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Diagnostic Imaging Pathways - Meningitis (Suspected)

Population Covered By The Guidance

This pathway provides guidance on the investigation of adult patients with suspected acute bacterial meningitis.

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Quick User Guide

Move the mouse cursor over the PINK text boxes inside the flow chart to bring up a pop up box with salient points.
Clicking on the PINK text box will bring up the full text.
The relative radiation level (RRL) of each imaging investigation is displayed in the pop up box.

SYMBOL	RRL	EFFECTIVE DOSE RANGE
	None	0
	Minimal	< 1 millisieverts
	Low	1-5 mSv
	Medium	5-10 mSv
	High	>10 mSv

Pathway Diagram

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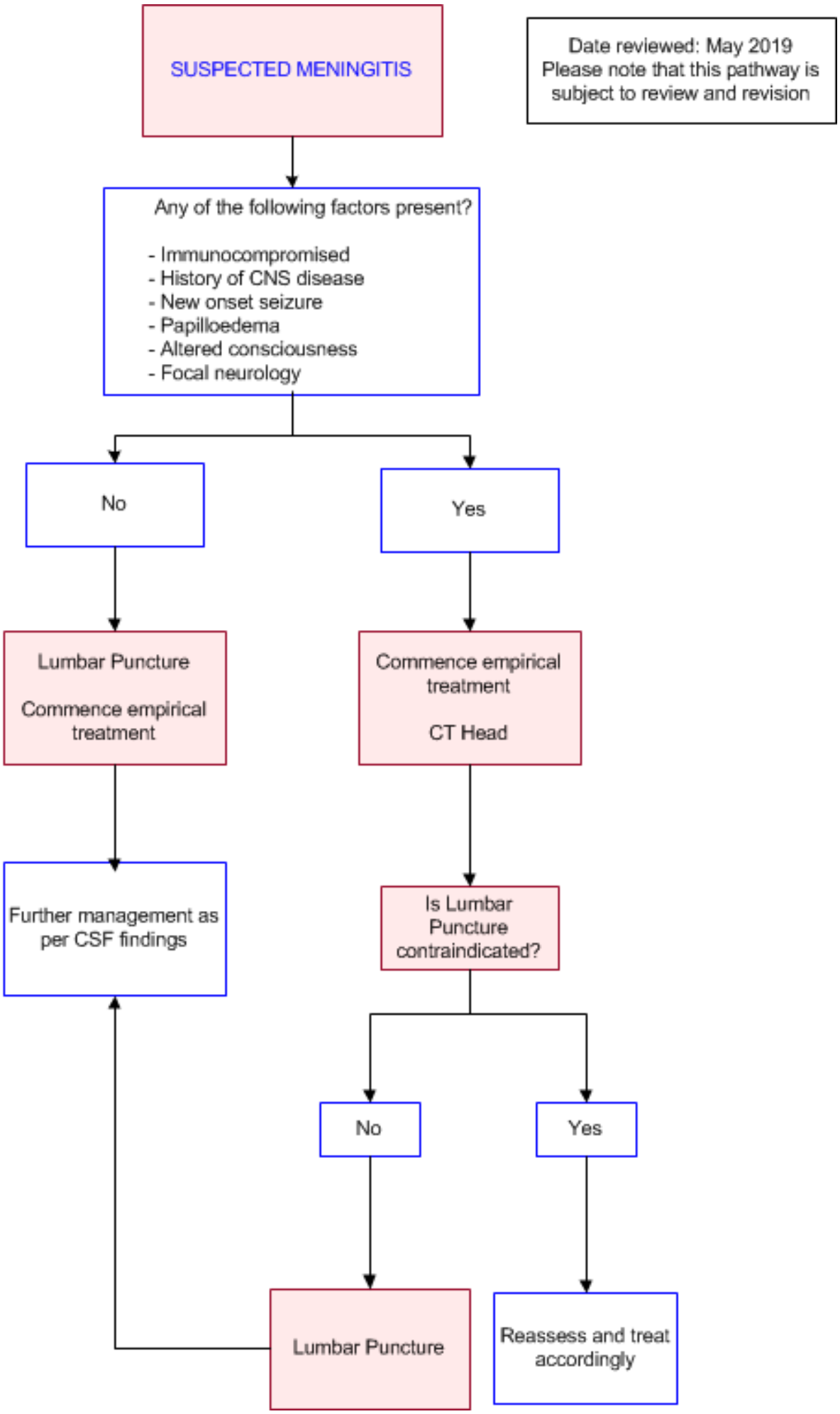

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Image Gallery

Note: Images coming soon

Teaching Points

- Meningitis is a potentially devastating disease associated with a high mortality and morbidity
- In most patients lumbar puncture followed by early initiation of antibiotics is essential
- CT of the brain is recommended before LP in a select group of patients:
    - Immunocompromised
    - History of CNS disease (e.g. mass lesion, stroke, or focal infection)
    - New onset seizure (within one week of presentation)
    - Papilloedema
    - Abnormal level of consciousness
    - Focal neurological deficit
- Treatment should not be delayed while waiting for a CT. Unless contraindicated or an alternate diagnosis is found, an LP should be performed following CT in these patients

Suspected Meningitis

- Meningitis is a potentially devastating disease associated with significant mortality and morbidity 1,2
- Aetiologies range in severity from benign and self-limiting to life-threatening 3
- Prompt diagnosis and initiation of treatment is critical, particularly for bacterial meningitis 1,2
- The classical symptoms of headache, fever, neck stiffness, vomiting, photophobia or altered mental state should prompt the clinician to consider the possibility of meningitis. 95% of patients with bacterial meningitis will have at least two of these features on presentation 1,4
- All patients who present with symptoms concerning for meningitis should undergo lumbar puncture (LP) and examination of the cerebrospinal fluid (CSF) unless contraindicated 3
- LP and examination of the CSF is critical for diagnosis and should be immediately followed by initiation of empirical treatment 5-7
- If delay in performing LP is expected, empirical treatment should be commenced. Blood cultures should be taken prior to initiating antibiotics to increase the chance of idenfying the causative organism 8
- When there is concern for raised intracranial pressure and potential LP-induced cerebral herniation, CT of the head is suggested. This includes patients who have: 2-3
    - A history of central nervous system disease (e.g. mass lesion, stroke, focal infection)
    - New-onset seizure (within one week)
    - Papilloedema
    - Abnormal level of consciousness
    - A focal neurological deficit
    - Immunocompromised state
- Obtaining a CT before LP often delays diagnosis and treatment, and has been associated with an

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increase in unfavourable outcomes. 2 CT should therefore not delay taking blood cultures and commencing antibiotics when acute bacterial meningitis is suspected 5

Lumbar Puncture (LP)

- LP is essential to establish the diagnosis, identify the pathogen, and determine antibiotic resistance. LP should be performed as early as possible in all patients with suspected meningitis unless contraindicated. 2,8,9 Empirical treatment should be commenced following LP while awaiting CSF investigation results
- If delay in performing LP is expected, empirical treatment should be commenced. Blood cultures should be taken prior to initiating antibiotics to increase the chance of idenfying the causative organism 8
- If treatment has been initiated, an LP should still be performed as soon as possible, preferebly within 4 hours of commencing antibiotics 10
- Contraindications to LP include: 10-12
    - Signs of raised intracranial pressure and/or coning (e.g. papilloedema, fixed dilated or unequal pupils, absent doll's eye movements, recent seizures, decerebrate or decorticate posture, hemiparesis)
    - Coma
    - Septic shock
    - Respiratory or cardiac compromise
    - Infection at the puncture site or spinal epidural abscess
    - Thrombocytopaenia (platelet count
    - Coagulopahty (INR > 1.4) or ongoing anti-coagulant use
- If neuroimaging is performed, LP should be performed as soon as possible afterwards unless: 10
    - Neuroimaging reveals significant brain shift
    - An alternative diagnosis is established
    - The patient's condition precludes an LP
- Although LP is the manstay in the diagnosis of acute bacterial meningitis, long-standing controversy exists regarding the potential risk of LP-induced brain herniation when there is raised intracranial pressure 8,13
- A mass lesion, brain abscess, subdural empyema or large cerebral infarction can be associated with brain shift and an increased risk of cerebral herniation 8
- However, a causal relationship is difficult to establish because brain herniation can also occur in patients with bacterial meningitis who do not undergo LP 8

Computed Tomography (CT) of the Head

- CT is not required in the majority of patients with suspected meningitis
- CT is helpful to exclude conditions that mimic bacterial meningitis with raised intracranial pressure such as tumours, cerebral abscess, intracranial bleeds, or large cerebral infarction and is indicated in patients with: 1,4,7,10,13-15
    - Immunocompromised state (e.g. HIV infection, immunosuppression therapy)
    - Background of central nervous system disease (e.g. mass lesion, stroke, focal infection)
    - Recent seizures (within one week of presentation)
    - Reduced level of consciousness
    - Focal neurological deficit
    - Papilloedema

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    - > 4 days of symptoms
- However, CT before LP is associated with delayed antibiotic treatment and increased risk of unfavourable outcomes 1,13
- Decision rules to selectively perform CT on individuals most likely to have intracranial mass effect lesions have not undergone validation. Furthermore, up to 80% of patients with bacterial meningitis experiencing herniation have no CT abnormalities and approximately 50% of patients with intracranial mass effect not undergoing LP herniate 15,16
- As a result, indications for CT vary between guidelines: 17

Indication for CT head prior to LP	**Infectious Diseases Society of America (IDSA) guideline** 6	**European Society of Clinical Microbiology and Infectious Diseases (ESCMID) guideline** 8	**Swedish guideline** 18
Immunosuppression	HIV, immunosuppression	Severely immunocompromised	Not an indication for CT
Background of CNS disease	Mass lesion, stroke or focal CNS infection	No recommendation	Not an indication for CT
Seizures	Seizures within last 1 week	New onset seizures	Not an indication for CT
Level of consciousness	GCS < 15	GCS < 10	'Imminent herniation': unconscious plus ? 1 of: rigid dilated pupils, increased BP and bradycardia, abnormal respirations, opisthotonus, loss of all reactions
Focal neurological deficit	Focal deficit including cranial nerve palsies	Focal deficit excluding cranial nerve palsies	Focal deficit excluding cranial nerve palsies
Papilloedema	Indication for CT	No recommendation	Avoid LP if present but fundoscopy not mandatory
Duration of symptoms	No recommendation	No recommendation	> 4 days of symptoms

- A retrospective review by Salazar et al. found that most clinicians do not adhere to guidelines and CT of the head is frequently performed when not indicated 2
    - In a group of 614 patients with meningitis they found that a CT head was performed before LP in 64% of patients when a CT was not indicated (based on IDSA guidelines)
    - In patients who had a CT when it was not indicated, intracranial abnormalities were detected in 0.05% of patients. These intracranial findings had no impact on clinical management 2
- Similar findings have been seen in other studies 19-21

References

References are graded from Level I to V according to the Oxford Centre for Evidence-Based Medicine, Levels of Evidence. Download the document

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