MALDI-TOF MS contribution to the diagnosis of *Campylobacter rectus* multiple skull base and brain abscesses

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Abstract

Campylobacter rectus is rarely associated with invasive infection. Both the isolation and the identification requirements of *C. rectus* are fastidious, probably contributing to an underestimation of its burden. We report the case of a 66-year-old man who developed several skull base and intracerebral abscesses after dental intervention. *Campylobacter rectus* was isolated from the brain biopsy. Within 45 minutes of reading the bacterial plate, the strain was accurately identified by MALDI-TOF MS. This rapid identification avoided the extra costs and delays present with 16S rRNA gene sequencing and allowed for a rapid confirmation of the adequacy of the empirical antibiotic treatment.

Keywords: *Campylobacter rectus*, Intracerebral abscess, MALDI-TOF MS, Mass spectrometry, Skull base abscess
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Introduction

Campylobacter rectus had long been considered a commensal bacterium of the human oral cavity but emerging evidence indicates that it could become a major periodontal pathogen [1]. A few cases of extraoral abscesses and systemic infections have been reported in which *C. rectus* was always identified using 16S rRNA gene sequencing [2–7]. We report here a case of multiple skull base and brain abscesses caused by *C. rectus*. Matrix-assisted laser desorption/ionization time-of-flight mass spectrometry (MALDI-TOF MS) allowed fast and accurate identification of this difficult-to-identify microorganism.

Case description

A 66-year-old man was admitted for vertigo, gait instability and repetitive falls for 8 weeks accompanied by a 25-kg weight loss. Medical history indicated a right superior tooth abscess treated by antibiotics and extraction 10 weeks previously. Ten days after the extraction, sudden hearing loss occurred and a right otitis media was diagnosed and treated with β-lactams. Clinical evaluation identified a generalized periodontitis, dysarthria, diplopia, nystagmus, right peripheral facial palsy and right deafness. The computed tomography (CT) scan showed right mastoid fluid filling, with focal erosions, and petro-occipital fissure enlargement, suggesting petrous apex osteomyelitis with reactive mastoiditis (Fig. 1). The brain magnetic resonance imaging (MRI) showed right mastoiditis with multiple ipsilateral abscesses: cerebellopontine angle next to the thrombosed sigmoid sinus, parapharyngeal along the Eustachian tube, surrounding the internal carotid artery (Fig. 2a) and within the cerebellum (Fig. 2b). There were also right cerebellopontine angle epidural abscess and lateral and sigmoid sinuses thrombosis (Fig. 2a,b). Laboratory results showed leucocytosis (15.5×10^9/L) and elevated C-reactive protein (25.8 mg/L). Drainage of the cerebellum abscess was performed and samples were sent for analysis. The biopsy confirmed necrotic abscess with neutrophil infiltrate. A Gram stain showed thin Gram-negative rods, and an anaerobic culture yielded small colonies after 3 days of incubation that were identified as *C. rectus* using MALDI-TOF MS (Microflex LT and Biotyper IVD 5627 entries; Bruker Daltonics, Bremen, Germany). The strain showed susceptibility to amoxicillin-clavulanate, erythromycin, tetracycline and ciprofloxacin tested by disc diffusion. Minimal inhibitory concentration for meropenem was determined using a gradient strip (0.012 mg/L). Meropenem 2 g three times per day was administered. A second surgery was necessary to drain the skull base (parapharyngeal

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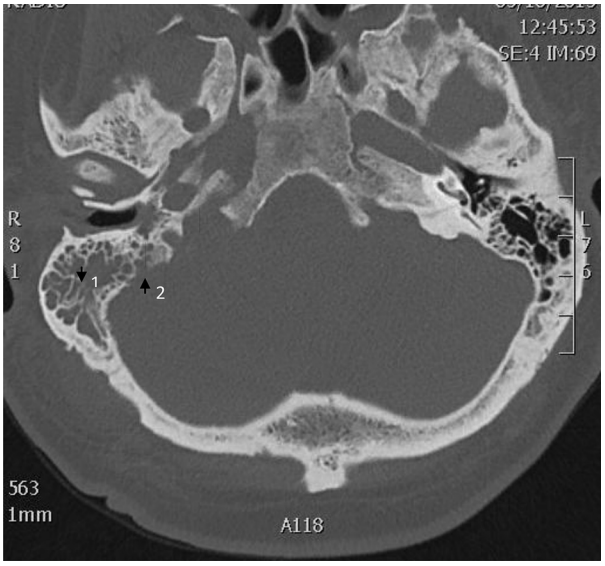

FIG. 1. Preoperative axial bone cranial CT: mastoid cells are fluid-filled (1), there is a subtle erosion of the petrous apex (2) and enlargement of the petro-occipital fissure, corresponding to osteomyelitis of the petrous apex with reactive mastoiditis.

FIG. 3. Control brain MRI 3D Axial T1 with gadolinium 10 months after surgery and prolonged antibiotic treatment, shows complete regression of the cerebellar and cerebellopontine angle abscesses, leaving on the site a thickened meningeal scar.

and para-Eustachian tube) abscesses. The osteitic cells were removed during mastoidectomy and the epidural empyema was reached and drained. Because of severe periodontitis, complete dental extraction was performed. The positron emission tomography (PET) -CT and brain MRI performed after 3 months showed a progressive decrease of the residual abscesses but moderate fluorodeoxyglucose reuptake persisted. After a 12-week period, meropenem was replaced by oral doxycycline 100 mg twice per day. The patient went home 4 months after admission with residual diplopia and a mild walking impairment treated respectively by prism glasses and a walking stick. Doxycycline was maintained for 3 months until the follow-up PET-CT and brain MRI showed no residual inflammation or residual lesions. The last PET-CT and brain MRI, performed 3 months after antibiotics cessation, showed no lesion recurrence (Fig. 3).

Discussion

We report a case of multiple skull base and brain abscesses caused by *C. rectus*. The most likely origin of the bacterial spread to the brain is a dental abscess, which occurred before admission [8,9]. Vascular dissemination of *C. rectus* is suggested by studies that have reported the presence of this pathogen in atherosclerotic plaque samples and the association with aortic aneurysm [10,11]. Extraoral infection by *C. rectus* is uncommon.

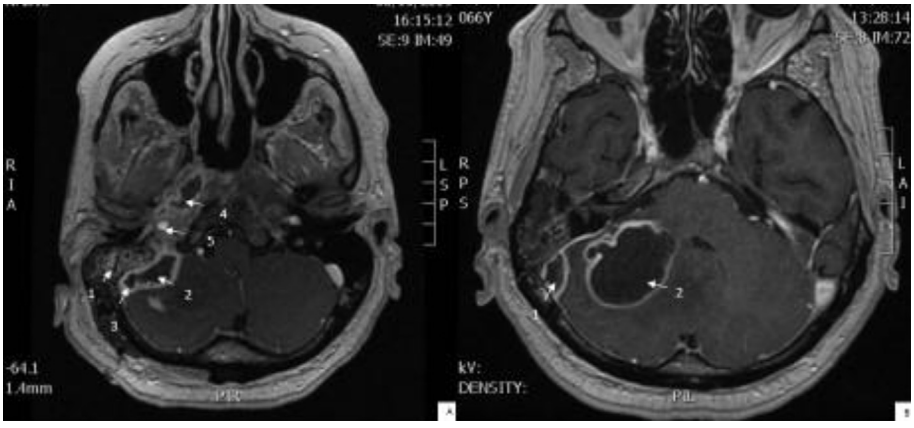

FIG. 2. Preoperative brain MRI 3D Axial T1 with gadolinium: (A) next to the mastoiditis (1) is an epidural abscess (2) anterior to the sigmoid sinus thrombosis (3); abscess along the Eustachian tube and parapharyngeal space (4) surrounding the internal carotid artery (5); (B) the upper slice shows lateral sinus thrombosis (1) and ipsilateral cerebellar abscess (3.5 cm) (2).

To our knowledge, only two cases of cerebral involvement caused by *C rectus* have been reported: one case of ruptured intracranial aneurysm with subdural empyema in a 41-year-old Indonesian woman and a septic cavernous sinus thrombosis in a 55-year-old Chinese man [6,7]. In the latter case, the patient had undergone dental extraction. Regarding our patient, the initial infectious focus was probably at the dental extraction site, spreading to the parapharyngeal space, going further along the Eustachian tube, surrounding the petrous internal carotid artery before reaching the middle ear. The osteomyelitis of the petrous apex then provided the path to the petro-occipital fissure, cerebellopontine angle and cerebellar dissemination. Because *C. rectus* has been recognized as a causative pathogen of otitis media, and despite the lack of a middle ear sample, we assume that there is a causal link between this microorganism and the otitis media observed in our patient before admission [5]. Both the culture and identification of *C. rectus* are challenging for the microbiology laboratory. Most campylobacters require a microaerobic atmosphere containing about 5% O_2 for isolation; however, some species, including *C. rectus*, can grow anaerobically in the presence of fumarate, aspartate, nitrate and/or H_2 [12]. The biochemical profile of *C. rectus* is well described but, in most reported cases, isolates were referred for 16S rRNA gene sequencing with excessive delays in the microbiological diagnosis and additional costs [2–7]. MALDI-TOF MS is a fast and accurate method that offers many advantages over conventional identification methods.

In clinical laboratories, the implementation of MALDI-TOF MS led to an increased number of identified bacterial species, allowing the correct identification of microorganisms that usually remained unidentified when using biochemical techniques [13]. The method has rapidly been considered a cost-effective alternative to 16S rRNA gene sequencing [14]. Superiority of MALDI-TOF MS over biochemical methods for the identification of *Campylobacter* sp. and related organisms has been illustrated in the literature, suggesting that MALDI-TOF MS could be a method of choice for the identification of *ε-Proteobacteriacae* [15–17]. In addition, such a method requires little biological material, which is of major interest for slow-growing organisms such as *C. rectus* [18]. In the present case, the communication of the identification to the physician occurred within 45 min of reading the culture plate. MALDI-TOF MS is now broadly implemented in clinical laboratories, which will probably solve *C. rectus* identification issues.

Conclusion

The use of MALDI-TOF MS made the usually challenging microbiological diagnosis of *C. rectus* much easier, allowing the fast and accurate identification of this slow-growing bacterium. MALDI-TOF MS constitutes an alternative to expensive 16S rRNA gene sequencing and is likely to lead to better recognition of this pathogenic microorganism, which is probably under-reported.

Conflicts of interest

None declared.

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