

CASE REPORT

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Listeria monocytogenes brain abscess in a patient with systemic lupus erythematosus (SLE): a case report

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Abstract

Background Brain abscesses caused by *Listeria monocytogenes* (*L. monocytogenes*) are very rare and lead to high mortality risk. To our knowledge, no prior studies have been reported in Malaysia on the brain abscess caused by *L. monocytogenes*.

Case presentation In this case report, we present 33-year-old female patient with known case of systemic lupus erythematosus (SLE) whom developed fever and left-sided body weakness. Initially, she was suspected to have high-grade glioma or lymphoma because the imaging shows multiple irregulars peripherally enhancing intra axial lesions with marked vasogenic edema. However, tissue biopsy confirmed *L. monocytogenes* infection. This report also presents the CT and MRI findings of this SLE patient with unusual *L. monocytogenes* brain abscesses. The patient was then treated with IV ampicillin, IV meropenem and IV amphotericin.

Conclusions Brain abscess caused by *L. monocytogenes* is uncommon and lethal. Therefore, it should be carefully examined in patients who are at high risk of listeriosis.

Keywords *Listeria monocytogenes*, Brain abscess, Systemic lupus erythematosus (SLE), Case report, Magnetic resonance imaging

Background

Listeria monocytogenes (*L. monocytogenes*) is a gram-positive bacterium and known as a foodborne pathogen which may enter the body through intestine [1]. The most common manifestation of *L. monocytogenes* infection at the central nervous system (CNS) is meningitis. Meanwhile, brain abscesses caused by *L. monocytogenes* are very rare and occurred in only 1–10% of listerial CNS

infections [2–4]. The common locations of brain abscess were thalamus, pons and medulla [5]. Blood cultures yielded positive results for *L. monocytogenes* infection in 79.5%, whereas in CSF or brain abscess biopsy, 50.8% showed positivity for *L. monocytogenes* infection [6].

The pregnant women, elderly group aged 65 years old or older, and immunocompromised patients or people with weakened immune systems are at high risk to *L. monocytogenes* infection. Besides, due to increase usage of immunosuppressive drugs for organ and bone marrow transplantation and autoimmune disease, the incidence of listeriosis in CNS has also increased. Previous work reported that brain abscesses due to *L. monocytogenes* are uncommon and stated that only 84 cases were reported in previous works within the year 1968–2020 [7]. To date, there is no conclusive guidance on the ideal type and duration of therapy for listeria brain abscess. Brain magnetic resonance imaging (MRI) and bacteriological

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examination is recommended in assisting the diagnosis of brain abscesses [1]. This report aims to present the imaging findings of an SLE patient with unusual *L. monocytogenes* brain abscesses and increase awareness regarding this rare disease. To our knowledge, no prior studies have been reported in Malaysia on the listeria brain abscess.

Case presentation

This study reports a 33-year-old systemic lupus erythematosus (SLE) Chinese female with lupus nephritis, hypertension and bilateral eye steroid-induced cataract. This patient was diagnosed with SLE in December 2020. Renal biopsy was performed on March 2023, and histopathology test comes back as diffuse proliferative lupus nephritis class IV. Besides, the patient was given tablet mycophenolate mofetil (MMF) 75 mg BD and T prednisolone 60 mg OD. She was presented to our hospital with sudden onset of left-sided weakness (lower limb is more affected than upper limb), fever and cough. Neurological examination showed the patient is alert, fully conscious and able to speak in full sentences. However, the left upper limb and lower limb muscles power was 4/5, while the muscles power on the right side was 5/5. Throughout the days, the symptoms worsened; power for left side dropped from 3/5 to 0/5. The patient was feverish with persistent temperature spike, and the highest temperature was 39.6 degree Celsius.

A series of brain computed tomography (CT) and magnetic resonance imaging (MRI) scans were conducted to confirm the findings. For contrast-enhanced computed tomography (CECT) of the brain, the patient was given 70 ml of omnipaque 300, an iodinated contrast medium. 5 ml Gadolinium was used for MRI contrast. Before the CT or MRI scanning, an initial assessment of renal

function was performed to determine baseline of renal function, and the assessment indicated an eGFR greater than 30 mL/min/1.73 m². Renal function was monitored before and after these studies to detect any potential decline.

Listeria monocytogenes was detectable in blood culture and cerebrospinal fluid (CSF) analysis. However, the route of infection for this patient is unidentified. She was then treated as *L. Monocytogenes* bacteremia and meningitis. The patient was given IV ampicillin, IV meropenem and IV amphotericin. Following these, CT brain examinations (non-contrast and contrast CT studies) were performed after the biopsy. The CT brain findings revealed a smaller abscess and perifocal edema was reduced (Fig. 1).

A series of MR brain imaging were also performed, and it showed the hypointense edema on T1-weighted image and hypointense edema in T2-weighted and fluid attenuated inversion recovery (FLAIR) images (Fig. 2). The diffusion-weighted imaging (DWI) and apparent diffusion coefficient (ADC) sequences show restricted diffusion of the edema (Fig. 3). The MR T1-weighted imaging with contrast detected multiple irregulars peripherally enhancing lesions with surrounding vasogenic edema (Fig. 4). She also underwent right decompressive craniectomy, image-guided stereotactic (IGS) biopsy and fasciculoduroplasty under neurosurgical team. Figure 5 shows the CT images after the post-right decompressive craniectomy which shows the white matter edema has slightly resolved.

Discussion

Meningitis is the most prevalent indicator of listeria CNS infection, while listeria brain abscesses are extremely rare. There were only 73 cases of listeria

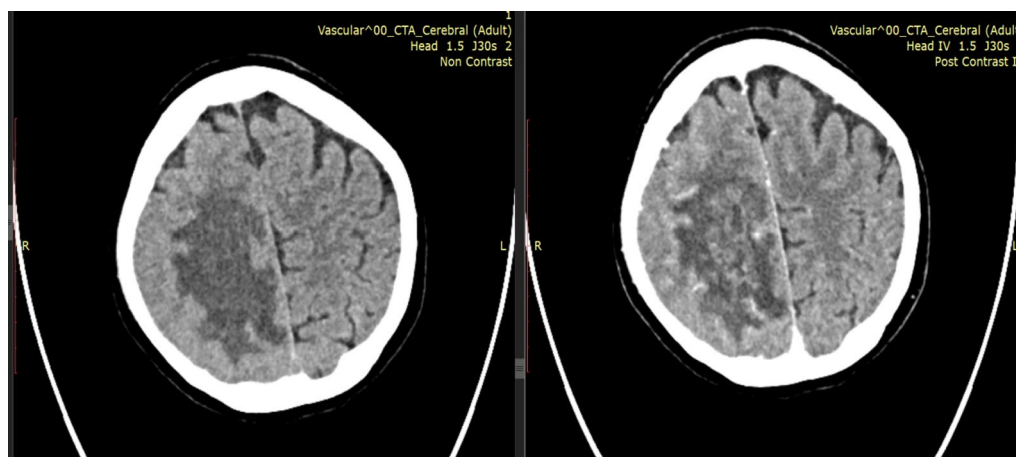


Fig. 1 Axial brain CT images show right frontal and posterior parietal white matter edema in plain or non-contrast CT brain (left) and peripheral lesions are enhanced in post-contrast CT brain (right)

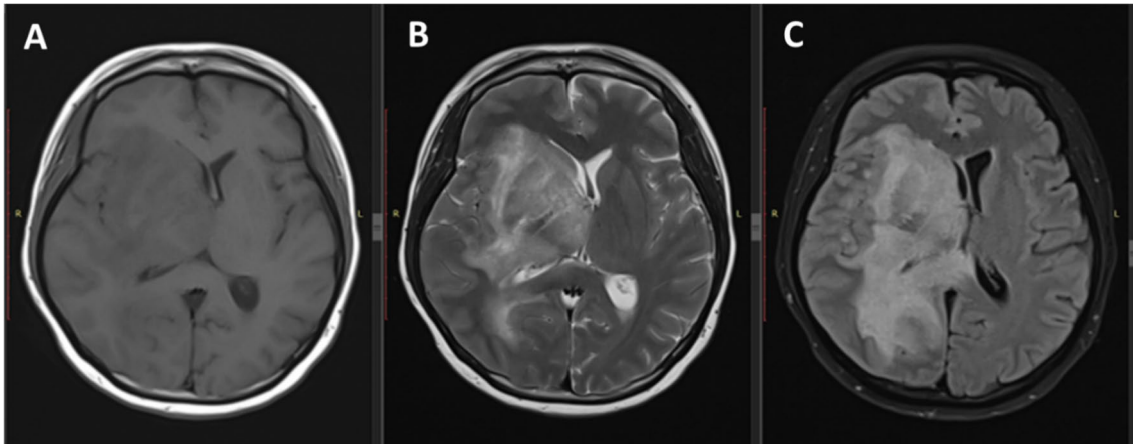


Fig. 2 Axial **A** T1W, **B** T2W and **C** FLAIR sequence of MRI brain images. The MRI findings demonstrate hypointense signal intensity of white matter edema on T1W image. Meanwhile, it demonstrates hyperintense of the edema on T2W and FLAIR images

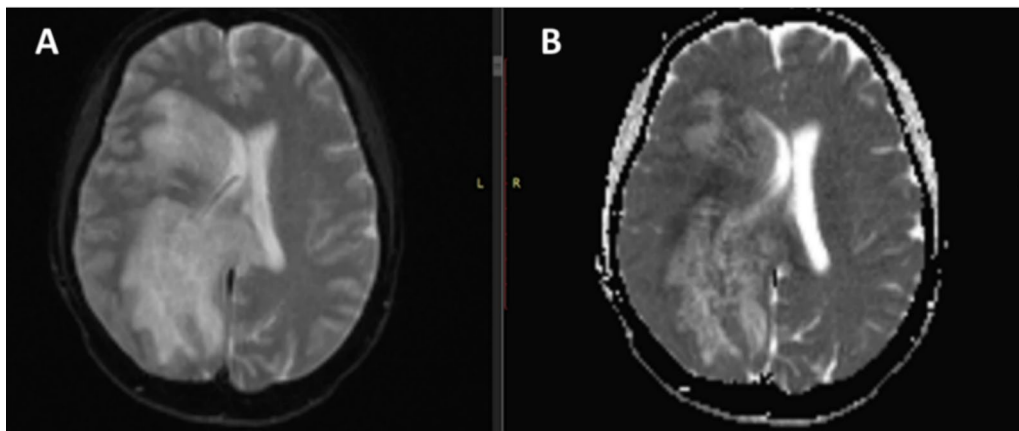


Fig. 3 Axial **A** DWI and **B** ADC MR images of the brain. It shows restricted diffusion of the white matter edema on both DWI and ADC MR mapping

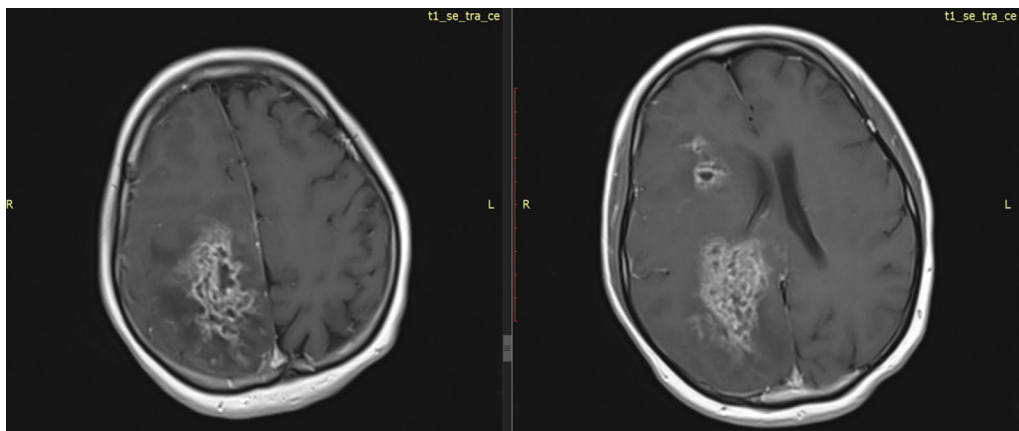


Fig. 4 MRI post-contrast T1-weighted images of the brain shows multiple irregulars peripherally enhancing lesions with surrounding vasogenic edema. The images revealed an enhanced pattern of serpiginous tubular lesions resembling beads

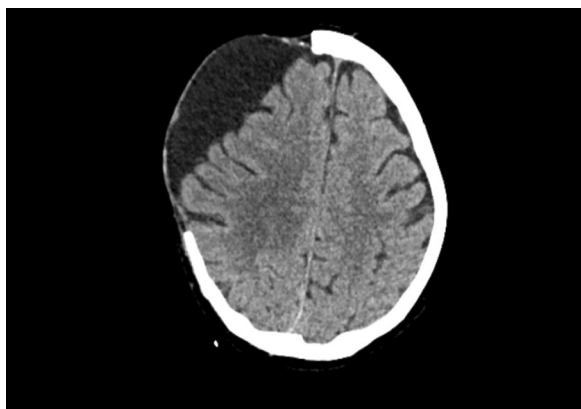


Fig. 5 Post-right decompressive craniectomy, image-guided stereotactic (IGS) biopsy and fasciuroplasty show the white matter edema has slightly resolved

brain abscesses reported from 1968 to 2017. However, *Listeria monocytogenes* infection is the third leading cause of foodborne related death in the USA with high fatality rate of 20% [8]. The risk factor for serious infection of *L. Monocytogenes* is the pregnant women and immunocompromised patients with defeated immune system such as SLE patients, as reported in this study. Thus, immunosuppressant patients that have acute onset of prodromal infection should be considered during the diagnosis and treatment of listeria brain abscess [1]. Besides, the elderly patients aged over 60 years old were also associated with increased risk of listeriosis, the mean age was 51.9, and the reported mortality rate was 27.3% [3, 9].

L. monocytogenes infection in humans typically occurs through the ingestion of contaminated food, particularly seafood and vegetables. The bacterium can then traverse the small bowel and accumulate in the mesenteric lymph nodes and bloodstream. Hematogenous spreading is the primary route of *L. monocytogenes* infection that spreads through middle cerebral artery route and transmitted through white matter fiber leading to brain abscess formation. The most frequent sites for brain abscess formation include the subcortical gray matter, particularly the thalamus, basal ganglia, pons and medulla, and less frequently found at supratentorial white matter and cerebellar hemispheres.

The most common clinical manifestations of *L. monocytogenes* that can be seen initially are fever, followed by headache and nausea. These will then be followed by CNS manifestations such as altered mental status and focal neurologic dysfunction such as impaired muscle strength. Headache and neurological deficits are common clinical presentations in cases of CNS involvement, particularly when the abscess is of a significant

size and accompanied by surrounding edema. These manifestations were shown in our patient.

For the diagnosis, the brain MRI with gadolinium contrast is the best choice for imaging tool. MRI findings demonstrate hyperintense signal on T2-weighted images and DWI images. Typical MRI features of listeria brain abscess include ring enhancement, perifocal edema and a local mass effect. The distinct multi-tubular appearance seen in listeria brain abscess is often referred to as the ‘tunnel sign’ or ‘wormlike’ appearance. Besides, blood cultures or cerebrospinal fluid (CSF) analysis of the patient may also be helpful for the diagnosis of *L. monocytogenes* infection. Currently, this patient’s condition has gradually improved through the admission and optimal antibiotics treatment. The patient was extubated and is currently on tracheostomy.

Conclusions

Brain abscesses caused by *Listeria monocytogenes* are rare in humans. This bacterium typically spreads through the bloodstream, often from soil and water sources. If it crosses the blood–brain barrier through cerebral capillary endothelium, a brain abscess may form. Its radiographic appearance can mimic parasitic infections like sparganosis, necessitating differential diagnosis to determine the best antibiotic treatment.

Abbreviations

ADC	Apparent diffusion coefficient
CNS	Central nervous system
CSF	Cerebrospinal fluid
CT	Computed tomography
DWI	Diffusion-weighted imaging
FLAIR	Fluid-attenuated inversion recovery
IV	Intravenous
MRI	Magnetic resonance imaging

Acknowledgements

The authors would like to thank all medical staff and fellow radiology specialists and staff at Radiology Department, Hospital Pulau Pinang, Penang, Malaysia.

Author contributions

Dr SR did study conception and design, and draft manuscript preparation. Dr NAO and Dr NDO contributed to draft manuscript preparation and supervision of the project. All authors discussed the case report and contributed to the final manuscript.

Funding

No funding was obtained for this study.

Availability of data and materials

The datasets generated and/or analyzed during the current study are not publicly available due to privacy of the study participant.

Declarations

Ethics approval and consent to participate

Approval and written informed consent were waived off for single patient case report. Only anonymized data and images were used.

Consent for publication

Written informed consent was waived for the publication. Only anonymized data and images were used.

Competing interests

The authors declared that there are no competing interests. All authors have read and understand the journal's publication ethics and hereby confirm that they comply with all its parts applicable to the present scientific work. Only anonymized data and images were used.

Received: 5 September 2023 Accepted: 18 September 2024

Published online: 26 September 2024

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