MENINGITIS AND MENINGOCOCCAL SEPTICAEMIA IN CHILDREN – Full Paediatric Clinical Guideline

Reference no.:CH CLIN G46/Sept 20/v010

1. Introduction

Meningitis and meningococcal septicaemia remain a serious and potentially fatal condition. Optimal management requires rapid diagnosis and initiation of appropriate treatment. Introduction of conjugate vaccines (*H. influenzae* type B, meningococcal group C and 13 valent Pneumococcal) has led to decline in cases due to these bacteria. More recently, 4 component men B vaccine was introduced to infant immunisation and Men ACWY for the adolescents.

Cases of group B meningococcal disease and more recently W and Y, are still a cause for concern. This guideline aims to address the management of both meningococcal septicaemia and meningitis, which can exist as separate conditions or can be seen in the same patient.

2. Aim and Purpose

To ensure a multidisciplinary approach is taken to provide effective management of children with meningococcal septicemia and meningitis. This guideline applies to the care of children within the Children's Directorate and children and young people.

3. Main body of Guidelines

- The successful implementation of this guideline requires a multidisciplinary approach to education and training
- Teaching will be undertaken for junior medical staff and nursing staff
- Junior medical staff should refer to The Royal College of Paediatrics and Child Health Foundation's handbook – Lessons from research for doctors in training – Recognition and early management of meningococcal disease in children and young people (available from RCPCH and www.meningitis.org).
- All doctors should refer to the RCPCH Bacterial meningitis and meningococcal septicaemia e-learning module designed to primarily **revise essential knowledge** and understanding of the disease. (Available via RCPCH compass; rcpch.learningpool.com).
- All doctors are encouraged to refer to http://neonatal.meningitis.org/ for the latest UK evidence for meningitis in young infants <3 months.

Signs and symptoms of meningitis and meningococcal septicaemia

Infant	Older child
Irritability	Vomiting
Poor feeding	Headache
Vomiting	Photophobia
Seizures	Neck stiffness
Lethargy	Muscle/Joint ache
Low temperature	Low temperature
Fever	Fever
Altered GCS	Seizures
Full fontanelle	Altered GCS
Papilloedema	Shock
Shock	Non-blanching Rash
Non blanching rash	Toxic state

Cranial nerve palsies, abnormal pupils are specific signs of focal neurological problems.

Fever is not always present.

Clinical manifestation of meningococcal disease:

Meningitis alone: 15%

Septicaemia alone: 25%

Mixed picture (meningitis and septicaemia): 60%

SEE APPENDIX 1 – BACTERIAL MENINGITIS (Link to NICE bacterial meninigitis pathway which will need to be inserted)

Usual organisms causing bacterial meningitis

- **Younger than 3 months**
  - ***Streptococcus agalactiae*** **(Group B Strep)**
  - ***Escherichia coli***
  - ***Listeria monocytogenes*** **(**infants <1m)
  - ***Streptococcus pneumoniae***
- **Older than 3 months**
  - ***Neisseria meningitidis***
  - ***Streptococcus pneumoniae***
  - **Other Gram negative/ positive bacteria**
  - ***H influenzae type b*** (rare due to vaccination)
  - **TB** *(rare but must be considered)*

2. GENERAL MANAGEMENT

See flowchart

- **https://www.meningitis.org/getmedia/21891bb1-198a-451a-bc1f-768189e7ecf1/Management-of-Bacterial-Meningitis-in-Children-and-Young-People-September-2018?disposition=attachment**
- ABC – If shocked or clear evidence of meningococcal disease, Please refer to the Meningococcal septicaemia flowchart. (Please see page 2 of below link) **https://www.meningitis.org/getmedia/8e76b051-8e9e-41bf-8a63-adcff1f698cb/Management-of-Meningococcal-Disease-in-Children-and-Young-People-September-2018?disposition=attachment** and the new sepsis 6 guideline https://derby.koha-ptfs.co.uk/cgi-bin/koha/opac-detail.pl?biblionumber=1580&query_desc=kw%2Cwrdl%3A%20sepsis .

- Gain IV/IO access and take bloods

Blood Culture	FBC	CRP
PCR (1-2mls EDTA)	Coagulation	UE, Ca, Mg, Phosphate
Venous/ Capillary gas	Osmolality	
Glucose	throat swab	

Blood bottles needed for enhanced meningococcal surveillance programme:

x2 EDTA (for PCR testing)

x1 gold top (Acute serum sample, 2mls **ONLY** if age < 5 years)

throat swab and blood culture (and CSF if appropriate)

See indications Appendix 6 for Blood Sample(s) for Meningococcal Surveillance)

- Ideally the LP should be performed before Antibiotics are given. However **antibiotics need to be given as soon as possible** and should not be delayed if investigations are unsafe/ difficult to obtain
- If safe to do so, perform LP without delay
  - A laboratory diagnosis is important for epidemiological and management decisions. ***(see appendix 2 'Handling of CSF)***
  - Send for MC&S, Glucose and Protein (Call Micro technician on 88218 select option 2 (day time) and via switchboard if out of hours)

    For Burton Contact micro technician on 4045 during 0900-1700 Monday to Saturday & via switch board for out of hours

  - Send a sample for PCR in case Gram stain is negative or culture is negative (Meningococcal and Pneumococcal) and for Herpes/ VZV/ Enteroviruses (this should be requested on the system).

- If the CSF is uniformly blood stained in a non-traumatic tap, arrange for a CT scan to exclude intracranial haemorrhage and consider non -accidental injury.
  Repeat LP if meningitis cannot be excluded based on the result of the CSF obtained (i.e. bloody or traumatic tap) and clinical suspicion remains.

Contraindications to LP

- Shocked child
- Signs of **R**aised **I**ntra**c**ranial **P**ressure (RICP) (GCS <9)
  ↓ or fluctuating GCS

  Hypertension / relative bradycardia
  Focal neurological signs
  Abnormal posturing
  Unequal/ dilated / poorly responsive pupils
  Papilloedema
  Abnormal "dolls eye" movements
  Bulging / Separated sutures or ↑ OFC
  Radiological evidence
- After seizures, until stabilised
- Clinically evident Meningococcal disease: extensive or spreading purpura
- Clinical Coagulopathy
  Results outside of normal range
  Platelet count < 100
  Receiving anticoagulant therapy
- Skin infection in lumbar area
- Respiratory insufficiency

Interpretation of CSF Results

Correcting CSF WBC based on RBC adds no diagnostic advantage. Contrary, cases can be missed. If in doubt repeat the LP.

CSF WBC decay over time. Ensure that samples are analysed within 2 hours.

Interpret a negative CSF culture growth with caution if LP done after antibiotics

Suggestive of bacterial meningitis if:

>20cells/µL in Neonates

> 5 cells or > 1 poly in older children

Glucose < 66% serum glucose

No single CSF parameter can preclude the diagnosis of meningitis.

- If indicated, organize a CT head – This does not rule out raised intracranial pressure but looks for alternative diagnoses.

Indications for CT head

- ↓ or fluctuating GCS
- Focal neurological deficit
- If diagnosis is in doubt
  - Hydrocephalus
  - Cerebral Abscess
  - Shaken Baby syndrome is considered

3. SPECIFIC MANAGEMENT

< 1 month

a. Antibiotic Therapy

IV Cefotaxime 50mg/kg QDS + IV Amoxicillin 100mg/kg QDS

(Cefotaxime- infants <21 days give TDS, <7 Days BD)

(Amoxicillin- infants <28 days TDS, <7 days BD)

Ceftriaxone* may be used instead of cefotaxime unless contraindicated

Ceftriaxone* is contraindicated in patients who are premature, jaundiced or hypoalbuminaemic. (See BNFC)

Add Vancomycin if recent overseas travel or multiple/ prolonged antibiotic exposure in past 3 months.

IMPORTANT NOTE 'Early antibiotic treatment saves lives in sepsis and to avoid delay if **ceftriaxone** has been started for a patient who is shocked, continue to give the ceftriaxone and ensure a fluid flush is given through that line. This will provide the patient with 24 hr antibiotics cover

Give **cefotaxime** 24 hours later if still in shock and likely to need calcium containing infusions."

Consider the possibility of Herpes encephalitis (History in mum, seizures or typical EEG findings, abnormal CNS imaging, abnormal LFTs). Request CSF PCR testing for HSV and consider treatment with Aciclovir

Duration of treatment

Confirmed disease

Group B strep: IV Cefotaxime for at least 14 days*

Listeria: IV Amoxicillin/Ampicillin for 21 day + gent for ≥ 7 days

Gram negative bacilli: IV Cefotaxime for at least 21 days

Meningococcal: IV Ceftriaxone for 7 days

Pneumococcal: IV Ceftriaxone for 14 days

*If the clinical course is complicated (for example, if there is poor response to antibiotic therapy, effusion or abscess, or concomitant intraventricular haemorrhage in a premature baby) consider extending the duration of treatment and consulting an expert in paediatric infectious diseases.

Unconfirmed disease *(High clinical suspicion, Suggestive microscopy, neg. culture)*

IV cefotaxime + Amoxicillin for at least 14 days

Therapy can be altered in light of culture and sensitivity of child's illness and resolution of fever (D/W Microbiology Consultant & Consultant Paediatrician)

> 1 month

Ceftriaxone 80mg/kg once a day (see Appendix 2) **unless shocked or receiving or likely to receive calcium containing fluids** (i.e. shocked patients)

If Ceftriaxone contraindicated, use Cefotaxime 50mg/kg QDS

Ceftriaxone* is contraindicated in patients who are premature, jaundiced or hypoalbuminaemic (see BNF-C)

- In infants >30 days old where the risk of *Listeria* has been reviewed and does not exist AND there is no evidence of *enterococci* UTI, empiric antibiotics can be rationalised. Cefotaxime or ceftriaxone (if not contraindicated) alone suffices

**Ceftriaxone has been found to interact with calcium containing solutions (including TPN) causing morbidity and mortality. Cefotaxime should therefore be used until the child is stable and then can be converted to Ceftriaxone after the acute phase, when calcium infusions will not be required. The first dose of Ceftriaxone (once daily) should be given 8 hours after the last dose of Cefotaxime.*

IMPORTANT NOTE *'Early antibiotic treatment saves lives in sepsis and to avoid delay if* ***ceftriaxone*** *has been started for a patient who is shocked, continue to give the ceftriaxone and ensure a fluid flush is given through that line. This will provide the patient with 24 hr antibiotics cover.*

Give ***cefotaxime*** *24 hours later if still in shock and likely to need calcium containing infusions. "*

- Add Vancomycin if recently overseas or prolonged/multiple antibiotic exposure within 3 months
- Consider the possibility of Herpes encephalitis (History in mum, seizures or typical EEG findings). Request CSF PCR testing for HSV and consider treatment with Aciclovir. See appendix 3 for dose banding information.
- Consider TB meningitis

Duration of treatment

Confirmed disease

Pneumococcal: IV Ceftriaxone for 14 days in total
Meningococcal: IV ceftriaxone for 7 days
Gram negative bacilli: IV Cefotaxime for at least 21 days
Haemophilus Influenza type b: IV Ceftriaxone for 10 days in total

Unconfirmed disease *(High clinical suspicion, Suggestive microscopy, neg. culture)*

As per NICE guidelines, if <3 months treat for 14 days, if >3 months old treat for 10 days

3.2 Dexamethasone for bacterial meningitis

Give Dexamethasone in children **> 3 months** with suspected or confirmed bacterial meningitis, **NO** meningococcal contact and **NO** purpuric rash, if lumbar puncture reveals **ONE** of the following:

- **Frankly purulent CSF**
- **CSF white blood cell count greater than 1000/µl**
- **Raised CSF white blood cell count with protein concentration >1g/L**
- **Bacteria on Gram stain**

If uncertain, speak to consultant.
Give with or before antibiotics for best results **150 micrograms/kg/dose IV, every 6 hours for four days. Max dose 10mg**

If dexamethasone was indicated but not given with or before the first dose of antibiotics try to administer within **4 hours** of starting antibiotics. Do not start dexamethasone more than **12 hours** after starting antibiotics.

Evidence for use of steroids:
Pneumococcus – evidence of decreased neurological sequelae
Meningococcus – no evidence of improved outcome, no evidence of risk
Viral meningitis – no evidence of improved outcome, no evidence of risk
*Haemophilus influenz*ae (rare) – Evidence for decreased audiological and neurological sequelae

If meningococcus is seen or cultured, Dexamethasone should be stopped.

Give Omeprazole to diminish risk of GI haemorrhage - see BNFc for doses (See BNFC**)**

3.3 Fluid Therapy

- 100% maintenance fluids unless SIADH or RICP is suspected
  - Use enteral feeds where possible
  - 0.9% NaCl and 5% Glucose as IV fluids
- Reduce to 2/3 maintenance if suspected SIADH
  - Serum – Low sodium and osmolality
  - Urine – High sodium and osmolality
- Strict input/output monitoring is essential
- Monitor electrolytes (+/- Glucose) 4hrly until stable and then daily

3.4 Seizures (See seizure guideline as per APLS)

1) IV Lorazepam (0.1mg/kg) – (max dose 4mg)
2) Paraldehyde in olive oil enema (0.8ml/kg PR of premixed enema) – max dose 20ml of premixed enema)
3) Phenytoin (20mg/kg over 30 mins IV with ECG monitoring)

If persistent seizures-Thiopental 4mg/kg in intubated patients (beware hypotension) or Midazolam / thiopental infusion.

3.5 Management of Raised Intracranial Pressure

- Give Mannitol (0.25 g/kg = 1.25 ml/kg of 20% mannitol) as an infusion over 30-60 minutes followed by Frusemide (1mg/kg)
- Steroids (Dexamethasone 150 micrograms/kg/dose IV, every 6 hours for four days if not already given)
- Treat shock if present then cautious fluid resuscitation
- Call anaesthetist for intubation and ventilation to control PaCO2 (4-4.5 kPa)
- Urinary catheter and NG tube
- Sedate (muscle relax for transport)
- Minimal handling, monitor pupillary size and reaction

3.6 Indications for admission to Dolphin Unit

- GCS≤8
- Signs of raised intracranial pressure
- Hypoxia
- Shock (40ml/kg fluid bolus)

Discuss each case with Dolphin Ward for their awareness and with the regional PICU.

3.7 Ward management

- Needs isolation until second dose of Ceftriaxone and/or has completed course of Rifampicin.
- Masks needed for staff when performing suction / physiotherapy.
- Every infant should have initial head circumference measured and repeated daily.
- IV access: consider long line / PICC line once diagnosis known for long-term antibiotics. Preferably after viral PCR report.
- Other children can be managed on the ward with initially ½ hourly observations (including neuro observations) and strict fluid balance
- Senior medical review within 1 hour

Observations:

▪ Oxygen saturations	May not read accurately due to vasoconstriction / poor perfusion
▪ Capillary refill time	Aim for <2 seconds centrally
▪ Core-peripheral temperature gradient	Should be <2 degrees
▪ Blood pressure, HR, RR.	Aim for a systolic BP = 80 + (2 x age in years)

- If meningococcal disease, please complete the Enhanced IMD form and send blood test as shown in appendix (acute sample within 72 hours, convalescent 3-6 weeks). This is best practice and part of national surveillance by PHE.

4. LONG TERM MANAGEMENT

- Discuss and document likely patterns of recovery and potential long term effects with the patient/family.
- Offer information about further care and contact details of patient support organizations. (Give them a copy of “your guide” and inform families about “my journal” which meningitis charities will send to them)
- Order a Hearing test for 6 weeks post presentation (4 weeks post fitness to test). This will need a referral letter to audiology (an email to dhft.childrensaudiology@nhs.net with form attached is now possible).
- **For Burton email the department uhdb.burtonhearingaidcentre@nhs.net copying in c.hines@nhs.net also complete the referral form and forward to the Paediatric Audiology department or attach to the email.**(This is good for audit trail of referral time).

- Offer those with severe or profound hearing impairment an urgent assessment for cochlear implants as soon as they are fit to undergo testing
- Review in OPD with the results of their hearing test 4-6 weeks after discharge
- Discuss morbidities (Hearing loss, Orthopaedic, Neurological, developmental, skin complications, psychosocial and renal failure). Offer referral to appropriate services

Immune Testing in Meningococcal Disease

Immune testing is indicated in children who fulfil one of the following criteria

- > 1 episode of confirmed meningococcal disease
- One episode of confirmed meningococcal disease caused by serogroups other than B
- Confirmed Meningococcal disease caused by any serogroup **and** a history of other recurrent or serious bacterial infections
- Confirmed Meningococcal disease plus a family history of meningococcal disease or complement deficiency

Immune testing should be discussed with local immunology staff but **should include terminal complement (C5-C9) levels as a minimum.**

If the child is shown to be complement deficient, they should be referred to an immunologist and parents and siblings should be tested for complement

Children who have recurrent episodes of meningococcal disease should be assessed by a specialist in immunology or infectious diseases. For such children perform ultrasound scan of the spleen ASAP.

5. PUBLIC HEALTH MANAGEMENT

5.1 Acute meningitis is a notifiable disease contact tracing is a legal requirement

Notify Public Health at the earliest opportunity **BY PHONE** and **BY WRITTEN NOTIFICATION FORM.**

Please see Page 11 of Trust Guideline Surveillance Trust policy & Procedure

The following numbers are applicable for all areas:

Normal Working Hours:
Health Protection - East Midlands North Team
0115 9296477
For Burton 0344 225 3560

Nights/weekends:
On call Public Health Physicians via East Midlands Ambulance Control
0115 942 5133
For burton 01384 679 031

5.2 Prophylaxis in Meningococcal and HiB disease

(See guideline for 'prophylaxis in meningococcal contacts')
https://derby.koha-ptfs.co.uk/cgi-bin/koha/opac-detail.pl?biblionumber=1362

Prophylaxis is used to eliminate asymptomatic carriage of the bacterium with consequent control of further cases. It does not prevent infection in the individual receiving prophylaxis and they must be told to report any symptoms of illness urgently. Antibiotics such as Ciprofloxacin, Rifampicin and Ceftriaxone are effective in eliminating carriage. Ciprofloxacin is now considered first line unless contraindicated. (*See BNFc for doses)*
Children treated with Ceftriaxone do not need prophylaxis. One dose of Ceftriaxone is sufficient to eliminate nasal carriage. After 24 hours of treatment the child can come out of a side room.
NB Cefotaxime does not eliminate carriage and Ciprofloxacin will be needed to eliminate nasal carriage

Refer to BNFc for doses

6. USEFUL ADDRESSES AND PHONE NUMBERS

Meningitis Now
Fern House
Bath Road, Stroud
Gloucester GL5 3TJ

Nurse-led Helplines

UK: ***Free phone 0808 80 10 388. Email:***
info@meningitisnow.org

Meningitis Research Foundation Tel: 0808 8003344
Tel: 01453 751 738
Fax: 01453 753 588
Email info@meningitis.org

4. References (including any links to NICE Guidance etc.)

Meningitis (bacterial) and meningococcal septicaemia in under 16s: recognition, diagnosis and management Clinical guideline [CG102] Published date: 23 June 2010 Last updated: 01 February 2015

BNFc

Early management of Meningococcal Disease in Children, 4th edition. Meningitis Research Foundation www.meningitis.org (original reference – Archives of Diseases in Childhood 1999: 80:290-296)
Management of neonatal bacterial meningitis (http://neonatal.meningitis.org/). Endorsed by RCPCH

Scholz H, Hofmann T, Noack R, Edwards D J, Stoeckel K. Prospective comparison of ceftriaxone and cefotaxime for the short-term treatment of bacterial meningitis in child. Chemotherapy 1998; 44: 142-147

Corticosteroids as adjunctive therapy in bacterial meningitis. A meta-analysis of clinical trials. Maves P, et al, Winconsin A.J.D.C. Vol. 143, Sept 1989

Control of Meningococcal Disease – Guidelines for Public Health management of meningococcal disease in the UK. Commun. Dis. Public Health 2002: 5(3):174-264

Fluid restriction does not improve the outcome of acute meningitis Singi SC et al, India Paediatric Infectious Disease J 1995: 14;495-503

The role of lumbar puncture in meningococcal disease
Sam WCC, Greenwich Arch Dis Child 2000;83:369

Dexamethasone as adjunctive therapy in bacterial meningitis

A meta-analysis of randomised clinical trials since 1988.

McIntyre PB et al, Sydney JAMA 278 (11): 925 – 31, 1997 Sep 17

Advantages on the Therapy for Sepsis in Children.Andreson M, Blumer J. Pediatric Clinics of North America, Vol 44, No 1 February 1997 (P194-197)

Ceftriaxone drug alert: No longer first line use in meningococcal sepsis. Faust SN et al. ADC 2008;93:184-185.

SIGN guideline: Management of invasive meningococcal disease in children and young people. http://www.sign.ac.uk/pdf/sign102.pdf

Okike IO, Lamont RF, Heath PT. Do we really need to worry about Listeria in newborn infants? *Pediatr Infect Dis J* 2013;32(4):405-6.

Okike IO, Awofisayo A, Adak B, Heath PT. Empirical antibiotic cover for Listeria monocytogenes infection beyond the neonatal period: a time for change? *Arch Dis Child* 2015;100(5):423-5.

http://neonatal.meningitis.org/

5. Documentation Controls

Reference Number CH CLIN G46	**Version:** 10.0.0		**Status** Final	**Author:** Dr. D N Sobithadevi and Dr I Okike **Job Title:**
Version / Amendment History	Version	Date	Author	Reason
	10.0.0	Sep 2020	Dr. D N Sobithadevi and Dr I Okike in consultation with Paediatric Consultants, Consultant Microbiologist, Consultant Adult ED, Paediatric Pharmacist	Review and merged into joint UHDB guideline
Intended Recipients: State who the Clinical Guideline is aimed at – staff groups etc.				
Training and Dissemination: How will you implement the Clinical Guideline, cascade the information and address training				
Linked Documents: State the name(s) of any other relevant documents				
Keywords:				
Business Unit Sign Off			**Group:** *Paediatric Business Unit Guidelines Group* **Date:** *22nd September 2020*	
Divisional Sign Off			**Group:** *Women and Children's Division* **Date:** *22nd September 2020*	
EIRA Stage One Completed Yes / No *Delete as appropriate* Stage Two Completed Yes / No *Delete as appropriate*				
Date of Approval			Sep 2020	

Review Date and Frequency	Sep 2023, every 3 years Extended to Aug 2024
Contact for Review	Dr Okike
Lead Executive Director Signature	

6. Appendices – where used

Initial management of Meningococcal Disease.

Handling of CSF samples

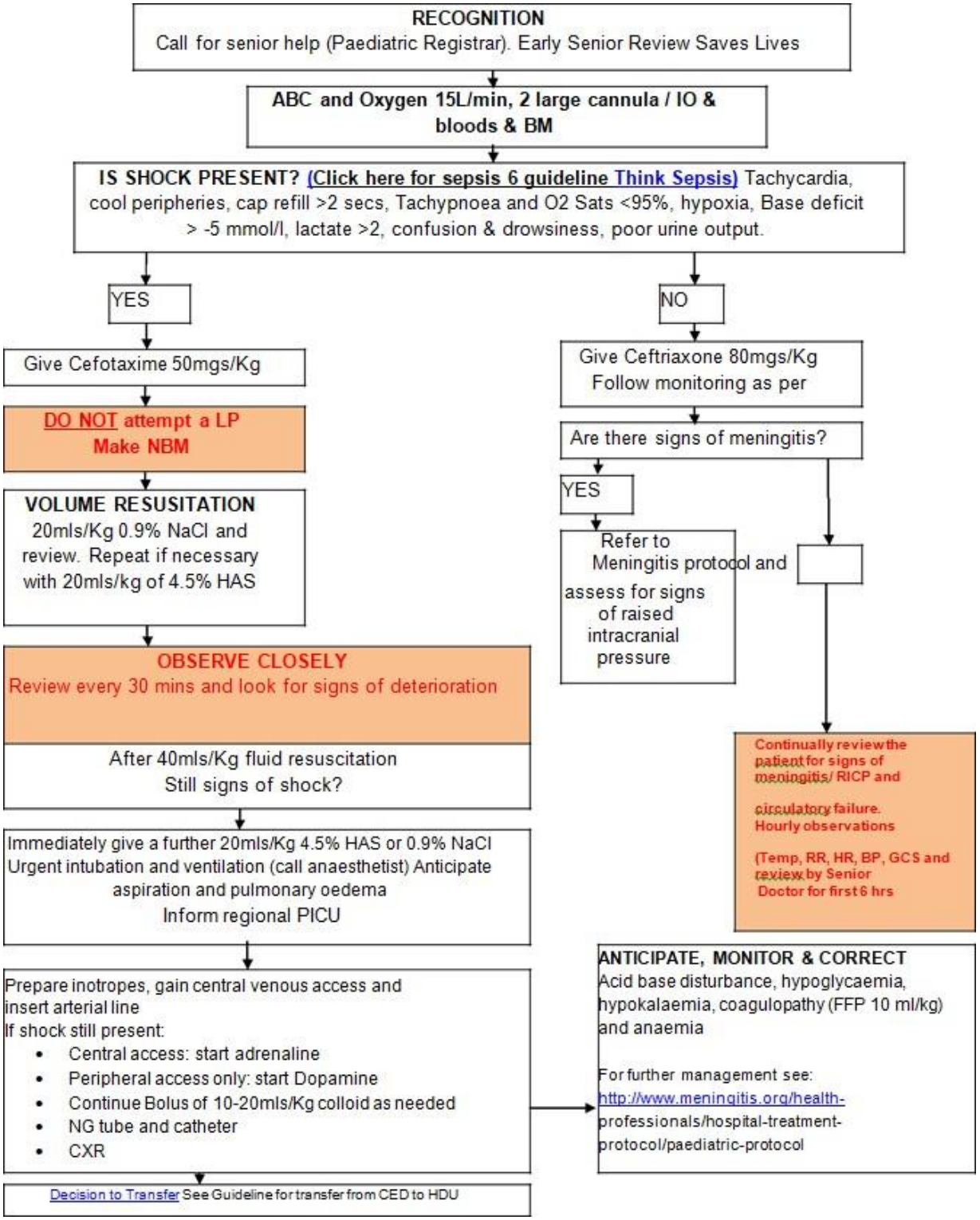
Ceftriaxone for suspected Meningitis/Septicaemia (>3 months old) prescribing and dose preparation guidance.

Aciclovir intravenous infusion for encephalitis treatment - Dose guidelines.

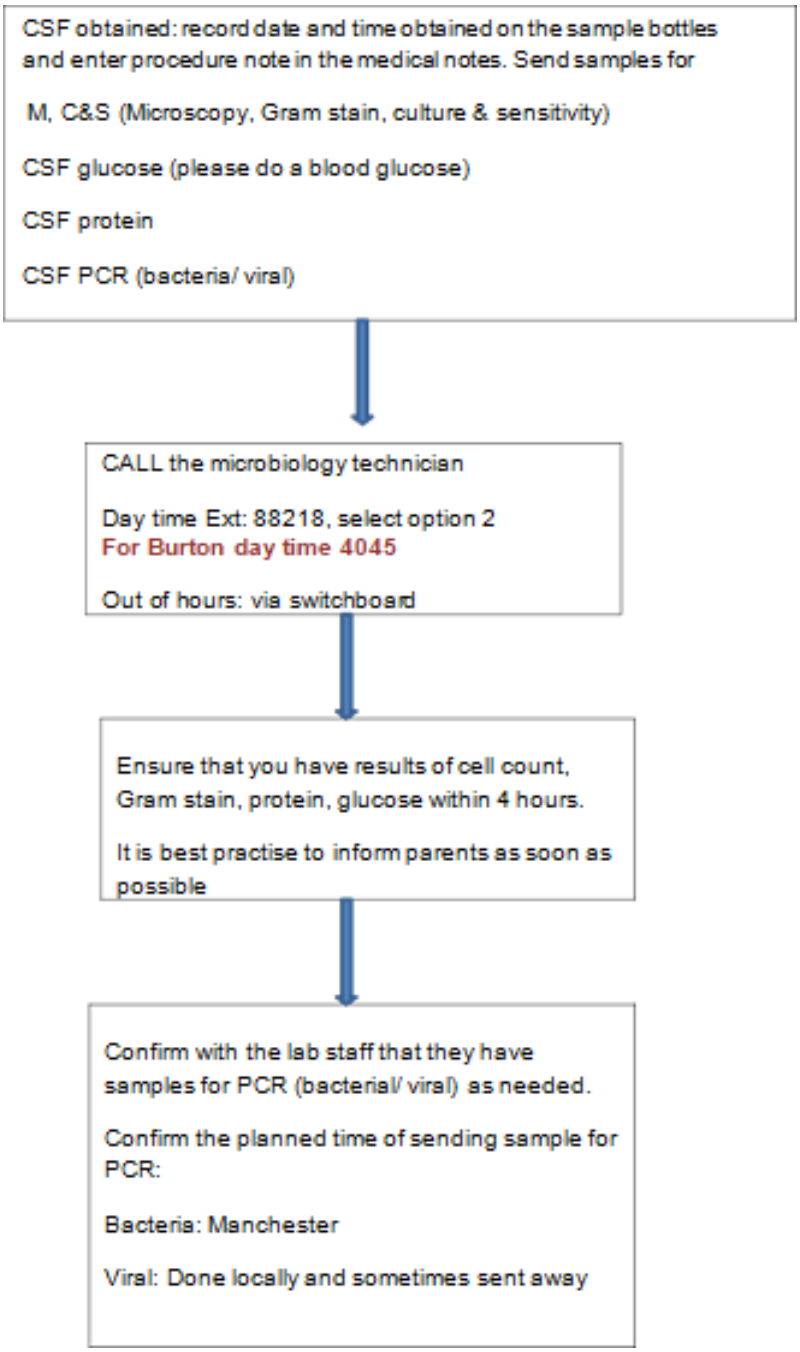
Discharge Checklists of treatment for meningitis/meningococcal sepsis

Enhanced surveillance of IMD by PHE

Appendix 1 : Initial Management of Meningococcal Disease


RECOGNITION
Call for senior help (Paediatric Registrar). Early Senior Review Saves Lives
ABC and Oxygen 15L/min, 2 large cannula / IO & bloods & BM
IS SHOCK PRESENT? (Click here for sepsis 6 guideline Think Sepsis) Tachycardia, cool peripheries, cap refill >2 secs, Tachypnoea and O2 Sats <95%, hypoxia, Base deficit > -5 mmol/l, lactate >2, confusion & drowsiness, poor urine output.
YES
NO
Give Cefotaxime 50mgs/Kg
DO NOT attempt a LP
Make NBM
VOLUME RESUSITATION
20mls/Kg 0.9% NaCl and review. Repeat if necessary with 20mls/kg of 4.5% HAS
OBSERVE CLOSELY
Review every 30 mins and look for signs of deterioration
After 40mls/Kg fluid resuscitation
Still signs of shock?
Immediately give a further 20mls/Kg 4.5% HAS or 0.9% NaCl
Urgent intubation and ventilation (call anaesthetist) Anticipate aspiration and pulmonary oedema
Inform regional PICU
Prepare inotropes, gain central venous access and insert arterial line
If shock still present:
Central access: start adrenaline
Peripheral access only: start Dopamine
Continue Bolus of 10-20mls/Kg colloid as needed
NG tube and catheter
CXR
Decision to Transfer See Guideline for transfer from CED to HDU
Give Ceftriaxone 80mgs/Kg
Follow monitoring as per
Are there signs of meningitis?
YES
Refer to Meningitis protocol and assess for signs of raised intracranial pressure
Continually review the patient for signs of meningitis/ RICP and circulatory failure.
Hourly observations
(Temp, RR, HR, BP, GCS and review by Senior Doctor for first 6 hrs
ANTICIPATE, MONITOR & CORRECT
Acid base disturbance, hypoglycaemia, hypokalaemia, coagulopathy (FFP 10 ml/kg) and anaemia
For further management see:
http://www.meningitis.org/health-professionals/hospital-treatment-protocol/paediatric-protocol

Appendix 2: HANDLING OF CSF



Appendix 3

CEFTRIAXONE FOR SUSPECTED MENINGITIS/SEPTICAEMIA

PRESCRIBING AND DOSE PREPARATION GUIDANCE

Dose = 80mg/kg ONCE daily, to give as an IV infusion over 30 minutes

Reconstitute the dry powder to give a concentrated solution of 100mg/ml (see separate table). Dilute further with sodium chloride 0.9% to a final concentration of no more that 50mg/ml

Weight (kg)	Dose (mg)	Volume conc. Solution (ml)	Final Volume (ml)	Weight (kg)	Dose (mg)	Volume conc. Solution (ml)	Final Volume (ml)	Pharmacy will prepare in:
4	320	3.2	7	21	1680	16.8	34	
4.5	360	3.6	8	22	1760	17.6	36	
5	400	4.0	8	23	1840	18.4	37	
5.5	440	4.4	9	24	1920	19.2	39	
6	480	4.8	10	25	2000	20.0	40	50ml minibag
6.5	520	5.2	11	26	2080	20.8	42	"
7	560	5.6	12	27	2160	21.6	44	"
7.5	600	6.0	12	28	2240	22.4	45	"
8	640	6.4	13	29	2320	23.2	47	"
9.5	680	6.8	14	30	2400	24.0	48	"
9	720	7.2	15	31	2480	24.8	50	"
9.5	760	7.6	16	32	2560 *	25.6	2x26	100ml minibag
10	800	8.0	16	33	2640	26.4	2x27	"
10.5	840	8.4	17	34	2720	27.2	2x28	"
11	880	8.8	18	35	2800	28.0	2x28	"
11.5	920	9.2	19	36	2880	28.8	2x29	"
12	960	9.6	20	37	2960	29.6	2x30	"
12.5	1000	10.0	20	38	3040	30.4	2x31	"
13	1040	10.4	21	39	3120	31.2	2x32	"
13.5	1080	10.8	22	40	3200	32.0	2x32	"
14	1120	11.2	23	41	3280	32.8	2x33	"

14.5	1160	11.6	24	42	3360	33.6	2x34	"
15	1200	12.0	24	43	3440	34.4	2x35	"
15.5	1240	12.4	25	44	3520	35.2	2x36	"
16	1280	12.8	26	45	3600	36.0	2x36	"
16.5	1320	13.2	27	46	3680	36.8	2x37	"
17	1360	13.6	28	47	3760	37.6	2x38	"
17.5	1400	14.0	28	48	3840	38.4	2x39	"
18	1440	14.4	29	49	3920	39.2	2x40	"
18.5	1480	14.8	30	50	4000	40.0	2x40	"
19	1520	15.2	31	>50	4000	40.0	2x40	
19.5	1560	15.6	32					
20	1600	16.0	32					

For doses of 2560mg or greater the doses should be split between two syringes and both diluted to the volume shown e.g. 2560mg required = 1280 (12.8ml) diluted to 26ml, twice.

Appendix 4

ACICLOVIR INTRAVENOUS INFUSION FOR ENCEPHALITIS TREATMENT

Dose guidelines

The dose for this indication is:

0 - 3 months: 20mg/kg tds

3 months – 12 years: 500mg/m² tds

>12 years: 10mg/kg tds

Administration: Each dose should be diluted to 5mg/ml with sodium chloride 0.9% or glucose 5% and infused over 1 hour.

Age	Weight (Kg)	Body surface area (m²)	IV Aciclovir dose (mg) to be given Three times a day (TDS)
< 3months of age	3.0	-	60
	3.5	-	70
	4.0	-	80
	4.5	-	90
	5.0	-	100
3 months to 12 years	5.5	0.32	160
	6	0.34	170
	6.5	0.36	180
	7	0.38	190
	7.5	0.40	200
	8	0.42	210
	9	0.46	230
	10	0.49	245
	11	0.53	265
	12	0.56	280
	13	0.59	295
	14	0.62	310
	15	0.65	325
(continued)	16	0.68	340

ACICLOVIR INTRAVENOUS INFUSION FOR ENCEPHALITIS TREATMENT

Age	Weight (Kg)	Body surface area (m^2)	IV Aciclovir dose (mg) to be given Three times a day (TDS)
3 months to 12 years	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	0.90	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
> 12 years old	40	-	400
	41	-	410
	42	-	420
	43	-	430
	44	-	440
	45	-	450
	46	-	460
	47	-	470

ACICLOVIR INTRAVENOUS INFUSION FOR ENCEPHALITIS TREATMENT

Dose guidelines

Age	Weight (Kg)	Body surface area (m^2)	IV Aciclovir dose (mg) to be given Three times a day (TDS)
> 12 years old	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

In obese patients the dose should be calculated on the basis of ideal weight for height (using 10mg/kg, rather than surface area) to avoid excessive doses

Dose adjustments are needed in patients with renal impairment.

Creatinine Clearance: 25 to 50 ml/min/1.73m^2 .The dose recommended above should be given every 12 hours.

Creatinine Clearance: 10 to 25 ml/min/1.73m^2. The dose recommended above should be given every 24 hours.

Creatinine Clearance: 0 (anuric) to 10 ml/min/1.73m^2. The dose recommended above should be halved and administered every 24 hours.

References:

BNF- for Children 2013-2014

Zovirax Summary of product Characteristics, Glaxo Smith Kline, accessed via www.medicines.org.uk **23/10/2013 (last updated 23/11/20120**

Appendix 5: Discharge checklists

Name: **DOB:** **Hospital number:**		
Public health informed? **Date:** **Name of doctor:**	Y / N …….../……/……. ……	
Microbiology	1. Blood PCR 2. CSF PCR 3. Blood culture 4. CSF culture 5. Urine culture 6. Throat swab	⊔ ⊔ ⊔ ⊔ ☐ ⊔
Length of treatment Start date of treatment End date of treatment	 …….../……/……. …….../……/…….	
Before discharge are there any:	1. Sensory 2. Neurological 3. Psychosocial 4. Orthopaedic 5. Cutaneous 6. Renal morbidities	Y / N Y / N Y / N Y / N Y / N Y / N
Follow up	**Hearing test booked?** (preferably before discharge or within 4 weeks) **Date:** …….../……/……. *(see App 5 for audiology referral form)* **Outpatient follow up?** (should be after hearing test approx. 4-6 weeks after discharge from ward) **Date:** …….../……/…….	☐ ☐
Aftercare	Discuss meningitis charities (MRF, Meningitis Now, GBSS) with parents and offer their number for support. Introduce parents to "Your guide" and "My Journal" **Date:** …….../……/…….	☐ ⊔

Bacterial meningitis and meningococcal septicaemia in children - A discharge checklist

Meningitis Research Foundation

The checklist (overleaf) is based on recommendations from the **NICE guideline on bacterial meningitis and meningococcal septicaemia in children and young people** (CG102) and **NICE Quality Standard** (QS19). It aims to help paediatricians follow best practice when discharging a child recovering from bacterial meningitis or meningococcal septicaemia. We encourage you to put a completed copy in the child's notes.

NICE recommendations apply to all children diagnosed with bacterial meningitis or meningococcal septicaemia. **Even if a child makes a rapid recovery and completes their course of antibiotics as an outpatient, this checklist should still be followed.**

NICE guidance highlights the importance of providing parents with information about recovery before their child is discharged from hospital and instructs paediatricians to signpost towards further help and patient support organisations. Meningitis Research Foundation and Meningitis Now have produced detailed information for parents which describes possible after effects, expected recovery patterns and how to access further care and support.

Your Guide - Recovering from childhood bacterial meningitis and septicaemia has been written in collaboration with medical experts with many years experience of treating this disease and has been endorsed by RCPCH, RCGP and RCN. It is the ideal supplementary information to give to parents to complement verbal information provided by the paediatrician before discharge.

We can provide multiple copies of Your Guide free of charge. Encourage parents to contact us for their free journal in which they can keep a detailed record about their child's illness recovery and follow-up care. It is helpful for families to start completing the journal as soon as possible and bring it with them for the review with the paediatrician.

Download more copies of this checklist from:
www.meningitis.org/news-media/download-resources
Order copies of Your Guide from: **www.meningitis.org/recovery** or
Contact our Freefone helpline: **080 8800 3344**

Acknowledgements: MRF would like to thank the following experts for their invaluable feedback and support: **Dr Nick Makwana**, Consultant Paediatrician, **Dr Simon Nadel**, Consultant in Paediatric Intensive Care, **Dr Andrew Riordan**, Consultant in Paediatric Infectious Diseases and **Dr Alistair Thompson**, Vice President (Education), Royal College of Paediatrics and Child Health.

Bacterial meningitis and septicaemia in children – Discharge checklist

COMPLETED VERSION CAN BE FILED IN MEDICAL RECORDS

Provide information before discharge

CG102 ☐ Discuss potential long-term effects and likely patterns of recovery providing opportunities for questions

CG102 ☐ Offer information and contact details of patient support organisations. Your Guide contains details of the meningitis charities who can offer further information and support.

Assess

CG102 QS19 ☐ Arrange a formal audiological assessment as soon as possible, ideally before discharge from hospital, within 4 weeks of being fit to test. Those with severe or profound deafness need an urgent assessment for cochlear implants as soon as they are fit to undergo testing[1].

CG102 ☐ Test for complement deficiency[2] if child has had meningococcal disease (MD):

- more than once; or
- caused by serogroups other than B (for example A, C, Y, W, X, 29E); or
- caused by any serogroup and has a history of other recurrent or serious bacterial infections; or
- there is a family history of meningococcal disease or complement deficiency

CG102 ☐ Refer to a specialist in paediatric infectious disease/ immunology if child has had more than one episode of MD/bacterial meningitis (BM)[3]

☐ Check immunisation status. Those with incomplete/unknown immunisation histories should be vaccinated accordingly[4]

☐ Check medical history to assess whether the child is in a recognised risk group and if so, ensure they are immunised appropriately[4]

Review

CG102 ☐ Consider requirements for follow-up taking into account potential sensory, neurological, psychosocial, orthopaedic, cutaneous and renal morbidities.

CG102 QS19 ☐ Make an appointment for a review with a paediatrician (preferably local) 4-6 weeks after discharge from hospital. Results from the hearing test should be discussed at this appointment.

Inform/Notify

CG102 QS19 ☐ Inform the child's or young person's GP, health visitor and school nurse about their BM or MD. Alert to possible late-onset sensory, neurological, orthopaedic and psychosocial effects of BM and MD.

☐ Ensure the child was notified to Public Health and that contacts have been given advice, symptoms information and prophylaxis where appropriate.

1 Further guidance on the use of cochlear implants for severe to profound deafness can be found in 'Cochlear implants for children and adults with severe to profound deafness' [NICE technology appraisal 166].
2 Discuss appropriate testing for complement deficiency with local immunology laboratory staff
3 Subbarayan, A., et al., Clinical features that identify children with primary immunodeficiency diseases. Pediatrics, 2011. 127(5): p. 810-6.
4 Department of Health immunisation recommendations
https://www.gov.uk/government/collections/immunisation-against-infectious-disease-the-green-book.

Offices: Belfast, Bristol, Edinburgh, Dublin and Blantyre - Malawi. A charity registered in England & Wales no 1091105, in Scotland no SC037586 and in Ireland 20034368. Registered office: Newminster House, Baldwin Street, Bristol BS1 1LT
03/16
www.meningitis.org
Meningitis Research Foundation

NHS
University Hospitals of Derby and Burton
NHS Foundation Trust

Referral to Children's Audiology
Please send completed form to: Children's Audiology, Derbyshire Children's Hospital, Uttoxeter Road, Derby DE22 3NE
dhft.childrensaudiology@nhs.net

Urgent: Yes

Patient Demographics:

Name of Child:
NHS Number: Click here to enter text. **Date of Birth:** Click here to enter a date.
Gender: Male **Telephone No:**

Address:

School / Nursery: Click here to enter text.

GP:
GP Address: Click here to enter text.
HV/SCMO/Speech Therapist: Click here to enter text.
Please indicate the most convenient clinic: Choose an item.

Newborn Hearing Screen Result: Pass

Parental Consent obtained? Yes
Interpreter: Not required **Which language?** Click here to enter text.

Reason for Referral (please check):

Bacterial meningitis confirmed ☐	Strongly suspected meningitis ☒
Meningococcal septicaemia☐	Incomplete newborn hearing screen☐
Temporal bone fracture☐	Severe unconjugated hyperbilirubinanaemia☐
Ototoxic drugs☐	Parental concern☐

Other neonatal risk factors (Ex 29/40, Laparotomy with stoma) ☐

(Note: Confirmed viral meningitis is not a specific risk to hearing)

Please specify: Click here to enter text.

If full details are not provided, this referral may be retuned

Referrer details
Name and designation of referrer: Click here to enter text.
Address: Royal Derby Hospital
Telephone Number:

Signature:..... **Date:**

Burton Hospitals NHS
NHS Foundation Trust

Referral to Audiology for Immediate Diagnostic Hearing Assessment

– (Please tick appropriate box below ☐)

- **Confirmed or Strongly Suspected Bacterial Meningitis** ☐
- **Meningococcal Sepsis** ☐
- **Confirmed Congenital Cytomegalovirus (cCMV)** ☐
- **Programmable Ventriculo-Peritoneal Shunts** ☐
- **Suspected or Known to have A1555G Mitochondrial Mutation** ☐

Name: ..... **DOB**: .....

Address: .....

.....

Postcode: ..... **Gestation**: .....

Hospital No: ..... **NHS No**: .....

Responsible Consultant Paediatrician:

.....

.....

Interpreter required: Yes/No

If yes, language.....

Parents names: .....

Contact telephone numbers: .....

Bacterial Meningitis or Meningococcal Sepsis – *(Please tick appropriate box below ☐)*

This baby has had Confirmed Bacterial Meningitis ☐ or Strongly Suspected ☐ and has been treated as such with a full course of antibiotics (for a minimum of 14 days).

Causative organism (if known): .....

Treatment given: .....

Planned date of discharge home: .....

A1555G Mitrochondrial Mutation – *(Please tick appropriate box below ☐)*

This baby is a suspected carrier ☐ or confirmed carrier ☐ of A1555G mitochondrial mutation and has received Ototoxic medication (irrespective of whether blood levels are within the therapeutic range or not and irrespective of screen result

Treatment given: .....

Planned date of discharge home: .....

Confirmed Congenital Cytomegalovirus (cCMV)

This baby has had confirmed Congenital Cytomegalovirus ☐

Date of confirmation:.....

Date treatment started:.....

Treatment given:.....

Planned date of discharge home: .....

Programmable Ventriculo-Peritoneal Shunts

Date Shunt Fitted: .....

Reason Shunt fitted:.....

Planned date of discharge home: .....

IMPORTANT - Please email C.hines@nhs.net with referral details and return completed form to Paediatric Audiology.

Date of referral: ..... **ENT Consultant referred to**: .....

Referred made by [PRINT NAME & TITLE]: .....

OFFICE USE ONLY

Referral Received: .....
Assessment to be completed by [within 4 weeks]: .....
Parents contacted: ..... **Diagnostic Appointment date**: .....
Interpreter booked: Yes/No/Not applicable (please circle)

Appendix 6: Blood Samples Form

Public Health England

Professor Ray Borrow, PHE Meningococcal Reference Unit,
Clinical sciences Building, Manchester Royal Infirmary,
Oxford Road, Manchester M13 9WZ.
Tel: 0161 276 6793. E-mail: ray.borrow@phe.gov.uk

Surveillance of Invasive Meningococcal Disease

Patient Name: _____ **NHS No.** _____

HOSPITAL: _____ **DOB** ____/____/____

Name of Paediatrician: _____

Blood Sample(s) for Meningococcal Surveillance

This form should be completed and sent with any blood sample taken for meningococcal surveillance.
Please write the date when the sample was taken and tick the appropriate box.

DATE Sample Taken: ____ / ____ / ____

1. ACUTE SAMPLES *(ideally within 72 hours of starting treatment)*

   ☐ **Serum sample (2 mL)** for acute antibody measurement
   ☐ **EDTA sample (2 mL)** for non-culture meningococcal characterisation

2. CONVALESCENT SAMPLE *(ideally 3-6 weeks after diagnosis)*

   ☐ **Serum sample (2 mL)** for convalescent antibody measurement

Completed By: _____ **Tel:** _____ **Date:** ...../...../.....

Thank you very much for your co-operation.

All samples should be sent through your local laboratory where they will be packaged in accordance with current transport and postal regulations, and
MUST BE ACCOMPANIED BY THIS FORM

Please send **Sample(s)** with **Form** to:
Professor Ray Borrow, PHE Meningococcal Reference Unit, Manchester Medical Microbiology partnership,
Clinical sciences Building, Manchester Royal Infirmary, Oxford Road, Manchester M13 9WZ.
Tel: 0161 276 6793. E-mail: ray.borrow@phe.gov.uk.
(HAYS DX Meningococcal Reference Unit, DX 6962410, Manchester 90M)

LAB use only (comments):