Case Report

Listeria Meningitis, one of your five a day? A case report of *Listeria Monocytogenes* Meningitis in a fit and well 62-year-old woman

L Harrington, G Fisk, M Elanchenny, S Shaikh & U Shah

Abstract

Listeria Monocytogenes is transmitted via ingestion of contaminated food products and can cause invasive disease in susceptible hosts. Risk factors include immunocompromise; pregnancy; being elderly; and new-born. Listeriosis is uncommon but can occur in immunocompetent individuals and has a high mortality rate. We report a case of a 62-year-old female with no obvious risk factors who presented with atypical meningism. The patient was subsequently diagnosed with *listeria* meningitis and made a good recovery. The patient was a gardener regularly handling soil and ingested vegetables from her allotment patch; this case is reported to highlight less common risk factors and atypical ways in which *listeria* may present to the acute medical take.

Keywords

Meningitis, Listeria

Key Learning Points

1. Listeria meningitis may not present with 'classical' symptoms of meningitis
2. Listeria meningitis can occur in immunocompetent adults
3. If a diagnosis uncertain or unclear; your social history is a vital diagnostic tool
4. An unrecordable or clotted white cell count in an LP sample may reflect a very high white cell count
5. Gardening and handling raw/root vegetables and the compost used can act as a medium for listeria contamination and transmission

Introduction and Background

Listeriosis is a gram-positive infection caused by the bacteria *Listeria monocytogenes*. Historically, patients contract listeriosis after eating contaminated food.[1] The disease is classically reported in four at-risk groups; pregnant women, newborns, older adults, and those who are immunocompromised.[2] Few case reports exist for patients otherwise fit and well who are diagnosed with *Listeria* infection. *Listeria monocytogenes* is the third most common cause of bacterial meningitis and is identified in 5-6% of adult cases, after *Streptococcus pneumoniae* and *Neisseria* respectively.[3] It is reported as one of the more severe forms of meningitis with a high mortality between 30% and 36%.[3] This case is of *Listeria* meningitis in an immunocompetent 62-year-old female with no significant medical history or co-morbidity. However, her main hobby was growing vegetables in an allotment. This report explores the association of listeriosis with growing root vegetables along with important learning points for the acute and general physician in how *listeria* meningitis can present on the unselected acute medical take.

Presentation

A 62-year-old female presented to the A&E department with a headache associated with fever for 24 hours. She described the headache as generalised, severe, radiating to the occiput and down her back with symptoms worsening over the last 24 hours: she described photosensitivity and associated nausea and vomiting, having vomited four times with little oral intake over 24 hours. There was no associated rash, diarrhoea or abdominal pain, shortness of breath, chest pain or palpitations and no confusion reported. The patient's daughter accompanied her to A&E and the collateral history described a subtle change in her mother's behaviour over 24 hours, characterised by being much slower than normal in response to simple questions and being unusually reluctant to mobilise. There was a past medical history of a recent benign ovarian tumour overseen by the gynaecology

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Table 1. Blood results

Bloods	14/08/22	17/08/22	18/08/22	22/08/22	26/08/22	27/08/22	31/08/22	05/09/22
WCC	17.7	11.3	10	10.7	7.8	6.9	5.7	5.7
Neuts	16	8.4	7.5	7.9	5.6	4.4	3.4	2.9
Lymphs	0.8	1.6	1.5	1.8	1.4	1.6	1.5	2.0
Platelets	285	243	308	488	555	471	420	305
CRP	12	108	79	10	3	2	-	<1
Hb	142	123	133	123	134	124	130	136

Table 2. Other investigations

	14/08/22	15/08/22
Blood cultures	No growth after 5 days incubation period	No growth after 5 days incubation period
HIV test		Not detected
HbA1c		46mmol/mol

Table 3. Lumbar Puncture (CSF) results

	14/08/22
Protein	5.96g/L
Glucose	0.3mmol/L
Cytology	**Macroscopy:** Less than 1ml of clear, colorless fluid received. No abnormal cells present. Slight increase in lymphocytes.
Microscopy, culture and sensitivity	**Microscopy:** CSF sample shows slight increase in poorly-preserved mature lymphocytes together with background red blood cells (the latter is consistent with a contaminant following sampling procedure). No acute inflammatory cells present. No epithelial cells present. No malignant cells seen. **Culture:** Scanty growth of Listeria monocytogenes Very scanty growth of Staphylococcus epidermidis Sensitive to Cotrimoxazole, Penicillin and Ampicillin

Table 4. Radiology results

CT head 14/08/22	Nil acute findings.
CXR 14/08/22	Clear lung fields with no evidence of consolidation or pleural effusion.
MRI brain 19/08/22	Normal brain and brainstem. No brain oedema, restricted diffusion, pathological enhancement, or subdural collections.
CT abdomen and pelvis 20/08/22	No significant findings. No evidence of malignancy.

team, and previous diagnoses of diverticulitis and treated hypertension. Medication history included amlodipine and indapamide. She had no significant family history, was a non-smoker and rarely drank alcohol, living at home with her daughter and grandchildren and was independent in all activities of daily living. The patient was originally from Lithuania but had lived in the UK for over 10 years and reported no recent travel. No one else in the household was reported to be unwell.

On examination, bedside observations were within normal parameters with no recorded fever and a national early warning score (NEWS) of zero. Her cardiovascular, abdominal, and respiratory examinations were unremarkable. On neurological examination, she had no focal neurological deficit but showed discomfort on specific examination for neck stiffness, with induced vomiting during passive examination of neck flexion and extension. She had no objective photophobia and both Kernig's sign and Brudzinski's sign were negative.

The primary differential diagnosis was that of suspected meningitis or meningoencephalitis and she was commenced on IV aciclovir and ceftriaxone whilst awaiting lumbar puncture.

Investigations and Diagnosis

The blood, cerebrospinal fluid (CSF) and radiology results are summarised in Tables 1-4. Initial blood results showed a neutrophilia of 16; CRP was 12 on admission with normal renal and liver function; CRP peaked at 108 on day two of admission with a down-trending neutrophilia. Two sets of blood cultures sent on admission were both negative at five days. Her urine dip was negative for leucocytes and nitrites with 2+ blood and 1+ protein. A CT brain was unremarkable on admission and a lumbar puncture was performed at five hours into admission. Lumbar puncture was well-tolerated, with initial vomiting improving with antiemetics and fluids. CSF was clear: samples were sent off for protein, glucose, white cell count (WCC) and microscopy culture and sensitivity. The lab phoned three hours later reporting that WCC in both CSF samples had clotted due to the very high count. The CSF protein was 5.96g/L and CSF glucose 0.3mmol/L, consistent with a bacterial meningitis. The patient was commenced on IV dexamethasone as per Trust protocol plus high dose ceftriaxone and aciclovir whilst awaiting further culture results. A HIV test and HbA1c were sent due to an

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incidentally raised random glucose of 8mmol on admission (Table 2).

Treatment

At 24 hours the CSF culture grew *listeria*, and the diagnosis of *listeria* meningitis was made. Through a joint approach with microbiology, the patient was changed to 4-hrly IV amoxicillin 2g. A HIV test was negative and a HbA1c was 46mmol/mol. Microbiology advised revisiting the social history to explore wider risk factors for *listeria* and report the case to the centre for disease control and prevention (CDC). A CT chest, abdomen and pelvis was also performed to exclude potential malignancy or paraneoplastic infiltration given such a high protein count in the CSF (Table 4) and prior history of ovarian malignancy. However, the raised CSF protein level could be related to a traumatic lumbar tap.

Social History

On further exploration the patient was specifically asked about raw food consumption, specifically any unpasteurised milk or cheese, or any raw vegetables; there was no unpasteurised milk or cheese consumption, but she described a plot on an allotment where she grew her own vegetables including onions, carrots, and cucumbers; she also consumed some fruit and vegetables straight off the tree/ from the ground respectively, and admitted at times her hand hygiene was poor using a trough of water to rinse her hands while spending time on the allotment.

Prophylaxis

There is limited literature regarding chemoprophylaxis in *listeria* meningitis specifically given its low incidence. Chemoprophylaxis (regardless of vaccination status and instigated by the public health team) against meningococcal disease should be considered within 24 hours for close contacts where contact was within seven days prior to symptom onset.[4] Close contacts are defined as those living or sleeping in the same household, or those who have been in contact with large secretory droplets. The Trust protocol and national guidance advise a single dose of oral ciprofloxacin 500mg (adults or children aged >12 years and dose adjustments made for those aged <12 years) for those close contacts of confirmed meningococcal meningitis. Rifampicin is an alternative for those who cannot take ciprofloxacin.[5]

Public Health

Listeriosis as a notifiable disease must be reported to the centre for disease control and prevention (CDC); this facilitates investigation from a public health perspective. However, specific source may be difficult to uncover given the long incubation time ranging from 1-67 days, with CNS cases 1-14 days.[6]

Discussion

Although this patient presented with several 'typical' meningitis symptoms, some atypical aspects of the case are of note. Although over 60 years old, the patient was immunocompetent and did not feature in the at-risk category; few case reports confirm invasive *listeria* infection in those without immunocompromise. National guidelines recognise that listeria meningitis is more common in over 60's but remains rare.[5]

This case is a reminder that conditions do not necessarily present in the 'textbook' way that we have been taught; social and collateral history is an important diagnostic tool, and reported changes in behaviour, headache and vomiting along with no other focus or explanation for symptoms, led to the differential of meningitis and subsequent decision to perform an urgent lumbar puncture. National guidance recommends obtaining CSF samples within 1 hour of presentation to increase probability of a positive culture.[5] However, in practice this is often very difficult; in this instance the sample was gained within 5 hours which helped to isolate listeria and appropriately focus the antibiotic regime.

Box 1 is a reminder for acute physicians to consider lumbar puncture in over 60s if they present with any of the red flag features listed.

L. monocytogenes is ubiquitous worldwide and is recognised to have several routes of transmission with the most common being via the consumption of raw food[7] and that unpasteurised dairy products, raw meats, and raw fish are known to be a source of transmission (Box 2). However, it is well-described that consumption of raw, ready-to-eat and frozen vegetables also present a significant risk.[8] It is thought that *Listeria* presence on plant materials is due to contamination from sources including soil, animal faeces and decaying vegetation.

L. monocytogenes is capable of surviving in plant materials for up to 10-12 years.[9] Elevated temperatures during the composting process have been documented to reduce food-borne pathogens in a lab setting, but studies have demonstrated that variation of compost environmental conditions could increase the survival and persistence of *L. monocytogenes* during the compositing process.[10] This patient was regularly

Box 2. Association with Listeria

- Soft cheese made with unpasteurised milk is estimated to be 50 to 160 times more likely to cause Listeria infection than when it is made with pasteurised milk.
- Raw sprouts
- Melons
- Hot dogs, deli meats
- Smoked (raw) fish
- Unpasteurised (raw) milk

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Box 1. Red flag indications for LP in >60s on the medical take

- New or worsening headache associated with non-specific infectious symptoms eg fever, myalgia
- Decreased consciousness level/ delirium + suspicion of infection with no clear source
- Focal neurology
- Meningism - photophobia, neck stiffness
- Non-blanching rash

Box 3. Causes of high protein in CSF

- CNS infections including viral, bacterial, fungal
- Intracranial haemorrhages
- Multiple sclerosis
- Guillan Barre syndrome
- Malignancy
- Elevated serum protein levels eg multiple myeloma
- Medications/ toxins - phenytoin, ethanol, heavy metals

consuming raw produce from her allotment in addition to handling soil and compost materials.

Listeriosis can present on a spectrum; ranging from a non-invasive gastroenteritis to the more severe invasive form, the latter of which can present as sepsis and meningitis. The primary bacteraemia can then be followed by dissemination to multiple sites including the central nervous system.[11] Although *listeria* meningitis is the third most common community-acquired meningitis worldwide, it is rare to cause invasive infection in immunocompetent individuals despite its high prevalence in at-risk groups.[12,13,14,15] But *Listeria* meningitis in immunocompetent adults has been associated with severe complications and mortality rates ranging from 30-50%.[16, 17]

Most cases of *listeria* meningitis in susceptible individuals are reported to present with classical 'meningism' signs. However, it is reported that immunocompetent patients especially are more likely to present with atypical general flu-like symptoms including fever, myalgia, diarrhoea, mild headache, and vomiting.[18]

This patient presented with some typical meningism symptoms, and whilst photophobia, fever and neck stiffness were not demonstrated on examination, an important examination finding was that of induced vomiting on neck movement; typical 'meningism' can present on a spectrum and the presence of neck pain and suspicion of infection in over 60's should prompt consideration of a lumbar puncture (Box 1). Other pathologies important to consider in those presenting with neck pain, fever and risk factors would be an epidural spinal abscess.

CSF analysis in *listeria* meningitis demonstrates a pleocytosis, a high WCC, specifically a lymphocytosis with a raised protein and a normal glucose. CSF culture is quoted to be positive in only 40% of suspected cases and blood cultures 60% of the time.[19] An interesting finding in this case was that of the unreadable WCC due to clumping (reflective of a very high WCC) and the high protein of 5.96 g/L. However due to the potential low yield rates of culture, it is possible that *L. monocytogenes* as the responsible pathogen may be missed. A high proportion of patients initially receive antibiotic therapy that does not cover for *L. monocytogenes*, hence the increased importance of history taking and clinical acumen in these cases.[20] Whilst extremely high WCC and protein levels in CSF are not specific to *listeria* meningitis (Box 3), it is important to consider this organism in the diagnosis in potential culture-negative cases who may share a similar CSF profile. An important learning point for the acute physician is that cell counts that cannot be reported due to clumping, should be discussed urgently with the on-call microbiologists as this may indicate a significant leucocytosis within the sample. This, combined with high protein levels as seen here, should prompt listeria to be at the forefront of consideration when selecting antibiotic regimes.

Conclusion

This case is presented to highlight that *listeria* meningitis should be on the acute physician's list of differential diagnoses when querying a diagnosis of meningitis in patients who are immunocompetent. A thorough search for risk factors should include direct questioning regarding gardening or handling of soil through recreational or occupational activities. It is also advised that there should be a lower threshold for performing a lumbar puncture in such individuals who may present with 'softer signs' of meningitis or atypical signs of meningism. A detailed social history is a most useful tool if a patient's presentation is vague or atypical. A new onset headache in a patient aged over 50 is a red flag symptom and a secondary cause must be considered. In cases of confirmed *listeria* meningitis, a thorough workup should be performed to rule out risk factors such as diabetes, HIV infection or an underlying malignancy. It is important to note the rise in outdoor hobbies such as gardening since the coronavirus pandemic, and recognise this may result in an increased risk of transmission of certain diseases, including *listeria*.

This case study is a reminder of the role for public health and public education in terms of the at least partial preventability of human listeriosis through good hand hygiene and through thorough cooking of raw food items.

Conflicts of Interest

none

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