

[ CASE REPORT ]

## The First Case Report of Mediastinal Abscess Caused by *Gemella bergeri*

Hirokazu Toyoshima<sup>1</sup>, Koji Fujii<sup>2</sup>, Motoaki Tanigawa<sup>3</sup>, Akiko Nakamura<sup>4</sup>, Masaki Tanabe<sup>5</sup>,  
Hiroyuki Tanaka<sup>1</sup>, Yuki Nakanishi<sup>1</sup> and Shigetoshi Sakabe<sup>1</sup>

### Abstract:

Most cases of mediastinal abscess occur as a postoperative complication of a thoracic surgical procedure or following trauma. The most common causative microorganism is *Staphylococcus aureus*, but it can be rarely caused by unusual microorganisms, such as *Gemella* species. These are relatively difficult-to-identify commensal microorganisms of the upper respiratory and gastrointestinal tracts and may cause several infections. A 66-year-old man was diagnosed with *Gemella bergeri* mediastinal abscess by the molecular detection of bacterial genes. He was successfully treated with penicillin antibiotic for eight weeks. To our knowledge, this is the first case report of mediastinal abscess caused by *G. bergeri*.

**Key words:** *Gemella bergeri*, mediastinal abscess, MALDI-TOF MS, 16S rRNA gene sequencing

(Intern Med 60: 1631-1635, 2021)

(DOI: 10.2169/internalmedicine.5043-20)

### Introduction

There have been no reports of mediastinal abscess caused by *Gemella bergeri* in the literature. *G. bergeri* is one of the nine species of the genus *Gemella* (1) and is a Gram-variable coccus arranged in pairs, tetrads, clusters, or short chains. It was first isolated by Collins et al. in 1998 from the blood cultures of six patients, three of whom had bacterial endocarditis (2). It is relatively difficult to identify since conventional biochemical methods may result in misidentification as other *Gemella* species or viridans streptococci (3).

A few cases of mediastinal abscess caused by *G. bergeri* have recently been reported, including ones of infective endocarditis (2-9), Lemierre's syndrome (10), and cutaneous orbital abscess (11) in humans. However, the pathogenicity of *G. bergeri* has not been clarified.

We herein report the first case of mediastinal abscess caused by *G. bergeri* in Japan.

### Case Report

A 66-year-old Japanese man with a history of gingivitis, acute appendicitis, and duodenal ulcer presented with a 3-month history of anorexia and loss of body weight at our hospital. His height and weight at the first visit were 159 cm and 55 kg, respectively [body mass index (BMI): 21.8]. He had no known allergies and had not been prescribed any recent medications. A detailed gastrointestinal examination revealed advanced carcinoma of the abdominal esophagus. After the second course of neoadjuvant chemotherapy (5-fluorouracil and cisplatin therapy; FP therapy), we conducted left trans-thoraco-abdominal retrosternal gastric tube reconstruction following subtotal esophagectomy with three-field lymphadenectomy. He developed a fever on the fourth day after the surgery for esophageal cancer.

He was alert (Glasgow Coma Scale 15) and presented with the following vital signs: temperature of 38.4 °C, blood pressure of 109/68 mmHg, heart rate of 110 beats/minute, respiratory rate of 22 breaths/minute, and oxygen saturation of 97% in ambient air. A physical examination revealed pro-

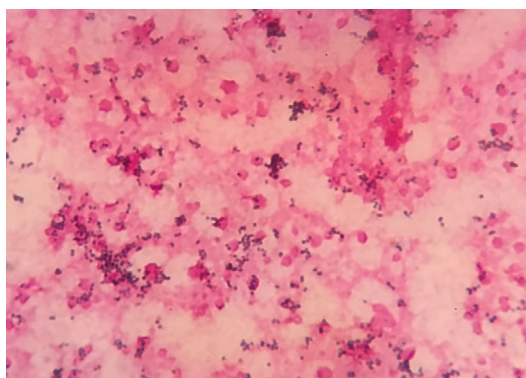
<sup>1</sup>Department of Infectious Diseases, Japanese Red Cross Ise Hospital, Japan, <sup>2</sup>Department of Surgery, Japanese Red Cross Ise Hospital, Japan, <sup>3</sup>Department of Respiratory Medicine, Japanese Red Cross Ise Hospital, Japan, <sup>4</sup>Department of Infection Control, Aichi Medical University, Japan and <sup>5</sup>Department of Infection Control and Prevention, Mie University Hospital, Japan

Received: April 8, 2020; Accepted: November 6, 2020; Advance Publication by J-STAGE: December 29, 2020

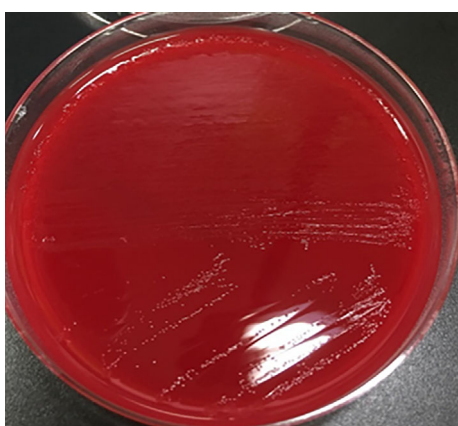
Correspondence to Dr. Hirokazu Toyoshima, hirokazutoyoshima@gmail.com



**Figure 1.** Chest computed tomographic image showed fluid collection and internal air bubbles (white arrow) in the left anterior mediastinum.



**Figure 2.** Gram staining (×1,000) revealed Gram-positive polymorphic cocci.



**Figure 3.** The isolates grew on 5% sheep blood agar media after 2 days of anaerobic incubation at 35 °C.

gressive destruction of the tooth-supporting apparatus on the right maxillary central incisor and hypoactive bowel sounds. The findings of other examinations, including those of the thoraco-abdominal wound, were all within normal limits.

Laboratory findings were as follows: albumin 2.1 g/dL, alanine transferase 38 U/L, aspartate aminotransferase 24 U/L, lactate dehydrogenase 155 U/L, blood urea nitrogen 9 mg/dL, creatinine 0.99 mg/dL, C-reactive protein 15.99 mg/dL, white blood cell count 13,200/μL with 85.0% neutrophils, hemoglobin 6.4 g/dL, and platelet count 45.6×10<sup>4</sup>/μL.

Chest computed tomography (CT) showed fluid collection and internal air bubbles in the left anterior mediastinum (Fig. 1). Consequently, aspiration and drainage of this area for Gram staining and culture were performed.

Gram staining showed Gram-positive polymorphic cocci arranged in pairs, tetrads, clusters, or short chains. Based on the history of gingivitis and trans-thoraco-abdominal retrosternal gastric tube reconstruction after subtotal esophagectomy, findings of periodontitis, and Gram-positive polymorphic cocci, we suspected involvement of *Gemella* species or nutritional variant streptococci (NVS) rather than viridans streptococci (Fig. 2). There was no evidence of infective endocarditis by transthoracic echocardiography. Two sets of aerobic and anaerobic blood cultures (BacT/Alert

FAN plus, bioMérieux, Marcy l'Etoile, France) were negative after incubation for 14 days. For drainage fluid cultures, no isolates grew on 5% sheep blood agar (Nihon Becton-Dickinson, Tokyo, Japan) or chocolate agar medium (Nissui Pharmaceutical, Tokyo, Japan) after 2 days of incubation under 5% CO<sub>2</sub> at 35 °C, while pinhead colonies grew on 5% sheep blood agar medium after 3 days of incubation under 5% CO<sub>2</sub> at 35 °C. In contrast, the isolates grew relatively well on 5% sheep blood agar medium after 2 days of anaerobic incubation at 35 °C (Fig. 3). The isolates were alpha-hemolytic, nonmotile, catalase-negative, leucine aminopeptidase (LAP)-positive, pyrrolidonylarylamidase (PYR)-positive, esculin-negative, urease-negative, and failed to type with Lancefield group A, B, C, D, F, or G antiserum (Kanto Chemical, Tokyo, Japan). The satellite test, known as satelliting, for NVS was negative. The bacteria were ultimately identified as *G. bergeri* by matrix-assisted laser desorption ionization time-of-flight mass spectrometry (MALDI-TOF MS) and 16S ribosomal ribonucleic acid (rRNA) gene sequencing (12)(Fig. 4). The E-test (bioMérieux) showed penicillin, ceftriaxone, and vancomycin with minimum inhibitory concentrations (MICs) of 0.008, 0.016, and 0.38 μg/mL, respectively, which indicated susceptibility to the breakpoint of related viridans streptococci.

The patient was diagnosed with a mediastinal abscess due to *G. bergeri* and treated with a combination of intravenous sulbactam/ampicillin 3 g every 6 hours and metronidazole 500 mg every 8 hours. He became afebrile on these combination therapies with drainage for two weeks, and metronidazole was discontinued (Fig. 5). After four weeks of intravenous therapy, sulbactam/ampicillin was changed to oral clavulanate/amoxicillin. Thereafter, the abscess disappeared on CT, and there has been no recurrence (Fig. 5).

## Discussion

There are two clinical issues regarding the diagnosis of *G. bergeri* infections. *G. bergeri* is a part of the normal flora of the oral cavity and upper respiratory and gastrointestinal tracts. Nevertheless, there have been no reports of mediastinal abscess caused by *G. bergeri* in the literature. Further-

Gemella bergeri strain 617-93 16S ribosomal RNA gene, partial sequence

Sequence ID: [NR\\_026420.1](#) Length: 1508 Number of Matches: 1[▶ See 1 more title\(s\)](#)

Range 1: 61 to 1457 [GenBank](#) [Graphics](#) ▼ Next Match ▲ Previous Match

Score	Expect	Identities	Gaps	Strand
2580 bits(1397)	0.0	1397/1397(100%)	0/1397(0%)	Plus/Plus

```

Query 1  ACTAGAAATTCCTTAGCGGCGAACGGGTGAGTAACACGTAAGAACCTGCCTTATAGACTG 60
Sbjct 61  ACTAGAAATTCCTTAGCGGCGAACGGGTGAGTAACACGTAAGAACCTGCCTTATAGACTG 120

Query 61  GGATAACTACGGGAAACTGTAGCTAATACCGGATAACAACATTTTCCGCATGGGAGATGT 120
Sbjct 121  GGATAACTACGGGAAACTGTAGCTAATACCGGATAACAACATTTTCCGCATGGGAGATGT 180

Query 121  TTAAAAGTTGGTGAAGCTAACACTATAAGATGGCTTTGCGGAGCATTAGCTAGTTGGTGG 180
Sbjct 181  TTAAAAGTTGGTGAAGCTAACACTATAAGATGGCTTTGCGGAGCATTAGCTAGTTGGTGG 240

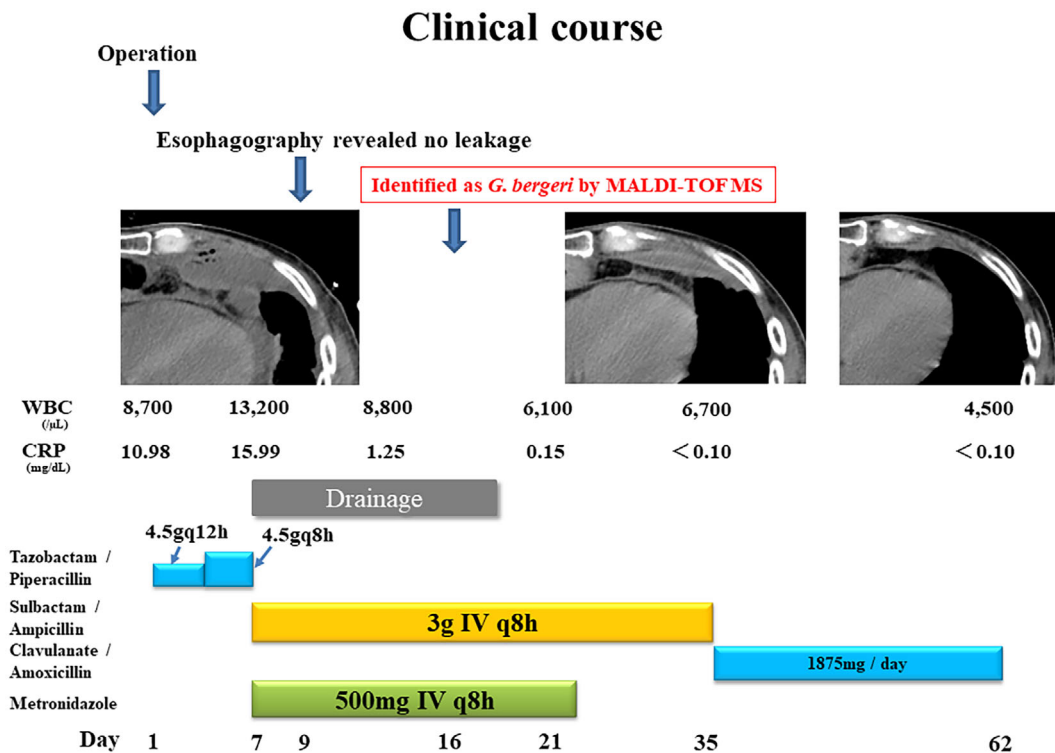
Query 181  GATAAAAGCCTACCAAGGCGACGATGCATAGCCGACCTGAGAGGGTGAACGGCCACATTG 240
Sbjct 241  GATAAAAGCCTACCAAGGCGACGATGCATAGCCGACCTGAGAGGGTGAACGGCCACATTG 300

Query 241  GGACTGAGACACGGCCCAAACCTCCTACGGGAGGCAGCAGTAGGGAATCTTCCGCAATGGA 300
Sbjct 301  GGACTGAGACACGGCCCAAACCTCCTACGGGAGGCAGCAGTAGGGAATCTTCCGCAATGGA 360

Query 301  CGAAAGTCTGACGGAGCAACGCCGCGTGAGTGAAGAAGGATTTTCGGTTCGTAAGCTCTG 360
Sbjct 361  CGAAAGTCTGACGGAGCAACGCCGCGTGAGTGAAGAAGGATTTTCGGTTCGTAAGCTCTG 420

```

**Figure 4.** The results of 16S rRNA gene sequencing (GenBank BLAST database).



**Figure 5.** Clinical course. Based on the findings of Gram staining, a combination of intravenous sulbactam/ampicillin and metronidazole with drainage of the mediastinal abscess was started on Day 7. Esophagography on Day 9 revealed no leakage. Metronidazole was discontinued on Day 22. Follow-up CT on Day 33 revealed the shrinkage of the abscess. Sulbactam/ampicillin was changed to oral clavulanate/amoxicillin on Day 35. Thereafter, the abscess disappeared in CT.

more, the conventional biochemical methods may lead to misidentification.

Regarding the first point, there have been few reports of mediastinal abscess or mediastinitis caused by *Gemella* species in the literature. Most cases of mediastinal abscess occur as a complication following surgery, trauma, esophageal

perforation (e.g., Boerhaave's syndrome), or the development of cervical infections (e.g., descending cervical mediastinitis). The most common causative microorganism in mediastinitis following thoracic surgery is *S. aureus* (13). In contrast, there have been only three case reports of mediastinitis caused by *G. morbillorum* (14-16), and no cases



caused by *G. bergeri* have been reported.

Regarding the second point, the conventional biochemical methods may result in misidentification. However, MALDI-TOF MS and 16S rRNA gene sequencing may be useful for the diagnosis of *G. bergeri* (3). To date, there have been 15 case reports of *G. bergeri* infections (2-11). Two reports did not mention how to identify the microorganisms. Of the remaining 13 cases, 8 were diagnosed by 16S rRNA gene sequencing, 2 were diagnosed by MALDI-TOF MS or MALDI-TOF MS+16S rRNA gene sequencing, 2 were diagnosed by conventional biochemical methods, and the last was diagnosed by real-time polymerase chain reaction. In brief, 10 of the 13 patients were diagnosed by MALDI-TOF MS or 16S rRNA gene sequencing. In our patient, the VITEK II system (bioMérieux) and BD BBL Crystal GP (Becton, Dickinson and Company, Sparks, USA) indicated an "Unidentified organism". This strain was identified as *G. haemolysans* by API 20 strep v.8.0 (%ID 64.2, T index 0.97; bioMérieux) and Rapid ID 32 strep v.4.0 (%ID 93.4, T index 0.73; bioMérieux) with low discrimination. It was identified as *G. bergeri* with a confidence value of 99.9 by MALDI-TOF MS (VITEK MS; bioMérieux) and confirmed by 16S rRNA gene sequencing and the GenBank Basic Local Alignment Search Tool (BLAST) database ([www.ncbi.nlm.nih.gov/genbank/](http://www.ncbi.nlm.nih.gov/genbank/)) (Identities 1,397/1,397, Gaps 0/1,397, Score 2,580bits) (Fig. 4). Consequently, we diagnosed *G. bergeri* as the pathogen responsible for the mediastinal abscess in our case.

In general, *Gemella* species are known to be catalase-negative, slow-growing, fastidious, facultatively anaerobic, salt-tolerant, nonsatelliting, Gram-positive cocci. In addition, *Gemella* species have variable Gram staining patterns and may exhibit a polymorphic shape. These properties can lead to its misidentification as viridans streptococci or other related microorganisms. Before 1988, there were only two known *Gemella* species: *G. haemolysans* and *G. morbillorum*. *G. bergeri* was first isolated by Collins et al. in 1998 (2). It is believed that *Gemella* species are harmless commensal microorganisms in the oral cavity and upper respiratory, gastrointestinal, and genitourinary tract; however, there have been several reports of localized and generalized infections due to *Gemella* species. Of the nine species in the genus *Gemella*, seven (*G. bergeri*, *G. morbillorum*, *G. haemolysans*, *G. sanguinis*, *G. asaccharolytica*, *G. parahaemolysans*, *G. taiwanensis*) have been recognized as causative agents of infective endocarditis (2-9, 17-19), brain abscess (20), septic arthritis (21), liver abscess (22), Lemierre's syndrome (10), and cutaneous orbital abscess (11) in humans. *G. bergeri* infection is especially rare and limited to a few case reports for this reason (2-11). In addition, because of limitations in conventional diagnostic testing and difficulty identifying *G. bergeri*, instances of this bacteria may have been misidentified as *G. haemolysans*, *G. morbillorum*, or viridans streptococci in the past (3, 23), accounting for the rarity of *G. bergeri*.

Clinically, the involvement of anaerobic bacteria or En-

terobacteriaceae should be considered because of air collection inside the abscess on chest CT (Fig. 1). In our case, Enterobacteriaceae did not grow on 5% sheep blood agar medium aerobically or anaerobically. Anaerobic transport devices and chambers were not available in our hospital. Therefore we prescribed metronidazole in combination with sulbactam/ampicillin based on the presumption of anaerobic bacteria. It is reported that the susceptibility rate of obligate anaerobes to sulbactam/ampicillin is high (24, 25). However, some obligate anaerobes (e.g., *Bacteroides* species) may show resistance to sulbactam/ampicillin (25, 26). We therefore prescribed metronidazole while being alert for encephalopathy in our case; consequently there was no evidence of antibiotic-associated encephalopathy (27).

Of the past 15 case reports of *G. bergeri* infections (2-11), 6 patients were treated with penicillin (3, 6, 8-11) and 4 with ceftriaxone, depending on the susceptibility (4-6, 9); however, the antibiotics were not mentioned in 7 reports. Ceftriaxone may be a viable option for treating *G. bergeri* infection if susceptible. Microorganisms responsible for mediastinal abscess are related to the primary source. *Gemella* species are commonly recognized as a part of the normal oral flora and are frequently found in patients with white-spot lesions and gingivitis (28). Bacteremia after toothbrushing and dental procedures is associated with poor oral hygiene and gingival bleeding. Thus, they are known causes of bacterial entry into the bloodstream (29, 30). Our patient had a history of gingivitis and a finding of chronic periodontitis, but 2 sets of blood cultures were negative despite a long 14-day incubation. In addition, he underwent ipsilateral trans-thoraco-abdominal retrosternal gastric tube reconstruction after subtotal esophagectomy. We concluded that this was the most likely source of infection in this case, as *G. bergeri* is part of the normal flora of the upper gastrointestinal tract (1). Obesity and diabetes mellitus are associated with mediastinitis following cardiac surgery (31). Furthermore, the risk of mediastinitis after surgical esophageal anastomosis is correlated with cervical anastomosis, female gender, and a pre-operative smoking habit (32). Our patient did not have a history of obesity, diabetes mellitus, or a smoking habit but had undergone cervical anastomosis, which may have been associated with this mediastinal abscess contaminated with intraesophageal *G. bergeri*. However, no leakage was found immediately after surgery by esophagography, and the abscess completely disappeared on the 62nd day, as revealed by CT.

A rare disease, mediastinal abscess caused by *G. bergeri*, was successfully treated with appropriate antibiotic therapy. The accurate diagnosis of rare or difficult-to-identify pathogens is challenging for clinical microbiological laboratories. In cases where pathogenic microorganisms cannot be identified by conventional methods, rare or difficult-to-identify pathogens can be identified using MALDI-TOF MS and 16S rRNA gene sequencing. There have been no reports of mediastinal abscess caused by *G. bergeri* in the literature. We herein report the first case of mediastinal abscess caused by

*G. bergeri* in Japan.

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

**The authors state that they have no Conflict of Interest (COI).**

## References

- Hung WC, Chen HJ, Tsai JC, et al. *Gemella parahaemolysans* sp. nov. and *Gemella taiwanensis* sp. nov., isolated from human clinical specimens. *Int J Syst Evol Microbiol* **64**: 2060-2065, 2014.
- Collins MD, Hutson RA, Falsen E, Sjöden B, Facklam RR. *Gemella bergeriae* sp. nov., isolated from human clinical specimens. *J Clin Microbiol* **36**: 1290-1293, 1998.
- Elsayed S, Zhang K. *Gemella bergeriae* endocarditis diagnosed by sequencing of rRNA genes in heart valve tissue. *J Clin Microbiol* **42**: 4897-4900, 2004.
- Logan LK, Zheng X, Shulman ST. *Gemella bergeriae* endocarditis in a boy. *Pediatr Infect Dis J* **27**: 184-186, 2008.
- Hussain K, Abubaker J, Al Deesi ZO, Ahmed R. Unreported neurological complications of *Gemella bergeriae* infective endocarditis. *BMJ Case Rep* **2014**: bcr2014204405.
- Virgilio E, Chieco PA. Sixth case of infective endocarditis caused by *Gemella bergeri*. *Braz J Infect Dis* **18**: 467, 2014.
- Pachirat O, Watt G, Pussadhamma B. First case of tricuspid valve endocarditis caused by *Gemella bergeri*. *Case Rep Med* **2015**: 1-3, 2015.
- Ukudeeva A, Hawkins HK, Ahmad M, et al. Second fatal case of infective endocarditis caused by *Gemella bergeri*. *Int J Biomed* **7**: 63-66, 2017.
- Zaidi SJ, Husayni T, Collins MA. *Gemella bergeri* infective endocarditis: a case report and brief review of literature. *Cardiol Young* **28**: 762-764, 2018.
- Yamagishi T, Hikone M, Sugiyama K, et al. Purpura fulminans with Lemierre's syndrome caused by *Gemella bergeri* and *Eikenella corrodens*: a case report. *BMC Infect Dis* **18**: 523-999, 2018.
- McQuinn M, Horswell BB. First case of cutaneous orbital abscess caused by *Gemella*: a case report and review of the literature. *J Oral Maxillofac Surg* **77**: 1414-1417, 2019.
- Suzuki MT, Giovannoni SJ. Bias caused by template annealing in the amplification of mixtures of 16S rRNA genes by PCR. *Appl Environ Microbiol* **62**: 625-630, 1996.
- Trouillet JL, Vuagnat A, Combes A, et al. Acute poststernotomy mediastinitis managed with debridement and closed-drainage aspiration: factors associated with death in the intensive care unit. *J Thorac Cardiovasc Surg* **129**: 518-524, 2005.
- Sofianou D, Pefoulidou M, Manolis EN, Sofianos E, Tsakris A. A fatal case of Ludwig's angina and mediastinitis caused by an unusual microorganism, *Gemella morbillorum*. *Scand J Infect Dis* **37**: 367-369, 2005.
- Savides TJ, Margolis D, Richman KM, Singh V. *Gemella morbillorum* mediastinitis and osteomyelitis following transesophageal endoscopic ultrasound-guided fine-needle aspiration of a posterior mediastinal lymph node. *Endoscopy* **39**: E123-E124, 2007.
- Young Ann J, Kwon JC, Eun Song J, et al. Sternal osteomyelitis with a mediastinal abscess caused by *Gemella morbillorum* following blunt force trauma. *Intern Med* **52**: 511-514, 2013.
- Youssef D, Youssef I, Marroush TS, Sharma M. *Gemella* endocarditis: a case report and a review of the literature. *Avicenna J Med* **9**: 164-168, 2019.
- Hikone M, Sakamoto N, Ota M, et al. The first case report of infective endocarditis caused by *Gemella taiwanensis*. *J Infect Chemother* **23**: 567-571, 2017.
- Shinha T. Endocarditis due to *Gemella morbillorum*. *Intern Med* **56**: 1751, 2017.
- Abu-Heija AA, Ajam M, Veltman J. *Gemella morbillorum* cryptogenic brain abscess: a case report and literature review. *Cureus* **10**: e3612, 2018.
- Desmottes MC, Brehier Q, Bertolini E, Monteiro I, Terreaux W. Septic arthritis of the knee due to *Gemella morbillorum*. *Int J Rheum Dis* **21**: 1146-1147, 2018.
- Borro P, Sumberaz A, Testino G. Pyogenic liver abscess caused by *Gemella morbillorum*. *Colomb Med* **45**: 81-84, 2014.
- Almuzara M, Barberis C, Velázquez VR, Ramirez MS, Famiglietti A, Vay C. Matrix-assisted laser desorption ionization-time-of-flight mass spectrometry (MALDI-TOF MS) as a reliable tool to identify species of catalase-negative gram-positive cocci not belonging to the *Streptococcus* genus. *Open Microbiol J* **10**: 202-208, 2016.
- Mikamo H, Arakawa S, Fujiwara M, et al. Anaerobic infections (General): epidemiology of anaerobic infections. *J Infect Chemother* **17**: 4-12, 2011.
- Shimura S, Watari H, Komatsu M, et al. Antimicrobial susceptibility surveillance of obligate anaerobic bacteria in the Kinki area. *J Infect Chemother* **25**: 837-844, 2019.
- Mikamo H, Arakawa S, Fujiwara M, et al. Appendix: drug-resistant anaerobes. *J Infect Chemother* **17**: 162-164, 2011.
- Bhattacharyya S, Darby RR, Raibagkar P, Gonzalez Castro LN, Berkowitz AL. Antibiotic-associated encephalopathy. *Neurology* **86**: 963-971, 2016.
- Tanner AC, Sonis AL, Lif Holgerson P, et al. White-spot lesions and gingivitis microbiotas in orthodontic patients. *J Dent Res* **91**: 853-858, 2012.
- Lockhart PB, Brennan MT, Thornhill M, et al. Poor oral hygiene as a risk factor for infective endocarditis-related bacteremia. *J Am Dent Assoc* **140**: 1238-1244, 2009.
- Woo PCY, Lau SKP, Fung AMY, Chiu SK, Yung RW, Yuen KY. *Gemella* bacteraemia characterised by 16S ribosomal RNA gene sequencing. *J Clin Pathol* **56**: 690-693, 2003.
- Rehman SM, Elzain O, Mitchell J, et al. Risk factors for mediastinitis following cardiac surgery: the importance of managing obesity. *J Hosp Infect* **88**: 96-102, 2014.
- Pastene B, Cassir N, Tankel J, et al. Mediastinitis in the intensive care unit patient: a narrative review. *Clin Microbiol Infect* **26**: 26-34, 2020.

The Internal Medicine is an Open Access journal distributed under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License. To view the details of this license, please visit (<https://creativecommons.org/licenses/by-nc-nd/4.0/>).