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Case report

A case of necrotizing fasciitis caused by *Bifidobacterium breve*

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ABSTRACT

Background: Bifidobacterium breve is an obligate anaerobic gram-positive bacillus mainly found in the gastrointestinal tract of human infants. Few cases of necrotizing fasciitis caused by *B. breve* have been reported.
Case presentation: A 42-year-old Japanese man with type 2 diabetes mellitus, obesity, cellulitis of the back, and subcutaneous abscess of the right inguinal region presented with rapidly developing erythema, swelling and severe pain in the right inguinal region. Computed tomography showed widespread gas in the right leg region. Cultures of blood and a swab of the wound abscess grew gram-positive bacilli. Mass spectrography and 16 S rDNA analysis confirmed the gram-positive bacilli as *B. breve*. The patient recovered following extensive debridement and antibacterial therapy.
Conclusion: Unidentified necrotizing fasciitis can be caused by *B. breve*, especially in compromised hosts.

Background

Bifidobacterium breve (B. breve) is an obligate anaerobic gram-positive bacillus mainly found in the gastrointestinal tract of human infants [1–3]. The Bifidobacterium family includes 50 species and 10 subspecies, but only 12 species have been detected in humans [3]. *B. breve* is currently used to make fermented food substances because of its probiotic properties, and usually does not cause infectious diseases in healthy individuals [4].

Necrotizing fasciitis is an infection of subcutaneous adipose tissue and superficial fascia, seen mostly in the limbs and genital area [5,6]. Most patients with necrotizing fasciitis have a history of diabetes mellitus, obese, heavy drinking, immunocompromised, postoperative patients or chronic organ dysfunction [6]. Delays in the diagnosis can allow spread of necrotizing fasciitis, risking multiple organ failure and death. Early treatment such as adequate antibiotics usage and emergency surgery including sufficient debridement or amputations is therefore very important [6]. Mixed infections with gram-negative and gram-positive bacteria often cause necrotizing fasciitis, including *Staphylococcus aureus*, *Streptococci* and anaerobic bacteria [5]. Few reports have described necrotizing fasciitis caused by *B. breve.* One case was reported orally in Japan (Yamamoto A, The 69th east Japan regional annual meeting of the Japanese Association for Infectious Diseases), but this case had not been published.

Here, we report a rare case of necrotizing fasciitis due to *B. breve*, representing the second report of a case in Japan. Written informed consent was obtained from the patient for publication of this case report and any accompanying images. A copy of the written consent is available for review by the Editor of this journal.

Case presentation

A 42-year-old Japanese man was transferred to our hospital for surgical treatment following a 3-day history of rapidly developing erythema, swelling and severe pain in the right inguinal region. He had suffered exacerbation of symptoms despite undergoing incision, drainage and antibacterial treatment with ceftriaxone for 5 days by a previous doctor. Medical history included type 2 diabetes mellitus, dyslipidemia and obesity (height, 178 cm; body weight, 139 kg; body mass index, 43 kg/m^2), cellulitis of the back, and repeated subcutaneous abscesses of the right inguinal region over a 2-year period. Physical examination showed: blood pressure, 135/68 mmHg; heart rate, 86

Abbreviations: B. breve, *Bifidobacterium breve*; CT, computed tomography.

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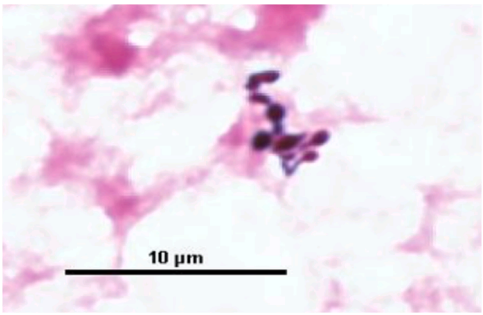

Fig. 1. Results of blood culture. Anaerobic gram-positive bacilli with short and club-shaped rods, often showing bifurcation. Identification of the species from morphological features alone was not possible.

beats/min; respiratory rate, 18 breaths/min; O_2 saturation, 99 % on room air; and axillary temperature, 39.0 °C. Necrotizing skin between the right hip joint and upper knee emitted a foul odor and showed snowball crepitation.

Laboratory studies revealed leukocytosis with nuclear left shift (white blood cell count, 24,860/mm^3; 90 % neutrophils), elevated levels of C-reactive protein (33.4 mg/dL, reference range: 0.00–0.14 mg/dL) and procalcitonin (4.8 ng/mL, reference range: ≤0.05 ng/mL), hyperglycemia (blood sugar level, 306 mg/dL, reference range: 73–109 mg/dL; glycosylated hemoglobin, 10.7 %, reference range: 4.9–6.0 %), slight anemia (hemoglobin, 13.2 g/dL), and hyponatremia (126 mmol/L, reference range: 138–145 mmol/L). No abnormality of hepatonephric function was evident (aspartate aminotransferase, 35 U/L, reference range: 13–30 U/L; alanine aminotransferase, 31 U/L, reference range: 10–42 U/L; creatinine, 0.82 mg/dL, reference range: 0.65–1.07 mg/dL). As a result, Laboratory Risk Indicator for Necrotizing Fasciitis score was 9 (Supplementary Table) [7]. The blood culture yielded positive results for gram-positive bacilli under anaerobic conditions (Fig. 1). Mass spectrography and 16 S rDNA analysis confirmed *B. breve* (Fig. 2). The swab culture from the wound abscess showed positive results for anaerobic gram-positive bacilli morphologically similar to *B. breve*. Computed tomography (CT) of the lower limb showed widespread gas (Fig. 3). Based on clinical findings, he was diagnosed with necrotizing fasciitis. Treatment was urgently performed, including debridement surgery and initiation of antibacterial treatment with sulbactam/ampicillin and clindamycin, followed by additional debridement on hospital day 3 (Supplementary Figure). Antibacterial therapy was terminated on hospital day 27, after resolution of infection. Negative-pressure wound therapy was performed several times, and split thickness skin grafting was performed twice, on hospital days 18 and 41. The patient was finally transferred for rehabilitation on hospital day 58.

Discussion and conclusion

We have reported a rare case of necrotizing fasciitis caused by *B. breve*, which is used in probiotic products to treat constipation and ulcerative colitis. This bacteria does not usually cause infection in healthy individuals [4]. *B. breve* has been reported to cause infection in infants, but only two cases of infection in compromised adults have been reported, neither of which involved necrotizing fasciitis [8,9]. Only one case of necrotizing fasciitis due to *B. breve* has been presented orally in Japan. That case involved a 43-year-old woman with untreated glucose tolerance disorders. Our patient was also vulnerable to infection due to uncontrolled type 2 diabetes mellitus. In addition, he had a history of frequently drinking lactic fermented beverages containing *B. breve* as a child. *B. breve* had presumably remained among the intestinal bacterial flora and had subsequently infected the right inguinal wound via feces, had entered the blood from there.

One reason why cases involving *B. breve* may not have been reported before is that the species lacks characteristic morphological features that would enable identification by microscopy alone [1,3]. Molecular biological identification is necessary to identify *B. breve* even if bifidobacteria is suggested from the morphology and Gram staining. Detection cannot be confirmed using regular anaerobic identification methods, instead requiring expensive and time-consuming next-generation sequencing [3,10].

Currently, it is difficult to identify the species in all bifidobacterial infections due to cost and technical reasons. However, many cases, including this one, have responded well to empiric antibiotic therapy such as sulbactam/ampicillin before identification of the species [8,11].

In conclusion, we encountered an exceptionally rare case of necrotizing fasciitis due to *B. breve*. Improvements in identification technologies such as next-generation sequencing will facilitate more precise determination of causative agents for infection. The possibility of *B. breve* infection should be kept in mind for compromised hosts with necrotizing fasciitis.

Ethics approval and consent to participate

Ethics approval was not required for this case report.

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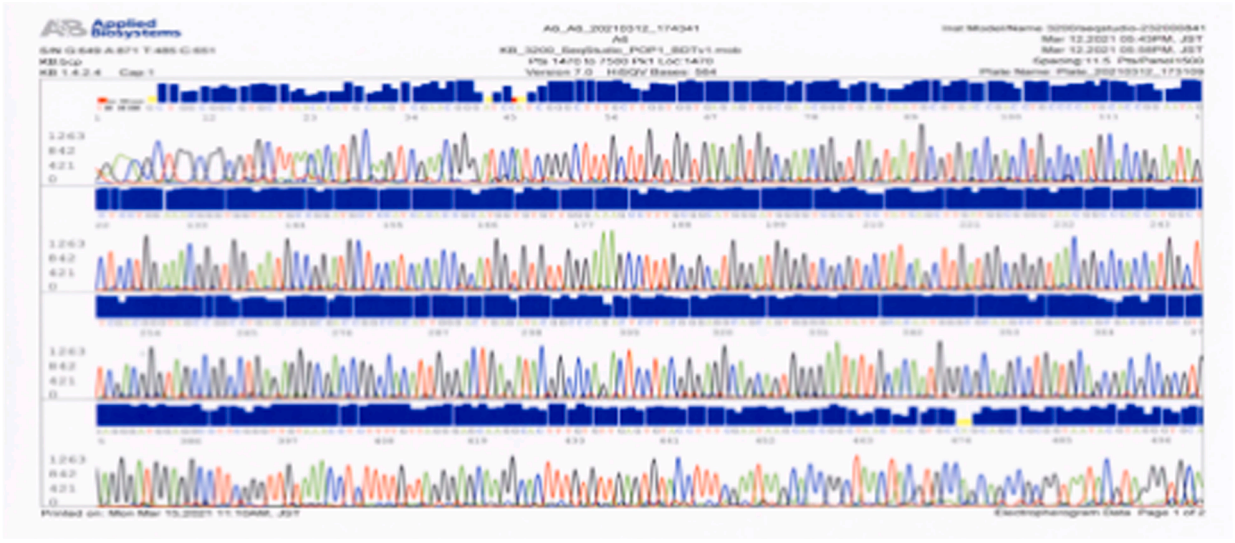
CRediT authorship contribution statement

AK, TN, NO, HY and KY treated the patient and made the clinical diagnosis, YT, KO and AT wrote and revised the manuscript. All authors have read and approved the manuscript.

Declaration of Competing Interest

The authors declare that they have no competing interests.

A



B

Request ID: wabs_blast_2021-0316-1651-07-490-956591

BLASTN 2.2.26 [Sep-21-2011]

Reference: Altschul, Stephen F., Thomas L. Madden, Alejandro A. Schaffer, Jinghui Zhang, Zheng Zhang, Webb Miller, and David J. Lipman (1997), "Gapped BLAST and PSI-BLAST: a new generation of protein database search programs", Nucleic Acids Res. 25:3389-3402.

ClustalW

Query= (662 letters)

Database: bct.vft.phg
5,578,666 sequences; 126,212,410,922 total letters

Searching.....done

Sequences producing significant alignments:	Score (bits)	E Value
CP034770|CP034770.1 Bifidobacterium breve strain BR03 chromosome,	1261	0
CP033041|CP033041.1 Bifidobacterium breve strain FDAARGOS_561 ch...	1261	0
CP023199|CP023199.1 Bifidobacterium breve strain DRBB30 chromosom...	1261	0.

>CP034770|CP034770.1 Bifidobacterium breve strain BR03 chromosome,
Length = 2274632

Score = 1261 bits (631), Expect = 0.0
Identities = 652/662 (98%)
Strand = Plus / Minus

Query: 1 gctggcggcgtgcttaacacatgcaagtcgaacgggatccatcgggcttgctttgtttgt 60
Sbjct: 6033 gctggcggcgtgcttaacacatgcaagtcgaacgggatccatcgggcttgctttgtttgt 5974

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Fig. 2. Results of 16 S rDNA analysis. A) Base sequence of the sample from the patient. B) Base sequence of the sample shows 98 % concordance with *Bifidobacterium breve*.

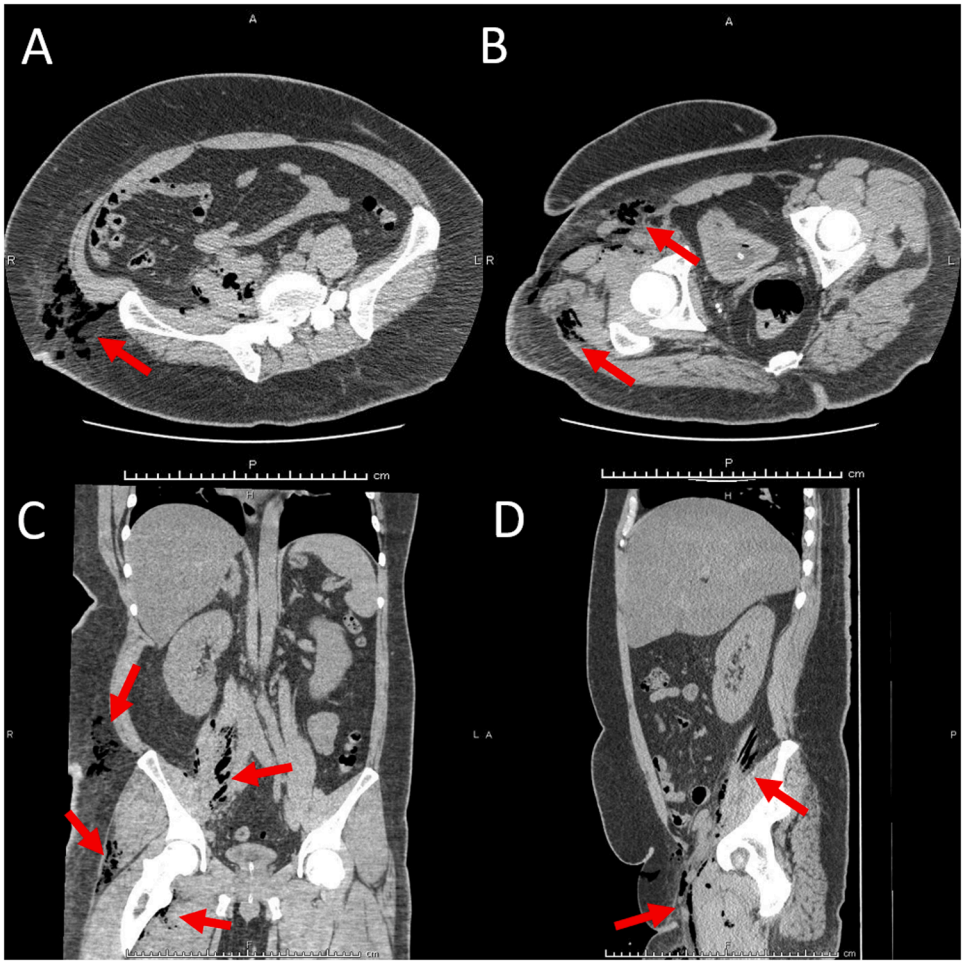

Fig. 3. Plain CT taken on hospital day 1, (A) Horizontal section of the pelvic CT shows gas in the adipose tissue of the right inguinal region (arrow). CT attenuation value of the subcutaneous adipose tissue is increased around the gas. These findings are consistent with necrotizing fasciitis. (B) Horizontal section of the CT at the level of the femoral head shows widespread gas around the right gluteus medius muscle and the right iliacus muscle (arrows). (C) Coronal section of the CT shows widespread gas from the inside of the right femur to subcutaneous tissue over the superior anterior iliac spine, and from the muscles around the right femur to the right iliopsoas muscle (arrows). (D) Sagittal section of the CT shows widespread gas from front of the right quadriceps femoral muscle to the right iliopsoas muscle (arrows).

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N/A.

Consent to publish

Verbal and written informed consent was obtained from the patient for publication of this case.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.idcr.2022.e01667.

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