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Case Report

***Bordetella bronchiseptica* empyema in patient with chronic alcohol use disorder**James Williams III^{*}, Andrew Chao, Joshua Fakess, Adonis Imam

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A B S T R A C T

Bordetella bronchiseptica is a veterinary pathogen that is rarely isolated in immunocompetent humans, and few cases have been recorded where alcoholism is the primary compromising factor. Furthermore, patients who contracted this pathogen have not been recorded developing a lung empyema that requires thoracic intervention. We present a case of a woman with chronic alcohol use disorder who contracted *Bordetella bronchiseptica* that required a prolonged course of antibiotics and thoracostomy tube placement.

1. Introduction

Bordetella bronchiseptica has rarely been isolated from humans despite their considerable exposure to animal sources, and the organism is rarely associated with human infection. In cases where this microorganism was found as a probable pathogen, most infections have been respiratory tract in origin and have occurred in severely immunocompromised hosts [13]. We report a case where a patient with a history of chronic alcoholism contracted *B. bronchiseptica* as a lower respiratory infection complicated by a loculated pleural empyema requiring prolonged courses of antibiotics and thoracostomy tube placement. Since there are no randomized clinical trials or guidelines regarding human treatment of this organism, the purpose of this report is to present our distinct clinical case presentation, diagnostic workup, and treatment course.

2. Case report

A 64-year-old Caucasian woman with a past medical history of chronic alcohol abuse disorder and recent poor oral intake presented for altered mental status. Initial labs were notable for a sodium 107 and a white blood cell count of 17.7. She was admitted for severe symptomatic hypovolemic hyponatremia which improved with one bolus of hypertonic saline and tube feeds. Initial chest x-ray (Fig. 1) showed no signs of consolidation. However, over the next 36 hours, she developed acute hypoxemic and hypercapnic respiratory failure, requiring intubation. Left subclavian central venous line was attempted and was complicated by left sided pneumothorax (Fig. 2). Considering this image and patient's clinical presentation, aspiration pneumonitis was considered. Her interval chest x-ray later showed a worsening right middle and lower lobe consolidation (Fig. 3), concerning for pneumonia. She treated with Ceftriaxone and Azithromycin and later escalated to Vancomycin and Cefepime for empiric treatment of community and hospital associated pneumonia, respectively. She failed to improve clinically on both courses. Over the next 5 days, she developed a large loculated right sided pleural effusion demonstrated on chest CT and x-ray (Fig. 4). Pulmonology obtained a bronchoalveolar lavage that grew >100,000 CFU of *Bordetella bronchiseptica*, and she was placed on droplet precautions. Due to high coinfection rates in the literature, she was tested for HIV and COVID-19 which were both negative. Of note, the patient endorsed having two dogs and a cat that lives indoors. The patient underwent ultrasound guided thoracentesis with thoracostomy tube placement for drainage. The pleural

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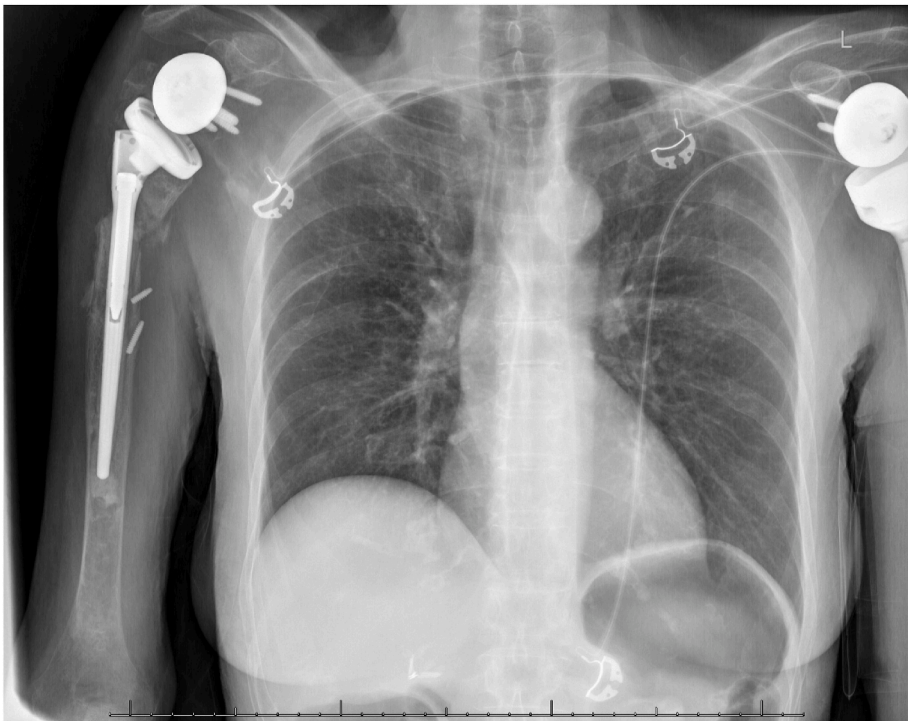


Fig. 1. Day 1 chest x-ray on admission.
Impression: No consolidation, no pneumothorax. Prominent perihilar lung markings bilaterally.

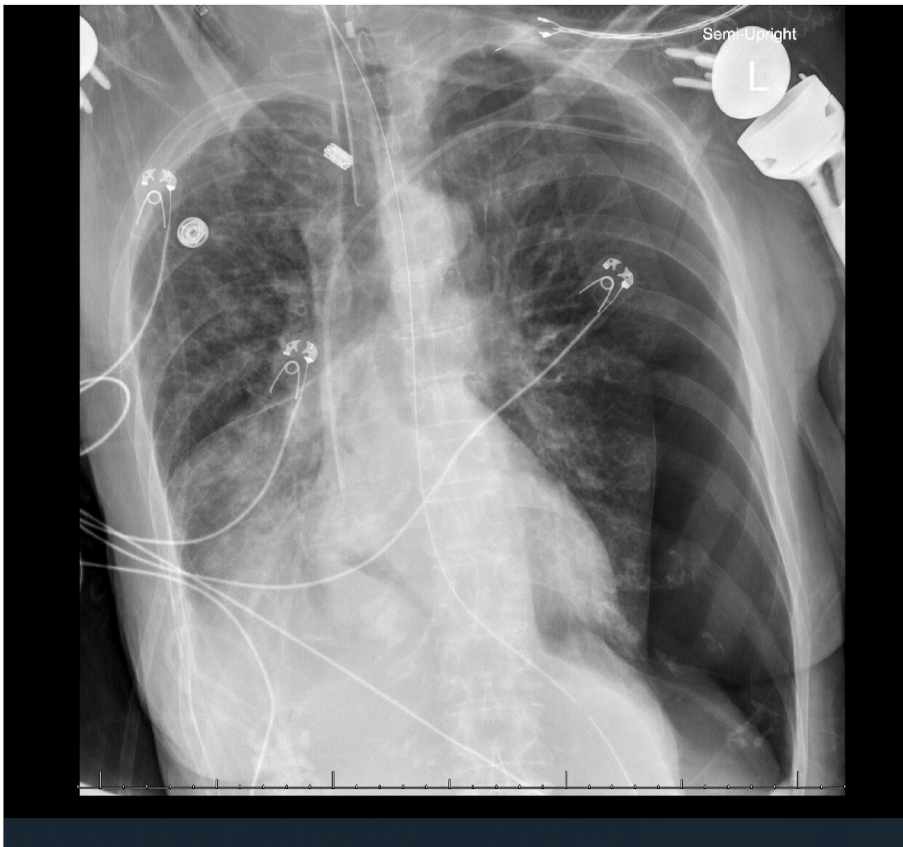


Fig. 2. Day 3 chest x-ray.
Impression: Interval development of large left tension pneumothorax post attempted left sided central venous line placement. Interval development of right lower lobe consolidation.



Fig. 3. Day 8 chest x-ray.
Impression: Worsening right lower lobe consolidation and development of right pleural effusion. Resolution of left sided pneumothorax.

fluid's LDH was 1,389, total protein was 3.5, and fluid culture grew *B. bronchiseptica*, confirming the diagnosis of empyema based on Light's criteria [6]. Her hospitalization course improved with a 10-day course of piperacillin-tazobactam, thoracostomy tube drainage, and alteplase/dornase alfa infusions for fibrinolysis of the loculations (Figs. 5 and 6). She was discharged on a 4-week course of Augmentin with follow up with the Infectious Disease clinic. At the follow up visit, the patient's respiratory symptoms were completely resolved, and her repeat chest x-ray (Fig. 7) showed complete resolution of pulmonary consolidations and empyema.

3. Discussion

The presentation of our patient's *Bordetella bronchiseptica* empyema was unexpected and subtle given the original reason for admission for acute metabolic encephalopathy. It was initially believed that the patient could have aspirated but was placed on empiric antibiotics given acute illness and chest imaging. This case was a challenge to achieve clinical improvement of the pneumonia and loculated empyema. The patient failed empiric antibiotic therapy for community and hospital acquired pneumonia. As there are currently no standardized guidelines to treat *B. bronchiseptica*, we relied heavily on review of the literature to guide antibiotic treatment. A previous retrospective study described in-vitro antibiotic susceptibilities and demonstrated that the most active agents against their *B. bronchiseptica* isolates were piperacillin and tetracycline [8]. A more recent retrospective antibiotic susceptibility study demonstrated antibiotics with the lowest minimum inhibitory concentration of 90% (MIC90) of isolates were tigecycline, minocycline, doxycycline, and meropenem, whereas the highest MIC90 were β -lactams, cephalosporins, macrolides, ketolides, and trimethoprim-sulfamethoxazole [4]. Unfortunately, our patient's bronchoalveolar lavage and pleural cultures were either inviable or had inadequate growth to permit susceptibility testing. We achieved clinical improvement in this patient once she was switched to piperacillin-tazobactam and received pulmonary interventions for her loculated empyema. We followed recommendations from the American Association of Thoracic Surgery (AATS) guidelines for empyema diagnosis and management which included frequent imaging, thoracostomy tube drainage, pleural fluid culture and staining, and fibrinolytic therapy for recurrent pleural effusions with loculations in non-surgical candidates. There are currently no standardized clinical trials regarding duration of antibiotic treatment for pleural empyema. The AATS suggested a range of 2–6 weeks of antibacterial therapy for acute empyema with an added minimum of 2 weeks from the time of drainage and defervescence [12]. We discharged this patient on 4-week course of amoxicillin-clavulanic acid with an Infectious Disease clinic appointment to monitor clinical response. Fortunately, patient was able to achieve resolution of respiratory symptoms and right empyema (Fig. 7).

Alcoholism is an ongoing national healthcare crisis with reported 15 million people ages 12 and older meeting criteria for Alcohol Use Disorder according to the 2019 National Survey on Drug Use and Health [10]. Recently, there have been several reported human cases of *B. bronchiseptica* infections with risk factors including COVID-19, HIV, lung malignancy and decompensated liver cirrhosis; however, we only found 2 previous case reports of *B. bronchiseptica* infections with the primary immunocompromising risk factor being related to alcohol use [3,5,9,11,13]. Additionally, a recent case report describes a pig farmer that contracted *B. bronchiseptica* [2].

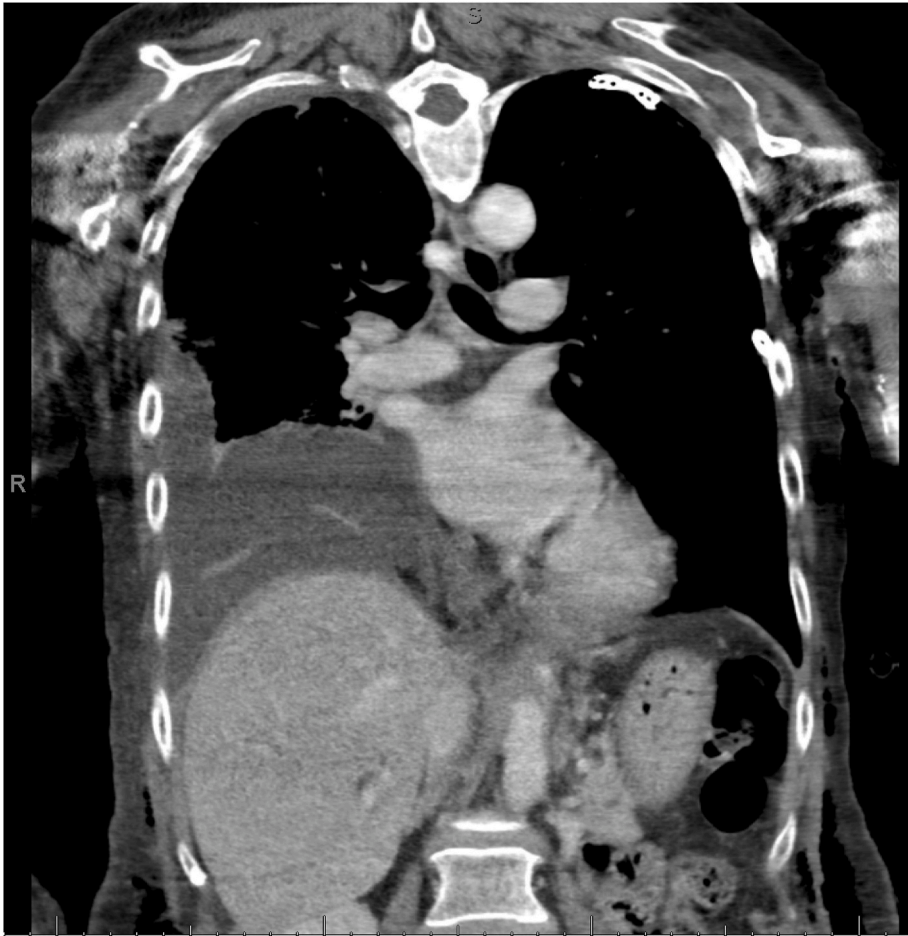


Fig. 4. Day 8 CT Chest with IV contrast.
Impression: Large loculated right pleural effusion primarily collecting at the right lung base and along the right lateral periphery.

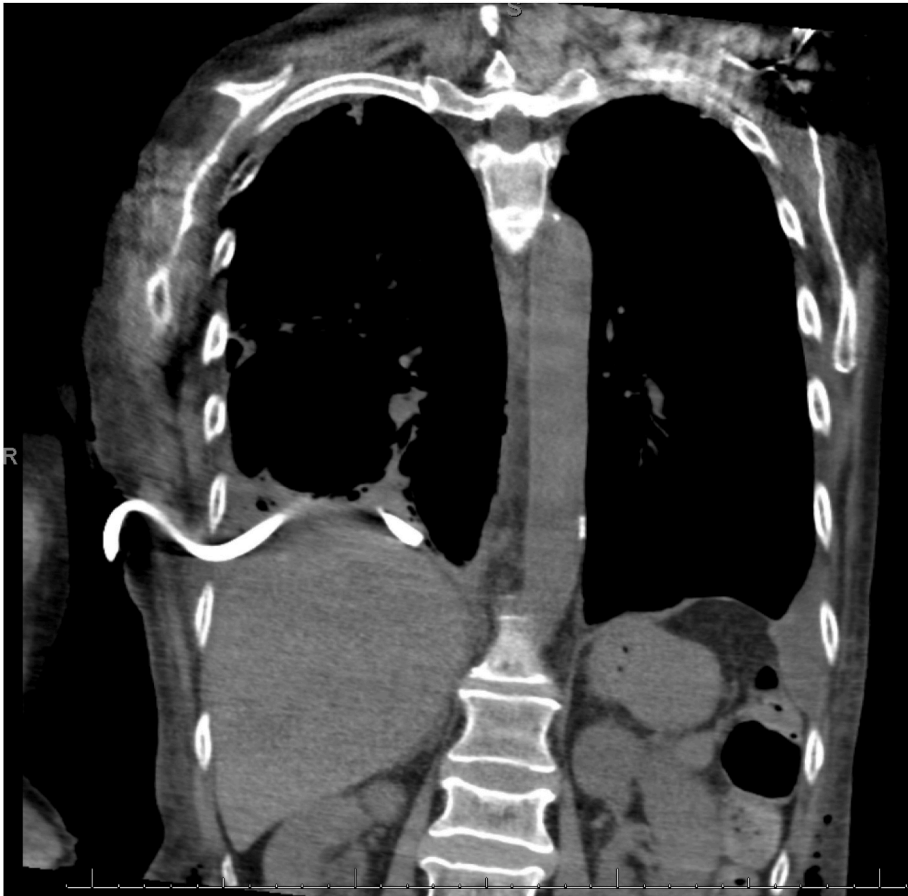


Fig. 5. Day 12 CT Chest with IV Contrast.

Impression: Interval placement of right sided chest tube with significant decrease in loculated right pleural effusion with small residual effusion in the right lung base.

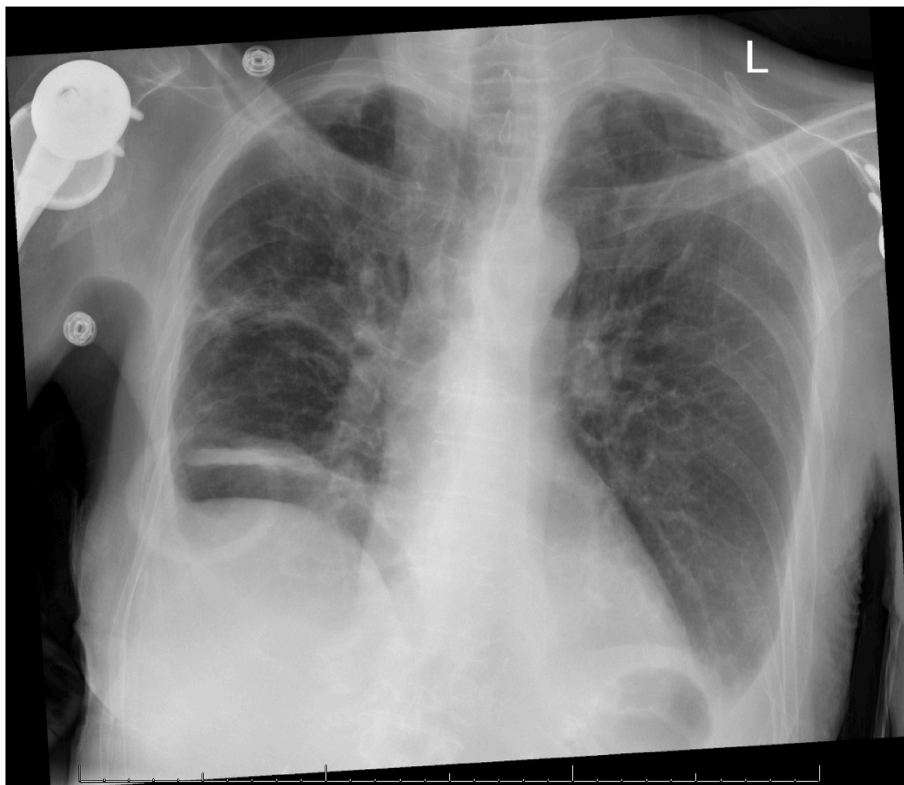


Fig. 6. Day 20 final chest x-ray prior to discharge.

Impression: Resolution of left and right sided pneumothorax. Resolution of right sided empyema. No new consolidations. Linear atelectasis versus scarring in the right mid and lower lung.

Although our patient was COVID-19 and HIV negative without signs of liver injury, her history of chronic alcoholism and animal exposure could have played a role in the severity of her respiratory infection. Acute and chronic alcoholism has been shown to impair both adaptive and innate human immunity and increases risk of morbidity and mortality in patients with respiratory distress [1]. Furthermore, a multicenter prospective study concluded that chronic alcohol abuse is an independent risk factor for acute respiratory distress syndrome, and it is also associated with an increased duration of mechanical ventilation and prolonged intensive care unit length of stay [7]. As alcoholism is a growing national healthcare issue, clinicians should be keenly aware of this pertinent past medical history and the increased risk of adverse pulmonary outcomes associated with it.

Due to lack of susceptibility testing of our isolate and standardized clinical guidelines to base our treatment choices or duration, we made our medical decisions with clinical improvement as our primary outcome. Our patient could have been at an increased risk for this rare infection and complication given her acute illness, pet exposure, and her chronic alcoholism. This case illustrates the need for continued reporting of clinical data regarding *B. bronchiseptica* and demands further clinical investigations that standardizes the treatment of this disease in humans.

4. Conclusion

- *Bordetella bronchiseptica* is a rare respiratory pathogen that can infect humans without labs suggestive of immunocompromise.
- Clinicians should be aware of acute and chronic alcoholism's association with increased risk of severe adverse pulmonary outcomes and acute/chronic immunologic impairment.
- Continued clinical reporting and investigation that standardizes the treatment of this disease in humans is need for the future.

Declaration of competing interest

The authors declare that they have no known conflict of interests, competing financial interests, or personal relationships that could influence the work reported in this paper.

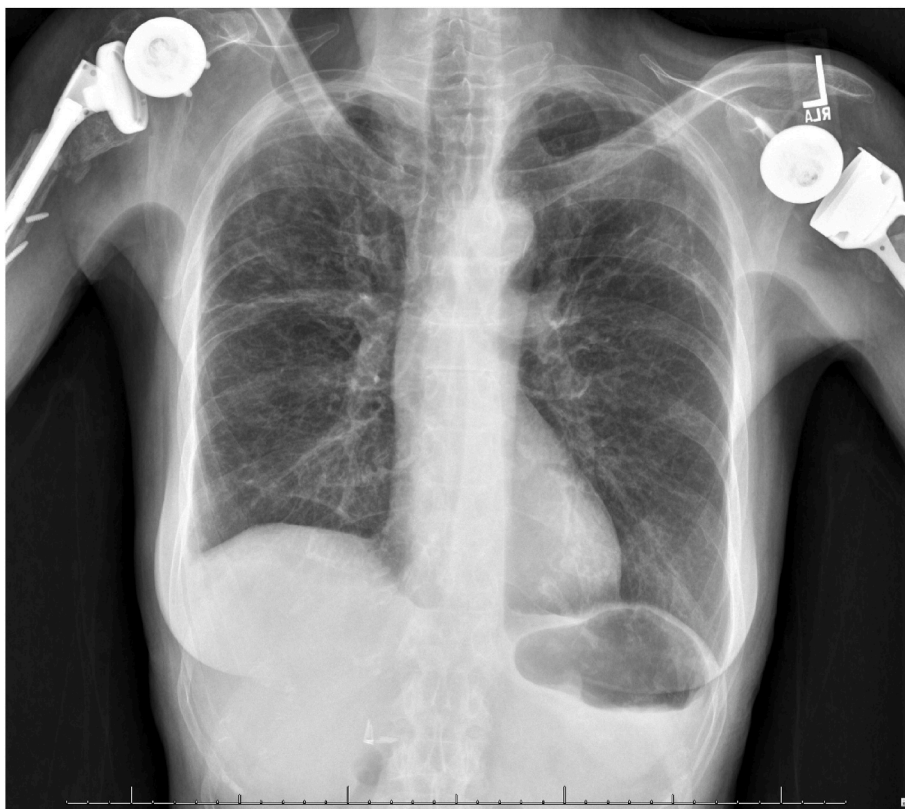


Fig. 7. Day 78 Ambulatory post-antibiotic chest x-ray.
Impression: No focal consolidation or pneumothorax. Resolution of previous right empyema.

References

- [1] M. Afshar, S. Richards, D. Mann, A. Cross, G.B. Smith, G. Netzer, E. Kovacs, J. Hasday, Acute immunomodulatory effects of binge alcohol ingestion, *Alcohol* 49 (1) (2015 Feb) 57–64, <https://doi.org/10.1016/j.alcohol.2014.10.002>. Epub 2014 Dec 5. PMID: 25572859; PMCID: PMC4314366.
- [2] J.M. Barcala Salido, J. Mora-Delgado, C. Lojo-Cruz, Bordetella bronchiseptica pneumonia in an immunocompetent pig farmer, *IDCases* 27 (2022), e01435, <https://doi.org/10.1016/j.idcr.2022.e01435>.
- [3] K.H. Chan, S.O. Ajao, I. Farouji, J. Slim, A case of bordetella bronchiseptica Bacteremia in a patient with decompensated liver cirrhosis, *Cureus* 13 (3) (2021), e13938, <https://doi.org/10.7759/cureus.13938>.
- [4] C. García-de-la-Fuente, L. Guzmán, M.E. Cano, J. Agüero, C. Sanjuán, C. Rodríguez, A. Aguirre, L. Martínez-Martínez, Microbiological and clinical aspects of respiratory infections associated with Bordetella bronchiseptica, *Diagn. Microbiol. Infect. Dis.* 82 (1) (2015 May) 20–25, <https://doi.org/10.1016/j.diagmicrobio.2015.01.011>. Epub 2015 Feb 2. PMID: 25703895.
- [5] V.R. Guju, B. Akram, D.R. Shibib, M.A. McGhee, D.A. Drevets, Bordetella bronchiseptica infections in patients with HIV/AIDS: a case report and review of the literature, *Medicine* 100 (51) (2021), e28244, <https://doi.org/10.1097/MD.00000000000028244>.
- [6] R.W. Light, Parapneumonic effusions and empyema, *Proc. Am. Thorac. Soc.* 3 (1) (2006) 75–80, <https://doi.org/10.1513/pats.200510-113JH>.
- [7] M. Moss, P.E. Parsons, K.P. Steinberg, L.D. Hudson, D.M. Guidot, E.L. Burnham, S. Eaton, G.A. Cotsonis, Chronic alcohol abuse is associated with an increased incidence of acute respiratory distress syndrome and severity of multiple organ dysfunction in patients with septic shock, *Crit. Care Med.* 31 (3) (2003 Mar) 869–877, <https://doi.org/10.1097/01.CCM.0000055389.64497.11>. PMID: 12626999.
- [8] J.E. Mortensen, A. Brumbach, T.R. Shryock, Antimicrobial susceptibility of Bordetella avium and Bordetella bronchiseptica isolates, *Antimicrob. Agents Chemother.* 33 (5) (1989 May) 771–772, <https://doi.org/10.1128/AAC.33.5.771>. PMID: 2751288; PMCID: PMC172531.
- [9] S. Papantoniou, A. Tsakiris, T. Ladopoulos, et al., A case of bordetella bronchiseptica Bacteremia in a patient with COVID-19: brief report, *Cureus* 13 (6) (June 27, 2021), e15976, <https://doi.org/10.7759/cureus.15976>.
- [10] SAMHSA, Center for Behavioral Health Statistics and Quality, National Survey on Drug Use and Health. Table 5.4A – Alcohol Use Disorder in Past Year among Persons Aged 12 or Older, by Age Group and Demographic Characteristics: Numbers in Thousands, 2018 and 2019, 2019.
- [11] E. Senturk, S. Sen, M. Telli, Empyema due to bordetella pertussis in an adult patient with lung cancer, *Arch. Bronconeumol. (Engl. Edn.)* 48 (7) (2012) 263–264, <https://doi.org/10.1016/j.arbr.2012.04.002>.
- [12] K.R. Shen, A. Bribriescio, T. Crabtree, C. Denlinger, J. Eby, P. Eiken, D.R. Jones, S. Keshavjee, F. Maldonado, S. Paul, B. Kozower, The American association for thoracic Surgery consensus guidelines for the management of empyema, *J. Thorac. Cardiovasc. Surg.* 153 (6) (2017), <https://doi.org/10.1016/j.jtcvs.2017.01.030>.
- [13] B.F. Woolfrey, J.A. Moody, Human infections associated with Bordetella bronchiseptica, *Clin. Microbiol. Rev.* 4 (3) (1991) 243–255, <https://doi.org/10.1128/CMR.4.3.243>.