



## Case report

# Corynebacterium bovis surgical site infection and brain abscess: The first case report and literature review

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## ABSTRACT

*Corynebacterium bovis* is a mainly zoonotic pathogen, a common cause of bovine mastitis. It is however rarely pathogenic in humans, with only few cases reported in the literature. We present the first reported case of neurosurgical site infection due to *c.bovis*, resulting in a brain abscess. A 75-year-old female presented with dysphasia resulting from lung metastases. She underwent surgical resection, and four months later presented with swelling, tenderness and crusted exudate over the surgical site. Mri revealed surgical site infection and brain abscess, therefore the patient underwent urgent surgery. *C.bovis* was isolated from all specimens sent from different locations. The patient received appropriate antibiotic treatment without sequela. *C. Bovis* is being increasingly reported as a cause of various human infections, and should not automatically be considered to be a mere contaminant. It is imperative to be certain, prior to the antibiotics treatment, that this particular isolate is likely to be the pathogen, as it can be evident when there are multiple positive cultures of this pathogen from several locations.

## Introduction

*Corynebacterium bovis* is a nonsporulating, catalase-positive, gram-positive, club-shaped rod, that belongs to the corynebacteriaceae family [1–3]. *C. Bovis* is a natural commensal in the bovine udder, and as such, is usually isolated from bovine mastitis [4]. It is however rarely pathogenic in humans, with only few cases reported in the literature, and only 4 involving the central nervous system (CNS) [4–6]. Herein, we present the first reported case of neurosurgical site infection due to *corynebacterium bovis*, resulting in a brain abscess.

## Case report

A 75-year-old right-hand-dominant female, was admitted to our hospital with progressive confusion, dysphasia, and disorientation. Her medical history included past smoking (35 pack-years, quit 10 years ago), ischemic heart disease with two past stents, peripheral vascular disease, hypertension, dyslipidemia, type 2 diabetes, and a history of local right thigh melanoma resection, without adjuvant treatments, nor systemic involvement. She had no contact with animals in or outside her home, except for a dog owned by her daughter's family. She resides in tel

aviv, and did not visit rural areas in recent past.

Upon arrival at the emergency department (ed), a non-contrast computed tomography (ct) was performed and showed a left temporal space occupational lesion, surrounded by edema. Her neurological examination was unremarkable, except for dysphasia. A magnetic resonance imaging (mri) was done, showing a hyperintense lesion on t1 imaging after gadolinium-contrast administration, surrounded by substantial vasogenic edema (Fig. 1). A high dose of dexamethasone was initiated, with mild improvement of her symptoms in subsequent days. A total body ct revealed a lesion on the left upper lobe of the lung. She underwent a ct-guided biopsy of this lesion, and the pathological results revealed adenocarcinoma. Next, a right temporal craniotomy for resection of the lesion was done, with similar pathological results of metastatic lung adenocarcinoma. The post-operative course was uneventful with fast resolution of all neurological symptoms. Subsequently, the patient underwent radiosurgery treatment of the resection cavity and started the oncological treatment with pembrolizumab, a pd-1 receptor antagonist. Four months after her surgery, the patient presented to the ed with swelling and mild tenderness over the surgical site wound that started a few weeks before, and discharge that started days before her arrival. She denied any fever or other symptoms. She was

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afebrile, and her physical examination was normal except for the mild swelling and yellowish-crust discharge over the surgical incision (Fig. 2). Notably, the patient did not have leukocytosis, and her c-reactive protein (crp) levels were normal. A non-contrast ct scan showed mild subcutaneous swelling over the surgical site (Fig. 3). Importantly, an mri done 2 weeks before for a follow-up, showed good local tumor control, with resolution of the vasogenic edema. However, the scalp swelling was overlooked, and a retrospective examination showed the swelling to be with restricted diffusion and enhancing periphery post-contrast injection (Fig. 4). A trial for local aspiration of the collection was made, with receiving of yellowish fluid material, that was sent to cultures. We decided to hold treatment with antibiotics until initial microbiological identification, because of the good clinical condition of the patients and the lack of any infection indices. Two days later, the patient underwent surgical wound revision. After shaving of the head, a minor fistula was found in the middle of the surgical scar. During surgery, the temporal muscle looked swollen and necrotic with cloudy fluid. The bone was removed, and underneath, more cloudy fluid was seen. No clear pus material was found. A titanium mesh was used for cranioplasty. Microbiological specimens were sent from all of the fluids found, including specimens from the bone and temporal muscle. Next, a peripherally inserted central catheter (picc) line was installed and empiric antibiotic therapy consisting of intravenous (iv) vancomycin 1gr\* 2/d and meropenem 2gr\* 3/d was initiated. The next day, bacterial growth from the local aspiration identified corynebacterium species, therefore the antibiotic change to iv ceftriaxone 2gr\* 2/d and oral metronidazole 500 mg\* 3/d. Gram stain showed gram-positive, club-shaped rods (Fig. 5).

The bacteria from all specimens were identified using MALDI-TOF (Biomerieux, Marcy l'etoile, france) as *c. Bovis*, susceptible to rifampicin and ciprofloxacin and resistant to clindamycin and benzylpenicillin. Therefore, the antibiotic regimen was changed accordingly to oral rifampicin 600 mg\* 1/d and oral ciprofloxacin 750 mg\* 2/d. The patient recovered well from the surgery. The picc line removed, and she was discharged home at postoperative day 6 and continued on oral antibiotic therapy as an outpatient, for a total duration of 6 weeks.

## Discussion

Corynebacterium species associated with human diseases include *c. Diphtheriae*, and non-diphtheriae species *c. Ulcerans*, *c. Amycolatum*, *c. Urealyticum* and *c. Jeikeium* [1,2].



Fig. 2. Mild swelling and yellowish-crust discharge over the surgical site incision.

These non-diphtheria corynebacteria are collectively termed diphtheroids and comprise a group of diverse strictly aerobic or facultatively anaerobic bacteria that can be found in the environment as well as constitute part of the microflora of human skin and mucous membranes, respectively [1]. They differ from *c. Diphtheriae* in their pathogenicity and toxin production, in addition to the fact that they are usually more uniformly stained [7]. As part of the human flora, they may be found incidentally, and therefore be considered as a contaminant [7,8]. Chandran et al. Showed that various species of diphtheroids can be isolated from different clinical specimens, and among them, 10% were identified as *c. Bovis* [7]. Recently, however, diphtheroids are being increasingly recognized as important biofilm-forming, multi-drug-resistant, opportunistic nosocomial pathogens, leading to various infections [1,3,7–10].

*C. Bovis* was first isolated by evans in 1916 from aseptic cow's milk [11,12]. It is a lipophilic, nonsporulating, gram-positive, club-shaped rod that is considered to be a principally zoonotic pathogen, commonly causing bovine mastitis, causing reduced milk production, an important cause of economic losses in dairy farms [12,13]. In addition, it is the causative agent of hyperkeratotic dermatitis ('scaly skin disease') in immunodeficient mice, leading to a major problem in preclinical oncology research [14]. Until recently, little was known about the

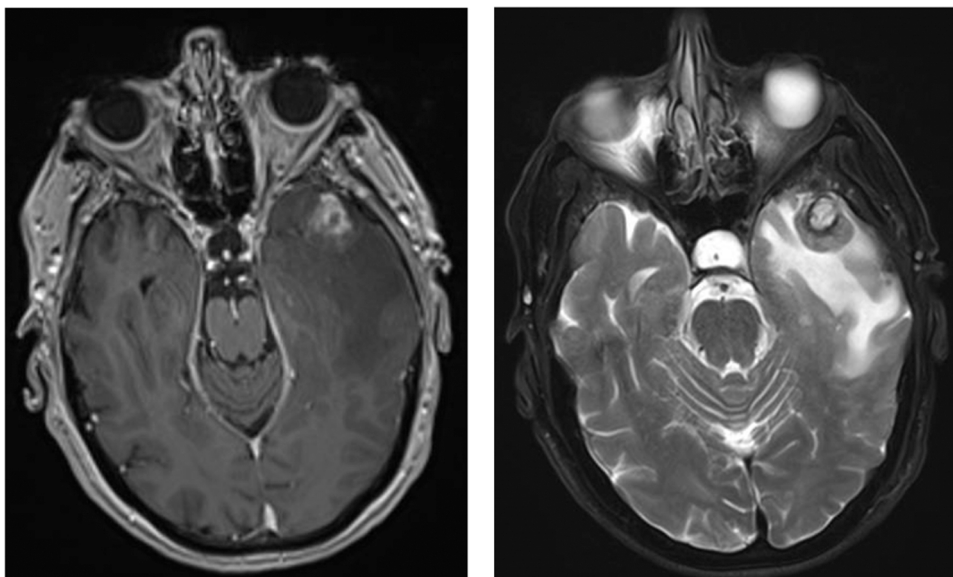
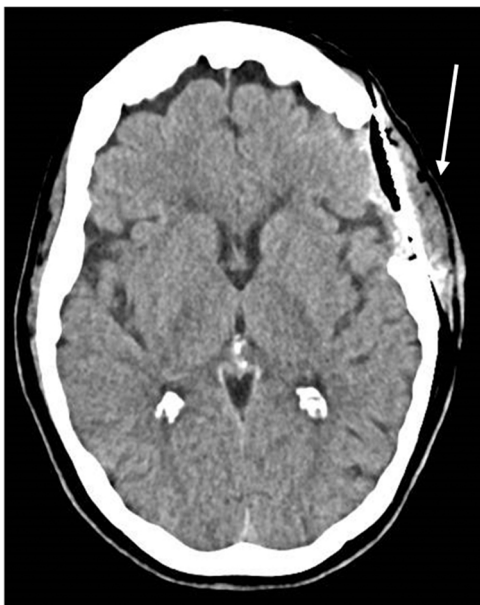


Fig. 1. MRI showing a hyperintense lesion on T1 imaging after gadolinium-contrast administration (left), surrounded by substantial vasogenic edema (right).



**Fig. 3.** A non-contrast CT scan showing scalp swelling over the surgical site (white arrow).

genetic characteristics and diversity of *C. Bovis* because only a single draft genome was available [3]. Interestingly, cheleuitte-nieves et al. showed that there are genetic differences among different *C. Bovis* bacteria, depending on the host, with human and bovine isolates having significantly fewer genomic virulence factors compared to mouse and rat isolates [3]. In contrast to other diphtheroids, *C. Bovis* has not been described as part of the normal human flora [15]. *C. Bovis* is only very rarely associated with human disease, and to date, only 18 cases of various human infections have been reported (Table 1) [1,4-6,8,12,15-21]. Bolton et al. were the first group to report on a human infection caused by *C. Bovis*, when they reported on a young man with ventriculojugular shunt infection associated with glomerulonephritis [5]. Other related CNS infections were reported by Vale et al. and include one case of meningitis where *C. Bovis* was isolated from the cerebrospinal fluid (CSF), and another case of spinal epidural abscess at the level of D8-9, where *C. Bovis* was isolated from the CSF, but *Staphylococcus aureus* grew from the pus material, leading the authors to assume that the

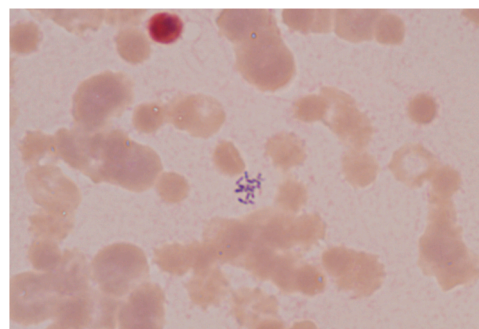
patient had, in addition to the epidural abscess, mild bacterial meningitis [4]. Vargas et al. were the only group to report on a case of young woman with SLE, that suffered from a brain abscess caused by *C. Bovis* and *actinomyces viscosus* co-infection, found after she presented with high fever, headache, and behavioral changes [6]. To the best of our knowledge, we present the first case of superficial and deep surgical site infection complicated by brain abscess, caused solely by *C. Bovis*.

The source of the infection in our patient remains unknown. No contact with cattle or other animals was reported by the patient. The timing and clinical findings may suggest two possible mechanisms, both originating from skin flora. The first is an intraoperative infection, and the other option is seeding from the fistula formed at the surgical scar. Because of the low-virulence characteristic of most skin flora, such as corynebacteria, it is likely that it may present as a late and low-grade surgical site infection.

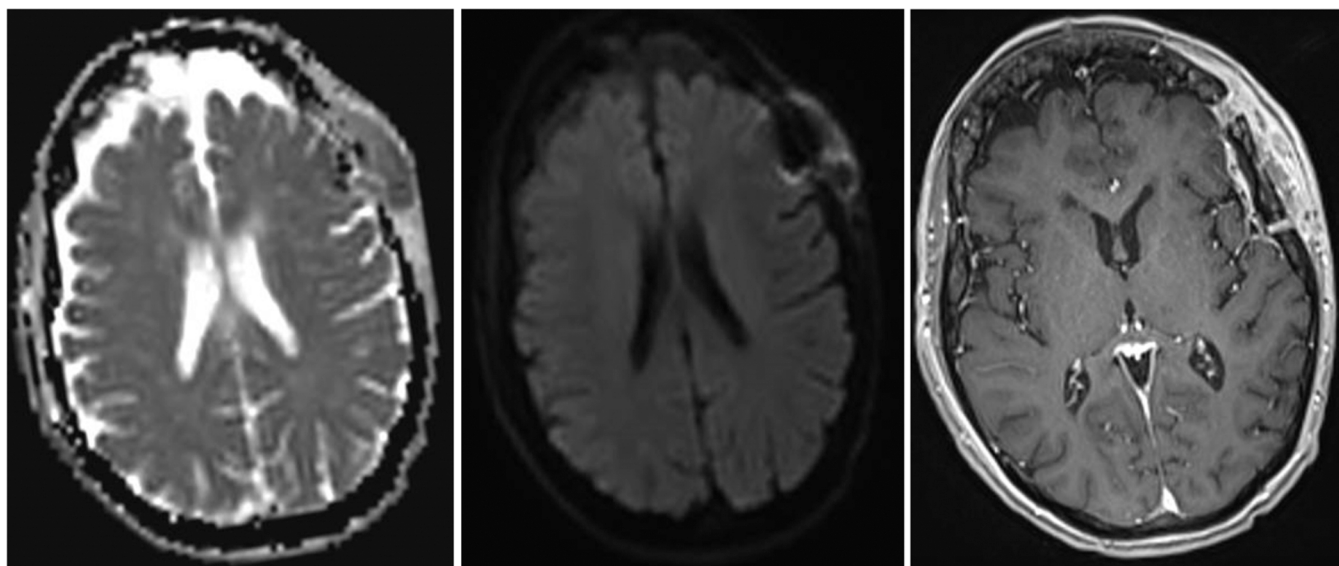
There are yet no formal recommendations regarding the optimal antibiotic regimens for *C. Bovis* human infections [18]. It seems that for non-ocular infections, the human isolates of *C. Bovis* have been shown to have variable sensitivity to penicillin, with more prominent sensitivity to rifampin, as was in our case [4,17].

### Conclusion

*C. Bovis* is being increasingly reported as a cause of various human infections, and should not automatically be assumed to be a contaminant. It is imperative to be certain, prior to the antibiotic treatment, that this particular isolate is likely to be the pathogen, as it can be evident



**Fig. 5.** Bacterial Gram stain showing Gram-positive, club-shaped rods.



**Fig. 4.** MRI showing the scalp swelling with restricted diffusion (ADC, left; DWI, middle) and enhancing periphery post-contrast injection (right).

**Table 1**  
Reported human *C. bovis* infections.

Reference	Number of patients	Age (years), sex (m/f)	Infection	Culture material	Country	Antibiotics Regimen
Bolton et al., 1975 [5]	1	29, m	Ventriculojugular shunt infection complicated by glomerulonephritis	Blood culture	Usa	Intravenous (iv) penicillin, followed by oral erythromycin and rifampin
Vale et scott, 1977 [4].	6	17, m	Meningitis	Csf	England	Ampicillin followed by penicillin, streptomycin and chloramphenicol.
		70, m	Spinal epidural abscess / meningitis	Csf (pus material grew <i>s. aureus</i> )	England	Cloxacillin
		42, f	Leg ulcer	Wound swab	England	Ampicillin
		22, m	Chronic otitis media	Aural swab	England	Neomycin\betamethasone drops followed by oral ampicillin
		45, f	Subacute endocarditis	Blood	England	Cephaloridine, erythromycin, and fusidic acid
		32, f	Subacute endocarditis	Blood	England	Erythromycin and fusidic acid
Duty et al., 2004 [16]	1	1.4, m	Purulent conjunctivitis	Ocular swab	Switzerland	Bacitracin\polymyxin b ointment
Dalal et al., 2008 [21]	1	84, f	Line-related septicemia	Blood	Usa	Iv vancomycin, meropenem, tigicycline and polymyxin, followed by iv vancomycin
Achermann et al., 2009 [17]	1	62, f	Prosthetic joint infection	Sonication fluid	Switzerland	Iv imipenem, followed by oral amoxicillin
Vargas et el, 2009 [6]	1	23, f	Brain abscess	Pus ( <i>c. bovis</i> - <i>a. viscosus</i> co-infection)	Philippines	Oral trimethoprim-sulfamethoxazole (tmp\smx)
Sbaai et al., 2011 [18]	1	65, m	Septicemia	Blood	Morocco	Iv amikacin and teicoplanine
Chow et al., 2013 [15]	4	49, m	Purulent conjunctivitis	Ocular swab	Usa	Tobramycin drops and oral amoxicillin/clavulanic acid
		25, m				Ofloxacin drops
		33, m				Erythromycin ointment and oral tmp\smx
		90, m	Skin ulcer	Wound swab		Oral doxycycline
Meeuwes et wolfs, 2019 [19]	1	0.8, f	Preseptal cellulitis	Ocular swab	Netherlands	Iv amoxicillin/clavulanic acid, followed by oral amoxicillin/clavulanic
Elsheikh et al., 2021 [20]	1	89, f	Corneal abscess	Ocular swab	England	Gentamicin drops, vancomycin drops and oral ciprofloxacin

when there are multiple positive cultures of this pathogen from several locations.

This report highlights the surprising and unexpected timeline for the development of brain abscesses following surgery and the challenges in treating this rare and unusual pathogen.

### Ethical approval

All authors have agreed to authorship, read and approved the manuscript, and given consent for publication of the manuscript.

### Consent

Consent to publish was not obtained since the case report does not contain any personal identifiers.

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### Declaration of Competing Interest

All authors report no potential conflicts of interest.

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