IDCases 38 (2024) e02104

Contents lists available at ScienceDirect

IDCases

journal homepage: www.elsevier.com/locate/idcases

Case report

Lemierre Syndrome involving *Schaalia* (Formerly *Actinomyces*) *odontolyticus* due to injection drug use into the neck

Roohali A. Sukhavasi [a,*], Nina J. Gao [a,b], Christopher J. Smith [c], Sarah A. Schmalzle [d]

[a] *University of Maryland School of Medicine, 655 W Baltimore St S, Baltimore, MD 21201, USA*
[b] *Department of Pathology, 655 W Baltimore St S, Baltimore, MD 21201, United States*
[c] *University of Maryland Medical Center, 22 S Greene St., Baltimore, MD 21201, United States*
[d] *Department of Medicine, Division of Infectious Disease, 655 W Baltimore St S, Baltimore, MD 21201, United States*

ARTICLE INFO

Keywords:
Actinomycosis
Actinomyces
Schaalia odontolyticus
Lemierre Syndrome
Injection drug use

ABSTRACT

Lemierre Syndrome, septic thrombophlebitis of the internal jugular vein following oropharyngeal infection, is classically caused by *Fusobacterium necrophorum* and associated with septic emboli. We present a case of Lemierre Syndrome involving *Schaalia odontolyticus* (formerly *Actinomyces*) in the setting of injection drug use. A 46-year-old man presented with right neck swelling and abscess with *S. odontolyticus* as the primary bacterium isolated from the abscess culture, which was introduced to the site when the patient had licked his needle and injected illicit drugs into his neck. The patient did not develop septic emboli, had sterile blood cultures, and was treated with surgical drainage and 2 weeks of oral linezolid without anticoagulation, with presumed cure. *S. odontolyticus* is a fastidious commensal oral bacterium involved in the formation of dental plaque, but has also been associated with severe extra-oropharyngeal manifestations. *S. odontolyticus* infections been increasingly reported in the literature, likely related to the advent of advanced identification technology like matrix-assisted laser desorption ionization-time of flight mass spectrometry, which can more easily identify fastidious organisms.

Introduction

Lemierre Syndrome (LS) classically presents as septic thrombophlebitis of the internal jugular vein with associated systemic septic emboli, following oropharyngeal infection caused by commensal oral bacterium *Fusobacterium necrophorum* [1,2]. While *F. necrophorum* is the etiological bacterium most associated with LS, there have also been reports of *Streptococcus, Staphylococcus, Enterococcus,* and polymicrobial infections [1]. We present the first reported case of Lemierre Syndrome caused by *S. odontolyticus*, a Gram positive, filamentous, anaerobic commensal bacterium that colonizes the oral mucosa, pharynx, and esophagus [3].

Schaalia odontolyticus, first discovered in 1958 (then *Actinomyces*), was isolated from early dental caries [4] and is now known to be the predominant oral Actinomyces species contributing to development of dental plaque and colonizes the tonsillar crypts and saliva [3,5]. Recent reclassification of the Actinobacteria phylum based on genome size and DNA G-C content has resulted in a change from *A. odontolyticus* to *S. odonotolyticus,* though designation as a cause of Actinomycosis has not changed [5].As a result, we will refer to infections by both *Schaalia* and *Actinomyces* organisms as actinomycoses.

Schaalia and *Actinomyces* species are commensal organisms of the oral cavity, gastrointestinal tract, and female genitourinary tract [6,7]. When mucosal barriers are breached, *Schaalia* and *Actinomyces* species become pathogenic [6]. These infections often occur with "companion organisms", including *Aggregatibacter actinomyecetemcomitans, Prevotella, Streptococcus,* Enterobacterales, *Peptostreptococcus, Fusobacterium, Bacteroides, and Staphylococcus* species [6,7]. Amoxicillin, ampicillin, and penicillin are antibiotics of choice, though the regimen is often broadened to cover co-recovered organisms [8]. Actinomycosis is most commonly caused by *Actinomyces israelii*, and has four classic presentations: cervicofacial ("lumpy jaw"), thoracic, abdominal, or pelvic [8]. It is typically a chronic indolent infection that crosses tissue planes, forming 'woody edema' pocked with deep sinus tracts and sulfur granules [8]. Though rare compared to *A. israelii*, prior case reports have also implicated *S. odontolyticus* in infections affecting the thoracic [9], genitourinary [10], and gastrointestinal systems [11] as well as associated with implanted devices [12].

* Correspondence to: Institute of Human Virology, 725 W Lombard St, Baltimore, MD 21201, United States
E-mail addresses: roohali.a.sukhavasi.mil@health.mil (R.A. Sukhavasi), sschmalzle@ihv.umaryland.edu (S.A. Schmalzle).

https://doi.org/10.1016/j.idcr.2024.e02104
Received 5 May 2024; Received in revised form 19 August 2024; Accepted 19 October 2024
Available online 20 October 2024

Case

A 46 year-old man who injects drugs presented with right neck and right groin swelling and pain following opioid injection at these sites 3 days prior. He was afebrile with normal vital signs and no leukocytosis. His medical history included asthma, bipolar disorder, seizures, chronic pain following a construction accident, C5-C7 fusion, and multiple infectious complications of injection drug use (IDU). Venous duplex imaging of bilateral lower extremities found no evidence of deep venous thrombosis. CT angiography of the neck revealed a thrombosed and inflamed right internal jugular vein occlusion extending from the level of C1 to C5, enveloped within a 3.1 × 3.0 × 4.7 cm abscess (Fig. 1). The abscess was incised and drained, then irrigated twice daily with clindamycin. Cultures from the abscess grew abundant *Schaalia* (formerly *Actinomyces*) *odontolyticus* with lower colony counts of *Lactobacillus* sp. and few *Streptococcus sanguinis*, as identified via MALDI-TOF Mass Spectrometry. One set of blood cultures remained sterile with the patient consistently afebrile throughout the admission. All Duke criteria for infectious endocarditis (IE) were absent aside from IDU, so further IE evaluation was not pursued. Empiric intravenous vancomycin and piperacillin-tazobactam were initiated on presentation, then narrowed to linezolid and ceftriaxone. CT angiography on post-operative day 2 did not show re-accumulation of the abscess, presence of cerebral or pulmonary septic emboli, or extension of the thrombosis cranially or caudally (Fig. 2). Due to the lack of evidence for septic emboli nor thrombosis, anticoagulation therapy was not initiated for the patient. The patient had a self-directed discharge on post-operative day 4 with penrose drain in place, returning to the hospital 3 days later with worsening swelling and drainage from his right neck abscess site. The right groin swelling had resolved. Additionally, he remained afebrile with normal vital signs and no leukocytosis. Oral linezolid was resumed, and he was discharged with a 2-week prescription, with total antibiotic duration to be determined at the scheduled follow up appointment. He missed this appointment but did take all doses of the 2-week linezolid prescription and returned 4 weeks after hospital discharge for anasarca due to renal and heart failure. There was no evidence of recurrent neck abscess on physical examination.

Discussion

Our patient had an atypical presentation of Lemierre Syndrome (LS) given lack of detected bacteremia, septic emboli, or *F. necrophorum*

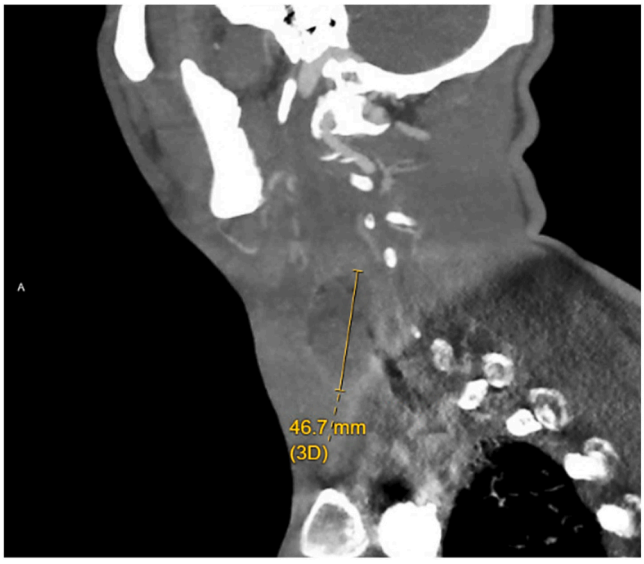

Fig. 1. Admission CTA Neck Sagittal View: 3.1 × 3.0 × 4.7 cm abscess enveloping the right Internal Jugular vein at level C4-C5.

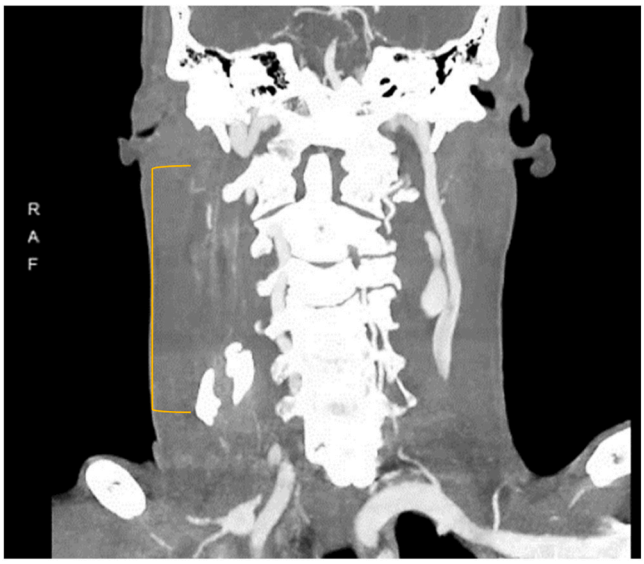

Fig. 2. POD-2 CTA Neck Coronal view: Occlusive thrombus in Right Internal Jugular vein from level C1 to C5 base; no abscess reaccumulation or thrombus extension.

recovery in the setting of septic thrombophlebitis of the internal jugular vein [1]. There was an abundance of *S. odontolyticus* recovered from the abscess culture, a pathogen that has only been recently reported in the literature as being associated with systemic, severe infections [12,13].

Actinomycosis can be categorized by location and severity into mild (limited oral disease) and extensive (systemic extra-oropharyngeal disease). There is limited data to direct current antibiotic duration guidelines for extensive *Actinomyces* and *Schaalia* infections. Current recommendations calling for IV induction therapy followed by prolonged oral penicillin or amoxicillin for up to 1 year are based only on a review of limited cases of actinomycosis occurring in the early-antibiotic era when this infection was more common, and have not been re-evaluated in a systemic fashion in modern times [14]. The referenced cases often received sub-optimal penicillin dosing compared to today's standards, short but repeated courses due to recurrence that added up to long total courses, or occurred without surgical debulking, making these experiences not directly applicable to current day [8]. Review of subsequent published cases reveals many examples of successful treatment with shorter durations, suggesting that treatment should be individualized based on disease severity, surgical intervention, and therapeutic response [8].

Similarly, LS treatment duration has not been systematically studied, though aggregate evaluation shows successful treatment with 2 weeks of IV antibiotics followed by 4–6 weeks of oral antibiotics until symptom resolution 4 [1].

Our patient's atypical actinomycosis was unintentionally treated with oral linezolid for only 2 weeks, but with presumed resolution of thrombophlebitis and no recurrence of abscess. Additionally, blood cultures drawn for evaluation of other infections 1, 3, 4, 6, 7, 8, and 11 months later did not grow *S. odontolyticus,* and no complications of LS were detected. Linezolid was chosen for our patient due to excellent bioavailability [15] and for the option of oral administration in a patient who was at a high risk for recurrent patient directed discharge.

75–90 % of *Actinomyces* isolates are recovered in polymicrobial cultures, frequently alongside *Streptococcus* spp. [16–18]. Few *Streptococcus sanguinis* colonies were isolated from our patient's abscess culture, an oral commensal bacteria that has been associated with oral inflammatory processes [19]. The specific bacteria *S. sanguinis* has been identified previously in monomicrobial isolates of septic thrombophlebitis cases involving facial cellulitis [20] as well as LS in an elderly diabetic patient with a concurrent dental abscess [21]. Additionally,

lower colony counts of *Lactobacillus sp.* were isolated from the abscess culture in our case. *Lactobacillus* species are commensal bacteria of the gastrointestinal and genitourinary tracts. Lactobacilli have been rarely implicated as a pathogenic agent, noted in limited historical reports of peritonsillar abscesses [22,23] as well as one recent report of septic emboli formation [24]. Lactobacilli are rarely pathogenic, but can transfer antibiotic resistance genes to pathogenic organisms in the same space [25].

Four cases of *S. odontolyticus* bacteremia in the setting of IDU have been previously described [26–29], 3 with septic thrombophlebitis [26–28]. One case noted licking of needles prior to injection [26], which was also described by our patient. While classic actinomycosis occurs when commensal organisms breach mucosa and spread 'outward' from the pharynx to the vascular bundle [3], this is an example of oral organisms being introduced 'outside-in' from direct injection into the soft tissue and vascular system.

Although our patient presented with extensive thrombosis of the right internal jugular vein from the level of C1 to C5, anticoagulation (AC) was not administered. The use of AC in septic thrombosis is also a historical recommendation based on the presumption that treating the venous thromboembolism could prevent propagation and assist in clearing the infection, but lacks controlled studies [1]. A 2016 systematic review of LS saw no apparent difference in mortality regarding AC administration [1] and in a 2020 meta-analysis of LS, AC utilization did not significantly improve overall patient outcomes or mortality [30]. Upon evaluation, this patient was deemed to have minimal risk of developing life-threatening thromboses as imaging revealed no extension of initial-noted thrombus and thus was not administered AC.

Our literature review through PubMed and Google Scholar found 25 extra-pharyngeal *S. odontolyticus* infections published between 2009 and 2023. 6 cases were reported in 2021 [12,13,31–34], and 12 cases were reported in 2022 [9,11,17,35–43]. These increased reports are likely indicative of the effect of diagnostic technological advancements, rather than an increasing rate of actinomycosis. Over the last 20 years, improvements in organism identification technology and laboratory medicine led to the development and widespread adoption of matrix-assisted laser desorption ionization-time of flight (MALDI-TOF) mass spectrometry (MS). MALDI-TOF MS is highly reliable in the identification of *Schaalia* and *Actinomyces* species to the genus and species level [44] and was the method through which *S. odontolyticus* was identified in this patient's culture as well as identified in the reports from 2021 and 2022.

Conclusion

Our case report addresses the novel presentation of the oral commensal bacterium *Schaalia* (formerly *Actinomyces*) *odontolyticus* cultured from an injection-drug-use associated abscess with adjacent septic internal jugular vein thrombophlebitis. While a rare condition, it is important to bring awareness to Lemierre Syndrome occurrence as well as its common and atypical presentations. With wider adoption of MALDI-TOF MS for clinical diagnostics there has been increased diagnosis of previously unrecognized pathogens like *Actinomyces* and *Schaalia* species. This report highlights the need for further research into appropriate treatment duration for actinomycosis, as well as treatment duration and use of anticoagulation in Lemierre Syndrome.

Ethical approval

This was a case report with appropriate patient consent that did not require IRB approval.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. There are no study sponsors to declare.

CRediT authorship contribution statement

Roohali A. Sukhavasi: Writing – original draft, Investigation. **Nina J. Gao:** Writing – review & editing. **Christopher J. Smith:** Writing – review & editing. **Sarah A. Schmalzle:** Writing – review & editing, Supervision, Conceptualization.

Conflict of interest statement

Authors have no conflict of interest to declare.

References

[1] Katrine M, Johannesen, Bodtger U. Lemierre's syndrome: current perspectives on diagnosis and management - PMC. Published 2016. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5028102/ [Accessed August 13, 2022].
[2] Kristensen LH, Prag J. Human Necrobacillosis, with Emphasis on Lemierre's Syndrome | Clinical Infectious Diseases | Oxford Academic. Published August 2000. https://academic.oup.com/cid/article/31/2/524/297556?login=false [Accessed August 13, 2022].
[3] Könönen E, Wade WG. Actinomyces and related organisms in human infections. Clin Microbiol Rev 2015;28(2):419. https://doi.org/10.1128/CMR.00100-14.
[4] Actinomyces odontolyticus, a new species of actinomycete regularly isolated from deep carious dentine - Batty - 1958 - The Journal of Pathology and Bacteriology - Wiley Online Library. Published 1958. https://onlinelibrary.wiley.com/doi/10.1002/path.1700750225 [Accessed August 13, 2022].
[5] Nouioui I, Carro L, García-López M, et al. Genome-based taxonomic classification of the Phylum Actinobacteria. Front Microbiol 2018;9:355158. https://doi.org/10.3389/fmicb.2018.02007.
[6] Li J, Li Y, Zhou Y, Wang C, Wu B, Wan J. Actinomyces and alimentary tract diseases: a review of its biological functions and pathology. Published August 26, 2018. https://www.hindawi.com/journals/bmri/2018/3820215/ [Accessed August 13, 2022].
[7] Sharma S, Hashmi MF, Valentino III DJ. Actinomycosis. StatPearls. StatPearls Publishing; 2023. http://www.ncbi.nlm.nih.gov/books/NBK482151/.
[8] Sudhakar SS, Ross JJ. Short-term treatment of actinomycosis: two cases and a review. Clin Infect Dis 2004;38(3):444–7. https://doi.org/10.1086/381099.
[9] Roig-Marín N, Roig-Rico P, Jover-Díaz F. Purulent pericarditis caused by Actinomyces odontolyticus in a nonagenarian patient. Med Interna México 2022;38(3):714–7.
[10] Peitsidis P, Papadimitriou C, Rodolakis A, Peitsidou A. Actinomycosis of the appendix and pelvis: a case report. J Reprod Med 2008;53(9):711–3.
[11] Furuya K, Ito K, Sugiyama K, Fujita A, Kanemoto H, Shimada T. A case of recurrent acute cholecystitis caused by Actinomyces odontolyticus, rare actinomycosis. BMC Infect Dis 2022;22:518. https://doi.org/10.1186/s12879-022-07491-3.
[12] Farah Khoury M, Perek S, Raz-Pasteur A. Implantable cardioverter defibrillator related Actinomyces Odontolyticus endocarditis and bacteremia—First reported case. IDCases 2021;25:e01228. https://doi.org/10.1016/j.idcr.2021.e01228.
[13] Patel K, MacDonald M, Hmoud H, Czinn E, Wutawunashe C, Fisher P. Aortic valve endocarditis by Actinomyces odontolyticus and Gemella morbillorum oral pathogens. IDCases 2021;24:e01079. https://doi.org/10.1016/j.idcr.2021.e01079.
[14] Peabody JW, Seabury JH. Actinomycosis and nocardiosis. A review of basic differences in therapy. Am J Med 1960;28:99–115. https://doi.org/10.1016/0002-9343(60)90226-6.
[15] Welshman IR, Sisson TA, Jungbluth GL, Stalker DJ, Hopkins NK. Linezolid absolute bioavailability and the effect of food on oral bioavailability. Biopharm Drug Dispos 2001;22(3):91–7. https://doi.org/10.1002/bdd.255.
[16] Smego RA, Foglia G. Actinomycosis. quiz 1262-1263 Clin Infect Dis Publ Infect Dis Soc Am 1998;26(6):1255–61. https://doi.org/10.1086/516337.
[17] Peralta DP, Najjar H. A case of Empyema due to Actinomyces odontolyticus and Streptococcus Species co-infection in an immunocompetent woman. Cureus 2022;14(12):e32700. https://doi.org/10.7759/cureus.32700.
[18] Wu CMY, Noska A. Case Report: Intrauterine device infection causing concomitant streptococcal toxic shock syndrome and pelvic abscess with Actinomyces odontolyticus bacteraemia. BMJ Case Rep 2016;2016. https://doi.org/10.1136/bcr-2015-213236.
[19] White T, Alimova Y, Alves VTE, et al. Oral commensal bacteria differentially modulate epithelial cell death. Arch Oral Biol 2020;120. https://doi.org/10.1016/j.archoralbio.2020.104926.
[20] Zelinsky-Gurung A, Cohen R, Lesprit E, Dieu S, Lemerle S, Reinert P. [Palpebral edema with fever and Streptococcus sanguis septicemia]. Arch Fr Pedia 1991;48(7):491–2.

[21] Deganello A, Gallo O, Gitti G, Campora ED. Necrotizing fasciitis of the neck associated with Lemierre syndrome. Acta Otorhinolaryngol Ital 2009;29(3):160.
[22] Sakamoto H, Naito H, Aoki T, Karakida K, Shiiki K. Necrotizing fasciitis of the neck due to an odontogenic infection: a case report. J Infect Chemother Springe Sci Bus Media BV 1996;2(4):290–3. https://doi.org/10.1007/BF02355131.
[23] Peritonsillar Abscess. Retropharyngeal abscess, mediastinitis, and nonclostridial anaerobic myonecrosis: a case report. Clin Infect Dis 1993;16:S299–303.
[24] Karime C, Barrios MS, Wiest NE, Stancampiano F. Lactobacillus rhamnosus sepsis, endocarditis and septic emboli in a patient with ulcerative colitis taking probiotics. BMJ Case Rep 2022;15(6):1–8. https://doi.org/10.1136/bcr-2022-249020.
[25] Colautti A, Arnoldi M, Comi G, Iacumin L. Antibiotic resistance and virulence factors in lactobacilli: something to carefully consider. Food Microbiol 2022;103:103934. https://doi.org/10.1016/j.fm.2021.103934.
[26] Bekelman JE, Francis JS, Berliner AR, DeRuiter CJ, Brown CD. Lemierre's variant. Lancet Infect Dis 2004;4(8):518. https://doi.org/10.1016/S1473-3099(04)01107-7.
[27] Weiand Daniel, Barlow Gavin. The rising tide of bloodstream infections with Actinomyces species: bimicrobial infection with Actinomyces odontolyticus and Escherichia coli in an intravenous drug user. Pmc Publ 2014. Accessed August 13, 2022. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4370021/.
[28] Nepal C., Morris P.E., Kalema A., et al. Actinomyces Odontolyticus and Streptococcus Mitis in Blood of an IVDU! Published online 2018:2.
[29] Townsend C, Wong S, Wang L, Kao R. Polymicrobial Bacteremia With *Actinomyces odontolyticus*, *Fusobacterium* and *Atopobium parvulum* Secondary to Septic Thrombophlebitis in an Immunocompetent Patient. J Med Cases 2016;7(11):515–7. https://doi.org/10.14740/jmc.v7i11.2685.
[30] Gore MR. Lemierre Syndrome: a meta-analysis. Int Arch Otorhinolaryngol 2020;24(3):e379–85. https://doi.org/10.1055/s-0039-3402433.
[31] Bonnesen B, Sivapalan P, Naghavi H, et al. A unique case of Fusobacterium nucleatum spondylodiscitis communicating with a pleural empyema through a fistula. APMIS 2021;129(11):626–30. https://doi.org/10.1111/apm.13171.
[32] Khiatah B, Shah K, Belikova A, Saeed M. Sepsis due to Actinomyces odontolyticus as a rare complication of neobladder. Case Rep Infect Dis 2021;2021:e6699046. https://doi.org/10.1155/2021/6699046.
[33] Hsu S-L, Wu C-T, Chang Y-C, Fan C-K, Lee Y-L. Case report of an unusual hepatic abscess caused by Actinomyces odontolyticus in a patient with human immunodeficiency virus infection|BMC Infectious Diseases|Full Text. Published 2021. https://bmcinfectdis.biomedcentral.com/articles/10.1186/s12879-021-06703-6 [Accessed August 13, 2022].
[34] Wu JJ, Wang JL, Tung CF, Tseng JS. Suppurative mediastinal lymphadenitis caused by Actinomyces odontolyticus: Successfully diagnosed by endobronchial ultrasound-guided transbronchial needle aspiration - PMC. Published 2021. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8098874/ [Accessed August 13, 2022].
[35] Razok A, Ali M, Aker L, Ziglam H. Actinomyces odontolyticus bacteraemia associated with cervical and mediastinal abscesses in an immunocompetent patient: First reported case in Qatar. N Microbes N Infect 2022;45:100956. https://doi.org/10.1016/j.nmni.2022.100956.
[36] Ali M, Razok A, Ziglam H. A 5-year retrospective study of Actinomyces odontolyticus bacteremia in the state of Qatar, case series. Ann Med Surg 2022;76. https://doi.org/10.1016/j.amsu.2022.103583.
[37] Fulton HM, Shirley RM. Renal actinomycosis with muscular invasion post-nephrostomy tube placement. IDCases 2022;29. https://doi.org/10.1016/j.idcr.2022.e01586.
[38] Patil SM, Beck PP, Vaznitsel M, et al. Acute disseminated actinomycosis presenting as pneumonia with bilateral pulmonary nodules and pelvic osteomyelitis in an immunocompetent patient. IDCases 2022;29. https://doi.org/10.1016/j.idcr.2022.e01540.
[39] Ruan H, Tao YM, Li SS. Actinomyces odontolyticus lung abscess and pleural empyema. Arch Iran Med 2022;25(6):402–4. https://doi.org/10.34172/aim.2022.65.
[40] Deltenre M, Thimmesch M, Creuven M, Pierart F. Actinomycose pulmonaire à Actinomycesodontolyticus chez un enfant de 2 ans: Pulmonary actinomycosis caused by Actinomycesodontolyticus in a two-year-old child (English). Rev Mal Respir 2022;39(3):270–4. https://doi.org/10.1016/j.rmr.2022.01.019.
[41] Tu J, MacDonald M, Mansfield D. Pulmonary actinomycosis and polymicrobial Empyema in a patient with ABPA and Bronchocoele. Respirology Case Reports, 10. Wiley-Blackwell,; 2022. https://doi.org/10.1002/rcr2.954.
[42] Sasatani Yuika, Satoh Hiroaki. Pulmonary co-infection with Actinomyces Odontolyticus and Mycobacterium Kansashii. Monaldi Arch Chest Dis 2022;92(2). https://doi.org/10.4081/monaldi.2021.2102.
[43] Pană AG, Neculicioiu V, Toc DA, Sprinjan GD, Rusu MC, Costache C. Tubo-Ovarian abscess with Actinomyces odontolyticus: case report and brief review of literature. Rep MDPI Ag 2022;5(4):46. https://doi.org/10.3390/reports5040046.
[44] Fong P, Francis MJ, Hamblin JF, Korman TM, Graham M. Identification and diversity of Actinomyces species in a clinical microbiology laboratory in the MALDI-TOF MS era. Anaerobe 2018;54:151–8. https://doi.org/10.1016/j.anaerobe.2018.09.007.