CASE REPORT


**Stereotactic Biopsy and Drainage of a Brainstem Abscess Caused by Listeria Monocytogenes**

—Case Report—

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**Abstract**

Listerial rhombencephalitis and brain abscesses are rare, but potentially life-threatening conditions. Early initiation of antibiotic therapy is crucial, but establishing the diagnosis of listerial brainstem abscess can be difficult. Stereotactic biopsy and drainage of space-occupying abscesses of the brainstem should be considered especially in cases of rapid clinical deterioration. We successfully performed stereotactic biopsy and drainage of a listerial brainstem abscess in a 42-year-old male patient who deteriorated despite antibiotic treatment, demonstrating that this approach is suitable in such patients.

Key words: brainstem abscess, Listeria monocytogenes, stereotactic biopsy, rhombencephalitis

**Introduction**

Listeria monocytogenes, an intracellular gram-positive rod, is the causative pathogen of human listeriosis, a potentially fatal foodborne infection. Listerial rhombencephalitis and brain abscesses are rare but associated with high rates of mortality and morbidity.¹) Establishing a diagnosis can be difficult in these cases and the formation of abscesses, particularly in highly eloquent-regions of the brain, may lead to an unfavorable outcome. Here we report the case of a patient in whom a listerial brainstem abscess showed significant enlargement despite antibiotic treatment. Stereotactic biopsy and drainage were performed resulting in a reduction of the lesion size, identification of the pathogen, and survival of the patient.

**Case Report**

A 42-year-old male patient presented with progressive headaches and right facial sensory deficits persisting for over 2 weeks. The past medical history as well as general laboratory values were unremarkable. Apart from hypesthesia in the dermatomes of the V₁/V₂ trigeminal branches on the right side, no further neurological deficits were found on clinical examination. Cerebrospinal fluid (CSF) analysis showed pleocytosis (87/μl) with normal range values of glucose and lactate. Magnetic resonance (MR) imaging revealed hyperintensity in the medulla oblongata, enhancement of the right trigeminal nerve with contrast medium, and several supratentorial periventricular lesions (Fig. 1A). Assuming an inflammatory disease such as acute disseminated encephalomyelitis, high-dose steroid therapy with methylprednisolone (Urbason; Sanofi, Frankfurt, Germany) was initiated which led to almost complete remission of symptoms. The patient was discharged from hospital on the 6th day in a good clinical condition.

Ten days later the patient was readmitted because of progressive gait disturbances and right hemiparesis (grade 4/5). MR imaging showed a new enhanced inflammatory lesion in the cerebellum and middle cerebellar peduncle. Laboratory examination showed no signs of inflammation.

![Fig. 1 Axial (upper row) and sagittal (lower row) magnetic resonance images on admission (A), prior to biopsy (B), and 5 months after the procedure (C).](image-url)
and CSF analysis revealed pleocytosis (42/µl) with normal glucose/lactate ratio. High-dose corticosteroids were administered and the clinical symptoms improved gradually, but on the 5th day after the second admission, the patient deteriorated with decreased vigilance, aggravated right hemiparesis, and bilaterally dilated pupils. MR imaging revealed expansion of the lesion into the mesencephalon. CSF analysis showed enhanced pleocytosis (309/µl) and increased lactate levels with decreased glucose levels, implying bacterial encephalitis. Therefore, antibiotic therapy with ampicillin and ceftriaxone was initiated (6th day). Due to respiratory failure, the patient was transferred to the neurological intensive care unit, and was intubated and mechanically ventilated. Blood cultures from the 5th day then revealed the growth of *Listeria monocytogenes*. Despite antibiotic therapy with ampicillin (12 g/day) and ceftriaxone (2 g/day) for a period of 8 days, MR imaging on the 14th day showed significant enlargement of the mesencephalic lesion which now displayed the characteristic features of an abscess (Fig. 1B). Remarkably, this enlargement was despite the fact that the culture antibiogram had revealed sensitivity of grown *Listeria monocytogenes* to ampicillin.

After careful assessment of the risks and benefits, we opted for stereotactic biopsy and drainage to identify pathogens, and to reduce the mass effect on the surrounding brain tissue. The procedure was carried out without complications: a stereotactic frame (CAAT; Precisis AG, Heidelberg, Germany) was fixed on the skull and intraoperative stereotactic computed tomography (CT) was carried out. For planning the stereotactic trajectory from a left-frontal precoronal entry point (Fig. 2A), the obtained images were co-registered and fused with preoperative T1-weighted MR images with contrast medium. We chose a trajectory route from a paramedian precoronal entry point into the abscess cavity to avoid highly eloquent regions of the brain and neurovascular structures. The biopsy needle trajectory illustrated in Fig. 2B did not penetrate the brain tissue of the motor strip or speech area. Furthermore, the chosen trajectory route enabled us to avoid puncture of the ventricular system. The lesion was targeted with a biopsy needle and after cautious aspiration of pus, a 10F polyurethane catheter (Silverline®; Spiegelberg, Hamburg, Germany) was inserted. Postoperatively, CT verified the catheter position in the abscess cavity (Fig. 2C).

Examination of the aspirated specimen showed positive results for deoxyribonucleic acid (DNA) of *Listeria monocytogenes*, thus confirming the previous diagnosis. Because of the progression despite antibiotic therapy, the antibiotic scheme was modified and continued with ampicillin, gentamicin (400 mg/day), and meropenem (6 g/day). The drainage catheter was removed on the 2nd postoperative day. Subsequently, MR imaging showed significant reduction of the lesion. The patient stabilized and improved clinically and was transferred to a neurological rehabilitation hospital on the 36th day after admission.

After 5 months of further clinical improvement, follow-up MR imaging showed almost complete remission of the intracranial lesions (Fig. 1C). Ten months after the initial admission, the patient was conscious and able to communicate. Due to dysphagia, a tracheostomy tube was still needed and neurological examination showed a right hemiparesis. The patient returned home and was cared for by his wife with the support of professional ambulatory care nursing.

**Discussion**

Listeriosis occurs sporadically (0.5/100,000 per year) or in epidemic outbreaks caused by contaminated food. Rhombencephalitis occurs in approximately 9% of patients with central nervous system involvement. Establishing a diagnosis of rhombencephalitis caused by this intracellular bacterium can be difficult, as results of laboratory investigations are often inconclusive. Analysis of CSF samples shows absence of pleocytosis in 22% and negative cultures in 59%, while Gram’s stain has a diagnostic yield of less than 4%. Blood cultures are positive in 61% with repeated cultures, but results are obtained with a significant delay. Cerebritis and abscesses due to *Listeria monocytogenes* are rare but associated with high mortality rates and survivors usually suffer serious sequelae. Patients with severe comorbidities and immunosuppression are at particular risk to develop listerial brain abscesses, but as our reported case demonstrates, previously healthy individuals are also at risk.

Early initiation of appropriate antibiotic therapy is essential in the treatment of these patients and should be considered in all patients in whom a listerial brain abscess cannot be ruled out. Nevertheless, the disease has a high mortality despite antibiotic treatment with penicillin or ampicillin. A review of 39 patients with supratentorial listerial brain abscesses showed that patients with surgical drainage either through stereotactic aspiration or craniotomy had a higher survival rate than patients treated with only antibiotics. Five deaths (24%) of 21 patients treated with only antibiotics were due to the absscess. In contrast, only one death (6%) in 18 patients treated with antibiotic therapy and surgical approach either through excision or stereotactic biopsy was attributed to the abscess. It is unknown whether patients with a listerial abscess localized in the brainstem may benefit from surgical drainage through stereotactic biopsy. Stereotactic biopsy and drainage of brainstem abscesses due to a variety of pathogens have been described. Regarding listerial brain-
stem abscess, a literature review identified two cases of stereotactic biopsy6,7) and one case of free-handed CT-guided biopsy6) (Table 1). This invasive procedure is not necessary in cases in which clinical signs, laboratory examinations, and radiological features are highly suggestive for listerial brainstem abscess. Nevertheless, a stereotactic biopsy should be considered in some cases, especially in patients with rapid neurological deterioration. This is a well-established procedure with low morbidity (4%) and mortality rates (0.3%) even for lesions located in the brainstem.8) The procedure has a high diagnostic yield and so can be helpful if other diagnostic measures are inconclusive. In our reported case, examination of aspirated pus showed positive results only for listerial DNA, thus proving active listeriosis and indicating as unlikely growth of a different pathogen as the cause of the abscess enlargement. Additionally, stereotactic drainage of the abscess cavity reduces the space-occupying mass effect on surrounding brain tissue, so also presents a therapeutic approach.

Stereotactic biopsy and drainage of abscesses can be of significant benefit in the treatment of listerial brainstem abscesses. We successfully identified pathogens and reduced the space-occupying mass effect of a listerial abscess, so also presents a therapeutic benefit in the treatment of listerial brainstem abscesses. We successfully identified pathogens and so can be helpful if other diagnostic measures are inadequate. In our reported case, examination of aspirated pus showed positive results only for listerial DNA, thus proving active listeriosis and indicating as unlikely growth of a different pathogen as the cause of the abscess enlargement. Additionally, stereotactic drainage of the abscess cavity reduces the space-occupying mass effect on surrounding brain tissue, so also presents a therapeutic approach.

**Conflicts of Interest Disclosure**

The authors have no personal financial or institutional interest in any of the drugs, materials, or devices in the article.

**References**

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**Table 1** Reported cases of listerial brainstem abscesses in which a biopsy was performed

<table>
<thead>
<tr>
<th>Author (Year)</th>
<th>Age (yrs)</th>
<th>Sex</th>
<th>Clinical presentation</th>
<th>Laboratory findings</th>
<th>MR imaging findings</th>
<th>Intervention</th>
<th>Antibiotic treatment</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lemole et al. (2003)6)</td>
<td>70</td>
<td>M</td>
<td>fever, right hemiparesis, somnolence</td>
<td>WBC 7000/µl, ESR 56 mm/hr, pleocytosis 229/µl, CSF culture negative</td>
<td>3–4 mm enhanced lesion from left internal capsule to mesencephalon</td>
<td>CT-guided stereotactic biopsy (left frontal)</td>
<td>ampicillin + gentamicin</td>
<td>good, incoordination of the right side of body</td>
</tr>
<tr>
<td>Medina-Flores et al. (2004)7)</td>
<td>59</td>
<td>F</td>
<td>diplopia, facial paresthesia, mild hypesthesia in lower extremities</td>
<td>not reported</td>
<td>15 mm enhanced lesion in left cerebral peduncle extending topons</td>
<td>CT-guided stereotactic biopsy (left frontal)</td>
<td>ampicillin + trimethoprim sulfamethoxazole</td>
<td>good, decreased sensation on right side of perioral region</td>
</tr>
<tr>
<td>Block et al. (2011)3)</td>
<td>54</td>
<td>F</td>
<td>fever, paresthesia on right side of body, dysarthria, dysphagia, bulbar paralysis</td>
<td>pleocytosis 1100/µl, protein 985 mg/l, lactate 2.3 mmol/l</td>
<td>two cystic lesions in medulla oblongata</td>
<td>CT-guided freehand biopsy (dorsolateral upper margin of atlas)</td>
<td>ampicillin + gentamicin</td>
<td>good, hemihypesthesia and hemi-dysesthesia of right hand</td>
</tr>
<tr>
<td>Present case</td>
<td>42</td>
<td>M</td>
<td>fever, right hemiparesis, somnolence, bulbar paralysis</td>
<td>WBC 11000/µl, PCT &lt; 0.05 ng/ml, pleocytosis 309/µl, lactate 7.2 mmol/l, CSF culture negative</td>
<td>enhanced lesion in middle cerebellar peduncle, expansion into mesencephalon</td>
<td>CT-guided stereotactic biopsy (left frontal)</td>
<td>ampicillin + gentamicin + meropenem</td>
<td>disabled, dysphagia, high-grade right hemiparesis</td>
</tr>
</tbody>
</table>


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