

PEDIATRIC INFECTIVE ENDOCARDITIS CAUSED BY ACHROMOBACTER XYLOSOXIDANS: A CASE REPORT

Endocarditis infecciosa pediátrica causada por Achromobacter xylosoxidans: reporte de caso

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Received: 09/07/2024 • Accepted: 03/08/2025

How to cite: Capestany, C., Ferreira, N., Vasquez, L., Matos Imbert, A., Ortiz Hernandez, I. (2026). Pediatric infective endocarditis caused by achromobacter xylosoxidans: a case report. *Ciencia y Salud*, 10(2), 93-99. <https://doi.org/10.22206/cisa.2026.v10i2.3227>

Resumen

Introducción: La endocarditis infecciosa es poco frecuente en la población pediátrica, pero con alta morbilidad y mortalidad, especialmente en pacientes con cardiopatías congénitas o cirugías cardíacas previas. *Achromobacter xylosoxidans* es un agente gramnegativo inusual, caracterizado por su resistencia a múltiples antibióticos y su asociación con infecciones polimicrobianas.

Descripción del caso: Se presenta el caso de un niño de 9 años con antecedente de conducto arterioso persistente tipo 1. Se le realizó la implantación quirúrgica de un conducto con válvula integrada para reemplazar la vía de salida del ventrículo derecho debido a un aneurisma. En el posoperatorio desarrolló fiebre de 39 °C, controlada con acetaminofén, y fue dado de alta sin tratamiento adicional. Una semana después, la fiebre persistente motivó su ingreso al Hospital B. El examen físico reveló

Abstract

Introduction: Infective endocarditis is uncommon in children but serious, especially in those with congenital heart disease or prior surgery. *Achromobacter xylosoxidans* is a rare Gram-negative cause, notable for its multidrug resistance and association with polymicrobial infections. **Case description:** We present the case of a 9-year-old boy with a history of type 1 patent ductus arteriosus. He underwent surgical implantation of a duct with an integrated valve to replace the right ventricular outflow tract due to an aneurysm. Postoperatively, he developed a 39°C fever, managed with acetaminophen, and was discharged without further treatment. One week later, the fever recurred, prompting evaluation at Hospital B. Examination revealed a 4/6 systolic murmur with thrill at the left parasternal border. Suspected valve endocarditis was

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un soplo sistólico 4/6 con frémito en el borde paraesternal izquierdo. Se inició tratamiento empírico con cefepime por sospecha de endocarditis valvular. Los hemocultivos identificaron *Achromobacter xylosoxidans* sensible a imipenem, ajustándose la terapia. No se observaron vegetaciones en el ecocardiograma. El paciente ingresó a cuidados intensivos bajo supervisión de infectología y cardiología y, tras 22 días, fue dado de alta en condición estable con seguimiento ambulatorio. **Discusión:** La endocarditis infecciosa pediátrica ocurre principalmente en niños con cardiopatías congénitas. *Achromobacter xylosoxidans* es rara fuera de los casos de fibrosis quística o trasplante y representa un desafío terapéutico por su resistencia a múltiples antibióticos. Los fármacos más eficaces incluyen trimetoprima-sulfametoxazol, ceftazidima, piperacilina y carbapenémicos. **Conclusión:** Este caso resalta la relevancia clínica de las infecciones por *Achromobacter xylosoxidans* y la importancia de un manejo multidisciplinario y oportuno, sirviendo como referencia útil para casos similares en el futuro.

Palabras clave: *Achromobacter xylosoxidans*, endocarditis, enfermedad cardíaca congénita.

Introduction

Infective endocarditis in pediatric patients is a rare entity with a complex diagnosis, characterized by its potential complications and high morbidity and mortality. The low incidence in children makes it challenging to extrapolate results, given that the medical literature primarily relies on studies conducted in adults. This context poses challenges in recognizing the disease, given its unique presentation in the pediatric setting. The most affected individuals are often those with a history of congenital heart disease, including those who have undergone corrective surgeries¹.

Achromobacter xylosoxidans, a gram-negative bacterium uncommon in cases of endocarditis, has been previously documented in older adults and people with cystic fibrosis. Its primary manifestation usually presents as pneumonia, with endocarditis being a rare occurrence. It is crucial to

treated empirically with cefepime. Blood cultures later identified *Achromobacter xylosoxidans* sensitive to imipenem, and therapy was adjusted accordingly. No vegetations were seen on echocardiography. The patient was admitted to the intensive care unit under joint infectious disease and cardiology supervision and, after 22 days, was discharged in stable condition with continued outpatient follow-up. **Discussion:** Pediatric infective endocarditis mostly occurs in children with congenital heart disease. *Achromobacter xylosoxidans* is rare outside cystic fibrosis or transplant cases and poses treatment challenges due to multidrug resistance. Effective agents include trimethoprim-sulfamethoxazole, ceftazidime, piperacillin, and carbapenems, though emerging resistance warrants close monitoring. **Conclusions:** This case highlights the clinical relevance of *Achromobacter xylosoxidans* infections and the value of timely, multidisciplinary management, offering a useful reference for similar future cases.

Keywords: *Achromobacter xylosoxidans*, congenital heart disease, endocarditis.

highlight that clinical manifestations vary widely among patients; however, fever occurs consistently in all cases. The individuals most susceptible to this bacterium are those hospitalized, with catheters or prosthetic devices. The clinical significance of *Achromobacter xylosoxidans* lies in its pronounced resistance to multiple antibiotics, particularly first-line antibiotics, and its tendency to coexist with other microorganisms, such as *Pseudomonas aeruginosa*. The limited evidence available on *Achromobacter xylosoxidans* restricts treatment to a more individualized one, adapted to the unique presentation of each patient. This emphasizes the pressing need for more comprehensive research to enhance the understanding and clinical approach to this pathology^{2,3}.

Case description

We present the case of a 9-year-old male patient with a relevant medical history of type I truncus

arteriosus is described. The surgical history includes three interventions: pulmonary artery cerclage in 2014, repair of the common truncus arteriosus with closure of the ventricular septal defect, and placement of a valved conduit between the right and left atria in 2016. Additionally, there are plans to place an integrated valved conduit to replace the natural right ventricular outflow tract due to an aneurysm in 2023. Postoperatively after the last surgery performed at hospital A, the patient experienced hypotension and fever (39°C). This episode was initially managed with acetaminophen and rest, leading to the resolution of the condition and subsequent discharge from the hospital. However, one week later, the child returned to Hospital A with a fever (39°C) and persistent hypotension, despite treatment with acetaminophen. At this hospital, he received a diagnosis of otitis media and was treated with amoxicillin, clavulanic acid, and ibuprofen. It is important to note that the patient was not initiated on treatment containing steroids at any point. Given the persistence of the fever, the family members decided to go to hospital B, where their primary cardiologist referred him to the hematology and infectious disease department. Various studies were conducted, and their details are provided in Tables 1, 2 and 3.

Table 1. Hemogram

WBC: $9.1 \times 10^3/\mu\text{L}$ (4.5-11.0)	Normal
RBC: $3.66 \times 10^6/\mu\text{L}$ (3.50-5.50)	Normal
HGB: 9.1 g/dL (12-16)	Low
HCT: 25.8 % (36.0-46.0)	Low
MCV: 70 fL (82-96)	Low
MCH: 24.9 pg (25-35)	Low
MCHC 35 g/dL (31-36)	Normal
PLT: $165 \times 10^3/\mu\text{L}$ (150-450)	Normal
Lymphocytes #: 1.1 (1.0-3.70)	Normal
Typification: group 0 RH positive.	Normal

Table 2. Chemical analysis

PCR: 84.27 mg/dL (less than or equal to 6.00)	Elevated
Procalcitonin: 3.13 ng/ml (0-0.5)	Elevated
Creatinine: 0.5 mg/dL (0.70-1.40)	Low
Proteins: 5.43 g/dL (6.60-8.30)	Low
Albumin: 3.36 g/dL (3.50-5)	Low
Calcium: 8.1 mg/dL (8.5-10.5)	Low

Table 3. Peripheral smear

Red series	Decrease in the erythroid population, microcytosis, and some target cells.
White blood series	Slight increase in the white population with a predominance of neutrophils.
Platelets	Adequate platelet population (manually counted) and few platelet clumps.

During the physical examination, the following positive findings were identified:

- **Skin:** A surgical scar with keloid characteristics is present on the anterior chest.
- **Vital Signs:**
 - Blood pressure: 100/60 mmHg.
 - Heart rate: 96 bpm.
 - Respiratory rate: 23 rpm.
 - Oxygen saturation: 98%.
 - Temperature: 39°C.
- **Thorax:** Keel configuration.
- **Cardiovascular System:** Systolic murmur (4/6 intensity) identified at the left parasternal border, accompanied by the presence of a thrill.
- **Lymphatic System:** Palpable lymph nodes observed in the left cervical region.

Given the persistence of the fever, the infectious disease department recommended the patient's admission and a transthoracic echocardiogram,

which did not reveal the presence of vegetation at that time. Despite the negative results, a trans-esophageal echocardiogram was conducted to definitively rule out the presence of vegetation, reaffirming the absence of suggestive findings. Although both studies did not show vegetation, the possibility of infective endocarditis was not ruled out. The infectious disease department performed a blood culture and, while waiting for the results, they decided to start prophylactic antibiotic therapy with Cefepime. In addition, the decision was made to keep the patient in the isolation room of the hospital. The suspicion of infective endocarditis was based on the prolonged febrile symptoms, the laboratory results, and the recent placement of the valved conduit, performed two months previously, as clinical and associated risk factors. On the fifth day after admission, abnormal blood culture results were reported, showing the growth of *Achromobacter xylosoxidans*. *Achromobacter xylosoxidans* exhibited resistance to Cefepime, Amikacin, and Gentamicin but was sensitive to Imipenem, Piperacillin-Tazobactam, and Trimethoprim-Sulfamethoxazole. These findings led to the suspension of treatment with Cefepime and the establishment of a therapeutic regimen with Imipenem and Amikacin. As part of the comprehensive management, a central venous catheter was placed through surgery. It is important to highlight that constant communication was maintained with the cardiology and nutrition departments for a multidisciplinary approach to the case. The patient remained hospitalized for 22 days under the treatment, showing a favorable evolution that culminated in his discharge, outpatient management, and continuous monitoring by the infectious disease department.

In the four weeks following discharge, the patient attended a follow-up appointment with no infectious findings during the physical examination, and blood cultures indicated the absence of microorganism growth. In one of the follow-ups, the

mother reported the appearance of mild pulmonary symptoms and two isolated episodes of fever during outpatient management. To date, almost a full year since discharge, medical reports and evaluations indicate that the patient has not experienced significant adverse events and has shown an adequate response and tolerance to treatment. This positive outcome is attributed to the prompt identification of the infectious agent, the selection of specific treatment based on sensitivity tests, and multidisciplinary coordination among specialists. This collaboration allowed timely adjustments and established continuous and systematic comprehensive follow-up for therapy.

Discussion

To date, the medical literature has recorded only 22 cases of infective endocarditis caused by *Achromobacter xylosoxidans*, with only one case previously documented in a pediatric patient. The patient presented in this report would constitute the second notable case of a child diagnosed with endocarditis attributed to *A. xylosoxidans*. Among the 22 previously documented cases, it is noteworthy that 36% of the patients had a prosthetic valve, and 65% presented with some form of valve anomaly. These data underline the significant association of *A. xylosoxidans* with pre-existing cardiac conditions, highlighting the importance of considering these factors in the diagnosis and management of infective endocarditis due to this bacterium. Although some studies suggest that antibiotic treatment can improve the patient's clinical condition, it is crucial to recognize that this does not guarantee the absence of recurrence without the incorporation of valve replacement surgery. The need for surgical interventions in specific cases is highlighted to achieve successful results. However, a small percentage of patients do manage to survive without undergoing surgery. This emphasizes the severity of *A. xylosoxidans* endocarditis and underscores the

importance of timely surgical intervention in improving survival rates⁴.

The only pediatric case recorded to date in the literature involves a six-month-old male patient with a history of generalized arterial calcification since childhood. This patient was not suitable for surgery and developed antibiotic resistance during the progression of his disease. However, he achieved a successful recovery by receiving treatment with colistin as part of his antibiotic regimen, which led to the complete resolution of his clinical condition⁵. The case underscores the significance of alternative approaches in treating *A. xylosoxidans* endocarditis, particularly in situations where surgical intervention is not a viable option for the patient. It is worth noting that several previous reports document outbreaks of *Achromobacter xylosoxidans* in neonatal intensive care units, hemodialysis units, and burn units. These outbreaks suggest the possibility of significant transmission in specific hospital settings⁶.

In general, infective endocarditis in the pediatric population predominantly manifests in those with congenital heart disease, accounting for approximately 50-70% of cases. It is crucial to note that a younger age of the patient correlates with a less favorable prognosis for the disease. Additionally, the specific type of congenital heart disease is associated with a higher or lower risk of developing infective endocarditis. Reconstructive cardiac surgery performed in patients less than 6 months of age, especially those with congenital heart disease, is presented as a relevant predisposing factor. While the incidence of endocarditis is low in the first post-operative month, it increases with time after the intervention, except in cases involving the use of prosthetic valves or conduits. The clinical presentation of infective endocarditis in children varies depending on the age of the patient. However, the presence of a history of congenital heart disease or

previous cardiac defects that have required surgical correction can significantly increase clinical suspicion. Detection of a new murmur or changes in a previous murmur may also be indicative. In the specific case of children with cardiac devices or a history of corrective surgeries, conventional transthoracic and transesophageal echocardiography may have limitations in its diagnostic performance. Therefore, considering more advanced and specific imaging methods for the evaluation of these patient populations is essential^{7, 8}.

Infections caused by *Achromobacter xylosoxidans* are more prevalent in patients with cystic fibrosis, especially those undergoing lung transplantation. For patients without cystic fibrosis, the medical literature is mainly based on case reports or case series. In this population, the predominant manifestation is pneumonia and bacteremia, with endocarditis and bone infections being the less common presentations. These infections pose significant public health challenges as they tend to occur more frequently in medical settings, during or after hospitalization. Individuals with medical devices (catheters, endotracheal tubes) and/or comorbidities (such as diabetes mellitus, heart conditions, kidney failure, among others) face a higher risk of contracting this bacterium. An additional challenge associated with this infection is the presence of strains that show resistance to a variety of antibiotics, including narrow-spectrum penicillins, first- and second-generation cephalosporins, ceftriaxone, cefotaxime, aztreonam, tetracycline, and aminoglycosides. While some strains may still be susceptible to ceftazidime, cefepime, piperacillin, carbapenems, sulfonamides, fluoroquinolones, doxycycline, tigecycline, and colistin, there is an increasing number of reports indicating acquired resistance to the latter. The most effective antibiotics with the best results include trimethoprim-sulfamethoxazole, ceftazidime, piperacillin,

and carbapenems; however, the need for continuous monitoring is highlighted due to the increase in reports of acquired resistance to these agents⁹. In a retrospective study based on data collected over 10 years, it was observed that Meropenem showed the best in vitro activity against *Achromobacter xylosoxidans*. It is followed in effectiveness by Imipenem and Piperacillin/Tazobactam¹⁰. It is important to highlight that in vitro activity does not always translate directly into clinical efficacy, and the choice of antimicrobial agent should be based on the specific susceptibility of the strain involved and the clinical response of the patient. Additionally, antibiotic resistance can vary, and continuous monitoring of antimicrobial resistance is essential for guiding therapeutic decisions. This underscores the importance of conducting specific susceptibility testing to determine the optimal choice of antibiotics in individual cases of *Achromobacter xylosoxidans* infections.

One of the main limitations of this case is that the patient was not treated from the beginning in the hospital where he was admitted, which could have resulted in the omission of some relevant details in the evolution of his condition, considering that this had been ongoing for approximately a month. However, the potential contribution of this case to the medical literature is appreciated, given that it represents an unusual situation of infective endocarditis in a pediatric patient caused by a rare pathogen, for which extensive knowledge about the best option is not available. therapy. Resistance to multiple antibiotics and variability in the response to different agents make treatment a critical aspect in the care of these cases. Furthermore, the importance of continuous epidemiological surveillance and the adoption of preventive measures to mitigate the spread of *Achromobacter xylosoxidans* in hospital environments is highlighted, especially in critical units where the vulnerability of patients is high.

Conclusion

The uniqueness of this case opens the possibility of enhancing both the clinical and therapeutic understanding of *Achromobacter xylosoxidans* infections. By documenting the favorable response to treatment and successful multidisciplinary management, this report not only contributes to the understanding of this type of atypical infection but also establishes itself as a valuable reference point for health professionals.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Authors' contributions

All authors participated equally in the collection of clinical information, literature review, and drafting of the preliminary manuscript for this case report. They also reviewed and discussed the findings described and approved the final version of the manuscript for publication.

Ethical statement

This case report was conducted in accordance with the ethical principles of the Declaration of Helsinki. Approval from the ethics committee was not required due to the descriptive nature of the case. Written informed consent was obtained from the patient's mother for the publication of the case.

Informed consent

The patient's mother provided consent for the preparation of this case report by signing an informed consent form.

Conflict of interest

The authors declare no conflicts of interest.

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