GUIDELINE	
Meningitis and Meningoencephalitis	
Scope (Staff):	Clinical Staff – Medical, Nursing, Pharmacy
Scope (Area):	Perth Children's Hospital (PCH)

This document should be read in conjunction with this DISCLAIMER

- Empirical regimens are intended for initial therapy (up to 48 hours only), therapy should be modified as soon as additional information (source of infection, Gram stain results, culture and susceptibility testing) is available.

CLINICAL SCENARIO	Usual duration	DRUGS/DOSES			
		Standard Protocol	**Known or Suspected MRSA[a]**	**Low risk Penicillin allergy[b]**	**High risk Penicillin allergy[b]**
Meningitis / meningoencephalitis < 1 month of age (community acquired)	See below	IV cefotaxime **AND** IV benzylpenicillin **AND** IV aciclovir (doses as per neonatal guidelines)	Discuss with ID or Microbiology Service		
		• Discuss all cases with ID/microbiology • Send CSF for cell count, protein, glucose, culture and viral PCR (HSV, enterovirus, parechovirus) • In addition consider blood culture, EDTA blood for HSV PCR, enterovirus/parechovirus swabs (throat, and rectal) and HSV swabs (throat, rectal, eye, umbilical) • For further information refer to ASID perinatal guidelines			

<table>
<tr><th rowspan="2">CLINICAL SCENARIO</th><th rowspan="2">Usual duration</th><th colspan="4">DRUGS/DOSES</th></tr>
<tr><th>Standard Protocol</th><th>Known or Suspected MRSA[a]</th><th>Low risk Penicillin allergy[b]</th><th>High risk Penicillin allergy[b]</th></tr>
<tr><td rowspan="3">Meningitis
≥ 1 month of age
(community acquired)</td><td colspan="5">Give IV dexamethasone before or with the first dose of antibiotics as per local guidelines
Consider the need to also cover for HSV encephalitis (see below).</td></tr>
<tr><td>See below</td><td>IV ceftriaxone 50mg/kg/dose (to a maximum of 2 grams) 12 hourly
ADD
IV vancomycin[c] 15mg/kg/dose (to a maximum initial dose of 750mg) 6 hourly via slow infusion if:
i.) Gram-positive cocci are seen on Gram stain; OR
ii.) the patient has known or suspected otitis media or sinusitis; OR
iii.) has been recently treated with a penicillin, cephalosporin or carbapenem antibiotic OR
iv.) is too unwell to undergo a lumbar puncture</td><td>As per standard protocol</td><td>IV moxifloxacin[d]</td></tr>
<tr><td colspan="5">Once the organism has been identified and the results of susceptibility testing are available choose the appropriate directed regimen and duration:
N. meningitidis 5-7 days — Group B strep 14-21 days
S. pneumoniae 10-14 days — Gram negative bacilli 21 days
H. influenzae 7-10 days — Listeria 21 days
No pathogen identified – Discuss with ID or Microbiology Service
For confirmed N. meningitidis, H. influenzae or S. pyogenes meningitis, consider the need for post exposure prophylaxis for contacts as per the ChAMP Medical prophylaxis guideline.</td></tr>
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<tr><td rowspan="3">Encephalitis

≥ 1 month of age</td><td rowspan="3">14-21 days if HSV confirmed</td><td colspan="4">If bacterial meningitis or sepsis has not been excluded, in addition to encephalitis treatment, start antibiotics as per Meningitis recommendations above.

IV aciclovir
<5 years: 20mg/kg/dose (to a maximum of 750mg) 8 hourly;
≥ 5 years to < 12 years: 15mg/kg/dose (to a maximum of 750mg) 8 hourly;
≥ 12 years old: 10mg/kg/dose (to a maximum of 750mg) 8 hourly
ADD
Oral oseltamivir 3mg/kg/dose (to a maximum of 75mg) twice daily for five days during flu season (July to September inclusive) and where there is clinical concern. Information regarding influenza activity can be found on Virus WAtch</td></tr>
<tr><td colspan="4">Major criteria (required):
• Decreased or altered level of consciousness or lethargy or personality change lasting >24 hours
Minor criteria (2 for possible; >3 for probable/confirmed encephalitis):
• Documented fever (>38°C) within 72 hours before or after presentation.
• Generalised or partial seizures not fully attributable to a pre-existing seizure disorder.
• New onset of focal neurological findings.
• CSF WBC count >5/mm^3.
• New abnormality of brain parenchyma on neuro-imaging suggestive of encephalitis.
• Abnormality on EEG that is consistent with encephalitis.</td></tr>
<tr><td colspan="4">Herpes simplex encephalitis can usually be excluded and empirical therapy stopped based on negative CSF nucleic acid amplification tests (e.g. polymerase chain reaction [PCR]) and a normal MRI. However, tests for herpes simplex virus in CSF can be negative in very early disease (before day 3 of illness); consider a repeat lumbar puncture and PCR if clinical suspicion is high.

If concerns for HSV encephalitis persist despite a negative PCR please discuss with ID Clinical microbiology.</td></tr>
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CLINICAL SCENARIO	Usual duration	DRUGS/DOSES			
		Standard Protocol	**Known or Suspected MRSA[a]**	**Low risk Penicillin allergy[b]**	**High risk Penicillin allergy[b]**
Suspected or proven nosocomial or post-neurosurgical meningitis (including shunt meningitis)	At least 14 days after last positive culture	IV cefepime 50mg/kg/dose (to a maximum of 2 grams) 8 hourly **AND** IV vancomycin 15mg/kg/dose (to a maximum initial dose of 750mg) 6 hourly via slow infusion.	As per standard protocol		Discuss with ID or Microbiology Service
Meningitis/ meningoencephalitis in an immunocompromised child	varies	Discuss with ID or Microbiology service			

a) Children known or suspected to be colonised with MRSA may need to have their therapy/prophylaxis modified. Children suspected of having MRSA include:
   i) Children previously colonised with MRSA
   ii) Household contacts of MRSA colonised individuals
   iii) In children who reside in regions with higher MRSA rates (e.g. Kimberley and the Pilbara) a lower threshold for suspected MRSA should be given
   iv) Children with recurrent skin infections or those unresponsive to ≥ 48 of beta-lactam therapy. For further advice, discuss with Microbiology or ID service

b) Refer to the ChAMP Beta-lactam Allergy Guideline:
   - Low risk allergy: a delayed rash (>1hr after initial exposure) without mucosal or systemic involvement (without respiratory distress and/or cardiovascular compromise).
   - High risk allergy: an immediate rash (<1hr after exposure); anaphylaxis; severe cutaneous adverse reaction {e.g. Drug Rash with Eosinophilia and Systemic Symptoms (DRESS) and Stevens – Johnson syndrome (SJS) / Toxic Epidermal Necrolysis (TEN)} or other severe systemic reaction.

c) IV vancomycin **15mg/kg/dose** (maximum initial dose 750mg) 6 hourly via slow infusion. Therapeutic drug monitoring required.

d) IV moxifloxacin **10mg/kg/dose** (to a maximum of 400mg) given once daily. Moxifloxacin is a red/restricted agent and requires ChAMP approval prior to prescribing.

Related internal policies, procedures and guidelines
Antimicrobial Stewardship Policy (PCH Website)
ChAMP Empiric Guidelines

References
Antibiotic Writing Group (2020). eTG complete. West Melbourne, Therapeutic Guidelines Ltd.
McMullen BJ, et al. (2016). "Antibiotic duration and timing of the switch from intravenous to oral route for bacterial infections in children: systematic review and guidelines." Lancet Infect Dis **16**: e139-152.
Britton P, et al. Consensus guidelines for the investigation of encephalitis in adults and children in Australia and New Zealand. Internal Medicine Journal. 2015;45:563-76.

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