

# Sulphur granules and red herrings: difficulties in anaerobic brain abscess diagnosis

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**ABSTRACT** An initially diagnosed actinomycotic brain abscess was reclassified to *Campylobacter gracilis*. Structural similarities between Gram-positive anaerobes highlight the diagnostic difficulties in identifying brain abscess-causing organisms. Advances in microbial identification have led to new species and genera recognition and reclassification of existing taxa. Awareness of these is necessary in order to understand the role of newly-described/reclassified organisms in disease processes.

**KEYWORDS** Actinomycosis, brain abscess, *Campylobacter gracilis*, Gram positive anaerobes, reclassification of taxa

**LIST OF ABBREVIATIONS** Blood pressure (BP), C reactive protein (CRP), computerised tomography (CT), erythrocyte sedimentation rate (ESR), Glasgow coma scale (GCS), white blood cell count (WBC)

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## CASE REPORT

A 73-year-old right-handed livestock farmer presented via his GP complaining of a four-day history of poor coordination and decreased mobility. This was preceded by a three-week history of nausea, lethargy and malaise. There was no headache, no speech, nausea or visual symptoms, no loss of consciousness or seizures. Past medical history included a nasal polypectomy, brucellosis and asthma, despite which he was a lifelong smoker. He had no allergies and was on no prescribed medication, but reported the use of over-the-counter deer velvet capsules, which a friend had imported from Canada.

On examination he was pyrexial at 37.6 °C with GCS 15, a regular pulse of 68 bpm and BP 120/55 mmHg, saturating at 98% on air with no wheeze. Neurologically he had a right hemiparesis together with right sided past-pointing, visual and sensory inattention. Haematological investigations revealed normochromic normocytic anaemia (Hb 9.2 g/dL) associated with marked neutropaenia: WBC 1.6 × 10<sup>9</sup>/L (Neu 0.6/ Lymph 0.5/ Mono 0.1/ Eos 0.0/ Basos 0.0). Blood film examination showed no left shift, but evidence of toxic granulation, rouleaux, macrocytosis and polychromasia. Platelets were 233 × 10<sup>9</sup>/L, folate 5.1 nmol/L, B12 813 pmol/L and ferritin raised at 560 ng/mL. CRP (33 mg/L) and ESR (47) were raised. Biochemical tests, including urea and electrolytes, calcium and liver function were normal. Blood cultures were negative.

A computerised tomography scan of the brain revealed a ring enhancing lesion in the left parietal region, for



**FIGURE 1** Postoperative axial CT brain scan showing persistence of a left parietal ring enhancing lesion with surrounding oedema and midline shift.

which the patient underwent a stereotactic aspiration and biopsy. Microbiological examination showed sulphur granules and Gram-positive branching bacilli clusters, Gram-negative bacilli and mixed anaerobes. The differential diagnosis was between *Actinomyces* and *Nocardia* intracranial abscess and intravenous ceftriaxone was commenced. The abscess persisted; two further aspirations were performed in the following fortnight. Cultures showed mixed anaerobic Gram-

positive and negative microaerophilic bacteria very suggestive of the genus *Actinomyces*.

The patient continued to have swinging pyrexia with rising inflammatory markers (CRP 264 mg/L, ESR 105) and a persistent leukopaenia (WBC  $0.3 \times 10^9/L$ ). Bone marrow aspiration revealed dysplastic megakaryopoiesis and erythropoiesis suggestive of preexisting myelodysplasia of unknown aetiology. Serum electrophoresis showed an IgG lambda band. Unfortunately, the patient continued to deteriorate with decreased respiratory effort, progressive sepsis, widespread rash and abdominal distension, eventually succumbing to a cardiac arrest. Subsequent to his death, post mortem examination revealed that the abscess had decreased in size, while results from a further microbiological investigation at the national reference laboratory for anaerobes in Cardiff classified the organism as *Campylobacter gracilis*.

## DISCUSSION

A broad spectrum of bacteria are involved in brain abscess pathogenesis, with a recent rise in the incidence of anaerobes. Studies have identified as many as 41 strains.<sup>1</sup> Such pathogens were more likely to be the causative agent in a unilocular brain abscess and/or those associated with an ENT infection. The ratio of anaerobic:aerobic:mixed infections can vary from 40.5%:47.5%:12% to 56%:18%:26%.<sup>1,2</sup> Predominant anaerobic isolates are Gram-positive cocci including the genus *Peptostreptococcus* and *Fusobacterium*, *Prevotella*, *Bacteroides*, *Actinomyces*. Advances in microbial identification such as phylogenetic 16S rRNA sequencing have led to major reorganisations amongst several genera of anaerobic organisms.<sup>3</sup> This has led to the description of new species and genera and the reclassification of existing taxa. The overall increase in anaerobic

bacteraemia observed in recent years (eg *Fusobacterium mortiferum*, *Leptotrichia buccalis*, *Actinomyces*, *Lactobacillus*, *Clostridia*) and such technological advances are likely to lead to continuing reclassification and nomenclature changes. For example, *Sutterella wadsworthensis* has been differentiated from *Campylobacter gracilis*, which itself was previously called *Bacteroides gracilis*.

The incidence of brain abscess is around four cases per million per annum. Despite a mortality of less than 5%, little prospective data exists to guide optimal treatment options. In our case the infection is believed to have been opportunistic, yet the aetiology of the neutropaenia was not found. An inclination towards the diagnosis of actinomycosis was supported by the repeated culture and microscopy results and the deer velvet capsules the patient had been taking for a long time. Although uncommon, infection in other species has been reported.<sup>4</sup> Furthermore, actinomycosis is common in North American deer,<sup>5</sup> the source of our patient's supply of deer velvet capsules.

The final diagnosis, albeit after the patient's death, highlights the potential role of *Campylobacter gracilis*. This is a Gram-negative, asaccharolytic, nitrate-positive, urease-negative organism that requires formate and fumarate or hydrogen as a growth additive. It can grow in the presence of 2–6% oxygen in the absence of blood (i.e. is microaerophilic). Although suppuration with *Campylobacter* species is relatively common, this particular species is not well represented in the literature. While this may represent underreporting, the difficulties in the taxonomy of anaerobic bacteria and the renaming of organisms, remind clinicians how important awareness of new bacterial names is. This will allow new insights into the role of newly described or reclassified organisms in disease and on their sites of normal carriage.

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