diphtheria and measles. Addressing these gaps is essential to reduce preventable morbidity and mortality in high-risk, under-immunized populations.

Data Sharing Statement

The data supporting the findings of this case report are available from the corresponding author upon reasonable request.

Ethical Approval and Consent to Participate

In our institution, ethical approval is not required for case reports.

Consent for Publication

Written informed consent was obtained from the patient's parent/guardian for publication of this case report.

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Disclosure

The authors declare no conflicts of interest in this work.

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