

Case Report

Streptococcus intermedius brain abscess with lung abscess and aortic valve endocarditis. A case report and literature review

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ABSTRACT: *Streptococcus intermedius* is frequently associated with brain and liver abscesses, while pleuropulmonary infections are considered rarer. Even less frequent is the association of lung and brain abscess due to this agent with left heart endocarditis. We describe the case of a 40-year-old man with a brain abscess due to *S. intermedius* and concomitant lung abscess and aortic native valve endocarditis. He was treated with surgical drainage of the brain abscess and a 4-week course of intravenous ceftriaxone, followed by oral amoxicillin/clavulanate, obtaining healing of the lesions without relapse of the infection.

KEYWORDS: Streptococcus intermedius; brain abscess; lung abscess; endocarditis

1. Introduction

Streptococcus intermedius is a gram positive, catalase-negative coccus belonging to the *Streptococcus anginosus* group (SAG), which is often referred to as the *Streptococcus milleri* group, including *S. intermedius*, *S. anginosus*, and *S. constellatus*. SAG bacteria have been detected in the mouth, the gastrointestinal and upper respiratory tract, and the vagina [1,2].

Streptococcus intermedius is frequently associated with brain and liver abscesses, while pleuropulmonary infections are considered rarer [3]. Even less frequent is the association of lung and brain abscess due to this agent with left heart endocarditis. We describe the case of a 40-year-old man with a brain abscess due to *S. intermedius* and concomitant lung abscess and aortic native valve endocarditis.

2. Case presentation

The patient was a 40-year-old male of Egyptian origin, residing in Italy for about 15 years. He denied allergies, previous hospitalizations, or surgical interventions. For about 20 days he experienced persistent cough, asthenia, intermittent fever, intense headache, and worsening back and lumbar pain partially responsive to therapy with paracetamol and non-steroidal anti-inflammatory drugs. Due to the worsening of these symptoms, he went to the Emergency Department (ED) of a peripheral Hospital, where his vital signs were as follows: blood pressure 140/80 mmHg, heart rate 105 bpm, respiratory rate 17 breaths per minute, oxygen saturation 97% in room air, body temperature 38°C, and Glasgow Coma Scale 15. There were no focal neurological deficits, no meningeal signs, no positive covid antigen tests. Blood tests showed neutrophilic leukocytosis (white blood cells 12,900/mm³; neutrophils 77.7%) and a slight increase in C-reactive protein (1.2 mg/dL). A non-contrast cranial computed tomography (CT) scan revealed a necrotic-colliquative expansive lesion measuring 36 mm in diameter in the left subcortical occipital area, with an associated perilesional oedema. The patient started treatment with ceftriaxone 2 g intravenously (IV) and methylprednisolone 4 mg.

He was then transferred to the ED of a second level Center with Neurosurgical facilities, where a contrast-enhanced chest CT scan showed a pleural-based consolidative lesion in the left lung lower lobe measuring 63 mm in diameter, associated with a 16 mm internal cavity (FIG 1). The patient was

admitted to the Oncologic Pneumology department. After an Infectious Diseases consultation, the antibiotic therapy was modified to include meropenem 2 g three times/day (TID) and vancomycin 500 mg four times/day. QuantiFERON-TB (QTF) Gold Plus and blood cultures resulted negative. A nuclear magnetic resonance (NMR) scan (FIG 2) confirmed the abscess nature of the brain lesion and revealed its communication with the trigone of the left lateral ventricle, along with perilesional oedema.

He was then transferred to the Neurosurgery department, where a bronchial aspiration was performed for direct microscopic examination, culture and DNA testing for *Mycobacterium tuberculosis* complex, non-tuberculous mycobacteria, and *Aspergillus*. A full spine NMR scan was also conducted but resulted negative for focal lesions. Pending microbiologic results, considering the possible tubercular etiology of the disease, empirical combination therapy with linezolid 600 mg two times/daily, meropenem 2 g TID, rifampicin 600 mg once daily (QD), isoniazid 300 mg QD, ethambutol 1200 mg QD, levofloxacin 750 mg QD, and dexamethasone 6 mg TID was initiated.

Subsequently, a left occipital parasagittal craniotomy procedure was performed, resulting in drainage of the abscess and partial removal of the abscess capsule, along with sampling of biological material. The culture of the cerebral abscess samples resulted positive for *Streptococcus intermedius* sensitive to ampicillin, ceftriaxone, clindamycin, teicoplanin, and vancomycin. Thus, the patient started targeted therapy with ceftriaxone 2 g IV BID and dexamethasone 12 mg IV BID. Following the QTF and PCR results, which tested negative for mycobacteria and fungi, the previous anti-tubercular therapy was discontinued.

The patient was then transferred to our Infectious Diseases Center in stable conditions and afebrile. During the hospitalization, a transesophageal color Doppler echocardiography revealed aortic valve thickening with a prolapsing attitude of the right cusp, and a nodular hyperechogenic image between the right and left cusps, along with mild valve insufficiency. Due to the presence of multiple carious lesions, a dental CT scan was performed, showing periapical bone resorption at tooth 14 in the upper arch and a large carious lesion of tooth 36, accompanied by an inflammatory periapical bone resorption area.

The patient received a four-week course of ceftriaxone 2 g IV BID, resulting in progressive improvement of his clinical, laboratory, and radiological findings (FIG. 3). He was discharged in good general conditions, with instructions to continue oral therapy with amoxicillin/clavulanate 875 mg TID for further 10 days and a program of cardiological, neurosurgical and dental outpatient visits. After a three-month follow-up the patient is still in good health with no signs of infection relapse.



Figure 1. Chest CT scan showing consolidated area with thick-walled cavity lesion in the left lung lower lobe.



Figure 2. A) First axial contrast-enhanced T1-weighted NMR showing an oval-shaped enhanced lesion in the left occipital lobe with ipsilateral ventricular communication. B) T2 weighted NMR showing ventricular communication of the lesion with T2 hyperintense fluid collection. C) T1-weighted sagittal view of the abscess.



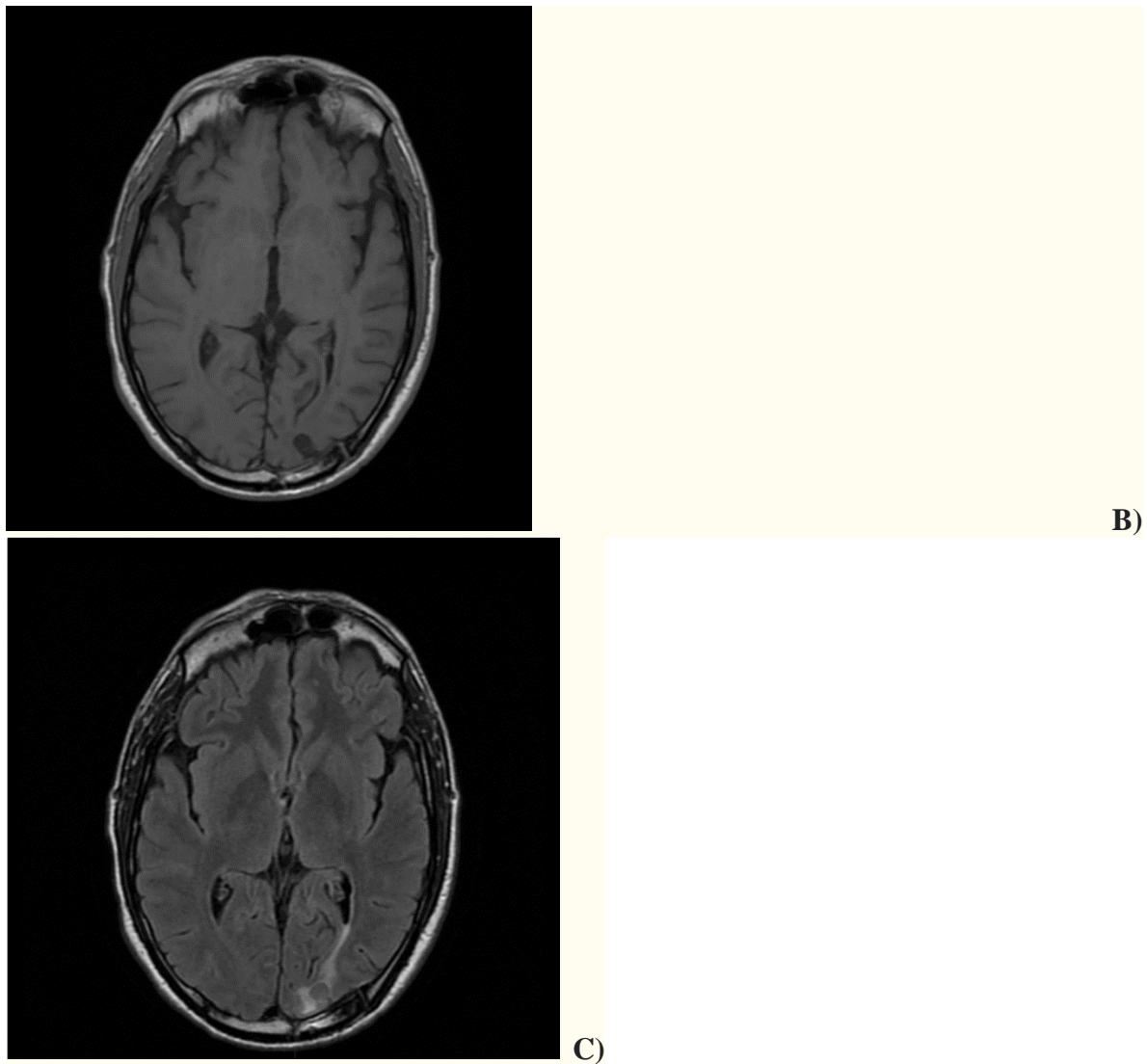


Figure 3. A) follow-up CT scan showing the reduction of the left lung lesion after a 4- week antibiotic course. B) Follow-up T1-weighted brain NMR after a 4-week antibiotic course. C) Follow-up T2-weighted brain NMR after a 4-week antibiotic course.

3. Discussion

Pleuropulmonary infections due to *Streptococcus intermedius* are considered uncommon [4]; however, in recent years their importance has been increasingly recognized. We reviewed the available medical literature by PubMed with the keywords “*Streptococcus intermedius*” AND “lung abscess”, “pleural effusion”, “pleural empyema” from 1993 to 2023, published in English. We found 34 articles meeting the inclusion criteria (Table), of which 4 described concomitant brain and lung abscesses, but none reported the presence of lung and brain abscess due to *S. intermedius* associated with left heart endocarditis [1-34]. Only one paper [14] described the case of lung and brain abscess associated with Chiari network endocarditis in the right heart.

TABLE. Articles describing lung abscesses and/or pleural infections due to *S. intermedius*

Article	n. of patients	Gender	Age (y)	Infection site	Outcome
Shinzato et al. ¹ , 1995	9	M=8 F=1	Mean 61.3	Lung, pleura	NA
Noguchi et al. ² , 2015	14	M=10 F=4	Mean 77.3	Lung/pleura	Recovered=12 Death=2
Bueno et al. ³ , 2023	1	F	25	Lung	Recovered
Erne et al. ⁴ , 2010	1	M	61	Lung, brain	Recovered
Jerng et al. ⁵ , 1997	17	NA	NA	Lung/pleura	NA
Chandy et al. ⁶ , 2001	1	M	21	Blood, lung, frontal sinus, epidural abscess	Recovered
May et al. ⁷ , 2010	1	M	53	Lung	Death
Van Laren et al. ⁸ , 2011	1	F	29	Blood, lung, genital	Recovered
De Cruif et al. ⁹ , 2012	1	F	63	Lung, dental abscess	Recovered
Trabue et al. ¹⁰ , 2014	1	M	36	Lung, brain	NA
Maeda et al. ¹¹ , 2012	1	F	46	Chest wall abscess, pleura	Recovered
Armendariz-Guezala et al. ¹² , 2017	1	M	33	Brain, lung	Recovered
Sakurai et al. ¹³ , 2020	1	M	80	Pleura, iliopsoas abscess	Recovered
Carrena et al. ¹⁴ , 2018	1	M	61	Lung, brain, Chiari network endocarditis	Recovered
Fujihara et al. ¹⁵ , 2021	1	M	64	Lung, pleura	Death
Tasleem et al. ¹⁶ , 2021	1	M	54	Lung, pleura	Death
Manasrah et al. ¹⁷ , 2021	1	M	54	Lung, pleura, vertebrae and discitis	Recovered
Nakagawa et al. ¹⁸ , 2022	1	M	6 mo	Lung, pleura	Recovered
Christensen et al. ¹⁹ , 1993	1	M	56	Lung	Recovered
Patail et al. ²⁰ , 2020	1	M	30	Lung, pleura	NA
Takahashi et al. ²¹ , 2019	1	F	83	Pleura	Recovered
Dyrhovden et al. ²² , 2019	16	NA	NA	Pleura	NA
Cobo et al. ²³ , 2018	9	M=7 F=2	Mean 63.9	Lung, pleura	Recovered=8 Death=1
Crespo Valades et al. ²⁴ , 2005	1	M	60	Pleural effusion, sub- phrenic abscess	Recovered
Noguchi et al. ²⁵ , 2014	1	M	79	Lung, pleura	Recovered
Hannoodi et al. ²⁶ , 2016	1	F	52	Lung, pleura	Recovered
Mautner et al. ²⁷ , 2000	1	M	80	Lung, pleura	Recovered
Huang et al. ²⁸ , 2022	1	M	10	Lung, pleura	Recovered
Kurkowski et al. ²⁹ , 2022	1	M	39	Liver, pleura, blood	Recovered
Jud et al. ³⁰ , 2019	1	M	59	Lung, pleura	Recovered
Lescan et al. ³¹ , 2013	1	M	74	Lung, pleura, epidural ab- scess	Recovered
Stelzmueller et al. ³² , 2006	2	NA	NA	Pleural empyema	Recovered
Iskandar et al. ³³ , 2006	1	NA	NA	Pleural empyema	NA
Lau et al. ³⁴ , 2002	1	M	32	Pleural empyema, blood	Recovered

NA: not available

Streptococcus intermedius is a Gram-positive, catalase-negative, nonmotile and facultative anaerobe coccus that colonize the mouth and the upper respiratory tract [2, 26]. SAG streptococci are oral

bacteria and may be unable to grow significantly on ordinary aerobic cultures; as a consequence, conventional cultivation may underestimate the role of these pathogens [25] in respiratory infections. The significance of anaerobes and oral bacteria in patients with community-acquired pneumonia and pleuritis has previously been reported [35, 36]. In some cases, a 16S rRNA gene sequencing analysis of bronchoalveolar or pleural effusion specimens was able to identify pathogens that are generally difficult to isolate using ordinary cultivation methods [25].

Risk factors for *S. intermedius* pleuropulmonary disease include smoking, alcoholism, dental diseases, chronic obstructive pulmonary disease, malignant neoplasms, liver cirrhosis, and diabetes [3]. Our patient had dental lesions that could have caused bacteremia and aortic valve endocarditis with brain abscess as a haematogenous spread complication. The lung abscess could have been caused by aspiration or haematogenous spread. Teramoto et al. [37] reported that aspiration may contribute to the pathogenesis of pneumonia in elderly patients, and that an increased age is associated with the risk of developing aspiration pneumonia. Given the young age of our patient, the aspiration in this case is less likely, whereas the haematogenous spread could have caused the lung abscess. Bacteraemic venous blood following the venous draining system to the right ventricle of the heart is pumped into the pulmonary arteries, until the capillary network of alveoli and parts of the visceral pleura. Indeed, several works described the simultaneous occurrence of brain abscess and lung abscess or pleural empyema [22]. In their recent work, Dyrhovden and coll. suggest that facultative and anaerobic oral bacteria, able to spread by deoxygenated venous blood to establish purulent infections in brain tissue, could also be able to reach and establish pyogenic infections in the lung parenchyma or pleural cavity [22].

S. intermedius is reported as a causative pathogen in only 2-5% of cases of bacterial pneumonia, but in 13-44% of pulmonary abscesses/empyema [21]. *S. intermedius* infections are commonly associated with abscess development. Virulence factors contributing to tissue invasion and abscess formation by this agent have recently been described by Issa and coll. [38] and include antigens I/II surface proteins; hydrolytic enzymes such as hyaluronidase, chondroitin sulfatase, and deoxyribonuclease; biofilm formation and defensive genes to oppose the human immune system, such as superantigens that cause lymphocyte apoptosis; the polysaccharidic capsule formation; the genes of the *Streptococcus* Invasion locus system; the intermedilysin, which initiates pore complex formation in host cell membranes, and the sialidase A that contributes to pathogenicity by controlling interbacterial communication and host-bacterial interactions. Abscess drainage and surgery should be considered, on a case by case basis, in order to successfully achieve an adequate source control of the infection.

4. Conclusions

In summary, we described a case of brain abscess caused by *S. intermedius*, associated with lung abscess and aortic valve endocarditis, in a young patient with dental disorders. In addition to being a well known cause of brain abscess, *S. intermedius* is increasingly recognised as a causative agent of pleuropulmonary disease.

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