1.0 INTRODUCTION / SUMMARY OF POLICY

1.1 Background

The intended outcome from these guidelines is to maintain the appropriateness of antibiotic prescribing decisions, taking account of both efficacy and unintended consequences of antibiotic use including rising prevalence of resistance and healthcare-associated pathogens.

1.2 Purpose

The purpose of this guideline is to provide consistent Trust-wide guidance for the empirical antibiotic management of hospitalised paediatric patients with the commonly encountered bacterial infections.

2.0 SCOPE OF THE POLICY

This guideline is intended to apply to all hospitalised children throughout the BHSCT aged between 0-14 years.

This guidance should also apply to young people admitted to RBHSC up to the age of 16 years, during any period in which admission age limit to RBHSC has been extended to 16.

3.0 ROLES AND RESPONSIBILITIES

It is the responsibility of the staff who prescribes antibiotics to do so broadly in accordance with this policy.

It is recognised that circumstances will arise necessitating use of antibiotics other than those suggested; it is expected that the reasons for prescribing alternative agents are recorded in the patient record.

The dissemination, education, audit and performance management measures which arise from this policy will be supported by the Drug & Therapeutics Antimicrobial Subcommittee, microbiologists, infectious disease physicians, pharmacy, the Medical Director and Trust Directors.

It is also expected that clinical service groups and individual clinical teams will participate in the systematic audit of antibiotic prescribing practice within their respective areas.

4.0 CONSULTATION

These guidelines have been reviewed by the RBHSC Drug and Therapeutics committee, Antimicrobial Steering Committee, Trust Drug and Therapeutics committee and have undergone review by the Standards and Guidelines committee.

The drafting process included contributions from a range of stakeholders relevant to the various components of the guideline. These included: Dr Sharon Christie, Dr Paul Moriarty, Dr Lynne Speirs, Dr Colin Goldsmith, Dr Anne Loughrey, Dr Grace Ong, Dr Judith Troughton, Dr Paul Rooney, Dr Elaine McHenry and Anne Burns.

5.0 POLICY STATEMENT/IMPLEMENTATION

5.1 Key Policy Statement

The importance of antibiotic stewardship has become increasingly clear in respect of both infection prevention and limiting the rise of antibiotic resistant organisms.

This guideline was developed specifically to address the need for quality improvement and standardisation in antibiotic use. It is an essential component of the Trust's infection prevention strategy.

Failure to adopt antibiotic prudence may threaten this strategy and expose the Trust and its clients to risk from increasing prevalence of healthcare-associated infection and antibiotic-resistant pathogens.

5.2 Policy Principles

To improve the quality of antibiotic prescribing and standardise the use of antibiotics across the Trust

The guideline provides direction for prescribers in the first-line empirical management of a variety of important and commonly encountered infections. These include: respiratory, neurological, intra-abdominal, skin/soft tissue, and urinary tract infection as well as septic shock.

It also includes guidance for prescribers on monitoring serum levels of certain antibiotics, the management of central line infections in short-term or non-tunnelled CVCs and information on tetanus prophylaxis

A regularly updated antibiotic guideline will be available to provide direction for prescribers in the first-line empirical management of a variety of important and commonly encountered infections in all clinical areas throughout the trust.

Antimicrobial prudence is an essential component of the Trust's infection prevention strategy.

It is expected that the majority of prescribing decisions will reflect these recommendations. Where alternative drugs are prescribed, the prescriber should record the reason for this in the patient record.

Prescribing practice, adopting this guideline as the reference standard, will be the subject of regular clinical and pharmacy-based audit.

5.3 Dissemination

Following ratification by the Standards and Guidelines Committee and approval by the Policy Committee this guideline will be published on the Belfast Trust Intranet Site and staff will be informed.

The policy and guidelines section is regularly accessed by staff.

The policy will be available on a Trust approved App available for smart phones and an intranet site.

5.4 Resources

All staff will be made aware when this guideline is published on the BHSCT intranet site.

5.5 Exceptions

This guideline applies to hospitalised children

6.0 MONITORING AND REVIEW

There is on-going prospective audit coordinated through HCAI improvement plan and Antimicrobial Steering Committee.

7.0 EVIDENCE BASE/REFERENCES

Cole TS, Riordan A. *Vancomycin dosing in children: what is the question? Arch Dis Child.* 2013;98:994-997

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8.0 APPENDICES

Appendix 1 Guidelines for Empirical Antibiotic Prescribing in Hospitalised Children 0-14 years in Belfast Health and Social Care Trust

9.0 NURSING AND MIDWIFERY STUDENTS

Nursing and/or Midwifery students on pre-registration education programmes, approved under relevant 2018/2019 NMC education standards, must be given the opportunity to have experience of and become proficient in **Guidelines for empirical antibiotic prescribing in hospitalised children 0-14 years in BHSCT** where required by the student's programme. This experience must be under the appropriate supervision of a registered nurse, registered midwife or registered health and social care professional who is adequately experienced in this skill and who will be accountable for determining the required level of direct or indirect supervision and responsible for signing/countersigning documentation.

Direct and indirect supervision

- Direct supervision means that the supervising registered nurse, registered midwife or registered health and social care professional is actually present and works alongside the student when they are undertaking a delegated role or activity.
- Indirect supervision occurs when the registered nurse, registered midwife or registered health and social care professional does not directly observe the student undertaking a delegated role or activity. (NIPEC, 2020)

This policy has been developed in accordance with the above statement. Wording within this section must not be removed.

10.0 EQUALITY IMPACT ASSESSMENT

The Trust has legal responsibilities in terms of equality (Section 75 of the Northern Ireland Act 1998), disability discrimination and human rights to undertake a screening exercise to ascertain if the policy has potential impact and if it must be subject to a full impact assessment. The process is the responsibility of the Policy Author. The template to be complete by the Policy Author and guidance are available on the Trust Intranet or via this **link**.

All policies (apart from those regionally adopted) must complete the template and submit with a copy of the policy to the Equality & Planning Team via the generic email address equalityscreenings@belfasttrust.hscni.net

The outcome of the equality screening for the policy is:

Major impact ☐
Minor impact ☐
No impact ☐

Wording within this section must not be removed

11.0 DATA PROTECTION IMPACT ASSESSMENT

New activities involving collecting and using personal data can result in privacy risks. In line with requirements of the General Data Protection Regulation and the Data Protection Act 2018 the Trust considers the impact on the privacy of individuals and ways to militate against any risks. A screening exercise must be carried out by the Policy Author to ascertain if the policy must be subject to a full assessment. Guidance is available on the Trust Intranet or via this **link**.

If a full impact assessment is required, the Policy Author must carry out the process. They can contact colleagues in the Information Governance Department for advice on Tel: 028 950 46576

Completed Data Protection Impact Assessment forms must be returned to the Equality & Planning Team via the generic email address equalityscreenings@belfasttrust.hscni.net

The outcome of the Data Protection Impact Assessment screening for the policy is:

Not necessary – no personal data involved ☐
A full data protection impact assessment is required ☐
A full data protection impact assessment is not required ☐

Wording within this section must not be removed.

12.0 RURAL NEEDS IMPACT ASSESSMENT

The Trust has a legal responsibility to have due regard to rural needs when developing, adopting, implementing or revising policies, and when designing and delivering public services. A screening exercise should be carried out by the Policy Author to ascertain if the policy must be subject to a full assessment. Guidance is available on the Trust Intranet or via this link.

If a full assessment is required the Policy Author must complete the shortened rural needs assessment template on the Trust Intranet. Each Directorate has a Rural Needs Champion who can provide support/assistance.

Completed Rural Impact Assessment forms must be returned to the Equality & Planning Team via the generic email address equalityscreenings@belfasttrust.hscni.net

Wording within this section must not be removed.

13.0 REASONABLE ADJUSTMENT ASSESSMENT

Under the Disability Discrimination Act 1995 (as amended) (DDA), all staff/ service providers have a duty to make Reasonable Adjustments to any barrier a person with a disability faces when accessing or using goods, facilities and services, in order to remove or reduce such barriers. E.g. physical access, communicating with people who have a disability, producing information such as leaflets or letters in accessible alternative formats. E.g. easy read, braille, or audio or being flexible regarding appointments. This is a non-delegable duty.

The policy has been developed in accordance with the Trust's legal duty to consider the need to make reasonable adjustments under the DDA.

Wording within this section must not be removed.

SIGNATORIES

(Policy – Guidance should be signed off by the author of the policy and the identified responsible director).

[redacted]

Date: 01/12/2020

Policy Author

[redacted]

Date: 01/12/2020

Director

Guidelines for Empirical Antibiotic Prescribing in Hospitalised Children 0-14 years in Belfast Health and Social Care Trust

Contents:

Guidelines for Empirical Antibiotic Prescribing in Hospitalised Children 0-14 years in Belfast Health and Social Care Trust

Contents cont.:

Page Number

Guidelines for Empirical Antibiotic Prescribing in Hospitalised Children 0-14 years in Belfast Health and Social Care Trust

1. Important notes about this guideline

These empirical guidelines are a generic indicator of good practice, which are based on Northern Ireland Regional Framework, and have been modified by Trusts to meet local conditions.

Treatment should be reviewed once sensitivities are known. If no bacterium is cultured the antibacterial can be continued or stopped on clinical grounds.

All senior clinicians are advised to note the contents of this guidance. Whilst the guidelines are not intended to restrict the clinical judgement of senior medical staff, it is requested that they specify the reasons for making a choice outside of the guidelines in the patient's notes.

All regimens assume normal hepatic and renal function

Regimens may not be appropriate for complex paediatric patients.

1.1 What is new in this guideline

All chapters of the version 1.0 guideline have been reviewed, with changes made to the following sections

- An alert added in relation to checking laboratory results
- Aciclovir dosing for Herpes simplex, treatment, in immunocompromised or in simplex encephalitis has been updated (see https://bnfc.nice.org.uk).
- Amoxicillin dosing for severe sepsis has been updated (see https://bnfc.nice.org.uk)
- Revised meningitis dosing for neonates
- Restructuring of the ear, nose and throat section
- Second Line/Alternate option for Otitis Media, Sinusitis and Severe CAP amended from Azithromycin to Clarithromycin.

In addition the following new chapters have been added to this guideline:

- Central Nervous Section: Encephalitis
- Eye: Facial/ Peri-orbital cellulitis
- Ear, Nose and Throat: Otitis media and Tracheitis
- Respiratory: Empyema and ventilator associated pneumonia
- Skin and Soft Tissue: Bites
- Gastrointestinal: Appendicitis and Clostridium difficile management
- Paediatric central line infection guideline
- Prophylaxis: Guideline for tetanus prophylaxis

1.2 Prudent Antibiotic Prescribing

To reduce emergence of multi resistant organisms and *Clostridium difficile* associated diarrhoea, de-escalate to narrow spectrum from broad-spectrum empirical regimens based on cultures where possible.

WHEN PRESCRIBING

You must document the following medical notes and on the kardex:

1. Indication
2. Drug prescribed: Drug (generic) name, NOT trade name.
3. Dose in correct units, and dose per kg where appropriate
4. Frequency
5. Route
6. Planned duration or review date
7. Patient's weight

2. Document baseline investigations requested.

3. Obtain samples for microbiological culture before administration of antibiotics (where possible)

4. Review microbiology results and de-escalate therapy as appropriate (contact microbiology/Infectious diseases if advice required)

5. Use BNFc doses unless otherwise stated

1.3 Penicillin Allergy

Obtain a reliable history & document exact nature in case notes and on kardex

High risk:

History of: anaphylaxis, urticaria, early onset rash, angioedema, bronchospasm, hypotension, laryngeal oedema, Stevens-Johnston or toxic epidermal necrolysis:

- Avoid penicillins, cephalosporins and other beta- lactam antibiotics.
- Aztreonam may be less likely to cause hypersensitivity in penicillin sensitive patients and can be used with caution (avoid aztreonam if allergic to ceftazidime)

Low risk:

Minor non confluent, non-pruritic rash restricted to a small area of the body, rashes >72 hours after administration, nausea, diarrhoea:

- Life threatening allergy very unlikely, therefore a trial of beta-lactam therapy e.g. cephalosporin under observation may be considered as appropriate.
- Consideration should be given to immunological proof of allergy once patient has recovered from their infection.

1.4 Useful Contacts

Paediatric Infectious Diseases:						
	Consultants		**Registrar**		**Paediatric ID Secretaries**	
On call rota available on Belvoir Ward: 02896150346 02896150347	Dr Paul Moriarty	[redacted]	Mon-Fri 9-5pm (may not always be available, check rota)	[redacted]	[redacted] [redacted]	[redacted]
	Dr Sharon Christie	[redacted]			[redacted]	[redacted]
	Dr Lynne Speirs	[redacted]				
Microbiology clinical advice						
Registrar	Mon-Fri 9-5pm	[redacted] [redacted] [redacted]	Out of hours ask for Microbiology Registrar on call via switchboard			
Specimens		[redacted] [redacted]	Out of hours ask for Microbiology Biomedical Scientist on call via switchboard			
Virology clinical advice						
Duty Virologist	Mon-Fri 9-5pm	[redacted] Or if any difficulty, call [redacted] (Virology Laboratory)	Out of hours ask for Clinical Virologist on call via switchboard			

Pharmacy **Out of hours contact on-call pharmacist via switchboard**						
Site	Main Tel No	Monday-Friday (advertised opening hours)	Monday-Friday (extended hours services)	Saturday	Sunday EHS	Public Holiday
Royal Victoria Hospital	[redacted]	8.15am-5pm	5pm-9pm	9am-5pm		
Belfast City Hospital	[redacted]	8.15am-5pm	Closed access RVH	9am - 1pm (after 1pm access RVH)	10am-1.45pm (after 1.45pm access RVH)	9am-5pm
Mater Hospital	[redacted]	8.30am-5pm	Closed access RVH	10am - 1.45pm (after 1.45pm access RVH)	Closed access RVH	10am-1.45pm (after 1.45pm access RVH)
Musgrave Hospital	[redacted]	8.30am-5pm	Closed access RVH	10am - 1.45pm (after 1.45pm access RVH)	Closed access RVH	10am-1.45pm (after 1.45pm access RVH)

Pharmacy enforce a cut off time for orders, 30 minutes prior to closing time

2. Interpretation of Blood Culture and Gram Stain Results

2.1 Gram Negative Rods/Bacilli

Always ensure result is communicated to the responsible medical team. Microbiology team will follow up with culture result within 24 hours.

Clinical assessment and source investigation

Review observations, blood results and microbiological history (e.g. history of resistant organisms)

Consider appropriate radiological investigations

Common sources of gram-negative bacteraemia include:

- Urinary: send urine sample
- Intra-abdominal

Action:

Patient STABLE and on antibiotics	**Patient STABLE and not on antibiotics**	**Patient is UNSTABLE**
Continue current antibiotic therapy if stable and on any of these antibiotics: IV Co-amoxiclav IV Piperacillin-tazobactam IV Ciprofloxacin IV Aztreonam IV Gentamicin IV Ceftriaxone IV Cefotaxime IV Meropenem	Commence antibiotics as per sepsis protocol (refer to Community Sepsis, Hospital Sepsis, Neutropenic Sepsis)	**Resuscitate as per APLS guidelines** Add IV Gentamicin and discuss with microbiology registrar on-call or paediatric infectious diseases

2.2 Gram Positive Cocci in clumps

Always ensure result is communicated to the responsible medical team

This organism could be:

- Staphylococcus aureus - always regarded as a pathogen
- Coagulase negative Staphylococcus - often a contaminant organism unless there is suspicion of line or device associated infection or endocarditis

Microbiology team will follow up with culture result within 24hours if a significant organism is isolated

Clinical assessment and source investigation
Review observations, blood results and microbiological history (e.g. history of resistant organisms)
Potential sources of staphylococcal bacteraemia include:

- **Skin and soft tissue infection -** if necrotising fasciitis suspected urgent surgical and microbiology advice is required
- **Line/device associated infection -** repeat paired cultures
- **Bone and joint infection**
- **Endocarditis -** repeat multiple sets of blood cultures and echo

Action:

Patient STABLE	Patient UNSTABLE
Continue current management If not on antibiotics but clinically well, consider repeat blood cultures and await formal organism with microbiology team (within 24 hours). If child at home, review available medical notes and make clinical decision on significance	**Resuscitate as per APLS guidelines** Commence antibiotics as per sepsis guidance (refer to Community Sepsis, Hospital Sepsis, neutropenic Sepsis) **Add** Vancomycin IV or Teicoplanin IV (refer to Vancomycin prescribing guideline and Children with renal impairment) Consider discussion with microbiology registrar on-call or paediatric infectious diseases

2.3 Gram Positive Cocci in Pairs and/or chains

This is a likely Streptococcus or Enterococcus

Always ensure result is communicated to the responsible medical team

Microbiology team will follow up with culture result within 24 hours if a significant organism is isolated

Clinical assessment and source investigation
Review observations, blood results and microbiological history (e.g. history of resistant organisms)
Potential sources of streptococcal/enterococcal bacteraemia include:

- **Skin and soft tissue infection -** if necrotising fasciitis suspected urgent surgical and microbiology advice is required
- **Line/ device associated infection -** repeat paired cultures
- **Bone and joint infection**
- **Endocarditis** - repeat multiple sets of blood cultures
- **Pneumonia**
- **Meningitis**
- **Urinary**
- **Intra-abdominal**

Action:

Patient is STABLE	If skin and soft tissue infection / necrotising fasciitis:	Patient is UNSTABLE
Continue current management If not on antibiotics but clinically well, consider repeat blood cultures and await formal identification of organism with microbiology team (within 24 hours) If child at home, review available medical notes and make clinical decision on significance	Discuss with microbiology registrar on-call. **Necrotising fasciitis is a medical emergency**	**Resuscitate as per APLS guidelines** Commence antibiotics as per sepsis guidance (refer to Community Sepsis, Hospital Sepsis, Neutropenic Sepsis) Add Vancomycin IV or Teicoplanin IV (refer to Vancomycin prescribing guideline, Children with renal impairment) Consider discussion with microbiology registrar on-call or paediatric infectious diseases.

2.4 Gram Positive Rods/Bacilli

Always ensure result is communicated to the responsible medical team

Microbiology team will follow up with culture result within 24 hours if a significant organism is isolated

Clinical assessment and source investigation

Review observations, blood results and microbiological history (e.g. history of resistant organisms)

Potential sources include:

- **Skin and soft tissue infection -** if necrotising fasciitis suspected, urgent surgical and microbiology advice is required
- **Line/ device associated infection -** repeat paired cultures
- **Meningitis**
- **Intra-abdominal**

Action

Patient is STABLE	Patient is UNSTABLE
Continue current antimicrobial management If not on antibiotics but clinically well, consider repeat blood cultures and await formal identification of organism with microbiology team (within 24 hours) If child at home, review available medical notes and make clinical decision on significance	**Resuscitate as per APLS guidelines** Discuss with microbiology registrar on-call or paediatric infectious diseases.

2.5 Gram Negative Cocci/Diplococci

Always ensure result is communicated to the responsible medical team

Microbiology team will follow up with culture result within 24hours if a significant organism is isolated

Clinical assessment and source investigation

Review observations, blood results and microbiological history (e.g. history of resistant organisms)

Investigate potential source

Action

ALL Patients	Patient is UNSTABLE
Commence IV Ceftriaxone 80mg/kg OD If Penicillin allergic - discuss with microbiology registrar on-call	**Resuscitate as per APLS guidelines** Commence IV antibiotics and discuss with microbiology registrar on-call or paediatric infectious diseases

2.6 Yeast

Always ensure result is communicated to the responsible medical team

Always consider this Gram stain finding as a pathogen

Microbiology team will follow up with culture result within 24 hours

Clinical assessment and source investigation

Review observations, blood results and microbiological history (e.g. history of resistant organisms) as appropriate.

Potential sources include

- Line/device associated infection - consider removal
- Intra-abdominal

Action

All patients
Neonate: see guidance (Candida blood stream infections) Child: Add Caspofungin IV or Micafungin IV (refer to BNFc for dosing) **Always discuss with paediatric infectious diseases**

3. Vancomycin prescribing guideline: Children > 1 month of age up to 14TH birthday

3.1 Vancomycin Dosing

Initial vancomycin dose = 15mg/kg 6 hourly

(Maximum daily dose = 2g (*500mg 6 hourly*), please consult notes below

- The dosage here is higher than the dosage recommendation in the British National Formulary for Children (BNFC).
- It is mandatory consult paediatric ID team if dosing increases >80mg/kg/**day** (**max 20mg/kg 6 hourly**) or courses >48 hours are required.
- A higher target trough (15-20mg/l) is required in some circumstances. Please consult with ID/Microbiology in the following cases
    - CNS infection
    - Multifocal infection or overwhelming sepsis caused by MRSA
- Monitoring:
    - Trough levels should be taken within 1 hour before the next dose
    - When considering dose adjustments, ensure *'true trough'*
        - correct timing of level
        - previous doses given on time
        - level not taken from contaminated line
- If the BMI is high use ideal body weight for height (using centile charts) for dose calculation
- For critically unwell patients consider a loading dose of 20mg/kg, followed by maintenance dose 6hrs later of 15mg/kg (continue this dose 6hrly)

3.2 Monitoring and dose adjustment

Check a trough level **before the 4th or 5th dose** (within 1 hour before next dose) and consult the table below

Give next dose while awaiting result

Adjustment

Target trough level = 10-15mg/l		
Level	**Adjustment***	**Recheck**
0-5 mg/l	Increase to 20mg/kg 6hourly	Recheck after 3-4 doses
5-10 mg/l	Increase by 2.5mg/kg/dose to max 20mg/kg 6 hourly	Recheck after 3-4 doses
10-15mg/l	Continue with current dose	Recheck after further 5 days
15-20 mg/l	Extend dosing interval to 8 hourly	Recheck after 3-4 doses. Give dose while awaiting result
20-25 mg/l	Ensure this was a 'true trough' level. Hold next dose. Review need for vancomycin (d/w ID/microbiology if necessary)	Recheck when next dose due. If level now below 15mg/l, extend interval to 8 hourly and recheck after 3-4 doses

* When considering dose adjustments, ensure 'true trough' i.e. level taken at correct time, previous doses given on time, and level not taken from contaminated line.

3.3 Children with renal impairment: Children > 1 month of age up to 14TH Birthday

If increased creatinine consult renal/ID teams before prescribing

- Regular monitoring of renal function if receiving other nephrotoxic drugs (e.g. gentamicin, regular NSAIDs, cyclosporin, tacrolimus, furosemide or ACE inhibitors)
- Too rapid infusion may be associated with the 'red man' syndrome - a histamine mediated reaction. Symptoms usually resolve within a few hours - antihistamines or corticosteroids can be used if required.
- In those >14 years old consider the BHSCT adult vancomycin prescribing tool see MicroGuide Adult Empirical Guidelines or Northern Ireland Regional guideline for the use of intravenous Vancomycin in adults intermittent (pulsed) infusion (available here)
- CONTACT ID/MICRBIOLOGY OR PHARMACIST FOR ADVICE IF UNCERTAIN

Renal dosing (Consider an alternative antibiotic - always discuss with ID/Microbiology and renal team)

Renal dosing				
eGFR	**Dose**	**Interval**	**First level**	**Monitoring**
50-90	15mg/kg (max 1g)	8hrly	Before 3rd dose	Every 24 hours
20-50	7.5mg/kg	24hrly	Before 2nd dose	HOLD next dose until level known
<20 **(or on dialysis)**	7.5mg/kg	Give one dose only	Check level at 24hrs or after next dialysis session	Only give another dose when target trough level reached

$$\text{eGFR } (\text{ml/min/1.73m}^2) = \frac{\text{height (cm)} \times 40}{\text{creatinine (micromol/l)}}$$

References

Cole TS, Riordan A. Vancomycin dosing in children: what is the question? *Arch Dis Child.* 2013;98:994-997

Gilbert et al. The Sanford Guide to Antimicrobial Therapy, 2016 (46th Edition)

Therapeutic Guidelines Australia :Antibiotics, 2014 (Version 15)

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www.nuh.nhs.uk/handlers/downloads.ashx?id=52240

4. Sepsis

If a child presents with suspected or proven infection AND has at least 2 of the following:

•Core temp (<360C or >38.50C)
•Inappropriate tachycardia for age
•Altered mental state (including: sleepiness/irritability/floppiness)
•Reduced peripheral perfusion/prolonged capillary refill

Think could this child have **SEPSIS** or **SEPTIC SHOCK**. Sepsis is a **CLINICAL EMERGENCY**

Remember **PAEDIATRIC Sepsis Management**

1. Give high flow oxygen
2. Obtain intravenous or intraosseous access and take blood tests
3. Give IV or IO resuscitation
4. Consider fluid resuscitation
5. Involve senior clinicians/specialists early
6. Consider inotropic support early

4.1Sepsis of unknown origin-Community Acquired	Preferred Regimen	Alternate Regimen
0-3 months	**Cefotaxime IV** **AND** 0-7 days 50mg/kg 12 hourly 8-20 days 50mg/kg 8 hourly >20 days 50mg/kg/6 hourly **Amoxicillin IV** 0-7 days 60mg/kg 12 hourly 8-28 days 60mg/kg/ 8 hourly >28 days 60mg/kg/6 hourly Add Gentamicin IV if severely systemically unwell, for example hypotension or requiring PICU admission	
> 3 months	**Ceftriaxone IV 80mg/kg once daily** Add Gentamicin IV if severely systemically unwell, for example hypotension or requiring PICU admission	

Indication	Preferred Regimen	Second Line/ Penicillin Allergy	Comment
4.2 Hospital Sepsis **>1 month** (< 1 month discuss ID)	**Piperacillin-tazobactam IV** **AND** **Vancomycin IV** Dosing see BNFc	Refer to microbiology/ID	Always review antibiotics once culture results known
4.3 Neutropenic Sepsis (Febrile neutropenia) **Febrile neutropenia is defined as:** **Temperature >38°C on one occasion** **Plus** **Neutrophil count less than 0.5 x10^9/l (irrespective of cause)** Febrile neutropenia should be considered a medical emergency Aim to deliver IV antibiotics within 30 minutes of arrival Assume that all patients on immunosuppressive therapy may be neutropenic and treat as such (without waiting for blood counts) If CNS infection is suspected, this should be discussed immediately with the consultant haematologist/oncologist and infectious diseases/microbiology consultant on-call Please consult the Children's Haematology Unit protocol for further information on the management of febrile neutropenia Investigations: • Blood cultures (central and peripheral if possible) • FBP,U&E, LFT, CRP • Serum lactate Optional (if clinically indicated) • Central venous catheter exit site swabs (if evidence of local infection) • Nasopharyngeal aspirate for respiratory viral PCR • Chest x-ray • Clean catch urine if < 5years or clinically indicated	**Piperacillin-tazobactam IV 90mg/kg (max 4.5g) qid** **In severe sepsis** (hypotension, poor perfusion, hypoxia, altered conscious state, ICU admission), **Consider addition of Gentamicin IV** (dosing see BNfc) Suspected **skin or sift tissue infection** Suspected **central line-associated infection** Known **MRSA colonisation add** **Vancomycin IV OR Teicoplanin IV** (dosing see BNfc) **Monotherapy** with **Piperacillin-tazobactam** is usually recommended for empirical treatment in uncomplicated febrile neutropenia. Additional antibiotics should be considered only after discussion with the consultant on-call. Always review previous microbiology results prior to prescribing empirical antibiotics.	If true penicillin allergy: **Vancomycin IV** **AND** **Ciprofloxacin IV** Dosing see BNFc	**N.B:** If haematology/ oncology patient discuss with appropriate specialist and/ or seek microbiology or ID advice. Always review previous microbiology results prior to prescribing empirical antibiotics. Duration: on advice from ID or microbiology

5. Body Systems:

Indication	Preferred Regimen		2nd Line/Penicillin Allergy	Suggested Duration	Comment
Central Nervous System					
5.1 Bacterial Meningitis **Do NOT delay treatment. Start antibiotics as soon as possible after appropriate investigations.** If recent travel abroad, MRSA or penicillin allergy discuss with Microbiology or ID Consider early use of steroids* Always refer to senior staff Initial Investigation: Complete a full septic screen: • Blood culture • Also send FBC, U&E, LFT, CRP • Throat swab for culture and sensitivity • Throat swab for respiratory viral PCR • Blood (EDTA sample) for PCR: Meningococcus, pneumococcus and enterovirus • Urine: Catheter sample or supra-pubic aspirate • Chest x-ray (if indicated) • Lumbar puncture (if appropriate)Send microbiology samples from any further site where infection is clinically suspected ○ CSF to be sent for microscopy and culture, viral and bacterial PCR and biochemistry ○ Check blood sugar prior to lumbar puncture	Up to 6 days old	**Amoxicillin IV** 100mg/kg every 12 hours **And** **Cefotaxime IV** 50mg/kg every 12 hours	Contact microbiology/ID	The duration and preferred Antibiotic choice varies depending on the organism identified. This is a guideline for Empirical Treatment. Antibiotic treatment should be reviewed daily in line with microbiology results and clinical progress.	HSV should be considered in the differential diagnosis of septic infants younger than 6 weeks. Consider sending eye, rectal and throat swabs, blood and CSF for HSV PCR. Start empirical **IV Aciclovir** (see Encephalitis guideline for dosing) if vesicular rash, haemodynamically unstable, abnormal clotting/LFTs or focal or generalised seizures CSF pleocytosis **References:** NICE guidelines [CG102] Published date: June 2010 Bacterial meningitis and meningococcal septicaemia https://www.nice.org.uk/guidance/cg102
	Neonate 7 days to One month old	**Amoxicillin IV** 100mg/kg every 8 hours **And** **Cefotaxime IV** 50mg/kg every 8 hours			
	1-3 months	**Amoxicillin IV** 60mg/kg every 8 hours **And** **Cefotaxime IV** 50mg/kg every 6 hours			
	> 3 months	**Cefotaxime IV** 50mg/kg 6 hourly **or Ceftriaxone IV** 100mg/kg in one or two divided doses per day (over 30 minutes) Add Vancomycin IV if recently overseas, or prolonged or multiple antibiotic exposure within last 3 months			

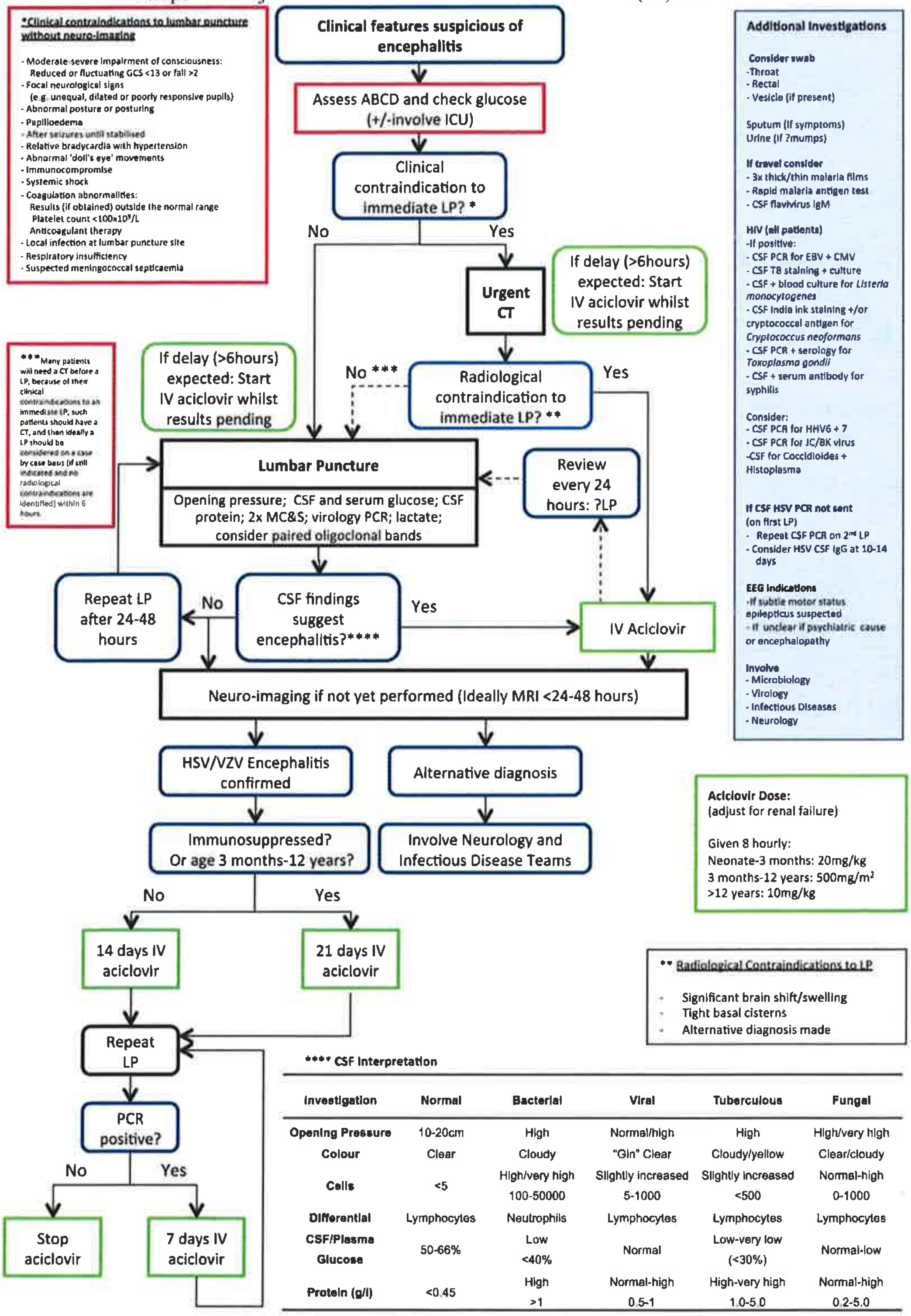
Steroids: Add Dexamethasone 150micrograms/kg 6 hourly for 4 days if bacterial meningitis without purpura starting before or with 1st dose of antibiotic.
If dexamethasone was not given before or with the first dose of antibiotics, but was indicated, try to administer the first dose within 4 hours of starting antibiotics, but do not start dexamethasone more than 12 hours after starting antibiotics.
May give Dexamethasone if any one of the following criteria: CSF Gram stain- bacteria seen, CSF wcc >1000/mm3, CSF pleocytosis + Protein >100mg/dL
Do NOT give if septicaemia, viral meningitis, pre-admission antibiotic or symptoms > 4days

Indication	Preferred Regimen
5.2 Encephalitis Encephalitis should be suspected in any child who presents with a current or recent febrile illness with altered behaviour, personality, cognition or consciousness or new onset seizures or new focal neurological signs Aetiology is wide ranging and non-infectious causes must also be considered MORE COMMON INFECTIVE CAUSES: • HSV • MENINGOCOCCUS • ENTEROVIRUS • VZV • MYCOPLASMA All suspected cases should be discussed with neurology and ID FOR FULL MANAGEMENT GUIDELINE SEE https://www.journalofinfection.com/article/S0163-4453(11)00562-7/abstract	**Aciclovir IV** Neonate < 3 months: 20mg/kg TDS 3 months - 12 years: 500mg/m2 TDS >12 years: 10mg/kg TDS Empirical antimicrobial cover for meningitis should also be started (see previous)

5.3 Viral Encephalitis

Algorithm for the management of patients with suspected viral encephalitis

Retrieved from: https://www.journalofinfection.com/article/S0163-4453(11)00562-7/abst



Investigation	Normal	Bacterial	Viral	Tuberculous	Fungal
Opening Pressure	10-20cm	High	Normal/high	High	High/very high
Colour	Clear	Cloudy	"Gin" Clear	Cloudy/yellow	Clear/cloudy
Cells	<5	High/very high 100-50000	Slightly increased 5-1000	Slightly increased <500	Normal-high 0-1000
Differential	Lymphocytes	Neutrophils	Lymphocytes	Lymphocytes	Lymphocytes
CSF/Plasma Glucose	50-66%	Low <40%	Normal	Low-very low (<30%)	Normal-low
Protein (g/l)	<0.45	High >1	Normal-high 0.5-1	High-very high 1.0-5.0	Normal-high 0.2-5.0

Patients (when conscious level permits) and their next-of-kin should be made aware of the support provided by voluntary sector partners such as the Encephalitis Society (www.encephalitis.info)

Abbreviations: ABCD Airway breathing circulation and disability; CMV Cytomegalovirus; CSF cerebrospinal fluid; CT computed tomography; EBV Epstein Barr virus; EEG Electroencephalograph; GCS Glasgow coma score; HHV Human herpes virus; HIV Human Immunodeficiency virus; IV intravenous; MC+S Microscopy culture and sensitivity; MRI Magnetic resonance imaging; PCR Polymerase chain reaction; TB Tuberculosis; VZV Varicella zoster virus

5.4 Eye: Preseptal/Orbital Cellulitis

Management Guidelines for Children with Preseptal/Orbital Cellulitis

History - URTI, sinus disease, trauma, dental or gum problems and meibomian cysts.
Systemic - malaise, pyrexia, sepsis.
Assess - pain, chemosis, proptosis, extraocular muscle restriction, pupils, colour vision.
Record Vision - fixes and follows, Snellen or equivalent.

Outpatient Pathway

If mild lid oedema only, +/- mild temperature.

Treat with:
PO co-amoxiclav for 1 week ***or***
PO clarithromycin for 1 week (if *penicillin allergic*).

Review in 48 hours or SOS.

If improved, finish 1 week course of PO antibiotic as planned.

Document **visual acuity**
Normal then discharge patient.
Not possible then ophthalmologist to refer to **POPCC** POPCC@belfasttrust.hscni.net for follow-up vision check.

If **no better/worse** ADMIT (as per Inpatient pathway).

Inpatient Pathway

Admit all other patients to RBHSC, including when eye exam is not possible.

All patients seen by paediatrics and ophthalmology at presentation.

Treat with:
IV antibiotic (see page 2) with first dose given ASAP.

Investigations
FBP, ESR, U&E and CRP.
Conjunctival/nasal swab if discharge for O&S.
If <3 months old chlamydia PCR.
Blood cultures if pyrexic.

Monitor (6 to 12 hourly by **nurse)**
Pupil obs
Temperature

Monitor (12 to 24 hourly by **ophthalmologist)**
Colour vision
Visual acuity

Twice daily review by senior ophthalmologist (ST3+).

URGENT CT scan orbits/sinuses/brain at presentation if:
1. Bilateral.
2. Proptosis.
3. Extraocular muscle restriction.
4. Optic nerve compromise (change in visual acuity).
5. CNS signs (headache, vomiting, lethargy etc).

Normal CT or CT not indicated

Continue to monitor closely.

CT shows ***sinusitis +/- subperiosteal abscess***

Urgent **ENT** opinion and add nasal decongestants.

CT shows ***dental abscess***

Urgent **dental/maxillofacial** opinion.

CT shows ***intracranial abscess*** or ***cavernous sinus thrombosis***

Urgent **paediatric neurology, neurosurgery** and **infectious diseases** opinion.

Improving in 24-48 hours
Consider switch to oral antibiotics after 72 hours and discharge after 24 hours of oral antibiotics on a 7 day course.

Ophthalmologist to refer to POPCC@belfasttrust.hscni.net for ophthalmology follow-up.

No improvement or deteriorating after 24-48 hours (or swinging pyrexia >36 hours)

Urgent repeat CT scan (consider MRI orbits/brain if repeat imaging).
Discuss antibiotic regime with microbiologist / paediatric infectious diseases.

Outpatient Pathway

First Line: Oral co-amoxiclav for 1 week

Child 1 month-11 months	0.25 ml/kg of 125/31 suspension TID
Child 1-5 years	5ml of 125/31 suspension TID (or 0.25ml/kg TID)
Child 6-11 years	5ml of 250/62 suspension TID (or 0.15ml/kg TID)
Child 12-16 years	one 250/125 tablet TID (or if severe one 500/125 tablet TID)

Penicillin allergic: Oral clarithromycin for 1 week

Child 1 month-11 years:

Body weight <8kg	7.5mg/kg twice daily
Body weight 8-11kg	62.5mg/kg twice daily
Body weight 12-19kg	125mg/kg twice daily
Body weight 20-29kg	187.5mg/kg twice daily
Body weight 30-40kg	250mg/kg twice daily
Child 12-16 years	250mg twice daily (or if severe 500mg twice daily)

Inpatient Pathway (child one month or older)

First Line: IV ceftriaxone
80mg/kg once daily (max 4 grams)

If allergic: IV clindamycin and Ciprofloxacin

Clindamycin: 3.75-6.25mg/kg given four times daily
increased if severe to 10mg/kg four times daily (max per dose 1.2 grams)

Ciprofloxacin: 10 mg/kg given three times daily (max per dose 400 mg).

Nasal Decongestants

Otrivine (xylometazoline hydrochloride 0.05%) paediatric nasal drops for children over 3 months only. Instill 1-2 drops into each nostril once/twice daily.
off-license use

<table>
<tr><th>Indication</th><th colspan="2">Preferred Regimen</th><th>Second Line/Penicillin Allergy</th><th>Suggested Duration</th><th>Comment</th></tr>
<tr><td colspan="6">Ear, Nose and Throat</td></tr>
<tr><td>5.5 Otitis Media
Most ear infections are viral in origin and do not require antibacterial therapy. Consider watchful waiting for children >2 years, those with unilateral disease and those without severe symptoms. However, review at 48 hours is advised to check for clinical improvement.

Consider starting oral antibiotics if any of the following criteria are met in a child presenting with AOM (bulging ear drum or discharge):
• Pyrexia > 39° C
• Moderate to severe otalgia > 2 days
• Systemically unwell
• Bilateral or recurrent disease
• Purulent discharge from ear canal (not due to otitis externa) and fever
• < 2 years old

MOST LIKELY CAUSATIVE ORGANISMS:
STREPTOCOCCUS PNEUMONIAE
Non-typeable H. INFLUENZAE
MORAXELLA CATARRHALIS</td><td colspan="2">Amoxicillin PO (Dosing see BNFc)

If failed treatment with amoxicillin and clinical reassessment

Co-amoxiclav PO (dosing see BNFc)</td><td>Clarithromycin PO
(Dosing see BNFc)</td><td>5 days</td><td>For further reference see 2018 NICE guidance: https://www.nice.org.uk/guidance/ng91</td></tr>
<tr><td rowspan="2">5.6 Otitis Externa
Acute otitis externa is a cellulitis of the externa ear canal skin and subdermis with acute inflammation and variable oedema

MOST LIKELY CAUSATIVE ORGANISMS
PSEUDOMONAS AERUGINOSA
STAPHYLOCOCCUS AUREUS</td><td>Mild</td><td>EarCalm® Spray (acetic acid 2%); 1 Spray three times a day (Licensed for children over 12 yrs)</td><td rowspan="2"></td><td></td><td rowspan="3"></td></tr>
<tr><td>Moderate/Severe</td><td>If tympanic membrane not perforated- Gentamicin 0.3% and Hydrocortisone 1% (2-4 drops QDS)

If tympanic membrane perforated- Cilodex (Dexamethasone 1mg/ml and Ciprofloxacin 3mg.ml) 4 drops BD for 7 days (>1 yr only)</td><td>7 days</td></tr>
<tr><td>Only prescribe oral antibiotic if
Cellulitis spreading beyond ear canal
Fever
Immunosuppressed</td><td></td><td>Flucloxacillin PO
(dosing as per BNFc)</td><td>Clarithromycin PO
(dosing as per BNFc)</td><td>Flucloxacillin 7 days
Clarithromycin 5 days</td></tr>
</table>

Indication	Preferred Regimen	Second Line/Penicillin Allergy	Suggested Duration	Comment
5.7 Sinusitis Consider treatment of sinusitis if any of the following: • worsening upper respiratory tract symptoms (fever, daytime cough or nasal discharge) following resolution of viral UTI • severe symptoms (fever >39° C, purulent nasal discharge) • persistent symptoms (nasal discharge or daytime cough >10 days) MOST LIKELY CAUSATIVE ORGANISMS: STREPTOCOCCUS PNEUMONIAE H. INFLUENZAE MORAXELLA CATARRHALIS ANAEROBIC bacteria	**Co-amoxiclav PO** (dosing see BNFc)	Clarithromycin PO (dosing see BNFc)	7 days	
5.8 Tonsillitis Most throat infections are caused by viruses and do not require antibacterial therapy. Prescribe antibiotics if any of the following: • beta-haemolytic streptococcal pharyngitis, • history of valvular heart disease, • marked systemic upset, • peritonsillar cellulitis, • increased risk of acute infection (e.g. immunosuppression, diabetes) • FeverPAIN score >4 FeverPAIN score (1 point for each) Fever Purulence Attend within 3 days or less Severely Inflamed tonsils, No cough or coryza Score <3: no antibiotics 3-4: consider delayed script ≥ 4: antibiotics https://ctu1.phc.ox.ac.uk/feverpain/index.php	**Phenoxymethylpenicillin (Penicillin V) PO** (dosing see BNFc) (Benzylpenicillin IV if unable to swallow) If suspected peritonsillar abscess consult ENT and c/o Co-amoxiclav IV (dosing see BNFc) **AVOID** amoxicillin because of risk of rash if Epstein Barr virus (EBV) is present	Clarithromycin IV or PO (dosing see BNFc	Phenoxymethylpenicillin 10 days Clarithromycin 5 days	Consider sending a throat swab only if there is diagnostic uncertainty, recurrent disease or clinical review planned. Pus or exudate on tonsils does not always mean bacterial infection. Adjust therapy as per culture results. Use IV therapy if there is poor oral intake or vomiting

Indication	Preferred Regimen	Second Line/ Penicillin Allergy	Suggested Duration	Comment
5.9 Acute Mastoiditis MOST LIKELY CAUSATIVE ORGANISMS: STREPTOCOCCUS PNEUMONIAE MORAXELLA CATARRHALIS HAEMOPHILUS INFLUENZAE GROUP A STREPTOCOCCUS LESS COMMON: STAPH. AUREUS Occasionally anaerobic bacteria	**Cefuroxime IV** **PLUS** **Metronidazole IV** Switching to Co-amoxiclav PO (dosing see BNFc)	Clindamycin IV and Gentamicin IV Switching to Clindamycin PO (dosing see BNFc)	Suggested MINIMUM duration of antibiotic therapy is 10 days. Consider early oral switch to Co-amoxiclav	If associated sinus thrombosis, will require minimum of 4 week course of antibiotics- 2 weeks intravenous followed by 2 weeks oral)
5.10 Acute Epiglottitis **CALL THE AIRWAY TEAM** via RBHSC A&E 02896150241 or 02896150242 (Anaesthetist/ENT surgeon). Secure the airway, and send blood cultures. MOST COMMON BACTERIAL CAUSES: H INFLUENZAE, STREPTOCOCCUS PNEUMONIAE STREPTOCOCCUS species	**Ceftriaxone IV 80mg/kg once daily**	If true penicillin allergy contact ID or microbiology for advice		
5.11 Tracheitis **CALL THE AIRWAY TEAM** via RBHSC A&E 02896150241 or 02896150242 (Anaesthetist/ENT surgeon) Secure the airway, and send blood cultures. MOST LIKELY CAUSATIVE ORGANISMS: S.AUREUS MORAXELLA CATARRHALIS S. PNEUMONIAE H. INFLUENZAE.	**Cefuroxime IV** (dosing see BNFc)	If true penicillin allergy contact ID or microbiology for advice		

Indication		Preferred Regimen	Second Line/ Penicillin Allergy	Suggested Duration
Respiratory				
5.12 Community Acquired Pneumonia (Including <5 days after admission) MOST LIKELY CAUSATIVE ORGANISMS: S. PNEUMONIAE Non-typeable H.INFLUENZAE STAPH. AUREUSMORAXELLA CATARRHALIS MYCOPLASMA PNEUMONIAECHLAMYDIA PNEUMONIAE BORDETELLA SPP Viral (especially RSV) Mycobacterium tuberculosis Send secretions for O&S and Respiratory Viral Screen if patient is admitted	Mild	**Amoxicillin PO** (dosing see BNFc for uncomplicated community acquired pneumonia)	Clarithromycin PO/IV Contact paediatric infectious diseases/microbiology (dosing see BNFc for uncomplicated community acquire pneumonia)	Usually 5 days duration guided by clinical response. Suggested minimum duration of antibiotic therapy dependent on organism.
	Moderate	**Amoxicillin PO or intravenous if not tolerating oral therapy** (review need for IV dosing after 48 hours) If unresponsive or suspicious of atypical pneumonia add Clarithromycin PO/IV (dosing see BNFc for uncomplicated community acquire pneumonia)		
	Severe	**Ceftriaxone IV 50mg/kg once daily** If concern for sepsis Ceftriaxone IV 80mg/kg once daily (see sepsis 6 guidance) If unresponsive or suspicious of atypical pneumonia add Clarithromycin PO/IV (dosing see BNFc)		

Indication	Preferred Regimen	Second Line/ Penicillin Allergy
5.13 Hospital Acquired Pneumonia (>5 days after admission) Early-onset infection (less than 5 days after admission)- treat as for severe Community Acquired Pneumonia Pneumonia complicating influenza or Late-onset infection (more than 5 days after admission) MOST LIKELY CAUSATIVE ORGANISMS: COMMUNITY ACQUIRED ORGANISMS MOST LIKELY IF EARLY-ONSET HAP PSEUDOMONAS AERUGINOSA ESCHERICHIA COLI ENTEROBACTER CLOACAE COLIFORMS Send secretions for O&S and Respiratory Viral Screen.	**Piperacillin-tazobactam IV** (dosing see BNFc)	If true penicillin allergy contact ID or microbiology for advice
5.14 Ventilator Associated Pneumonia Ventilator-associated pneumonia (VAP) is defined as pneumonia that occurs 48-72 hours or thereafter following endotracheal intubation, characterized by the presence of a new progressive infiltrate, signs of systemic infection (fever, altered white blood cell count), changes in sputum characteristics, and detection of a causative agent. If ventilator associated pneumonia (VAP) is being considered, please refer to VAP screening tools (based on CDC definition) which are completed daily by the physiotherapy team on ventilated patients. Investigation: Ensure repeat BAL is sent.	**Piperacillin-Tazobactam IV** refer to BNFc for dosing	Contact micro/ID for advice
5.15 Empyema Should be managed with input from respiratory and infectious diseases team MOST LIKELY CAUSATIVE ORGANISMS: S.PNEUMONIAE STAPH.AUREUS GROUP A STREPTOCOCCUS	**Ceftriaxone IV 80mg/kg OD** **Plus** **Clindamycin IV 10mg/kg QDS** (consider oral treatment if patient is tolerating	

Indication		Preferred Regimen	Second Line/ Penicillin Allergy	Suggested Duration	Comment
Skin and Soft Tissue					
5.16 Cellulitis (not Peri-orbital) MOST LIKELY CAUSATIVE ORGANISMS: STAPHYLOCOCCUS AUREUS GROUP A STREPTOCOCCUS GROUP G STREPTOCOCCUS CONSIDER Î±-HAEMOLYTIC STREPTOCOCCI OR ANAEROBES IF FACIAL CELLULITIS		**Flucloxacillin PO** (dosing see BNFc) If severe or not tolerating oral antibiotics Flucloxacillin IV 50mg/kg If complicating VZV, add Benzylpenicillin IV 50mg/kg	If true penicillin allergy **Clarithromycin or Clindamycin** (dosing see BNFc)	7-10 days.	
5.17 Bites Bite wounds can take a number of forms including lacerations, puncture wounds, and crush or degloving injuries Animal bites are usually polymicrobial, with a mixture of aerobic and anaerobic organisms	Human Most likely causative organism: STREPTOCOCCUS SPP. STAPH. AUREUS HAEMOPHILUS SPP EIKENELLA CORRODENS BACTEROIDES SPP OTHER ANAEROBES	**Co-amoxiclav PO** (dosing see BNFc) IF UNDER 72 hours since bite, consider risk of HIV/Hepatitis B/C, discuss with ID if unsure.	Metronidazole PO PLUS Clarithromycin PO (dosing see BNFc)	7 days	For further reference see 2018 NICE guidance: https://cks.nice.org.uk/bites-human-and-animal
	Cat Most likely causative organism PASTEURELLA MULTOCIDA Dog Most likely causative organism STAPH. AUREUS PASTEURELLA CANIS P.MULTOCIDA CAPNOCYTOPHAGA CANIMORSUS	**Co-amoxiclav PO** (dosing see BNFc) If bitten abroad, consider rabies risk, discuss with ID if unsure.	Metronidazole PO PLUS Clarithromycin PO (dosing see BNFc)		

Indication		Preferred Regimen	Second Line/ Penicillin Allergy	Suggested Duration	Comment
Bone and Joint					
5.18 Osteomyelitis or Septic Arthritis MOST LIKELY ORGANISM: S. AUREUS S. PNEUMONIAE Group A STREPTOCOCCUS H. INFLUENZAE KINGELLA KINGAE Consider TB and SALMONELLA in patient with Sickle cell disease Ensure samples sent as per orthopaedic guideline	<3months	**Flucloxacillin IV** **PLUS** **Cefotaxime** (See BNFC for age-appropriate dosing)	In true penicillin allergy, contact ID or microbiology for advice	Duration guided by clinical signs and symptoms and CRP. Usual duration: 4-6 weeks.	**Contact Infectious Diseases Team** **If ongoing pyrexia: daily blood culture (aim >4ml, and >2ml for those < 2yo)** Consider IV to oral switch when improvement in pain, resolution of fever and CRP<20mg/L
	>3months to 5yrs or unimmunised	**Cefuroxime IV 50mg/kg QID** Switching to Cefalexin PO (See BNFC for age-appropriate dosing)			
	>5yrs	**Flucloxacillin IV 50mg/kg QID** Switching to Flucloxacillin or Cefalexin PO If previous known MRSA infection, ADD Vancomycin IV (See BNFC for age-appropriate dosing)	Clindamycin IV 10mg/kg QDS		

Indication	Preferred Regimen	Second Line/ Penicillin Allergy	Suggested Duration	Comment
Gastrointestinal				
5.19 Intra-abdominal Sepsis > 1 month old * < 1 month Consult Neonatal guidelines or Seek microbiology advice/ID consult. MOST LIKELY CAUSATIVE ORGANISMS GRAM NEGATIVE ORGANISMS SUCH AS E. COLI ANAEROBE BACTER	**>1 month old*** **Cefuroxime IV** **PLUS** **Metronidazole IV** (dosing see BNFc) If systemically unwell consider early Gentamicin IV treatment **Severe > 1month** **Piperacillin-tazobactam IV** (dosing see BNFc) If systemically unwell consider early Gentamicin IV treatment	If true penicillin allergy contact ID or microbiology for advice		
5.20 Appendicitis See surgical guidelines for full management	**Co-Amoxiclav IV 30mg/kg TDS** If systemically unwell consider early Gentamicin IV treatment	Contact micro/ID for advice		
Operative Findings	Management			
Simple Appendicitis	2 further doses IV antibiotics			
Necrotic or perforated appendicitis	Add gentamicin 7mg/kg (if not already started) Continue antibiotics and review at 48 hours with WCC and CRP			

5.21 Clostridium Difficile Investigation & Management

Clostridium difficile infection (CDI) is a common cause of diarrhoea in adults and can lead to significant morbidity and mortality. Its significance in the paediatric population is, however, less clear. In under 2 years old, colonisation is common, making positive results difficult to interpret. This guideline aims to suggest when we should consider testing in the paediatric population and how to differentiate between Clostridium Difficile colonisation and infection. It also recommends an approach to treatment.

Who Should We Test?

Consider any age group in an outbreak situation		
< 1 year	1 - 2 years	> 2 years
Routine testing as part of diarrhoea work-up not advised Consider in Hirschsprung's or other severe gut motility disorder **And** High clinical suspicion / risk factors** **And** Other causes excluded	**Routine testing as part of diarrhoea work-up not advised** Consider if More common causes of diarrhoea excluded And Recent history of antibiotic use (within 1 month) or other risk factors**	**Routine testing is appropriate in prolonged/worsening diarrhoea** If Other causes excluded Or Recent history of antibiotic use (within 1 month) or other risk factors** for CDI
* Tests of cure not recommended in any age group *		
Test interpretation: Test is positive if C Diff PCR screen and Toxin positive. **Do not treat if C Diff toxin negative** ****Risk factors for CDI in children**: Recent antibiotic use (past 1 month), use of acid-suppressing agents, immunosuppression, prolonged hospital stay, inflammatory bowel disease, Cystic fibrosis, gastrostomy/jejunostomy, household contact Consult paediatric infectious diseases team for clinical advice		

Management of first occurrence of Clostridium Difficile Infection in children 0-14 years

Review currently prescribed antibiotics and consider whether these can be stopped, particularly broad-spectrum antibiotics		
NON severe CDI Temperature <38° C; WBC <15 x 10^9/L and Creatinine <130 micromol/L	**Metronidazole PO/NG 7.5 mg/kg/dose three or four times daily (Maximum dose 500 mg TDS or QDS) For 10 days.** **OR** Vancomycin PO/NG 10 mg/kg/dose four times daily (Maximum dose 125 mg four times daily) For 10 days. *IV formulation of Vancomycin can be used orally)	**In all cases:** - Regular fluid balance review - Regular U&E monitoring - Regular pain relief (avoid opiates to avoid ileus) - Isolation until resolution of diarrhoea
Severe CDI Fever >38; WBC >15 x 10^9/L and Creatinine >130 micromol/L OR Fulminant CDI This is a medical emergency- **consult paediatric ID and surgery immediately** **Presence of Hypotension; shock; ileus; toxic mega-colon; colonic perforation**	**Vancomycin PO/PR 10 mg/kg/dose four times daily (Maximum dose 500 mg four times daily) For 10 days** **With or Without** Metronidazole IV 10 mg/kg/dose four times daily (Maximum dose 500 mg four times daily) For 10 days	

Management of recurrent Clostridium Difficile Infection

Management of recurrent Clostridium Difficile		
First Recurrence (NON severe)	**Metronidazole PO/NG 7.5 mg/kg/dose three to four times daily for 10 days (Maximum dose 500 mg three to four times daily** OR Vancomycin PO/NG 10 mg/kg/dose four times daily for ten days (Maximum dose 125 mg four times daily, IV formulation of Vancomycin can be used orally)	
Severe CDI Fever >38; WBC >15 x 10^9/L and Creatinine >130 micromol/L OR Fulminant CDI **This is a medical emergency-** consult paediatric ID and surgery immediately Presence of Hypotension; shock; ileus; toxic mega-colon; colonic perforation	**Vancomycin PO/PR10 mg/kg /dose four times a day for 10 days (Maximum dose 500 mg four time daily, IV formulation of Vancomycin can be used orally)** **With or Without** Metronidazole IV 10 mg/kg/dose three times daily (maximum dose 500 mg three times daily) for 10 days	**In all cases:** Regular fluid balance review Regular U&E monitoring Regular pain relief Single room isolation until 72 hrs post resolution of symptoms
More than one recurrence	Consult paediatric ID **Vancomycin PO as tapered and pulsed regimen - PO vancomycin 10 mg /kg/dose max 125 mg four times daily for 10-14 days, followed by 10 mg/kg/dose max 125 mg twice daily for 7 days, then 10 mg/kg/dose max 125 mg once per day for 7 days and then 10 mg/kg/dose every 2-3 days for 2-8 weeks.**	

Indication		Preferred Regimen	Second Line/ Penicillin Allergy	Suggested Duration	Comment
Urinary Tract					
5.22 UTI: Non- severe Always check for previous cultures and treat as per previous sensitivities Further investigation according to renal team guideline Always check culture results and modify antibiotic choice accordingly MOST LIKELY CAUSATIVE ORGANISM: •E. COLI •KLEBSIELLA SPP. •PROTEUS SPP. •Enterococcus		**Cefalexin PO** (Refer to BNFc for dosing)	Trimethoprim / Nitrofurantoin PO (Refer to BNFc for dosing)	Duration 3-5 days for lower UTI/cystitis 7-10 days for pyelonephritis	
5.23 UTI – Severe MOST LIKELY CAUSATIVE ORGANISM: AS FOR UNCOMPLICATED UTI AND PSEUDOMONAS AERUGINOSA Choice of oral switch agent based on sensitivities.	< 3 Months Antibiotics after cultures as per Severe Sepsis 0-3 months (refer to Community Sepsis) and NICE guideline on 'Management of Feverish Illness in Children'	**Cefotaxime IV** 0-7 days 50mg/kg 12 hourly 8-20 days 50mg/kg 8 hourly > 20 days 50mg/kg 6 hourly + **Amoxicillin IV** 0-7 days 60mg/kg 12 hourly 8-28 days 60mg/kg 8 hourly > 28 days 60mg/kg 6 hourly Add Gentamicin IV if severely systemically unwell, for example, hypotension or requiring PICU admission	If true penicillin allergy, consult ID or microbiology for advice	Duration dependent on clinical response. Usual duration minimum 10 days.	
	>3 months	**Cefotaxime IV** Add Gentamicin IV if severely systemically unwell, for example, hypotension or requiring PICU admission (dosing see BNFc)	If true penicillin allergy, consult ID or microbiology for advice		

6.0 Paediatric Central line infections Infection Guidance (For children aged over 1 month)

6.1 General Principles

A variety of central venous access devices are used in RBHSC.

- Peripherally inserted Central Catheter (PICC)
- Tunnelled Central Venous Catheters (Broviac/Hickman)
- Totally implantable devices (Port-a-Cath)

Central line-associated bloodstream infection (CLABSI) can arise at any time after insertion. Additionally, exit site infection, tunnel infection or port site infections can arise in association with CVC devices. These are usually an indication for removal. Guidelines for care around insertion, and maintenance of central lines are available on the trust intranet:

http://intranet.belfasttrust.local/policies/Documents/Central%20venous%20access%20devices%20(CVADs)%20in%20children%20-%20Care%20of.pdf

Diagnosis

- A full clinical assessment should be undertaken to look for an alternate source, and for metastatic infection in suspected CVC infection.
- Fever/rigors related to CVC access should be treated as catheter related bloodstream infection (CRBSI) until proven otherwise
- Inspect the insertion site, tunnel site; look for tenderness, erythema along the course of the line
- Blood cultures: Send paired blood cultures (under 1 year 2ml, over 1 year 4ml) where possible i.e. peripheral and line simultaneously, clearly labelling sites and time of sampling on the request form.
- CVC tip: Send line tip for culture when there is clinical suspicion of infection.
- Repeat blood cultures daily in proven infection until culture negative at 48hrs.
- Swab discharging exit site, tunnel or Port site.

6.2 Empirical Antibiotic Therapy

Always consult Paediatric infectious diseases or microbiology for advice.

Piperacillin-tazobactam IV (dose as per BNFc)

PLUS

Vancomycin IV (See RBHSC Vancomycin prescribing guidance)

In severe sepsis requiring inotropes or paediatric intensive care unit admission add: Gentamicin IV.

Teicoplanin is an alternative to Vancomycin

Antibiotic therapy should be rationalised once culture and sensitivity results are available.

References

Clinical Practice Guidelines for Diagnosis and Management of Intravascular Catheter-Related Infection:2009 Update by the Infectious Diseases Society of America Clin Infect Dis 2009 Jul 1; 49(1):1-45

AHA endocarditis guidelines

Other guidelines Line care and Line insertion

6.3 Indications for Echocardiography or Cardiology Review

- New murmur
- Persistently positive blood cultures, especially Staph aureus
- Evidence of deep/metastatic infection
- Presence of other risk factors for, or signs of endocarditis

6.4 Line Removal

Removal of CVC should be considered in all cases of PROVEN CVC related bloodstream infection.
In cases of severe sepsis, where CVC infection IS SUSPECTED, line removal should also be considered.

Indications for tunnelled (long term Broviac or similar) line removal:

- No longer required
- Severe sepsis
- Tunnel infection, port abscess
- Blood culture still positive >72 hours into appropriate therapy
- Organism specific; *Staphylococcus aureus, Staphylococcus lugdunensis, Pseudomonas*, fungi, mycobacteria, *Stenotrophomonas maltophilia.*
- May need to consider line removal for less virulent organisms that are difficult to eradicate e.g. bacillus, micrococcus, Propionibacterium
- Deep/metastatic infection, such as, infective endocarditis, intravascular hardware infection, suppurative thrombophlebitis, osteomyelitis

Indications for non-tunnelled (short term) line removal:

- Short-term central venous catheters should almost *always* be removed in the setting of a strongly suspected or proven CLABSI
- As for long-term line removal (see above)
- Organism specific also to include; gram negative bacilli, enterococci, bacillus, micrococcus, Propionibacterium

6.5 Line Salvage

There is a high risk of treatment failure with line salvage. Paediatric ID should be consulted in all cases.

Line salvage can be considered in the following circumstances:
- Long term lines required for treatment
- Or PICC line with low risk pathogen such as coagulase-negative staphylococcus (CONS) or suspected contaminant (under paediatric ID advice only)

AND

Absence of indication for line removal (see above)

AND

No high risk organism (outlined above) cultured

If feasible, treatment with line retention/salvage should include antibiotic lock therapy (ALT). A salvaged line should be cultured daily until 72 hours into appropriate therapy. Blood cultures that remain positive >72 hours into appropriate therapy should prompt line removal and investigation for a deep/metastatic infection as well as consultation with Microbiology/Infectious Diseases for further advice.

Indicators of failure of therapy with line salvage:

- Persistent fever
- Persistently positive blood culture
- Relapse of infection once antibiotics discontinued
- Endocarditis/septic thrombosis /osteomyelitis
- Clinical concern

6.6 Antibiotic Lock Therapy (ALT)

Antibiotic solution is instilled and locked into each lumen of the line during periods when the line is not being used. Ideally the lock should be left in place for 24 hours (minimum of 12 hours) and then replaced.

Systemic therapy should be given via a separate line if the infected line is being locked. If this is not possible the line lock volume should be removed and, following administration of the systemic antibiotic, a new line lock solution should be instilled into the line.

If it is not feasible to use ALT, systemic antibiotic treatment should be given through the infected line.

First Line Antibiotic Therapy		
Pathogen	Antibiotic	Lock Concentration
Gram-negative species	Gentamicin	1mg/ml
Gram- Positive species	Vancomycin	5mg/ml
For alternate antibiotic regimens consult paediatric ID		

Lock volumes for commonly used CVCs

Line type		Lock volume
PICC line*	Cook PICC and Turbo-Ject Single/Double/triple lumen	1ml
Tunnelled CVC (Single lumen)**	Broviac 2.7 Fr	0.5ml
	Broviac 4.2 Fr	0.5ml
	Broviac 6.6 Fr	1ml
Tunnelled CVC (Double lumen)**	Hickman 7 Fr	1ml
	Hickman 9 Fr	2ml
Total Implantable Device	PortaCath	1.4ml

*Consider removal of non-tunnelled CVCs if possible.

** All tunnelled CVCs with tunnel infection should be removed.

6.7 Organism Directed Therapy

The guidance below is based on typical susceptibility patterns and uncomplicated infections. Always check sensitivities with Microbiology, and rationalise therapy accordingly.

Pathogen	First Line Antibiotic	Duration	Additional notes
Staphylococcus aureus	Flucloxacillin IV 50mg/kg 6-hourly	14 days minimum	Remove line Daily blood cultures to ensure clearance of bacteraemia Look for deep/metastatic infection
Gram negative bacilli (excluding pseudomonas and stenotrophomonas)	Piperacillin-tazobactam IV (dose as per BNFc)	Usually 14 days	Remove short-term lines Daily blood cultures to ensure clearance Line salvage: Add gentamicin ALT
Coagulase negative staphylococci	Vancomycin IV See RBHSC Vancomycin-prescribing guidance	Line removed; 5 days post removal Line salvaged; 7-10 days	Line salvage: Add ALT Vancomycin
Candida species	Fluconazole IV 12mg/kg OD (discuss with ID)	14 days minimum	Remove line Daily blood cultures to ensure clearance Look for deep/metastatic infection

6.8 Preparation of Antibiotic Lock Lines

Gentamicin

Final concentration 1 mg/ml

1. Add 0.25mL (10mg) of 80mg/2mL Gentamicin to 9.75mL of 0.9% Sodium Chloride to give a final concentration of Gentamicin 1mg/1mL and a total volume of 10mL. Prepare fresh for each lumen.
2. Instil the required volume for size and type of central venous access device and allow to dwell for up to 24 hours as prescribed by doctor.
3. **Make sure that the line is not flushed during this time by labelling appropriately**
4. Withdraw the volume added to each lumen after dwelling for up to maximum of 24 hours.
5. Document in patient's medical notes & contact Medical officer if unable to aspirate.

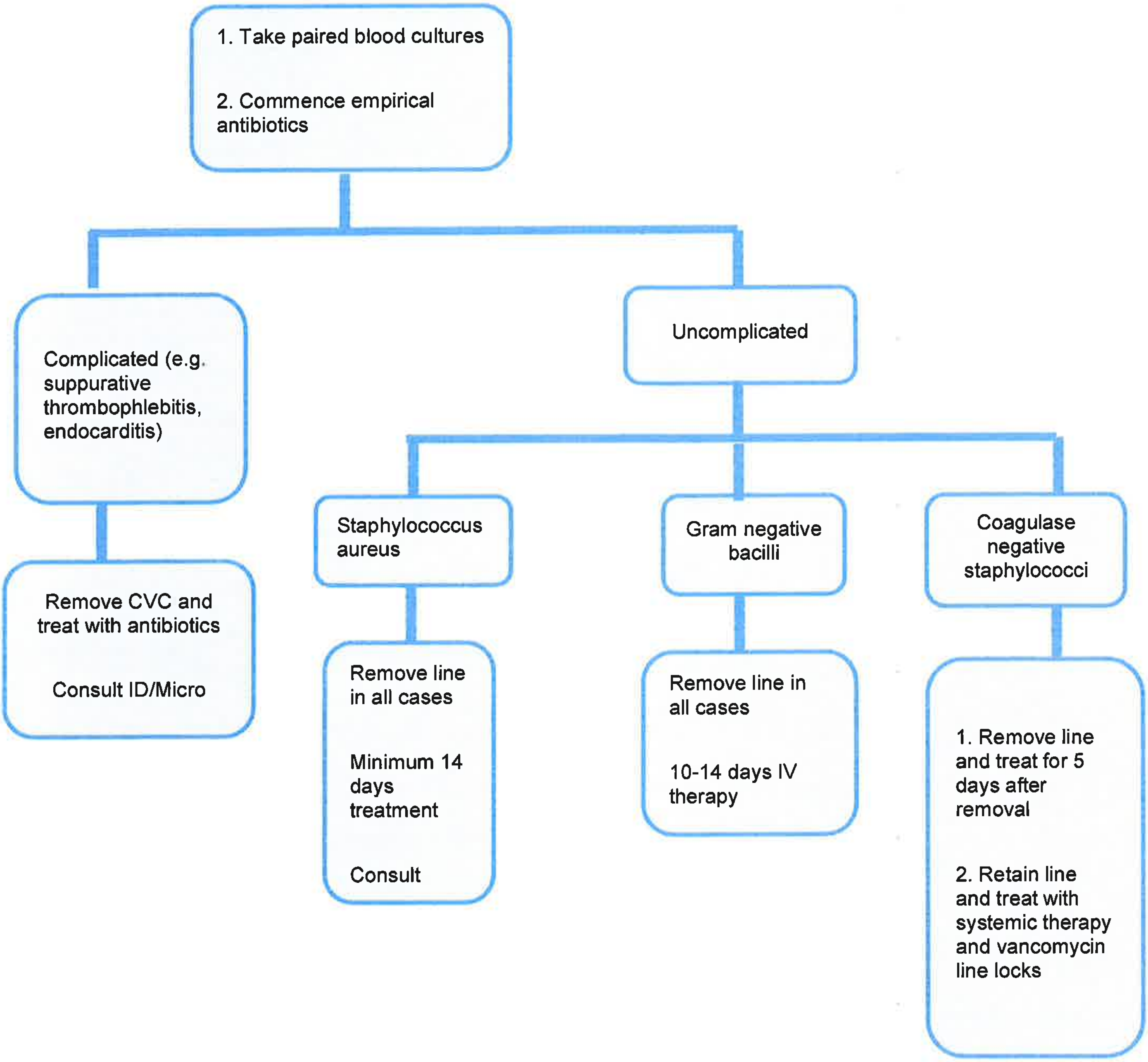
Vancomycin

Final concentration 5mg/ml

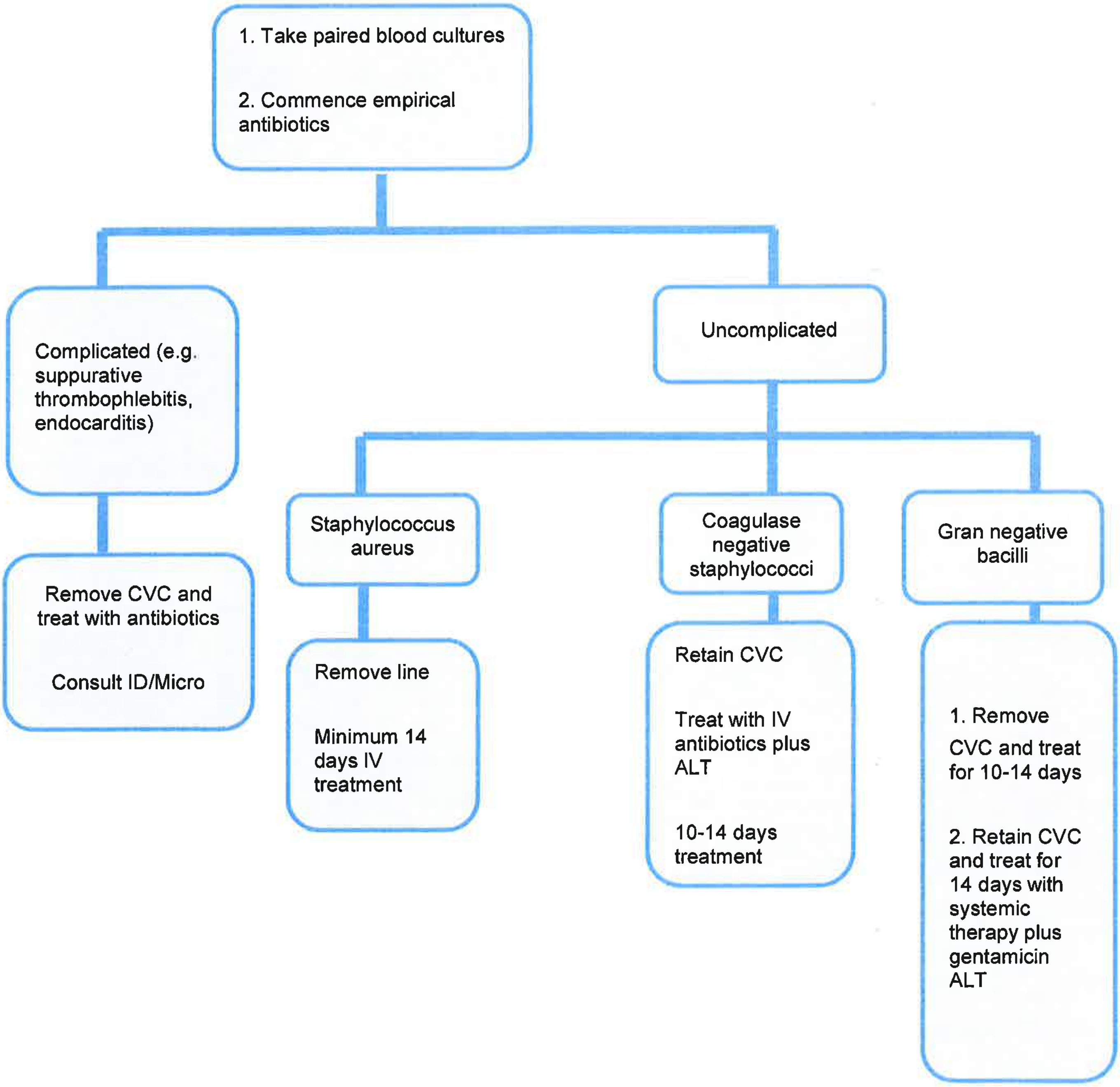
1. Reconstitute a 500mg vial of vancomycin with 9.7ml of water for injections. The resulting solution has a concentration of 50mg/ml.
2. Withdraw 0.5ml (25mg) and make up to 5ml with glucose 5% or sodium chloride 0.9%. Mix well. This solution contains vancomycin 5mg/ml.
3. Instil the required volume for size and type of central venous access device and allow to dwell for up to 24 hours as prescribed by doctor.
4. **Make sure that the line is not flushed during this time by labelling appropriately**
5. Withdraw the volume added to each lumen after dwelling for up to maximum of 24 hours.
6. Document in patient's medical notes & contact Medical officer if unable to aspirate.

N.B. There is poor evidence supporting the use of heparin in preventing central venous catheter thrombosis. Heparin has also been associated with antibiotic lock precipitation.

6. 9 SUMMARY OF MANAGEMENT OF INFECTION IN SHORT-TERM OR NON-TUNNELLED CVCS



6. 10 SUMMARY OF MANAGEMENT OF INFECTION IN TUNNELLED CVCS



7.0 PROPHYLAXIS

7.1 PAEDIATRIC GUIDELINES FOR TETANUS PROPHYLAXIS

Tetanus toxin is released following infection by the bacterium *Clostridium tetani*. The spores are present in soil or manure and can be introduced to the body through a puncture wound, burn or scratch. Neonatal tetanus is due to infection of the baby's umbilical stump.

The disease is characterised by generalised rigidity and spasms of skeletal muscles. The muscle stiffness usually involves the jaw (lockjaw) and neck and then becomes generalised.

Definitions:

Tetanus Prone Wound	High-risk Tetanus Prone Wound Tetanus prone wound with either:
• puncture-type injuries acquired in a contaminated environment e.g. gardening injuries • wounds containing foreign bodies • compound fractures • wounds or burns with systemic sepsis • certain animal bites and scratches (not usually domestic pets)	• heavy contamination e.g. soil, manure • wounds or burns that show extensive devitalised tissue • wounds or burns that require surgical intervention that is delayed for more than six hours

Tetanus vaccination:

Vaccines containing tetanus

- Revaxis (diphtheria/tetanus/inactivated polio vaccine (Td/IPV))

Tetanus immunoglobulin (TIG) has limited availability in the UK. Human Normal Immunoglobulin (HNIG) for subcutaneous or intramuscular use is a suitable alternative.

TIG doses:

- 250 IU
- 500 IU if more than 24 hours have elapsed or there is risk of heavy contamination or following burns.

  250 IU TIG is equivalent to one vial of 1000mg Subgam 16% (administered in divided doses)

  ****Request immunoglobulin from pharmacy****

Immunisation Status	Immediate Treatment		
	Clean Wound	**Tetanus Prone Wound**	**High risk tetanus prone**
Age > 11 years, fully immunised with the last tetanus dose within last 10 years Children aged 5-10 years who have received primary course and pre-school booster Children under 5 years who have received primary course	None required	None required	None required
Received adequate primary immunisations but last tetanus dose > 10 years ago Children aged 5-10 years who have received primary immunisations but no pre-school booster	None required	Give tetanus vaccine immediately	Give tetanus vaccine immediately One dose human tetanus immunoglobulin in a different site
Not received adequate Primary immunisations (Includes uncertain immunisation status)	Give tetanus vaccine immediately	Give tetanus vaccine immediately One dose human tetanus immunoglobulin in a different site	Give tetanus vaccine immediately One dose human tetanus immunoglobulin in a different site

References:

Green book Tetanus chapter
https://www.gov.uk/government/publications/tetanus-the-green-book-chapter-30

Public Health England. Tetanus Guideline. 2018.
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/754976/Tetanus_information_for_health_professionals.pdf