



Bacillus clausii Bacteremia During Rotavirus Gastroenteritis: A Case Report

Rotavirüs Gastroenteriti Sırasında *Bacillus clausii* Bakteriyemisi: Olgu Sunumu

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Abstract

A seven-month-old male patient who was previously healthy applied to our clinic with fever, vomiting and diarrhea ongoing for four days. The patient had been taking metronidazole and probiotic supplements (Enterogermina™ containing 2 billion CFU/5 mL *Bacillus clausii* spore suspension) for three days before admission. Physical examination revealed that he appeared weak and had 38.3 °C of body temperature, prolonged capillary refill time, moderate dehydration and hyperactive bowel sounds. Laboratory findings of the patient were as follows: White blood cell count= 18.680/mm³, neutrophile= 10.330/mm³, C-reactive protein levels= 142 mg/L. The patient's stool parasite test result was negative, while rotavirus antigen test was positive. Fluid replacement was initiated, and ceftriaxone was administered to prevent potential secondary bacteremia. Blood culture obtained prior to antibiotic therapy yielded *B. clausii*. Based on the patient's blood culture results, teicoplanin was added to the treatment regimen, and intravenous antibiotic therapy was administered for a total of seven days. We hypothesize that increased intestinal permeability associated with rotavirus infection may predispose to *B. clausii* bacteremia.

Keywords: *Bacillus clausii*, bacteremia, child

Öz

Daha önce bilinen bir hastalığı olmayan yedi aylık erkek hasta, dört gündür devam eden ateş, kusma ve ishal şikayetleri ile kliniğimize başvurdu. Hastaya üç gün önce dış merkezde metronidazol ve probiyotik (2 milyar kob/5 mL *Bacillus clausii* spor süspansiyonu içeren Enterogermina™) başlanmıştı. Fizik muayenesinde hastanın genel durumunun düşük görünümde, kapiller dolum süresi 4-5 saniye olduğu, vücut sıcaklığının 38.3 °C olduğu ve hiperaktif bağırsak sesleri saptandı. Laboratuvar sonuçlarında lökositoz (18.680/mm³), nötrofili (10.330/mm³) ve yüksek C-reaktif protein düzeyi (142 mg/L) tespit edildi. Gaitada parazit test sonucu negatif, rotavirüs antijen testi ise pozitif. Hastaya sıvı replasmanı başlandı ve olası sekonder bakteriyemi önlemek için seftriakson uygulandı. Antibiyotik tedavisinden önce alınan kan kültüründe *B. clausii* üremesi saptandı. Hastanın kan kültür sonucuna göre tedaviye teikoplanin eklendi ve toplam yedi gün boyunca intravenöz antibiyotik tedavisi verildi. Rotavirüs enfeksiyonu ile ilişkili bağırsak geçirgenliğindeki artışın *B. clausii* bakteriyemisine yatkınlık oluşturabileceğini düşünüyoruz.

Anahtar Kelimeler: *Bacillus clausii*, bakteriyemi, çocuk

Introduction

Gastroenteritis is an important health problem that affects people of all ages and can cause death. Worldwide, an estimated 800.000 infants and children die each year from diarrhea.

Studies report that viral pathogens are the most common cause of diarrheal diseases. Rotavirus and enteric adenovirus have been shown to be the most common viral pathogens (1).

Probiotics are widely used for viral gastroenteritis and antibiotic-associated diarrhea in children (2). The World Health

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Organization defines probiotics as preparations containing live bacteria (*Bacillus*, *Lactobacillus*, *Enterococcus*) and fungi (*Saccharomyces*) that provide a health benefit when used in adequate amounts (3). *Bacillus clausii* is a gram-positive, rod-shaped bacterium that forms endospores resistant to environmental conditions (4). *B. clausii* was registered as a probiotic in 1958 and is widely used today. Although probiotics have many known benefits, the circumstances requiring caution when using them have not been clearly defined. Although bacteremia and other systemic infections associated with *B. clausii* are rare, it should be kept in mind that it may cause adverse effects instead of benefits in some patients (2). We report a case of rare *B. clausii* bacteremia developing after probiotic use in a healthy child during rotavirus gastroenteritis.

Case Report

A seven-month-old male patient with no known medical history presented to our department with complaints of fever, vomiting, and diarrhea for the past four days. The patient had been started on metronidazole and probiotics (Enterogermina™ containing 2 billion CFU/5 mL of *B. clausii* spore suspension) at an external center three days prior. On physical examination, the patient appeared lethargic and exhibited signs of moderate dehydration. His body temperature was= 38.3 °C, capillary refill time was 4-5 seconds, there were increased bowel sounds, and other systemic examinations were unremarkable. There were no significant findings in the patient's medical and family history. Laboratory findings included: Leukocytes= 18.680/mm³; neutrophils= 10.330/mm³; lymphocytes= 6.900/mm³; hemoglobin= 10.3 g/dL; platelets: 639.000/mm³; C-reactive protein= 142 mg/L, erythrocyte sedimentation rate= 29 mm/hour. Parasite examination in stool was negative, and rotavirus antigen was positive. The patient received fluid replacement, ceftriaxone was initiated for possible secondary bacteremia, and ongoing probiotic therapy was continued. Blood culture obtained before antibiotic therapy revealed the growth of *B. clausii* using Matrix-Assisted Laser Desorption/Ionization Time-of-Flight Method. The antimicrobial susceptibility test was performed using the disk diffusion method according to the European Committee on Antimicrobial Susceptibility Testing methodology. *B. clausii* was found to be susceptible to oxacillin, vancomycin, and linezolid, and resistant to penicillin-G, erythromycin, and clindamycin. Teicoplanin was added to the patient's treatment based on the blood culture results. The patient's fever did not recur 48 hours after treatment initiation. No growth was observed in two blood cultures taken every other day after the culture grew. No growth was observed in stool and urine cultures. Immunoglobulin G, A, and M were within normal limits for age, and human immunodeficiency virus (HIV) serology was negative. No additional immunological evaluation was performed. The abdominal ultrasound was normal. The patient, who received intravenous antibiotic therapy for a total of seven days, was discharged

with a normal temperature and good clinical condition. The patient was evaluated at intervals at outpatient clinic visits. No serious infection requiring re-hospitalization occurred during the approximately six-month follow-up period.

Discussion

Rotavirus is the most common cause of acute gastroenteritis in young children and of gastroenteritis-related deaths in children under five years of age. *B. clausii*, which is widely used in the treatment of gastroenteritis, has been shown to reduce the duration and severity of diarrhea in children with gastroenteritis. Studies suggest that *B. clausii* has a protective effect against reduced cell proliferation and increased apoptosis in enterocytes infected with rotavirus (5). Probiotics containing *B. clausii* are believed to have a positive effect on the humoral immune system in children with rotavirus infection (6). Contrary to all this knowledge, in our case, *B. clausii* bacteremia developed during the course of rotavirus-associated gastroenteritis. The gut microbiota has long been recognized as a key component of the intestinal barriers (7). We thought that *B. clausii* bacteremia developed as a result of rotavirus increasing intestinal permeability, as can be seen in many factors associated with intestinal infection.

Groups at risk of developing probiotic-associated bacteremia have not yet been identified. Therefore, more data and further research are needed to elucidate the mechanism of bacteremia and risk factors in the host. In previous case reports, advanced age, immunodeficiency, chemotherapy, and factors increasing the risk of impaired intestinal permeability have been identified as risk factors (2). In our case, only rotavirus-associated impaired intestinal permeability was observed among these risk factors. However, no further immunological evaluation or genetic testing was performed, except for immunoglobulin and HIV serology.

In a study evaluating the demographic and clinical characteristics of eight patients with *B. clausii* bacteremia, seven patients had a history of underlying disease and one patient had a history of prolonged hospitalization (8). The absence of known underlying conditions in our case is noteworthy, and probiotic-associated bacteremia should be considered in cases of unexplained clinical deterioration, such as sepsis, during probiotic use in otherwise healthy children. Additionally, no cases of *B. clausii* septicemia following rotavirus infection have been reported in the literature.

The treatment of *B. clausii* bacteremia is challenging. Due to natural resistance mechanisms, antimicrobial treatment options are limited, and the duration of treatment is uncertain (9). This bacterium has been shown to have natural resistance to many antimicrobial agents, including clindamycin, erythromycin, macrolides, aminoglycosides, and cephalosporins (first and second generations) (2,4). Additionally, a case report has

Table 1. Cases of *B. clausii* bacteremia reported in pediatric patients associated with probiotics

Author	Duration of Probiotics Use	Year	Age	Medical Status	Treatment	Treatment Duration	Susceptibility	Outcome
Our case	3 days	2024	7 months	Previously healthy	Ceftriaxone Teicoplanin	7 days	Oxacillin Vancomycin Linezolid	Cure with treatment
Joshi et al. ¹⁰	3 weeks, twice daily	2019	5 months	Congenital heart disease (had undergone surgery)	Levofloxacin Piperacillin-tazobactam Vancomycin	3 weeks	Penicillin Vancomycin	Exitus
Muñoz et al. ¹¹	4 days	2022	4 months	Malnutrition	Ceftriaxone Clindamycin Oxacillin Ceftazidime Ciprofloxacin Ceftaroline Vancomycin Metronidazole	12 days	-	Exitus
Khatri et al. ⁴	4 days	2021	17 months	Previously healthy	Ceftriaxone Ampicillin Gentamicin Levofloxacin Vancomycin Levofloxacin	111 days	Ceftriaxone Levofloxacin Vancomycin	Cure with treatment
Erbaş et al. ⁸	6 days	2024	15 months	CINCA/NOMID	Vancomycin	7 days	Imipenem Meropenem Vancomycin Linezolid	Cure with treatment
Mohamed et al. ¹²	2 weeks, once daily	2025	7 months	Necrotizing enterocolitis and short bowel syndrome	Vancomycin	10 days	Vancomycin Gentamisin	Cure with treatment

CINCA: Chronic infantile neurological, cutaneous, articular syndrome, NOMID: Neonatal-onset multisystem inflammatory disease.

raised concerns about the effectiveness of treatment against this pathogen, as bacterial growth persisted in blood cultures despite prolonged treatment with an antibiotic known to be effective against it. The case in question involved a 17-month-old female patient with no known underlying conditions, who developed *B. clausii* growth in blood cultures following probiotic use. Despite comprehensive investigations, including position emission tomography, the source of infection could not be identified. Empirical treatment with ceftriaxone was initiated and continued with ampicillin, levofloxacin, gentamicin, and oral vancomycin. Although *B. clausii* was found to be susceptible to antibiotics, bacteremia persisted for 111 days (4). The antimicrobial susceptibility pattern of the isolate identified in our patient was similar to those reported in the literature. Treatment was discontinued on the seventh day due to the absence of growth in subsequent blood cultures and the patient's good clinical condition. No recurrence was observed after treatment. Therefore, we believe that a short treatment duration may be sufficient in patients where antimicrobial susceptibility results can be obtained quickly and appropriate treatment is initiated early. The details of pediatric bacteremia cases reported in the literature are presented in Table 1.

In conclusion, we believe that *B. clausii* may cause bacteremia in patients with gastroenteritis due to increased intestinal permeability. Although *B. clausii* is a rare cause of bacteremia, its clinical course and outcomes are unclear. Considering the widespread use of probiotics, we recommend that clinicians consider this microorganism as a potential causative agent when systemic infection, metabolic dysfunction, or hemodynamic instability occurs after probiotic use, and no other pathogen can explain the clinical presentation. We believe that this rare case will be clarified in larger groups and controlled randomized studies.

Informed Consent: Patient consent was obtained.

Peer-review: Externally peer-reviewed.

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