Clostridium glycolicum isolated from a patient with otogenic brain abscesses

Severe complications of otitis media following clay in the ear as a home remedy

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Abstract

We describe a case of brain abscesses with gas formation following otitis media, for which the patient treated himself by placing clay in his ear. Several microorganisms were cultured from patient material, including Clostridium glycolicum. This is the first report of infection in an immune-competent patient associated with this microorganism.
A previously healthy male patient, 62 years of age, presented in our hospital with severe pain in his right ear. Ten days prior to presentation, the patient had started treating his earache by placing pieces of clay in his external auditory meatus. When the patient was seen in our hospital, the clay was removed and the ENT specialist diagnosed acute otitis media and otitis externa, with perforation of the tympanum. Amoxicillin-clavulanic acid was prescribed and the patient was discharged home. Two days later the patient presented again with headache, earache, hearing loss and neck stiffness. Physical examination now showed Kernig and Brudzinski’s sign positive, a right-sided nystagmus and diplopia. He was febrile (39.5°C) and hypertensive (160/100 mm Hg) but was well orientated. The patient was admitted with suspected bacterial meningitis secondary to otitis media and blood was taken for cell count, chemistry, and culture for which it was inoculated into paired aerobic and anaerobic bottles of the Bactec blood culture system (Becton Dickinson Diagnostic Instrument Systems, France). CRP on admission was 168mg/L and ESR was 105 mm/h. Following a CT scan, lumbar puncture was performed using standard aseptic techniques, with collection of CSF for cell count, chemistry, gram stain and culture. CSF examination revealed increased leukocyte count (1733/mm3), proteins (1.98 g/L) and decreased glucose (1.1 mmol/L, with serum glucose 8.9 mmol/L). On gram stain no leukocytes and no microorganisms were seen. Culture results are represented in table 1.

A CT scan made before lumbar puncture showed signs of right-sided otitis media and mastoiditis. Gas was seen along the tentorium and vermis cerebri (figure), compatible with intra-cranial gas formation. Broad-spectrum antibiotic treatment with flucloxacillin, ceftazidime and metronidazole was started. Surgical intervention aimed at draining the mastoid was carried out one day after admission by the ENT specialists. Direct inspection during surgery revealed
abundant pus and necrotic tissue extending to the brain tissue. Swabs were taken of pus present in
the mastoid for culture, however no samples were collected specifically for anaerobic culture.
The swabs were plated on sheep blood agar, MacConkey and chocolate agar plates (Oxoid,
United Kingdom) which were incubated under aerobic conditions, and on one sheep blood agar
plate which was incubated under anaerobic conditions.

The patient’s condition deteriorated in the days following admission, when he required
mechanical ventilation following an epileptic seizure. An MRI scan showed signs of encephalitis
and thrombosis of the right sigmoidal sinus and the patient was transferred to a tertiary care unit
for neurosurgical care.

Necrotic tissue from the mastoid was subsequently excised and intra-cerebral pus was drained,
and samples were placed in a sterile container for culture. Although no anaerobic transport
medium was used, the transport time to the microbiology unit was sufficiently short to assure
survival of aerobic as well as anaerobic microorganisms. Gram stain of the excised necrotic tissue
showed few leukocytes and abundant gram negative rods, gram positive cocci and gram positive
rods. Material was plated onto sheep blood agar (Becton Dickinson), MacConkey agar (Oxoid),
chocolate agar, and CNA agar plates (Becton Dickinson), and incubated under aerobic
conditions, and on a Brucella blood agar plate (Becton Dickinson) which was incubated under
anaerobic conditions. Also, material was cultured for fungi and mycobacteria, but these cultures
remained negative. Culture results are represented in table 1. On the clostridium spp. which were
cultured, we performed an API rapid ID 32 A test (BioMerieux, France). The result was
confirmed by sequencing the 16S rRNA region of the genome of both strains (5).

Following excision and drainage of the intracranial necrotic tissue and pus, the patient’s
inflammatory parameters improved rapidly. His neurological condition nevertheless remained
poor for several weeks, but he eventually recovered with residual profound bilateral hearing loss, for which he received two cochlear implants.

Brain abscesses are focal suppurative processes, usually originating from a chronic otitis media, mastoiditis, sinusitis or dental infection, from penetrating traumas or post surgery. Brain abscesses are associated with otitis media in around 30% of cases. Less frequently, brain abscesses are complications of septicemia or dental infections. In a quarter of cases, the origin of the brain abscess is not known (7, 12). It is estimated that only 1 in $2 \times 10^6$ episodes of otitis media results in a brain abscess (9).

Microorganisms most commonly found in otogenic brain abscesses include streptococci, staphylococci, enterobacteriaceae and anaerobic bacteria, as well as fungi, in particular *Aspergillus* spp. In about a third of cases multiple microorganisms are cultured from a brain abscess, the majority of have only a single microorganism (1,2).

Gas containing brain abscesses may result from either bacterial fermentation or penetration of gas through an abnormal communication between the exterior and intracranium. In the case we presented, CT scan images suggest that the intracranial gas was due to bacterial fermentation as no communication was seen on CT and MRI scans. Although Clostridium species, which are often associated with gas formation, were isolated from this patient, *C. glycolicum* and *C. cadaveris* are rarely found in infections and therefore limited clinical data exists on gas formation during infections by these two species. Both species however are able to form gas. Biochemically they can be distinguished by gelatin hydrolysis, indol, and milk digestion, for which *C. cadaveris* tests positive and *C. glycolicum* negative. The *C. glycolicum* was cultured twice, from blood as well as from necrotic intracranial tissue, whereas *C. cadaveris* was only cultured once from CSF, and only sporadic colonies were seen. The case for involvement of *C.
glycolicum is therefore stronger than for C. cadaveris. However, pus taken at the first surgical intervention initially yielded two types of anaerobic gram positive rods, with different colony morphology. Unfortunately these strains could not be identified (table 1).

Other microorganisms associated with gas formation include some enterobacteriaceae (13), Bacteroides spp. (8), Peptostreptococcus (10) and Fusobacterium (14). In the case of this patient, the infection was polymicrobial and the Clostridium spp. which were cultured may have contributed to the formation of intracranial gas.

Only small studies have investigated the outcome of intracranial infections with gas formation. Interestingly, the mortality due to these infections tends to be low, contrary to infections with gas formation elsewhere in the body. Prompt surgical intervention nevertheless, appears to be essential in addition to antibiotic treatment. Overall mortality due to brain abscesses outside the developing world is still significant around 10%, and in the developing world it is be as high as 30% (3, 11).

Although C. glycolicum has been isolated from human wounds, peritoneal fluid and feces (4), it was, until recently unclear whether any pathogenic role could be ascribed to this microorganism. Recently, Elsayed et al reported the isolation of C. glycolicum from blood cultures of a bone marrow transplant patient, implying clinical significance in an immune compromised patient (5).

The patient we described was fully immune competent. The presence of clay, blocking the external auditory meatus, may have contributed to a local environment in which an otherwise non-pathogenic anaerobic microorganism could become pathogenic. The clay may also have been the source of the microorganism as it is prevalent in soil (6), but unfortunately the clay was not cultured.
The choice of home remedy of this patient prompted an Internet search on use of clay in common ailments. A large number of alternative medicine websites were found promoting the use of clay as a ‘sponge-like material which absorbs toxins from the outside without harming the body’ (15).

In conclusion, *Clostridium glycolicum* may act as a co-pathogen in infections in immune competent individuals.
References


Table 1: microorganisms isolated from clinical materials

<table>
<thead>
<tr>
<th>date</th>
<th>Material</th>
<th>Culture result</th>
<th>Culture details</th>
</tr>
</thead>
<tbody>
<tr>
<td>17/01</td>
<td>Blood</td>
<td><em>C. glycolicum</em></td>
<td>Anaerobic bottle Bactec</td>
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<tr>
<td>17/01</td>
<td>CSF</td>
<td><em>C. cadaveris</em></td>
<td>Anaerobic culture for 48 hours</td>
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<tr>
<td>18/01</td>
<td>Pus from mastoid</td>
<td>2 types <em>E. coli</em></td>
<td>Sheep blood and MacConkey agar Anaerobic culture for 48 hours, strains dead</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 types anaerobic gram positive rods</td>
<td></td>
</tr>
<tr>
<td>23/01</td>
<td>Necrotic tissue mastoid</td>
<td><em>Streptococcus</em> spp. 2 types <em>E. coli</em> Coagulase negative staphylococcus Brevibacterium spp <em>C. glycolicum</em></td>
<td>Sheep blood agar Brucella blood agar, anaerobic culture for 48 hours</td>
</tr>
</tbody>
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Figure legend
Figure: CT scan images showing intracerebral gas along the vermis (arrows, left) and cerebellitis (arrows, right).