

Stenotrophomonas maltophilia Infections in Infants: A Case Series from an Indian Neonatal and Pediatric Intensive Care Unit

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ABSTRACT

Introduction: *Stenotrophomonas maltophilia*, a Gram-negative, multidrug-resistant bacterium, is an emerging cause of hospital-acquired infections, particularly in immunocompromised pediatric patients. Its resistance to multiple antibiotics complicates therapeutic management, contributing to significant morbidity and mortality. This case series examines the risk factors and management strategies for *S. maltophilia* infections in a Neonatal and Pediatric Intensive Care Unit (NICU/PICU). **Methods:** This retrospective case series was conducted involving four infants (aged 1–4 months) admitted to the NICU or PICU at a tertiary care hospital in Upper Assam, India, from January to December 2023. Clinical data, risk factors, antibiotic susceptibility, treatments, and outcomes were analyzed with parental consent. **Results:** All patients presented with sepsis, three with pneumonia and two with suspected meningitis. Risk factors included prematurity (n=2), low birth weight (n=2), mechanical ventilation (n=3), and prior antibiotic exposure (n=4). Blood cultures confirmed *S. maltophilia*, resistant to empirical antibiotics (ciprofloxacin, gentamicin) but isolates were susceptible to levofloxacin (n=4) and minocycline (n=4); two isolates were also susceptible to trimethoprim-sulfamethoxazole (TMP-SMX) (n=2). Treatment with levofloxacin (14–21 days; n=3) or oral TMP-SMX (10 days; n=1) resulted in recovery in three patients with no residual sequelae. One patient died post-discharge after being readmitted for severe respiratory distress; the definitive cause of death was unknown. **Conclusion:** Tailored antibiotic therapy guided by susceptibility testing was associated with improved outcomes in *S. maltophilia* infections, despite multidrug resistance. Prematurity and mechanical ventilation were identified as key risk factors, highlighting the need for infection control and judicious antibiotic use.

INTRODUCTION

Stenotrophomonas maltophilia (*S. maltophilia*) is a non-lactose-fermenting, Gram-negative bacterium and the primary *Stenotrophomonas* species implicated in human infections [1]. As a predominantly nosocomial organism, it infects vulnerable populations such as neonates and ventilated infants through exposure to contaminated water, equipment, or biofilms; its intrinsic multidrug resistance often complicates treatment [2].

In pediatric intensive care, *S. maltophilia* is an emerging threat, especially in neonates and infants in resource-limited settings like India [3]. The incidence of *S. maltophilia* bacteremia is approximately 0.8% in cardiac pediatric intensive care units, with mortality rates of 40–50% [4]. Bloodstream infections are associated with prior carbapenem exposure; while mortality is linked

to risk factors such as multiple antimicrobial use, central venous catheters, mechanical ventilation, septic shock, prolonged hospitalization, and steroids [5]. Empirical therapies for *Pseudomonas* infections often fail against *S. maltophilia*, warranting specific consideration in carbapenem-treated patients [6]. The occurrence of meningitis highlights its severity in neonates and infants [7].

Despite known environmental reservoirs, data on pediatric *S. maltophilia* infections in a Neonatal and Pediatric Intensive Care Unit (NICU/PICU) setting remain limited; therefore, this study aims to characterize the clinical profiles, risk factors, and treatment outcomes in infants within our NICU/PICU to contribute to the limited pediatric evidence on this emerging pathogen.

CASE SERIES

This retrospective case series describes four infants (aged 1–4 months) with *S. maltophilia* infections admitted to the NICU/PICU of a tertiary hospital in Upper Assam, India, from January to December 2023. Most infants were referred from nearby districts, while one was inborn; they presented with clinical syndromes including sepsis, pneumonia, and suspected meningitis. In contrast to reported mortality rates of 40–50% [4], three of the four infants (75%) in this series survived to discharge after successful treatment with tailored antibiotics, highlighting the potential for effective management of this multidrug-resistant pathogen. Case details were documented after obtaining written informed parental consent for data collection and publication.

CASE 1

A late-preterm male neonate (36 weeks' gestation, birth weight 2 kg) was born vaginally to a primigravida with preterm premature rupture of membranes (PPROM) for 24 hours. On Day of Life (DOL) 1, he was admitted to the NICU with asymptomatic hypoglycemia and treated via a peripheral intravenous line with a dextrose infusion calculated to a glucose infusion rate (GIR) of 6 mg/kg/min. Examination revealed normal neurological findings. Due to maternal PPRM, empirical antibiotics (ciprofloxacin, gentamicin) were initiated for suspected early-onset sepsis, per unit protocol [8]. Sepsis screening and blood culture were negative. On DOL 3, neonatal jaundice (unconjugated hyperbilirubinemia; total serum bilirubin: 17 mg/dL) attributed to glucose-6-phosphate dehydrogenase (G6PD) deficiency was managed with single-surface phototherapy. Antibiotics were discontinued on DOL 5, and he was discharged on the same day after successfully breastfeeding and remaining neurologically intact.

On DOL 22, he was readmitted with respiratory distress (Downes score 4/10), requiring noninvasive mechanical ventilation (NIMV). Examination revealed a respiratory rate of 78 breaths per minute (breaths/min), moderate subcostal retractions, and bilateral crepitations, consistent with moderate pneumonia. Central nervous system examination was normal. Laboratory tests indicated a positive sepsis screen, with an elevated absolute neutrophil count (per Manroe's chart [9]) and an elevated C-reactive protein level. Cerebrospinal fluid (CSF) analysis revealed changes suggestive of meningitis, including elevated protein, low glucose, and pleocytosis, despite a sterile culture. The patient was diagnosed with late-onset sepsis manifesting as pneumonia and suspected meningitis and initially received empirical ciprofloxacin and gentamicin. Blood culture identified *S. maltophilia*, susceptible to levofloxacin and minocycline but resistant to trimethoprim-sulfamethoxazole, per Clinical and Laboratory Standards Institute (CLSI) guidelines [10]. Treatment was switched to levofloxacin, which was administered for 21 days due to the CSF findings

suggestive of central nervous system (CNS) involvement. Following clinical improvement and successful weaning from NIMV, he was discharged. At 1-year follow-up, he exhibited age-appropriate neurodevelopmental milestones and maintained a normal nutritional status.

CASE 2

A preterm male neonate (34 weeks' gestation, birth weight 1.3 kg) was born at a peripheral hospital to a mother with PPRM for over 24 hours. On DOL 2, he was referred to our NICU for management of respiratory distress (Downes score 2/10), requiring oxygen via nasal cannula. He was lethargic with a poor suck but had normal tone for gestational age. A chest X-ray showed perihilar patchy infiltrates, suggesting pneumonia. Sepsis screening revealed an elevated absolute neutrophil count (12,800/mm³) per Mouzinho's ranges [11], with an elevated C-reactive protein level. CSF analysis was suggestive of meningitis, although the CSF culture remained sterile. Blood culture confirmed *S. maltophilia*, with the isolate showing it was susceptible to levofloxacin and minocycline but resistant to ciprofloxacin, gentamicin, and trimethoprim-sulfamethoxazole, according to CLSI guideline [10].

Based on the initial diagnosis of neonatal sepsis with pneumonia and suspected meningitis, the infant was started on empirical ciprofloxacin and gentamicin. Following the culture results, therapy was switched to levofloxacin, which was administered for 21 days due to suspected CNS involvement. On DOL 4, unconjugated hyperbilirubinemia was managed with monitoring alone and resolved without phototherapy. After his clinical condition improved, demonstrated by resolution of respiratory distress and successful weaning from oxygen support, he was discharged on DOL 23, clinically stable, achieving an adequate weight gain of 15–20 g/day for three consecutive days on a combination of breastfeeding and spoon-feeding. During a telephone follow-up at 1.5 months post-discharge, the parents reported that the infant had been readmitted to a local hospital for severe respiratory distress and subsequently died. The precise cause of death could not be determined due to the lack of a post-mortem report or accessible hospital records.

CASE 3

A 4-month-old male infant was referred to our PICU after admission to a community healthcare center for severe pneumonia. He received empirical antibiotics, including a single-dose amoxicillin injection, and was discharged after a reported improvement. Ten days after discharge, he was admitted to our facility with a history of worsening cough, breathing difficulty, refusal to feed, and severe respiratory distress. Severe pneumonia was diagnosed based on Integrated Management of Neonatal and Childhood Illness (IMNCI) guidelines [12], supported by clinical findings of tachypnea and chest indrawing. Treatment was initiated with empirical

intravenous amoxicillin, noninvasive mechanical ventilation (NIMV), and supportive care, consistent with institutional protocols for community-acquired pneumonia. However, the patient's condition failed to improve with this regimen.

Blood culture identified *S. maltophilia*, susceptible to trimethoprim-sulfamethoxazole, levofloxacin, and minocycline, per CLSI guidelines [10]. Based on these results, treatment was switched to intravenous levofloxacin, which was administered for 14 days. After a prolonged PICU stay of 15 days, he demonstrated clinical improvement, including a normalized respiratory rate and oxygen saturation, with increased activity, allowing for successful weaning from NIMV and subsequent discharge in a stable condition. At one-month follow-up appointment, he was found to be thriving, meeting age-appropriate developmental milestones, and had no residual sequelae from his illness. The failure of the initial amoxicillin therapy is consistent with *S. maltophilia*'s known intrinsic resistance to beta-lactam antibiotics [1].

CASE 4

A 1-month-old male infant was referred to our PICU for recurrent apneic episodes and congenital hypothyroidism. His past medical history was significant for neonatal seizures and hypoglycemia, which had been managed with phenobarbital and dextrose, respectively. On presentation, he exhibited hypoxia and suspected sepsis, raising concern for meningitis due to the signs of apnea and a history of seizures. On examination, no meningeal signs were present; however, due to the high suspicion of sepsis, he was started on empirical ciprofloxacin and gentamicin per protocol, and levothyroxine was initiated for congenital hypothyroidism. He also required supportive NIMV. Blood culture confirmed *S. maltophilia*, susceptible to levofloxacin, trimethoprim-sulfamethoxazole, and minocycline, per CLSI guidelines [10]. The analysis of CSF was normal, ruling out meningitis. Guided by the culture results, therapy was de-escalated to oral trimethoprim-sulfamethoxazole for a 10-day course. The infant responded well, with resolution of apnea and active feeding observed within three days of

initiating targeted therapy. He was discharged in a stable condition on hospital day 12, with no further apneas. A 1-month follow-up was scheduled for neurodevelopmental and hypothyroidism monitoring, with no infection-related complications noted at discharge.

DISCUSSION

This case series from a NICU/PICU in Upper Assam, India, describes the management and outcomes of four infants with *S. maltophilia* infections. In this series, three infants (75%) survived with favorable neurodevelopmental outcomes following treatment with culture-guided antibiotics (levofloxacin or trimethoprim-sulfamethoxazole). This survival rate contrasts favorably with historically reported mortality rates of 40–50% [4]. The single mortality occurred post-discharge following readmission for severe respiratory distress; the lack of post-mortem data precluded determination of a definitive cause. Nonetheless, this outcome highlights the importance of vigilant post-discharge surveillance for this vulnerable patient population.

S. maltophilia is a major nosocomial pathogen, often isolated from water, catheters, and ventilators [1]. The risk factors identified in our series are consistent with existing literature [2, 5, 6] and include prematurity, low birth weight, mechanical ventilation, and prior antibiotic exposure. Notably, while prior antibiotic use was a universal factor in our cohort, prematurity, low birth weight, and mechanical ventilation were each present in two of the four cases. The presence of infection in two preterm infants (Cases 1 and 2) underscores their heightened vulnerability, while the infections in older or term infants (Cases 3 and 4) demonstrate that the risk extends across the broader infant population. Notably, the absence of prior carbapenem exposure in our patients suggests acquisition through other routes, such as from contaminated hospital environments [2, 5, 6]. The observed resistance to empirical antibiotics necessitated a switch to targeted therapy with either levofloxacin or trimethoprim-sulfamethoxazole. As detailed in Table 1, all isolates demonstrated susceptibility to levofloxacin, highlighting its potential reliability in our setting.

Table 1. Antimicrobial susceptibility profiles for *S. maltophilia* isolates from four infant cases

Antimicrobial agent	Case 1 isolate	Case 2 isolate	Case 3 isolate	Case 4 isolate
Levofloxacin	S	S	S	S
Minocycline	S	S	S	S
Trimethoprim-sulfamethoxazole	R	R	S	S

Note: Susceptibility testing was performed on isolates from blood cultures according to CLSI guidelines [10]. Abbreviations: S, susceptible; R, resistant.

The clinical presentations observed in our series (sepsis, pneumonia, suspected meningitis) are consistent with those described in the literature [1, 7]. The survival of Case 1, for instance, contrasts with reports of fatal neonatal cases, such as one complicated by purpura fulminans [13]. Our 75% survival rate compares

favorably with outcomes reported in other neonatal case studies [14], a difference that may be attributed to the early availability of blood culture results, which enabled prompt targeted therapy. The potential role of environmental reservoirs, such as NICU water sources [15], as the source of infection in our cases underscores

the critical importance of infection control measures, including diligent water quality monitoring. The susceptibility patterns observed in our isolates are consistent with patterns reported in the literature for levofloxacin, minocycline, and trimethoprim-sulfamethoxazole [1, 6]. Since minocycline, a tetracycline antimicrobial, is contraindicated in children due to risks of tooth discoloration and bone growth inhibition, it was avoided in these cases [16]. Although the safety profile of levofloxacin in neonates is a consideration, its use in our cohort was justified by the multidrug-resistant nature of the *S. maltophilia* infection and the absence of safer, effective alternatives [17].

While mortality in adult ICUs can be high (e.g., 46.2%) [18], outcomes in pediatric patients also vary widely and remain a significant concern. For example, reported mortality rates have ranged from 20% in a 1996 NICU outbreak [13] to other severe outcomes in neonatal case reports [19], illustrating the pathogen's high virulence in this population. The successful outcomes in our patients treated with levofloxacin (including a 21-day course for suspected CNS involvement) contribute to the limited clinical data suggesting its potential utility for neonatal *S. maltophilia* infections [7]. This study has several inherent limitations, including its small sample size, retrospective design, lack of a control group, and missing data, such as the definitive cause of death in Case 2. Therefore, larger, prospective studies are warranted to better define optimal treatment regimens, explore host factors like neonatal immunity, and develop effective prevention strategies.

In conclusion, this study highlights the challenges of *S. maltophilia* infections in neonates, with three of the four infants (75%) recovering following susceptibility-guided therapy (levofloxacin or trimethoprim-sulfamethoxazole), a survival rate that contrasts favorably with reported mortality rates of 40–50% [4, 14]. The single death, which occurred post-discharge following a subsequent readmission, nonetheless underscores the vulnerability of preterm infants and the importance of post-discharge monitoring [14]. Ultimately, this series demonstrates that despite presenting as severe, empirically resistant pneumonia, favorable outcomes in neonatal *S. maltophilia* infections are achievable with prompt, culture-guided antimicrobial therapy.

Despite this study's limitations, such as its small sample size and retrospective design, our findings reinforce the critical importance of rigorous infection control measures—including strict hand hygiene, aseptic management of intravenous lines and ventilator equipment, and antimicrobial stewardship—to curb multidrug resistance. Future research should prospectively evaluate key areas such as neonatal immune responses to *S. maltophilia*, optimal treatment durations, the role of environmental reservoirs, and the pharmacokinetics of targeted therapies like levofloxacin in this vulnerable population.

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CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest associated with this manuscript.

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AI DISCLOSURE

The authors used an AI-powered language tool to assist with grammar and clarity checks during the preparation of this manuscript. The authors reviewed and edited the content and take full responsibility for the final version.

DATA AVAILABILITY

All relevant data supporting the findings of this study are contained within the manuscript itself.

AUTHORS' CONTRIBUTIONS

KB: Conceptualization; Data curation; Investigation; Supervision; Writing – original draft; Writing – review & editing; Project administration. AG: Conceptualization; Data curation; Investigation; Writing – review & editing. AKSI: Investigation; Methodology; Writing – review & editing. RB: Conceptualization; Supervision; Validation; Writing – review & editing.

ETHICS STATEMENT

Ethical approval was not required for this retrospective case series, as the study was based on a review of anonymized patient records collected during routine clinical practice, and written informed consent for data collection and publication was obtained from the parents of all infants.

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