

## CASE REPORT

## PEER REVIEWED | OPEN ACCESS

# A case of rapidly progressive empyema caused by *Streptococcus anginosus* group bacteria in a young male patient

Sarah Wing-Yin Chiu, Julia Zefirova

## ABSTRACT

**Introduction:** The *Streptococcus anginosus* group bacteria (SAG; formerly *Streptococcus milleri*) are facultative anaerobes that rarely cause pneumonia but have been increasingly found in empyema. Several reports have suggested that patients with SAG empyema commonly have underlying comorbidities that include diabetes mellitus and malignancy. **Case Report:** A 30-year-old male with no past medical history presented with progressive shortness of breath and pleuritic chest pain despite recent treatment with azithromycin. Lung examination was significant for decreased tactile fremitus, decreased breath sounds, and egophony over the left lower lobe. Laboratories demonstrated leukocytosis with marked bandemia. Chest X-ray revealed marked opacification of the left hemithorax and CT chest showed left lung collapse and multiple loculations over the left lower lobe. Intravenous ceftriaxone and clindamycin were initiated, and two left chest tubes drained 2500 ml of pus; however, the patient had intermittent fevers. Thoracotomy was performed on day nine of admission, from which a repeat pleural fluid culture revealed *Streptococcus anginosus* that was sensitive to penicillin and resistant to clindamycin, erythromycin, and tetracycline. The

antibiotic therapy was changed to IV penicillin G, and the patient improved clinically with a resolved leukocytosis. **Conclusion:** This was a case of severe empyema in a young male with no underlying medical comorbidity. It is important to conduct appropriate tests to effectively treat the disease as bacteriology changes over time and antibiotic resistance is becoming more prevalent.

**Keywords:** Antibiotic choice, Empyema, *Streptococcus anginosus*, Thoracotomy

### How to cite this article

Chiu SWY, Zefirova J. A case of rapidly progressive empyema caused by *Streptococcus anginosus* group bacteria in a young male patient. J Case Rep Images Med 2018;4:1000047Z09SC2018.

Article ID: 1000047Z09SC2018

\*\*\*\*\*

doi: 10.5348/100047Z09SC2018CR

Sarah Wing-Yin Chiu<sup>1</sup>, Julia Zefirova<sup>2</sup>

**Affiliations:** <sup>1</sup>Medical Student, Frank H. Netter MD School of Medicine, Quinnipiac University, USA; <sup>2</sup>Fellow, Department of Infectious Diseases, University of Pittsburgh Medical Center, Pittsburgh, Pennsylvania, USA.

**Corresponding Author:** Sarah Wing-Yin Chiu, California, 94403 USA; Email: swchiu@quinnipiac.edu

Received: 17 August 2018

Accepted: 31 October 2018

Published: 22 November 2018

## INTRODUCTION

Pleural empyema is defined as bacterial infection of the pleural space that results in either pus or the presence of bacterial organisms on Gram stain. Pleural empyema can be an outcome of complicated parapneumonic effusions, frequently requiring invasive procedures such as thoracostomies and thoracotomies in addition to antibiotic therapy. The incidence of empyema is increasing worldwide and rises by 3% per year in the United States [1]. The reason is not known, though it is suspected that it may be due to the increasing number of patients living with chronic disease and risk factors (e.g. heart disease, diabetes, obesity, tobacco and alcohol

use), and increased identification and coding of pleural empyema [1]. Up to half of the four million patients who suffer from pneumonia each year will develop a parapneumonic effusion [2]. More than 65,000 patients suffer from pleural empyema each year in the United Kingdom and United States, with an estimated \$500 million US dollars in hospital costs [3].

The *Streptococcus anginosus* group bacteria (SAG; formerly known as *Streptococcus milleri*), consists of *Streptococcus anginosus*, *Streptococcus intermedius*, and *Streptococcus constellatus*. These three microorganisms were ultimately distinguished via advanced technology by DNA homology, polypeptide patterns of whole cells, and phenotypic characteristics [4]. SAG are facultative anaerobes, Gram-positive, catalase-negative cocci, and exhibit variable hemolysis patterns. They are part of the normal flora in the oral cavity and gastrointestinal tract but have been documented to cause a variety of infections including dental abscesses, central nervous system abscesses (epidural and subdural spaces), thoracic infections (pneumonia, empyema, mediastinitis), and abdominal infections (liver abscess, cholangitis, subphrenic abscess, peritonitis) [5–7]. Several reports have suggested that patients with SAG empyema commonly have underlying comorbidities that include diabetes mellitus and malignancy [8–9]. This report presents a case of severe empyema in a young male with no underlying medical comorbidity.

## CASE REPORT

A 30-year-old male without prior medical history was admitted to the hospital for increasing shortness of breath and pleuritic chest pain. The patient was treated with oral azithromycin for community-acquired pneumonia diagnosed by chest X-ray showing a left lower lobe infiltrate a week prior (Figure 1). Social history was significant for smoking tobacco and polysubstance use. Review of systems was positive for chills, cough, and diaphoresis.

On initial assessment, the patient had a heart rate of 112 beats per minute, blood pressure of 123 mmHg/79 mmHg, respiratory rate of 16 breaths per minute, temperature of 98.0°F, and borderline hypoxia of 92% oxygen on room air. On physical examination, the patient was in no acute distress and spoke in full sentences, but appeared diaphoretic. Oral cavity examination revealed poor dentition with tooth decay. There was no cervical, supraclavicular, or infraclavicular lymphadenopathy on palpation. Cardiovascular examination was significant for tachycardia but demonstrated no murmurs, rubs, or gallops. Lung examination was significant for absent breath sounds, decreased tactile fremitus, and egophony over the left lower lobe in addition to mild crackles over the right lower lobe. Laboratories revealed a white blood count (WBC) of 27,500 cells/uL with 16% bandemia. Laboratory values are shown in Tables 1–3. His urine

toxicology results were positive for cocaine, opiates, tetrahydrocannabinol, and phencyclidine. Chest X-ray showed opacification of the left hemithorax (Figure 2), and computed tomography revealed left lung collapse with a large, multiloculated left pleural effusion (Figure 3). On day one, two left chest tubes were placed which evacuated a total of 2500 ml of frank pus. Gram stain of the fluid showed Gram-positive cocci in chains. Pleural fluid culture grew *Gemella morbillorum* and revealed glucose of 92 mg/dL, pH 7.3, protein less than 3.0 g/dL, WBC 18,000 cells/uL with 72% neutrophils, and lactate dehydrogenase of 719 U/L. Blood cultures remained negative.

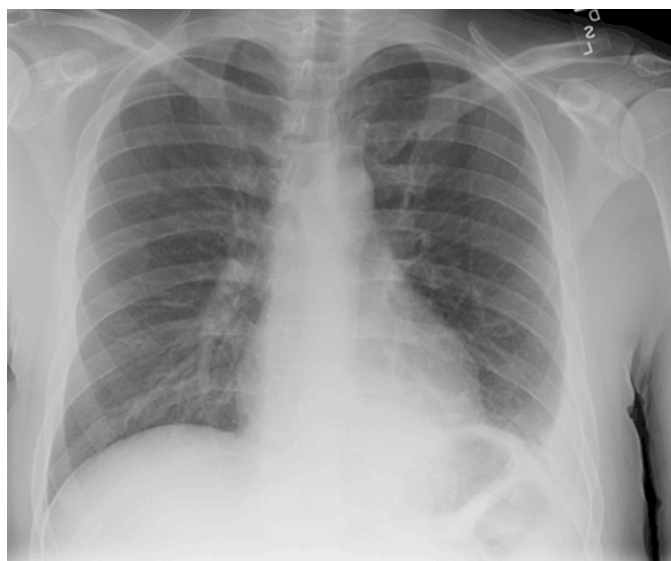


Figure 1: Chest X-ray one week prior to admission: Left lower lobe infiltrate and possible small left effusion suggesting pneumonia.



Figure 2: Chest X-ray on admission: Marked opacification of left hemithorax. There is collapse of much of the left lung with possible multiloculated pleural effusions and a left apical hydropneumothorax.

Table 1: Basic metabolic profile, lactic acid, and LDH on admission

	Reference Range and Units	Value
Sodium	136-145 mEq/L	132
Potassium	3.5-5.1 mEq/L	4.2
Chloride	98-107 mEq/L	97
Carbon dioxide	21-32 mmol/L	25
Anion Gap	5-14 mEq/L	10
Glucose	70-105 mg/dL	129
BUN	7-25 mg/dL	30
Creatinine	0.7-1.3 mg/dL	1.2
Calcium	8.6-10.3 mg/dL	7.8
Estimated GFR	ml/min/1.73 m <sup>2</sup>	>60
BUN/Cr Ratio	12-20	25
Lactic acid	0.5-2.0 mmol/L	1.7
Serum LDH	140-271 U/L	94

Abbreviations: BUN=blood urea nitrogen; Cr=creatinine; GFR=glomerular filtration rate; LDH=lactate dehydrogenase.

Table 2: Complete blood count with differential during hospital course

	Reference Range	D1	D3	D4	D5	D7	D8	D9	D10	D11	D13	D15	D18	D19	D20
WBC	4.0-10.5 k/uL	27.5	24.8	23.1	31.4	24.7	32.3	31.3	33.9	23.9	13.2	8.6	6.9	7.4	9.2
Hb	13.5-18.0 g/dL	11.1	10.3	10.5	11.3	10.6	10.9	10	8.4	8	7.9	7.2	7.1	7.5	7.8
Hct	40-54%	33.5	32.1	32	35.6	33	34	30.3	24.9	23.8	24.4	22	21.4	22.8	23.4
Plt	150-450 k/uL	239	250	245	327	352	371	328	288	315	361	339	299	297	316
SegNeut	25-62%	68	70	76	71	64	68	77	84	85	75	67	60	n/a	76
Bas	0-2%	0	0	0	0	0	0	0	0	0	0	0	1	n/a	1
Eos	0-6%	0	0	1	1	1	3	0	0	0	1	1	1	n/a	0
Lymph	20-48%	2	3	10	17	11	15	13	6	8	17	23	30	n/a	18
Mono	2-12%	13	9	2	11	14	3	6	4	7	7	9	9	n/a	6
Abs Neut	1.8-7.8 k/uL	18.7	17.4	17.6	22.3	15.8	22	24.1	28.5	20.2	9.9	5.7	4.1	n/a	7

Abbreviations: D=day; WBC=white blood count; Hb=hemoglobin; Hct=hematocrit; Plt=platelet count; Seg Neut=segmented neutrophils; Bas=basophils; Eos=eosinophils; Lymph=lymphocytes; Mono=monocytes; Abs Neut=absolute neutrophils

Table 3: Liver profile

	Reference Range and Units	D2	D4	D5	D8	D11
Albumin	3.5-5.0 g/dL	2.5	2	2	2.1	1.7
Total bilirubin	0.3-1.0 mg/dL	2.4	2.3	1.6	1.1	0.6
Direct bilirubin	0.0-0.2 mg/dL	1.8	n/a	0.9	n/a	0.3
ALP	34-104 U/L	65	101	126	106	96
AST	13-39 U/L	8	34	49	23	24
ALT	7-52 U/L	11	24	40	35	22
Total protein	6.0-8.3 g/dL	5.7	5	5.3	6	5
Globulin	g/dL	3.2	3	3.3	3.9	3.3
Alb/Glob ratio	1.0-1.7	0.8	0.7	0.6	0.5	0.5

Abbreviations: ALP=alkaline phosphatase; AST=aspartate transaminase; ALT=alanine transaminase; Alb=albumin; Glob=globulin



Figure 3: Computed tomography of chest without intravenous contrast on day one: Collapse of much of the left lung with a minimal amount of aerated lung along the periphery of the left hemithorax. Large multiloculated left pleural effusion with apical hydropneumothoraces. This may represent a postinfectious process. There is associated mediastinal shift to the right. Small right pleural effusion and posterior right lower lobe atelectasis. Minimally prominent mediastinal lymph nodes, possibly reactive.

## Hospital Course and Treatment

The patient was initially treated with ceftriaxone and clindamycin in addition to serial thoracostomies with local tissue plasminogen activator administration. However, adequate drainage of multiple loculations was still not achieved (Figures 4–5). The patient had persistent leukocytosis and intermittent fevers, thus requiring thoracotomy nine days after admission. Pleural culture obtained during the procedure revealed *Streptococcus anginosus* sensitive to penicillin and resistant to clindamycin, erythromycin, and tetracycline. The patient's antibiotic course was changed to intravenous penicillin G (Table 4). After surgery, the patient felt better and the leukocytosis resolved to a WBC of 6,900 cells/uL eight days post-thoracotomy (Figure 6). On day 20, he was discharged home on oral penicillin with instructions to take 500 mg every eight hours for eight weeks. The patient did not follow up with us as an outpatient.

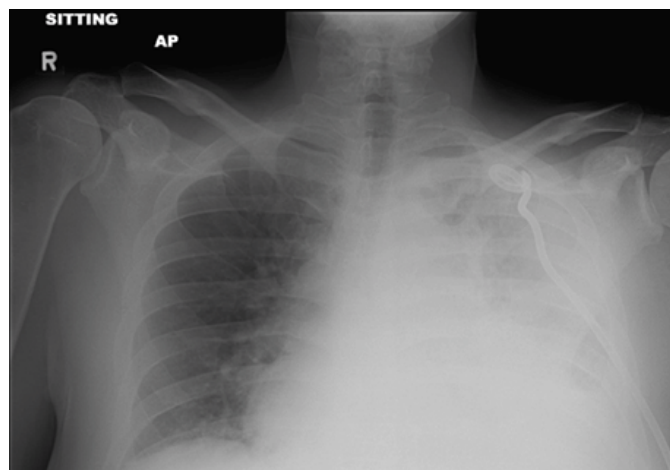


Figure 4: Chest X-ray showing increased opacification of left hemithorax post-thoracostomy on day three: Mild cardiomegaly. Two pigtail chest tubes overlie the hemithorax, one at the apex, and one inferiorly at the lateral costophrenic sulcus. There is opacification of the intervening left hemithorax, which may be on the basis of infiltrate or pleural fluid. The right lung is clear. There is no pneumothorax on either side.

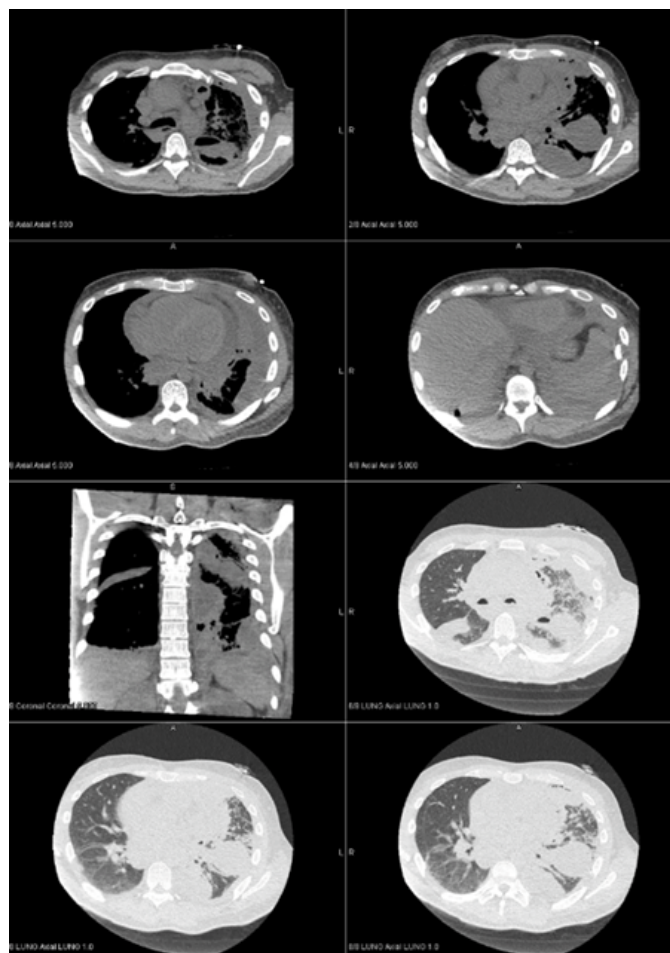


Figure 5: Computed tomography of chest without contrast on day five: Dense left lower lobe consolidation, slight improvement compared to prior CT chest imaging. Mild right base subsegmental consolidation. Two left chest tubes, interval decrease in the multiloculated left effusion, residual pleural thickening. Moderate right pleural effusion with interval increase.

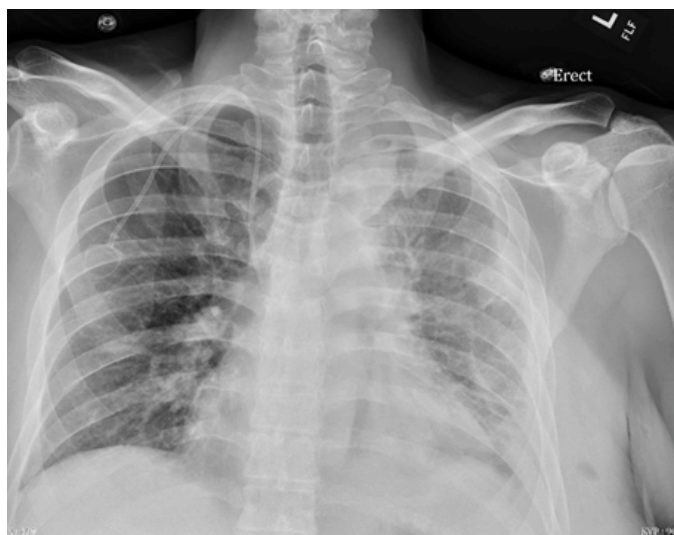


Figure 6: Chest X-ray on day 18: Mild cardiomegaly. There is mildly improved aeration of the lungs from prior exam and the diffuse left lung infiltrate appears mildly less prominent. Blunting of the left costophrenic angle suggesting a small left pleural effusion, without significant change. No pneumothorax identified. Interval removal of left chest tubes. There is a new right chest port with tip projecting over the superior vena cava.

Table 4: Antibiotic course

Antibiotic	Days of administration
Vancomycin	Days 1 and 8
Clindamycin	Days 1 through 9
Ceftriaxone	Days 1 through 7
Cefuroxime	Days 8 through 10
Penicillin G	Days 10 through 20

## DISCUSSION

This relatively young patient was ultimately found to have rapidly progressive empyema caused by *Streptococcus anginosus*, a pathogen not commonly known to cause empyema in the United States. In such a patient who did not improve on empiric antibiotic therapy, it is important to order appropriate diagnostic tests such as pleural fluid cultures, Gram stain, and antimicrobial susceptibility testing to identify the pathogen which will guide treatment. The empiric antibiotic therapy for this patient included clindamycin since aspiration pneumonia was considered as a possible cause in light of his risk factors (i.e. polysubstance use); however, it was found that this strain of *Streptococcus anginosus* was resistant to clindamycin. Previous case studies have reported that SAG are susceptible to penicillin, and that these cases of empyema typically require thoracotomies for complete resolution [10].

Pleural infection rates in adults has increased by 3% per year in adults in the last two decades [1]. In developing countries, empyema represents a major health problem as delay in treatment is common. The prevalence of HIV/AIDS, the widespread use of immunosuppressants

and organ transplantation, and the increasing age of population mean that empyema will remain a common and significant illness [11]. Studies from the UK, Canada, Scandinavia and New Zealand all revealed SAG as the most common isolate accounting for 30-50% of adult cases of community-acquired empyema [12-14].

The bacteriology of pleural infection and antimicrobial susceptibility change over time. The most common causes of empyema are *Streptococcus pneumoniae*, *Streptococcus pyogenes*, and *Staphylococcus aureus*; however, SAG are gaining importance as causative organisms [2]. They are known to form abscesses, be rapidly progressive, and demonstrate synergy with oral anaerobes in causing pleural infection [15]. For instance, it is known that anaerobes impair the function of polymorphonuclear leukocytes (PMNL) in the host [4]. In a study comparing the interaction between human PMNL and SAG, it was found that even after being ingested by PMNL, the SAG were killed at only a rate of 3% of that of *Staphylococcus aureus*. Therefore, SAG are highly resistant to phagocytosis by PMNL, yet the mechanism is still unclear [16]. Due to the lack of reliable in vivo models, the pathophysiology of pleural empyema has yet to be elucidated.

Of note, the bacterial etiology of empyema is not necessarily similar to that of pneumonia; thus, pleural infection requires different treatment [17]. The varied microbial etiology is likely due to the acidic and hypoxic environment of the pleural space in contrast to the high oxygen tension in the lung parenchyma.

The microbial causes of empyema vary by geographic location, source of infection (community vs. nosocomial), and host type (pediatric vs. adult, immunocompetent vs. immunocompromised). Most studies lack detailed characterization, for instance serotyping, of bacteria to identify the cause of empyema. In our case, *Gemella morbillorum*—also a Gram-positive, catalase-negative coccus and facultative anaerobe—was the initial report before the thoracotomy. Our microbiology laboratory reported that there was an 86% probability that this could be a different microorganism. *Gemella morbillorum* is known to cause endocarditis, especially of native valves, septic arthritis, and meningitis [18]. According to the literature, there are only 14 cases of pleural empyema being caused by this microorganism; these patients had predisposing factors such as poor oral hygiene, smoking history, cardiovascular or respiratory disease, drug abuse, alcohol abuse, or malignancies [19]. The most recent case report identified *Gemella morbillorum* as the cause of pleural empyema via diagnosis with 16S ribosomal RNA gene sequencing [19]. Nevertheless, more studies on this diagnostic technique is required before confirming the true microbiological cause of empyema as *Gemella* species can be frequently mistaken as *Streptococcus* species.

Another possibility is mixed infection with other anaerobic bacteria: it is known that SAG bacteria cohabit with other anaerobes of oral origin such as the

*Peptostreptococcus*, *Prevotella*, or *Fusobacterium* species and may demonstrate synergy [15]. However, as noted previously, current diagnostic techniques are limited. For instance, up to 40% of empyema fluid fails to reveal microorganisms by conventional culture [17]. Moreover, the lack of in vivo models is a large contributor to our limited understanding of the pathological causes of empyema [2]. Hence, more research into comprehensive identification of the pathogens that cause severe infections such as empyema is needed.

## CONCLUSION

Successful management of empyema includes appropriate antibiotic treatment, pleural fluid culture, antimicrobial susceptibility testing, and thoracostomy or thoracotomy to decrease mortality risk. More research into accurate and comprehensive diagnostic techniques is needed in order to appropriately treat this severe disease with significant morbidity and mortality. Fortunately, both SAG and *Gemella* species are known to be susceptible to penicillin.

## REFERENCES

1. Farjah F, Symons RG, Krishnadasan B, Wood DE, Flum DR. Management of pleural space infections: A population-based analysis. *J Thorac Cardiovasc Surg* 2007 Feb;133(2):346–51.
2. Lisboa T, Waterer GW, Lee YC. Pleural infection: Changing bacteriology and its implications. *Respirology* 2011 May;16(4):598–603.
3. Colice GL, Curtis A, Deslauriers J, et al. Medical and surgical treatment of parapneumonic effusions: An evidence-based guideline. *Chest* 2000 Oct;118(4):1158–71.
4. Shinzato T, Saito A. The *Streptococcus milleri* group as a cause of pulmonary infections. *Clin Infect Dis* 1995 Dec;21 Suppl 3:S238–43.
5. Giuliano S, Rubini G, Conte A, et al. *Streptococcus anginosus* group disseminated infection: Case report and review of literature. *Infez Med* 2012 Sep;20(3):145–54.
6. Noguchi S, Yatera K, Kawanami T, et al. The clinical features of respiratory infections caused by the *Streptococcus anginosus* group. *BMC Pulm Med* 2015 Oct 26;15:133.
7. Kobo O, Nikola S, Geffen Y, Paul M. The pyogenic potential of the different *Streptococcus anginosus* group bacterial species: Retrospective cohort study. *Epidemiol Infect* 2017 Oct;145(14):3065–9.
8. Kobashi Y, Mouri K, Yagi S, Obase Y, Oka M. Clinical analysis of cases of empyema due to *Streptococcus milleri* group. *Jpn J Infect Dis* 2008 Nov;61(6):484–6.
9. Jerng JS, Hsueh PR, Teng LJ, Lee LN, Yang PC, Luh KT. Empyema thoracis and lung abscess caused by viridans streptococci. *Am J Respir Crit Care Med* 1997 Nov;156(5):1508–14.

10. Porta G, Rodríguez-Carballeira M, Gómez L, et al. Thoracic infection caused by *Streptococcus milleri*. *Eur Respir J* 1998 Aug;12(2):357–62.
11. Brims FJ, Lansley SM, Waterer GW, Lee YC. Empyema thoracis: New insights into an old disease. *Eur Respir Rev* 2010 Sep;19(117):220–8.
12. Maskell NA, Davies CW, Nunn AJ, et al. U.K. Controlled trial of intrapleural streptokinase for pleural infection. *N Engl J Med* 2005 Mar 3;352(9):865–74.
13. Ahmed RA, Marrie TJ, Huang JQ. Thoracic empyema in patients with community-acquired pneumonia. *Am J Med* 2006 Oct;119(10):877–83.
14. Lindstrom ST, Kolbe J. Community acquired parapneumonic thoracic empyema: Predictors of outcome. *Respirology* 1999 Jun;4(2):173–9.
15. Shinzato T, Saito A. A mechanism of pathogenicity of “*Streptococcus milleri* group” in pulmonary infection: Synergy with an anaerobe. *J Med Microbiol* 1994 Feb;40(2):118–23.
16. Wanahita A, Goldsmith EA, Musher DM, et al. Interaction between human polymorphonuclear leukocytes and *Streptococcus milleri* group bacteria. *J Infect Dis* 2002 Jan 1;185(1):85–90.
17. Maskell NA, Batt S, Hedley EL, Davies CW, Gillespie SH, Davies RJ. The bacteriology of pleural infection by genetic and standard methods and its mortality significance. *Am J Respir Crit Care Med* 2006 Oct 1;174(7):817–23.
18. Senent C, Sancho JN, Chiner E, Signes-Costa J, Camarasa A, Andreu AL. Pleural empyema caused by *Gemella* species: A rare condition. [Article in Spanish]. *Arch Bronconeumol* 2008 Oct;44(10):574–7.
19. Yamakawa H, Hayashi M, Tanaka K, Kuwano K. Empyema due to *Gemella morbillorum* Is Diagnosed by 16S Ribosomal RNA Gene Sequencing and a Phylogenetic Tree Analysis: A Case Report and Literature Review. *Intern Med* 2015;54(17):2231–4.

\*\*\*\*\*

## Acknowledgements

We thank Dr. Diana Nurutdinova, MD for her insight and feedback in the writing of the manuscript. Thanks to Dr. Brittney Latouf, MD who provided additional patient information for the contribution of this case report. The abstract of this patient case was presented at the national American College of Physicians Internal Medicine Meeting of 2018.

## Author Contributions

Sarah Wing-Yin Chiu – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published  
Julia Zefirova – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published

**Guarantor of Submission**

The corresponding author is the guarantor of submission.

**Source of Support**

None.

**Consent Statement**

Written informed consent was unable to be obtained as the patient was lost to follow up. However, the manuscript has been written to include only the necessary information to maintain patient anonymity.

**Conflict of Interest**

Authors declare no conflict of interest.

**Data Availability**

All relevant data are within the paper and its Supporting Information files.

**Copyright**

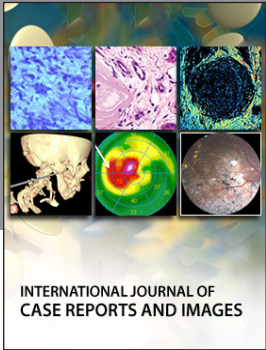
© 2018 Sarah Wing-Yin Chiu et al. This article is distributed under the terms of Creative Commons Attribution License which permits unrestricted use, distribution and reproduction in any medium provided the original author(s) and original publisher are properly credited. Please see the copyright policy on the journal website for more information.

Access full text article on  
other devices



Access PDF of article on  
other devices





INTERNATIONAL JOURNAL OF  
CASE REPORTS AND IMAGES



VIDEO JOURNAL OF  
CLINICAL RESEARCH



VIDEO JOURNAL OF  
BIOMEDICAL SCIENCE



INTERNATIONAL JOURNAL OF  
HEPATOBIILIARY AND  
PANCREATIC DISEASES



INTERNATIONAL JOURNAL OF  
BLOOD TRANSFUSION AND  
IMMUNOHEMATOLOGY



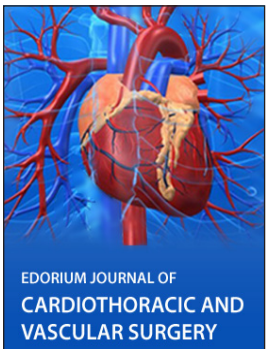
EDORIUM JOURNAL OF  
OPHTHALMOLOGY



**Submit your manuscripts at**  
[www.edoriumjournals.com](http://www.edoriumjournals.com)



EDORIUM JOURNAL OF  
MEDICINE



EDORIUM JOURNAL OF  
CARDIOTHORACIC AND  
VASCULAR SURGERY



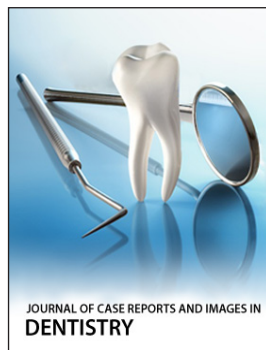
JOURNAL OF CASE REPORTS  
AND IMAGES IN ORTHOPEDICS  
AND RHEUMATOLOGY



EDORIUM JOURNAL OF  
PSYCHOLOGY



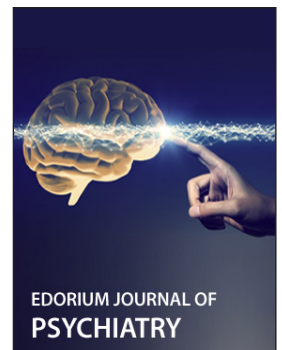
EDORIUM JOURNAL OF  
CELL BIOLOGY



JOURNAL OF CASE REPORTS AND IMAGES IN  
DENTISTRY



EDORIUM JOURNAL OF  
CANCER



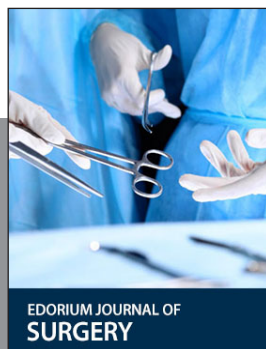
EDORIUM JOURNAL OF  
PSYCHIATRY



JOURNAL OF CASE REPORTS AND  
IMAGES IN INFECTIOUS DISEASES



EDORIUM JOURNAL OF  
ANATOMY AND EMBRYOLOGY



EDORIUM JOURNAL OF  
SURGERY



JOURNAL OF CASE REPORTS  
AND IMAGES IN PATHOLOGY



EDORIUM JOURNAL OF  
ANESTHESIA