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Achromobacter Xylosoxidans Bacteremia: A Retrospective Review Between 2015-2022 of 77 Published Cases Describing the Demographics, Clinical Features, Risk Factors and Outcomes

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Review Article

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Abstract

Background: Achromobacter xylosoxidans is an opportunistic, aerobic, gram-negative, non-fermenting bacillus increasingly recognized as a healthcare-associated pathogen, particularly in immunocompromised and critically ill patients. Intrinsic and acquired resistance to multiple antimicrobial agents makes bloodstream infection with this organism difficult to treat.

Methods: We conducted a structured retrospective review of 77 published cases of A. xylosoxidans bacteremia from case reports and case series between 2007 and 2025 and included one institutional case within that series. Data on demographics, comorbidities, infection sources, antimicrobial susceptibilities, and outcomes were extracted and analyzed using descriptive statistics.

Results: Mean age was 43.6 years (range, neonate to 86 years); 41 of 77 patients (53.2%) were male. Common comorbidities were hematologic malignancy (25/77, 32.5%), cystic fibrosis (12/77, 15.6%), and diabetes with end-stage renal disease (10/77, 13.0%). Central venous catheters were the most common source (30/77, 39.0%). Device-associated infection accounted for 48 of 77 cases (62.3%). Meropenem, piperacillin-tazobactam, and trimethoprim-sulfamethoxazole had the highest reported susceptibility rates (88%, 79%, and 75%, respectively). Endovascular infection (22/77, 28.6%) was associated with higher morbidity (>75% ICU-level care or prolonged hospitalization) and mortality (5/22, 22.7%) than non-endovascular infection (9/55, 16.4%). Septic shock occurred in 12 patients, with 6 deaths (50%). Overall mortality was 14 of 77 (18.2%).

Conclusion: A. xylosoxidans bacteremia predominantly affects immunocompromised patients and carries substantial morbidity and mortality. Most cases were associated with indwelling vascular devices. Meropenem, piperacillin-tazobactam, and trimethoprim-sulfamethoxazole demonstrated the highest reported in vitro susceptibility in this series. Early identification, source control, and timely administration of effective antimicrobial therapy are essential.

Keywords: Achromobacter xylosoxidans; Demographics; Chest radiography; Comorbidities; Cardiomegaly; Sources of Bacteremia; Endovascular Infection; Septic Shock and Mortality; Antibiotic Susceptibility

Introduction

Achromobacter xylosoxidans is an aerobic, non-fermenting gram-negative bacillus that has emerged as an important opportunistic healthcare-associated pathogen, particularly in immunocompromised and critically ill patients [1-5]. Although it remains an uncommon cause of bacteremia, its intrinsic antimicrobial resistance and association with

indwelling vascular devices present significant diagnostic and therapeutic challenges [1,2,6].

Published clinical experience has identified hematologic malignancy, cystic fibrosis, solid tumors, and chronic kidney disease as important underlying conditions associated with A. xylosoxidans infection [1-4]. Bloodstream infections are frequently associated with central venous catheters and other intravascular devices, emphasizing the importance of identifying and controlling the source of infection [1,2,4,5,7].

The organism exhibits variable susceptibility to commonly used antimicrobial agents, with resistance mediated by multiple mechanisms, including multidrug efflux pumps, beta-lactamase production, and alterations in outer membrane permeability [6,8,9]. Intrinsic aminoglycoside resistance has been specifically associated with the AxyXY-OprZ efflux system [8]. These mechanisms complicate empiric antimicrobial selection and underscore the importance of isolate-specific susceptibility testing.

Despite increasing recognition of A. xylosoxidans as a cause of healthcare-associated bloodstream infection, large clinical series remain limited. Previous investigations have described bacteremia epidemiology, catheter-associated infection, antimicrobial susceptibility, and clinical outcomes, but important questions regarding severe complications and optimal treatment remain [1,2,5,10].

We therefore reviewed 77 cases to characterize the clinical spectrum, antimicrobial susceptibility patterns, and outcomes of A. xylosoxidans bacteremia and report in detail one institutional case of multidrug-resistant sepsis included in that series.

Case Report

An 86-year-old woman with end-stage renal disease on maintenance hemodialysis, severe aortic stenosis treated with transcatheter aortic valve replacement, coronary artery disease, and congestive heart failure was brought to the emergency department after multiple unwitnessed falls and altered mental status. She was hypotensive on arrival, required vasopressors, and was admitted to the intensive care unit.

Examination showed tenderness and erythema of the left lower extremity, concerning cellulitis. Chest radiography showed cardiomegaly and a large right pleural effusion. Laboratories showed leukocytosis and elevated inflammatory markers. Admission blood cultures grew gram-negative rods within 24 hours.

Intravenous ceftriaxone was started empirically. Hypotension remained vasopressor-refractory, with end-organ hypoperfusion. Once susceptibilities identified multidrug-resistant A. xylosoxidans susceptible to carbapenems, ceftriaxone was stopped and intravenous meropenem was started. She improved. The source was suspected to be lower-extremity cellulitis or contamination related to dialysis access; imaging and vascular ultrasound were inconclusive.

This case supports considering A. xylosoxidans in gram-negative sepsis among dialysis patients, particularly when soft-tissue infection or vascular-access infection is possible [1,3]. Susceptibility-guided therapy, here with meropenem, was associated with recovery [2,8].

Methods

We reviewed case reports and case series of laboratory-confirmed A. xylosoxidans bloodstream infection and included one institutional case. The intended publication window stated in the protocol was 2015–2022; the compiled case list also contains reports outside that window, which is a limitation of the dataset as assembled. Only English-language reports were included.

Extracted variables were age, sex, comorbidities, source of bacteremia, antibiotic susceptibility, treatment, and outcomes (morbidity, ICU or prolonged hospitalization, and death). Data were anonymized and summarized with descriptive statistics. No inferential testing was performed. Definitions of septic shock, endovascular infection, and source were taken as reported and were not re-adjudicated.

Results

Demographic

Seventy-seven cases were included. Mean age was 43.6 years (range, younger than 1 month to 86 years). Forty-one patients (53.2%) were male and 36 (46.8%) were female (Table 1). Neonates and other NICU or PICU cases were a small but clinically relevant subset [4].

Characteristic	Value
Mean age	43.6 years
Age range	<1 month to 86 years
Male	41 (53.2%)
Female	36 (46.8%)

Table 1: Demographic Characteristics (N = 77).

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Comorbidities

Hematologic malignancy was the most common underlying condition (25/77, 32.5%), followed by cystic fibrosis (12/77, 15.6%) and diabetes with end-stage renal disease (10/77, 13.0%) (Table 2). Only 3 patients (3.9%) had no major comorbidity. This distribution is consistent with the opportunistic pattern described in earlier series [1,2].

Comorbidity	N	%
Hematologic malignancy (AML, ALL, HSCT)	25	32.5
Cystic fibrosis	12	15.6
Diabetes mellitus and ESRD	10	13
Solid tumors	6	7.8
Other (CKD, HIV, COPD, cirrhosis, and related)	21	27.3
No major comorbidity	3	3.9

Table 2: Underlying Comorbidities (N = 77).

AML, acute myeloid leukemia; ALL, acute lymphoblastic leukemia; HSCT, hematopoietic stem-cell transplantation; ESRD, end-stage renal disease; CKD, chronic kidney disease; COPD, chronic obstructive pulmonary disease.

Sources of Bacteremia

Central venous catheters were the leading source (30/77, 39.0%), followed by pulmonary infection, including cystic fibrosis and ventilator-associated infection (15/77, 19.5%), dialysis catheters (10/77, 13.0%), and NICU or PICU central lines (8/77, 10.4%) (Table 3). Fourteen cases (18.2%) had another or unknown source.

Combining central venous catheters, dialysis catheters, and NICU or PICU lines gives 48 of 77 cases (62.3%) linked to indwelling vascular devices. This pattern fits prior descriptions of biofilm-associated, healthcare-associated infection [3,6].

Source	n	%
Central venous catheter	30	39
Pulmonary (cystic fibrosis or ventilator-associated)	15	19.5
Dialysis catheter	10	13
NICU/PICU central line	8	10.4
Other or unknown	14	18.2

Table 3: Sources of Bacteremia (N = 77).

Endovascular Infection

Twenty-two patients (28.6%) had endovascular or cardiovascular infection: endocarditis in 7, dialysis catheter-associated infection in 9, and central venous catheter infection with vascular complications in 6 (Table 4). Mortality was 5 of 22 (22.7%) in the endovascular group and 9 of 55 (16.4%) in the non-endovascular group. ICU stay or prolonged hospitalization was reported in more than 75% of the endovascular group and about 50% of the non-endovascular group. Vascular infection, including endocarditis due to non-fermenting gram-negative bacilli, has been linked to worse outcomes in other series [5].

Finding	Endovascular (n = 22)	Non-endovascular (n = 55)
Endocarditis	7	—
Dialysis catheter-associated infection	9	—
CVC infection with vascular complications	6	—
Deaths	5 (22.7%)	9 (16.4%)
ICU or prolonged hospitalization	>75%	~50%

Table 4: Endovascular and Cardiovascular Infections and Outcomes.
CVC, central venous catheter. Endovascular subtypes sum to 22. Some deaths likely overlap with septic shock; the source reports did not allow a full cross-tabulation.

Septic Shock and Mortality

Twelve patients had septic shock, and 6 died (50%). Among 65 patients without septic shock, 8 died (12.3%). Overall mortality was 14 of 77 (18.2%) (Table 5). Several deaths occurred in patients who had both shock and endovascular infection, although overlap could not be fully quantified. Prior case series have likewise described a fulminant course when shock is present [1,2].

Status	Patients	Deaths	Mortality
Septic shock	12	6	50.00%
No septic shock	65	8	12.30%
All patients	77	14	18.20%

Table 5: Septic Shock and Mortality (N = 77).

Antibiotic Susceptibility

The highest susceptibility rates were observed for meropenem (88%), piperacillin-tazobactam (79%), and trimethoprim-sulfamethoxazole (75%) (Table 6).

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Susceptibility was lower for colistin (49%), cefepime (29%), amikacin (24%), and gentamicin (18%). These values represent susceptibility rates, not resistance rates; thus, most isolates were not susceptible to cefepime or the aminoglycosides tested. Similar susceptibility patterns have been reported in other studies, with relatively high activity of carbapenems, piperacillin-tazobactam, and trimethoprim-sulfamethoxazole, together with frequent resistance to aminoglycosides and cefepime [5,6,8].

Antibiotic	Susceptibility
Meropenem	88%
Piperacillin-tazobactam	79%
Trimethoprim-sulfamethoxazole	75%
Colistin	49%
Cefepime	29%
Amikacin	24%
Gentamicin	18%

Table 6: Reported Antibiotic Susceptibility.

Denominators were not uniformly reported across source papers, so these percentages should be read as aggregated reported rates, not as a single laboratory antibiogram.

Composite Risk Pattern

From the tabulated groups, the highest-risk profile in this series was hematologic malignancy or end-stage renal disease, an indwelling vascular catheter (especially a dialysis catheter), endovascular infection, and septic shock. Patients with shock had roughly four times the mortality of those without shock (50% vs 12.3%). That comparison is descriptive only.

Discussion

This review of 77 cases provides one of the larger consolidated descriptions of Achromobacter xylosoxidans bacteremia and further characterizes its epidemiology, antimicrobial susceptibility patterns, clinical complications, and outcomes. The findings reinforce previous observations that this organism is an important opportunistic healthcare-associated pathogen, particularly among immunocompromised and chronically ill patients. Previous bacteremia series and contemporary multicenter investigations have similarly demonstrated its association with underlying disease, healthcare exposure, and substantial clinical morbidity [1-5].

The patient population was heterogeneous, with a mean age of 43.6 years and cases ranging from neonates to older adults. Underlying conditions included hematologic malignancies, cystic fibrosis, end-stage renal disease, and other chronic illnesses. This distribution is consistent with previous reports describing infections in both pediatric and adult populations, including patients with malignancy and other significant underlying conditions [1-5]. These findings emphasize that A. xylosoxidans bacteremia is not restricted to a particular age group but occurs predominantly in patients with significant underlying disease or healthcare exposure.

Vascular access devices represented the predominant identifiable source of bacteremia. Central venous catheters accounted for 39.0% of cases, while dialysis catheters accounted for an additional 13.0%. Collectively, these findings suggest that catheter-associated infection is a major route of bloodstream invasion. This observation is consistent with earlier bacteremia studies in which intravenous catheter contamination and catheter-related bloodstream infections were frequently identified [1,2,4,7]. More recent multicenter data have also demonstrated a high prevalence of central venous catheters among patients with Achromobacter bloodstream infections [5]. The organism's capacity for biofilm formation provides a plausible explanation for persistent infection and difficulty achieving microbiological eradication with antimicrobial therapy alone [6]. Consequently, identification of A. xylosoxidans in blood cultures should prompt careful evaluation of intravascular devices, with removal of infected catheters when clinically indicated.

Endovascular infection represented an important complication in this series. Patients with endovascular involvement experienced higher mortality (22.7% versus 16.4%) and more frequent ICU-level care or prolonged treatment (>75% versus approximately 50%) compared with patients without documented endovascular infection. Although these differences were unadjusted and cannot establish an independent association with mortality, they suggest that endovascular involvement may identify a subgroup with greater clinical complexity and resource utilization. Previous reports of A. xylosoxidans infective endocarditis demonstrate that this organism can cause serious endovascular infection, including prosthetic valve involvement [11]. Persistent bacteremia, particularly in patients with intravascular devices or prosthetic material, should prompt consideration of endocarditis and other endovascular complications. Echocardiographic evaluation and timely source control are important components of the diagnostic and therapeutic approach [1,11].

Septic shock was the most concerning clinical outcome identified in this review. Among the 12 patients who developed septic shock, mortality reached 50%, substantially exceeding

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the overall mortality of 18.2%. Although the contribution of delayed effective antimicrobial therapy could not be directly evaluated because treatment timing was inconsistently reported, inadequate initial antimicrobial coverage remains a plausible contributor to adverse outcomes. Contemporary retrospective data have also highlighted the importance of antimicrobial susceptibility and appropriate initial therapy in patients with Achromobacter bacteremia [10]. These findings underscore the importance of early recognition, prompt administration of potentially active antimicrobial therapy, and appropriate hemodynamic and intensive care support in critically ill patients [1-3,10,12].

Antimicrobial susceptibility patterns represent another important finding. The aggregated data demonstrated variable susceptibility across commonly used antimicrobial agents, limiting the reliability of conventional empiric regimens. Meropenem demonstrated the highest reported activity (88%), followed by piperacillin-tazobactam (79%) and trimethoprim-sulfamethoxazole (75%). In contrast, susceptibility to gentamicin and amikacin was only 18% and 24%, respectively, while cefepime demonstrated activity in 29% of reported isolates. These findings suggest that empiric cephalosporin or aminoglycoside monotherapy may provide inadequate coverage in patients with suspected A. xylosoxidans bacteremia. Previous studies have similarly described intrinsic resistance to several commonly used antimicrobial agents, particularly aminoglycosides and certain cephalosporins [6,8,9].

The organism's resistance profile is likely multifactorial, involving intrinsic and acquired mechanisms, including multidrug efflux systems, beta-lactamase production, and alterations in outer membrane permeability and porin expression [6,8,9]. Experimental studies have specifically demonstrated the role of the AxyXY-OprZ multidrug efflux pump in intrinsic aminoglycoside resistance, providing a mechanistic explanation for the limited activity of gentamicin and amikacin [8]. Contemporary genomic investigations have further identified resistance determinants, including efflux systems and beta-lactamases, that contribute to the organism's variable susceptibility profile [9]. Its ability to persist in healthcare environments further complicates infection control, particularly in intensive care settings [6,7].

Although meropenem appears to be a reasonable empiric consideration in severely ill patients with suspected infection, piperacillin-tazobactam and trimethoprim-sulfamethoxazole may also represent treatment options when supported by local susceptibility data and the clinical circumstances. Contemporary multicenter data have demonstrated substantial activity of these agents against bloodstream isolates, although susceptibility varies between studies and isolate populations [5,10]. Definitive treatment should always be guided by isolate-specific susceptibility testing. Colistin demonstrated activity in approximately 49% of reported isolates but should generally be reserved for selected resistant infections because of its limited reliability and potential toxicity [6].

Overall mortality in this review was 18.2%, somewhat higher than previously reported estimates of approximately 10–15% [1,2,4]. Contemporary multicenter data reported 30-day mortality of 10.2% and 90-day mortality of 18.4%, while a recent retrospective bacteremia cohort documented substantial mortality in a particularly ill patient population [5,10]. These differences may reflect the inclusion of patients with severe underlying illnesses, endovascular complications, and septic shock. However, publication and selection bias are important considerations, as severe or unusual infections are more likely to be reported than uncomplicated cases. The substantial proportion of patients requiring ICU care or prolonged treatment, particularly those with endovascular involvement, also highlights the considerable healthcare burden associated with this infection, even among survivors.

Several limitations should be considered when interpreting these findings. This study represents a retrospective compilation of published case reports and case series rather than a prospective multicenter cohort. Consequently, selection and publication bias are likely. Clinical definitions, microbiological methods, antimicrobial susceptibility testing, and outcome reporting varied considerably among the included studies. Susceptibility percentages were derived from heterogeneous reports without a uniform denominator or standardized breakpoint methodology. Furthermore, the case compilation was not strictly limited to the 2007-2022 period. The overlap between septic shock and endovascular infection could not be adequately separated, and no adjusted statistical analysis was possible. Therefore, observed differences in mortality and clinical outcomes should be interpreted as descriptive associations rather than independent predictors of prognosis. Recent multicenter studies also emphasize the challenges of species-level identification, variable susceptibility patterns, and the limited availability of standardized organism-specific clinical evidence [5,6,9,10].

Conclusion

Achromobacter xylosoxidans bacteremia is an important opportunistic healthcare-associated infection associated with substantial morbidity and mortality, particularly in immunocompromised patients with indwelling vascular devices. This review identifies catheter-associated infection as the predominant source, while endovascular involvement and septic shock represent important markers of severe disease and adverse outcomes.

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The variable and frequently unpredictable antimicrobial susceptibility profile presents a significant therapeutic challenge. Meropenem demonstrated the greatest reported in vitro activity in this series, although definitive treatment must be individualized according to susceptibility testing and local antibiograms [5,6,9,10].

The principal clinical implications are early recognition of the organism as a potentially serious bloodstream pathogen, prompt evaluation and removal of infected vascular devices, investigation for endovascular complications when bacteremia persist, and early administration of an antimicrobial agent likely to be active.

Prospective multicenter studies are needed to better define resistance trends, identify independent predictors of mortality, and establish optimal antimicrobial regimens, treatment duration, and the role of combination therapy.

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