

## CASE REPORT

# A rare case of invasive *Enterococcus cecorum* infection and related diagnostic difficulties

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## Key Clinical Message

This report presents a rare case of invasive infection caused by *Enterococcus cecorum*. There are no specific guidelines regarding antibiotic therapy for this infection. Based on this case, it can be concluded that linezolid demonstrates in vivo activity against *Enterococcus cecorum* and can be successfully used in therapy.

## Abstract

*Enterococcus cecorum* is an extremely rare pathogen in humans. Since 1984, when the microorganism was first described, only a dozen cases of invasive infections in humans have been reported in the literature. The diagnostic pathway may involve difficulties in correctly identifying this microorganism. Based on the case described, it can be thought that *Enterococcus cecorum* is a more challenging bacterium than the much more common *Enterococcus faecium* or *Enterococcus faecalis*. The described case underscores the importance of medical vigilance in clinical practice. It seems that due to increasingly advanced techniques in molecular biology, we will more frequently detect pathogens that were previously encountered only sporadically. Since not every center has access to modern and advanced microbiological diagnostic methods, publications that practically combine classical microbiological diagnostic methods with those less accessible but more modern are exceptionally valuable. In the case described, it is also worth noting that classical methods still play a significant and crucial role in conducting microbiological diagnostics. In the era of rapid diagnostic tool development, it is important to emphasize the necessity of combining different methods rather than replacing one with another.

## KEYWORDS

case reports, Enterococcus, immunosuppression, opportunistic infections

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## 1 | INTRODUCTION

Enterococci are Gram-positive cocci that play an important role in nosocomial infections. Among the pathogenic species, *E. faecalis* and *E. faecium* are the most clinically relevant, while *E. gallinarum* and *E. casseliflavus* are isolated less frequently from clinical materials.<sup>1–6</sup> Due to their widespread presence, including in the human gastrointestinal tract, and their tendency to cause infections only in rare cases, they are considered opportunistic commensal bacteria.<sup>7</sup> They are one of the first microorganisms to colonize the human gastrointestinal tract, establishing themselves in the intestinal lumen as early as in infancy.<sup>8</sup>

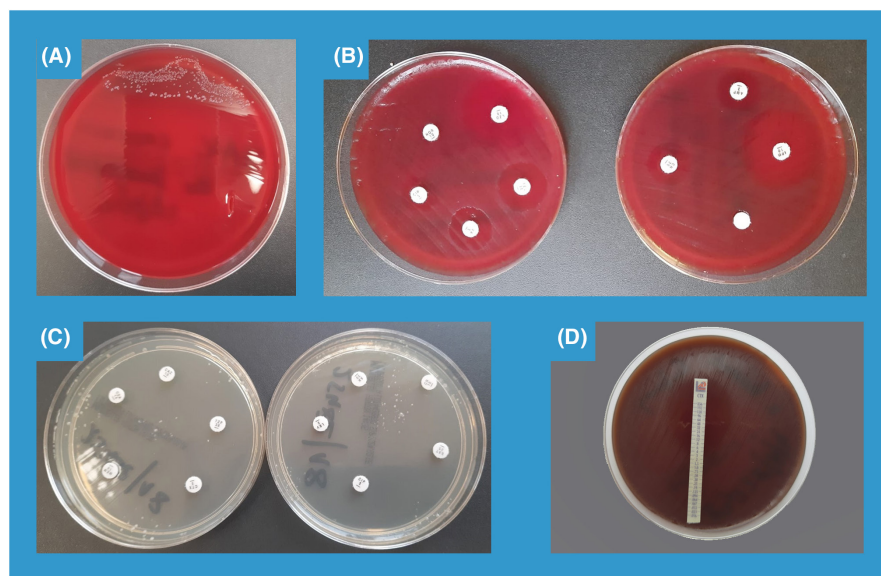
## 2 | CASE HISTORY

A 57-year-old patient, male, a farmer with vocational education, a childless bachelor with no previous chronic illness, who had been abusing alcohol for a long time, nonsmoker, was admitted to the hospital due to signs of upper gastrointestinal bleeding and ascites. The patient was diagnosed with decompensated alcoholic cirrhosis. The patient underwent a gastroscopy, which revealed the presence of esophageal varices. On the third day of hospitalization, the patient's condition rapidly deteriorated. Disturbed consciousness, hypotension, and increased respiratory rate up to 30 breaths per minute were observed. Laboratory tests showed elevated inflammatory markers (acute-phase proteins, procalcitonin, leukocytes, neutrophils, and lactic acid). The patient was qualified for further treatment in the intensive care unit (ICU). A pharmacological coma was induced in the ICU, and ventilator therapy was initiated. Blood cultures were obtained (three sets). Due to increasing ascites with concomitant

intra-abdominal compartment, paracentesis was performed, and the collected ascitic fluid was sent for microbiological examination.

## 3 | METHODS

A Gram-stained slide made from the peritoneal fluid sample showed Gram-positive cocci arranged in pairs and short chains. Cultures were established from the collected material on routinely used agar media, and some material was injected into a transport-propagation liquid medium. From the first day of hospitalization in the ICU, empirical antibiotic therapy included linezolid. Only after a 3-day incubation of agar media with 5% sheep blood (Columbia-agar), sparse growth of small, heterogeneous gray-white colonies was obtained (Figure 1A). Next, identification by MALDI-TOF mass spectrometry was performed. MALDI-TOF was setup for IVD diagnostics. Identification of *Enterococcus cecorum* was obtained. Antibiotic susceptibility testing was performed using the Kirby–Bauer method with discs of gentamicin, linezolid, ampicillin, vancomycin, and imipenem. The plates were incubated according to EUCAST recommendations for 24 h, with no bacterial growth observed (Figure 1C). In view of the above, 150  $\mu$ l of material from the bottle was applied to Mueller–Hinton agar with horse blood, in which bacterial growth was found. Taking into account the clinical sensitivity of *Enterococcus cecorum* to third-generation cephalosporins described in the literature,<sup>9,10</sup> the actual MIC for cefotaxime was also determined (Figure 1D). After a 24-h incubation, bacterial growth was noted on Mueller–Hinton agar with horse blood, allowing assessment of zones of bacterial inhibition around the antibiotic discs. Due to the unvalidated method (Mueller–Hinton



**FIGURE 1** (A) *Enterococcus cecorum* colonies on 5% sheep blood agar after 72 h of incubation at 37°C. (B) Antibiogram using the disc-diffusion method read after 24 h of incubation on Mueller–Hinton agar with horse blood. (C) Antibiogram using the disc-diffusion method read after 24 h of incubation on Mueller–Hinton agar. (D) Determination of the actual MIC for *Enterococcus cecorum* using a gradient strip with cefotaxime on Mueller–Hinton agar with horse blood.

agar with horse blood) and the lack of reading zones in the EUCAST recommendations for such a method, the above observation was not for clinical purposes, but only for laboratory observation (Figure 1B).

The actual MIC for antibiotics was determined by the microdilution method in broth, read with fluorescence using the ARIS system (Table 1). Given the good clinical outcome, the decrease in inflammatory markers and the stabilization of the general condition, treatment with linezolid was continued. In follow-up blood cultures performed on the third and fourth days of hospitalization in the ICU, bacteria were no longer detected.

## 4 | CONCLUSION AND RESULT

The patient was diagnosed with invasive *Enterococcus cecorum* infection. Invasive infections caused by *Enterococcus cecorum* are extremely rare and mainly affect immunosuppressed patients. Linezolid can be an effective drug for invasive infections caused by *Enterococcus cecorum*.

## 5 | DISCUSSION

*Enterococcus cecorum* is a component of the intestinal microbiota of birds. In recent years, there have been many reports of invasive infections caused by *Enterococcus cecorum*, mainly among chickens. The infections mostly involved bone and marrow. The microorganism was found to exhibit tropism for cartilage, resulting in necrosis

of the femoral head and inflammation of the synovial membranes. In affected chickens, inflammation of the heart and perihepatic inflammation were also observed, indicating the potential involvement of other organs. Infections also frequently involved the bloodstream.<sup>11–14</sup> *Enterococcus cecorum* has a high tolerance to changing environmental conditions.<sup>15</sup>

*Enterococcus cecorum* is an extremely rare pathogen in humans. Since 1984, when the microorganism was first described, only a dozen cases of invasive infections in humans have been reported in the literature. These have mainly involved vascular bed infection, infective endocarditis, pleural abscess, peritonitis, and knee arthritis.<sup>9,16–22</sup> As Hsu H. et al. note in their paper, half of the cases involved patients with decompensated cirrhosis or other pathology related to the gastrointestinal tract (such as Crohn's disease), where the immune mechanisms of the intestinal mucosa may be impaired.<sup>23</sup>

Cirera et al. found that translocation of intestinal bacteria is significantly higher in cirrhotic patients compared to those without cirrhosis.<sup>24</sup> Interestingly, there are reports in the literature of two cases where infections caused by *Enterococcus cecorum* were successfully treated with third-generation cephalosporins. This is noteworthy because the most commonly encountered enterococci, such as *Enterococcus faecalis* and *Enterococcus faecium*, are typically insensitive due to their low affinity of the drug for penicillin-binding proteins (PBP).<sup>9,10</sup>

The phenomenon of antibiotic overuse contributes to the increasingly prevalent antibiotic resistance, including among enterococci.<sup>25,26</sup> According to the ERAS-NET

**TABLE 1** Actual MIC determined by the microdilution method in broth, along with the size of the growth inhibition zone (in mm) on Mueller–Hinton agar with horse blood, read after 24 h of incubation at 35°C.

	Mueller–Hinton agar with horse blood. The growth inhibition zone around the antibiotic disc is provided in millimeters (mm)	Actual MIC ARTI/ Interpretation
Amoxicillin + clavulanic acid		2/S
Ampicillin	14	2/S
Ciprofloxacin	15	4/NI
Levofloxacin		4/NI
Imipenem	35	≤0.5/I
Gentamicin 30	21	≤32/NI
Linezolid	36	≤0.5/S
Quinupristin/dalfopristin		0.5/NI
Teicoplanin	19	≤0.5/S
Tigecycline		≤0.06/S
Trimethoprim		4/IE
Vancomycin	23	1/S

Abbreviations: I, Sensitive, increased exposure; IE, Too little evidence of drug activity against the microorganism; NI, No interpretation; R, Resistant; S, Sensitive.

report, the resistance of *Enterococcus faecium* and *Enterococcus faecalis* significantly increased in all antibiotic classes between 2015 and 2021.<sup>27</sup>

Since *Enterococcus cecorum* is an extremely rare pathogen in humans, the diagnostic pathway may involve difficulties in correctly identifying this microorganism. Based on the case described, it can be thought that *Enterococcus cecorum* is a more challenging bacterium than the much more common *Enterococcus faecium* or *Enterococcus faecalis*. Culturing and determining the drug susceptibility profile for this bacterium requires more time than for other more common pathogens. Therefore, linezolid was used as the safest therapeutic option. According to ERAS-NET, among Enterococci, the percentage of strains resistant to linezolid is the lowest compared to all other antibiotics.<sup>27</sup> Despite the choice of linezolid, it is important to note that based on observations under in vitro conditions (antibiogram using the disc-diffusion method) and the automatic result from the ARIS system, it can be speculated that other antibiotic groups might also be effective. Among the antibiotics with possible sensitivity are ampicillin, imipenem, gentamicin, teicoplanin, tigecycline, vancomycin (Table 1). Due to the lack of compliance with the EUCAST methodology (medium and incubation time) and for safety reasons in therapy, linezolid was employed, and eradication of the pathogen was confirmed in follow-up microbiological tests.

For years, we have been continuously observing the constantly changing percentage contribution of individual bacteria in causing nosocomial and community acquired infections. Differences are noticeable both locally as well as on a national, continental, and even global scale. The described case underscores the importance of medical vigilance in clinical practice. It seems that due to increasingly advanced techniques in molecular biology, we will more frequently detect pathogens that were previously encountered only sporadically.<sup>28</sup> In the era of rapid diagnostic tool development, it is important to emphasize the necessity of combining different methods rather than replacing one with another.

## AUTHOR CONTRIBUTIONS

**Mateusz Szymanski:** Conceptualization; data curation; formal analysis; funding acquisition; investigation; methodology; project administration; resources; software; supervision; validation; visualization; writing – original draft. **Małgorzata M. Skiba:** Conceptualization; data curation; formal analysis; funding acquisition; investigation; methodology; project administration; resources; software; supervision; validation; visualization; writing – original draft. **Małgorzata Piasecka:** Conceptualization; data curation; formal analysis; funding acquisition; investigation;

methodology; project administration; resources; software; supervision; validation; visualization; writing – original draft. **Alina Olender:** Conceptualization; data curation; formal analysis; funding acquisition; investigation; methodology; project administration; resources; software; supervision; validation; visualization; writing – original draft.

## CONFLICT OF INTEREST STATEMENT

The authors have no conflict of interest to declare.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

## CONSENT

Written informed consent was obtained from the patient to publish this report in accordance with the journal's patient consent policy.

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