Document Control

Title

Antibiotic Guidelines for Meningitis and Meningococcal Septicaemia in Paediatrics over 1 month of age

Author	**Author's job title**
	Consultant Microbiologist Antibiotic Pharmacist Consultant Paediatrician
Directorate Women's and Childrens	**Department** Paediatrics

Version	Date Issued	Status	Comment / Changes / Approval
0.1	Sep 2011	Draft	After consultation with paediatricians, microbiologists, review of epidemiology, NICE guidance and HPA guidance.
0.2	Feb 2012	Draft	Initial AWG review suggested reformatting of guidance (done by Dr G. Smith)
0.3	Feb 2012	Draft	Reviewed in AWG. Accepted after minor changes.
1.0	Mar 2012	Final	Ratified by Drug and Therapeutics Committee on 8th March 2012 with minor change.
1.1	Jun 2012	Revision	Minor amendment by Corporate Governance to header and footer, table of contents, document control report and added hyperlinks.
1.2	Sep 2017	Draft	Update references, review doses and clinical guidance. Inclusion of aciclovir and poster for display on the ward.
2.0	Nov 2017	Final	Approved on 16/11/17 by DTC with change to protocol – addition of "start antibiotics within the first hour of the patient's arrival at hospital for patients with clear symptoms of meningitis or meningococcal sepsis", addition of call ICU team.
2.1	Mar 2018	Revision	Minor changes as per feedback from Paediatricians
3.0	Nov 2020	Final	References reviewed, wording in diagnosis changed to reflect new NICE guideline. Approval process updated. Submitted to IPDG and approved 24th November 2020

Main Contact
Consultant Microbiologist
Microbiology, Pathology Dept.
North Devon District Hospital
Raleigh Park
Barnstaple, EX31 4JB

Tel: Direct Dial –
Tel: Internal –
Email:

Lead Director
Director of Medicine

Superseded Documents
Antibiotic Guidelines for Meningitis (Paediatrics) v2.1 120218

Issue Date	Review Date	Review Cycle
Nov 2020	Sept 2023	Three years

Consulted with the following stakeholders:

- AWG
- IPDG
- Women's and Children's Pharmacist
- Consultant Paediatricians

Approval and Review Process

- Antibiotic Working Group
- Infection Prevention and Decontamination Group
- Clinical Audit and Guidelines Group (major changes only)

Local Archive Reference
G:\ANTIBIOTICSTEWARDSHIP
Local Path
G:\ANTIBIOTIC STEWARDSHIP\Stewardship\Antibiotic policies\Published policies
Filename
Antibiotic Guidelines for Meningitis (Paediatrics) v2.2 02112020

Policy categories for Trust's internal website (Bob)	Tags for Trust's internal website (Bob)
Pharmacy, Microbiology, Paediatrics	Meningitis, meningococcal sepsis, children

CONTENTS

1. Purpose

1.1. This document sets out Northern Devon Healthcare NHS Trust's best practice guidelines for appropriate microbiological investigation and antimicrobial prescribing in paediatric patients (from 1 month to 18 years of age) with meningitis infection.

1.2. This guideline applies to all paediatric patients between 1 month and 18 years, and must be adhered to. Special considerations exist for pregnant and breastfeeding patients; liaise with specialist clinicians as appropriate in these cases. See separate guidance for adult patients.

1.3. Non-compliance with this guideline may be for valid clinical reasons only. The reason(s) for non-compliance must be documented clearly in the patient's notes.

1.4. This guideline is primarily aimed at all prescribing teams but other staff (e.g. nursing staff, pharmacists) may need to familiarise themselves with some aspects of the guideline.

1.5. Implementation of this guideline will ensure that:

- Meningitis infection is managed according to current evidence and standards of practice in the wider healthcare community.
- A standard of care is specified to facilitate a consistent approach between paediatrics, microbiology and pharmacy in terms of patient management, specimen processing and drug availability.

2. Responsibilities

2.1. Responsibility for education and training on antibiotic use lies with the Lead Consultant Microbiologist for Antibiotic Stewardship. It will be provided through formal study days and informal training on the ward.

2.2. The author will be responsible for ensuring the guidelines are reviewed and revisions approved by the Infection Prevention and Decontamination Group in accordance with the Document Control Report.

2.3. All versions of these guidelines will be archived in electronic format by the author within the Antibiotic Stewardship policy archive.

2.4. Any revisions to the final document will be recorded on the Document Control Report.

2.5. To obtain a copy of the archived guidelines, contact should be made with the author.

2.6. Monitoring of implementation, effectiveness and compliance with these guidelines will be the responsibility of the Lead Clinician for Antibiotic Stewardship. Where non-compliance is found, the reasons for this must have been documented in the patient's medical notes.

Role of Antibiotic Working Group (AWG)

2.7. The AWG is responsible for:

- Leading antibiotic guideline development and review within Northern Devon Healthcare Trust
- Involving all relevant stakeholders in guideline development and review

3. Contacts

3.1. Contact numbers:

• Microbiologist	Bleep 193. Via switchboard out of hours.
• Antibiotic Pharmacist	Bleep 029 (Mon-Fri only)

4. Management of Meningitis infections

4.1. See appendix 1

5. Monitoring Compliance with and the Effectiveness of the Guideline

Suggested audit criteria

5.1. The following could be used:

- Percentage of patients receiving correct antibiotics
- Percentage of patients receiving correct investigative procedures e.g. lumbar puncture

Process for Implementation and Monitoring Compliance and Effectiveness

5.2. Incidents involving meningitis infection should be reported according to the Trust's Incident Reporting Policy. Critical incident reports relating to meningitis infection will be collated by the Antibiotic Pharmacist. Results will be reported on an annual basis to the Infection Prevention and Decontamination Group.

6. Equality Impact Assessment

6.1. The author must include the Equality Impact Assessment Table and identify whether the policy has a positive or negative impact on any of the groups listed. The Author must make comment on how the policy makes this impact.

Table 1: Equality impact Assessment

Group	Positive Impact	Negative Impact	No Impact	**Comment**
Age	X			Separate guidance for paediatrics
Disability			X	
Gender			X	
Gender Reassignment			X	
Human Rights (rights to privacy, dignity, liberty and non-degrading treatment)			X	
Marriage and civil partnership			X	
Pregnancy		X		Some treatment advice may harm the unborn foetus, discuss on a case-by-case basis with Obstetricians and Pharmacy for advice.
Maternity and Breastfeeding		X		Some treatments may be excreted in breast milk. Discuss on a case-by-case basis with Paediatricians and Pharmacy for advice.
Race (ethnic origin)			X	
Religion (or belief)			X	

7. References

7.1. NICE. 2010 (updated 2015, 2018). Clinical Guideline 102: Meningitis (bacterial) and meningococcal septicaemia in under 16s: recognition, diagnosis and management.

7.2. BNF for children [online] via www.new.medicinescomplete.com/mc

7.3. RCPH. 2015 (revised Aug 2016, Mar 2019). The management of children and young people with an acute decrease in conscious level. https://www.rcpch.ac.uk/resources/management-children-young-people-acute-decrease-conscious-level-clinical-guideline

7.4. NICE (2019). NICE Guideline 143: Fever in under 5s: assessment and initial management (Previously CG47: Feverish illness in children, and CG160: Fever in under 5s: assessment and initial management)

7.5. Sammons, H. (2015) Guideline for Management of Meningitis and Meningococcal Septicaemia in Children. Derby Hospitals Foundation Trust.

7.6. NICE. 2012. (Checked and validated 2017). Quality Standard 19: Meningitis (bacterial) and meningitis in children and young people.

8. Associated Documentation

- Incident reporting policy
- Antibiotic guidelines for management of severe sepsis in paediatric patients
- Antibiotic prescribing policy
- Penicillin allergy policy

9. Appendix 1 – Guideline for App

9.1. Name of guideline on app

Meningitis

9.2. Location on app

Infection
Paediatric Treatment
CNS

9.3. Header

This guidance applies to **children over 1 month, not applicable to neonates**. **See neonatal sepsis policy for children under 1 month**. Suspected bacterial meningitis is a medical emergency, and even with prompt treatment some patients may still suffer serious sequelae.

9.4. Diagnosis and Differentials [open/closed]

Children who are otherwise healthy and have no risk factors for developing a bacterial meningitis infection may present with mainly non-specific symptoms. If stable, these patients should be monitored at least every hour over the next 6 hours for development of worsening symptoms, or more specific signs of bacterial meningitis which will require treatment.

Symptoms may include:

- Headache
- Muscle/joint pain
- Recent history of coryzal illness, with ENT symptoms
- Vomiting, diarrhoea, or abdominal pain and distension
- Fevers or rigors (chills / shivering)
- Appears ill
- Irritability / unsettled
- Lethargy (floppy / less responsive child)
- Refusing food/drink
- Respiratory symptoms/signs or breathing difficulty

Other patients demonstrate clear hallmarks of bacterial meningitis at presentation to hospital, and require immediate treatment, as this constitutes a medical emergency.

Hallmarks of bacterial meningitis (severe):

Neck/back stiffness	Non-blanching rash, or petechiae (check soles of feet, palms or hands and conjunctivae if pigmented skin)
Decreased level of consciousness / altered mental state (confusion, delirium, drowsiness)	Photosensitivity / Focal neurological deficit / cranial nerve involvement / abnormal pupils
Signs of septic shock, meningococcal septicaemia: hypotension, mottled skin, cold peripheries, increased CRT *[more than 2 seconds]*, toxic / moribund state, tachycardia, low urine output, respiratory failure/difficulty breathing	
Leg pain	Bulging anterior fontanelle (if still open) in young children [under 2yrs]
Seizures / convulsive status epilepticus	Paresis
Brudzinski's sign (neck bend causing involuntary knee/hip flexion)	Kernig's sign (thigh/knee bend 90 degrees causing neck/head pain)

Consider other non-specific features of the child or young person's presentation, such as:

- The level of parental / carer concern (particularly compared with previous illnesses in the patient or their family)

- Progression of symptoms
- Clinical judgement of overall severity of the presenting illness (document symptoms against the NICE traffic light symptoms checker from fever and illness in children under 5 guideline)

Consider the possibility of viral meningitis, and also Herpes encephalitis if there is a history of cold sores in Mum/close family, presenting with seizures, or atypical EEG findings.

9.5. Always Remember To… [open/closed]

Notify PHE on suspicion of meningitis or meningococcal septicaemia via the Microbiology Consultant.

Start appropriate antibiotic treatment as soon as possible, preferably after completing investigations, **but definitely within the first hour of the patient's arrival at hospital for patients with clear symptoms of meningitis or meningococcal sepsis**.

Investigations:

- Blood culture before first dose of antibiotics
- Peripheral EDTA blood bottle to save for PCR for *Neisseria meningitidis* and *Streptococcus pneumoniae* – sample only tested if CSF culture negative
- FBC
- Coagulation screen
- CRP
- Blood gas, including peripheral blood glucose
- **Lumbar puncture – perform this as soon as possible after admission, and preferably prior to first dose of antibiotics (see contraindications below)**
  - Send CSF to microbiology for culture, protein and white cell count as soon as possible after admission
  - Send CSF to biochemistry for glucose and protein
  - **Make sure the laboratories are aware that a sample is being sent, this may involve contacting the on-call service for each specialty out-of-hours. Check when results will be made available to support decision regarding adjunctive steroid therapy.**
  - Abnormal CSF = more than 5 white cells / mm^3 or more than 1 neutrophil / mm^3
  - If considering viral meningitis (e.g. Herpes encephalitis), request PCR for viruses
  - Only if waiting to perform LP would cause undue delay to the timely administration of antibiotics, should antibiotics be given first

Ask for Consultant Paediatrician review at the earliest opportunity, if they have not been involved in the initial care of the patient.

Patients with meningococcal septicaemia should be nursed on HDU and have constant monitoring for the following parameters; all other patients with suspected or confirmed meningitis should be monitored for the following at least every hour (or more often if needed) until they are stabilised:

- temperature,
- respiratory rate,
- pulse,
- blood pressure,
- urine output,
- oxygen saturation,
- neurological condition (GCS level)

Contraindications to lumbar puncture:

- Signs suggesting raised intracranial pressure
  - *reduced or fluctuant GCS – less than 9 or a drop of 3 or more from baseline;*
  - *relative bradycardia and hypertension;*
  - *focal neurological signs;*
  - *abnormal posture or posturing;*
  - *unequal, dilated or poorly responsive pupils;*
  - *papilloedema; abnormal "doll's eye" movements);*
- shock;
- extensive or spreading purpura;
- uncontrolled convulsions (LP can be performed once stabilised);
- coagulation abnormalities (coagulation results outside normal range, platelet count below 100 x 10^9/L, current anticoagulant therapy);
- local superficial infection at the lumbar puncture site;
- respiratory insufficiency (LP is considered to have a high risk of precipitating respiratory failure in the presence of respiratory insufficiency)

In children/young people with contraindications to LP at first, delayed LP can be useful in cases of diagnostic uncertainty or lack of progress on standard treatment.

9.6. Watch Out For (red flags)… [open/closed]

Treat any child with a petechial non-blanching rash if:

Petechiae start to spread

Rash becomes purpuric (lesions more than 2mm diameter)

Signs of meningococcal septicaemia are present

Child appears ill to the healthcare professional

Ring Microbiology for advice if recent history of foreign travel to areas with endemic malaria.

If indicated, organize a CT head – this does not rule out raised intracranial pressure (or mean that a LP can be safely performed), but looks for alternative diagnoses. NB. Treatment for suspected meningitis should not be delayed for a CT scan. Indications for CT head include:

- Reduced or fluctuating GCS
- Focal neurological deficit

- ⇨ If diagnosis is in doubt (differentials include hydrocephalus, cerebral abscess, shaken baby syndrome)

9.7. General Interest [closed]

- Public health will usually advise on prophylaxis for contacts. In exceptional cases, liaise with duty Microbiologist via bleep 193 to arrange prescriptions. Ensure that NDDH white outpatient prescriptions are endorsed “meningitis prophylaxis, no charge to be levied” or similar in the diagnosis box.
- Long-term care and follow-up

  Testing for hearing damage should take place as soon as feasible: Offer a formal audiological assessment, preferably before discharge, within 4 weeks of being fit to test.

  Offer patients with a severe or profound deafness an urgent assessment for cochlear implants as soon as they are fit to undergo testing.

  Before the patient leaves hospital, discuss the potential long-term effects and likely patterns of recovery with the patient and their parents / carers, and provide them with opportunities to discuss issues and ask questions.

  Consider their requirements for follow-up, taking into account potential sensory, neurological, psychosocial, orthopaedic, cutaneous and renal morbidities.

  Patients must have a follow-up appointment with a Consultant Paediatrician within 4-6 weeks of discharge from hospital, where the following should be considered and addressed, with referral to appropriate services as needed:

  - ⇨ Results of audiology assessment, to discuss any hearing loss (with the child or young person having undergone an urgent assessment for cochlear implants as soon as they are fit)
  - ⇨ Orthopaedic complications (damage to bones and joints)
  - ⇨ Skin complications (including scarring from necrosis)
  - ⇨ Psychosocial problems
  - ⇨ Neurological and developmental problems
  - ⇨ Renal failure.

  Provide information on meningitis support groups for patients and their families, including meningitis charities that can offer support, befriending, in-depth information, advocacy, counselling, and written information to signpost families to further help and advice on accessing future care.

  Inform the child's or young person's GP, health visitor and school nurse (for school-age children and young people) about their bacterial meningitis or meningococcal septicaemia.

- Immune testing

  Test children and young people for complement deficiency if they have had either:

- ⇨ more than one episode of meningococcal disease, or
- ⇨ one episode of meningococcal disease caused by serogroups other than B (for example A, C, Y, W135, X, 29E), or
- ⇨ meningococcal disease caused by any serogroup and a history of other recurrent or serious bacterial infections.

Discuss appropriate testing for complement deficiency with local immunology laboratory staff.

Children and young people with recurrent episodes of meningococcal disease should be assessed by a specialist in infectious disease or immunology.

If a child or young person who has had meningococcal disease has a family history of meningococcal disease or complement deficiency, test the child or young person for complement deficiency.

If a child or young person who has had meningococcal disease is found to have complement deficiency, they should be referred to an immunologist, and their parents and siblings tested for complement deficiency.

9.8. Treatment [closed]

Empirical Treatment – contact microbiology for advice where cases of genuine allergy to penicillins, 3rd generation cephalosporins require alternative

Less than or equal to 3 months

IV Cefotaxime

Age 1 month – 3 months: 50mg/kg every 6 hours (max. 12g daily)

Plus

IV Amoxicillin

Age 1 month – 3 months: 50mg/kg every 4-6 hours (max. per dose 2g every 4 hours)

Usually for at least 14 days

More than 3 months

Contraindications to dexamethasone: septic shock, meningococcal septicaemia, immunocompromised, meningitis following surgery.

Consider dexamethasone treatment in addition to antibacterials for the following patient groups:

For children 3 months of age or older with:

- suspected bacterial meningitis and unable to take lumbar puncture specimen,
- Bacterial meningitis that is clinically diagnosed, or where lumbar puncture reveals any of the following:
  - Frankly purulent CSF
  - CSF white blood cell count greater than 1000 / microlitre
  - Raised CSF white blood cell count with protein concentration greater than 1g/litre
  - Bacteria on Gram stain

Dexamethasone 150 micrograms/kg to a maximum dose of 10mg, four times daily (every 6 hours) for 4 days.

If corticosteroids are appropriate, preferably give with the first dose of antibiotics, or within 4 hours, but definitely start no later 12 hours after the first dose of antibiotics.

IV Ceftriaxone*

Child 3 months – 11 years and body weight under 50kg: 80mg/kg daily (max. dose 4g) via intravenous infusion only (compatible with sodium chloride or glucose, avoid calcium containing infusion fluids)

Child 9 – 11 years and body-weight 50kg and over: dose as for child 12-18 years

Child 12-17 years: 2 – 4 g once daily via intravenous infusion only (compatible with sodium chloride or glucose, avoid calcium-containing infusion fluids)

Usually for at least 10 days.

* Only after discussion with Microbiology and Paediatric Consultants: In children younger than 3 months, ceftriaxone may be used as an alternative to cefotaxime (with or without ampicillin or amoxicillin), but be aware that ceftriaxone should not be used in premature babies or in babies with jaundice, hypoalbuminaemia or acidosis as it may exacerbate hyperbilirubinaemia.

If recent history (within the past 3 months) of prolonged or multiple exposure to antibiotics, or travel outside the UK to areas of highly resistant pneumococci, add:

IV Vancomycin as per Trust protocol

For patients with suspected viral meningitis or encephalitis, start aciclovir and await LP viral PCR results – microbiology need to be contacted for course length advice in these cases:

Aciclovir IV, as per dosing schematic below (assuming normal renal function)

Age	Weight (Kg)	Body surface area (m^2)	IV Aciclovir dose (mg) to be given EVERY 8 HOURS
3 months to 12 years (500mg / m^2 to be given every 8 hours)	6	0.34	170
	6.5	0.36	180
	7	0.38	190
	7.5	0.40	200
	8	0.42	210
	8.5	0.44	220
	9	0.46	230
	9.5	0.47	235
	10	0.49	245
	11	0.53	265
	12	0.56	280
	13	0.59	295
	14	0.62	310
	15	0.65	325
	16	0.68	340
	17	0.71	355
	18	0.74	370
	19	0.77	385
	20	0.79	395
	21	0.82	410
	22	0.85	425
	23	0.87	435
	24	0.9	450
	25	0.92	460
	26	0.95	475
	27	0.97	485
	28	1.0	500
	29	1.0	500
	30	1.1	550
	31	1.1	550
	32	1.1	550
	33	1.1	550
	34	1.1	550
	35	1.2	600
	36	1.2	600

	37	1.2	600
	38	1.2	600
	39	1.3	650

Age	Weight (Kg)	Body surface area (m^2)	IV Aciclovir dose (mg) to be given EVERY 8 HOURS
> 12 years old (10 mg/kg to be given every 8 hours)	40	-	400
	41	-	410
	42	-	420
	43	-	430
	44	-	440
	45	-	450
	46	-	460
	47	-	470
	48	-	480
	49	-	490
	50	-	500
	51	-	510
	52	-	520
	53	-	530
	54	-	540
	55	-	550
	56	-	560
	57	-	570
	58	-	580
	59	-	590
	60	-	600
	61	-	610
	62	-	620
	63	-	630
	64	-	640
	65	-	650

Where a clinical diagnosis of meningitis has been made but there are no organisms isolated, patients usually complete the recommended course of empirical treatment unless specifically advised otherwise by a Consultant Microbiologist or Consultant Paediatrician.

Treatment of specific pathogens

Neisseria meningitides (meningococcus)

IV Ceftriaxone

Child 3 months – 11 years and body weight under 50kg: 80mg/kg once daily (max. dose 4g) administered via intravenous infusion only (compatible with sodium chloride or glucose, avoid calcium containing infusion fluids)

Child 9 – 11 years and body-weight 50kg and over: dose as for child 12 – 18 years

Child 12 - 18 years: 2 – 4 g once daily via intravenous infusion only (compatible with sodium chloride or glucose, avoid calcium-containing infusion fluids)

Usually for at least 7 days.

Group B Streptococcus

IV Cefotaxime

Age 1 month – 18 years: 50mg/kg every 6 hours (max. 12g daily)

Usually for at least 14 days, if clinical course is complicated consider extending the duration of treatment.

Listeria monocytogenes

IV Gentamicin (at least the first 7 days)

Dose according to Trust gentamicin policy

plus

IV Amoxicillin

Age 1 month – 18 years: 50mg/kg every 4-6 hours (max. 2g per dose every 4 hours)

Usually for at least 21 days

Gram negative bacilli

IV Cefotaxime

Age 1 month – 18 years: 50mg/kg every 6 hours (max. 12g daily)

Usually for at least 21 days, if clinical course is complicated consider extending the duration of treatment.

Haemophilus influenzae (NB. For children over 3 months only)

IV Ceftriaxone

Child 3 months – 11 years and body weight under 50kg: 80mg/kg (max. dose 4g) once daily administered via intravenous infusion only (compatible with sodium chloride or glucose, avoid calcium containing infusion fluids)

Child 9 – 11 years and body-weight 50kg and over: dose as for child 12 – 18 years

Child 12 - 18 years: 2 – 4 g daily administered via intravenous infusion only (compatible with sodium chloride or glucose, avoid calcium-containing infusion fluids)

Usually for at least 10 days

Unless directed otherwise by results of sensitivities

Streptococcus pneumoniae (NB. For children over 3 months only)

IV Ceftriaxone

Child 3 months – 11 years and body weight under 50kg: 80mg/kg (max. dose 4g) daily administered via intravenous infusion only (compatible with sodium chloride or glucose, avoid calcium containing infusion fluids)

Child 9 – 11 years and body-weight 50kg and over: dose as for child 12 – 18 years

Child 12 - 18 years: 2 – 4 g daily; single intravenous doses above 1 g by intravenous infusion only (compatible with sodium chloride or glucose, avoid calcium-containing infusion fluids)

Usually for at least 14 days

Unless directed otherwise by results of sensitivities

9.9. If No Better… [closed]

Discuss case with the duty microbiologist in case additional samples are required.

Review or repeat scans and consider discussion with neurosurgery if intra-cranial collections apparent.

Send cultures when temperature spikes

Consider alternative diagnoses

Look for other sites of infection – some bacteria can seed deep-seated infection into other parts of the body.

9.10. Other Relevant Guidelines [closed]

WATCH SW Retrieval drug calculator via watch.nhs.uk

Bristol children's hospital guidelines (via BOB) http://nww.swretrieval.nhs.uk/infectious_diseases.htm

9.11. Organisms and Sensitivities [closed]

9.12. Version Control [closed]

Antibiotic Guidelines for Meningitis (Paediatrics) v2.2 02112020

10. Appendix 2 – Meningitis Management Protocol for display