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CASE REPORT

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# Secondary subcutaneous abscess due to mixed infections by *Peptoniphilus olsenii* and *Gleimia europaea* after COVID-19

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## Abstract

This report described a rare case of subcutaneous anaerobic bacterial abscess due to *Peptoniphilus olsenii* and *Gleimia europaea* after COVID-19. The patient received incision and drainage of the abscess and antibiotics, thereby achieving recovery. Immunodeficiency related to COVID-19 and its treatment might contribute to secondary skin and subcutaneous bacterial infections.

**KEYWORDS**

critical care medicine, dermatology, infectious diseases, respiratory medicine

## 1 | INTRODUCTION

Immunosuppressive therapy has been increasingly used for the treatment of coronavirus disease 2019 (COVID-19), the worldwide infectious disease by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).[1] Immunosuppressant administration generally increases the risk of secondary bacterial infections.[2] Additionally, SARS-CoV-2 infection affects the host immune system, especially T lymphocytes, and contributes to immunodeficiency and

secondary bacterial infections.[3,4] However, due to its rarity, few studies have investigated skin and soft tissue secondary infections related to COVID-19, especially those by anaerobes.

Anaerobes comprise the main microorganisms of skin and mucous membrane flora, the infections by which occur endogenously and can be life-threatening.[5,6] Some of the major pathogens of skin and soft tissue infections in immunocompromised patients (e.g., patients with diabetes mellitus or taking immunosuppressants) are *Peptostreptococcus* spp., *Prevotella* spp., and *Actinomyces* spp.[6] The treatments of these infections are complicated by the polymicrobial nature and the slow in vitro growth of anaerobes.[6]

At this juncture, we present the case of a patient with COVID-19 and subcutaneous abscess caused by two anaerobic bacteria, *Peptoniphilus olsenii* (*P. olsenii*) and *Gleimia europaea* (*G. europaea*).

## 2 | CASE HISTORY

A 52-year-old man with moderate COVID-19 was hospitalized in an isolation ward. He was administered 6.0 mg of dexamethasone once daily for 10 days. As an antiviral treatment, he received intravenous remdesivir 200 mg on Day 1 and 100 mg from Days 2 to 5 once daily. He presented with back pain on Day 7, but based on the physician's discretion, he was discharged from the former hospital without a recurrence of COVID-19 on Day 10. No other treatments, including immunosuppressants and antibiotics, were administered to the patient during the first hospitalization. The patient had dyslipidemia and hypertension but did not have immunodeficiency, diabetes mellitus, or cutaneous diseases. He did not have a specific life history related to hygiene. On Day 12, he was admitted to the intensive care unit (ICU) in our hospital with severe back pain, oxygen desaturation, and low blood pressure.

### 2.1 | Differential diagnosis, investigations, and treatment

A high-resolution computed tomography scan of his chest revealed a subcutaneous lesion without deterioration of his COVID-19 lung disease (Figure 1A). Blood tests showed 29,630 per μl of leukocyte count with an increased neutrophil ratio and a decreased lymphocyte ratio (94.1% and 3.8%, respectively), 16.49 mg/dl of C-reactive protein, 1.10 μg/ml of D-dimer, 2.19 ng/ml of procalcitonin, 1806 pg/ml of presepsin, and 7.9 mmol/L of lactate. Thereafter, he was diagnosed with subcutaneous abscess-related septic shock.

The patient received invasive mechanical ventilation and 0.1 μg/kg/min of noradrenaline. Consequently, his mean arterial pressure was maintained at 65 mmHg. After incision and drainage of the subcutaneous abscess (Figure 1B), the patient was administered meropenem (1.0 g every 8 h), vancomycin (1.0–1.5 g every 12 h with therapeutic drug monitoring), and clindamycin (0.9 g every 8 h) as an empiric therapy. The subcutaneous abscess specimens were cultured on ABHK agar and Bacteroides Bile Esculin agar (Nissui Pharmaceutical Co. Ltd.) at 35°C for 48 h. After verifying bacterial growth, each colony

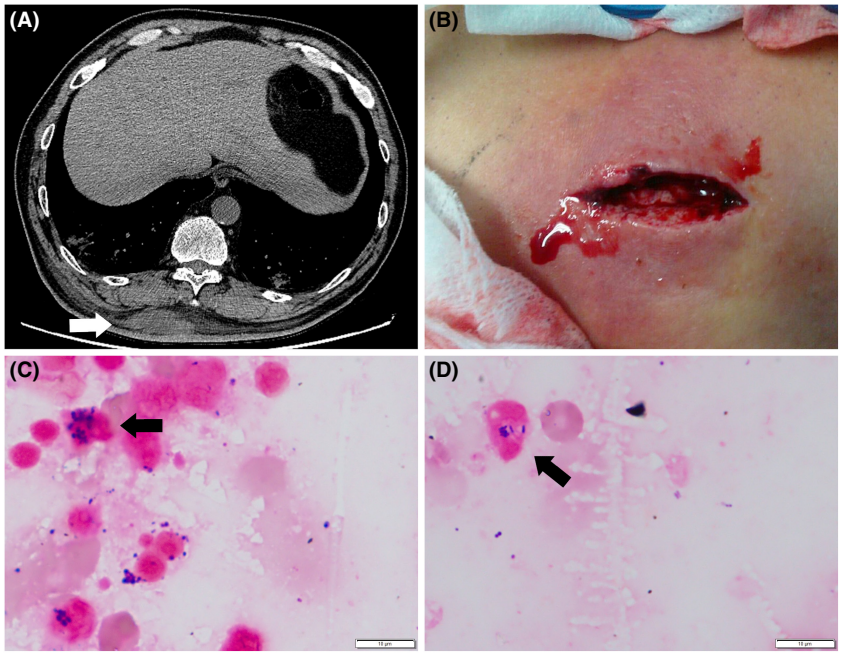


**FIGURE 1** Findings of subcutaneous abscess caused by anaerobic bacteria. (A) High-resolution computed tomography results suggestive of subcutaneous abscess (arrow). (B) Subcutaneous abscess after incision and drainage. (C) A Gram stain smear of the subcutaneous abscess (original magnification, ×400) where Gram-positive cocci were phagocytosed (arrow). (D) A Gram stain smear of the subcutaneous abscess (original magnification, ×400) where Gram-positive rods were phagocytosed (arrow).

was isolated and cultured on horse blood agar (Kyokuto Pharmaceutical Industrial Co., Ltd.) at 35°C. The cultures were positive for *Peptoniphilus* sp. and *Gleimia* sp., indicating a mixed anaerobic bacterial infection (Table 1). Matrix-assisted laser desorption/ionization-time of flight mass spectrometry (MALDI-TOF MS) estimated the anaerobes to be *P. olsenii* and *G. europaea* (the BD Bruker MALDI Biotyper; Bruker Daltonics Inc.). The log score values were 2.42 (*P. olsenii*) and 2.08 (*G. europaea*), respectively. The Gram stain smear of the abscess identified that these bacteria were phagocytosed (Figure 1C,D). Thus, the microbiological tests proved both the anaerobes to be the causative pathogens. There were no other infectious microorganisms, even in blood cultures. Based on the culture results, the administered antibiotics were de-escalated to ampicillin–sulbactam (2.0 and 1.0 g/day, respectively, every 6 h) and clindamycin, without recurrence. The total duration of intravenous antibiotics was 19 days.

### 2.2 | Outcome

The patient was extubated on Day 26 and discharged from the ICU on Day 28.

## 3 | DISCUSSION

This case report provided a precise clinical presentation of a subcutaneous anaerobic bacterial infection with *P. olsenii* and *G. europaea* in a patient with COVID-19 who received systemic corticosteroid therapy in an isolation ward. The subcutaneous infection occurred relatively soon after initiating the corticosteroid administration. This report highlights the need for managing secondary infections of the skin and soft tissues in immunocompromised patients with COVID-19.

**TABLE 1** Minimum inhibitory concentration of antibiotics for *Peptoniphilus olsenii* and *Gleimia europaea* measured by the microbroth dilution method

| Antibiotics | *Peptoniphilus olsenii* (μg/ml) | *Gleimia europaea* (μg/ml) |
|---|---|---|
| Ampicillin | ≤0.25 | ≤0.25 |
| Piperacillin | ≤16 | ≤16 |
| Ceftriaxone | 0.25 | ≤8 |
| Meropenem | ≤2 | ≤2 |
| Moxyfloxacin | 4 | 4 |
| Clindamycin | >8 | >8 |
| Chloramphenicol | ≤4 | ≤4 |
| Linezolid | ≤0.5 | |

*Note*: According to the Clinical and Laboratory Standards Institute guidelines, the microbroth dilution method was performed using an air-dried microplate (Eiken Chemical Co., Ltd.). The results were measured after incubating the bacteria for 48 h at 35°C.

SARS-CoV-2 infection and immunosuppressive therapy can affect the immune system in patients with COVID-19, thereby contributing to secondary infections. SARS-CoV-2 inhibits interleukin-2 (IL-2)/IL-2 receptor and reduces $CD8^+$ T lymphocytes but increases serum IL-6 levels.[7] Since IL-6 is involved in cytokine storm,[8] systemic corticosteroids are widely used to mitigate the immune response and preventing a hyperinflammatory state.[9] The COVID-19-related lymphocytopenia leads to secondary infections, especially in the lungs and the bloodstream.[10] Moreover, systemic corticosteroids increase the risks of secondary bacterial infections in patients with severe COVID-19.[11] Although little has been investigated about secondary infections in the skin and soft tissues in patients with COVID-19, their risks might increase theoretically. Given the absence of the patient's medical or life history relating to the anaerobic bacterial infections, even a short-term corticosteroid administration could have contributed to the secondary subcutaneous infection and septic shock under COVID-19-related immunosuppression.

Additionally, isolated situations during hospitalization limit COVID-19 patients' access to medical workers and can increase device-related and secondary skin infections.[12] Since the patient was treated with systemic corticosteroid therapy in the isolation ward during the first hospitalization, the subcutaneous abscess might have progressed beyond medical workers' expectations. Therefore, careful assessment of the skin might help medical workers to avoid treatment failure in immunocompromised patients with COVID-19.

*Peptoniphilus* spp. is part of the Gram-positive anaerobic cocci (GPAC) and was reclassified in 2001 by Ezaki et al.[13,14] Although GPAC is isolated from 25% to 30% of all infections involving anaerobes,[14] studies investigating the clinical significance of GPAC did not make much progress due to an inadequate taxonomy and the lack of a valid identification scheme. However, the 16S ribosomal ribonucleic acid (rRNA) sequencing data contributed to the revised taxonomy of GPAC; thus, *P. olsenii* was first identified from clinical specimens in 2007.[15,16] Moreover, enzyme tests and MALDI-TOF MS contribute to identifying the strain.[15–17]

*Peptoniphilus* spp. is generally associated with chronic skin and soft tissue infections.[18] In fact, *P. olsenii* was originally identified in patients with skin and soft tissue infections (e.g., dry gangrene caused by peripheral vascular disease, diabetic foot ulcer, and toe infection).[15] Although 16S rRNA sequencing was not performed for the identification, it might have been clinically typical that the strain

identified in this case infected the subcutaneous tissue. Furthermore, this case showed a mixed infection with *G. europaea* that was estimated to be *G. europaea*. Similar to *Actinomyces* spp., *G. europaea* (previously classified as *Actinomyces europaeus*) causes skin and soft tissue infections.[19] Since *G. europaea* can cause severe infectious diseases, including necrotizing fasciitis,[20] the mixed infection by *G. europaea* might have contributed to the pathogenesis of severe disease in this case. This case report warrants further studies of anaerobic bacterial infections because the COVID-19 pandemic can significantly increase the frequency of systemic corticosteroid administration and the population of immunocompromised patients.

In conclusion, this report showed subcutaneous abscess and septic shock caused by a mixed anaerobic bacterial infection in a patient with COVID-19. *P. olsenii* and *G. europaea*, anaerobes comprising the skin and mucous membrane flora, contributed to the disease onset. Even a short-term administration of systemic corticosteroids can lead to immunosuppression and severe subcutaneous anaerobic bacterial infections in patients with COVID-19. Since patient isolation can prevent medical workers from detecting the disease progression, careful assessment of the skin might help medical workers to avoid treatment failure in immunocompromised patients with COVID-19. Further studies are necessary to investigate the anaerobic bacterial infections in immunocompromised patients, including those with COVID-19.

## AUTHOR CONTRIBUTIONS

Y. Yamamoto contributed to conceptualization and design and writing the original draft. T. Shiroyama and H. Hirata contributed to methodology. Y. Yamamoto, K. Matsumoto, T. Kuge, M. Yoneda, M. Yamamoto, and A. Uchiyama contributed to data collection. T. Shiroyama, Y. Takeda, and A. Kumanogoh contributed to supervision. All authors have reviewed and approved the submission of the final manuscript.

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## CONFLICT OF INTEREST

The authors declare no conflicts of interest.

## DATA AVAILABILITY STATEMENT

None.

## 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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