IDCases 23 (2021) e01014

Contents lists available at ScienceDirect

IDCases

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

Case report

When upper respiratory tract infections go rogue: A case report of *Arcanobacterium haemolyticum* Cerebral Abscess

Nehkonti Adams[a,*], Christopher Snitchler[a], Michael Kong[b], Daniel Ikeda[c], Anthony Skinner[d], Juan Rodriguezbarrantes[e], Ryan Leverette[e], Randy Bell[f]

[a] Departments of Medicine, US Naval Hospital Okinawa, Okinawa, Japan
[b] Departments of Otolaryngology-Head and Neck Surgery, US Naval Hospital Okinawa, Okinawa, Japan
[c] Departments of Surgery, US Naval Hospital Okinawa, Okinawa, Japan
[d] Departments of Opthaolmology, US Naval Hospital Okinawa, Okinawa, Japan
[e] Departments of Laboratory Services, US Naval Hospital Okinawa, Okinawa, Japan
[f] Department of Neurosurgery, Walter Reed National Military Medical Center, Maryland, United States

ARTICLE INFO

Article history:
Received 7 September 2020
Received in revised form 15 November 2020
Accepted 16 November 2020

Keywords:
Cerebral abscess
Arcanobacterium haemolyticum
Sinusitis
Preseptal cellulitis

ABSTRACT

Arcanobacterium haemolyticum is an extremely rare cause of cerebral abscess. We present a unique case of *Arcanobacterium haemolyticum* sinusitis complicated by preseptal cellulitis and cerebral abscess. The patient initially presented with pharyngitis and then developed sinus congestion, headache and facial pain. Computed tomography and magnetic resonance imaging revealed a right gyrus rectus cerebral abscess and paranasal sinus infection. The patient underwent endoscopic sinus surgery and cultures revealed *Arcanobacterium haemolyticum*. Repeat imaging revealed maturation and progression of intracranial abscess. The abscess was drained and patient was treated with parenteral and oral antibiotics until complete clinical and radiological remission. This case highlights the importance of recognizing *Arcanobacterium haemolyticum* as a cause of invasive disease in immunocompetent hosts.

Introduction

Arcanobacterium haemolyticum is a pleomorphic, gram-positive bacillus that has been associated with pharyngitis in young adults [1]. In 1946, it was first described by Maclean et al. in deployed US military personnel and local population in the South Pacific [2]. Since then it has rarely been associated with invasive infections such as sepsis, wound infections, endocarditis and cerebral abscess [3]. Invasive infections have typically been described in immunocompromised hosts [3]. *A. haemolyticum* isolates have two colony biotypes, smooth and rough [4]. The smooth biotype is associated with pharyngitis in young adults and the rough biotype with invasive infections [4]. We describe a case of bacterial sinusitis with intracranial extension leading to right frontal cerebral abscess due to *A. haemolyticum*.

Case report

A previously healthy 24 year old male initially presented with pharyngitis and subsequently developed intense headaches with sinus pain and pressure three weeks later. He was treated symptomatically but then presented again for persistent headache and new left facial pain and orbital swelling. He also reported nasal congestion and yellow-green nasal discharge. He had a nonfocal neurological exam. His white blood cell count (WBC) was 15,400/μL (56 % neutrophils, 11 % monocytes, 31 % lymphocytes). Computed tomography and magnetic resonance imaging studies of head (Figs. 1 and 2) revealed a 2.6 cm right gyrus rectus cerebral abscess in early capsular phase, pansinusitis and extensive left preorbital cellulitis with bifrontal scalp involvement. He was placed on vancomycin, ceftriaxone and metronidazole and hospitalized. He underwent functional endoscopic sinus surgery with septoplasty. Intraoperative findings included purulent material in maxillary, ethmoid and sphenoid sinuses with inflammed mucosa. Specimens were obtained for microbiological studies. Gram stain revealed pleomorphic gram-positive rods (Fig. 3). Ophthalmologic examination was consistent with preseptal cellulitis. Neurosurgical evaluation was conducted with recommendation for medical management and close monitoring due to size and location of abscess and patient's re-assuring neurologic status. Cultures yielded moderate growth of rough colonies (Fig. 4). Reverse CAMP (Christie-Atkins-Munch-Petersen) test performed on isolates were positive (Fig. 5). The patient did well clinically with improvement of sinusitis and preseptal cellulitis. Clinical specimens collected

* Corresponding author.
E-mail address: nehkonti.adams.mil@mail.mil (N. Adams).

http://dx.doi.org/10.1016/j.idcr.2020.e01014

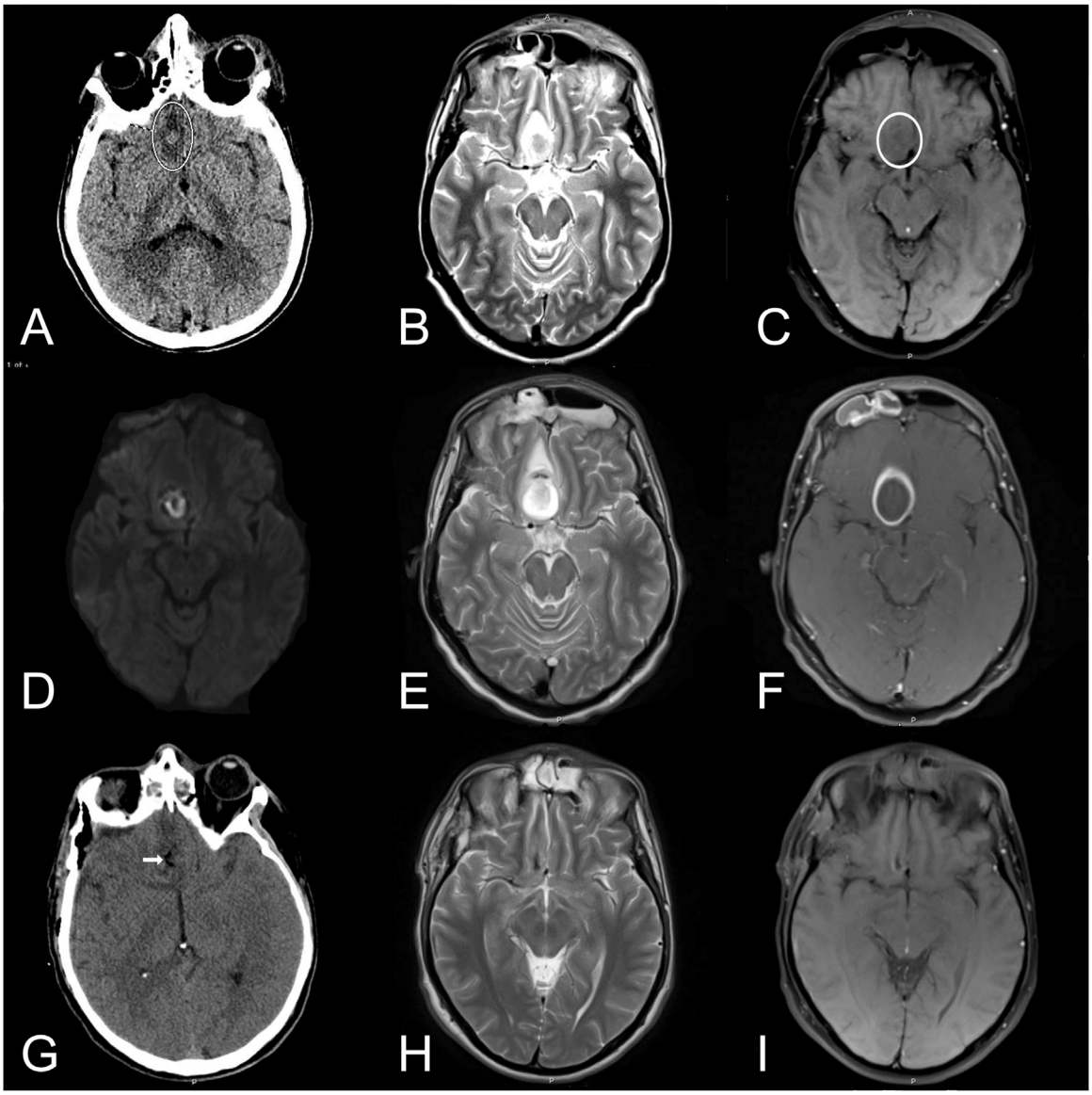

Fig. 1. CT head (A) demonstrates hyperdense cerebritis in right gyrus rectus with surrounding edema further detailed by the admission MR T2 (B) and T1 with gadolinium (C) studies. Note the minimal enhancement (C with white circle around cerebritis. The MR on hospital day 9 demonstrates the DWI hyperintense abscess (D), T2 fluid accumulation (E), and well defined abscess with the enhancing wall (F). The postoperative CT head (G) demonstrates pneumocephalus where the abscess was resected (white arrow).The MR (H and I) at one month post op demonstrates only a small area of gliosis with no residual abscess.

from sinus surgery grew moderate *Arcanobacterium haemolyticum*, identified by matrix-assisted laser desorption/ionization time-of-flight (MALDI-TOF) mass spectrometry. The pathogen was sensitive to ampicillin, amoxicillin/clavulanic acid, cefotiam, cefotaxime, imipenem/cilastatin, erythromycin, minocycline, vancomycin, levofloxacin and resistant to clindamycin. Vancomycin was discontinued. Blood and urine cultures obtained yielded no growth. Repeat imaging ten days later revealed interval enlargement, worsening adjacent edema, and worsening mass effect of abscess. A right frontal craniotomy and resection/aspiration of gyrus rectus abscess was performed. Clinical specimens obtained intraoperatively revealed no organisms on gram stain and culture yielded no growth. Several weeks later few pansensitive *Propionobacterium avidum* was also identified from anaerobic cultures of sinus specimens. The patient continued to improve post-surgery and was discharged with intravenous ceftriaxone and oral metronidazole for a total of 7 weeks of antibiotic therapy.

Discussion

Arcanobacterium haemolyticum (formerly known as *Corynebacterium haemolyticum*) is an aerobic, catalase negative, gram-positive bacilli that causes a diverse range of infections [4]. *A. haemolyticum* is normal flora of throat and skin but implicated in 2% on non streptococcal pharyngitis in young adults [5]. The clinical features are similar to group A streptococcal pharyngitis including a scarlet-fever-like presentation [6].

A. haemolyticum can cause localized to systemic and deep-seated infections [7]. Our case did initially present with pharyngitis and later developed a sinusitis. Sinusitis is an

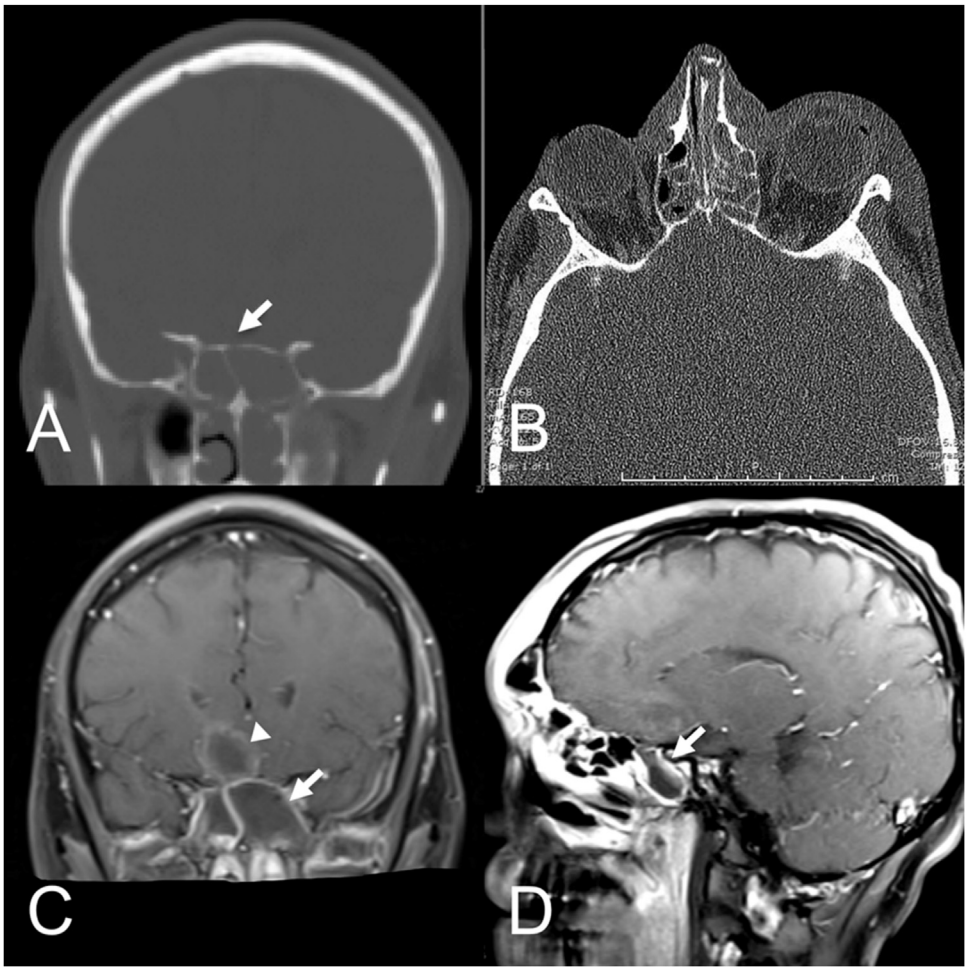

Fig. 2. The CT head (A) bone windows with coronal reconstruction demonstrates a bony dehiscence (white arrow) as the possible route of intracranial extension from the sphenoid sinus. The facial CT (B) demonstrates the left sided pre-septal cellulitis. Preoperative MR T1 with gadolinium coronal (C) and sagittal (D) reconstructions show an organized abscess in the sphenoid sinus (white arrows) and late cerebritis in the right gyrus rectus (arrowhead).

uncommon presentation of this pathogen. Volante et al. reported a case of sinusitis complicated by a maxillary sinus mass that responded to resection and a 10-day course antibiotic therapy [1]. Sinusitis can progress to localized complication. Limjoco-Antonio AD et al. described sinusitis and orbital cellulitis in a nine-year old girl who required two surgeries and antibiotic therapy [8]. Ford JG et al. described a similar presentation in a 16-year old boy [9]. Our patient developed pre-septal cellulitis and had evidence of early orbital cellulitis on imaging.

Intracranial abscess due to *A. haemolyticum* is another rare occurrence and has been reported as a complication of sinusitis, head trauma and odentogenic source [10–12]. Ouriemchi et al. reported *A. haemolyticum* cerebral abscess that mimicked a brain tumor [13]. To our knowledge only seven cases have been reported previously. Our case was likely contiguous spread to the brain from sinuses. The abscess fluid gram stain revealed no organisms and culture was negative but patient had been on antibiotic therapy for nearly 11 days. *A. haemolyticum* isolated from sinuses is the presumed cause of the cerebral abscess. The growth of few *P. avidum* (now renamed Cutibacterium avidum) weeks later is likely not a contributing co-pathogen. It is a gram-positive, anaerobic bacilli that is a colonizer of human skin [14]. It can cause invasive disease but would have been the dominant pathogen isolated if this was the case.

A. haemolyticum has two colony types, smooth and rough. The smooth type is most often isolated from wound sites and the rough type – from the respiratory tract [4]. Rough colonies have an irregular edge with absent or weak beta hemolysis (Fig. 4). We performed a Reverse CAMP test which aids in the identification of Arcanobacterium haemolyticum when streaked perpendicular to Staphylococcus aureus on sheep blood agar. This was done to assist in diagnosis while waiting for official results from a reference laboratory.

There is no standard therapy for *A. haemolyticum* cerebral abscess. The pathogen is usually sensitive to beta lactams, carbapenems and a range of other antibiotics [15,16]. Penicillins and cephalosporins are commonly used for invasive infections including cerebral abscesses [10,16]. Some *A. haemolyticum* isolates are tolerant to penicillin and may not be eradicated from pharynx [17]. This may explain why infections may progress after what may be considered appropriate treatment for pharyngitis. We chose to reset patient antibiotic days to day of surgery to complete 6 weeks post craniotomy and drainage. We then monitored clinical symptoms, inflammatory markers and improvement on imaging studies.

Some invasive *A. haemolyticum* infections have been associated with immunocompromised hosts [3]. Poplin et al. reported a case of EBV mononucleosis treated with prednisone complicated by

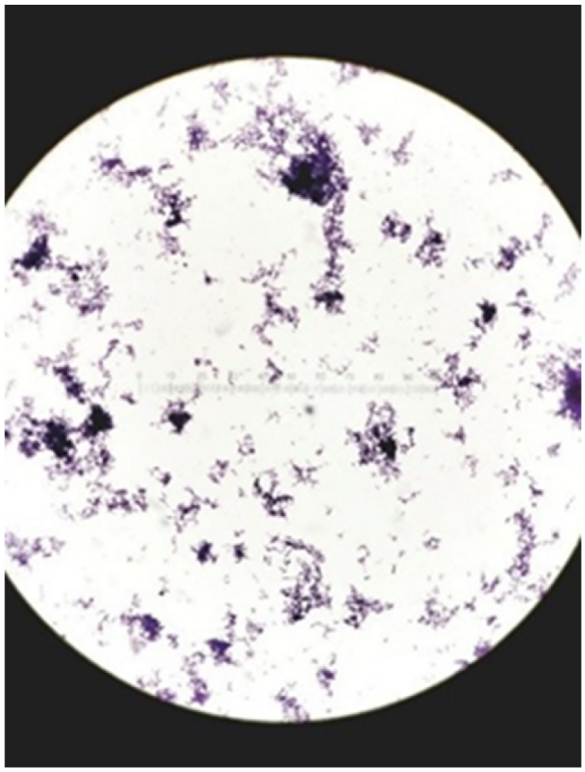

Fig. 3. gram stain of sinus fluid demonstrating pleomorphic gram-positive rods. Microscopic magnification: 1000x.

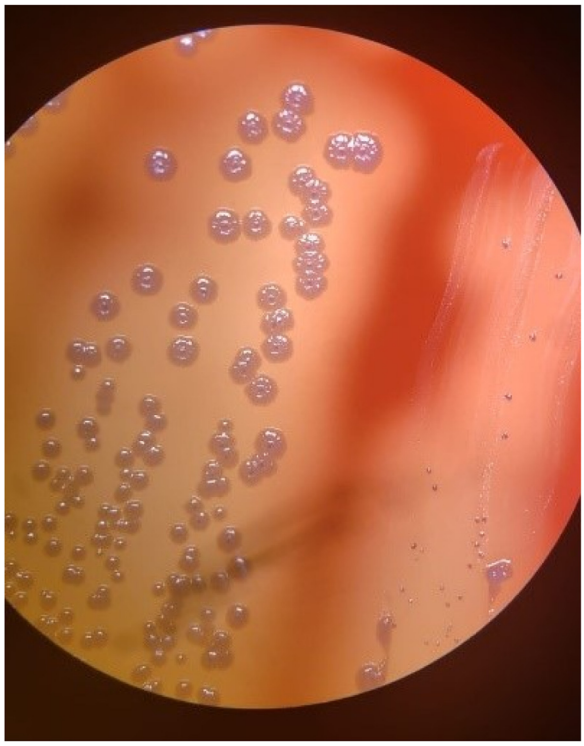

Fig. 4. rough colony morphology with beta hemolysis on blood agar.

secondary bacterial sinusitis with intracranial extension leading to cerebral abscess [11]. There was an initial concern about immune status of our patient, but he did not relay a history of multiple infections or recent use of immunosuppressants and HIV testing retuned negative.

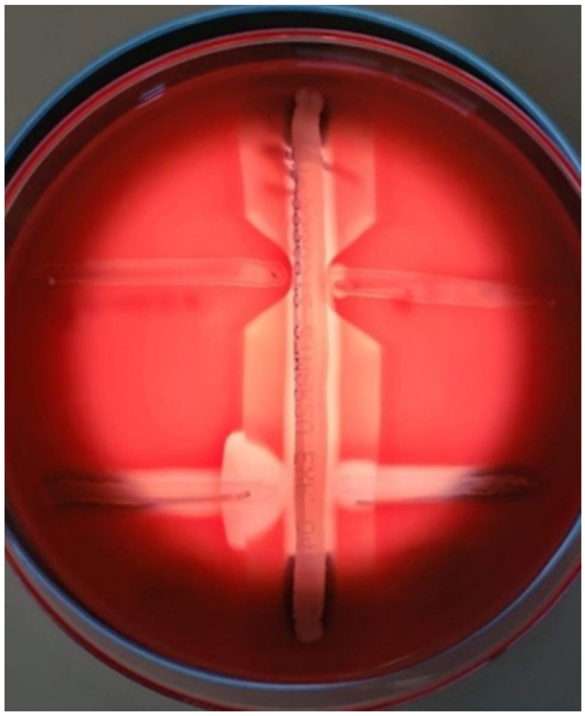

Fig. 5. Reverse CAMP (Christie-Atkins-Munch-Petersen) test performed on isolates from sinus specimens.

Conclusion

Arcanobacterium haemolyticum causes mild disease such as pharyngitis but can also cause invasive disease. *A. haemolyticum* invasive disease typically presents in immunocompromised hosts. However immunocompetent hosts can also develop severe disease. Sinusitis is a rare presentation of *A. haemolyticum* infection and can progress to cerebral abscess. *A. haemolyticum* should be considered in the differential for severe sinusitis and cerebral abscess in immunocompetent hosts. The empiric antibiotic regimen for cerebral abscesses covers this organism.

Funding

This case study did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Ethical approval

No ethical approval was required for this publication.

Consent

Consent for submitting this case report was provided by the patient.

Declaration of Competing Interest

The authors have no conflict of interest to declare.

References

[1] Volante M, Corina L, Contucci AM, Calò L, Artuso A. *Arcanobacterium haemolyticum*: two case reports. Acta Otorhinolaryngol Ital 2008;28(June (3)):144–6.

[2] MacLean PD, Liebow AA, Rosenberg AA. A hemolytic corynebacterium resembling *Corynebacterium ovis* and *Corynebacterium pyogenes* in man. J Infect Dis 1946;79:69–90.

[3] Miyamoto H, Suzuki T, Murakami S, et al. Bacteriological characteristics of *Arcanobacterium haemolyticum* isolated from seven patients with skin and soft-tissue infections. J Med Microbiol 2015;64(Pt 4):369–74, doi:http://dx.doi.org/10.1099/jmm.0.000038.
[4] Carlson P, Lounatmaa K, Kontiainen S. Biotypes of *Arcanobacterium haemolyticum*. J Clin Microbiol1994 1994;32(7):1654–7.
[5] Kang H, Park G, Kim H, Chang K. Haemolytic differential identification of *Arcanobacterium haemolyticum* isolated from a patient with diabetic foot ulcers. JMM Case Rep 2016;3(February (1))e005016.
[6] Tanz RR, Shulman ST. Sore throat. Practical strategies in pediatric diagnosis and therapy. . p. 3–15.
[7] Sklov RL, Sanden AK, Danchell VH, Robertsen K, Ejlertsen T. Systemic and deep-seated infections caused by Arcanobacterium haemolyticum. Eur J Clin Microbiol Infect Dis 1998;17(8):578–82.
[8] Limjoco-Antonio AD, Janda WM, Schreckenberger PC. *Arcanobacterium haemolyticum* sinusitis and orbital cellulitis. Pediatr Infect Dis J 2003;22:465–7.
[9] Ford JG, Yeatts RP, Givner LB. Orbital cellulitis, subperiosteal abscess, sinusitis, and septicemia caused by *Arcanobacterium haemolyticum*. Am J Opthalmol 1995;120:261–2.
[10] Poplin V, McKinsey DS. Arcanobacterium brain abscesses, subdural empyema, and bacteremia complicating epstein-barr virus mononucleosis. Kans J Med 2018;11(February (1)):11–4.
[11] Cortes- Penfield N, Kohli A, Weatherhead J, El Sahly H. *Arcanobacterium haemolyticum* central nervous system abscess and bacteremia following head trauma: a case report and literarture review. Infect Dis Clin Pract 2017;25 (3):9–e11.
[12] Vargas J, Hernandez M, Silvestri C, Jiminez O, Guevara N, Carballo M, et al. Brain abscess due to *Arcanobacterium haemolyticum* after dental extraction. Clin Infect Dis 2006;42:1810–1.
[13] Ouriemchi W, Jeddi D, El Quessar A, Benouda A. Arcanobacterium haemolyticum brain abscess mimicking a brain tumor. Med Mal Infect 2011;41(7):397–9.
[14] Corvec S. Clinical and biological features of cutibacterium (Formerly Propionibacterium) avidum, an underrecognized microorganism. Clin Microbiol Rev 2018;31(3):e00064–17.
[15] Carlson P, Kontianen S, Renkonen OV. Antimicrobial susceptibility of *Arcanobacterium haemolyticum*. Antimicrob Agents Chemother 1994;38 (1):142–3.
[16] Carlson P, Korpela J, Walder M, Nyman M. Antimicrobial susceptibilities and biotypes of *Arcanobacterium haemolyticum* blood isolates. Eur J Clin Microbiol Infect Dis 1999;18(12):915–7.
[17] Nyman M, Danek G, Thore M. Penicillin tolerance in *Arcanobacterium haemolyticum*. J Infect Dis 1990;161(February (2)):261–5, doi:http://dx.doi.org/10.1093/infdis/161.2.261.