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MOI TEACHING AND REFERRAL HOSPITAL

MOI TEACHING AND REFERRAL HOSPITAL

EMPIRIC ANTIMICROBIAL THERAPY GUIDELINES

FORWARD

The discovery of antibiotics in the 1920s revolutionized humans' ability to treat infectious disease and save lives.

The prevalence of multidrug-resistant microorganisms has risen alarmingly in the last 40 years and has emerged as a major public health problem globally. Antimicrobial resistance is accelerated by the overuse of antibiotics worldwide. Increased antimicrobial resistance is the cause of severe infections, complications, longer hospital stays and increased mortality. Overprescribing of antibiotics is associated with an increased risk of adverse effects, more frequent re-attendance and increased medicalization of self-limiting conditions. The pace of new antimicrobial development has slowed markedly in the past 20 years. As more resistance accumulates, we are left with increasingly ineffective drug therapies. Dr Margaret Chan, Former Director-General of the World Health Organization (2006-2017) in the Global Action Plan on Antimicrobial resistance stated that "Antimicrobial resistance threatens the very core of modern medicine and the sustainability of an effective, global public health response to the enduring threat from infectious diseases".

Antimicrobial stewardship interventions which mainly focuses on rational antibiotics use have been proven to improve individual morbidity and mortality due to infection with resistant organisms as well as reduce cost incurred in patient management. Scientific management can promote the rational use of antibiotics, reduce the expense of drug use and slow the development of drug resistance.

Infection Prevention & Control (IPC) and diagnostic stewardship play a significant role in supporting antimicrobial stewardship activities as well as preventing the development and spread of antimicrobial resistance. This guide should be used together with the available diagnostic stewardship guidelines as well the IPC guidelines.

I would like to remind clinical teams that while we focus on the treatment of the individual patient, we must always be cognizant of the collateral damage of antimicrobial resistance (AMR).

Practice guidelines, of any kind, would only be effective if they are adhered to. We all have a role in preserving antibiotics for this and future generations.

Dr. Wison K. Aruasa, MBS, EBS.

Chief Executive Officer, MTRH

GUIDELINE IDENTIFICATION AND APPROVALS

	MOI TEACHING AND REFERRAL HOSPITAL		
TITLE	EMPIRIC ANTIMICROBIAL THERAPY GUIDELINES	Reference	MTRH/POL/EAT /001
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NB: Revision done after two years or whenever necessary for suitability and adequacy. Any printed copy becomes uncontrolled document, unless otherwise stamped.

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ABBREVIATIONS

ABU	Asymptomatic Bacteriuria
AMS	Antimicrobial Stewardship
ANC	Absolute Neutrophil Count
C&S	Culture & sensitivity
CAP	Community-Acquired Pneumonia
CNS	Central Nervous System
CRBSI	Catheter Related Bloodstream Infection
CrCl	Creatinine Clearance
CRP	C-reactive Protein
CSF	Cerebrospinal Fluid
CT SCAN	Computed Tomography Scan
Div	Divided
GBS	Group B Streptococcal
IE	Infective Endocarditis
IM	Intramuscular administration
IV	Intravenous administration
LD	Loading dose
LP	Lumbar Punctures
OD	Once a day
PCR	Polymerase Chain Reaction
PO	(*per os*) oral administration
RBS	Random Blood sugar
RR	Respiratory rate
Sp.	Species
TDS	Three times a day (8 hourly)
QID	Four times a day (6 hourly)

PURPOSE OF THE EMPIRIC ANTIBIOTIC GUIDELINES

These treatment guidelines provide recommendations for empiric antibiotic therapy. Empiric therapy refers to an appropriate choice of one or more antibiotics to treat an infection for which identification of a specific pathogen has not yet been made. Empiric therapy targets the most likely pathogen for the site of infection. Ideally it should be the narrowest -spectrum, single agent that matches the likely pathogen with adequate target tissue penetration. The purpose of these guidelines therefore is:

- To improve patient care by promoting evidence-based practice in antibiotic prophylaxis and therapy.
- To promote the safe, effective, economic and rational use of antibiotics
- To retard the emergence and spread of multiple antibiotic – resistant bacteria.
- To eliminate the use of unnecessary or ineffective antibiotics and curb the use of expensive or reserve antibiotics when not indicated.
- To combat emergence of antibiotic resistance
- To minimize the morbidity and mortality due to antimicrobial-resistant infections

PRINCIPLES OF ANTIBIOTIC THERAPY AND RATIONAL ANTIBIOTIC PRESCRIBING

The appropriate use of antimicrobials is mandatory for the effective delivery of care for patients and is a key factor in the management of antimicrobial resistance. Antimicrobial stewardship is defined as processes which assist and support clinicians with decisions regarding the optimal selection, dose and duration of an antimicrobial agent. The objective of antimicrobial stewardship is to ensure the best clinical outcome for the treatment or prevention of infection, with minimal toxicity to the patient and minimal impact on subsequent development of resistance. Key tenets of rational antibiotic use include the following:

- Formulate a clinical diagnosis of microbial infection.
- Send the appropriate investigations for all the infections as recommended. These are the minimum requirements for diagnosis, prognosis and follow up of these infections.
- Microbiological samples (for culture and sensitivity testing) should always be sent PRIOR to initiating antimicrobial therapy.
- Formulate a specific microbiologic diagnosis.
- Determine and document the need for antimicrobial therapy.
- Identify the most common organism causing the infection and institute pharmacologic antimicrobial treatment. Ensure that the appropriate drug, dose, frequency, route and duration is prescribed.
- Check for factors which will affect drug choice & dose, e.g., renal function, drug interactions, adverse effect profiles and allergy.
- Where empiric therapy is used the accuracy of diagnosis should be reviewed regularly and treatment altered/stopped when C & S results are available. The need for antimicrobial therapy should be reviewed daily.
- Institute adjunctive and non-pharmacologic therapy.
- Empiric IV antibiotics may only be given for 48 – 72 hours. After this time frame all available clinical and microbiological data should be reviewed and treatment adjusted accordingly.
- New microbiological or other information (e.g., defervescence for at least 24h, marked clinical improvement; low CRP) should at this stage often permit a switch to oral antibiotic(s), or switch to a narrow spectrum antibiotic, or cessation of antibiotics (no infection present).

In uncomplicated infections, oral antibiotics or early change from IV to oral therapy is frequently justified.

- **Use simple generic antibiotics first (Access group of antibiotics)** whenever possible. Avoid broad spectrum antibiotics (e.g., Amoxiclav, quinolones and cephalosporins- Watch & Reserve antibiotics) when standard and less expensive antibiotics remain effective, as they increase the risk *of Clostridioides difficile*, MRSA and resistant UTIs.
- **Wait for at least 48hrs** of antimicrobial therapy before labeling the patient as non-responding to the therapy and to switch to the next appropriate antibiotic. Also consider escalation if the patient's condition deteriorates.
- Once the culture / sensitivity report is available initiate specific antimicrobial therapy. Antimicrobials may require being changed/de-escalate or escalated. **De-escalate to the narrowest spectrum, most efficacious and most cost-effective option.**
- Duration of therapy should be determined by clinical factors such as site of infection, severity of illness and response to treatment. As a general guide, antibiotics can be discontinued within 5-7 days of the temperature returning to normal. Infections at certain sites (e.g., pyelonephritis, osteomyelitis or endocarditis) or with organisms (e.g., Staphylococcus aureus) may require more prolonged therapy.
- **Prescribing antibiotics just in case an infection is present is rarely justified**. Where patients are in hospital, close observation is usually a better option.

NOTE:

- Preferred antibiotics choice, dosage and duration should be followed when possible. Select alternative treatment if there are other compelling reasons to prevent the use of the preferred antibiotics.
- When step-down therapy is recommended, the duration is the total treatment duration including the intravenous therapy.
- **For PARENTERAL administration** instructions and compatible fluids **REFER to MTRH IV administration chart**
- Consult your pharmacist for dose adjustment in Kidney & Hepatic impairment, Therapeutic drug monitoring etc.

MTRH ACCESS, WATCH AND RESERVE (AWaRE) CLASSIFICATION OF ANTIBIOTICS

Access group antibiotics	Watch group antibiotics	Reserve group antibiotics
This group of antibiotics have activity against a wide range of commonly encountered susceptible pathogens while also showing lower resistance potential than antibiotics in the other groups. They are recommended as essential first or second choice empiric treatment options for infectious syndromes to improve access and promote appropriate use.	This group of antibiotics have higher resistance potential and includes most of the highest priority agents among the Critically Important Antimicrobials that are at relatively high risk of selection of bacterial resistance. Selected Watch group antibiotics are recommended as essential first or second choice empiric treatment options for a limited number of specific infectious syndromes.	This group of antibiotics are reserved for treatment of confirmed or suspected infections due to multidrug-resistant organisms. Reserve group antibiotics should be treated as "last resort" options. Their use should be tailored to highly specific patients and settings, when all alternatives have failed or are not suitable.
Pharmacy supply does not require approval. A close monitoring to check their usage (indication, quantity and pattern)	Unrestricted use of these antibiotics may be allowed for empirical use for the first 48-72 hrs. After that a prescription by a consultant or AMS team along with justification for use. Evidence of C&S lab request should be provided	Pharmacy supply requires a prescription by a consultant OR for specific indications (e.g., sepsis). Evidence of C&S lab request should be provided
Can be started empirically as per antibiotic guidelines/clinical indication but to be reviewed after availability of laboratory evidence Laboratory evidence (Culture & sensitivity report)	There should be clear indications /Laboratory evidence (Culture & sensitivity report)	There should be clear indications /Laboratory evidence (Culture & sensitivity report)
Azithromycin Amoxicillin Amoxicillin/clavulanic Acid Ampicillin Ampicillin/sulbactam Benzathine benzylpenicillin Benzylpenicillin Ceftriaxone** Chloramphenicol Clindamycin Cloxacillin Doxycycline Flucloxacillin Gentamicin Metronidazole (IV) Metronidazole (oral) Nitrofurantoin Procaine benzylpenicillin Sulfamethoxazole/trimethoprim Tinidazole Tetracycline Trimethoprim	Amikacin Cefepime Cefixime Cefotaxime Cefpodoxime proxetil Ceftazidime Ceftriaxone Cefuroxime Ciprofloxacin Clarithromycin Erythromycin Fosfomycin (oral) Levofloxacin Moxifloxacin Neomycin	Colistin (polymyxin E) Fosfomycin (IV) Imipenem/cilastatin Linezolid Meropenem Piperacillin/tazobactam Polymyxin B Tigecycline Vancomycin
**Access drug for meningitis and pneumonia only		

DIAGNOSTIC STEWARDSHIP AND SPECIMEN HANDLING GUIDELINES

FUNDAMENTALS OF SPECIMEN COLLECTION

- **Sterile technique** should be observed. Appropriate sterile containers should be used.
- Samples should be collected at the time of patient presentation/onset of illness and before administration of any antibiotics.
- Samples should be collected **ONLY** when clinically indicated. Avoid routine screening cultures eg routine tracheal aspirates
- Adequate patient data including any antibiotic use, and clinical history is vital.

ADEQUATE SPECIMEN COLLECTION

- All specimens should be properly **labeled** with patient information **AFTER specimen collection.**
- **Blood samples for culture should** be taken from 2 sites **e.g., from a central line and a peripheral site** or 2 peripheral sites.
- When taking a blood culture sample from a peripheral site, clean the site with an alcohol swab and allow 30 seconds to dry before puncture, do not palpate the vessel before puncture unless sterile gloves are worn.
- For adults draw 8 -10 ml of blood from each site, for children under 5 years, collect 1-3 ml
- Central venous catheter tip cultures MUST be accompanied by blood for culture.
- **Urine samples for culture** should be **a clean catch midstream sample,** from a freshly inserted catheter or cleaned catheter hub where urine will be collected directly from the tubing.
- Do not collect urine from a urine bag. Urine catheter tip cultures are not acceptable for cultures.
- **Abdominal fluid for culture** should be taken straight from the abdomen or from a newly placed drain.
- Do not collect specimens from existing drains.
- **Wound swabs** are often not useful due to contamination. To collect a swab: First clean the wound with normal saline and attempt to get a swab from the base or alternatively, get a tissue specimen for culture.
- Do not collect a superficial sample from the surface of a wound.
- **CSF samples:** A sterile procedure should always be used for collection of CSF samples. A mask should be worn to avoid respiratory contamination.
- **Abscesses, bullae, blisters samples** - aspirate directly from the abscess with a sterile needle and syringe. Transfer the aspirate to a sterile container. DO NOT take a sample in a syringe to the lab.
- Drain all pus before administering antibiotics (Source control)

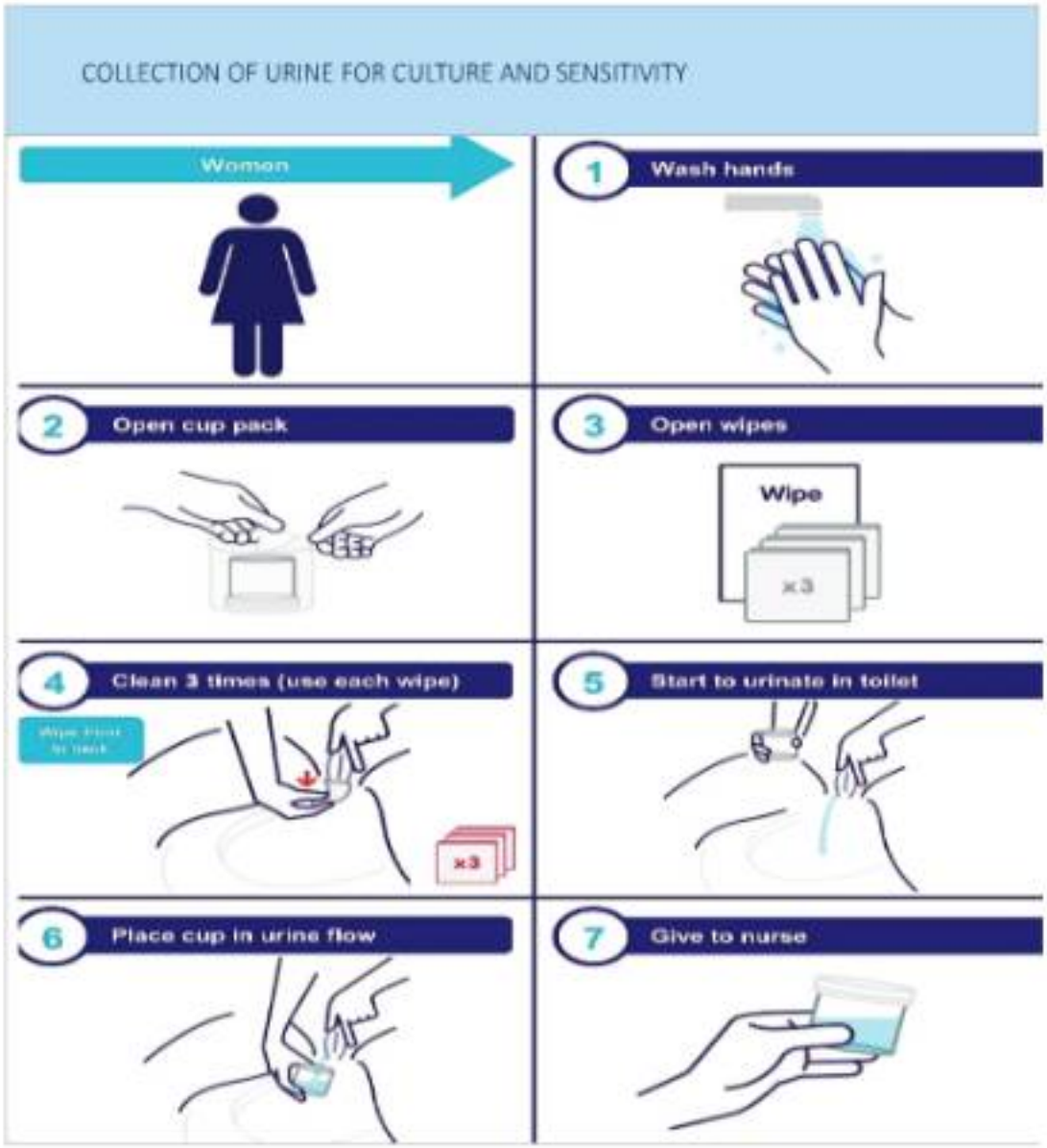
INTERPRETING BACTERIOLOGY RESULTS

- The clinical context must be taken into account when interpreting cultures as this will help in differentiating true infection from colonization and contamination.
- Select appropriate antibiotics only (narrowest spectrum that can adequately penetrate to the site of the infection) interpreted as SUSCEPTIBLE. **Do NOT** simply use the lowest MIC. Appropriate/ recommended duration of treatment should **ALWAYS** be indicated. Consult ID physicians or pharmacists for further guidance when needed.
- Coagulase negative staphylococci in blood will only be considered relevant if grown in more than 1 bottle in an appropriate clinical scenario (e.g., infective endocarditis) in neonates and in patients with cardiac devices.
- **True infection is almost always present** if the blood culture is positive for Streptococci (non-viridans), *S. aureus*. Aerobic and facultative gram-negative rods **e.g.**, *E. coli, K. pneumoniae*, Enterobacter, Pseudomonas and Yeast e.g., candida spp.
- Suspect contamination if only one of several cultures is positive, if detection of bacterial growth is delayed (≥5 d), or if multiple organisms are isolated from one culture.

- **AVOID ROUTINE TRACHEAL ASPIRATES.** Tracheal aspirates should only be collected if clinically indicated, consider the organism cultured as the possible cause of infection if the Chest radiograph shows infiltrates consistent with pneumonia.

SPECIMEN TYPES					
Specimen	**Collection**	**Quality determinant**	**Transport**	**Common pathogens**	**Turn Around Time**
Blood	Aseptic technique -before antibiotics	Quantity **Adults:** 8-10 mL **Pead's:** 1-3 mL **Neonates:** 1 mL At least 3 sets in suspected infective endocarditis	< 1 hr.	*S. aureus* *Enterobacterales* *Enterococci*	3-7 days
Urine	Voided- midstream clean catch. Suprapubic aspirate. Aspirate from catheter tube.	Do NOT obtain urinary catheter tip or sample from cathetar bag. Note. Urine culture with growth of more than 2 organisms is a contaminated sample. A properly collected sample will be required.	< 2hr	*E. coli* *Klebsiella,* *S. saprophyticus* *S. agalactiae* (only in pregnancy)	1-3 days
Sputum	Early morning	Rinse mouth with sterile water before collection.	<2hr	*S. pneumonia* *H. influenzae* *S. pyogenes* *Pseudomonas*	2-5 days
Pus swab and aspirate	Collect using sterile swabs with transport media. Aspirates should be collected aseptically with syringe and contents dispensed in sterile container for transportation.	For swabs clean area thoroughly with normal saline before collecting sample. Tissue and pus aspirates are preferred to swabs.	<1hr	*S. aureus* *S. pyogenes* *E. coli and Enterobacterales in SSI* *Enterics in superficial wounds are usually contaminants*	2-5 days
CSF	Collect aseptically into **3 screw capped bottles.** 1ST -biochemistry, 2nd -microbiology, 3rd -hematology	Quantity **Adults:** 2 mL per bottle **Pead's:** 1 mL per bottle	Immediate	*S. Pneumoniae* *S. aga actiae* *E. coli* *C. neoformans* *H. influenza* *L. monocytogenes*	2-7 days
Tissue	Collect at least 5mm³ in sterile container	Do not submit samples in formalin	Immediate	*S. aureus* *S. pyogenes* Anaerobes	2-7 days
Stool	Collect with a stool collection bottle.	Non formed stool only Avoid contamination with urine or toilet water.	<30 min	*Salmonella* *Shigella* *EPEC for under 5 yrs.*	2-3 days

	Avoid collecting formed stool.				
High vaginal swab	Sterile swab with use of speculum	Swab should be inserted 1-2 cm into endocervical canal	Immediate	*N. gonorrhoeae* *Candida albicans* *Trichomonas vaginalis*	2-3 days
Urethral swab	Clean the surface, insert a urethrogenital swab. If smear is needed, squeeze the discharge on a clean slide and make a smear	Swab should be rayon/dacron/alginate with plastic handle and inserted 2-3 cm into urethra, turn and leave in place for 1-2 seconds.	Immediate	*N. gonorrhoeae* *T. vaginalis*	2-3 days


COLLECTION OF URINE FOR CULTURE AND SENSITIVITY
Women
1
Wash hands
2
Open cup pack
3
Open wipes
Wipe
x3
4
Clean 3 times (use each wipe)
x3
5
Start to urinate in toilet
6
Place cup in urine flow
7
Give to nurse

RECOMMENDATIONS FOR BLOOD CULTURE COLLECTION

1 CHECK PATIENT ID & PREPARE MATERIAL

2 PREPARE BOTTLES FOR INOCULATION

Wash hands or use an alcohol hand rub.

Remove the plastic "flip-cap".

Disinfect the bottle septum and **allow to air dry**

3 PREPARE VENIPUNCTURE SITE

Palpate to find the vein.

Apply clean examination gloves.

Disinfect the skin.

Allow the site to **air dry**

4 COLLECT WITH WINGED SET

Attach the collection set to the adapter cap.

To prevent contamination, **do not re-palpate.**

Insert the needle into the prepared vein.

5 BOTTLE INOCULATION

Collect the **aerobic bottle first.**

Ensure the bottle is **correctly filled to the Fill to Mark or target fill level, as shown.**

Repeat for **anaerobic bottle.**

6 FINISH THE PROCEDURE

Record collection date, **time** and **site.**

Label bottles according to manufacturer's recommendations.

Transport inoculated bottles **as quickly as possible** at room temperature to laboratory for testing.

7 CORRECT LABELING

DO NOT

Leave cotton over the septum

Replace the plastic "flip-cap"

Position label in the wrong place

1: BACTERIAL PNEUMONIA

1. BACTERIAL PNEUMONIA

MTRH Empiric Antibiotic Guide: ADULT BACTERIAL PNEUMONIA	
Definition	Pneumonia is an acute respiratory illness associated with radiological pulmonary shadowing. a) Community acquired pneumonia: pneumonia acquired in the non-hospital environment. b) Nosocomial pneumonia: pneumonia acquired in the hospital setting. This includes: 1. Hospital acquired pneumonia: Pneumonia acquired ≥48 hours after hospital admission 2. Ventilator Associated pneumonia: pneumonia acquired ≥48 hours after endotracheal intubation **c) Aspiration pneumonia**: pneumonia resulting from entry of gastric or oropharyngeal fluid which may contain bacteria or exogenous substances and may be of low pH.
Clinical findings	• Acute: less than 2-week onset • Cough, pleuritic chest pain, fever, difficulty in breathing, sputum production, tachypnoea, respiratory distress, bronchial breath sounds, crackles • The CURB-65 scoring can be used to assess for severity of illness in CAP: Score of 0-1: low severity, 2: moderate severity requiring hospital admission, 3-4: high severity requiring HDU/ICU admission. **C**- Confusion (1 point), **U**- Urea >7 mmol/L (1 point), **R**- Respiratory rate>30 bpm in (1 point), **B**- Blood pressure <90mmHg systolic or <60mmHg diastolic (1 point) ,**65**-Age >65 (1 point)
Diagnostic tests:	• **Determine severity**: CURB-65 score. Interpretation: 0-1: Probably suitable for home treatment (low risk of death) 2: Consider hospital supervised treatment ≥ 3: manage in hospital as severe pneumonia; high risk for death. • **Chest radiographs** for all patients.

Lab investigations

Community Acquired Pneumonia	Hospital Acquired Pneumonia
Only perform tests if likely to influence empiric management decisions. **Mild (CURB-65 score < or = 2)** • Sputum culture and Genexpert if failed antibiotic therapy **Severe: (CURB-65> or = 3 or comorbidities)** • Blood culture • Sputum gram stain and culture • Sputum for PJP DFAT (direct fluorescent antibody testing) if HIV positive • NP swab from influenza PCR if flu season • CRP and Procalcitonin	Always send specimens prior to initiation of antibiotics. In all cases: – Blood culture – Sputum for gram stain and culture – CRP and Procalcitonin – Sputum for PJP DFAT (direct fluorescent antibody testing) if HIV positive

Empiric Therapy			ALTERNATIVE THERAPY	

ORGANISM	ANTIBIOTIC	(Intolerance or allergy)	COMMENTS
CONDITION: Community acquired pneumonia OUTPATIENT, no contact with healthcare system, no prior antibiotic treatment, less than 60 years with no comorbidities CURB 65: 0-1, MILD			
S. pneumoniae *H. influenzae* *M. pneumoniae*	Adult/ Pregnancy **PO Amoxicillin 500mg TDS** for 5-7 days	**PO co-amoxiclav 625 mg q8h** for 5-7 days OR **PO Doxycycline 100mg BD** for 7 days	Avoid Quinolones
CONDITION: CAP INPATIENT, no contact with healthcare system, no prior antibiotic treatment less than 60 years without underlying disease CURB 65: 0-1, MILD			
S. pneumoniae *H. influenzae*	Adult/ Pregnancy **Po co-amoxiclav 1g BD** (OR IV co-amoxiclav 1.2g BD) PLUS **Po Azithromycin 500mg OD** **Duration**: 5 - 7 days	Penicillin allergy **IV Ceftriaxone 2g OD** PLUS **Po Azithromycin 300 mg OD** for 3 days OR **Po Clarithromycin 500mg BD** **Duration**: 5 - 7 days	Switch to oral therapy when clinical condition improves, and patient can tolerate orally
CONDITION: Community acquired pneumonia INPATIENT; recent hospital admission; dialysis etc. without invasive procedure; recent antibiotic therapy; > 60 years and/or those with underlying comorbidity and in pregnancy; single organ failure CURB 65=2 **MODERATE TO SEVERE**			
S. pneumoniae *H. influenzae*	Adult/ Pregnancy **IV Co-amoxiclav 1.2g IV TID** PLUS **Po Azithromycin 500mg OD** **Duration:** 7 days for immunocompetent and 14 days for immunocompromised.	If allergic to penicillin IV Ceftriaxone 2g OD PLUS **Po Azithromycin 500mg OD** **Duration:** 7 days for immunocompetent and 14 days for immunocompromised	**Send cultures** (blood and sputum) at the time of admission; blood cultures – 2 sets from different sites. **Combination therapy** for hospitalized cases of CAP have a better outcome than monotherapy.
CONDITION: Community acquired pneumonia in severely ill patients. CAP is defined as severe if two or more of the parameters are present: CURB 65: ≥ 3 SEVERE			
S. pneumoniae *H. influenzae*	Adult/ Pregnancy **IV co-amoxiclav 1.2g**	**IV ceftriaxone 1-2g**	☐ Send culture (blood and sputum) at the time of admission. blood cultures – 2

	TID PLUS **Po Azithromycin 500mg** **OD** **Duration:** 7-14 days	**OD** PLUS **Po Azithromycin** **500mg OD** **Duration:** 7-14 days	sets from different sites. ☐ Treatment should be culture guided. ☐ Combination therapy for hospitalized cases of CAP have a better outcome than monotherapy. ☐ If aspiration pneumonia suspected, consider adding clindamycin.
CONDITION: Nosocomial Pneumonia Long hospitalization; With multiple invasive procedures, Recent and multiple antibiotic therapies, advanced immunodeficiencies; severe neutropenia; multiple organ failure			
Gram-negative rods including *Pseudomonas* & *Acinetobacter* **Multidrug resistant organisms including** *Pseudomonas* *E. coli* *Klebsiella, Enterobacter, Citrobacter, Acinetobacter*	**IV cefepime 2g TDS** PLUS **IV Amikacin 15mg/kg OD** OR **IV Piperacillin/ Tazobactam 4.5g QID** **Duration:** 7 days	For true penicillin allergy and for VAP use **IV Meropenem 1g TDS** **Duration**: 7 days	☐ Always get sputum and blood culture prior to starting antibiotics and adjust when results are out. ☐ Duration of antibiotics could be shortened to 7 days even for MDR *Pseudomonas aeruginosa* and *Acinetobacter baumannii* infections. ☐ Longer duration may be indicated depending upon clinical, radiological and laboratory parameters. ☐ *De-escalate antibiotics according to culture and sensitivity results.

- Consult ID team for patients with significant antibiotic exposure or known to be colonized with MDR organisms.
- *For patients not improving, evaluate for complications e.g., empyema thoracis.*
- *For severely ill on a carbapenem and not improving consult an Infectious Disease specialist.*
- *Clinicians should use CURB-65 prediction tools to support, not replace clinical judgments.*
- Anaerobic coverage is NOT routinely recommended for aspiration pneumonia unless lung abscess or empyema is suspected.
- Agents given parenterally initially then switched to oral once:
  - the temperature has settled; afebrile on two occasions eight hourly apart,
  - Can tolerate orally with adequate oral intake.

MTRH Empiric Antibiotic Guide: BACTERIAL PNEUMONIA IN CHILDREN	
Definition	Pneumonia is an acute respiratory illness associated with radiological pulmonary shadowing. a) Community acquired pneumonia: pneumonia acquired in the non-hospital environment. b) Nosocomial pneumonia: pneumonia acquired in the hospital setting. This includes: 1. Hospital acquired pneumonia: Pneumonia acquired ≥48 hours after hospital admission 2. Ventilator Associated pneumonia: pneumonia acquired ≥48 hours after endotracheal intubation c) Aspiration pneumonia: pneumonia resulting from entry of gastric or oropharyngeal fluid which may contain bacteria or exogenous substances and may be of low pH.
Clinical findings and Severity grading	Pneumonia (non-severe): **Cough or difficulty in breathing with at least one of the following:** • Fast breathing (RR: age < 2 months > 60/min; age 2-11 months > 50/min; age 1-5 year> 40/m; > 5 years: >20/min) • Lower chest wall in drawing Severe Pneumonia: **Cough or difficulty in breathing plus at least one of the following:** • Oxygen saturations < 90 on pulse oximetry or central cyanosis • Severe respiratory distress (e.g., grunting, very severe chest indrawing) • Signs of pneumonia with a general danger sign (inability to breastfeed or drink convulsions, lethargy or reduced level of consciousness) • Also, some or all the symptoms of pneumonia (non-severe) may be present. • Auscultation findings of decreased or bronchial breath sounds or signs of pleural effusion or empyema. *(Adopted from WHO 2016)*
Diagnostic tests:	Lab investigations • Complete blood count • ESR, CRP or PCT • Blood culture (prior to antibiotics if possible) • Nasopharyngeal swab for BioFire respiratory PCR Panel (if available) • Induced sputum for PJP Direct Fluorescent Antibody testing (DFAT) if HIV positive or severely malnourished. Imaging Chest x-ray: Indicated in treatment failure, worsening of pneumonia, non-response after 48 hours, recurrent pneumonia. Children (>5 years) and adolescents: The clinical presentation of viral pneumonia may not be easy to distinguish from bacterial pneumonia. In viral Pneumonia: Complaints are related to slowly progressive systemic symptoms over 3-7 days with malaise, pharyngitis and headache, followed by cough that is irritative and nonproductive (lasting 2-4 weeks). Physical examination may show rales, rhonchi and wheezes in the context of a child who does not appear ill ("walking pneumonia"). Do NOT treat it with antibiotics.
Empiric Therapy	

ORGANISM	ANTIBIOTIC	COMMENTS
Pneumonia (Non-severe)		
Viral infection is more common. (Influenza, RSV, human metapneumovirus(hMPV), Parainfluenza, Adenovirus) Bacteria *S. pneumoniae* *Group A Streptococcus* *H. influenzae* *S. aureus.*	**Po Amoxicillin 40-45 mg/kg/dose** (max 4g/day) **q12h** (high dose) for 5-7 days if unresponsive in 48-72 hours shift to **Po co-amoxiclav 45mg/kg/dose** (amoxicillin component; max 1g) BD 5-7 days	Counsel on danger signs, review after 48 hours **Antibiotics are not routinely recommended since viral infections are common.** For infant & children admitted to hospital, treat as presumed bacterial unless viral origin confirmed. Experts recommend using high dose amoxicillin to overcome resistance conferred by cell wall changes of the bacteria (pneumococcus). If a child cannot tolerate high dose, the standard amoxicillin dose can be used. **Standard dose:** Amoxicillin 45-50 **mg/kg/day** PO in 3 divided doses for 5-7 days. **Duration:** minimum 5 days & until afebrile for 2-3 days in empiric therapy with absence of an identified specific etiology & specific therapy with known pneumonia due to pneumococcus, *H. influenzae* & *Moraxella catarrhalis*
Severe Pneumonia		
0-2 months *E. coli* *Group B Strep* *S. pneumoniae* *Chlamydia*	**First Line** **IV Benzylpenicillin (x-pen): 25,000-50,000 IU/kg/dose TDS** (age 1-4 weeks); **50,000 IU/kg/dose QID** (age >4 weeks) PLUS **IV Gentamicin 4-6 mg/kg OD** for 5-7 days **Second line** **IV Cefotaxime 150-200 mg/kg/day (max 2g/dose) div TDS-QID** for 5-7 days	- **Consider chlamydia if failure** to respond; **add Azithromycin 10mg/kg/day OD.** - IV gentamicin should be **given as a slow push over 2-3 minutes.** - **Monitor** UECs for children on **gentamicin**
>3 months • *S. pneumonia* • *H. influenzae*	**IV Benzylpenicillin (x-pen) 50,000 IU/kg/dose** (max 4MU/dose) **QID** PLUS **IV Gentamicin 7.5mg/kg OD** for at least 5 - 7 days If no signs of improvement within 48 hours and staphylococcal pneumonia is suspected:	- Remove thick **secretions** at the entrance of the nasal passage or throat which the child cannot clear by **gently suction.** - **Switch from IV to oral** from 2-3 days after initiation of treatment in patients who are:

	IV Flucloxacillin 50 mg/kg/dose (max 2g/dose) **QID** PLUS **IV Gentamicin 7.5mg/kg OD** for 5-7 days 2nd line **IV co-amoxiclav 90mg/kg/day** (based on the amoxicillin content) (max. 1.2gm/dose) **TDS** for 7 days	☐ Responding to initial treatment ☐ Able to feed with, intact GI absorption. ☐ Free from pulmonary/ extrapulmonary complications
NOSOCOMIAL PNEUMONIA (Risk for MDR Pathogens)		
Gram-negative rods including *Pseudomonas* & *Acinetobacter* **Multidrug resistant organisms including** *Pseudomonas* *E. coli* *Klebsiella, Enterobacter, Citrobacter, Acinetobacter*	**IV Piperacillin/ Tazobactam QID** 2-9 months: 80 mg/kg /dose (piperacillin component) >9 months < 40kg: IV: 100 mg/kg /dose (piperacillin component) Children and adolescents >40kg IV: 4000 mg (piperacillin component)/dose (Max 16g piperacillin/component/day) PLUS **IV Amikacin 15mg/kg OD for 7 days**	☐ Always get **sputum and blood culture prior to starting antibiotics** and adjust therapy when results are out. ☐ **Acinetobacter or Pseudomonas use dual therapy** including a beta lactam and aminoglycoside. ☐ Monitor UEC 48-72 hours

- *Continue with IV antibiotics until there is evidence of good clinical response and/or laboratory markers of infection improve, then consider switching to oral therapy to complete the duration of treatment.*
- *For patients not improving, evaluate for complications. Some complications e.g., empyema will require drainage of infected pleural fluids and intrapleural antifibrinolytics e.g., alteplase (if not contraindicated) with prolonged duration of treatment (10-14 days) to minimize further complications.*
- *Additional coverage for anaerobic organisms and S. aureus may be required in the presence of a lung abscess. Clindamycin may be added.*
- *Supportive therapy:*
  - *Give paracetamol if child has fever.*
  - *If wheezing, give inhaled rapid acting bronchodilator and a can give a steroid is appropriate.*
  - *Ensure the child received adequate hydration: maintenance fluids, encourage breastfeeding and food as soon as possible.*

2: ACUTE BACTERIAL MENINGITIS

2. ACUTE BACTERIAL MENINGITIS

MTRH Empiric Antibiotic Guide: Acute Bacterial Meningitis	
Definition	Inflammation of meninges and subarachnoid space. Major causes of bacterial meningitis include *N. meningitidis, S. pneumoniae, L. monocytogenes.*
Classification	**Community-acquired bacterial meningitis:** usually caused by *Streptococcus pneumoniae, Neisseria meningitidis*, and, primarily in patients over 50 years of age or those who have deficiencies in cell-mediated immunity. **Health care-associated ventriculitis and meningitis:** usually caused by staphylococci and aerobic gram-negative bacilli. Typically follow neurosurgical procedures such as post-craniotomy, ventriculo-peritoneal shunts or after head trauma
Clinical presentation	**Common symptoms include** headache, fever, stiff neck, reduced consciousness. **History:** Severe headache, fever, change in mental status, convulsions, skin rash **Physical signs:** nuchal rigidity, positive Kernigs' and Brudzinski sign, cranial nerve palsies, papilledema **In children, common signs and symptoms include** fever, irritability, poor feeding, bulging fontanel and seizures. In neonates, S&S are subtler and may resemble neonatal sepsis.
Diagnostic tests	**Blood tests:** **Complete blood count**: elevated white blood cell with a left shift • Two aerobic blood cultures prior to the initiation of antimicrobial therapy (positive in 50-90%) • Serum electrolytes: hyponatremia in 30% of case • Serum glucose: helpful in determining the cerebrospinal fluid (CSF) to-blood glucose ratio. • HIV test **Lumbar puncture should be done in all patients with meningitis except for those with contraindications such as:** • Raised intracranial pressure (focal neurologic deficits, recent onset seizures, papilledema) with risk for cerebral herniation due to obstructive hydrocephalus, cerebral edema, or space-occupying lesion. • Thrombocytopenia (<50,000/uL) or other bleeding diathesis, including ongoing anticoagulant therapy. • Suspected spinal epidural abscess. **Brain Imaging:** Should not delay initiation of therapy; imaging is often NOT necessary. A head CT should be performed **before** LP in adults with suspected bacterial meningitis who have one or more of the following risks factors. • History of central nervous system (CNS) disease (mass lesion, stroke, or focal infection) • New onset seizure (within one week of presentation) • Papilledema • Abnormal level of consciousness • Focal neurologic deficit **CSF studies**

- Opening pressure with the patient lying in the lateral decubitus position is usually > 200mmH$_2$0.
- Cell count and differential: WBC count above 1000/uL, with a percentage of neutrophils usually greater than 80 percent
- Glucose concentration: <2.22 mmol/L, a CSF to serum glucose ratio of ≤0.4,
- Protein concentration: a protein concentration >45mg/dL
- Gram stain and bacterial culture
- GeneXpert mtb/rif
- CRAG and India Ink
- Other tests, e.g., multiplex PCR (BIOFIRE)

In presentations of sub-acute or chronic nature, consider diagnostic tests for TB meningitis, particularly in HIV –infected patients.

Once suspected and awaiting laboratory results, empiric therapy should be started within an hour or presentation to prevent complications and mortality.

Empiric antibiotics

ORGANISM	ANTIBIOTIC	ALTERNATIVE THERAPY	COMMENTS
ACUTE BACTERIAL MENINGITIS: ADULTS			
A) Community acquired *S. pneumoniae* *N. meningitidis* *H. influenzae* Other organisms Gram-negative rods	IV Ceftriaxone 2gm BD Duration: 10 -14 days		• If lumbar puncture is delayed by radiological investigation, start antibiotics after obtaining blood cultures. DO NOT delay initiation of antibiotics.
B) Healthcare-associated ventriculitis and meningitis *Staphylococci* *Aerobic gram-negative bacilli*	Adult IV Ceftazidime 2gm TDS PLUS/MINUS *IV Vancomycin 25-30 mg/kg loading dose then 15-20 mg/kg/dose BD/TDS (Max dose 2g) Duration: 21 days	Cefepime 2 g IV TDS PLUS/MINUS *IV Vancomycin 25-30 mg/kg loading dose then 15-20 mg/kg/dose BD/TDS (Max dose 2g) Duration: 21 days	• Start IV Dexamethasone 0.15mg/kg QID 15 to 20 minutes before or at the time of first dose of antibiotics. Continue for 4 days if the Gram stain and/or culture is consistent with *S. pneumoniae*. • Discontinue if not *S. pneumonia* or if bacterial meningitis is subsequently thought not to be present. • De-escalate antibiotics to targeted therapy when the culture results are available. **Refer below for organism specific duration of treatment.**

			Removal of infected shunts (source control) where feasible
ACUTE BACTERIAL MENINGITIS: CHILDREN			
A) Community Acquired Neonates *E. coli* *S. pneumoniae* *Klebsiella* *Enterobacteriaceae* Group B *streptococcus* (rare)	IV Cefotaxime 200-300 mg/kg/day div QID (max. 2gm/dose) PLUS IV Benzylpenicillin 300,000-400,000 units/kg/day div QID (max. 24MU/day) Duration: 14 days	IV ampicillin 100mg/kg/d div q12h (< 1200g); 100-150mg/kg/d div q12h (<7 days & > 1200g) 150-200 mg/kg/day div q8h (> 1200g & 7-28d) PLUS IV Cefotaxime 200-300 mg/kg/day (max 2g/dose) div QID Duration: 14 days	• Adjust therapy based on culture. • Start antibiotic therapy immediately after LP or if this is delayed, after obtaining blood cultures. • For children below 3 months of age: Cefotaxime is the preferred third generation cephalosporin because of less drug-drug interactions (in terms of interaction with calcium-containing infusion & bilirubin displacement) • Dexamethasone has no role in neonatal meningitis
1-3 months: Group B *streptococcus* (GBS), *E. coli*, *S. pneumoniae*, *N. meningitidis* > 2 months- 5 years *S. pneumoniae* *H. influenzae* *N. meningitidis* (less common) 5 years- 18 years *S. pneumoniae* *N. meningitidis*	IV Ceftriaxone 100 mg/kg/day (max 2g/dose) div BD Duration: 10-14 days		• If *H. influenzae* type b meningitis is suspected: Add IV dexamethasone 0.15mg/kg/day div QID for 4 days along or shortly before the 1st antibiotic dose. • Do **NOT** start dexamethasone > 12 hours after starting antibiotics. • Adjust therapy based on culture.
B) Healthcare Associated meningitis in children Coagulase negative *Staphylococcus aureus* *S. aureus*	IV cefepime 50 mg/kg/dose (max 2g/dose) TDS PLUS IV Vancomycin 15 mg/kg/dose TDS		• Mainly in children with previous VP shunt, external ventricular drain (EVD), spina bifida, myelomeningocele, neonates • Consult a pharmacist on vancomycin

Gram negative organisms *E. coli* *K. pneumoniae* *Ps. Aeruginosa*	**Dose and frequency should be individualized based on serum concentration (TDM)** Duration: 21 days	therapeutic drug monitoring (TDM) • De-escalate antibiotics to targeted therapy when the culture results are available. • **Removal of infected shunts (source control)** where feasible

DURATION DEPENDS ON ETIOLOGY AND ADDITION COMPLICATIONS

Neisseria meningitidis	7 days
Streptococcus pneumoniae	10-14 days
Haemophilus influenzae	10 days
Staphylococcus aureus	14 -28 days
Group B *streptococci* *L. monocytogenes* Gram negative organisms (e.g., *E. coli* and other coliforms)	21 days Longer duration in immunocompromised patients

- *If no organism is isolated on CSF C&S but LP is suggestive of bacterial meningitis and patient is responding, continue antibiotics for 14 days.*
- *Corticosteroids for patients > 3 months with probably meningitis (frankly purulent CSF, CSF white cell count > 1000 cells/μl, raised CSF white cells with protein more than 1 mg/dL, bacteria on Gram stain)*
- *Correct any electrolyte abnormalities.*
- *Do NOT restrict fluids or overhydrate. Give maintenance fluids.*
- *If there is no improvement after 48-72 hours, re-evaluate the patient.*
- *In suspected meningococcal meningitis high dose corticosteroids should NOT be used*
- *If immunocompromised consider TB meningitis or Cryptococcal meningitis*

3: SEPSIS

3. SEPSIS

<table>
<tr><th colspan="3">MTRH Empiric Antibiotic Guide: SUSPECTED SEPSIS IN ADULTS</th></tr>
<tr><td>Definition</td><td colspan="2">Sepsis is a life-threatening organ dysfunction caused by dysregulated host response to infection.</td></tr>
<tr><td>Recognition</td><td colspan="2">Sepsis: suspected infection PLUS qSOFA score ≥ 2 points

** targeted history and physical examination**

secure airway and breathing

<table>
<tr><th colspan="2">Quick Sepsis Related Organ failure Assessment (qSOFA) Clinical score in sepsis diagnosis</th></tr>
<tr><th>Assessment</th><th>qSOFA score</th></tr>
<tr><td>Low blood pressure (SBP < 100mmHg)</td><td>1</td></tr>
<tr><td>High respiratory rate (≥22 b/min)</td><td>1</td></tr>
<tr><td>Altered mentation (GCS≤ 14)</td><td>1</td></tr>
</table>

Septic shock can be identified with a clinical construct of sepsis with persisting hypotension, requiring vasopressor therapy to elevate MAP >65mmHg and lactate > 2 mmol /L despite adequate fluid resuscitation.</td></tr>
<tr><td rowspan="6">Initial management:

Sepsis Six</td><td>1.Oxygen</td><td>target sats >95% or 88-92% in patients with chronic lung disease</td></tr>
<tr><td>2. Blood cultures and lab works BEFORE antibiotics</td><td>Blood cultures, CBC, CRP/PCT, BGA with lactate, evaluate for end organ damage: renal function test, LFTs</td></tr>
<tr><td>3. Lactate</td><td>Venous blood gas/ serum lactate >2 mmol/L; >4 severe sepsis</td></tr>
<tr><td>4.IV Fluids</td><td>Bolus 30 mL/kg NS target MAP >65mmHg or systolic BP >100mmHg

If not at target, repeat; early critical care consult for inotropic support

** caution in cardiac patients and patients on dialysis: early senior review</td></tr>
<tr><td rowspan="3">5. Empiric antibiotics: within 1 hour from recognition.

*Do Not wait for Results

**Target suspected source where possible*</td><td>Identified site of infection: see appropriate section</td></tr>
<tr><td>a) Unidentified source community acquired infection:

Target organisms: strep/e. coli

IV Amoxiclav 1.2 g Q8hr

PLUS

IV Amikacin 15mg/kg/day</td></tr>
<tr><td>b) Unidentified source with high risk</td></tr>
</table>

		(comorbid medical conditions/immune suppressed/ elderly/ recent hospital contact or admission) or hospital acquired. Target organism: *E. coli/ strep/ Pseudomonas/ Klebsiella* **IV cefepime 2g TDS** **PLUS** **IV Amikacin 15 mg/kg/day**
	6. Monitoring	Recheck: vital signs/ fluid balance
		Review to identify possible source of infection
Reassess	• **Target MAP** >65mmHg, systolic BP >100mmHg, oxygen saturation > 95% • UOP> 0.5ml/kg/hr • Decreasing serum lactate • Improving level of consciousness	
Refer	Appropriate investigations and management: guided by suspected source. Admitting team/ critical care review	
• **Review cultures within 48hrs-72hrs and tailor antimicrobial therapy.** • **If no improvement noted:** review appropriate dosing/ source control/ nonbacterial cause of presentation/ Non-infectious cause. • **Repeat cultures and consult ID**		

MTRH Empiric Antibiotic Guide: SUSPECTED SEPSIS IN PAEDIATRICS	
Definition	The **Systemic inflammatory response syndrome** (SIRS) in the presence of suspected or proven infection constitutes sepsis. **SIRS combined with acute organ dysfunction = severe sepsis or septic shock**
SIRS	**SIRS requires ≥2 abnormal measure** of the following (one of which must be HR or RR, and the other must one of the following: temperature, WBC or % banding) • Core **temperature** >38.5°C (if axillary, < 37.9°C) **OR** <36°C (if axillary, 35.4°C) • **HR** abnormal (Tachycardia, or <1yr old, bradycardia) • **RR** abnormal for age or mechanical ventilation for an acute pulmonary process • **WBC** abnormal (Leukocyte count elevated or depressed for age), or >10 percent immature neutrophil (> 10% neutrophil banding) *(NOTE: refer below for normal refence ranges of vital signs, BP and WBC.)*
Recognition	A) **SIRS components AND 1 major organ dysfunction** • **Respiratory:** requires mechanical ventilation • **Cardiovascular:** • Blood pressure below 5th percentile of normal value for age **OR** • Vasoactive agents administered **OR** • Base excess < - 5 MEq/L **AND** at least one of the following: Lactate > 4 mmol/L or Cap refill > 3 sec **OR**

	B) **SIRS components AND 2 minor organ dysfunctions** • **Respiratory** (not mechanically ventilated) o > 2 SPO2 measurements < 90% OR o Requires supplemental oxygen with FIO2 > 50% to maintain oxygen saturation > 90% and < 94% (and has not received asthma and seizure medications within 2 hours) • **Hematologic** o Low platelet count (< 80,000/mm3) or decline in platelet count > 50% from the highest value in the past 3 days **OR** o PT > 18.5 sec **OR** o INR > 2.0 • **Renal** o Elevated creatinine (Age < 1 year: 106 mmol/L Age ≥1 year: 265 mmol/L **OR** o Creatinine increase ≥ 100% from baseline level • **Hepatic** o ALT: **Age ≤ 2 months** > 156 units/L; **Age ≥ 2 months** > 72 units/L OR o AST: **Age < 1 year** > 148 units/L; **Age 1-17 years** > 92 units/L NOTE: *The > 2 SIRS components AND organ dysfunction MUST occur within 24 hours of each other to meet the criteria for sepsis*		
	Focused History and physical examination, identify evidence of shock or sepsis -associated organ dysfunction. Majority of mortality in pediatric sepsis results from refractory shock and/or multiple organ dysfunction syndrome with many deaths occurring within the initial 48-72 hours of treatment. **Early identification and appropriate resuscitation and management** are critical to optimizing outcomes.		
Common Pathogens	Staph aureus, MRSA, Streptococcus pneumoniae, Streptococcus pyogenes, *Pseudomonas aeruginosa, Escherichia coli*, Enterococcus species, Klebsiella species Alpha streptococcus in children with acute myelogenous leukemia with mucositis and neutropenia		
Evaluation **Do NOT wait for results to start antibiotics**	Work up for infection	CBC	
		CRP/PCT	
		Blood culture	**Get Blood culture before starting antibiotics**
		Look for source	Urinalysis, Chest X Ray, abdominal ultrasound, LP, wound secretion, stool etc. if indicated
	Work up for organ dysfunction	RBS	Hypoglycemia occasionally stress hyperglycemia
		Lactate	• >2.0 mmol/L suggests hypoperfusion. • Initial blood lactate>3.5 mmol/L (31.5 mg/dL) in pediatric patients with septic shock
		Renal dysfunction BUN/ Serum creatinine	Serum creatinine ≥2 times upper limit of normal for age/ Twofold increase in baseline creatinine defines renal dysfunction
		Electrolyte	• Include Serum calcium/serum phosphorus and magnesium
		Liver dysfunction	• Total bilirubin ≥4 mg/dL or • alanine aminotransferase (ALT) >2 times upper limit of normal for age
		DIC	Elevation in PT and aPTT or INR, Decreased fibrinogen and increased D-dimer

Treatment

- **Secure airway and ensure breathing.**
- **Initiate IV fluids 10-20 ml/kg boluses to maximum of 40-60 ml/kg:**
  Fluid refractory shock: assess cardiac function, ICU consult, start vasoactive therapy early.
- **Treat hypoglycemia, hypercalcaemia**

Empiric antibiotics (Initiate within 1 hr)

**** review culture results within 48-72 hrs****

For suspected meningitis /UTI/pneumonia see relevant empiric guidelines

- Low risk: no comorbidities and no central line.
  IV Benzylpenicillin 50 000 I.U /kg/dose QID (max 4 MU/dose) **OR**
  IV Ampicillin 50 mg/kg/dose QID (max 8g/day)

  PLUS

  IV Gentamicin 5-7.5mg /kg/dose OD
  Duration 5 – 7 days

2. High risk

Central line, Immunocompromised, non-oncology, Receiving immunosuppressive Rx (other than chemotherapy), Recent hospitalization (> 4 days within 2 months), Long term care facility resident, hemodynamically unstable on vasoactive therapy and/ or ICU admission for shock.

Cefepime 50 mg/kg TDS (max 2g/dose)
PLUS
Amikacin 7.5mg/kg BD (max 1.5g/day) (if not in renal failure)
ADD
metronidazole 7.5mg/kg/dose TDS (max 500mg/dose) **if intraabdominal infection is suspected**

Reassess

- Assess work of breathing and sepsis specific parameters every 15 min: Mental status/ Capillary refill/ Pulse strength/ Extremity temperature Vital signs
- **Normal range /Target age-related vital signs** (*adapted from Sepsnski et al. 2014*)

Age	Heart Rate (corrected to 37° C)	RR (corrected to 37° C)	WBC count ($10mm^3$) excluding pt with SCD	Age	5th percentile SBP normal values
1 month - < 2 years	90-180	≤ 58	<5 or > 17	1 month- 1 year	70
2 -5 years	≤160	≤ 44	<6 or >15.5	1 -10 years	70 + (2 x Age)
6 - 12 years	≤140	≤ 38	< 4.5 or >13.5	> 10 years	90
13 -18 years	≤ 130	≤ 35	<4.5 or >11		

Temperature correction formulas	
HR (corrected to 37°C)	HR measured – 10 x [measured body temp - 37°C]
RR (corrected to 37°C)	RR measured – X multiplied by [measured body temp - 37°C] Where X = 7 for 0-2 years = 5 for other ages

MTRH Empiric Antibiotic Guide: Neonatal Sepsis

Early-onset sepsis (EOS): Neonatal infection <72 hours after birth.

Late-onset sepsis (LOS): Neonatal infection > 72 hours after birth

Risk factors

Red flag risk factor:

• Suspected or confirmed infection in another baby in the case of a multiple pregnancy.

Other risk factors:

- Invasive group B streptococcal (GBS) infection in a previous baby
- Maternal GBS colonization, bacteriuria or infection in the current pregnancy.
- Pre-term birth < 37 weeks' gestation.
- PPROM > 18 hours before birth.
- PROM > Confirmed at term for > 24 hours before the onset of labour.
- Intrapartum fever > 38°C
- Clinical diagnosis of chorioamnionitis.

Clinical indicators

Red flag clinical indicators:

- Apnoea (temporary stopping of breathing)
- Seizures
- Need for cardiopulmonary resuscitation.
- Need for mechanical ventilation.
- Signs of shock

Other clinical indicators

- **CNS:** lethargy, irritability, Signs of neonatal encephalopathy-Altered responsiveness, altered muscle tone, bulging fontanelle.
- **Respiratory:** tachypnoea, worsening respiratory distress, Hypoxia Persistent pulmonary hypertension of newborns
- **CVS:** • Signs of shock (tachycardia >180 beats/min, bradycardia <100 beats/min, hypotension (<-2 SD for age), capillary refill > 3 sec, mottled skin)
- **Abdomen:** distension, recurrent vomiting, bile-stained vomitus, Feeding difficulties, Feed intolerance and abdominal distension
- **Skin and subcutaneous:** petechial rash, sclerema.
- **Jaundice** within 24 hours of birth
- **Temperature instability** (core > 38°C or < 36°C)
- **Jaundice** within 24 hours of birth
- **Haematologic**: Unexplained excessive bleeding, thrombocytopenia, or abnormal coagulation

Any red flag risk factors
Or
2 non-red flag risk factors or Clinical indicator

1 non-red flag risk factor or non-red flag clinical indicator

No red flags, risk factors or clinical indicators
No laboratory evidence of possible infection

Take a complete history and examination and Perform investigation.

Early-onset sepsis

- Full blood count
- Blood culture
- CRP /Procalcitonin
- Lumbar puncture (LP) if clinical features of meningitis are present or blood culture is positive.

Late-onset sepsis

- Same as early onset sepsis PLUS
- LP
- Chest or abdominal x-ray if indicated.
- Do not routinely perform urine microscopy or culture.

Do not routinely give antibiotics treatment.
Monitor vital signs and clinical condition counsel on danger sign

Start empiric antibiotics.
Benzyl penicillin (a. pen) and an aminoglycoside (Gentamicin)
For renal failure– use cefotaxime instead of gentamicin.
** For necrotizing enterocolitis is include metronidazole
** Follow culture results within 48-72 hrs and adjust tailor the antimicrobials**

DIAGNOSIS

Table 1: Positive / Expected laboratory results in sepsis.

Test	Abnormal parameter	
Glucose	> 10 mmol/L or < 2.6 mmol/L	CSF findings varies according to gestational and chronological age, birth weight.
Base excess	> -10 mmol/L	• WBC of > 30 cells/μL • Protein of >150 mg/dL in preterm >100 mg/dL in term infants • Glucose < 1.7 mmol/L in a term infant or < 1.1 mmol/L in a preterm infant o The ratio of CSF to serum glucose is not useful in acutely ill neonates. • Neonates with culture-proven meningitis can have negative Gram-stained smears if the concentration of organisms in the CSF is low
Lactate	>2 mmol/L	
White blood cell	WBC > 20-29 000 x10^9/L or < 4 000 x10^9/L	
Platelet	< 150 000 x10^9/L	
CRP	> 10 mg/L	
Procalcitonin	0.5 μg/L	
Blood culture	Positive	

Repeat tests (Investigations during antibiotic treatment)

- Repeat CBC, CRP and PCT after 24 - 48 hours to assess response to treatment or pick up delayed changes.
- Repeat LP in 72 hours to exclude or confirm meningitis if the CSF was a bloody tap with a high white cell count. Or the baby was too unstable initially for an LP
- A blood culture should be repeated:
  - Prior to the commencement/addition of a new antibiotic(s).
  - The baby has a positive blood culture.
  - The baby does not respond satisfactorily to antibiotic treatment
  - The initial culture was negative and there is a strong clinical suspicion of infection or there are clinical symptoms or signs suggesting meningitis.

NB: If the baby fails to respond to above antibiotics, consider:

- Do multidisciplinary discussion including ID.
- Review clinical presentation.
- Ensure correct dosing.
- Look for a source (investigate for a focus- Do echocardiography, renal and cranial ultrasound.)
- **Source control** in settings of abscess
- Look for non- bacterial cause of the presentation

When to stop antibiotics

Baby on Empiric antibiotics

- Review 48 hours after staring treatment.
- Call the laboratory for interim blood culture results.

Culture negative

Stop antibiotics if:

- Initial clinical suspicion of infection was not strong, **and**
- Reassuring the baby's clinical condition with no clinical indicators of possible infection, **and**
- The levels and trends of CRP reassuring

Culture positive

- Change to targeted treatment based on the blood culture results.
- Repeat the culture after 72 of appropriate antibiotic depending on sensitivity results.

Repeat culture is again positive,

- Check if the drug is correct and appropriate dose.
- Repeat a culture.
- Evaluation every 48 to 72 hours until culture is negative.
- For cultures which remain positive despite adequate appropriate therapy
  - Investigate for a focus.
  - (Do echocardiography, renal, and cranial ultrasound.)

Repeat culture is negative.

- Complete at least 5- 7 days of treatment depending on the initial organism.

Continue antibiotics > than 7 days if:

- The baby has not yet fully recovered
- Pathogen identified on blood culture require longer duration (for example, Gram-negative bacteria -14 days or MRSA (14 days)
- Site of infection requires longer treatment e.g. meningitis (21 days), osteomyelitis (4-6 weeks)

Differentiating true CoNS infection from contamination is challenging.

- CoNs contaminants and sepsis is rarely fulminant, occurring almost exclusively in ELBW infants.
- Two positive blood cultures done within 72 hours of each other are required for treatment initiation.
- If infant is not improving clinically, a CoNS can also be considered to be a true infection, especially with a central line.
- Discuss with AMS
- Vancomycin remains the drug of choice for proven infections.

DOSING REGIMEN FOR NEONATES			
Drug	<1 kg	1-2 kg	>2 kg
Amikacin	PNA 15-28 days – 15 mg/kg/dose every 24-48 hours	PNA <7 days 15 mg/kg/d every 48 hours PNA 8-28 days 15 mg/kg/d every 24-48 hours	<8 days – 15 mg/kg/d every 24 hours 8-28 days- 15 mg/kg/d every 12-24 hours
Amoxicillin	20–50 mg/kg/day po 12 hourly		
Ampicillin	PNA 15-28 days: 50 mg/kg/dose every 8 hrs. For meningitis, Group B Streptococcal PNA >7 days: 50-75 mg/kg/dose iv 6 hrly	PNA 8-28 days: 50 mg/kg/dose every 8 hrs.	PNA: 8-28 days: 50 mg every 6 hrs.
Cefepime	PNA 0-14 days: 50 mg/kg/dose every 12 hrs., iv	PNA 0-7 days: 50 mg/kg/dose every 12 hrs. iv	50 mg/kg/dose every 8 hrs. iv
Cefotaxime	PNA 15-28 days: 50 mg/kg/dose every 8-12 hrs., iv/im hrs., iv/im For meningitis PNA >7 days: 150-200 mg/kg/day divided every 6-8 hrs., iv	PNA 8-28 days: 50 mg/kg/dose every 8-12	PNA: 8-28 days: 50 mg/kg/dose every 6-8 hrs., iv/im
Ceftazidime	PNA 15-28 days: 50 mg/kg/dose every 8 hrs-12, iv/ im For meningitis, PNA >7 days: 150 mg/kg/day divided every 8 hrs.	PNA 8-28 days: 50 mg/kg/dose every 8-12 hrs., iv/im	PNA: 8-28 days: 50 mg/kg/dose every 8 hrs., iv/im
Ciprofloxacin	For severe infection, usually due to multidrug resistant organisms 10 mg/kg/dose every 12 hrs		
Clindamycin	PNA 15-28 days: 5 mg/kg/dose every 8 hrs-12,	PNA 8-28 days: 5 mg/kg/dose every 8-12 hrs.,	PNA: 8-28 days: 5 mg/kg/dose every 6 hrs., iv/im
Colistimethate (Colistin)	IV/IM: Colistin base – 2.5-5 mg/kg/day or 75 000 – 150 000 units/kg/day divided every 6-12 hrs.		

Gentamicin	PNA 15-28 days – 4-5 mg/kg/dose every 24-48 hours	PNA 8-28 days – 4-5 mg/kg/dose every 24-48 hours iv	8-28 days- 4 mg/kg/dose every 12-24 hours iv
Meropenem	PNA 15-28 days – 20 mg-40 mg/kg/dose IV every 8 hours PNA 8-28 days – 20 mg-40 mg /kg/dose IV every 8 hourly	For body weight 1-2 kg	20 mg-40 mg /kg/dose IV every 8 hrs.
Metronidazole	PNA 15-28 days – 15 mg/kg/dose IV every 24 hours	PNA 8-28 days – 15 mg/kg/dose iv every 24 hours	<8 days – 15 mg/kg/dose iv, every 24 hrs. 8-28 days- 15 mg/kg/dose iv, every 12 hrs.
Oxacillin	PNA 15-28 days – 25 mg/kg/dose Iv/IM every 8 hours	PNA 8-28 days – 25 mg/kg/dose iv/im every 8 hours	<8 days –25 mg/kg/dose iv/im, every 8 hrs. 8-28 days- 25 mg/kg/dose iv, every 12 hrs.
Penicillin G (Aqueous) Xpen	PNA 15-28 days – 50, 000 units/kg/dose IV every 8 hrs.	PNA 8-28 days – 50, 000 units/kg/dose iv every 6 hrs.	PNA 8-28 days – 50, 000 units/kg/dose iv every 6 hrs.
Vancomycin	PNA <7 days <1200 g: 15 mg/kg/dose every 24 hrs. <1200 g: 15 mg/kg/dose every 24 hrs.	PNA <7 days 1200-2000 g: 10-15 mg/kg/dose every 12-18 hrs. 1200-2000 g: 10-15 mg/kg/dose every 8-12 hrs.	PNA <7 days 10-15 mg/kg/dose every 8-12 hrs. 10-15 mg/kg/dose every 6-8 hrs.

THERAPEUTIC MONITORING

- A process of measuring the concentration of a drug in the bloodstream
  - To avoid excessive levels causing adverse effects (Trough levels)
  - To ensure adequate levels for therapeutic effect.
- Trough levels – done if aminoglycosides and vancomycin will be administered for more than 2–3 days.
  - For gentamicin trough level - taken 30 hours after the first dose (i.e., before the 3rd dose
- Peak concentrations -Consider peak blood gentamicin concentrations in selected babies, such as in those with oedema, macrosomia (birthweight more than 4.5 kg), an unsatisfactory response to treatment.
- Acceptable levels:
  - Vancomycin: Peak 20 - 40 µg/mL Trough 5-10 µg/mL
  - Gentamicin: Peak 6 - 12 µg/mL Trough < 2 µg/mL
  - Amikacin: Peak 20 - 30 µg/mL Trough < 5 µg/ml
- Do not withhold a dose of antibiotics because of delays in getting a trough concentration measurement, except where there is evidence of impaired renal function.

4: CATHETER RELATED BLOODSTREAM INFECTION

4. CATHETER RELATED BLOODSTREAM INFECTIONS

MTRH Empiric antimicrobial guidelines: CATHETER RELATED BLOODSTREAM INFECTIONS	
Definition	Presence of blood stream infection in a patient with a central line or hemodialysis catheter
Recognition	• Haemodialysis catheter/ central line/PICC line/ umbilical catheters • + signs of infection: fevers/rigors/chills/pus from exit site • No alternative site of infection *** Thorough History and physical exam to evaluate potential source and/or complications
Evaluation	**Two Sets of Blood cultures BEFORE antibiotics:** • Paired blood cultures drawn from **both catheters & peripheral vein.** • If blood cultures cannot be drawn from peripheral vein, it is recommended that two or more blood cultures should be drawn through different catheter lumen. Most common causative agents are **gram positive organisms**: *S. aureus*/CoNS
	Other lab work: CBC/ CRP/PCT Echo if *Staphylococcus aureus*
Empiric antibiotics	Adult: **IV Piperacillin-tazobactam 4.5g QID + IV vancomycin 15-20 mg/kg/dose BD or TDS.** Children: **IV Piperacillin-tazobactam 100 mg/kg** (piperacillin component) **QID** (max piptazo 18g/day) + **IV vancomycin 15-20 mg/kg/dose** (max 3600 mg/day) **TDS or QID**. * Adjust doses in renal failure *Follow through levels for vanc if possible (consult pharmacist) ** **Review cultures and tailor antimicrobial therapy within 48hrs (Consult ID/AMS if needed)** ***For CONS, need to decide whether isolates from blood culture is colonizer or true pathogen**
Catheter management	**Remove catheter if:** temporary catheter or complicated CRBSI i.e. • sepsis or septic shock • hemodynamic instability • evidence of infection at tunnel or at exit site, • suppurative thrombophlebitis • endocarditis • Cultures grow staph aureus or MDR organisms (e.g., *S. aureus, Ps. aeruginosa*, mycobacterium or fungi) • persistent bacteraemia 48 hrs. after tailored antibiotics or longer to which the infecting organism is susceptible.

	• metastatic infection: new murmur/ osteomyelitis ** Catheter break for at least 48 hrs. before a new one. *** If there is urgent indication for dialysis (hyperkalemia/ pulmonary edema) use the infected catheter.
	Exchange catheter: Complicated CRBSI with limited vascular access. • Afebrile for 48-72 hrs. after tailored antimicrobial therapy. • Hemodynamically stable • No evidence of tunnel or exit site infection. • Consult ID in case of S. aureus (High risk of treatment failure) Attempts at catheter salvage are only recommended in uncomplicated CRBSI or CLABSI caused by bacteria that are neither too virulent nor too difficult to eradicate
Review	Review for improvement: resolution of fevers/ no hemodynamic instability. **Review cultures drawn in 48 hrs. and adjust antibiotics appropriately.** If Negative cultures and no improvement within 48hrs: **2nd line** Adult: **IV meropenem 1g TDS** + IV vancomycin 15-20 mg/kg/dose BD or TDS. Children: **IV meropenem 20–40 mg/kg/dose** (max 2g/dose) **TDS + IV vancomycin 15-20 mg/kg/dose** (max 3600 mg/day) **TDS or QID.** Adjust dose in renal impairment. ** follow through levels for vancomycin (if possible): consult a pharmacist • ***Vancomycin- Heparin Lock therapy: 2.5 mg/mL vancomycin 500 units/mL heparin For any patient with fungal (i.e., candida) bacteremia, consult ID/AMS team
Duration of treatment	**Uncomplicated**: 2-3 weeks of tailored antibiotics **Complicated**: 6 – 8 weeks of tailored antibiotics * Duration is from **first negative culture/ clearance of bacteraemia**** ** *Staphylococcus aureus* bacteremia: 4 weeks of antibiotics (the first 2 weeks of IV antibiotic) ** *If conservative therapy fails in *S. aureus* suppurative thrombophlebitis Surgical resection of involved vein may be considered
Prevention	• Infection prevention strategies (hand hygiene/adequate skin prep/ barrier precautions/aseptic techniques/change dressings when indicated. • Discourage femoral catheters where possible. • Remove unnecessary lines

5: UPPER RESPIRATORY TRACT INFECTION

5. UPPER RESPIRATORY TRACT INFECTION

MTRH Empiric Antibiotic Guide: UPPER RESPIRATORY TRACT INFECTION	
Definition	Upper respiratory tract infections can be defined as self-limited irritation and swelling of the upper airways with associated cough and no signs of pneumonia, in a patient with no other condition that would account for their symptoms, or with no history of chronic obstructive pulmonary disease, emphysema, or chronic bronchitis. Upper respiratory tract infections involve the nose, sinuses, pharynx, larynx, and large airways. Pharyngitis: The inflammation of Pharynx (Sore throat). Clinical findings: Sore throat (often worse when swallowing) with a usual duration of 1 week, Common cold, Pain and discomfort at the back of the throat, Painful swallowing, Enlarged Lymph Nodes, Pyrexia. Associated cough, rhinorrhea, hoarseness and/oral ulcers suggest viral etiology. Acute rhinosinusitis: The inflammation of nasal and sinus mucosal membrane. Clinical findings: Nasal obstruction, Nasal discharge, Facial pain, Anosmia/hyposmia, cough, fever, halitosis, headache, pharyngitis (lasts approx. 1 to 33 days) Common cold: a common viral infection of the nose and throat caused by different viruses. Clinical findings: sneezing, rhinorrhea, sore throat, cough, low grade fever, headache and malaise that lasts up to 14 days. Acute Otitis Media: is acute inflammation or an infection of the air-filled space behind the eardrum (middle ear). Clinical Findings: Ear pain, Ear discharge, Fever, Hearing Loss, Red ear drum/ TM Chronic Suppurative Otitis Media: Long standing infection of the middle ear with mastoid air cells. Clinical findings: Hearing loss, Otorrhea, Low pitched tinnitus. Peritonsillitis or Tonsillar Abscess: Is the collection of the pus between tonsil capsule and superior constrictor muscles. Clinical findings: General: fever, chills, rigors, GBM, body aches Local: Throat ache. Odynophagia, Hot potato voice/muffled and thick speech, Halitosis. Laryngitis: an inflammation of the voice box from overuse, irritation or infection, Inhalation/ ingestion of corrosive substances. Clinical Findings: Hoarseness of the voice, Voice loss, Dry irritative cough Evidence has consistently shown that antibiotics are NOT effective for MOST respiratory tract infections in adults and children and complications are likely to be rare if antibiotics are withheld. GOAL: To reduce the antibiotic prescription for respiratory tract infections.

Empiric Antibiotic Therapy

ORGANISM	ANTIBIOTIC	ALTERNATIVE THERAPY	COMMENTS
• Pharyngitis/ Tonsillitis			
Viral causes: > 70% Non-viral causes :<15% include: *group A beta hemolytic streptococc* (GAS) (most common) and *group C and G streptococci*	Antibiotics are NOT indicated. • unless clinical signs of strep infection (Use centor score below) • OR if severe and young age <2yrs		• Supportive therapy indicated. antipyretics and analgesic • Associate cough, rhinorrhea, hoarseness and/or oral ulcer suggest viral infection. • Point of care Respiratory panel can be used to diagnose GAS pharyngitis.
	Adult **PO Amoxicillin 500mg** BD for 10 days	**PO Azithromycin 500 mg OD** for 5 days	
	Children • **Mild/ moderate: PO Amoxicillin 20-30mg/kg/dose mg/ kg/day (max 1g/day) BD** for 10 days • **Severe: PO Amoxicillin 45 mg/kg/dose** (max 3g/day) BD for 10 days	**PO Azithromycin 12 mg/kg/day** (max 500mg/dose) **OD** for 5 days	**Complications of Group A Streptococcus pharyngitis include:** 1). Acute rheumatic fever- follows Group A S. pyogenes infection and is rare after Group C/G infection. The rational of therapy is to eradicate GAS and prevent ARF. 2). Post streptococcal glomerulonephritis in children < 7 years old. 3). Peritonsillar abscess and suppurative phlebitis 4). Pediatric autoimmune neuropsychiatric disorder (PANDAS)

After consideration of strep pharyngitis mimics and deciding that GAS is a likely cause, use Modified centor criteria to determine the utility of rapid streptococcal antigen testing and empiric treatment of symptoms OR rapid strep test if available.

Modified Centor Criteria (mclsaac)	Score
Fever ">38°C	1
Tonsillar exudate	1
Absence of cough (as a cough is more likely associated with viral infection)	1
Anterior cervical LAD	1

Age 3 - 14 years	1
Age 15 - 44 years	0
Age > 44 years	1

Modified Centor Criteria Score	Gas Infection Risk (%)	AAP/IDSA	CDC/ACp/AAFP
0	1 - 2.5	No test/Treatment	No test/Treatment
1	5 - 10	No test/Treatment	No test/Treatment
2	11 -17	Rapid antigen test	Rapid antigen test
3	28 – 35	Rapid antigen test	Test or treat empirically
4	51 – 53	Rapid antigen test	Test or treat empirically

• Peritonsillitis or Tonsillar Abscess

The collection of pus between tonsil capsule and superior constrictor muscles

Fusobacterium necrophorum (44%) *Group A streptococci (33%)* *C/G Streptococci* *Streptococcus anginosus group*	Adult **IV co-amoxiclav 1.2g TID** for 10 days	**IV Clindamycin 600mg TDS** for 10 days	• Sometimes a serious complication of exudative pharyngitis. • Surgical drainage is required in treatment. • **Admit** and **refer to ENT. Specialist** • **Step down to ORAL antibiotics once able** tolerate to complete 10 days. • *Fusobacterium is* resistant to macrolides hence **macrolides are NOT recommended.**
	Children **IV co-amoxiclav 30 mg/kg/dose** (amoxicillin component; max 500mg) **TID** for 10 days	**IV Clindamycin 15 mg/kg/dose (max 600mg/dose) TDS** for 10 days	

• Acute rhinosinusitis (< 4 weeks)

Most causes are viruses, allergies or irritants. (>98%) Non-viral causes (<2%) *S. Pneumoniae, H. influenza, S. pyogenes,*	**Antibiotics NOT indicated unless** S & S of bacterial infection present.		Signs & Symptoms of presence of bacterial infection. • symptoms are >10d, • **severe symptoms or signs** of high fever (>39°C) and • purulent nasal discharge or facial pain lasts >3 consecutive days or • onset of worsening of symptoms following a typical viral illness lasts that lasted 5 days that was
	Adults Po Amoxicillin 500mg TDS for 5 days	Po Doxycycline 100mg BD for 5-7 days	
	Children **Mild/ moderate: Po co-amoxiclav 40 mg/kg/dose**		

Moraxella catarrhalis & *Anaerobic bacteria* Some other streptococcal species	(amoxicillin component max 500 mg/dose) **BD** for 10-14 days **Severe:** **Po co-amoxiclav 45mg/kg/dose** (amoxicillin component; max 875 mg/dose) **BD** for 10-14 days	**Po Cefuroxime 15mg/kg/dose** (max 1g/day) BD for 10-14 days	initially improving (double sickening) • If there is no improvement after 3 days of antibiotic, refer ENT. • Refer to an ENT specialist for chronic rhinosinusitis (> 4 weeks). Antibiotics are usually not effective. Treat acute exacerbation as acute rhinosinusitis
• Common cold			
All causes are viral.	**Antibiotics are NOT indicted**		
• Acute Otitis Media			
Bacterial pathogens account for **85%** of middle ear infections. *S. pneumoniae (49%)* *H. influenzae* *M. catarrhalis* Virus causes up to **6 %** of middle ear infections **In children 6 months -3 years, there may be 2 episodes of AOM** per year and 63% are caused by viruses	*No prior antibiotics in the prior month use amoxicillin if prior antibiotics use amoxiclav.* Adult **1st line** **PO amoxicillin 1g TDS** for 10-days days (high dose) 2nd line **PO co-amoxiclav 1g PO BD** for 10 days Children **1st line** **PO Co-amoxiclav 45mg/kg/dose**	**PO cefuroxime 500mg BD** for 7 days **PO cefuroxime 15 mg/kg/dose** (max 1g/day) **BD** for	• For **all ear problems, swab first** if there is a discharge for C & S testing. • No role for topical antibiotics • If complicate or immunocompromised IV antibiotics should be used • **Non-severe AOM:**(> 2 years) • Mild otalgia • Temp <39°C • negative or questionable exam Consider analgesic treatment without antimicrobials. There may be favourable results in mostly afebrile patients with waiting for 48 hours before deciding to use antibiotics. • Treat children < 2 years. • For severe disease duration of treatment is unclear but 5 days may be inadequate. • **Pead's**: Persistent middle ear effusion for 2-3 months after therapy is expected and does not require retreatment.

	(Amoxicillin content; max 875md/dose) BD for < 2 years: 10 day > 2 year: 7 days	< 2 years: 10 day > 2 year: 7 days	
Chronic Suppurative Otitis Media (CSOM)			
Aerobic *P. aeruginosa; E.coli; S.aureus; S. pyogenes; proteus mirabilis; klebsiella sp.* **Anaerobic** *Bacteroides; Peptostreptococcus ; Propionibacterium*	Adult **Ciprofloxacin 0.3% drops 3-4 drops TID** until dry for 14 days. Dry mopping before applying drops.	Acetic acid Boric acid 3% Hydrogen peroxide	• **Refer to ENT Specialist** • Aural toilet is essential part of treatment of CSOM in all patients. • C& S should be done for persistent discharge. **Caution on using potentially ototoxic ear drops e.g.,** Gentamicin +/- oral Antibiotics for acute exacerbation
• **Laryngitis**			
Viruses	Antibiotics NOT indicated		

6: GASTROINTESTINAL INFECTIONS

6. GASTROINTESTINAL INFECTIONS

MTRH Empiric Antibiotic Guide: GASTROINTESTINAL INFECTIONS		
ACUTE DIARRHEA AND GASTROENTERITIS		
Definition	• Frequent loose watery stool (> 3 episodes /24hrs) with or without vomiting	
	• Should not be treated empirically with antibiotics except in the presence of dysentery (bloody, mucoid stool) • Non - bloody infectious diarrhea is generally caused by viruses. • Timely supportive care and rehydration is essential (for paediatrics refer to the national paediatric protocol.	
Investigations	• Send stool sample for microscopy, culture and sensitivity prior to starting antibiotics. • Blood culture in systemic illness	
A) DIARRHEA AND GASTROENTERITIS IN CHILDREN		
Definition	Acute diarrhea is diarrhea lasting less than 14 days. Mainstay of therapy is to give **fluids, zinc supplements and food**. (Refer to KENYA PEADIATRIC PROTOCOL for dehydration classification and management)	
Etiology by age	< 12 months: Rotavirus, Enterotoxigenic *Escherichia coli* (ETEC), *Cryptosporidium* 12-23 months: Rotavirus, ETEC, *Shigella* 24- 59 months: Rotavirus, *Shigella*, *Vibrio cholerae*	
Infection/ Condition & Likely Organism	**Antibiotic choice**	**Comments**
Acute gastroenteritis		
Usually acute GE is caused by viruses **e.g.**, rotavirus	Antibiotics NOT recommended	Oral rehydration is the cornerstone of treatment. Antibiotic therapy may prolong carriage state of salmonellosis. Refer to **Pead's** protocol for management of dehydration.
Dysentery (bloody diarrhea) Mostly caused by *Shigella*, *Campylobacter*, *E. coli*, *Salmonella*, *E. histolytica*		

Mild or uncomplicated	PO cefixime 10mg/kg/dose BD (max 400mg) PLUS PO Metronidazole 10/kg/dose (max 500mg) TDS	**Adjust antibiotics once C&S results are known.** Duration of antibiotics: • Non-*Salmonella* infection: 5 days • Uncomplicated *Salmonella* infection: 7 days • Complicated *Salmonella infection*: 14 days **Avoid Fluoroquinolones whenever possible**: associated with arthropathy, hypoglycemia & neuropsychiatric symptoms
Severe illness (hospitalization, invasive or other complications) or immunocompromised patients	IV ceftriaxone 50-75 mg/kg/day (max 2g/dose) OD PLUS IV metronidazole 15mg/Kg/dose (max 500mg/dose) TDS for 5 days	
Suspected Cholera		
Suspected Cholera (Causative organism *Vibrio cholerae*)	**REHYDRATION (Oral or IV) is the cornerstone of treatment.** PO Azithromycin 20 mg/kg/day OD (max. 1gm)	• Prompt initiation of antibiotic therapy reduces the volume & duration of diarrhea. • Antimicrobials should be considered for people who are moderately to severely ill. Fluoroquinolones are not approved for children younger than 18 years old for this indication.
Antibiotic associated (C.diff) colitis (also known as Pseudomembranous colitis)		
Suspected antibiotic -associated colitis presenting as severe disease or with prolonged symptoms. *Clostridioides difficile* (formerly *clostridium difficile*)-induced diarrhea)	IV metronidazole 30mg/kg/day (max 500mg/dose) div QID for 10-14 days OR Po vancomycin 40 mg/kg/day (max 1g/dose) div QID for 10-14 days NOTE: Vancomycin is given orally NOT IV. Consult a pharmacist for extemporaneous preparation.	• Mild cases of antibiotic associated colitis do NOT warrant antibiotic treatment since symptoms resolve within 7-10 days after discontinuation of precipitating antibiotics. • Probiotic therapy in children with *C. difficile* diarrhea has not been well studied.
B) GASTROENTERITIS (INFECTIOUS DIARRHEA) IN ADULTS		
Mild Diarrhea	Oral Hydration	

(< 3 uninformed stools/day; minimal associated symptomatology)		• Most community-acquired diarrhea is viral in origin (norovirus, rotavirus, and adenovirus). • Antibiotic therapy does **NOT** shorten the duration of symptoms, therefore should be discouraged.
Moderate Diarrhea (3-4 unformed stools/day; with or without systemic symptoms)	Oral or Parenteral Hydration	
Severe Diarrhea (>6 unformed stools/day; +/- fever, tenesmus, blood or fecal leukocytes) Bacterial: *Shigella sp., Salmonella sp.,* *C. jejuni, C. difficile* (toxin positive) *E. coli* (enterotoxigenic, enteroaggregative, Shiga toxin producing) *K. oxytoca*(Toxin producer) Parasitic: *Giardia lamblia, E. histolytica, Cryptosporidium*	Empiric therapy: **IV Ciprofloxacin 400 mg BD** PLUS **IV Metronidazole 500 mg TDS**	• Send stool MCS early and de-escalate therapy as per results. • Switch to oral meds once patient can tolerate. **Duration of treatment:** • Non-*Salmonella* infection: **5 days** • Uncomplicated *Salmonella* infection: **7 days** • Complicated *Salmonella infection:* **14 days** If ***E. histolytica*** is isolated, to eradicate cysts and prevent relapse after acute treatment, consider adding: • Po Aminosidine 500 mg TDS for 7 days
Suspected Cholera		
Causative organism *Vibrio cholerae*	**PO Azithromycin 1g single dose** OR **PO Ciprofloxacin 500mg BD** for 3 days	• Antibiotic in *vibrio cholerae* is to reduce the shedding time
Antibiotic associated (C.diff)colitis		
Definition	• >3 watery stools per day • occurs a few hours up to 2 months after antibiotic intake. • with no other plausible explanation of the diarrhea	
Risk factors	Prolonged use of broad-spectrum antibiotics; Age over 65 years; Recent antibiotic intake (amoxicillin & Ampicillin, Cephalosporins, Clindamycin); Hospitalization; Comorbidities; Proton Pump Inhibitors intake; Recent *C. difficile* infection.	
Causative organism	***Clostridioides difficile*** (formerly *clostridium difficile*-induced diarrhea)	

	(Spore forming, Toxin producing, Gram -positive anaerobic bacterium)		
	Preferred	**Alternative**	
Initial (Non-severe)	**PO Vancomycin 125 mg QID** for 10 days	**PO Metronidazole 400 mg TDS** for 10 days	**Discontinue** therapy with inciting antibiotic agent as soon as **possible as may influence risk of** CDI recurrence.
Initial (Severe)	**PO Vancomycin 125 mg QID** for 10 days	**IV Metronidazole 500mg IV TDS** PLUS **PO Vancomycin 125 mg** QID for 10 days	Symptoms to indicate severe colitis: •WCC >15 x 109 •Creatinine 50% increase from baseline •Temperature > 38.5OC • Evidence of severe colitis (abdominal signs; radiography). **Oral vancomycin is compounded from the IV formulation: Consult a pharmacist**

OTHER COMMENTS

- *In patients with advanced HIV disease consider CMV colitis*
- *For HIV infected patient consider cryptosporidium and start Aminosidine*
- *For organisms like typhoid/cholera the patient should be isolated with contact precautions until eradication of the organism from stool is confirmed.*
- *There is no robust data to support the use of probiotics.*
- *Prevention and treatment of dehydration and hypovolemic shock is essential. For children refer to the pediatric protocol for rehydration regimen.*

7: INTRA-ABDOMINAL INFECTIONS

7. INTRA-ABDOMINAL INFECTIONS

MTRH Empiric Antibiotic Guide: INTRA-ABDOMINAL INFECTIONS				
Definition	Intra-abdominal infections (IAI) describe a diverse set of diseases. It is broadly defined as peritoneal inflammation in response to microorganisms, resulting in purulence in the peritoneal cavity.			
Diagnostic tests:	1. Clinical features Hypotension or low MAPs, PR> 100 bpm; RR > 22 bpm; altered mental status; urine output <30mL /kg/hour. 2. Lab investigations WBC > 120,000; Lactate > 2; elevated CRP/Procalcitonin; deranged BGA 3. Imaging Ultrasound, X-ray, CT–scan abdomen			
	Management of IAI requires resuscitation, source control, and antibacterial treatment. The MOST important of these factors is source control. There are three key components of source control: drainage, debridement, and definitive management.			
Empiric antimicrobials	**ORGANISM**	**ANTIBIOTIC**	**ALTERNATIVE THERAPY**	**COMMENTS**
	PRIMARY SPONTANEOUS BACTERIAL PERITONITIS (PSBP)			
	ADULTS *Enterobacteriaceae (e.g.: E. coli, K. pneumoniae, and Streotococcus sp.)* *Enterococcus spp.* *Anaerobes*	**IV Ceftriaxone 1gm BD** for 5 days **OR** **IV Cefotaxime 2g QID** for 5 days	**IV co-amoxiclav 1.2gm TDS** for 5 days	• Perform analysis (e.g. bleeding parameters) Gram stain and culture of peritoneal fluid to distinguish primary from secondary peritonitis. • Start antimicrobials as soon as possible. Generally managed medically. Do surgical consult. • Ceftriaxone may cause bile sludge in patients with jaundice or cirrhosis. It should be avoided in liver impairment. • Maintain fluid and electrolyte balance. • Consider repeat paracentesis >48 hours after therapy if no clinical improvement, or unusual organism. Change antibiotics if PMN count has not declined by 25% • If blood culture is positive (bacteremia) treat for 2 weeks
	Children *S. Pneumoniae (most common)* *E. coli* *Staphylococci* *Group A strep.* *Enterococci* *K. pneumoniae*	**IV Cefotaxime 50 mg/kg/dose** (max 2g/dose) **QID** for 5 days OR **IV Ceftriaxone 50 mg/kg/dose** (max 2g/dose) **BD** for 5 days		

<table>
<tr><th colspan="4">SECONDARY BACTERIAL PERITONITIS- Perforated viscus/penetrating intra-abdominal trauma</th></tr>
<tr><td>Usually, polymicrobial consisting of anaerobes and facultative Gram-negative bacilli: Bacteroides fragilis group, Peptostreptococcus, E. coli, Klebsiella, Ps. aeruginosa, Enterococcus</td><td colspan="2">Adult
IV Piperacillin/tazobactam 300 mg/kg/day TDS

Children
IV Piperacillin/tazobactam 300mg/kg/day (max 16g/day) TDS/QID for 7- 14 days</td><td>• Patients may require either immediate surgery to control the source of contamination and to remove the necrotic tissue, blood and intestinal content from the peritoneal cavity.
OR
• Drainage procedure if a limited number of large abscesses can be shown.</td></tr>
<tr><th colspan="4">CHOLECYSTITIS AND CHOLANGITIS</th></tr>
<tr><td rowspan="3">Community acquired.
Common organisms Enterobacteriaceae is the commonest organism (>50%)

Bacteroides only comprise 4-20% of biliary infection.</td><td>Adult
IV co amoxiclav 1.2 g TDS for 4-7 days</td><td>IV Ceftriaxone 1 gm BD
PLUS/MINUS
IV Metronidazole 500mg TDS
for 4-7 days
(if biliary enteric anastomosis/ obstruction is present)</td><td rowspan="3">• Appropriate source control to drain infected foci and restoration of anatomic and physiological function is recommended for all patients, as antibiotics will not enter bile duct in the presence of obstruction. Obtain surgical consult.

• Anti-anaerobic therapy is NOT indicated unless there is biliary obstruction or biliary enteric anastomosis.

• Convert to oral antibiotics on clinical improvement.</td></tr>
<tr><td>Children
IV Cefotaxime 200mg - 300mg/kg/day IV QID (max. 2gm/dose)

PLUS

IV Metronidazole 22.5-40 mg/kg/day TDS (max. 4gm/day) for 5-7 days with adequate source control</td><td>IV Ceftriaxone 100 mg/kg/day in OD/BD (max. 2gm/dose; 4gm/day)

PLUS

IV Metronidazole 22.5-40 mg/kg/day TDS (max. 4gm/day) for 5-7 days with adequate source control</td></tr>
<tr><td>Hospital acquired</td><td colspan="2">Adult</td></tr>
</table>

	IV Piperacillin/tazobactam 4.5gm QID for 5-7 days with adequate source control		
	Children **IV Piperacillin/tazobactam 300mg/kg/day** (max 16g/day) QID for 5-7 days with adequate source control		
ACUTE PANCREATITIS			
Mild to moderate	Antibiotic therapy or prophylaxis is not recommended		**CT severity index** is a reliable indicator of severity. In severe pancreatitis there is more than 30% necrosis with increased risk of infection • In the absence of CT, CRP > 150 mg/dL or persistent fever may be suspected of having infected severe pancreatitis. • **CT guided percutaneous aspiration** is recommended when infected necrosis is suspected. • **Treatment choice** in infected necrosis is **surgical debridement**. Specimens should be sent for Gram stain and C&S.
Severe acute pancreatitis with necrosis	Adult **IV Piperacillin/tazobactam 4.5g TDS** for 5-7 days with adequate source control	**IV Ceftazidime 2g TDS** PLUS **IV metronidazole 500 mg TDS** for 5-7 days with adequate source control	
	IV Piperacillin/tazobactam 300mg/kg/day (max 16g/day) QID for 5-7 days with adequate source control	**IV Ceftazidime 200mg - 300mg/kg/day div TDS** (max 12g/day) PLUS **IV Metronidazole 22.5-40 mg/kg/day TDS** (max. 4gm/day) for 5-7 days with adequate source control	

8: NEUTROPENIC FEVER

8. NEUTROPENIC FEVER

MTRH Empiric Antibiotic Guide: NEUTROPENIC FEVER	
Definition	☐ **Febrile neutropenia**: Fever during a period of severe neutropenia is an oncologic emergency in patients with cancer due to increased risk of death and severe infections. **Fever**: When concern for a fever in a patient or in an ill-appearing child, a single oral or axillary temperature ≥38ºC with a digital thermometer. (Thermo Gun for non-sick patients only). **Neutropenia**: Temporary reduction of the absolute neutrophil count (ANC) <1000 cells/µL (<1.0 x10^3/L) ☐ **Severe neutropenia**: Absolute neutrophil count (ANC) ≤500/µL (0.5x10^3/L) **OR** Expected to be ≤500 within the next 48 hours **OR** suspected leukemia / newly diagnosed acute leukemia in the induction phase of therapy. ☐ **Shock**: Failure of the circulatory system / dynamics and unstable pathophysiologic state characterized by inadequate tissue perfusion ☐ **Clinical signs of shock**: Delayed capillary refill, low blood pressure, doughy skin turgor, cool skin temperature, decreased urine output, altered level of consciousness, increased respiratory support. ☐ **Culture negative sepsis**: Clinical evidence of septic shock or severe clinical illness, but blood cultures results are no growth or contaminated. ☐ **Neutropenic enterocolitis (typhlitis)**: Fever neutropenia + abdominal pain, tenderness and/or bloody stool in a child with cancer due to breakdown of gut mucosa integrity with high risk of sepsis. Require gut rest, nothing by mouth and additional anaerobic. ☐ **End of febrile neutropenia episode**: Afebrile >48 hours, recovery of ANC beyond nadir and antibiotic cessation
Clinical Presentation:	Fever, Neutropenia and other signs and symptoms of infections. Monitor for signs of sepsis and septic shock.
Evaluation Begin with ☐ clinical status assessment **AND** evaluation for shock	**A. CLINICAL ASSESSMENT** ☐ **Required tests:** Obtain blood cultures before antibiotics (aerobic, anaerobic), malaria/parasite screen, full haemogram, lactate. **Review of systems**. with special focus on neuro, nose/sinuses, mouth, lower respiratory, GI, and skin ☐ **Detailed Exam** with focus on nose/sinuses, mouth, pulmonary, abdomen, and skin. Attention on sites of medical devices (e.g., CVC, G-tube), wounds, and perianal region. **Assess risk** for Tuberculosis, leishmaniasis, malaria

B. SYMPTOMS OF SEPTIC SHOCK OR SEVERE ILLNESS

The presence of >2 is concerning. Please use clinical judgment	
Neurologic	**Altered mental status (lethargic, increased sleeping**, difficulty to wake, confusion), shakes/chills/rigors, new or worsening seizures
Cardiovascular	Increased heart rate, low blood pressure, abnormal heart rhythm, evidence of **low perfusion** (delayed capillary refill, cool extremities, pale, mottling)

Pulmonary	Increased work of breathing (retractions, increased rate, extra muscle use), low oxygen levels, new requirement for oxygen support
Renal	Low or absent urine output, blood in urine

C. ADDITIONAL WORKUP BASED ON CLINICAL STATUS ASSESSMENT

Respiratory Symptoms	Chest X-ray 2 view COVID if URI
Genitourinary Symptoms	Clean catch urinalysis Urine culture
Severe Abdominal Pain	CT abdomen/pelvis Abdominal US Plan film 2 view

Febrile neutropenia can be characterized according to the identified causative pathogen and source of infection:

- **Microbiologically documented infection:** Causative organism identified.
- **Clinical focus of infection** diagnosed but no pathogen identified (e.g., pneumonia)
- **Unexplained fever:** neither a clinical focus nor an identified pathogen (most common scenario)

Non-infectious fever (e.g., drug-induced)

Severity

Severity	Absolute neutrophil count
Mild	< 1000 cells/μL(1X10^3/L)
Severe Neutropenia	< 500 cells/μL (0.5x10^9/L)
Profound neutropenia	< 100 cells/μL (0.1x10^9/L)

RISK STRATIFICATION

LOW RISK	HIGH RISK
ANC <500 expected to last for less than ≤7 days.	Expected Neutropenia of <500 for more than seven days
Clinically stable (**NO**: hypotension or dehydration, altered mental status, hypoxia, or oliguria, pneumonia)	Clinically unstable (Presence of hypotension, altered mental status, hypoxia, new onset abdominal pain or oliguria).
No active uncontrolled comorbidities	Presence of active uncontrolled comorbidity.

Diagnostic Tests:

- **Microbiological: Dependent on source of infection**
  - 1 set blood cultures (aerobic and anaerobic bottles) from the central line and 1 set blood cultures from peripheral blood before antibiotics
  - Antibiotics **MUST** be administered within one hour of diagnosis.
  - Other samples for microscopy and cultures include urine, pus, sputum, CSF and stool.
- **Others:** Complete blood cell count, UECs, LFTs, ABGs, C-reactive protein and/or procalcitonin

	☐ Imaging suspected sites of infection if indicated.

	Causative organisms	Risk Category	Recommended Regimen	Alternative Regimen
Neutropenic Fever	Gram Positive: predominantly *coagulase negative staphylococci and S. aureus* Gram Negative: *Gram-negative bacilli* Other pathogens Fungal infections uncommon	LOW RISK	Adult **PO Co-amoxiclav 625mg TDS** PLUS **Po Ciprofloxacin 500mg BD** Mouth care with antiseptic Close observation within 72 hours	
			Children **PO Co-amoxiclav 20mg/kg/dose** (amoxicillin component) (max 875 mg/dose) **BD** PLUS **Po Ciprofloxacin 10-15 mg mg/kg /dose** (max dose 500mg/dose) **BD**	
			-Start empiric antibiotic ASAP after taking blood cultures Duration of treatment: until ANC > 0.5 x 109/L. -Can consider stopping the antibiotic after reassessing the patient following 2 days afebrile at the discretion of the treating haemato-oncologist.	
	Gram Positive: *S. aureus* *Streptococcus Spp* *E. faecalis* Gram Negative: *E. Coli* *Klebsiella sp,* *Enterobacter spp.,* *P. aeruginosa (causing the more serious infections)* *Acinetobacter spp.,* Other pathogens *Candida spp,* *Aspergilus spp,* *Varicella Zoster,* *Herpes simplex virus* *CMV*	HIGH RISK	Adult Monotherapy: 1st Line **IV Piperacillin-tazobactam 4.5g QID** OR **IV Cefepime 2g TDS** Until clinical signs of infection resolved AND no fever for at least 48 hours. ADD **IV vancomycin 25-30 mg/kg loading dose then 1g BD** *if with suspected central line infection, severe mucositis, skin and soft tissue infection, pneumonia, hypotension or MDR pathogen suspected.* Consider adding. **IV Metronidazole 500mg TDS (if on cefepime)** *In the presence of severe mucositis; intra-abdominal infections; peri-anal abscesses; colitis or if in 72h and no improvement.* 2nd line Persistent fever > 72 hours and no source is identified;	

			IV Meropenem 1gm TDS ADD antifungal. **If fever continues beyond 4-7 days and no source is identified.** **IV /kg OD Amphotericin B. 0.7-1.0mg**
			Children Monotherapy **IV Piperacillin-tazobactam 100mg/kg/dose** (piperacillin component (max 18g/day of piptazo)) **QID** OR **IV Cefepime 50 mg/kg/dose** (max 2g/dose) **TDS** Until clinical signs of infection resolved AND no fever for at least 48 hours. **Consider adding.** **IV vancomycin 10mg/kg QID (max 2-4g/day)** *If with suspected central line infection, severe mucositis, skin and soft tissue infection, pneumonia, hypotension/sepsis* **Consider adding.** **IV Metronidazole 7.5mg TDS (if on cefepime)** *In the presence of severe mucositis; intra-abdominal infections; peri-anal abscesses; colitis; if in 72h and no improvement.* **2nd line** Persistent fever > 72 hours and no source is identified: • **IV Meropenem 60-120mg/kg/day** (max 1g/dose) div TDS +/- Vancomycin 60 mg/kg/day div TDS doses (max. 2gm/day) Persistent fever 4-7 days and no source is identified: ☐ **IV Amphotericin B. 0.5mg/kg/dose OD** & gradually escalate by (0.25- 1 mg/kg/dose) (max. 1.5mg/kg/day)
			Duration: dictated by specific organism identified, site and duration of neutropenia. Low-risk patients who have: • received IV antibiotics for ≥72hrs. • been afebrile for ≥24 hours. • no identified source of infection can be discharged from the hospital without antibiotics regardless of marrow recovery if follow-up is ensured.

			☐ In patients with unexplained fever, the initial regimen should be continued until marrow recovery (ANC > 0.5 x 109/L.) ☐ Treat staph bacteremia for at least 2 weeks after negative blood culture; prolong (4-6 weeks) if disseminated or deep infections.

Principles of antibiotic stewardship:

- ☐ *Source control*
- ☐ *In high-risk febrile neutropenia, urgent therapy with intravenous broad-spectrum antimicrobial is required.*
- ☐ *Septic screen including blood culture before commencing antibiotics.*
- ☐ *Use monotherapy with an anti-pseudomonal β-lactam as 1st line agent. Meta-analysis has shown that there is no clinical advantage with β-lactam & aminoglycoside combination therapy*
- ☐ *Modification of antibiotic regime if deterioration of clinical status or if there is no clinical improvement over 72-96 hours in a stable patient.*
- ☐ *Attention must be paid to: Strict isolation measures; Handwashing and strict aseptic technique and Patient's personal hygiene and diet.*
- ☐ *Vancomycin is not a routine in the initial antibiotic regime. Consider adding vancomycin for patients: colonized with MRSA; suspected to have catheter-related infection, skin and soft-tissue infection; in septic shock. Stop vancomycin after 48 hours if no evidence of gram in after 48 hours if no evidence of gram-positive cocci.*
- ☐ *Antifungal therapy should be started earlier in: severe mucositis; oral thrush; dysphagia; suspicious skin infiltrates or pulmonary infiltrates; fundal exudates; prolonged steroid use more than 2 weeks.*
- ☐ *1/3 of febrile neutropenic patients with persistent fever >1 week have systemic fungal infections.*
- ☐ ***For Peadiatric oncology patients with severe neutropenia refer to the Peadiatric oncology fever treatment guidelines/algorithm (available in Subira ward).***

Prophylaxis	**Only recommended for high -risk neutropenic patients**; expected to have profound neutropenia ANC threshold <100 cells/μmol) for >7 days. **Antibacterial prophylaxis** ☐ Ciprofloxacin 500 mg orally twice daily until the neutropenia is resolved OR ☐ Levofloxacin 750 mg daily until the neutropenia is resolved. **Antiviral prophylaxis** ☐ Acyclovir 800 mg orally twice daily ☐ Valacyclovir 500 mg orally twice daily **Hepatitis B:** For patients at high risk of reactivation Tenofovir 300 mg orally once daily (continued for at least 6 months after completion of chemotherapy. **Antifungal prophylaxis** Voriconazole 200 mg orally twice daily **Patients with acute leukemia undergo induction chemotherapy at risk of developing severe oral/gastrointestinal mucositis.** Fluconazole 400 mg orally once daily.

9: INFECTIVE ENDOCARDITIS

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<table>
<tr><th colspan="3">MTRH Empiric Antibiotic Guide: Infective Endocarditis</th></tr>
<tr><td>Definition</td><td colspan="2">Infection of the endocardial surfaces of the heart

▯ Native valve endocarditis
▯ Prosthetic valve endocarditis: Infection associated with insertion or presence of prosthetic valve, pacemaker, or implanted defibrillator. Can be early (<12 months post op) or late (>12 months post op) prosthetic valve endocarditis.</td></tr>
<tr><td rowspan="5">Recognition</td><td colspan="2">Duke criteria</td></tr>
<tr><td>Major criteria</td><td>Minor Criteria</td></tr>
<tr><td rowspan="3">1)Positive blood cultures with typical IE organisms form 2 separate blood cultures: def as

▯ Typical IE organism v'r'do rs g ro.p st'ep/staph aureus /enterococcus/HACEK group/S. bovis In the absence of primary focus.
▯ Typical IE organism with at least 2 positive cultures drawn > 12 hours apart OR all 3 or majority of 4 separate blood cultures, with first and last sample drawn > 1 hour apart.</td><td>1)Predisposing valvular or cardiac abnormality</td></tr>
<tr><td>2)Fever ≥ 38 ° C</td></tr>
<tr><td>3)Vascular phenomenon: arterial or septic emboli/mycotic aneurysm/Janeway lesions/ conjunctival hemorrhage/pulmonary infarcts

4)Immunologic phenomenon: glomerulonephritis/Osler's nodes/Roth spots/ positive Rheumatoid Factor</td></tr>
<tr><td>2) Evidence of endocardial involvement with positive ECHO findings</td><td>5)Positive culture with not meeting major criteria</td></tr>
<tr><td colspan="2">Definite Infective Endocarditis: 2 major OR 1 major 3 minor OR 5 minor criteria</td></tr>
<tr><td colspan="2">Probable Infective Endocarditis: 1 major + 1 minor OR 3 minor are fulfilled</td></tr>
<tr><td>Diagnostic tests:</td><td colspan="2">At least 4 sets of blood cultures at 0, 20min, 40 min and 60 min from 3 anatomic sites within 1 hour, before administration of antibiotic therapy.

**follow blood culture results within 48hrs and use culture guided therapy

***Follow-up blood cultures should be obtained 48 to 72 hours after antimicrobial therapy is begun and repeated every 48 to 72 hours until clearance of bacteremia is documented</td></tr>
<tr><td></td><td colspan="2">ECG, ECHO, Full hemogram, ESR, rheumatoid factor, Urinalysis, chest radi ograph, other imaging dictated by the clinical presentation.</td></tr>
</table>

<table>
<tr><td>Empiric antimicrobials</td><td>
<table>
<tr><th>ORGANISM</th><th>ANTIBIOTIC</th><th>COMMENTS</th></tr>
<tr><td rowspan="2">A)Native Valve Endocarditis
Streptococci viridans
other streptococci
Enterococci
Staphylococci
HACEK group
Culture negative (10%)</td><td><u>Empiric antibiotics</u>

<u>ADULTS</u>
IV Vancomycin 20 mg/kg/dose BD
PLUS
IV cefepime 2g TDS</td><td rowspan="3">* Repeat blood cultures every 48-72 hrs. until No growth obtained*

<u>Duration of therapy</u>
Average 6 weeks BUT actual duration depends on isolate, and clinical scenario (Consult ID/AMS team)

Once pathogen is identified, antibiotics should be adopted to susceptibility pattern.

Duration of therapy is counted from the 1st day of negative culture.
**monitor renal functions

** Follow Vancomycin levels: Target trough levels 15-20 mcg/ml ** Involve clinical Pharmacy. (Available in MTRH)

Early surgical consultation is recommended.

<u>Surgical indications:</u>
-S & S of congestive heart failure due to valve dehiscence
-Intracardiac fistula and prosthetic valve dysfunction
-Persistent bacteremia despite 5-7 days of treatment
-Heart block, annular or aortic abscess
-Recurrent emboli
-Caused by fungal or highly resistant organisms.</td></tr>
<tr><td><u>CHILDREN</u>
IV ceftriaxone 100 mg/kg/day OD or BD (max 4g/day;2g/dose) for 6 weeks
PLUS
IV gentamicin 1 mg/kg/dose TDS for 14 days.</td></tr>
<tr><td>B) Prosthetic Valve Endocarditis

Early (< 2 months post-surgery): mostly
S. epidermidis
S. aureus

Late (> 2 months post-surgery):
S. epidermidis
S. viridans
enterococci
S. aureus</td><td><u>ADULT</u>
IV Vancomycin 15-20 mg/kg/dose q 8-12h
PLUS
IV Cefepime 2g TDS for 6 weeks

<u>CHILDREN</u>
IV Vancomycin IV 40-60mg/kg/day div 6-8h (max 2g/day)
PLUS
IV cefepime 50 mg/kg/dose (max 2g/dose) TDS for 6 weeks</td></tr>
</table>
</td></tr>
<tr><td>Review/Follow up</td><td>Consult cardiology team and refer patient to cardiology clinic for long term follow up</td></tr>
</table>

10: URINARY TRACT INFECTION

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MTRH Empiric Antibiotic Guide: Urinary Tract Infection	
Definition	Classic symptoms of UTI - dysuria, frequency of urination, suprapubic tenderness, urgency, polyuria, haematuria Cystitis - Infection of the lower urinary tract, mucosa, or more specifically, the urinary bladder. Symptoms include dysuria, urgency, frequency without fever, haematuria, chills, suprapubic pain and back pain. Pyelonephritis - Infection of the **upper urinary tract** (renal pelvis and parenchyma). Symptoms include loin pain, flank tenderness, fever, rigors, or other evidence of systemic inflammatory response. Infants and children who have bacteriuria and fever > 38C OR those presenting with fever >38 C with loin pain/ tenderness and bacteriuria should be worked up for pyelonephritis. Asymptomatic bacteriuria - Presence of bacteria in the urine in significant quantities without signs and symptoms of UTI. This may represent colonization, particularly with non-virulent bacteria. Treatment and screening is **NOT** recommended except in pregnant women or persons undergoing invasive genitourinary tract procedures. Uncomplicated UTI – An infection limited to the lower urinary tract with no associated urological anomalies and no concern that the infection has extended beyond the bladder i.e., no evidence of flank pain, fever, pelvic/perineal pain in men or signs of systemic illness like sepsis. Complicated UTI – An infection involving the renal parenchyma (acute pyelonephritis) or which is associated with underlying structural or functional abnormality of the kidney, urinary tract and concerns that the infection has extended beyond the bladder i.e. evidence of flank pain, fever, pelvic/perineal pain in men or signs of systemic illness like sepsis. Differentiating uncomplicated and complicated UTI is often not feasible in neonates and infants, they should be treated as complicated UTI. Pyuria: the appearance of leukocytes (≥10 WBC/mL (uncentrifuged) OR ≥5 WBC/hpf (centrifuged)) in a freshly voided urine specimen. It is evidence of inflammation in the genitourinary tract and is present in almost all persons with symptomatic UTIs. Pyuria is suggestive of, but not diagnostic for, UTI.

Diagnostic tests:

Children

MUST meet at least 1 parameter each from requirement 1 and requirement 2.

Requirement 1:

Urine Dipstick Positivity	Urinalysis (UA) Positivity	
	Centrifuged	Uncentrifuged
≥1+ Leukocyte Esterase **OR** Positive Nitrite	Pyuria (≥5 WBC or ≥1+ Leukocyte Esterase) **OR** Positive Nitrite	Pyuria (≥10 WBC or ≥1+ Leukocyte Esterase) **OR** Positive Nitrite

AND

Requirement 2: Clean/non-bagged urine culture specimen with infectious quantity of uropathogen

Positive Bacterial Urine Culture	
Clean Catch Mid-stream	≥ 50,000 CFU
Indwelling* or I/O Catheter	
Suprapubic Catheterization/Suprapubic aspiration (SPA) or Sterile Surgical Culture	≥ 10,000 – 50,000 CFU

* If the catheter can be discontinued, voided midstream urine specimen culture should be obtained prior to the initiation of antimicrobial therapy. In patients requiring ongoing catheterization, it is preferred to insert a fresh urinary catheter to obtain urine culture, rather than using an existing catheter. In urology patients, please check with urology team prior to removing any indwelling catheter, as some require surgical placement

Adult

Both symptom and microbiologic criteria **MUST** be present for diagnosis of UTI

	Microbiologic Criteria	Symptom criteria*
No indwelling catheter	**Positive urinalysis** (WBC ≥10/HPF) AND **Positive urine culture**[¥] (≥10^5cfu/ml in voided specimen)	**Acute dysuria** —OR— **Fever**[ŧ] +at least 1 of following (new or worsening): * If no fever, 2 of the following (new or worsening) • Urinary urgency • Frequency • Suprapubic pain • Gross haematuria • Costovertebral angle tenderness • Urinary incontinence
Indwelling catheter[ǂ]	**Positive urinalysis** (WBC ≥10/HPF) AND **Positive urine culture** (≥10^5cfu/ml)	**At least 1 of the following** (new or worsening): • Fever • Costovertebral angle (CVA) tenderness • Rigors • Delirium • Frank pain (back, side pain) • Pelvic discomfort • Acute haematuria • Malaise or lethargy with no other cause

AND

*New onset delirium is NOT a symptomatic criterion of a UTI for patients without an indwelling catheter

ŧ Fever: >37.9 [100°F] or 1.5°C [2.4°F] increase above baseline temperature

¥ some use a lower colony count cut off of 10^2CFU/ml in a specimen collected by in and out catheter.

ǂ If catheter in place for >2 weeks, change catheter before obtaining a urine sample of culture

ORGANISM	ANTIBIOTIC	ALTERNATIVE THERAPY	COMMENTS
1. Acute cystitis			
E. coli (85%) *Klebsiella pneumoniae*	Adults PO Nitrofurantoin macrocrystals	PO co- amoxiclav 625mg BD for 3	• Nitrofurantoin monohydrate-macrocrystals formulation is dosed as 100mg BD to confirm which formulation is in stock.

Staphylococcus saprophyticus *Proteus species* *Enterococc'*	100 mg QID for 5 days in females and 7 days in males	days in females and 7 days in males	• **Urine culture** is indicated ONLY is symptoms are unresolved or recur • **Avoid nitrofurantoin** in eGFR< 30 ml/min • **Avoid Co- amoxiclav** in the 3rd trimester. • Nitrofurantoin is typically avoided in the 1st trimester but can be used if other options cannot be used. • **Avoid nitrofurantoin** in the 3rd trimester due to the small risk of hemolytic anemia in newborn **Fluoroquinolones are NOT recommended for empirical treatment of UTIs because of:** • Propensity for collateral damage (e.g., selection of drug resistant bacteria) • Potentially serious adverse events i.e. aortic aneurysm or structurally and functionally normal urinary tract. dissection, tendinopathy or tendon rupture and peripheral neuropathy
	Pregnancy **PO Nitrofurantoin macrocrystals 100 mg BD or 50mg QID** for 7 days	**PO co- amoxiclav 625mg TDS** for 7 days OR PO Cefuroxime 250 mg BD for 7 days	
	Children **Po co- amoxiclav 10-15 mg/kg /dose**(amoxicillin component; max 500mg) **TDS** OR for children > 25 kg 1g BD for 5-7 days OR **Nitrofurantoin 1-2 mg/kg/dose QID** (max 100mg/dose) for 5-7 days	If unable to tolerate orally **IV co-amoxiclav** • < 3 months **30 mg/kg/dose** (amoxicillin component; max 875mg) BD for 5-7 days • 3 months- 12 years **30 mg/kg/dose** (amoxicillin component) TDS for 5-7 days	
2. Acute pyelonephritis uncomplicated			

Adults *Enterobacteriaceae* *Enterococci* **In non-pregnant, pre-menopausal women without urological abnormalities or comorbidities** Children *Escherichia coli* *Proteus spp* *Klebsiella spp.* *Enterobacter spp*	Adult Outpatient Po co-amoxiclav 1 g BD Inpatient IV co-amoxiclav 1.2g TDS IV for 10-14 days	IV cefuroxime 750mg TDS for 10-14 days	• Urine analysis, gram stain, C & S tests should be done. • Blood cultures are not routinely done unless septic • Routine urologic evaluation and imaging not recommended unless still febrile after 72 hours. If clinically responding to treatment, post treatment urine culture is NOT recommended. • **IV antibiotics should be continued until the patient is clinically improved** (e.g. afebrile for 24 hours) and able to tolerate orally can be switched to oral to complete the duration of treatment. • Avoid Amikacin in renal dysfunction • **Caution** on co-amoxiclav in late preg. (3rd trim :) Co-amoxiclav is generally safe in pregnancy (Category B), but there may be an increased risk of necrotizing enterocolitis associated with use in preterm, premature rupture of membranes. Use ceftriaxone 1g OD • **Nitrofurantoin should NOT** be used for pyelonephritis or renal sepsis due to poor kidney & serum concentration. • **Cephalosporins are NOT useful if Enterococcus is suspected**
	Pregnancy: IV Ceftriaxone 1 g OD for 14 days	IV co-Amoxiclav 1.2 g TDS for 14 days	
	Children > 2 - <3 months IV co-amoxiclav 30 mg/kg/dose (amoxicillin component) BD for 10-14 days 3 months- 12 years IV co-amoxiclav 30 mg/kg/dose (amoxicillin component; max 875mg) TDS for 10-14 days OR >2 months old: IV Cefuroxime 30 mg/kg/dose TDS	ill young infant: IV Cefotaxime 150-200 mg/kg/day (max 2g/dose)TDS for 10-14 days	

	(max. 4.5gm/day) **PLUS/MINUS** **IV Gentamicin 5mg/kg/dose OD** for 10-14 days		
3. Other urinary tract infections			
a)Complicated UTIs			
Enterobacteriaceae *Enterococci* *Pseudomonas sp* **UTI symptoms in men OR presence of structural OR functional abnormality** • urinary tract obstruction • CKD • Poorly controlled T2DM • immunosuppression • urinary catheter in situ • Neurogenic bladder • Post-menopausal women • History of recurrent UTIs • Nephrolithiasis	Adults Oral Therapy: Po co-amoxiclav 1g BD for 7 days Parenteral therapy: IV co-amoxiclav 1.2g TDS OR IV Cefuroxime 750mg TDS PLUS/MINUS Gentamicin 5 mg/kg OD for 7 days	IV Ceftriaxone 1g OD PLUS/MINUS Gentamicin 7.5mg/kg OD for 7 days	• Obtain urine culture before starting treatment. • **Start with parenteral broad spectrum antibiotics in severely ill patients** then switch to oral agent/deescalate when there is clinical improvement. • Adjust medication when C & S testing results are available • **Treat for 10-14 days** in patients with - upper tract symptoms, OR - delayed response or sepsis. • May step down to oral antibiotic guided by culture and sensitivity result once can tolerate orally and afebrile > 48 hours
	Children Oral Therapy: Po co-amoxiclav 30mg/kg/dose (based on the		

	amoxicillin component; max 875 mg/dose) **TDS** for 7 days Parenteral therapy: **> 3 months** **IV co-amoxiclav 25 mg/kg/dose** (amoxicillin component; max 1g))**TDS** OR **IV Cefuroxime 50-100mg/kg/day dlv TDS** (max 1.5mg/dose) PLUS/MINUS **Gentamicin 7.5mg/kg/dose OD** for 7 days	**IV Ceftriaxone 50 mg/kg/dose OD** (max 2g/day) PLUS/MINUS **Gentamicin 7.5mg/kg/dose OD** for 7 days	
B) Asymptomatic Bacteriuria (ABU)			
• Urine bacterial growth ≥ 10^5 **cfu/mL in 2 serial , samples in women OR a single sample in men** without UTI symptoms	Screening for, and treating asymptomatic bacteriuria is not recommended, except; in pregnant women, OR Prior to transurethral resection of prostate (TURP) or urological procedures breaching the mucosa.		• Whenever indicated, treatment should be guided by urine culture and sensitivity results. • Duration of treatment for pregnant women: 5-7 days
C) Catheter-Associated UTI			
1. Asymptomatic bacteriuria	Adults/Children Antibiotics **NOT** indicated		• Urinary catheter should be **REMOVED** or replaced if

2. Significant bacteriuria in afebrile patients with signs and symptoms	Adults Nitrofurantoin 50mg QID for 7 days	PO co- amoxiclav 625mg BD for 7 days	catheter has been in-situ for > 7 days. • Obtain urine Gram stain and culture and sensitivity testing prior to initiation of treatment. • DO NOT obtain urine culture for asymptomatic patients. • Treatment should be guided by C&S results. **Duration:** • 7 days if responds promptly after change of catheter. • 10-14 days for those with delayed response without regards to whether the patient remains catheterized or not.
3. Significant bacteriuria in febrile patients with other signs and symptoms	Adults PO co- amoxiclav 625mg TDS for 7 -14 days OR IV amikacin 15 mg/kg OD if unable to tolerate orally for 7-14 days		
Children	IV co-amoxiclav < 3 months: 30 mg/kg /dose (amoxicillin component; max 500mg) BD for 7 days 3 months - 12 years: 30 mg/kg /dose(amoxicillin component ; max 875mg) TDS for 7 days	IV cefotaxime 1 month to 18 years 50 mg/kg/dose TDS (max 2000mg/dose) for 7 days increase to QID in very severe infections	

Principles of antibiotic stewardship:

- *Obtain urine culture for all patients with cystitis not responding to empiric antibiotic.*
- ***For suspected urosepsis, refer to sepsis guidelines.***
- *Always obtain urine Gram stain, culture and sensitivity for all patients with pyelonephritis prior to initiation of treatment and adjust regimen as needed based on culture results. Select the narrowest spectrum antibiotic.*
- ***Avoid the use of fluoroquinolones** whenever possible.*

- *Empirical therapy is **NOT** recommended in children with **afebrile UTI**. Therapy should be guided by antibiotic culture and sensitivity results.*
- *If there is a good clinical response to treatment after **24** hours of parenteral therapy, consider switching to an oral antibiotic to complete the course of treatment.*
- *Pyelonephritis in men can indicate the presence of lower urinary tract abnormalities. Urological investigations are recommended to diagnose possible abnormalities.*
- *Do not treat asymptomatic patients outside of pregnancy*

Other notes

Children < 5 years with confirmed UTI and children with recurrent or persistent UTIs should have an ultrasound scan of the kidneys, ureter and bladder to screen for abnormalities of the urinary tract infection and/or be referred to a specialist for further investigations.

11: SKIN AND SOFT TISSUE INFECTIONS (SSTIS)

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<table>
<tr><th colspan="2">MTRH Empiric Antibiotic Guide: Skin and Soft Tissue Infections (SSTIs)</th></tr>
<tr><td>Definition</td><td>SSTIs involve microbial invasion of the skin and underlying soft tissues. They have variable presentation, aetiology and severities. They range from simple superficial infections to necrotizing infections.

SSTIs present clinically diverse challenges requiring management strategies that effectively and efficiently identify those cases requiring immediate attention and intervention from the less severe cases.</td></tr>
<tr><td>Diagnosis</td><td>a) Clinical features: features of inflammatory responses with other manifestations such as fever (>38°C), rapidly spreading areas of erythema, oedema, tenderness, skin warmth, pain or tenderness (The minimum diagnostic criteria). Systemic features (e.g., fever, raised WBC) are not always present but are associated with more severe infections.

b) Lab investigations: WBC (leukocytosis with neutrophilia), CRP, Laboratory risk indicators for Necrotizing Fasciitis (LRINEC) score (it is based on Lab indications like HB, Na, Glucose, WBC, creatinine and CRP), Pus culture if present, skin aspiration culture.
c) Imaging: Ultrasound, CT scan with deep abscesses</td></tr>
<tr><td>Risk factors</td><td>Patient-related factors: critical illness, elderly age, immunocompromised state, liver and kidney disease, and vascular (especially lymphatic or venous) insufficiency. (Lower leg has been shown to be the most frequent location for SSTIs).

Etiological risk factors: The mechanism of injury (trauma or others) or specific exposures increases the likelihood of SSTIs caused by specific microbes e.g., diabetes mellitus: Staphylococcus aureus, group B streptococci, anaerobes, Gram-negative bacilli; Neutropenia: Pseudomonas aeruginosa.</td></tr>
<tr><td>Empiric antimicrobials</td><td>
<table>
<tr><th>ORGANISM</th><th>ANTIBIOTIC</th><th>ALTERNATIVE THERAPY</th><th>COMMENTS</th></tr>
<tr><td colspan="4">1. <u>Skin abscess, boils, furuncles</u>

• Incision and drainage (I&D) is the mainstay of therapy.
• May treat patients with <u>I&D ONLY</u> and in an outpatient setting if: there is NO diabetes or immunosuppression, and boil or abscess is < 2 cm (children) and < 2 cm (adult) in diameter.
• <u>Oral therapy PLUS I&D</u> maybe effective in abscesses >2 cm(children) and > 2 cm (adult) in diameter and in multiple abscesses
• <u>Antibiotic therapy is recommended for abscesses with the following conditions:</u>
  ◦ Severe or extensive diseases (e.g., involving multiple sites of infections) or rapid progression in presence of cellulitis.
  ◦ Presence of systemic inflammatory response syndrome (SIRS) e.g., temp > 38°C or <36°C, tachypnoea, tachycardia or WBC > 12,000 or < 4000 cell/uL
  ◦ Associated comorbidities or immunosuppression.
  ◦ Extremes of age
  ◦ Abscess in areas difficult to drain (e.g., face, hand and genitalia)</td></tr>
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• Associated septic phlebitis. • Lack of response to I&D alone.			
S. aureus (MSSA, MRSA)	**I &D mainstay** **For I&D + Antibiotic:** Adult **PO Flucloxacillin 500mg QID** for 5-7 days	**PO Clindamycin 300-450 mg TDS** for 5 -7 days (if MRSA is suspected)	☐ **Send Exudate/pus and blood culture.** ☐ **Note:** Needle aspiration is inadequate ☐ Systemic agents should be used in patients who are toxic, who have extensive disease, or who have associated cellulitis. ☐ Avoid fluoroquinolones. ☐ Use IV route only for those cannot tolerate oral meds
	Children **PO Flucloxacillin 25 – 50mg/kg/day** (max 500mg/dose) **div QID** for 5-7 days OR **IV cefazolin 50mg/kg/day div TDS** (max. 3g/day) for mild to moderate infections (severe: 100-150 mg div TDS (max 6g/day) for 5-7 days	**PO clindamycin 10mg/kg/dose** (max 450 mg/dose) **TDS/QID** for 5-7 days (where MRSA is suspected) OR **IV Clindamycin 25-40 mg/kg/day** (max 600mg/dose) **TDS** for 5-7 days	

2. Cellulitis – Purulent(abscesses): Non-diabetic patients
 	
• **Incision and drainage** (I&D) is the mainstay of therapy.
 	
• Oral therapy **PLUS** I&D is indicated when:
  • abscesses >1 cm (infants and young children) and > 2 cm (adult) in diameter and in multiple abscesses
  • Severe or extensive diseases (e.g., involving multiple sites of infections) or substantial surrounding cellulitis.
  • Presence of systemic inflammatory response syndrome (SIRS) e.g., temp > 38°C or <36°C, tachypnoea, tachycardia or WBC > 12,000 or < 4000 cell/uL
  • Associated comorbidities or immunosuppression.
  • Extremes of age
  • **abscess in areas difficult to drain** (e.g., face, hand and genitalia)
  • Lack of response to I&D alone.			

S. aureus (most cases) *S. pyogenes*	**I &D mainstay** **For I&D + Antibiotic:** Adult	**Po clindamycin 300-450 mg TDS** 5-	☐ **Culture of blood, exudate and /or bullae** is needed when there are signs and of systemic toxicity, extensive skin involvement, or underlying comorbidities.

	Mild (outpatient) **PO Flucloxacillin 500mg QID** for 5-10 days Moderate (Inpatient) IV **Flucloxacillin 0.5-1g QID** for 5-10 days ***For severe see Necrotizing Fasciitis below***	10 days (if MRSA is suspected)	• Administer using parenteral route for **extensive lesions.** **Gram negative coverage may be necessary** in the following: **1.**Potential relation of the **cellulitis to a decubitus ulcer** **2.**Crepitant cellulitis **3.** Prominent skin necrosis/ gangrene **4.**Location: Perioral &Perirectal cellulitis **5.**Clinical condition: Septicaemic **shock, suspecting necrotizing** fasciitis. **6.** Immunocompromised patients. • Change to oral when **condition** improves. • Total treatment until 3 days after acute inflammation disappear. • Other references recommend **a** duration of 10-14 **days**
	Children **Po Flucloxacillin 25 – 50mg/kg/day (max** 500mg/dose) **div QID** for 7-10 days (mild to moderate) OR **IV Flucloxacillin 50mg/kg/dose** (max 2g) QID for 7-10 days OR **IV cefazolin 50mg/kg/day div TDS** (max. 3g/day) for mild to moderate infections (severe: 100-150 mg div TDS (max 6g/day) for 7-10 days **For severe see necrotizing fasciitis below**	**Po clindamycin 10mg/kg/dose** (max 450mg/dose) **TDS/QID** for 7-10 days (where MRSA is suspected) OR **IV Clindamycin 25-40 mg/kg/day** (max 600mg/dose) **TDS** for 7-10 days. (where MRSA is suspected)	

3. Necrotizing Fasciitis

Infection causing necrosis extending to fascial plane(s): usually involving an extremity, perianal area, genitals. Necrosis manifests by a decrease in pain and dusky, cyanotic skin, often with blood-filled bullae. Typically, gas is present in the involved tissue. May have associated toxic shock syndrome as defined by hypotension, nausea, vomiting, diarrhea, renal failure, respiratory failure and erythroderma.

Mixed aerobic - anaerobic bacteria	**Surgical Debridement + antibiotic** Adult **IV Piperacillin/tazobactam 4.5g QID** PLUS **IV Clindamycin 600 mg QID for 5-10 days** (De-escalate once cultures are available/ Necrotizing fasciitis ruled out)		X-ray, CT scan or MRI may show gas involved tissue. Urgent surgical debridement and antibiotics are the mainstay of therapy. **Early exploratory surgery** is recommended to establish diagnosis (Include aerobic and anaerobic cultures) and resect all non-viable tissue.
	Children **IV Piperacillin/tazobactam 80mg/kg/dose** (piperacillin component) (max 3g piperacillin component/dose) **QID** PLUS **IV Clindamycin 10mg/kg/dose** (max 600mg/dose) **TDS** for 5-10 days (De-escalate once cultures are available OR Necrotizing fasciitis ruled out)		**Combination therapy is needed** with clindamycin to block toxin production whether a patient manifest or does not manifest toxic shock syndrome. **IVIG can be used as an** adjunct, typically at 1 gm/kg on Day 1, followed by 0.5mg/kg on 1-2 subsequent days. **Debridement no longer needed when there is:** • Clinical improvement, and • Minimum of 48-72 hours after completion of surgical debridement **Duration of treatment:** at least 2 weeks if no foci is found (no deep-seated involvement plus no involvement of heart, bone, joint etc.)
	4. Non-Purulent Cellulitis		
Usually beta-haemolytic *streptococci* (e.g., Group A, B, C G *streptococci)*	Adult: **PO Amoxicillin 500mg TDS** for 7-10 days	**PO Azithromycin 500mg OD day 1 then 250 mg OD** for 5 days	Cover for both staph and strep

S. aureus (rare)	Children **PO Co- amoxiclav (7:1 formulation) 25-45mg/kg/day** (amoxicillin component; max 1g/dose) div **BD** for 7-10 days **IV co-amoxiclav 90mg/kg/day** (amoxicillin component; max 1g/dose) div **TDS** for 7-10 days **IV cefazolin 50mg/kg/day div TDS** (max. 3g/day) for mild to moderate infections (severe: 100-150 mg div TDS (max 6g/day) for 7-10 days	**PO clindamycin 30-40 mg/kg/day** (max 450mg) div **TDS/QID** for 7-10 days (where MRSA is suspected) **IV Clindamycin 30-40 mg/kg/day** (max 600mg/dose) **TDS** for 7-10 days. (where MRSA is suspected)	• Treatment includes leg elevation to reduce local **oedema**. Mixed infection (strep. and staph.) is rare. • If S. aureus is present, I &D is needed. • Other references recommend **treating** until the patient is afebrile for 3-5 days. • Change to oral when condition improves.
	5. Staphylococcal scalded skin syndrome (SSSS)		
S. aureus	Adult: **IV Flucloxacillin 1-2 g QID** **Step down** **PO Flucloxacillin 500mg QID** for 7- 10 days Children **IV Flucloxacillin 50mg/kg/dose** (max 2g) QID **Step down** Children <25kg: **PO Flucloxacillin 25-50mg/kg/day** (max 1g) Children > 25kg: **use adult dose.** for 7- 10 days		**Early ID consult if no improvement** If no positive blood culture is associated with SSSS, then IV therapy can be stopped following clinical improvement & switch to oral. Consider adding clindamycin to limit exotoxin production in severe cases.

6. BED SORE/PRESSURE SORE/DECUBITUS ULCER		
Streptococcus sp. *S. aureus* *Enterobacteriaceae, P. aeruginosa, Anaerobic streptococci, B. Fragilis*	Local treatment is preferred. Superficial infection: **1% silver sulfadiazine** cream **If there is If there is surrounding cellulitis/signs of bacteraemia/ fasciitis/ surrounding intramuscular abscess/ OM changes:** Adult **IV co-amoxiclav 1.2g TDS** Children **IV co-amoxiclav 90mg/kg/day** amoxicillin component div TDS	Debride necrotic tissue and use moist wound dressing. Remove pressure if decubitus ulcer, **elevate leg** if venous stasis; evaluate for revascularization if there is arterial insufficiency. **Do NOT use povidone iodine or chlorhexidine,** both may damage granulation tissue and fibroblasts. **For histology and culture,** the best method is surgically obtaining deep tissue **specimens. If osteomyelitis is** suspected, obtain a bone biopsy. Needle aspiration from the ulcer margin is acceptable.
7. Wound infections - post-trauma		
Polymicrobic (microbial flora depended on nature of the trauma) • *S. Aureus* • *Streptococcus sp.* • *Enterobacteriaceae,* • *C. perfringens,* • *C. tetani,* • *Pseudomonas sp. (water exposure),* • *Acinetobacter sp.* • *Aeromonas sp*	• **No** Infection- **No** Antimicrobial • infected wound: Adult: **Po Flucloxacillin 500mg QID** Children **Po Flucloxacillin 25 – 50mg/kg/day div QID**	• Give Tetanus prophylaxis and vaccine if indicated. • Debridement of wound may be indicated. • Obtain culture and sensitivity test.
For Animal bites and human bites- Refer to WHO guidelines		

Principles of antibiotic stewardship:

- If IV antibiotic therapy is indicated, review patient progress daily and consider switching form IV to oral therapy.
- Streptococcal infections are more likely to be non-purulent. Staphylococcal especially CA-MRSA infections more likely to present with purulence/abscesses

12: SURGICAL PROPHYLAXIS

12. SURGICAL PROPHYLAXIS

SURGICAL PROPHYLAXIS

Introduction

Surgical site infections or post-operative wound infections remain a common postoperative complication and account for approximately 15% of nosocomial infections. Post-operative wound infections are associated with prolonged hospital stay and increase cost of hospitalization by 20%.

Most postoperative infections are caused by organisms that are endogenous to the patient. The goal of prophylactic antibiotics is to reduce the incidence of post-operative wound infection. Antibiotic prophylaxis is not aimed at achieving bacterial sterility but at reducing numbers of viable bacteria to levels, which are unlikely to overwhelm the host's defense and prevent infection from occurring.

Most centres worldwide have adopted the National Academy of Science/ National Research Council (NAS/NRC) classification of surgical wound as shown below:

Classification of operative wounds and risk of infection

Classification	Criteria	Risk of infection
Clean	Elective, non-emergency, non-traumatic primarily closed, no acute inflammation, no break in aseptic technique, not communicating with respiratory, gastrointestinal, biliary or genitourinary systems	<2%
Clean Contaminated	Urgent or emergency case that is otherwise clean, elective, communicating with respiratory, gastrointestinal, biliary or genitourinary tract with minimal spillage (e.g., appendectomy), not encountering infected urine or bile, minor break in aseptic technique	<10%
Contaminated	Non-purulent inflammation, gross spillage from gastrointestinal tract, entry into biliary or genitourinary tract in the presence of infected bile or urine, major break in aseptic technique, penetrating trauma <4 hours old, chronic open wounds to be grafted or covered	<20%
Dirty (Septic)	Purulent inflammation (e.g. abscess), pre-operative perforation of respiratory, gastrointestinal, biliary or genitourinary tract, penetrating trauma >4 hours old	40%

Antibiotic prophylaxis is **NOT** warranted for procedures in the category of **clean** unless you are using a prosthetic material or surgery prolonged more than 4 hours.

Antibiotic prophylaxis is also indicated in patients undergoing procedures associated with high infection rates e.g. abdominal surgery, operations lasting more than four hours and in patients with two or more comorbid conditions.

In case of established infections postoperatively e.g. due to perforated appendix or after abscess drainage, antibiotic treatment is indicated and this **does not constitute prophylaxis and hence is not covered by this guideline.**

Definitions

Coliforms are the Gram-negative bacilli (rods) that normally inhabit the colon and include *Escherichia coli, Klebsiella pneumoniae, Proteus spp., Enterobacter spp.* and others.

Fundamental principles

1. Pre-wash, sterile dressing and recommended IPC should be adhered to.
2. Appropriately administered antibiotic prophylaxis reduces the incidence of post- operative surgical wound infections.
3. A selected antibiotic should be effective against probable contaminating organisms (flora) associated with the operative procedures/site using evidence from RCTs where available.
4. Prophylactic antibiotics must be administered in sufficient dosage 30 minutes prior to the incision (usually with induction of anaesthesia to ensure adequate tissue concentration). Administration after skin incision or > 60 minutes before incision reduces effectiveness.
5. IV infusion should be started 30-60 minutes prior to skin incision.
6. For procedures lasting greater than 3 hours, an additional dose of antibiotics is advised. Likewise, procedures in which there is rapid blood loss (over 1.5 litres) and/or fluid administration will dictate an additional dose of antibiotic.
7. When indicated, prophylactic antibiotics should be given as a **SINGLE** dose at induction of anaesthesia except in the following situations:
    - Operations where prosthetic material is implanted or inserted.
    - Break in the sterile technique or aseptic barriers
    - Emergency caesarean section in patients with ruptured foetal membranes. In caesarean surgery the recommendation is infuse the antibiotic after cord- clamping (to avoid exposing the foetus to unnecessary antibiotic doses)
8. An appropriate prophylactic antibiotic should: -
    - Be effective against anticipated micro-organisms/flora of the operative site.
    - Achieve adequate local tissue level.
    - Cause minimal toxicity.
    - Be relatively inexpensive.
9. Antimicrobial prophylaxis does not substitute for good surgical technique.
10. We recommend **AGAINST THE PROLONGATION** of Surgical antibiotic prophylaxis administration after completion of the operation for the purpose of preventing SSI (WHO, strong recommendation, moderate evidence)

1. ORTHOPAEDIC SURGERY		
ORGANISMS	**ANTIBIOTICS**	**DOSAGE**
PROCEDURE: Elective orthopaedic surgery without prosthesis		
	Usually, **NO** prophylaxis is required.	
	Unless surgery expected to last more than 4 hours, then **IV cefazolin**	**Adult:** 2g prior to incision **Children:** 50 mg/kg IV prior to incision
PROCEDURE: Implantation procedures e.g., arthroplasty, internal fixation with screws, plate wires including spinal fusion		
Skin commensals especially *S. aureus Coagulase negative staphylococc' Coliforms*	**IV cefazolin**	**Adult:** 2g prior to incision **Children:** 50 mg/kg IV prior to incision
PROCEDURE: Amputation surgery		
Risk of anaerobic infection e.g., gas gangrene	**IV co-amoxiclav**	**Adult:** 1.2 g prior to incision **Children and Adolescents**: 30 mg/kg prior to incision
PROCEDURE: Laminectomy		
		Benefit not proven.

2. HEAD AND NECK SURGERY

ORGANISMS	ANTIBIOTICS	DOSAGE
PROCEDURE: Clean non-neurosurgical head and neck surgery - Tonsillectomy/Adenoidectomy/ Rhinoplasty		
(Oropharyngeal Flora) *Streptococcus spp.* *S. aureus Anaerobes* *Corynebacteria*	No proven benefit/not recommended	
PROCEDURE: Clean non-neurosurgical head and neck surgery - Involving Oropharynx		
(Oropharyngeal Flora) *Streptococcus spp.* *S. aureus Anaerobes* *Corynebacteria*	IV co-amoxiclav	**Adult:** co-amoxiclav 1.2g prior to incision **Children and Adolescents:** 30 mg/kg prior to incision
PROCEDURE: Clean contaminated neurosurgery/ maxillofacial (Cranial air sinuses are opened)		
(Oropharyngeal Flora) *Streptococcus spp.* *S. aureus Anaerobes* *Corynebacteria*	IV co-amoxiclav	**Adult:** Co-amoxiclav 1.2g prior to incision **Children and Adolescents:** 30 mg/kg prior to incision
PROCEDURE: Clean Implant neurosurgery		
S. aureus *Corynebacteria*	**IV Vancomycin**	**Adults:** 1g IV, administered an hour prior to incision. No re-dosing required peri-operatively. **Infants, Children, and Adolescents:** IV: 15 mg/kg/dose within 120 minutes prior to surgical incision (maximum 1gm)
PROCEDURE: Clean non-Implant neurosurgery		
S. aureus Corynebacteria	**IV cefazolin**	**Adult:** 2g prior to incision **Children:** 50 mg/kg IV prior to incision
PROCEDURE: CSF shunt surgery		
Coagulase negative staphylococci *S. aureus Corynebacteria*	**IV cefazolin**	**Adult:** 2g prior to incision **Children:** 50 mg/kg IV prior to incision

3. UROLOGICAL SURGERY

ORGANISMS	ANTIBIOTICS	DOSAGE
PROCEDURE: Endoscopic Procedure Cystoscopy/TURP; Cystoscopy/TURBT; Cystoscopy with stone removal; Ureteroscopy		
Coliforms Enterococci *S. aureus*	**IV Gentamicin**	IV 5 mg/kg single dose
PROCEDURE: Open Prostatectomy		
Coliforms Enterococci *S. aureus*	**IV Gentamicin**	IV 5 mg/kg single dose
PROCEDURE: Urinary Diversion procedure		
Coliforms Enterococci *S. aureus*	**IV Gentamicin**	IV 5 mg/kg single dose
PROCEDURE: Renal Transplantation		
S. aureus *Enterococci*	IV Piperacillin/Tazobactam	**Adult:** 4.5g as a single dose **Children:** 100 mg /kg (piperacillin component) (max 3g/dose of piperacillin component) as a single dose

4. CARDIAC, THORACIC AND VASCULAR SURGERY

ORGANISMS	ANTIBIOTICS	DOSAGE
PROCEDURE: Cardiac prosthetic valve, CABG, median sternotomy, pacemaker insertion		
S. aureus *Coagulase negative staphylococci* *Corynebacteria*	**IV Cefuroxime**	**Adult:** 1.5g STAT pre-op then 750mg TDS until all indwelling tubes and catheters are removed **Children:** 50 mg/kg IV prior to surgical incision (max dose: 1.5g) then TDS until all indwelling tubes and catheters are removed
PROCEDURE: Non-cardiac vascular aortic resection and vascular grafts		
S. aureus *Coagulase negative staphylococci* *Corynebacteria* *Coliforms* in groin incisions	**IV Cefuroxime**	**Adult:** 1.5g STAT pre-op then 750mg TDS until all indwelling tubes and catheters are removed **Children:** 50 mg/kg IV 1.5g prior to surgical incision (max dose: 1.5g) pre-op, then TDS until all indwelling tubes and catheters are removed
PROCEDURE: General thoracic: pulmonary surgery		
S. aureus *Coagulase negative staphylococci Coliforms*	**IV Cefuroxime** continued for up to **48 hours** to prevent empyema or pneumonia	**Adult:** 1.5g stat pre-op then 750mg TDS **Children:** 50 mg/kg prior to surgical incision (max dose: 1.5g)
PROCEDURE: Laparoscopic and thoracoscopic procedures		
	Special data supporting antibiotic prophylaxis unavailable. Therefore, pending availability, recommendations follow those of "open technique"	

5. ABDOMINAL SURGERY

ORGANISMS	ANTIBIOTICS	DOSAGE
PROCEDURE: Esophageal Surgery, Gastroduodenal and small bowel surgery, Endoscopic Gastroscopy		
Coliforms Peptos-treptococci	**IV Cefazolin**	**Adult:** 2g prior to incision **Children:** 50 mg/kg IV prior to incision
PROCEDURE: Biliary Surgery (Open) –Uncomplicated		
Coliforms *Anaerobes*	**IV Cefazolin**	**Adult:** 2g prior to incision **Children:** 50 mg/kg IV prior to incision
PROCEDURE: Biliary Surgery (Open) -Complicated (If obstruction to bile is present)		
Coliforms *Anaerobes*	**IV Cefazolin**	**Adult:** 2g prior to incision **Children:** 50 mg/kg IV prior to incision
PROCEDURE: Uncomplicated Appendectomy		
Coliforms Anaerobes Enterococci	**IV Cefazolin** PLUS **IV Metronidazole**	**Adult:** 2g prior to incision **Children:** 50 mg/kg IV prior to incision PLUS **Adult:** Metronidazole 500mg **Children:** Metronidazole 7.5mg/kg IV prior to incision
PROCEDURE: Colorectal Surgery		
Anaerobes Enterococci *Coliforms*	**IV Cefazolin**	**Adult:** 2g prior to incision **Children:** 50 mg/kg IV prior to incision
PROCEDURE: Inguinal hernia repair (with mesh) – open or laparoscopic		
S. aureus Coagulase negative staphylococci	**IV Cefazolin**	**Adult:** 2g prior to incision **Children:** 50 mg/kg IV prior to incision
PROCEDURE: Breast Surgery Mastectomy and axillary node dissection		
S. aureus Coagulase negative staphylococci.	**No antibiotics**	
PROCEDURE: Thyroidectomy		
S. aureus	**No antibiotics**	

6. OBSTETRICS & GYNAECOLOGY

ORGANISMS	ANTIBIOTICS	DOSAGE
PROCEDURE: D & C / Evaluation		
Coliforms Enterococci *Group B streptococci*	**IV co-amoxiclav**	**Adult:** 2g prior to incision **Children:** 50 mg/kg (as amoxicillin component) prior to incision (maximum dose: 1.5g)
PROCEDURE: Postpartum BTL		
Coliforms Enterococci *Group B streptococci*	**No antibiotic required**	
PROCEDURE: Cervical Cerclage		
Coliforms Enterococci *Group B Streptococci*	**No antibiotic required**	
PROCEDURE: Caesarean Section –Elective		
Coliforms Enterococci *Group B Streptococci*	**IV cefazolin**	**Adult:** 2g prior to incision **Children:** 50 mg/kg IV prior to incision (maximum dose: 1.5g)
PROCEDURE: Caesarean Section -Emergency (ruptured membranes, multiple VEs >5)		
Coliforms Enterococci *Group B Streptococci*	**IV Cefazolin** PLUS **IV Gentamicin**	**Adult:** 2g prior to incision **Children:** 50 mg/kg IV prior to incision (maximum dose: 1.5g) **PLUS** Gentamicin 5mg/kg IV single dose **NB:** Women with prolonged rupture of membranes and perimortem CS should receive treatment regimen.
PROCEDURE: Total Abdominal Hysterectomy		
Coliforms Enterococci *Group B Streptococci*	**IV Cefazolin**	**Adult:** 2g prior to incision **Children:** 50 mg/kg IV prior to incision (maximum dose: 1.5g)
PROCEDURE: Vaginal Hysterectomy		

Coliforms Enterococci Group B Streptococci	**IV Cefazolin**	**Adult:** 2g prior to incision **Children:** 50 mg/kg IV prior to incision (maximum dose: 1.5g)
PROCEDURE: Perineal Tear		
Coliforms Enterococci **Group B Streptococci**	**IV Cefazolin**	**Adult:** 2g prior to incision **Children:** 50 mg/kg IV prior to incision (maximum dose: 1.5g)
PROCEDURE: Diagnostic Laparoscopy, D&C		
Coliforms, Enterococci Group B Streptococci	**No antibiotic required**	
PROCEDURE: Operative Laparoscopy		
Coliforms, Enterococci Group B Streptococci	**Antibiotics depend on the indication, generally:** **IV Cefazolin**	**Adult:** 2g prior to incision **Children:** 50 mg/kg IV prior to incision

7. INTERVENTIONAL RADIOLOGY

PROCEDURE: Operative Laparoscopy		
Central Venous Access		
• Chemoport Perm Catheter	**IV Cefazolin**	**Adult:** 2g prior to incision **Children:** 50 mg/kg IV prior to incision
Percutaneous Drainage		
• PTBD	**IV cefazolin + IV metronidazole**	**IV cefazolin** **Adult: 2g** prior to incision **Children:** 50 **mg/kg** IV prior to incision PLUS **IV Metronidazole** **Adult:500mg** **Children: 7.5mg/kg** prior to incision
• Ureteric stenting and Nephrostomy	**IV co-amoxiclav**	**Adult: 1.2g** prior to incision **Children and Adolescents:** 30 **mg/kg** prior to incision
• Abscess drainage	**IV co-amoxiclav**	**Adult:** 1.2g prior to incision **Children and Adolescents:** 30 **mg/kg** prior to incision
Embolization		
• Post TACE	**Metronidazole + co-amoxiclav**	**Adult** Tab Metronidazole 400mg, tab co-amoxiclav 625mg **prior to** incision **Children and Adolescents:** PO metronidazole 7.5mg/kg + co-amoxiclav 30 mg/kg **prior to** incision
• Uterine Artery Embolization	**IV co – amoxiclav**	**Adult**: 1.2g prior to incision **Children and Adolescents:** 30 **mg/kg** prior to incision
• Prostate Artery Embolization(Kidney + Bladder)	**IV co-amoxiclav**	**Adult**: 1.2g prior to incision **Children and Adolescents:** 30 **mg/kg** prior to incision
Stent Replacement		

• EVAR/TEVAR/Iliac or Large Vessel Stenting	IV co - amoxiclav	**Adult:** 1.2g prior to incision **Children and Adolescents:** 30 mg/kg prior to incision
Tumor Ablation		
• Microwave Ablation or RFA Ablation > 3cm	**IV co-amoxiclav** + **IV metronidazole**	**IV co-amoxiclav** **Adult:** 1.2g prior to incision **Children and Adolescents:** 30 mg/kg prior to incision + **IV Metronidazole** **Adult:500mg** **Children:** 7.5mg/kg prior to incision
NB: 1. Diagnostic procedures – prophylaxis not indicated. 2. Stenting and embolization – antibiotic prophylaxis indicated with single dose **IV cefazolin**		

SPECIAL CONSIDERATIONS	
IN PATIENTS ALLERGIC TO PENICILLIN'S/ CEPHALOSPORINS USE;	
DRUG	**DOSAGE**
IV Clindamycin **OR**	**Adult:** IV: 900 mg **Children and Adolescents:** IV: 10 mg/kg prior to incision; may repeat in 6 hours. (maximum single dose: 900 mg)
IV Vancomycin	**Adults:** 1g IV, administered an hour prior to incision. No re-dosing required peri-operatively. **Infants, Children, and Adolescents:** IV: 15 mg/kg/dose within 120 minutes prior to surgical incision (maximum 1gm)

APPENDIX

APPENDIX 1: INTRAVENOUS (IV) TO ORAL (PO) ANTIBIOTICS CONVERSION

- **Early intravenous-to-oral conversion (IVOC) as a key stewardship measure**. Several clinical trials have demonstrated the efficacy and safety of IV to PO antimicrobial conversion, and several studies have also addressed the economic impact of this conversion.

- **Cost savings** are achieved through lowering direct acquisition costs, eliminating the need for ancillary supplies, reducing pharmacy and nursing time, and shortening the length of hospital stay. IV to oral antimicrobials conversion also benefits the patient by eliminating adverse events associated with IV therapy, increasing patient comfort and mobility and increasing the possibility of earlier discharge.

- **The optimal time to consider switching a patient to oral therapy is after 48 to 96 hours of intravenous therapy**. This period allows the clinician to evaluate the patient's microbiology results and assess their response to treatment. Many clinical trials support the early switching to oral antibiotics after this period with equal treatment efficacy and no adverse effect on patient outcome.

- **All intravenous antibiotics should be reviewed after 48 hours and daily thereafter**. Wis should be documented clearly in the medical notes.

Before switching to oral antimicrobial, a **patient must meet the following criteria:**

A. Display signs of clinical improvement **AND**

B. Able to tolerate oral therapy **AND**

C. Not have a condition in which higher concentrations of antibiotic are required in the tissue or a prolonged course of IV therapy is essential Criteria used to determine Patients for IV to PO therapy Conversion.

CRITERIA USED TO DETERMINE PATIENTS FOR IV TO PO THERAPY CONVERSION:

A. Display signs of clinical improvement

- Afebrile (temp >36°C and <38°C for past 48 hours)
- CRP trending down
- Stable immune response (WCC > 4 and <12 x 109 cells/L or trending towards normal range) It is important to examine the patient's medication therapy for other medications that can cause an increase or sustained high WBC count such as steroids.
- No unexplained tachycardia
  No unexplained hypotension
  No tachypnoea

B. Able to tolerate oral therapy.

- Patient is not nil by mouth.
- Patient is tolerating oral food or enteral feeding.

- Oral absorption is not compromised (e.g., diarrhea, vomiting, malabsorptive disorder, partial or total removal of the stomach, short bowel syndrome, unconscious, swallowing disorder)

C. Not have a condition in which higher concentrations of antibiotics are required in the tissue or a prolonged course of IV therapy is essential.

- Prolonged parenteral therapy is required for the following indications:
  - Endocarditis
  - Central nervous system infections (e.g., meningitis, brain abscess, etc.)
  - Staphylococcus aureus bacteraemia
  - Osteomyelitis
  - Septic arthritis
  - Infected implant or prosthesis
  - Necrotizing soft tissue infection
  - Deep-seated infection e.g., abscesses/empyema
  - Complicated orbital cellulitis (abscess or other complication)
- There are number of conditions in which a switch to oral therapy should be considered including:
  - Pneumonia
  - Skin and soft tissue infections
  - Urinary tract infections
  - Uncomplicated Gram-negative bacteraemia
  - Intra-abdominal infection without deep seated collection

APPENDIX 2: Common oral antimicrobial options for switch from IV

Current parenteral regimen		Oral Regimen (Adult dose)	Oral Bioavailability
IV Amoxicillin/Clavulanate 1.2g TDS	→	Po co-amoxiclav 625mg BD	Amoxicillin: 80% Clavulanate: 30-98%
IV Ampicillin/Sulbactam 1.5g QID	→	PO co-amoxiclav 625mg BD	
IV Cefazolin 1g TDS	↘	PO Cephalexin 500mg QID	Cephalexin: 90%
IV Cefazolin 2g TDS	↘	PO Cephalexin 1g QID	
IV Cefepime 2g BD/TDS	↘	PO co-amoxiclav 625mg TDS **Pseudomonas: Seek advice from ID specialist or Clinical microbiology**	Amoxicillin: 80% Clavulanate: 30-98%
IV Ceftazidime 1-2g TDS	↘	PO co-amoxiclav 625mg TDS **Pseudomonas: Seek advice from ID specialist or Clinical microbiology**	
IV Ceftriaxone 1-2g OD	↘	PO co-amoxiclav 625mg TDS **OR** PO Cefuroxime axetil 500mg BD	Cefuroxime axetil: 37-52%
IV Cefuroxime 750mg-1.5g IV TDS	→	PO Cefuroxime axetil 500mg BD	Cefuroxime axetil: 37-52%
IV Ciprofloxacin 200-400mg BD	→	PO Ciprofloxacin 500mg-750 BD	Ciprofloxacin: 50-85%

IV Clindamycin 300mg-600mg TDS/QID	↔	Clindamycin 300mg-600mg TDS/QID	Clindamycin: ~90%
IV Flucloxacillin 1-2g QID	→	PO Flucloxacillin 500mg-1g Qid	Cloxacillin: ~50% (1H before meal)
IV Fluconazole 200mg-400mg OD	↔	PO Fluconazole 200mg-400mg OD	Fluconazole: >90%
IV Levofloxacin 500mg-750mg OD	↔	PO Levofloxacin 500mg-750mg PO	Levofloxacin: ~99%
IV Linezolid 600 mg BD	↔	PO Linezolid 600 BD	Linezolid: ~100%
IV Metronidazole 500mg TDS	↔	PO Metronidazole 400mg TDS	Metronidazole: 100%
IV Piperacillin/Tazobactam 4.5g TID/QID	↘	PO co-amoxiclav 1g BD **Pseudomonas: Seek advice from ID specialist or Clinical microbiology**	Amoxicillin: 80% Clavulanate: 30-98%
The following IV drugs have equivalent oral doses: Fluconazole, Azithromycin, co-trimoxazole			

↔ =Sequential therapy with direct conversion (same medication with the same IV to oral dose)

→ =Sequential therapy without direct conversion (same medication but different IV to oral dose)

↘ =Switch or step-down therapy (same or different class of medication with same/similar spectrum of activity)

APPENDIX 3: ANTIMICROBIAL STEWARDSHIP

Antimicrobial resistance (AMR) occurs when microorganism that causes infection resist the effects of the medications used to treat them. There is evidence that overall rates of antimicrobial resistance correlate with the use of antimicrobials.

The emergence of AMR can cause the resistance to first-line medicines and lead to the use of second or third-line drugs which can be less effective, more toxic, more costly and have collateral damage to the body's gut microbiota with negative outcomes to the patients. The World Health Assembly in May 2014 addressed a global consensus to combat the antimicrobial resistance. The action plan emphasized the need of an effective "one health" approach involving coordination among various sectors including human and veterinary medicine, agricultural, financial, environmental and well-informed consumers to combat the antimicrobial resistance. 5 strategic objectives had been included, and it involves:

1. Improving awareness and understanding of antimicrobial resistance through effective communication, education and training

2. Strengthening the knowledge and evidence base through surveillance and research

3. Reducing the incidence of infection through effective sanitation, hygiene and infection prevention measures

4. Optimizing the use of antimicrobial medicines in human and animal health

5. Developing the economic case for sustainable investment that takes account of the needs of all countries, and increase investment in new medicines, diagnostic tools, vaccines and other interventions

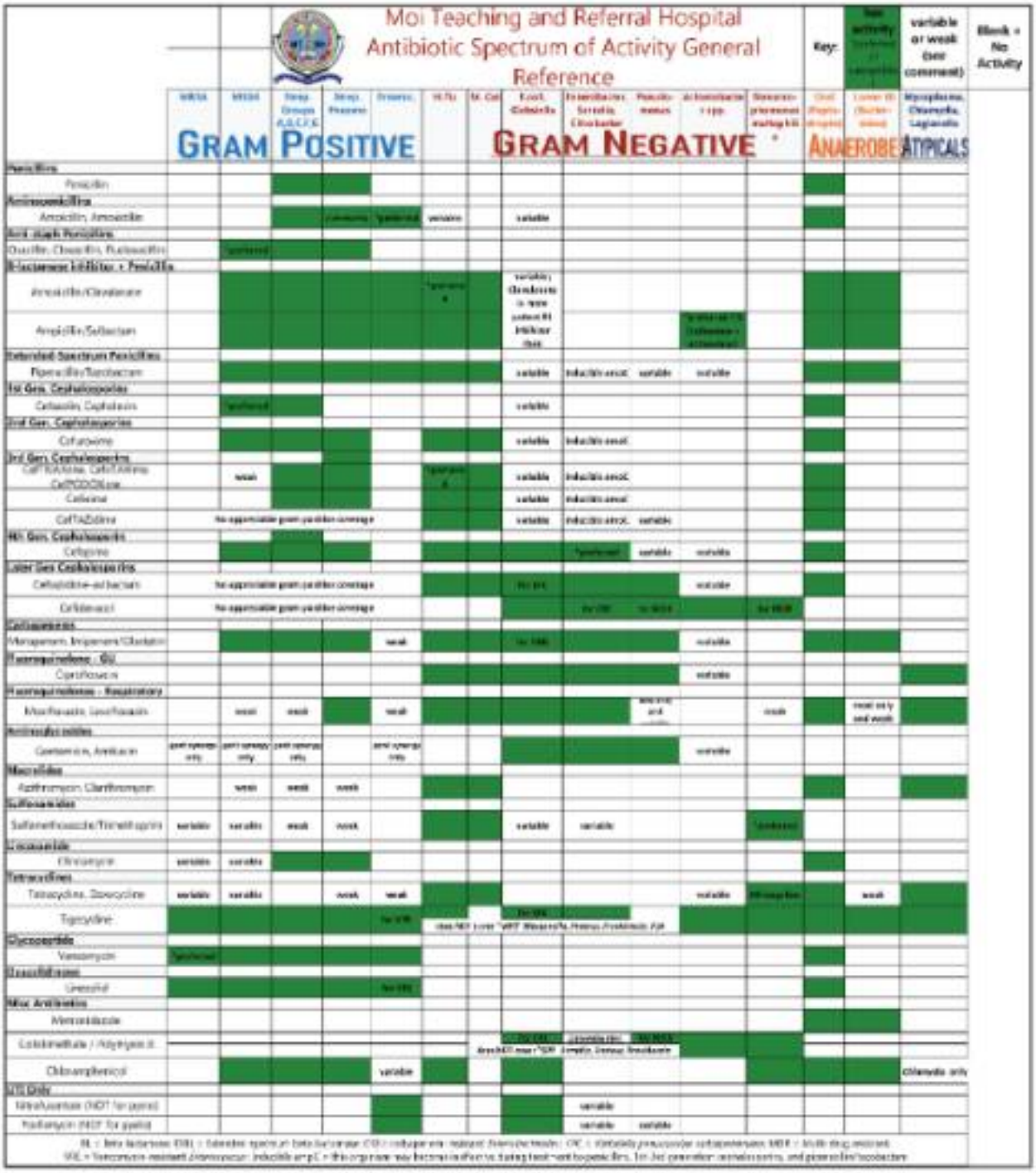
In line with strategy 4, antimicrobial management or stewardship programs have developed as a response.

Antimicrobial Stewardship (AMS) is a coordinated systematic approach to improve the appropriate use of antimicrobials by promoting the selection of the optimal antimicrobial drug regimen; right choice of antimicrobial, right route of administration, right dose, right time, right duration to optimize patients' outcomes and minimize harm to present and future patients. The development of antimicrobial resistance strains in hospitals is intensified because of the high level of antimicrobial use and concentration of patients with multiple pathogens. Ongoing monitoring and prospective audits and surveillance have been shown to improve patient care, decrease unnecessary antimicrobial use and microbial resistance and reduce pharmacy expenditures.

MTRH ANTIMICROBIAL STEWARDSHIP GOALS/STATEGIES INCLUDE:

1. Surveillance and feedback mechanism on specific antimicrobial consumption. (Core Strategy).
2. Prospective audit and feedback according to our needs. (Core Strategy).
3. Antimicrobial rounds by AMS team (Core Strategy)
4. Implement formulary restriction and preauthorization. (Core Strategy)
6. Streamlining the antibiotic usage
7. Antimicrobial selection and dose optimization of the antimicrobial
8. Initiation of intravenous (IV) to oral (PO) switch program.

APPENDIX 4. MTRH SPECTRUM OF ACTIVITY



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