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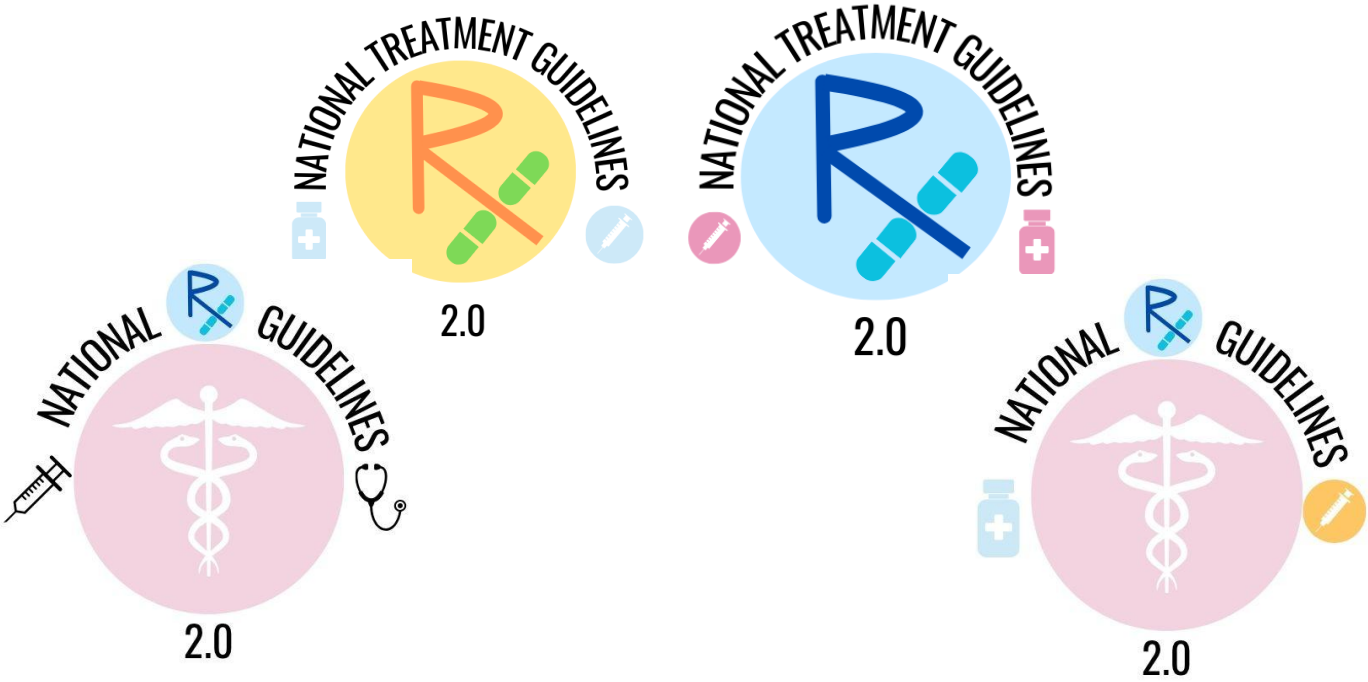
GOVERNMENT OF INDIA

National Treatment Guidelines for Antimicrobial Use in Infectious Disease Syndromes



राष्ट्रीय रोग नियंत्रण केन्द्र
NATIONAL CENTRE FOR DISEASE CONTROL
DELHI

INDIAN COUNCIL OF MEDICAL RESEARCH
NEW DELHI

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National Treatment Guidelines for Antimicrobial use in Infectious Disease Syndromes

Developed jointly by

National Centre for Disease Control
Directorate General Health Services
Ministry of Health and Family Welfare
Government of India

Indian Council of Medical Research
Ministry of Health and Family Welfare
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Version 2.0

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Before initiating the empiric therapy given in these guidelines appropriate clinical samples must be sent to the laboratory so that once the laboratory results are available, pathogen based targeted therapy must be initiated.

Contents

Acknowledgements

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Abbreviations

AMR	Antimicrobial resistance
ACE inhibitors	Angiotensin-converting enzyme inhibitors
AFB	Acid Fast Bacilli
AGE	Acute Gastroenteritis
AHA	American Health Association
ANC	Absolute Neutrophil Count
ARBs	Angiotensin 2 receptor blockers
AST	Antimicrobial Susceptibility Test
BD/bid	Twice Daily
BL-BLI	Beta Lactam-Beta Lactamase Inhibitor
BMT	Bone Marrow Transplant
CAP	Community Acquired Pneumonia
CAUTI	Catheter associated urinary tract infection
Caz-Avi	Ceftazidime Avibactam
CBA	Colistin Base Activity
CLABSI	Central Line-Associated Bloodstream Infection
CMS	Colistimethate Sodium
CMV	Cytomegalovirus
CoNS	Coagulase Negative Staphylococcus
COPD	Chronic Obstructive Pulmonary Disease
CR Klebsiella	Carbapenem Resistant Klebsiella
CrCl	Creatinine Clearance
CRO	Carbapenem Resistant Organisms
CSF	Cerebro Spinal Fluid
CT	Contrast Tomography
CVCs	Central venous catheters
DVT	Deep Vein Thrombosis
EBV	Ebstein Bar Virus
ECIL	European Conference on Infections in Leukaemia
G6PD	Glucose-6-phosphate dehydrogenase
GDH	Glutamate Dehydrogenase
g	Gram
GNBs	Gram Negative Bacteria
GVHD	Graft Versus Host Disease
HAI	Healthcare Associated Infections
HESs	Hydroxyethyl starches
HIV	Human Immunodeficiency Virus
hrly	Hourly

HSCT	Hematopoietic Stem Cell Transplant
ICMR	Indian Council of Medical Research
ICU	Intensive Care Unit
IgM	Immunoglobulin-M
Inj	Injection
IPC	Infection Prevention and Control
IPD	In Patient Department
IV	Intravenous
LCMV	Lymphocytic Choriomeningitis Virus
MDROs	Multi-drug-resistant organisms
mg	Milligram
ml	Millilitre
MOHFW	Ministry of Health & Family Welfare
MRI	Magnetic Resonance Imaging
MRSA	Methicillin resistant Staphylococcus aureus
MU	Million Unit
MUD	Matched Unrelated Donor
NAAT	Nucleic Acid Amplification test
NACO	National AIDS Control Organisation
NAP-AMR	National Action Plan on Antimicrobial Resistance
NCDC	National Centre for Disease Control
NLEM	National List of Essential Medicines
NSAIDs	Nonsteroidal anti-inflammatory drugs
OD	Once Daily
OPD	Outpatient Department
ORS	Oral Rehydration Solution
PA view	Postero-anterior view
PCP	Pneumocystis Pneumonia
PCR	Polymerase Chain Reaction
PK-PD	Pharmacokinetics-Pharmacodynamics
PNS	Para Nasal Sinuses
PO	Per Oral
PUO	Pyrexia of Unknown Origin
QID	Quarter in die (Four times a day)
RDT	Rapid Diagnostic Test
RSV	Respiratory Syncitial Virus
RTI	Reproductive Transmitted Infections
SDGs	Sustainable Developmental Goals
SOT	Solid Organ Transplant

STDs/STIs	Sexually Transmitted Diseases/Infections
Tab.	Tablet
TDM	Therapeutic Drug Monitoring
TDS	Thrice a day
TMP	Trimethoprim
URTI	Upper Respiratory Tract Infection
USG	Ultrasonography
VAP	Ventilator Associated Pneumonia
VZV	Varicella Zoster Virus
WASH	Water, Sanitation and Hygiene
WHA	World Health Assembly
WHO	World Health Organisation

Introduction

Antimicrobial resistance (AMR) is a major global health threat overshadowing the potential gains made since the discovery of antimicrobials. The Global Burden Disease study on antimicrobial resistance conducted in 2021 reported that 4.71 million deaths were associated with bacterial AMR including 1.14 million deaths attributable to bacterial AMR.[1] AMR threatens all age groups of people in all regions, with low- and middle-income countries most affected, making it a major socio-economic problem. The emergence of various multi-drug-resistant organisms (MDROs), commonly referred to as "superbugs" are further complicating the problem, making common infections much more difficult to treat. AMR also poses risk to safety of routine medical procedures, cancer treatments and surgeries which in absence of effective antibiotics may lead to increased treatment expenses, prolonged hospital stays and even increased mortality.

It is well known that AMR is primarily driven by misuse and overuse of antimicrobials. Also, the research and development for newer antimicrobials is slow, which generates an urgent need to tackle the issue of AMR with a multidisciplinary approach. The most important component of this approach is prevention of infections, both in the community and hospital settings through improved WASH and IPC practices, other measures being universal access to quality and affordable diagnostics and appropriate treatment of infections based on appropriate laboratory investigations and inputs from qualified antimicrobial stewardship team where relevant e.g. while prescribing reserve group of antimicrobials or when managing patients with high risk of infections. Moreover, monitoring trends of AMR based on data from well-equipped and well utilised laboratories helps in understanding local trends of antimicrobial susceptibility, which guides the practitioners in selecting appropriate empirical antimicrobial therapy for management of patients with severe infections.

In 2015, World Health Assembly in its Sixty-eighth resolution (WHA68.7), adopted the global action plan on AMR. The resolution urged all the Member States to develop and implement national action plans on antimicrobial resistance, as per their local needs while adopting the resolution to endorse a global action plan on antimicrobial resistance (GAP AMR).

India developed its National action plan on AMR (NAP AMR) in alignment with the GAP AMR with involvement of various sectors and launched it in April 2017. India has updated its NAP AMR (2025-2029) which lays out the National Strategy for AMR Containment involving six strategic objectives. One of the strategic objectives is to strengthen laboratory capacity to enable appropriate use of antimicrobials and generate quality surveillance data. The fourth strategic objective focused on optimising use of antimicrobials includes revision of the National Treatment guidelines for common infectious diseases in humans as one of the activities to be carried out by NCDC and ICMR.

The National Treatment Guidelines for Antimicrobial Use in Infectious Diseases was released in 2016 by National Centre for Disease Control. Indian Council of Medical Research in 2017 published Treatment Guidelines for Antimicrobial Use in Common Syndromes and 2nd edition of the same was released in 2019.

Based on the trends of antimicrobial resistance in commonly isolated pathogens being tracked under NARS-NET coordinated by NCDC and AMRSN coordinated by ICMR and inputs from clinical experts

[1] *GBD 2021 Antimicrobial Resistance Collaborators. Global burden of bacterial antimicrobial resistance 1990–2021: a systematic analysis with forecasts to 2050. Lancet 2024. https://doi.org/10.1016/ S0140-6736(24)01867-1*

from across the country, this updated version of the guidelines has been developed. These guidelines are expected to help in establishing consistency across the country for the empiric treatment of commonly identified infectious disease syndromes and ensure timely management of such patients.

This 'National Treatment Guidelines for Antimicrobial use in Common Infectious Disease Syndromes' (Version 2.0) aims to guide the empiric use of antimicrobials where the severity of infections mandate initiation of antimicrobials before culture and antimicrobial sensitivity results are available.

These guidelines list the recommended empiric treatments for common infectious disease syndromes while results of cultures of clinical samples are awaited. These recommendations are based on scientific evidence, literature review and are consistent with the already existing international guidelines and formulated with in-depth discussions with a large group of recognised national experts. The syndromes covered in this document include the commonly encountered syndromes in clinical practice, infections of specific body sites, and infections seen in certain special settings. Annexed at the end of these guidelines are common etiological agents causing the infections which are linked in appropriate sections.

Instructions to use these guidelines

- These are general guidelines and primarily cater to places which do not have their local hospital/institute antibiotic policy. It is encouraged to develop/formulate institutional antibiotic policy. These guidelines can serve as a broad framework on which such policy can be based upon.
- Before initiating the empiric therapy given in these guidelines appropriate clinical samples must be sent to the laboratory so that once the laboratory results are available, pathogen based targeted therapy must be initiated.
- These guidelines are for prescriptions of antibiotic empirically (i.e. after making a clinical diagnosis), and must be modified based on culture and antimicrobial susceptibility testing (AST) results.
- Antibiotic recommendations given here are based on clinical syndrome, likely pathogens causing that infection and antibiotic-resistance pattern in our country. Local antibiograms may be used to modify these recommendations.
- All possible clinical conditions which require empirical use of antibiotics are covered in these guidelines, readers are advised to read the comments sections also to get additional information for that particular clinical condition.

Basics of antibiotic prescriptions

Step 1: Making a clinical diagnosis is often not given enough importance and instead multiple lab tests are prescribed to establish the diagnosis. However, a clinical diagnosis made based on detailed history and existing signs and symptoms often helps to predict presumptive diagnosis along with suspected causative agents which would tailor the use of correct antibiotic rather than blindly relying on non-specific indicators like CRP, procalcitonin etc. Even results of more specific tests like WBC counts, culture & antimicrobial sensitivity tests or radiology must be correlated clinically before initiating or modifying therapy. Our thought process here should be:

- How likely is it that the patient has an infection?
- What are the possible non-infectious causes that the current clinical condition mimics?
  Have we sent appropriate clinical samples for culture and AST to confirm the final diagnosis?

Step 2: Consider the possible etiology of the clinical syndrome

- Elucidate possible sources of infection.
- Identify possible microbial pathogens.
- Review the local resistance pattern based on institutional antibiogram.

Step 3: Limiting empiric antibiotic therapy to seriously ill patients: Generally, empiric antibiotic therapy is ONLY recommended for a select group of patients, some of which are described below (after sending appropriate clinical samples for culture and AST)

- Febrile neutropenia
- Severe sepsis and septic shock
- Community acquired pneumonia
- Ventilator associated pneumonia
- Necrotizing fasciitis
- Meningitis

It is important to start smart and then based on culture and AST result evaluate if empiric therapy is justified or needs to be de-escalated and then make a plan with regard to the duration of therapy.

Step 4: **Selection of the appropriate antibiotic**

- Based on the spectrum of the antibiotic taking into account possible resistant patterns
- Use the correct dose, route and duration
- Ensure chosen antibiotic has adequate tissue penetration at the site of infection
- Optimize PK-PD parameters according to co-morbidities
- Give β-lactams in extended infusion (3 hrs), particularly in sick patients: For example: Inj Meropenem 1g IV 8hrly (over 3 hrs), [provided that the particular brand used has stability as per manufacturer's instruction for extended infusion].

Step 5: De-escalation/modification/targeted therapy

- Targeted Therapy: Modify empiric broad spectrum antibiotics depending on culture and AST results, other appropriate diagnostic tests and patient status.
- Stop polymyxins and glycopeptides if no carbapenem resistant organisms (CRO) or methicillin resistant *Staphylococcus aureus* (MRSA) identified on cultures.
- Avoid double or redundant gram negative or anaerobic coverage. For example: antibiotics like carbapenems, BL-BLI like amoxicillin-clavulanic acid, piperacillin-tazobactam, cefoperazone-sulbactam and tigecycline have good an-aerobic cover, so adding metronidazole is not warranted. (Annexure A)
- Discontinue antibiotics if a non-infectious etiology is identified.
- De-escalate combination therapy to a single agent.
- Change a broad-spectrum antibiotic to a narrow spectrum one.
- Change IV to oral antibiotics.
- De-escalation is safe in all patients including febrile neutropenia and septic shock and reduces mortality and length of hospital stay.

Note:

- It is emphasized that antimicrobials should be prescribed only when they are necessary for treatment following a definitive diagnosis.
- Not all patients need antibiotics; in many cases only symptomatic management may be suitable and this has been emphasized in these guidelines. In all cases, the benefit of administering the medicine should be considered in relation to the risk involved. This is particularly important during pregnancy where the risk to both mother and foetus must be considered. The content of these treatment guidelines will undergo a process of continuous review. Comments or suggestions for improvement are welcome. These suggestions may be sent to: **napamrindia@gmail.com**

DISCLAIMER:

This publication provides only suggestive guidelines and the opinions expressed herein reflect those of the contributors. The protocols described herein are general and may not apply to a specific patient. They should NOT supplant clinical judgment, factors like hemodynamics of specific patients, availability of antimicrobials and local antibiogram of the healthcare setting.

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1. Cardiovascular Syndromes

1.1 *Infective Endocarditis* (Empirical therapy pending blood culture results)

Type of Infection	First Line (with Dosage and Duration)	Alternative First Line (with dosage and Duration)	Comments
Uncomplicated - Native valve*	Penicillin G 4 million units IV 4th hrly for 4 weeks Or Ampicillin 2g IV 4 hrly for 4 weeks + Gentamicin 1mg/kg IM or IV 8 hrly for first 2 weeks	Vancomycin 15mg/kg IV 12 hrly (maximum 1g 12 h) for 4-6 weeks Gentamicin 1mg/kg IM or IV 8hrly for 4 weeks	These are among the few conditions where combination antimicrobial therapy is contemplated as synergism of antimicrobials is established. If patient is stable, ideally wait for blood cultures and modify antibiotics based on culture results and complete 4-6 weeks of antibiotics. Two sets of blood cultures within 1 h of each other in patients with suspected endocarditis and acute sepsis and three sets of blood cultures spaced ≥6 h apart in cases of suspected subacute or chronic endocarditis are recommended for best results.
Uncomplicated - Prosthetic valve*	Vancomycin 15mg/kg IV 12 hrly (maximum 1g 12 h) for 6 weeks + Gentamicin 1mg/kg IM or IV 8 hrly for first 2 weeks	Daptomycin 10mg/kg every 24 hours + Gentamicin 1mg/kg IM or IV 8hrly for first 2 weeks	
Complicated (In Severe Sepsis)	Vancomycin 15mg/kg IV 12 hrly (maximum 1g 12 h) for 4-6 weeks + Meropenem 1g IV q8h for 4-6 weeks Or Teicoplanin 12mg/kg IV 12 hrly x 3 doses followed by 6 - 12mg OD IV depending upon severity + Gentamicin 1mg/kg IM or IV 8 h for 4-6 weeks	Daptomycin 10mg/kg IV OD + Meropenem 1g IV q8h Duration: 4-6 weeks	

For common etiological agents of Infective Endocarditis, see Annexure B.1.1

Additional Information:

- Echocardiography should be done in cases of suspected infective endocarditis (IE).
- Guidance from Infectious disease specialist or clinical microbiologist is recommended.
- Host factors like age, physiological state of the patient (e.g. pregnancy and lactation), organ function (e.g. renal or hepatic function), genetic variation (e.g. G6PD deficiency), allergy or intolerance must be kept in mind while prescribing antimicrobial therapy.

- Initial therapy of IE is empirical; typically, results of blood cultures are monitored for hours to days until a pathogen is identified. During this time, empirical antimicrobial therapy is administered with the expectation that the regimen will be revised once a pathogen is defined and susceptibility results are obtained. The selection of an optimal empiric regimen is usually broad and is based on factors that relate to patient characteristics, prior antimicrobial exposures and microbiological findings, and epidemiological features.
- PET-CT scan can be done in patients with inconclusive echocardiography or in those patients in whom TEE is not possible.

Reference:

1. Infective Endocarditis in Adults: Diagnosis, Antimicrobial Therapy, and Management of Complications A Scientific Statement for Healthcare Professionals From the American Heart Association Endorsed by the Infectious Diseases Society of America. Circulation. 2015;132:1435-1486. DOI: 10.1161/CIR.0000000000000296.

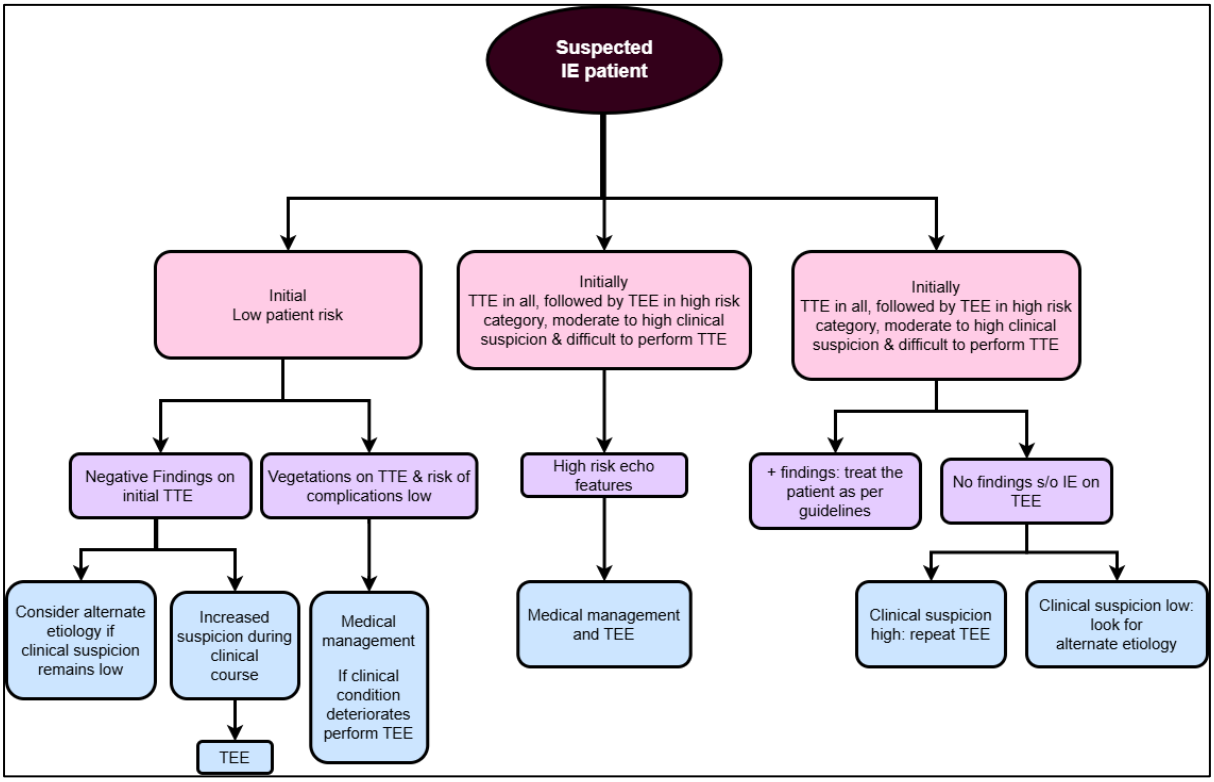

Figure 1.1: Approach in a case of suspected Infective Endocarditis

1.2 *Acute Myocarditis:*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Uncomplicated	No empirical antibiotics required		Mild myocarditis may only need rest and supportive medicine. If myocarditis is severe, immunomodulators like steroids may be administered to improve cardiac function. Myocarditis is a diagnosis of exclusion. If bacterial cause is ascertained through culture, start antibiotics based on AST results.
	No empirical antibiotics required		If myocarditis is causing severe heart failure or arrythmia, to reduce the risk of blood clots anticoagulants may be administered. In addition, to address fluid overload and to reduce the strain on the heart, diuretics, beta blockers, angiotensin-converting enzyme (ACE) inhibitors or angiotensin 2 receptor blockers (ARBs) need to be given.

For common etiological agents of Myocarditis, see Annexure B.1.2

1.3 *Pericarditis*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Uncomplicated	No empirical antibiotics required		Mostly viral etiology
Complicated (features of tamponade)	No empirical antibiotics required		Pericardiocentesis is recommended, when possible, to establish cause. If microbiology laboratory evidence indicates bacterial infection, antibiotics should be started.

For common etiological agents of Pericarditis, see Annexure B.1.3

Additional Information:

- Corticosteroid therapy may be considered on a case-to-case basis for treatment of pericarditis.
- Pericardiocentesis may be considered where cardiac tamponade is imminent.

1.4 *Rheumatic fever*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Uncomplicated	Penicillin G benzathine 0.6 million {weight < 27 Kgs}, 1.2 million {>27Kgs} units IM as a single dose Penicillin V, 500 mg q8h for 10 days Or Amoxicillin 500 mg q8h for 10 days	Confirmed penicillin allergy – Azithromycin 500 mg per oral / q24h for 5 days	Secondary prophylaxis: An injection of 0.6-1.2 million units of Benzathine penicillin G intramuscularly every 3 weeks is the recommended regimen Or Penicillin V, 250 mg BD Or Oral erythromycin 20 mg/Kg/dose Maximum dose of 500 mg BD.

For common etiological agents of Rheumatic fever, see Annexure B.1.4

Additional Information:

- Aspirin, steroids, or nonsteroidal anti-inflammatory drugs (NSAIDs) may be given to reduce inflammation.

2. Central Nervous System Infections

2.1 *Brain Abscess*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Uncomplicated (abscess <2.5cm & patient neurologically stable)	Ceftriaxone 2g IV q12h Or Cefotaxime 2g IV q6h + Metronidazole 500mgIV q8h (10 mg/kg/dose)	Inj Meropenem 2g IV q8h In case of allergy to penicillins, cephalosporins and carbapenems antibiotics: Vancomycin 1g IV q12h + Aztreonam IV 2g q8h	To exclude TB, *Nocardia, Aspergillus, Mucor, Cladophialophora, Candida, Cryptococcus neoformans, Entamoeba histolytica, Listeria monocytogenes.* Duration of treatment: 3- 12 weeks (depending on resolution of lesions and symptoms.
Complicated (Patient neurologically unstable)	Meropenem 2mg IV q8h + Vancomycin 25 mg/kg IV stat followed by 15mg/kg q 8-12h		Drain pus, rationalize antibiotics according to culture and sensitivity and continue for 3 to 12 weeks.

For common etiological agents of brain abscess, see Annexure B.2.1

Additional Information:

- If abscess >2.5cm consider aspiration/surgical drainage and modify antibiotics as per sensitivity of aspirated/drained secretions.

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2.2 Encephalitis syndrome

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Complicated (encephalitis with meningeal signs and features of sepsis)	Acyclovir (use in all suspected sporadic viral encephalitis): 10 mg/kg IV q8h. Duration of IV acyclovir therapy: 14-21 days + Ceftriaxone 2g IV q12h (when not certain bacterial or viral and till CSF cell count, sugar, protein or culture results are available) + Doxycycline 100mg PO q12h/IV (Where scrub typhus is endemic) Duration: 10-14 days	.	Empiric therapy should be started immediately after drawing blood cultures pending results of tests. If RDT positive, follow malaria treatment guidelines; Attempts to have tele consult from neurologist/ID Physician. (utilize govt tele consult services). Use CSF cultures, PCR tests and other serology markers to exclude pathogens and change to targeted therapy.

For common etiological agents of acute encephalitis, see Annexure B.2.2

Additional Information:

- Supportive care should be continued and then therapy narrowed based on the results of investigations.
- Acyclovir: Renal impairment: CrCl 25–50ml/min: give dose every 12 hours; CrCl 10–25ml/min: give dose every 24 hours; CrCl<10ml/min: reduce dose by 50% and give every 24 hours.

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2.3 *Meningitis syndrome*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Acute Meningitis	Ceftriaxone 2g IV 12 h Or Cefotaxime 2g IV 4-6 h + Vancomycin 25 mg/kg IV stat followed by 15mg/kg q 8-12h (if penicillin or Ceftriaxone/ Cefotaxime resistance in pneumococcus is a concern) Duration:10-14 days	In immunocompromised and patients with age more than 50 yrs Inj Meropenem 2g IV q8hr + Vancomycin 25 mg/kg IV stat followed by 15mg/kg q8-12h Duration:10-14 days	Antibiotics should be started as soon as possible without waiting for CT scan or LP results. If difficult to distinguish between meningitis and encephalitis, follow same treatment as under encephalitis. Duration of therapy: 10-14 days. If infection with *Listeria spp*. is suspected, add Inj Ampicillin 2g q4h IV (immunocompromised/pregnant host) Duration of therapy in Listeria infections: 21 days.

For common etiological agents of Meningitis, see Annexure B.2.3

Additional Information:

- Treat bacterial meningitis due to Gram-negative bacilli or *Staphyloccocus* spp. for at least 21 days.
- May need intra ventricular antimicrobial therapy in severe cases.
- Pyogenic meningitis should be differentiated from tubercular meningitis, which has relatively longer history of low to high grade of fever, constitutional symptoms, and CSF shows lymphocytic predominance, normal to mildly reduced sugar and raised proteins.
- A high index of suspicion must be maintained to diagnose amoebic meningoencephalitis especially if an epidemiologic link is present.

Reference:

1. Van de Beek D, Cabellos C, Dzupova O, Esposito S, Klein M, Kloek AT, Leib SL, Mourvillier B, Ostergaard C, Pagliano P, Pfister HW, Read RC, Sipahi OR, Brouwer MC; ESCMID Study Group for Infections of the Brain (ESGIB). ESCMID guideline: diagnosis and treatment of acute bacterial meningitis. Clin Microbiol Infect. 2016 May;22 Suppl 3:S37-62. doi: 10.1016/j.cmi.2016.01.007. Epub 2016 Apr 7. PMID: 27062097.

2.4 *CSF shunt infections*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
CNS device infections in stable patients	Vancomycin 25 mg/kg IV stat followed by 15mg/kg q 8-12h + Ceftazidime 2g IV q8h Or Cefepime 2g IV q8h		For confirmed shunt infections, the shunt should be removed and a temporary external ventricular drain inserted. The shunt should be sent for cultures. Adjunctive intraventricular antibiotics are not routinely necessary for treatment of CSF shunt infections. Intraventricular antibiotics may be required for: infections that are refractory to appropriate systemic antibiotic therapy, infections caused by highly resistant organisms susceptible only to antimicrobials with poor CSF penetration, and infections in which the shunt cannot be removed. When intraventricular antibiotics are used, they should be administered in combination with intravenous therapy. Uncomplicated shunt infections can be treated with a total course of 7–12 days of intra-ventricular and intravenous antibiotics. Complicated shunt infections can be treated with 2 weeks intra-ventricular (given OD) and 3 weeks intravenous antibiotics. Complicated shunt infections are defined for

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
			the purpose of this protocol as multiple compartment hydrocephalus, multiple organism shunt infection, severe peritonitis, or infections in other sites of the body.
In sick patients	Vancomycin 25 mg/kg IV stat followed by 15mg/kg q8-12h + Meropenem 2g IV 8 h		

For common etiological agents of CSF shunt infections, see Annexure B.2.4

Additional Information:

- The time of shunt re-implantation depends on the causative organism and extent of infection. It can be done as soon as after 2 days of negative cultures in patients with CoNS and normal CSF sugar, or 7 days of negative cultures in patients with CoNS and abnormal CSF findings, 10 days of negative cultures in patients with infection with S. aureus/ gram negative bacilli. The total duration of antimicrobial therapy varies from 7-10 days for CoNS to 10-14 days for *S. aureus* and Gram-negative bacilli.
- The Infectious Diseases Society of America guidelines recommended intrathecal/intraventricular therapy daily dose of colistin 10 mg of CMS or colistimethate sodium (about 125 000 IU CMS; 3.75 mg CBA).
- Doses of other intra-ventricular antibiotics:
    i. Colistin: 125,000 IU for 9 to 16 days
    ii. Vancomycin: 12.2 mg/day for 5 days
    iii. Gentamicin/tobramycin: 6.7 mg/day for 6 days
- Doses of drugs to be given by the intrathecal/ intraventricular route (CSF shunt infections) are tabulated below:

Drug	Dose
Vancomycin	5-20 mg
Teicoplanin	5-40 mg
Amikacin	5-50 mg
Gentamicin	1-8 mg
Colistin	10-20 mg
Polymyxin B	50,000 units
Daptomycin	2-5 mg
Tobramycin	5-20 mg

References:

1. Robinson JL, Freire D, Bialy L. Treatment strategies for cerebrospinal shunt infections: a systematic review of observational studies. *BMJ Open.* 2020 Dec 10;10(12): e038978. doi: 10.1136/bmjopen-2020-038978. PMID: 33303443; PMCID: PMC7733168.
2. James HE, Bradley JS. Management of complicated shunt infections: a clinical report. *J Neurosurg Pediatr.* 2008 Mar;1(3):223-8. doi: 10.3171/PED/2008/1/3/223. PMID: 18352767.
3. Eljaaly K. Dose and duration of intraventricular antibiotic therapy in meningitis. *Clin Microbiol Infect.* 2016 Sep;22(9):817. doi: 10.1016/j.cmi.2016.05.019. Epub 2016 May 30. PMID: 27256064.
4. Lewin JJ 3rd, Cook AM, Gonzales C, Merola D, Neyens R, Peppard WJ, Brophy GM, Kurczewski L, Giarratano M, Makii J, Rowe AS, Tesoro EP, Zaniewski A, Clark S, Ziai WC. Current Practices of Intraventricular Antibiotic Therapy in the Treatment of Meningitis and Ventriculitis: Results from a Multicenter Retrospective Cohort Study. *Neurocrit Care.* 2019 Jun; 30(3):609-616. doi: 10.1007/s12028-018-0647-0. PMID: 30446934.

2.5 *Healthcare Associated Ventriculitis*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Complicated (Meningitis-Post-neurosurgery or Penetrating head trauma or with basilar skull fractures)	Meropenem 2g IV q8h + Vancomycin 25 mg/kg IV stat followed by 15mg/kg q 8-12h + If local antibiograms of healthcare associated ventriculitis are suggestive of high incidence of carbapenem resistant Gram-negative bacteria; then add cover for carbapenem resistant organisms (Inj Fosfomycin 4g IV q6h or Inj Polymyxin B 15lacs IV stat and 7.5lacs IU BD) Duration of treatment: 14 -21 days		Healthcare associated Ventriculitis and meningitis maybe a sequelae of infections occurring in the proximal part of CSF shunts.

For common etiological agents of Healthcare Associated Ventriculitis, see Annexure B.2.5

Additional Information:

- May need intra ventricular antimicrobial therapy in severe cases.
- Factors which increase the risk of post neuro-surgical infections:
  CSF leak, CSF drainage, prolonged duration of surgery (> 4 hours), venous sinus surgery, implantation of foreign materials, posterior approach to spinal surgery, diabetes, tobacco smoking, previous neuro-surgeries, hair shaving in ventriculo-peritoneal shunt placement.
- **Guidance on the microbiological specimens to be submitted to the laboratory when shunt infections are suspected is tabulated below:**

S. No	Suspected Condition and time of collection	Specimen to be collected
1.	Community Acquired Meningitis Suspected in a Shunted Patient	CSF by LP not through the shunt[a]
2.	Suspected Shunt Infection – Ventriculitis at Time of Presentation	CSF[a] from: - - Needle aspiration of the valve - The implantable reservoir if present But NOT the bag If there is an obstacle to obtain the appropriate specimen and a less useful specimen is collected then the specimen needs to be clearly labeled stating the collection method with liaison with the laboratory
3.	At Procedure of Surgical Removal[b]	Ventricular catheter Various sites of Shunt tubing "proximal, distal" The Spitz-Holter valve Reservoir "if present" Intraventricular portion of EVD if applicable
4.	Following Shunt Removal[c]	CSF from the temporary EVD apparatus every other day to check for sterility and schedule for a new shunting
5.	During re-shunting surgery	CSF and external wound Avoid unnecessary sampling and introduction of organisms in the new apparatus
6.	After surgery	As clinically indicated. Minimize invasive procedures to avoid iatrogenic infection.

a-In suspected cases of ventriculitis and meningitis collected CSF samples should be processed for Gram stain, analysis and culture (prefer to inoculate in automated blood culture bottle at bed side for better yield);
b-Microscopy from site of pathology and culture of various sites for bacteria, fungi and mycobacteria; samples should not be fixed in formalin;
c-CSF labeled as D1, D3, D5 etc: Gram stain, Analysis, (Giemsa for sterility) & Culture to be done. These clinical presentations should be managed at Tertiary Health Care Centres.

Doses of drugs used in CNS infections is tabulated below:

Drug	Adult dose	Paediatric dose
Artesunate	2.4 mg/kg 0,12 and 24 hours and then q 24 hrly	< 20 kg 3 mg/kg at 0,12 and 24 hours and then q 24 hrly
Acyclovir	10 mg/kg 8 hrly	10 mg/kg 8 hrly and in children below 12; 20 mg/kg 8 hrly
Ceftriaxone	2 g 12 hrly	50 mg/kg 12 hrly
Ceftazidime	2 g q 6-8 hrly	50 mg/kg 8 hrly
Cefepime	2 g 8-12 hrly	50 mg/ kg 12 hrly
Cefotaxime	2 g 6 hrly	50 mg/kg 6 hrly
Meropenem	2 g 8 hrly	40 mg/kg 8 hrly

Drug	Adult dose	Paediatric dose
Colistin	9 million unit loading and then 3 million 8 hrly	150,000 units/ kg loading and then 50,000 units/ kg 8 hrly
Polymyxin B	15,00,000 units loading and then 7,50,000 12th hrly Loading dose of 25,000 units/kg followed by a total daily dose of 25,000 units/kg divided into two doses of 12,500 units/kg every 12 hours.	15-25,000 units/ kg loading and then 5000-7500 units/ kg 8 hrly
Fosfomycin	4 g 6 hrly	75-100 mg/kg/dose 6 hrly
Cotrimoxazole	3-6 mg/kg of TMP TDS	
Vancomycin	15 mg/kg (max 2 g) eight hrly	15 mg/kg 6 hrly
Cloxacillin	2 g 4 hrly	50 mg/kg 6 hrly
Doxycycline	100 mg 12 hrly	1.5-2 mg/kg 12 hrly
Chloramphenicol	1-2 g 6 hrly	25 mg/kg 6 hrly
Rifampicin	600 mg OD	10-20 mg/kg OD
Metronidazole	400 mg 8 hrly	10 mg/kg 8 hrly
Amphotericin B	1 mg/kg/day	
Liposomal amphotericin B	3-5 mg/kg/day	
Fluconazole	800 mg loading and then 400 mg OD	12 mg/kg loading and then 6 mg/ kg daily 25 mg/kg loading in neonates and then 12 mg/kg daily

References:

1. Alnimr, Amani. (2012). A Protocol for Diagnosis and Management of Cerebrospinal Shunt Infections and other Infectious Conditions in Neurosurgical Practice. Basic and Clinical Neuroscience. 3. 61-70.
2. Fiani B, Cathel A, Sarhadi KJ, Cohen J, Siddiqi J. Neurosurgical Post-Operative Wound Infections: A retrospective study on surgical site infections for quality improvement. Int Wound J. 2020 Aug;17(4):1039-1046. doi: 10.1111/iwj.13367. Epub 2020 Apr 21. PMID: 32315121; PMCID: PMC7948741.
3. Vazquez S, Gold J, Spirollari E, Akmal S, Hanft SJ. The story of dexamethasone and how it became one of the most widely used drugs in neurosurgery. J Neurosurg. 2023 Nov 24;140(4):1191-1197. doi: 10.3171/2023.9.JNS231099. PMID: 38000066.

3. Febrile Syndromes

3.1 *Acute Undifferentiated Febrile illness*

Acute febrile syndrome presents with headache, chills, or muscle and joint pains and is usually viral and often resolves without treatment. Acute febrile syndrome can also be caused by bacterial, rickettsial or parasitic infections and non-infective conditions like autoimmune disorders. Timing of blood tests is important for diagnosing it correctly.

Day 1 or 2 (of fever onset): A. Defer investigations or use of antimicrobials.

Day 3 or 4 (of fever onset): B. Total leukocyte count with differential, liver function tests, renal function tests, complete urine examination and random blood sugar and further investigations based on clinical symptoms and risk factors like: test for dengue antigen, peripheral blood smear for malarial parasite and rapid diagnostic test for malaria.

> 5 days of fever: C. Tests in B as above and 2 sets of blood cultures. Serology (IgM) for dengue, chikungunya, scrub typhus, leptospirosis can be done based on clinical suspicion. X-ray chest PA view.

> 7 days of fever: D. Tests as in C as above and USG abdomen and other tests as appropriate

If the patient is immunocompromised, focus on early investigations to know the organism responsible and organ system affected.

Even though most of the viral infections are self-limiting, influenza can lead to severe respiratory failure in immunocompromised hosts especially in elderly. This patient subset will benefit with early diagnosis with molecular diagnostics and early treatment with antivirals.

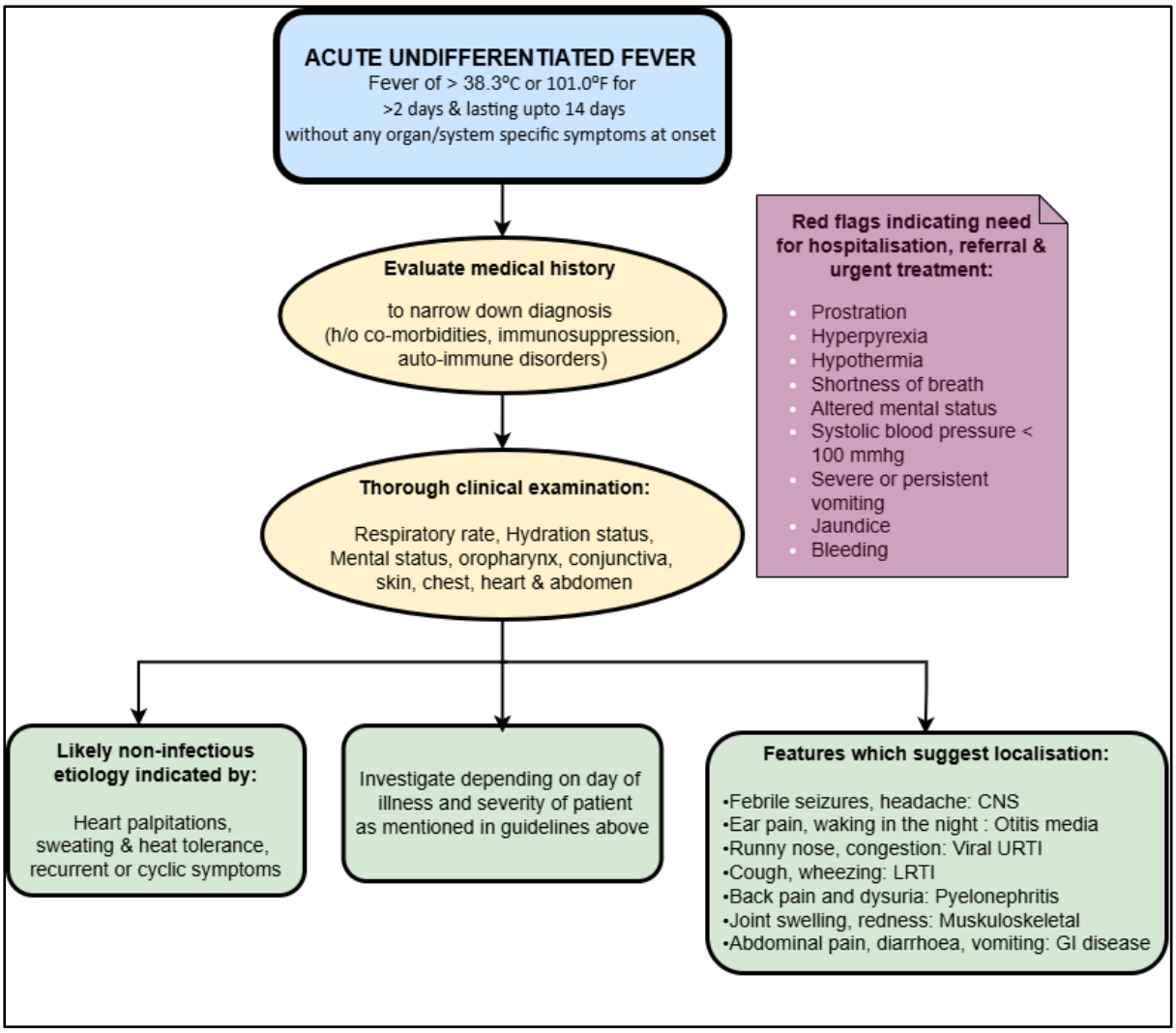

Figure 3.1: Protocol for management of patients with acute undifferentiated fever

For common etiological agents of Acute Undifferentiated Fever, see Annexure B.3.1

References:

1. Treatment Guidelines for Antimicrobial Use in Common Syndromes. 2nd edition. ICMR. 2019. New Delhi (Accessed on 2nd April, 2025). Available from: https://www.icmr.gov.in/icmrobject/custom_data/pdf/resource guidelines/Treatment_Guidelines_2019_Final.pdf
2. NCVBDC. Diagnosis and Treatment of Malaria. MOHFW, NCDC. 2013. Available from: https://ncvbdc.mohfw.gov.in/Doc/Diagnosis-Treatment-Malaria-2013.pdf

3.2 *Enteric fever*

Type of Infection	First Line	Alternative	Comments
Uncomplicated - Can be treated at OPDs (if without complications such as severe dehydration, weakness, abdominal haemorrhage, encephalitis)	Azithromycin 20 mg /kg/ day for 7 days (maximum 1g/day) Or Cotrimoxazole 960 mg BD for 2 weeks (10 mg/kg of TMP)	Cefixime 20mg/kg/day for 10-14 days	Blood culture remains the gold standard. Avoid using Widal test for diagnosis of Enteric fever. Resistance rates are low for co-trimoxazole, chloramphenicol and third generation cephalosporins. Empirical use of fluoroquinolones should be avoided. Defervescence of fever may take up to 4-5 days; so mere persistent fever for 4-5 days should not be the reason to switch antibiotics. Cefixime has been associated with longer time to defervescence compared to other antibiotic classes.
Complicated - persistent high fever or any of the complications mentioned above	Ceftriaxone 2g IV OD for 10- 14 days and / Or Azithromycin 20mg/kg/ day for 7 days for Inpatients		Follow up with culture susceptibility to modify and plan oral switch. Ceftriaxone can be changed to oral cefixime/ cotrimoxazole, when patient improves to complete total duration of 10- 14 days. Empiric use of carbapenems should be avoided.

For common etiological agents of Enteric fever, see Annexure B.3.2

References:

1. Kuehn R, Stoesser N, Eyre D, Darton TC, Basnyat B, Parry CM. Treatment of enteric fever (typhoid and paratyphoid fever) with cephalosporins. *Cochrane Database Syst Rev*. 2022;11(11):CD010452. Published 2022 Nov 24. doi:10.1002/14651858.CD010452.pub2
2. Treatment Guidelines for Antimicrobial Use in Common Syndromes. 2nd edition. ICMR. 2019. New Delhi (Accessed on 2nd April, 2025). Available from: https://www.icmr.gov.in/icmrobject/custom_data/pdf/resource-guidelines/Treatment_Guidelines_2019_Final.pdf

3.3 *Pyrexia of unknown origin (PUO)*

Type of Infection	First Line (with Dosage and Duration)	Comments
PUO	No antibiotics suggested unless the patient has features of sepsis	Empiric antimicrobial therapy is generally not recommended for treating pyrexia of unknown origin (PUO) as it can delay the evaluation for the cause of the fever. Needs work up for infectious & non-infectious causes.

For common etiological agents of Pyrexia of unknown origin, see Annexure B.3.3

References:

1. Fernandez C, Beeching NJ. Pyrexia of unknown origin. *Clin Med (Lond)*. 2018;18(2):170-174. doi:10.7861/clinmedicine.18-2-170
2. Varghese G M, Trowbridge P, Doherty T. Investigating and managing pyrexia of unknown origin in adults BMJ 2010; 341: c5470 doi:10.1136/bmj.c5470

3.4 *Sepsis syndrome- Community acquired and Hospital acquired*

Type of Infection	First Line	Alternative	Comments
Sepsis – Community acquired without localization	Piperacillin-tazobactam 4.5g IV q6h	Cefoperazone-sulbactam 3g IV q12h	Add Doxycycline 100mg IV q12h if from endemic area for rickettsial infections. Duration of therapy will depend upon: • Finding focus of infection • Identification of infectious agent • Patient clinical status
Septic shock-community acquired infection without localization	Inj Meropenem 1g IV q8h + Inj Teicoplanin 400mg IV q12h for 3 doses followed by 6-12mg/kg IV q24h	Inj Imipenem-cilastatin 1g stat and 500mg IV q6h + Inj vancomycin 25 mg/kg IV stat followed by 15mg/kg q8-12h	Add Doxycycline 100mg q12h IV if from endemic area for rickettsial infections. Duration of therapy will depend upon: • Finding focus of infection • Identification of infectious agent • Patient clinical status If blood cultures are negative at 48 hours and if patient is improving, antibiotics can be de-escalated.
Hospital acquired sepsis (organ / device	Meropenem 1g IV q8h Or Imipenem-cilastatin IV 1g stat and 500mg q6h	Meropenem 1g IV q8h + Polymyxin B 15-20 lakhs	Hospital antibiogram is crucial for selecting empiric antibiotics for HAI. Duration of therapy will depend upon:

specific infection is dealt under HAI)		units IV stat, then 7.5-10 lakhs IV q12h Or Colistin 9MU IV stat, then 4.5 MU IV q12h	• Finding focus of infection • Identification of infectious agent • Patient clinical status Add Vancomycin or Teicoplanin if risk for MRSA is noted. (eg central line infection suspected) Add Colistin or Polymyxin B if risk factors for CRO are present, which include history of carbapenem use in last 3 months, history of a positive carbapenem resistant organism culture in last 3 months. Need close renal monitoring and dose adjustment. Prefer polymyxin B over Colistin unless urine is suspected as a source of infection. Ceftazidime-avibactam +/- Aztreonam is a reserve drug to be used as targeted therapy after susceptibility reporting for carbapenem resistant *Klebsiella* species. Resistance among *E.coli* and *Pseudomonas* spp. is common and it is inactive against *Acinetobacter* spp., hence it is not recommended for empiric use.
Septic Shock - with localisation	See below for the recommendation based on the site of infection		

For common etiological agents of sepsis, see Annexure B.3.4

Additional Information:

The Golden Hour Management

1. Measure lactate level. Re-measure if initial lactate level > 2 mmol/L.*
2. Obtain blood cultures before administering antibiotics.**
3. Administer broad-spectrum antibiotics.
4. Begin rapid IV administration of 30ml/kg crystalloid for hypotension or lactate level ≥ 4 mmol/L.***
5. Apply vasopressors if patient is hypotensive during or after fluid resuscitation to maintain MAP ≥ 65 mm Hg ****

"Time zero" or "time of presentation" is defined as the time of triage in the emergency department or, if presenting from another healthcare facility, from the earliest time-point in the treatment chart wherein, the patient had all the features consistent with sepsis.

***Two or more sets of blood cultures are recommended before initiation of any new antimicrobial in all patients with suspected sepsis.*

****Hydroxyethyl starches (HESs) are not recommended for intravascular volume replacement in patients with sepsis or septic shock.*

***** Norepinephrine is the first-choice vasopressor.*

References:

1. Guarino M, Perna B, Cesaro AE, et al. 2023 Update on Sepsis and Septic Shock in Adult Patients: Management in the Emergency Department. *J Clin Med*. 2023;12(9):3188. Published 2023 Apr 28. doi:10.3390/jcm12093188
2. Treatment Guidelines for Antimicrobial Use in Common Syndromes. 2nd edition. ICMR. 2019. New Delhi (Accessed on 2nd April, 2025). Available from: https://www.icmr.gov.in/icmrobject/custom_data/pdf/resource-guidelines/Treatment_Guidelines_2019_Final.pdf
3. Harris PNA, Tambyah PA, Lye DC, Mo Y, Lee TH, Yilmaz M, Alenazi TH, Arabi Y, Falcone M, Bassetti M, Righi E, Rogers BA, Kanj S, Bhally H, Iredell J, Mendelson M, Boyles TH, Looke D, Miyakis S, Walls G, Al Khamis M, Zikri A, Crowe A, Ingram P, Daneman N, Griffin P, Athan E, Lorenc P, Baker P, Roberts L, Beatson SA, Peleg AY, Harris-Brown T, Paterson DL; MERINO Trial Investigators and the Australasian Society for Infectious Disease Clinical Research Network (ASID-CRN). Effect of Piperacillin-Tazobactam vs Meropenem on 30-Day Mortality for Patients with *E coli* or Klebsiella pneumoniae Bloodstream Infection and Ceftriaxone Resistance: A Randomized Clinical Trial. JAMA. 2018 Sep 11;320(10):984-994. doi: 10.1001/jama.2018.12163. Erratum in: JAMA. 2019 Jun 18;321(23):2370. doi: 10.1001/jama.2019.6706. PMID: 30208454; PMCID: PMC6143100.

4. Gastro-intestinal (GI) Syndromes

4.1 *Oesophagitis*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Oesophagitis	Fluconazole 6-12mg/kg (200-400 mg orally or IV on day 1 then 200 to 400 mg daily) for 2 weeks	Itraconazole 200 mg per day orally for 14 days	Most common cause of Oesophagitis is Candida, followed by HSV and CMV. Oesophageal Candidiasis can be picked up by endoscopic examination, HSV and CMV requires histopathology examination. Rule out immunocompromised condition (eg: HIV), if clinical diagnosis of esophagitis is made. Minimize or discontinue the use of broad-spectrum antimicrobial agents and immunosuppressants.

For common etiological agents of infective oesophagitis, see Annexure B.4.1

References:

1. Andrew Chao, Jose A. Vazquez, Fungal Infections of the Gastrointestinal Tract, Gastroenterology Clinics of North America, Volume 50, Issue 2, 2021, Pages 243-260. Available from: https://doi.org/10.1016/j.gtc.2021.02.009.

2. Mohamed AA, Lu XL, Mounmin FA. Diagnosis and Treatment of Esophageal Candidiasis: Current Updates. Can J Gastroenterol Hepatol. 2019 Oct 20; 2019:3585136. doi: 10.1155/2019/3585136. PMID: 31772927; PMCID: PMC6854261.

4.2 *Acute Gastroenteritis*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Acute onset diarrhoea with no danger signs*	No antibiotic required	----	Mostly caused by viruses or self-limiting bacterial pathogens. Oral hydration with ORS or other isotonic liquids is recommended.
Acute onset diarrhoea with danger signs*	Azithromycin 500mg OD for 3 days	Cefixime 400mg BD for 5 days Or Inj Ceftriaxone 2g IV OD (if admitted) for 5 days	Rehydration either oral or IV fluids is essential. Avoid fluoroquinolones as high resistance reported in India (NCDC and ICMR data).
Persistent diarrhoea or Chronic Diarrhoea	Avoid empirical antibiotics		Look for pathogens on stool routine microscopy and modified AFB stain (for coccidian parasites) and stool culture. Administer antimicrobials as per pathogen isolated.

For common etiological agents of Acute Gastroenteritis, see Annexure B.4.2

Additional information:

- Danger signs in Acute Gastroenteritis are:
  i. Severe dehydration requiring IV fluids
  ii. Dysentery (blood in stool): perform stool routine microscopy to rule out *Entamoeba histiolytica* and add metronidazole 400mg TDS (preferably oral)
  iii. Elderly with poor oral intake
  iv. Immunocompromised condition

4.3 *Hepatitis Syndrome*

Refer to the National Guidelines on Diagnosis and Management of Viral Hepatitis[2]

[2] https://nvhcp.mohfw.gov.in/common_libs/diagnosis-management-viral-hepatitis.pdf

4.4 *Infections of Liver, Gall Bladder and Biliary tract*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Liver abscess with no predisposing hepato-biliary tract abnormality or immunocompromised condition	Metronidazole 750mg q8h (IV or oral) as per general condition for total 10 days	Tinidazole 2g OD for 5 days	Add Diloxanide Furoate 500mg TDS for 10 days. Most liver abscesses with no hepato-biliary tract abnormality are amoebic in origin and don't require antibacterial agents; however, if there are no clinical signs of resolution after 72 hrs of anti-amoebic therapy or multiple (>2) abscesses or single large abscess (>5 cm); it is recommended to aspirate the abscess to look for possible pathogens.
Liver Abscess with predisposing hepato-biliary tract abnormality or immunocompromised condition	Ceftriaxone 2g IV OD + Metronidazole 750mg q8h	Piperacillin-tazobactam 4.5g IV q6h Or Meropenem 1g IV q8h Or Cefoperazone-sulbactam 3g IV q12h + Metronidazole 750mg q8h	It is recommended to aspirate the abscess to look for possible pathogens. Empiric regimes will cover for bacterial and amoebic etiology, and will need to be de-escalated based on aspirate results. Duration of therapy: 3-4 weeks
Cholecystitis & Cholangitis (without signs of sepsis)	Amoxicillin-clavulanic Acid 1g BD	Cefixime 400mg BD Or Inj Ceftriaxone 2g IV OD	Duration of therapy: 5-7 days
Cholecystitis & Cholangitis (with sepsis)	Piperacillin-tazobactam 4.5g IV q6h Or Cefoperazone-sulbactam 3g IV q12h	Meropenem 1g IV q8h Or Imipenem-cilastatin 0.5g IV q6h	Drainage of biliary tract/reliving of any obstruction in biliary tract is of utmost importance. Duration of therapy 5-7 days (if surgical drainage done and no

			complications like liver abscess identified)

For common etiological agents of infections of Liver, Gall Bladder and Biliary tract infections, see Annexure B.4.3.1 & B.4.3.2

4.5 *Appendicitis*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Appendicitis without any abscess	Amoxicillin-clavulanic Acid 1.2g IV q8h for 5 days	Inj Ceftriaxone 2g IV OD + Inj Metronidazole 500 mg IV q8h	Surgery is the preferred choice of management. In case of conservative management, antibiotics to be given for 5 days.
Complicated (Appendicitis with high severity and or Abscess)	Inj Piperacillin-tazobactam 4.5g IVq6h Or Inj Cefoperazone-sulbactam 3g IV q12h for 7-10 days	Imipenem-cilastatin 500mg IV q6h Or Meropenem 1g IV q8h for 5 days	Surgery is the primary mode of treatment.

For common etiological agents of Appendicitis, see Annexure B.4.4

Additional Comments:

- In early stages of infection, the growth is mainly of aerobic organisms, but as the disease progresses, it transitions to a mix of aerobic and anaerobic bacteria.

4.6 *Diverticulitis*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Diverticulitis without features of sepsis	Ceftriaxone 2g IV q24h + Inj Metronidazole 500 mg IV q8h Or Tab Cefixime 400 mg BD + Metronidazole 400 mg TDS	Piperacillin-tazobactam 4.5 g IV q6h Or Cefoperazone-sulbactam 3g IV q12h Or Ertapenem 1g IV q24h	Ceftriaxone to be changed to oral cefixime when patient is afebrile. BL-BLI agents and carbapenems have very good anaerobic cover, so no need to add metronidazole. Duration of therapy: 5-7 days
Diverticulitis with features of sepsis	Meropenem 1g IV q8h Or Imipenem-cilastatin 500mg IV q6h		Duration of therapy: 5-7 days

For common etiological agents of diverticulitis, see Annexure B.4.5

4.7 Peritonitis – Primary / Secondary

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Spontaneous Bacterial Peritonitis	Piperacillin-tazobactam 4.5g IV q6h for 7-10 days	Cefoperazone-sulbactam 3g IV q12h	Optimize therapy based on culture and susceptibility results.
Secondary peritonitis	Piperacillin-tazobactam 4.5g IV q6h Or Cefoperazone-sulbactam 3g IV q12h Or Ertapenem 1g IV q24h	Meropenem 1g IV q8h Or Imipenem-cilastatin 500mg IV q6h	Surgical drainage is required. Duration of therapy: 5-7 days (surgical drainage done and no complications like persistent abscess/collection identified).

For common etiological agents of peritonitis, see Annexure B.4.6

4.8 Splenic Abscess

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Splenic Abscess, stable hemodyamics	Defer antibiotics till microbiological diagnosis made from blood or splenic aspirate		The culture results guide the choice of antibiotics. Splenic abscesses are most regularly seen as complications of infective endocarditis, in about 5% of patients. Duration of therapy: 3-4 weeks
Splenic abscess, patient in shock or unstable	Meropenem 1g IV q8h + Vancomycin 1g IV q12h	Teicoplanin (alternative to Vancomycin) Loading dose of 400 mg q12h IV for three doses then 400 mg IV q24h	

For common etiological agents of splenic abscess, see Annexure B.4.7

Additional Information:

- The gold standard for treating a splenic abscess is splenectomy; however, recent studies have shown success using different approaches based on abscess characteristics.
- Percutaneous aspiration may be a less invasive option in patients at high risk for surgery or a temporary solution used as a bridge to surgery, avoiding the risk of a fulminant and potentially life-threatening infection.
- Percutaneous aspiration is a successful approach when the abscess collection is unilocular or bilocular, with a complete and thick wall and no internal septations. Aspiration is easier to

achieve when the content is liquid enough to be drained. If there are multiple collections or associated coagulopathy, either laparoscopic or open surgical treatment is preferred.

4.9 *Pancreatitis*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Pancreatitis without infection	No antibiotics		Surgery opinion to be taken.
Infected pancreatic necrosis, Infected pseudocyst	Piperacillin-tazobactam 4.5g IV q6h (To stop after 5-7 days of source control initiation)	Imipenem-cilastatin 500mg IV q6h Or Meropenem 1g IV q8h (To stop after 5-7 days of source control initiation)	Surgery opinion to be taken Therapy to be adjusted as per the culture and sensitivity results from pancreatic aspirate or necrosectomy. Antifungal cover with fluconazole, or echinocandins like Caspofungin/ Micafungin may be added if risk factors for disseminated candidiasis are present.

For common etiological agents of infected pancreatic necrosis, see Annexure B.4.8

References:

1. Huston JM, Barie PS, Dellinger EP, Forrester JD, Duane TM, Tessier JM, Sawyer RG, Cainzos MA, Rasa K, Chipman JG, Kao LS, Pieracci FM, Colling KP, Heffernan DS, Lester J; Therapeutics and Guidelines Committee. The Surgical Infection Society Guidelines on the Management of Intra-Abdominal Infection: 2024 Update. Surg Infect (Larchmt). 2024 Aug;25(6):419-435. doi: 10.1089/sur.2024.137. Epub 2024 Jul 11.
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DS, Choi IS, Jonas E, Chen XP, Fan ST, Ker CG, Giménez ME, Kitano S, Inomata M, Mukai S, Higuchi R, Hirata K, Inui K, Sumiyama Y, Yamamoto M. Tokyo Guidelines 2018: antimicrobial therapy for acute cholangitis and cholecystitis. J Hepatobiliary Pancreat Sci. 2018 Jan;25(1):3-16. doi: 10.1002/jhbp.518. Epub 2018 Jan 9. PMID: 29090866.

5. Tenner S, Vege SS, Sheth SG, Sauer B, Yang A, Conwell DL, Yadlapati RH, Gardner TB. American College of Gastroenterology Guidelines: Management of Acute Pancreatitis. Am J Gastroenterol. 2024 Mar 1;119(3):419-437. doi: 10.14309/ajg.0000000000002645. Epub 2023 Nov 7. PMID: 38857482.

5. Urinary Tract Infections

5.1 *Cystitis*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Uncomplicated - Acute dysuria, frequency and urgency without fever with chills.	Nitrofurantoin 100 mg q12h for 5 days	Cotrimoxazole 960 mg BD for 5 days	Collect urine for culture before antibiotics. These are recommendations for empirical drug usage. Clinicians must narrow down the drug once culture reports are available.

For common etiological agents of Cystitis, see Annexure B.5.1

5.2 *Pyelonephritis*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Acute Pyelonephritis	Piperacillin-tazobactam 4.5g IV q6h for 7-10 days	Ertapenem 1g IV/IM q24h for 7-10 days Or Inj Cefoperazone-sulbactam 3g IV BD Or Inj Amikacin 15mg/kg IV OD	Collect urine and blood specimens prior to the administration of antibiotics. Change the empiric regimen based on susceptibility testing.

For common etiological agents of Acute Pyelonephritis, see Annexure B.5.1

6. Gynaecological & Reproductive organ Infections and STDs

6.1 *Genital Ulcers*

Refer to: *National Technical Guidelines on Sexually Transmitted Infections and Reproductive Tract Infections (2024). Pg 52-55. National AIDS Control Organization, Ministry of Health and Family Welfare, Government of India.2024.*[3]

For common etiological agents of Genital Ulcers, see Annexure B.6.1

Additional Information:

- Below mentioned are recommendations given by WHO:
  i. Treat syndromically for syphilis and herpes simplex virus on the same day.
  ii. Treat for herpes simplex virus if the ulcer is recurrent or vesicular, and treat for syphilis if the person has no history of recent treatment for syphilis (in the past three months).
  iii. Treat for chancroid only in geographical settings where cases are reported or emerging. Performing serological tests for syphilis, including an RPR-equivalent test, if available, to attempt to identify active syphilis and for monitoring the response to treatment.

References:

1. Guidelines for the management of symptomatic sexually transmitted infections. Geneva: World Health Organization; 2021. Licence: CC BY-NC-SA 3.0 IGO.
2. STI Guidelines 2021, CDC, MMWR Recomm Rep 2021;70(4).

6.2 *Anogenital Warts*

Refer to: National Technical Guidelines on Sexually Transmitted Infections and Reproductive Tract Infections (2024). Pg 91-92. National AIDS Control Organization, Ministry of Health and Family Welfare, Government of India.2024.[3]

For common etiological agents of Anogenital warts, see Annexure B.6.2

Additional Information:

- Counselling for the patient as well as their partners should be done.
- HPV vaccines can prevent and also protect against the majority of genital warts but it will not treat existing HPV or genital warts.
- Persons should inform current partners about having genital warts because the types of HPV that cause warts can be passed on to partners.

[3]https://naco.gov.in/sites/default/files/National%20Technical%20Guidelines%20on%20STI%20and%20RTI_Final.pdf

6.3 *Septic abortion*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Septic Abortion – Fever, Vaginal discharge, pelvic/abdominal pain, etc	Ampicillin 2g IV q6h + Gentamicin 5 mg/kg daily IV + Metronidazole 500 mg IV q8h Or Amoxicillin-clavulanic acid 1.2g q8h IV for 7-10 days	Clindamycin 600 IV q8h + Gentamicin 5 mg/kg daily IV for 7-10 days	Be vigilant and suspect sepsis early. These symptoms usually appear within 24 to 48 hours after an abortion. Obtain blood and cervical cultures to help guide antibiotic therapy.
Complicated with Sepsis– Associated with organ dysfunction (Peritonitis, Vaginal bleeding, and Severe pelvic/abdominal pain).	Piperacillin-tazobactam 4.5g IV q6 h, for 7-10 days	Meropenem 1g IV q8h for 7-10 days	

For common etiological agents of Septic Abortions, see Annexure B.6.3

Additional Information:

- Evacuation of any retained product of conception is crucial for optimal response.

References:

1. Abortion care guideline. Geneva: World Health Organization; 2022. Licence: CC BY-NC-SA 3.0 IGO. Available from: https://iris.who.int/bitstream/handle/10665/349316/9789240039483-eng.pdf?sequence=1
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6.4 *Vaginal Discharge Syndrome*

Refer to: *National Technical Guidelines on Sexually Transmitted Infections and Reproductive Tract Infections (2024). Pg 41-43. National AIDS Control Organization, Ministry of Health and Family Welfare, Government of India.2024.*[4]

For common etiological agents of Vaginal Discharge Syndrome, see Annexure B.6.4

[4] https://naco.gov.in/sites/default/files/National%20Technical%20Guidelines%20on%20STI%20and%20RTI_Final.pdf

6.5 *Epididymo-Orchitis*

Refer to: *National Technical Guidelines on Sexually Transmitted Infections and Reproductive Tract Infections (2024). Pg 61-62. National AIDS Control Organization, Ministry of Health and Family Welfare, Government of India.2024.*[5]

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Epididymo-orchitis – of elderly men (likely caused by enteric organism only)	Amoxicillin-clavulanate 1g BD	Ertapenem 1g IV OD for 7 -10 days Or Piperacillin-tazobactam 4.5g IV q6h	Seen in elderly or with persons with structural urinary tract abnormality Duration of therapy: 10-14 days
Epididymo-orchitis of young sexually active men (likely due to *N. gonorrhoeae*, *C. trachomatis*)	Ceftriaxone 500mg IM Stat + Doxycycline 100mg BD for 10 days	Tab Cefixime 800mg stat + Doxycycline 100mg BD for 10 days Or Azithromycin 1g stat	Seen in young, sexually active with no structural urinary tract abnormality.

For common etiological agents of Epididymo-Orchitis, see Annexure B.6.5

Additional information:

- Acute onset unilateral scrotal pain with / without swelling; Torsion to be ruled out.
- First pass urine /urethral swab for nucleic acid amplification test (NAAT) for *N. gonorrhoeae, C. trachomatis* and *M. genitalium*, if available.
- Colour Doppler ultrasound for Testicular vascularity assessment to differentiate between epididymo-orchitis and testicular torsion.

6.6 *Pelvic Inflammatory Disease syndrome*

Refer to: *National Technical Guidelines on Sexually Transmitted Infections and Reproductive Tract Infections (2024). Pg 47-50. National AIDS Control Organization, Ministry of Health and Family Welfare, Government of India.2024.*[5]

For common etiological agents of Pelvic Inflammatory Disease, see Annexure B.6.6

[5] https://naco.gov.in/sites/default/files/National%20Technical%20Guidelines%20on%20STI%20and%20RTI_Final.pdf

6.7 *Prostatitis*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Acute Prostatitis (seen in young, sexually active with no structural urinary tract abnormality)	Ceftriaxone 500 IM Stat + Doxycycline 100mg BD for 10 days	Tab Cefixime 800mg stat + Doxycycline 100mg BD for 10 days	
Acute Prostatitis (seen in elderly or with persons with structural urinary tract abnormality)	Amoxicillin-clavulanate 1g BD Or Piperacillin-tazobactam 4.5g IV 6 hrly	Ertapenem 1g IV OD for 7-10 days	Urine and prostatic massage specimen for cultures to be collected before antibiotics. Duration of therapy 14 days or longer if complications like abscess present.

For common etiological agents of Acute Prostatitis, see Annexure B.6.7

Additional Information:

- Review antibiotic treatment after 14 days and either stop antibiotics or continue further if needed (based on assessment of history, symptoms, clinical examination, urine and blood tests).
- A stop date should be planned and recorded in advance to ensure antibiotic is not given beyond the recommended duration.

6.8 *Puerperal sepsis*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Puerperal sepsis: defined as: "'a serious infection of the genital tract which occurs within 42 days of delivery"	Inj Piperacillin-tazobactam 4.5g IV q6h for 7-14 days	Clindamycin 600-900mg IV q8h + Gentamicin 5mg/kg IV OD (if penicillin allergic) for 7-14 days	
Puerperal sepsis in Septic Shock	Imipenem-cilastatin 500mg IV q6h / Meropenem 1g IV q8h for 7 -14 days		Consider optimum and appropriate antibiotics like Vancomycin 1g BD, or Teicoplanin 400mg q12h for 3 doses followed by 400mg OD to cover MRSA with a total duration of therapy for 14 days.

For common etiological agents of puerperal sepsis, see Annexure B.6.8

Additional Information:

- Presence of 2 or more of the following symptoms - Pelvic pain, Pyrexia *i.e.* oral temperature 38.5°C or higher on any occasion, Abnormal vaginal discharge, *e.g*. presence of pus or discharge with a foul odour, Delay in the rate of reduction of the size of the uterus (<2cm/day during the first 8 days) indicate puerperal sepsis.
- It is important to consider and cover *C. sordelli* and *C. perfringens* in emergency sepsis cases

6.9 *Urethral discharge syndrome*

Refer to: *National Technical Guidelines on Sexually Transmitted Infections and Reproductive Tract Infections (2024). Pg 34-38. National AIDS Control Organization, Ministry of Health and Family Welfare, Government of India.2024.*[6]

For common etiological agents of urethral discharge syndrome, see Annexure B.6.9

6.10 *Chorio-amnionitis*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Chorio-amnionitis	Ampicillin 2g IV q6h + Gentamicin 5 mg/kg daily OD IV + Metronidazole 500mg IV q8 h Or Amoxicillin-clavulanic acid 1.2g q8h for 7-10 days	Clindamycin 600 IV q8h + Gentamicin 5 mg/kg daily IV for 7-10 days	
Chorio-amnionitis (Sepsis)	Inj Piperacillin-tazobactam 4.5g IV q6h for 7-14 days	Imipenem 500mg IV q6h / Meropenem 1-2g IV q8h +/- Amikacin 15 mg/kg IV OD for 7-10 days	If the patient is in septic shock, consider adding Vancomycin or Teicoplanin to cover MRSA.

For common etiological agents of Chorioamnionitis, see Annexure B.6.10

References:

1. Guidelines for the management of symptomatic sexually transmitted infections. Geneva: World Health Organization; 2021. Licence: CC BY-NC-SA 3.0 IGO. Available from: https://iris.who.int/bitstream/handle/10665/342523/9789240024168-eng.pdf?sequence=1
2. STI Guidelines 2021, CDC, MMWR Recomm Rep 2021;70(4). Available from: https://www.cdc.gov/std/treatment-guidelines/STI-Guidelines-2021.pdf

[6] https://naco.gov.in/sites/default/files/National%20Technical%20Guidelines%20on%20STI%20and%20RTI_Final.pdf

7. Ear, Nose and Throat Infections

7.1 *Rhinitis/ Common cold*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Uncomplicated - Viral Rhinitis (mostly at OPDs)	Symptomatic therapy including paracetamol, nasal saline drops, rest, oral fluids, humidification (as indicated)		Some cases might need oral and nasal decongestants and antitussives such as dextromethorphan/ codeine and nasal irrigation.
Influenza-like symptoms (lab confirmed or outbreak situation or in high-risk persons)	Oseltamivir 75mg q12h for 5-7 days. [Antivirals may be considered for Cat B1, B2 and C as per ABC guidelines for influenza[7]]		In patients with influenza: when Oseltamivir is started within 48 hours of onset, duration of symptoms reduces by 1 day, there is a decrease in viral shedding/ infectiousness and it may reduce the risk of development of complications. Consider Empiric therapy of Oseltamivir in: patients with influenza like illness during an ongoing outbreak, who are at high risk of complications such as pregnant women, those with co-morbidities and immunocompromised.

For common probable etiological agents of Rhinitis/common cold, see Annexure B.7.1

Additional Information:

- Antimicrobial therapy is not indicated for viral rhinitis. The patients should be warned about symptoms which indicate complications like breathing difficulty, persistent fever beyond 4-5 days or ear pain.

References:

1. Bhardwaj N, Mathur P, Behera B, Mathur K, Kapil A, Misra MC. Antimicrobial resistance in beta-haemolytic streptococci in India: A four-year study. Indian J Med Res. 2018 Jan;147(1):81-87. doi: 10.4103/ijmr.IJMR_1517_16. PMID: 29749365; PMCID: PMC5967222.
2. Kim K, Jung S, Kim M, Park S, Yang HJ, Lee E. Global Trends in the Proportion of Macrolide-Resistant Mycoplasma pneumoniae Infections: A Systematic Review and Meta-analysis. JAMA Netw Open. 2022 Jul 1;5(7):e2220949. doi: 10.1001/jamanetworkopen.2022.20949. PMID: 35816304; PMCID: PMC9274321.
3. Muthanna A, Shamsuddin NH, Abdul Rashid A, Ghazali SS, Hamat RA, Mawardi M, Salim HS, Zakariah SZ. Diagnostic Accuracy of Centor Score for Diagnosis of Group A Streptococcal Pharyngitis among Adults in Primary Care Clinics in Malaysia. Malays J Med Sci. 2022

[7] https://ncdc.mohfw.gov.in/technical-guidelines-for-h1n1/

Aug;29(4):88-97. doi: 10.21315/mjms2022.29.4.9. Epub 2022 Aug 29. PMID: 36101529; PMCID: PMC9438850.

7.2 Laryngitis/Laryngopharyngitis/URTI

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Uncomplicated Viral infection	No antibiotics needed, only symptomatic management		90% are viral infections, so no antibiotics needed. Symptomatic therapy- Steam inhalation, voice rest and warm saline gargles.
Complicated - persistence and non-improvement of symptoms & new onset fever, headache etc.	Amoxicillin-clavulanate 875/125 mg q12h for 5-7 days	Azithromycin 500mg OD for 3 days	

For common etiological agents of Laryngitis/Laryngopharyngitis/URTI, see Annexure B.7.2

Additional Information:

- Laryngitis usually gets better on its own within 1 to 2 weeks.
- Empiric therapy of Oseltamivir, in patients with influenza like illness during an ongoing outbreak, if they are at high risk of complications such as pregnant women, those with co-morbidities and the immunocompromised.
- **For antimicrobial therapy in URTI, see the information below:**

Antimicrobial therapy in URTI:

Condition	Preferred drug	Alternative	Penicillin allergy
Acute pharyngitis with low Centor score (≤2)	No antibiotics required		
Acute Pharyngitis with high Centor score (≥3)	Amoxicillin 1g TDS for 5-7 days	Amoxicillin-clavulanate 1g BD for 5-7 days	Anaphylactic: clindamycin/ clarithromycin/ azithromycin Non-anaphylactic: cephalexin/ cefadroxil
Membranous pharyngitis	Erythromycin 500 mg IV QID Or Azithromycin 500mg OD Or		

	Penicillin G 50000 units/kg IV 12 hrly Diphtheria antitoxin: Horse serum < 48 hours: 20,000-40,000 units, Nasopharyngeal membranes: 40,000-60,000 units >3 days and bull neck: 80,000-1,20,000 units		

- **Centor Score (Modified/McIsaac):** is used to estimate the probability of Group A Streptococcus (GAS) pharyngitis and suggest further management course.

Clinical variables	Score
Age: 3-14 years 14-44 years >44 years	 1 0 -1
High fever (>100.4 F)	1
Tonsillar Exudate	1
Absence of cough	1
Presence of Lymphadenopathy	1

Interpretation of Centor Score:

- **Low risk (0-1):** A low Centor score suggests a low probability of strep throat, and further testing or antibiotic treatment may not be necessary.
- **Moderate risk (2):** A score of 2 indicates a moderate risk. Some guidelines suggest rapid strep testing.
- **High risk (3-4):** A higher Centor score (3 or 4) indicates a higher probability of strep throat, and further testing (rapid antigen test or throat culture) is generally recommended, along with consideration for antibiotic treatment if the test is positive.

7.3 *Sinusitis*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Patient-haemodynamically stable	Most commonly it is viral in etiology and hence not required to treat with antibiotics, unless signs of bacterial infection are present like: new onset fever after initial improvement or facial pain or purulent discharge, in that case		Symptoms for 10 days or less: no antibiotic required. Systemically very unwell or high risk of complications: immediate antibiotics. Indications for antibiotics:

	treat like complicated sinusitis as mentioned below		A. Signs/symptoms >10 days without improvement. B. fever>39[102], purulent nasal discharge, facial pain>3 days from beginning. C. double sickening {worsening of symptoms at 5 to 6 days after initial improvement}.
Complicated sinusitis (Patient with acute onset high fever with facial pain or purulent nasal discharge with orbital/ soft tissue cellulitis or cranial complication)	Amoxicillin 1000 mg q8h for 5-7 days Or Amoxicillin-clavulanate 1.2g IV q8h in adults for 5 -7 days Or Amoxicillin-clavulanate 1g BD PO	Cefixime 400mg BD for 7 days Or Doxycycline 100 mg q12h for 5-10 days	
Suspicion of Fungal sinusitis	Treatment based on microbiological test reports		Scraping from middle meatus to be done for microscopy (KOH mount). Surgical debridement; treatment of comorbidities.

For common etiological agents of sinusitis, see Annexure B.7.3

Additional Information:

- Steam inhalation is advised for alleviation of symptoms

7.4 Otitis media

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Acute otitis media: If the patient has recent onset of ear pain/ erythema of the tympanic membrane	Mostly viral- antibiotics not indicated		Treat children <2 years. If >2 years, afebrile and no ear pain- consider analgesics and defer antibiotics. Pain assessment and relief by using analgesics.
Severe: Temperature 39 ^{0}C or higher OR severe otalgia OR otalgia persisting for more than 48 hours or bulging tympanic membrane or complication like mastoiditis or abscess	Amoxicillin-clavulanate 90/6.4mg /kg/day BID for 5-7 days	Cefuroxime axetil 250mg BD for 5-7 days Or Piperacillin- tazobactam 4.5g IV 8h or Cefepime or Ceftazidime 2g IV OD and Metronidazole (in immunocompromised or intracranial extension/ diabetes mellitus)	

For common etiological agents of acute otitis media, see Annexure B.7.4

7.5 *Otitis externa*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Patient presents with painful ear and pain and tenderness on moving the pinna, itching of ear canal, ear discharge	Amoxicillin-clavulanate oral 1g BD/ IV 1.2g TDS for 5-7 days		Local measures like ichthammol glycerine.
Malignant otitis externa (Spreading infection, cranial nerve involvement, Diabetes Mellitus or immunocompromised)	Piperacillin-tazobactam 4.5g IV q6h Or Ceftazidime 2g IV q8h for 4-6 weeks	Meropenem 1g IV q8h /Imipenem-cilastatin 500mg IV q6h for 4-6 weeks	Debridement may be required. Send samples for culture at the earliest (from ear canal or surgical debridement specimen). Evaluate for osteomyelitis; Do CT or MRI, if bone is involved.

For common etiological agents of Acute otitis externa, see Annexure B.7.5

7.6 *Head and neck abscesses (peritonsillar/parapharyngeal and retropharyngeal abscess)*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Patient-hemodynamically stable and immunocompetent	Amoxicillin-clavulanate 1.2g IV TDS for 7 days	Inj Ceftriaxone 2g IV OD + Inj Metronidazole 500mg IV TDS for 7 days	Consider surgical drainage with general measures like pain control and radiologic evaluation and airway management. Work up for tuberculosis as per indication. Treatment for 2-3 weeks depending on source control and patient's clinical response.
Patient hemodynamically unstable or presence of immunocompromising condition	Inj Piperacillin-tazobactam 4.5g IV q6h + Inj Clindamycin 600mg IV TDS for 7 days	Inj Meropenem 1g IV TDS + Inj Vancomycin 1g q12h/ Inj Teicoplanin 400mg IV BD for 3 doses and then 400mg OD for 7 days	

For common etiological agents of head & neck abscesses (peritonsillar/parapharyngeal and retropharyngeal abscess), see Annexure B.7.6

Additional information:

- A pure submental abscess like presentation should be evaluated for Ludwig's angina.

8. Oral cavity, Head and Neck Infections

8.1 *Oropharyngeal Candidiasis*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with Dosage and Duration)	Comments
Mild	Clotrimazole troches/ lozenges 10mg 4-5 per days for 7 days	Fluconazole 200mg OD for 7-14 days	Common local infection seen in infants, older adults who wear dentures, patients treated with antibiotics, chemotherapy or radiation therapy to the head and neck, and those with cellular immune deficiency like HIV. In cases of denture stomatitis, the patient should refrain from using their denture for at least two weeks.
Moderate to severe or immunosuppressed	Fluconazole 100–150 mg (3 mg/kg for children) for 7 to 14 days	Itraconazole 200mg PO daily x7-14 days	

For common etiological agents of oropharyngeal candidiasis, see Annexure B.8.1

Additional Information:

- Clinicians should avoid prescribing fluconazole in the first trimester of pregnancy.
- When there is no response to fluconazole after 14 days of treatment, consider a higher dose or alternate therapy based on culture sensitivity.
- In addition to the drug treatment, ensure that the patient has adequate hydration and nutrition.

Reference:

1. Guidelines on the Treatment of Skin and Oral HIV-Associated Conditions in Children and Adults. Geneva: World Health Organization; 2014. 12, Evidence and recommendations on oropharyngeal candidiasis. Available from: https://www.ncbi.nlm.nih.gov/books/NBK305416/

9. Skin and Soft Tissue Infections

9.1 *Paronychia*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Acute paronychia - Lasting less than six weeks, painful and purulent condition; most frequently caused by a bacterial infection, especially *Staphylococcus* spp.	Topical antibiotic ointment: Bacitracin or Mupirocin Or Amoxicillin 500mg TDS Or Amoxicillin-clavulanate 625mg q8h for 5-10 days	Cephalexin (500mg three to four times a day) for 5 to 10 days depending on whether incision and drainage is performed	Fluctuant paronychia is usually treated with incision and drainage.

For common etiological agents of acute paronychia, see Annexure B.9.1

Reference:

1. Rerucha CM, Ewing JT, Oppenlander KE, Cowan WC. Acute Hand Infections. Am Fam Physician. 2019 Feb 15;99(4):228-236.Available from: Acute Hand Infections - PubMed Leggit JC. Acute and Chronic Paronychia. Am Fam Physician. 2017 Jul 1;96(1):44-51. PMID: 28671378. Available from: https://pubmed.ncbi.nlm.nih.gov/28671378/

9.2 *Impetigo*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Impetigo – localised skin involvement	Topical antibiotic therapy: Mupirocin 2% & Fusidic acid 2% for 7 days		Wash skin, remove crust and use disinfectants.
Impetigo – extensive skin involvement, bullous disease and/or lymphadenopathy	Topical antibiotic therapy: Mupirocin 2% & Fusidic acid 2% for 7 days + Amoxicillin 500mg TDS (25-50 mg/kg/day) Or Amoxicillin-clavulanate 625mg q8h	Cephalexin 500 mg every 6 hours for 5 days	

For common etiological agents causing impetigo, see Annexure B.9.2

Reference:

1. Griffiths, C.E.M. and Barker, J. and Bleiker, T.O. and Hussain, W. and Simpson, R.C. Rook's Textbook of Dermatology. 10th Edition 2024. United Kingdom: Wiley.

9.3 *Cellulitis*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Cellulitis – non purulent	Prefer β-lactams. Penicillin V 250-500 q6h Or Amoxicillin 500mg TDS (25-50 mg/kg/day) Or Cloxacillin 500mg QID (50mg/kg/day) Or Cephalexin 250-500mg QID (25–50 mg/kg/day) Or Cefadroxil 500 mg q12h	Clindamycin: 300-600mg BD/TID (20mg/kg/day)	Duration of therapy is 5 to 7 days based on clinical response.
Cellulitis- moderate to severe	Inj Cefazolin 1-2g q8h Or Inj Amoxicillin-clavulanate 1.2g TDS	Severe infection: Inj Cefuroxime 1.5g q8h Or Inj Clindamycin 600-900mg IV TDS (if allergic to penicillins)	Duration of therapy is 7 to 10 days based on clinical response.
Cellulitis with MRSA risk factors: **Mild** **Moderate to Severe**	Trimethoprim-sulfamethoxazole 800 mg/160 mg BD Vancomycin 15 to 20 mg/kg/dose every 8 to 12 hours.	Doxycycline 100 mg q12h Inj Linezolid 600mg q12 h	Duration of therapy is 5 to 10 days based on severity. A longer duration of antibiotic treatment may be a consideration in patients who show minimal improvement with antibiotic therapy within 48 hours.
Cellulitis in patients with comorbidities, poor response to oral antibiotics, immunocompromised, signs of deeper infection	Inj Piperacillin-tazobactam 4.5g q6h ±	As per culture susceptibility reports	Duration of therapy is 7 to 10 days based on severity.

like bullae, skin sloughing or signs of systemic infection	Vancomycin 15 to 20 mg/kg/dose every 8 to 12 hours along with surgical debridement		

For common etiological agents causing cellulitis, see Annexure B.9.3

Additional Information:

- Bacteria causing infection below the skin surface leading to an acute superficial infection affecting the deep dermis and subcutaneous tissue is cellulitis. Cellulitis is relatively common, and most often occurs in middle-aged and older adults.

Reference:

1.Dennis L. Stevens, Alan L. Bisno, Henry F. Chambers, E. Patchen Dellinger, Ellie J. C. Goldstein, Sherwood L. Gorbach, Jan V. Hirschmann, Sheldon L. Kaplan, Jose G. Montoya, James C. Wade, Practice Guidelines for the Diagnosis and Management of Skin and Soft Tissue Infections: 2014 Update by the Infectious Diseases Society of America, *Clinical Infectious Diseases*, Volume 59, Issue 2, 15 July 2014, Pages e10–e52, https://doi.org/10.1093/cid/ciu296

9.4 *Necrotizing fasciitis*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Necrotizing Fasciitis	Surgical debridement and Piperacillin-tazobactam 4.5g every 6 hours + Clindamycin 600 mg to 900 mg q8h Duration is 48 to 72 hours after clinical improvement and fever resolution or until no surgical intervention is needed	Meropenem 1g IV every 8 hours + Clindamycin 600 mg to 900 mg q8h Use vancomycin 15 to 20 mg/kg/dose every 8 to 12 hours instead of Clindamycin. (if MRSA is suspected) If organism isolated is group A beta-hemolytic streptococci use: Inj crystalline penicillin 4 million units q4h + Inj Clindamycin 600-900 mg q8h Duration is 48 to 72 hours after clinical improvement and fever resolution or until no surgical intervention is needed.	These patients are extremely ill and should be transferred immediately to the intensive care unit. The treatment of necrotizing fasciitis is surgery, and no time should be wasted calling for a surgical consult. The earlier the surgery is undertaken, the better the outcome. Based on culture reports, prompt de-escalation should be done. Gram stain may be used for de-escalation.

For common etiological agents causing Necrotizing fasciitis, see Annexure B.9.4

Additional Information:

- Empiric antibiotic treatment should be broad as the etiology of necrotizing fasciitis can be polymicrobial (mixed aerobic–anaerobic microbes) or monomicrobial (group A streptococci, community-acquired MRSA).
- Necrotizing fasciitis, also known as flesh-eating disease is a type of aggressive skin and soft tissue infection (SSTI) that spreads rapidly and can lead to death.

Reference:

1. Guliyeva G, Huayllani MT, Sharma NT, Janis JE. Practical Review of Necrotizing Fasciitis: Principles and Evidence-based Management. Plast Reconstr Surg Glob Open. 2024 Jan 19;12(1):e5533. doi: 10.1097/GOX.0000000000005533. PMID: 38250213; PMCID: PMC10798703

9.5 *Primary Pyomyositis*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Primary Pyomyositis	Amoxicillin-clavulanic acid 1g+200 mg q8h IV) Or Cefalexin 500 mg q8h per oral Or Inj Cloxacillin 2g q6h IV Or 500 mg q6h per oral Or Inj Cefazolin 1g q8h Duration: 48-72 hours after clinical improvement and adequate source control	In case of primary pyomyositis with features of sepsis, consider Inj Piperacillin-tazobactam 4.5g q6h + Inj Vancomycin 15-20 mg/kg/day every 8 to 12 hours. Duration: 48-72 hours after clinical improvement and adequate source control	Optimize antibiotics based on pus culture and susceptibility report.

For common etiological agents causing primary pyomyositis, see Annexure B.9.5

9.6 *Folliculitis*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with Dosage and Duration)	Comments
Folliculitis – uncomplicated superficial	Topical Mupirocin Or Topical Fusidic acid Duration based on clinical response	Oral antibiotics if multiple lesions present • Amoxicillin 500mg TDS (25-50mg/kg/day) • Cloxacillin 500mg QID (50mg/kg/day)	Non-infectious causes of folliculitis include: excessive use of oils (especially in hot humid season), waxing,

		• Cephalexin 250-500mg QID (25–50 mg/kg/day) • Cefadroxil 500 mg q12h • Amoxicillin-clavulanate combination: 625mg TDS Duration: 3 to 5 days based on clinical response	epilation, occlusive dressings, etc. In case of recurrent lesions, look for nasal Staphylococcus carriage. Simple cases of Gram-negative folliculitis, Staphylococcal folliculitis, will generally resolve spontaneously after 7 to 10 days with good skin hygiene. A large furuncle may also require drainage.
Furuncle and carbuncle	Furuncles require oral antibiotics. The following can be used: Amoxicillin 500mg TDS (25-50 mg/kg/day) • Cloxacillin 500mg QID (50mg/kg/day) • Cephalexin 250-500mg QID (25–50 mg/kg/day) • Amoxicillin-clavulanate combination: 625mg TDS Carbuncles require surgical drainage in addition to oral antibiotics; duration of antibiotics is 5 to 7 days based on clinical response.	For severe infection in sick patients, carbuncle would require parenteral antibiotic, treatment as follows: Inj Cefuroxime 1.5 g q8h Inj Amoxicillin-clavulanate 1.2g TDS Alternatively - Inj Clindamycin 600-900mg TDS	
Gram Negative folliculitis – Not responding to regular acne management	Trimethoprim-Sulfamethoxazole DS (800+160) q12h for 10-14 days	Amoxicillin 500mg TDS (25-50 mg/kg/day) for 7-10 days	
Pityrosporum Folliculitis	Itraconazole 100-200mg/day for 3 weeks Or Fluconazole 100-200mg/day for 1-2 weeks*		
Demodex Folliculitis	Topical Permethrin + Metronidazole 400mg q12h Duration based on clinical response; may range from weeks to months.		

Eosinophilic folliculitis	Topical corticosteroids, antihistamines, phototherapy, and Itraconazole 100-200mg/day for 3 weeks		In patients with eosinophilic folliculitis, HIV should be ruled out. First-line treatment for this condition is antiretroviral therapy.

For common etiological agents causing folliculitis, see Annexure B.9.6

*In case of long-term treatment if patient is not improving, TDM (therapeutic drug monitoring) for itraconazole should be considered.

References:

1. Jacob S, VanDaele MA, Brown JN. Treatment of Demodex-associated inflammatory skin conditions: A systematic review. Dermatol Ther. 2019 Nov;32(6): e13103. doi: 10.1111/dth.13103. Epub 2019 Oct 28. PMID: 31583801.
2. IDSA 2014: Clinical Practice Algorithm for management of skin and soft tissue infections: Dennis L. Stevens, Alan L. Bisno, Henry F. Chambers, E. Patchen Dellinger, Ellie J. C. Goldstein, Sherwood L. Gorbach, Jan V. Hirschmann, Sheldon L. Kaplan, Jose G. Montoya, James C. Wade, Practice Guidelines for the Diagnosis and Management of Skin and Soft Tissue Infections: 2014 Update by the Infectious Diseases Society of America, *Clinical Infectious Diseases*, Volume 59, Issue 2, 15 July 2014, Pages e10–e52, https://doi.org/10.1093/cid/ciu296

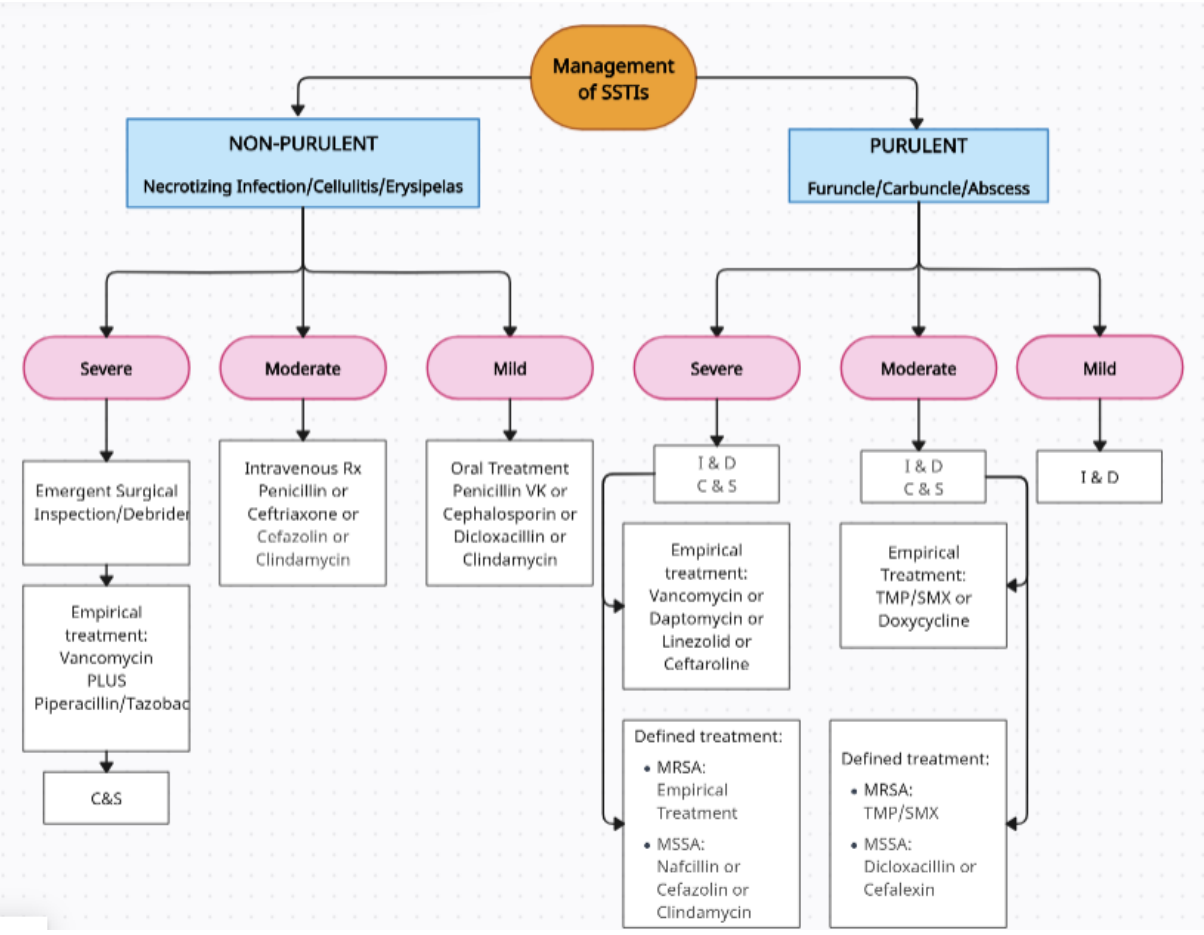

Figure 9.1: Approach to management of patients with SSTI

9.7 *Diabetic foot infections (DFI)*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Mild: local infection with 0.5cm to < 2cm erythema	Cloxacillin 500 mg q6h Or Cephalexin 500 mg q6h Or Cefadroxil 500 mg q12h Duration: 1 to 2 weeks based on clinical response	Sulfamethoxazole/trimethoprim (Bactrim) 160/800 mg orally BD Or Doxycycline 200mg on day 1, then 100mg OD (can be increased to 200mg daily)	Start antibiotic treatment as soon as possible. Take samples for microbiological testing before, or as close as possible to the start of treatment. When choosing an antibiotic, take account of severity, risk of complications, previous microbiological results and antibiotic use. Empiric antibiotic regimen should include an agent active against *Staphylococcus aureus*, including methicillin-resistant *S. aureus* if necessary, and Streptococci. Surgery is the cornerstone of treatment for deep diabetic foot infections. Procedures range from simple incision and drainage to extensive multiple surgical debridement and amputation.
Moderate: local infection with > 2cm erythema or involving deeper structures (such as abscess, osteomyelitis, septic arthritis or fasciitis)	Amoxicillin-clavulanic acid 625mg q8h Or Cefuroxime 500mg q12h Or Inj Piperacillin-tazobactam 4.5 q6h [if there is history of recent antibiotic use or *Pseudomonas* colonization] Duration: 1 to 2 weeks based on clinical response	Inj Cefuroxime 1.5g q12h Or Inj Cefoperazone-sulbactam 3g q12h	
Severe: local infection with signs of a systemic inflammatory response.	Cefoperazone-sulbactam 3g IV q12h Or Piperacillin-tazobactam 4.5g IV q8h *If patient is in septic shock, then:* Meropenem 1g IV q8h or Imipenem-cilastatin 500 q6h should be added as first line antibiotic. In case of MRSA risk factors, Inj Vancomycin must be added. Duration: 1 to 2 weeks based on clinical response. Consider continuing treatment for 3-4 weeks, if the infection is improving, but is extensive and is resolving slower than	Meropenem 1g IV q8h Or Imipenem- cilastatin 500mg IV q6h	

	expected, or if the patient has severe peripheral arterial disease.		

For common etiological agents causing diabetic foot infections, see Annexure B.9.7

Additional Information:

- For culture, tissue specimen (collected by curettage or biopsy) is preferred over swabs in soft tissue DFI. The sensitivity and specificity are higher for tissue specimens, though sampling from tissue requires training and may pose a minimal risk of discomfort or bleeding.

References:

1. Diabetes Metab Res Rev. 2020;36(S1):e3280. Available at https://doi.org/10.1002/dmrr.3280
2. Eric Senneville, Zaina Albalawi, Suzanne A van Asten, Zulfiqarali G Abbas, Geneve Allison, Javier Aragón-Sánchez, John M Embil, Lawrence A Lavery, Majdi Alhasan, Orhan Oz, Ilker Uçkay, Vilma Urbančič-Rovan, Zhang-Rong Xu, Edgar J G Peters, IWGDF/IDSA Guidelines on the Diagnosis and Treatment of Diabetes-related Foot Infections (IWGDF/IDSA 2023), *Clinical Infectious Diseases*, 2023;, ciad527, https://doi.org/10.1093/cid/ciad527

10. Musculoskeletal Infections

10.1 *Acute Osteomyelitis*

- **Blood culture should be obtained before starting antimicrobial therapy**
- **Empirical treatment should be started with narrow spectrum antibiotic**
- **Definitive antibiotic therapy should be started as soon as culture results are available**

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Non Hematogenous - Caused by bacteria that gain access to bone directly from an adjacent focus of infection, direct inoculation during surgery or after trauma	Inj Cloxacillin 2g IV q6h	Amoxicillin-clavulanic acid 1g + 200mg q8h IV Inj Cefazolin 1g q8h Or Inj cefuroxime 1.5g q8h	Treatment based on culture results. Surgical debridement should be done to drain out the infected area, the extent of surgery may preferably be guided by ultrasound or MRI evaluation (if possible). Drain pus, rationalize antibiotics according to culture and susceptibility reports. Treatment starting with IV therapy to be continued until there are clinical signs of improvement (defervescence, other signs of septicemia reduced, CRP reduction, ESR reduction), then only consider change from IV to oral therapy. (total duration of antibiotics 4 – 6 weeks) In diabetic foot: before starting antibiotics, take blood sample for culture and renal function estimation.
Hematogenous osteomyelitis	Inj Cloxacillin 2g q6h IV	Amoxicillin-clavulanic acid 1g+ 200mg q8h IV Inj Cefazolin 1g q8h Or Inj Cefuroxime 1.5g q8h	
Complicated osteomyelitis (diabetic foot infection or any other reason for diminished blood supply to the bones)	Piperacillin-tazobactam 4.5g 6 h +/- Clindamycin 900mg IV q8h Or Inj Vancomcyin 15-20 mg/kg/day every 8-12 hrly	Cefoperazone-sulbactam 3 g q12h	

For common etiological agents of acute osteomyelitis, see Annexure B.10.1

Additional Information:

- Risk factors of bone vulnerability to osteomyelitis include recent trauma, having diabetes, being on hemodialysis, intravenous drug abuse, and history of splenectomy.

Reference:

1. The WHO AWaRe (Access, Watch, Reserve) antibiotic book. Geneva: World Health Organization; 2022. Licence: CC BY-NC-SA 3.0 IGO. Available from: https://www.who.int/publications/i/item/9789240062382

10.2 *Chronic Osteomyelitis*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with Dosage and Duration)	Comments
Acute on chronic (accompanied with fever)	Blood culture should be obtained before starting antimicrobial therapy. Empirical treatment should be started with narrow spectrum antibiotic. Definitive antibiotic therapy should be started as soon as culture results are available. Empirical therapy as per guidelines for acute osteomyelitis.	Same as in acute osteomyelitis	It is a continuous bacterial infection involving cortical bone. Surgical debridement of all diseased bone is often required as antibiotics penetrate poorly into infected fluid collections such as abscesses and injured or necrotic bone. Once susceptibility data becomes available, antibiotic therapy should be narrowed for targeted coverage of the susceptible organisms.

For common etiological agents of chronic osteomyelitis, see Annexure B.10.2

Additional Information:

- Supportive care should be continued and then narrow spectrum therapy must be initiated based on the results of investigations.

Reference:

1. Ahmed Barakat, William HK. Schilling, Sunil Sharma, Enis Guryel, Richard Freeman. Chronic osteomyelitis: a review on current concepts and trends in treatment, Orthopaedics and Trauma, Volume 33, Issue 3,2019,Pages 181-187,ISSN 1877-1327. DOI: 10.1016/j.mporth.2019.03.005

10.3 *Gas gangrene*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Traumatic gas gangrene: lethal infection of soft tissue and is synonymous with myonecrosis usually	Penicillin G 4million Units per day 4 hrly + Clindamycin 900mg 8 hr +	Clindamycin 900 mg IV q8h may be used alone in case of past history of anaphylaxis to penicillin	Immediately start treatment with antibiotics, early surgical consultation with extensive debridement, intravenous fluid resuscitation, ICU monitoring, and

arise in traumatized tissue. **Spontaneous Gas gangrene**	Aggressive surgical debridement In spontaneous gas gangrene; Inj Piperacillin-tazobactam 4.5g q6h + Inj Clindamycin 900mg q8h Duration of therapy: 10 to 21 days till wound is stabilized and clear of infection.	Duration of therapy: 10 to 21 days till wound is stabilized and clear of infection	samples should be collected for anaerobic culture. Fasciotomy may be necessary to relieve compartment pressures. It is important to have coordinated care for these critically ill patients with an intensivist, general surgeon, orthopaedic surgeon, urologist (in the setting of Fournier's gangrene of the testicles and perineal structures), gynaecologist (in the setting of uterine gas gangrene), infectious disease specialist, gastroenterologist (in the setting of spontaneous gas gangrene).

For common etiological agents of gas gangrene, see Annexure B.10.3

References:

1. Carter GP, Cheung JK, Larcombe S, Lyras D. Regulation of toxin production in the pathogenic clostridia. Mol Microbiol. 2014 Jan;91(2):221-31. doi: 10.1111/mmi.12469. PMID: 24563915.
2. Altemeier WA, Fullen WD. Prevention and Treatment of Gas Gangrene. *JAMA.* 1971;217(6):806–813. doi:10.1001/jama.1971.03190060046011

10.4 *Septic arthritis*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with Dosage and Duration)	Comments
Septic Arthritis	Antibiotic selection is same as that for acute osteomyelitis. Duration of therapy: 4-6 weeks for adults, 2 weeks for Gonococcal arthritis (monoarticular arthritis in those with risk of STD). Ceftriaxone 1g q24h for 2 weeks		Acute septic Arthritis (in hip joints) may be secondary to osteomyelitis of proximal femur; Duration of therapy may be 3-6 weeks. Acute septic arthritis of hip joint is an emergency condition that often requires early decompression of hip joint with early initiation of antibiotics to avoid Tom Smith arthritis.

For common etiological agents of Septic arthritis, see Annexure B.10.4

Reference:

1. Ringold, S., Angeles-Han, S.T., Beukelman, T., Lovell, D., Cuello, C.A., Becker, M.L., Colbert, R.A., Feldman, B.M., Ferguson, P.J., Gewanter, H., Guzman, J., Horonjeff, J., Nigrovic, P.A., Ombrello, M.J., Passo, M.H., Stoll, M.L., Rabinovich, C.E., Schneider, R., Halyabar, O., Hays, K., Shah, A.A., Sullivan, N., Szymanski, A.M., Turgunbaev, M., Turner, A. and Reston, J. (2019), 2019 American College of Rheumatology/Arthritis Foundation Guideline for the Treatment of Juvenile Idiopathic Arthritis: Therapeutic Approaches for Non-Systemic Polyarthritis,

Sacroiliitis, and Enthesitis. Arthritis Rheumatol, 71: 846-863. https://doi.org/10.1002/art.40884

10.5 *Skin and soft tissue injuries*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Clean incised wounds/stroke cuts/sharp cuts involving only skin	Clean the wound and depending on the depth of wound, decision to suture or not to be made. No role of antibiotics		Booster dose of tetanus toxoid to be administered, if the last dose was taken more than 10 years back.
Contused lacerated wounds/Contaminated wounds (farmyard wounds roadside wounds) *Contamination from anaerobic organisms is a possibility	Amoxicillin-clavulanate 625mg q8h for 3 to 7 days based on clinical response	Oral Cefuroxime 500mg BD /oral Clindamycin 300mg q8h In case of features of sepsis: Inj Amoxicillin-clavulanic acid 1.2g q8h for 3 to 7 days based on clinical response	These wounds need to be washed thoroughly with sterile normal saline and need surgical debridement depending on the degree of contusion/contamination. In case of a contaminated/dirty wound, give a booster dose of tetanus toxoid, if last dose was taken more than 5 years back. No need for additional metronidazole.

For common etiological agents associated with skin and soft tissue injuries, see Annexure B.10.5

References:

1. Maillard JY, Kampf G, Cooper R. Antimicrobial stewardship of antiseptics that are pertinent to wounds: the need for a united approach. JAC Antimicrob Resist. 2021 Mar 25;3(1):dlab027. doi: 10.1093/jacamr/dlab027. PMID: 34223101; PMCID: PMC8209993
2. Surgical site infections: prevention and treatment. London: National Institute for Health and Care Excellence (NICE); 2020 Aug 19. (NICE Guideline, No. 125.) Available from: https://www.ncbi.nlm.nih.gov/books/NBK542473/
3. Pinchera B, Buonomo AR, Schiano Moriello N, Scotto R, Villari R, Gentile I. Update on the Management of Surgical Site Infections. Antibiotics (Basel). 2022 Nov 11;11(11):1608. doi: 10.3390/antibiotics11111608. PMID: 36421250; PMCID: PMC9686970

10.6 *Orthopaedic implant associated infections*

- Blood/Pus culture should be obtained before starting antimicrobial therapy
- Empirical treatment should be started with acute osteomyelitis guidelines
  Definitive antibiotic therapy should be started as soon as culture results are available

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Orthopedic implant associated infections	Debridement Empirical treatment as per acute osteomyelitis guidelines Targeted antibiotic as per culture report	As in acute osteomyelitis Definitive antibiotic therapy should be started as soon as culture results are available	Implant-related infections are the result of bacteria adhesion or subsequent biofilm formation. Implant removal or debridement as per the clinical decision. In case there is pus discharge/implant visible do not start empirical antibiotics, preferably wait for deep culture report.

For common etiological agents of Orthopaedic implant associated infections, see Annexure B.10.6

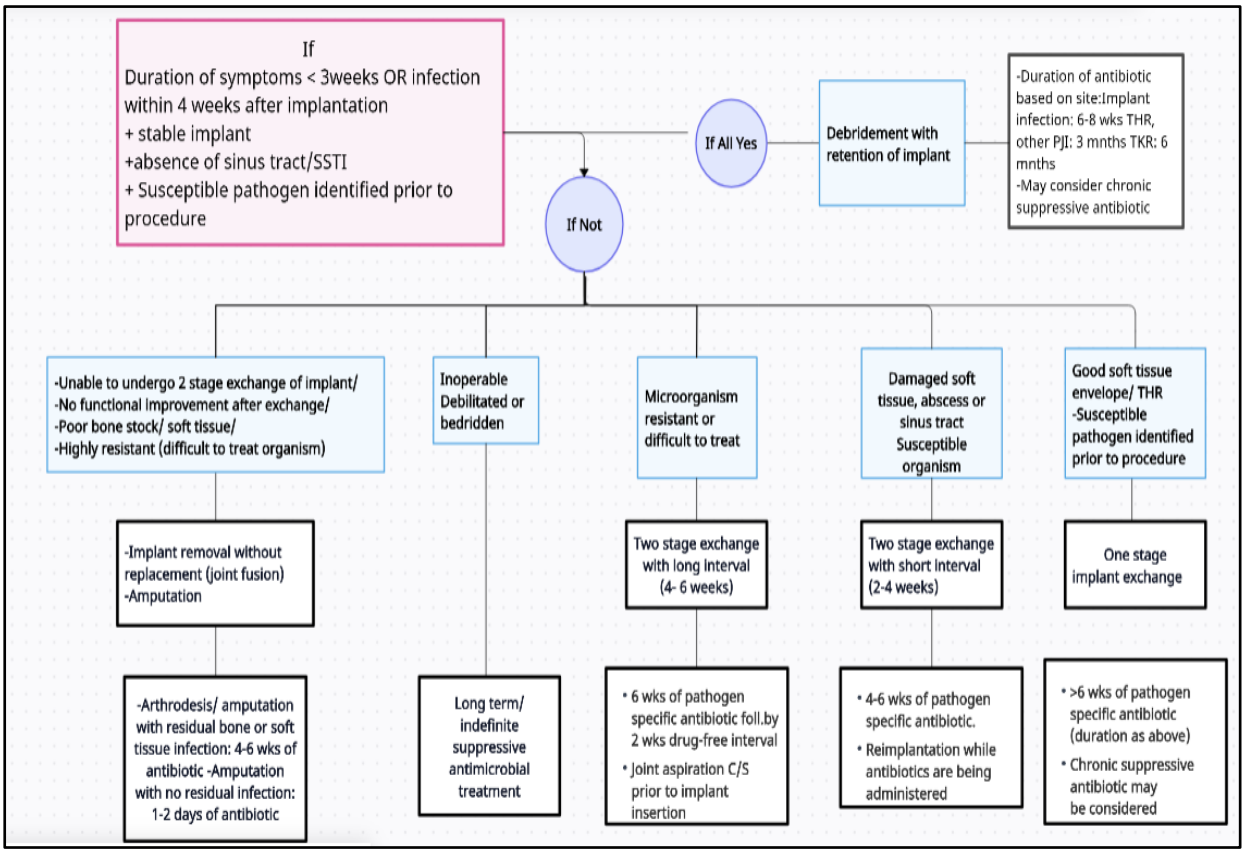

Figure 10.1: Approach to orthopaedic implant infections

References:

1. Li X, Sun L, Zhang P, Wang Y. Novel Approaches to Combat Medical Device-Associated BioFilms. *Coatings*. 2021; 11(3):294. Page 1-31. Available from: https://doi.org/10.3390/coatings11030294
2. Ihtisham Ul Haq, Taj Ali Khan, Katarzyna Krukiewicz, Etiology, pathology, and host-impaired immunity in medical implant-associated infections, Journal of Infection and Public Health, Volume 17, Issue 2, 2024, Pages 189-203, ISSN 1876-0341, https://doi.org/10.1016/j.jiph.2023.11.024.
3. Kennedy DG, O'Mahony AM, Culligan EP, O'Driscoll CM, Ryan KB. Strategies to Mitigate and Treat Orthopaedic Device-Associated Infections. Antibiotics (Basel). 2022 Dec 15;11(12):1822. doi: 10.3390/antibiotics11121822. PMID: 36551479; PMCID: PMC9774155.
4. Treatment Guidelines for Antimicrobial Use in Common Syndromes. 2nd edition. ICMR. 2019. New Delhi (Accessed on 2nd April, 2025). Available from: https://www.icmr.gov.in/icmrobject/custom_data/pdf/resource-guidelines/Treatment_Guidelines_2019_Final.pdf

10.7 *Surgical Prophylaxis*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Classified as Clean, Clean Contaminated, Contaminated and Dirty (Detailed in table below)	Routine use of antibiotic prophylaxis for clean non-prosthetic uncomplicated surgery is not recommended.	-	Surgical prophylaxis is to ensure adequate serum and tissue levels of the drug at the time of incision, and for the duration of surgery. Antibiotics should be started within 60 min of the surgical incision. Antibiotics should be discontinued at the time of the incision's closure, except in implant-based breast reconstructions, joint arthroplasty and cardiac procedures where the optimal duration of antibiotic therapy remains unknown. Repeat the dose if the duration of surgery is more than 4 hours.

For common etiological agents of Surgical site infections, see Annexure B.10.7

Additional Information:

- Surgical infection can be prevented by pre-operative chlorhexidine gluconate (2%-4%) bath/body wipes preferably one day prior to, and on the day of surgery. Adopting hair clipping instead of shaving in surgical site preparation can help in reducing surgical site infections.
- **Classification of operative wounds and risk of infection is tabulated below:**

Classification	Criteria	Risk (%)
Clean	Elective, not emergency, non-traumatic, primarily closed; no acute inflammation; no break in technique; respiratory, gastrointestinal, biliary and genitourinary tracts not entered	< 2
Clean-contaminated	Urgent or emergency case that is otherwise clean; elective opening of respiratory, gastrointestinal, biliary or genitourinary tract with minimal spillage (e.g., appendectomy) not encountering infected urine or bile; minor technique break	<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 technique; penetrating trauma < 4 hours old; chronic open wounds to be grafted or covered	Approx. 20
Dirty	Purulent inflammation (e.g., abscess); preoperative perforation of respiratory, gastrointestinal, biliary or genitourinary tract; penetrating trauma > 4 hours old	Approx. 40

- **Antibiotic prophylaxis in specific procedures is tabulated below:**

Specific operations	Expected organism	Antibiotic of choice	Dosage in adults
Esophagus	*S. aureus, Streptococci*	Cefazolin	1-2 g IV
Thoracic	*S. aureus, S. epidermidis*	Cefazolin	1-2 g IV
Gastroduodenal	Gram-positive cocci, enteric gram-negative bacilli	Cefazolin	1-2 g IV
Colorectal	Enteric gram-negative bacilli, anaerobes	Cefazolin + Metronidazole	1-2g IV+500 mg

Appendectomy for uncomplicated appendicitis	Enteric gram-negative bacilli, anaerobes	Cefuroxime	1-2 g IV
Biliary	Enteric gram-negative bacilli	Cefazolin	1-2 g IV
Vascular	*S. aureus, S. epidermidis*, enteric gram-negative bacilli	Cefazolin	1-2 g IV
Breast and hernia	*S. aureus, S. epidermidis*	Cefazolin	1-2 g IV
Urology-Clean with entry into urinary tract		Cefazolin (the addition of a single dose of an aminoglycoside may be recommended for placement of prosthetic material [e.g., penile prosthesis])	
Urology-Clean without entry into urinary tract		Cefazolin (the addition of a single dose of an aminoglycoside may be recommended for placement of prosthetic material [e.g., penile prosthesis])	
Genitourinary Lower tract instrumentation with risk factors for infection (includes transrectal prostate biopsy]		Fluoroquinolones, Cefazolin	
Liver transplantation		Piperacillin -tazobactam	4.5 g
Heart/Lung transplantation		Cefazolin	1-2 g IV
Hysterectomy		Cefazolin	1-2 g IV
Caesarean section		Cefazolin	1-2 g IV
Neurosurgery		Cefazolin	1-2 g IV
Small Intestine-Non obstructed		Cefazolin	1-2 g IV+500 mg
Small intestine-obstructed		Cefazolin + Metronidazole	1-2g IV+500 mg

Administration of prophylactic antimicrobials should be performed only when indicated. It should be administered within 1 hour before incision for all antimicrobials except Vancomycin and Fluoroquinolones, for which it should be administered within 2 hours before incision. Redosing should be considered to maintain adequate tissue levels on the basis of on agent half-life. A single dose of a prophylactic antimicrobial is adequate for most surgical procedures. If Cefazolin is not available, use Inj Cefuroxime 1.5 g IV instead.

- **Doses of drugs used in Musculoskeletal infections is tabulated below:**

Drug	Adult dose	Paediatric dose
Ceftriaxone	2g 12 OD	50 mg/kg 12 hrly
Ceftazidime	2g q 6-8 hrly	50 mg/kg 8 hrly
Cefepime	2g 8-12 hrly	50 mg/ kg 12 hrly
Cefotaxime	2g 6 hrly	50 mg/kg 6 hrly
Meropenem	2g 8 hrly	40 mg/kg 8 hrly
Colistin	9 million unit loading and then 3 million 8 hrly	150,000 units/ kg loading and then 50,000 units/ kg 8 hrly
Polymyxin B	7,50,000 q12h	15-25,000 units/ kg loading and then 5000-7500 units/kg 8 hrly
Fosfomycin	4g 6 hrly	75-100 mg/kg/dose 6 hrly
Cotrimoxazole	3-6 mg/kg of TMP TDS	
Vancomycin	15 mg/kg (max 2 g) 8 hrly	15 mg/kg 6 hrly
Cloxacillin	2 g 4 hrly	50 mg/kg 6 hrly
Doxycycline	100 mg 12 hrly	1.5-2 mg/kg 12 hrly
Chloramphenicol	1-2 g 6 hrly	25 mg/kg 6 hrly
Metronidazole	400 mg 8 hrly	10 mg/kg 8 hrly
Amphotericin B	1 mg/kg/day	
Liposomal amphotericin B	3-5 mg/kg/day	
Fluconazole	800 mg loading and then 400 mg OD	12 mg/kg loading and then 6 mg/ kg daily g/kg loading in neonates and then 12 mg/kg daily

References:

1. Bucataru A, Balasoiu M, Ghenea AE, Zlatian OM, Vulcanescu DD, Horhat FG, Bagiu IC, Sorop VB, Sorop MI, Oprisoni A, Boeriu E, Mogoanta SS. Factors Contributing to Surgical Site Infections: A Comprehensive Systematic Review of Etiology and Risk Factors. Clin Pract. 2023 Dec 28;14(1):52-68.
2. Surgical site infections: prevention and treatment. London: National Institute for Health and Care Excellence (NICE); 2020 Aug 19. (NICE Guideline, No. 125.) Available from: https://www.ncbi.nlm.nih.gov/books/NBK542473/
3. Lerano C, Nankervis JM, James R, Rajkhowa A, Peel T, Thursky K. Surgical antimicrobial prophylaxis. Aust Prescr. 2017 Dec;40(6):225-229. doi: 10.18773/austprescr.2017.073. Epub 2017 Nov 14. PMID: 29377021; PMCID: PMC5768598.

11. Ocular Infections

11.1 *Conjunctivitis & Keratitis*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with Dosage and Duration)	Comments
Allergic (reaction is secondary to allergens such as pollen)	Cool compresses and artificial tears help in relieving discomfort. Topical and systemic anti-histaminics. Topical mast-stabilizers. Topical NSAIDs (Ketorolac 0.5%/ Flurbiprofen 0.03% w/v). Persistent allergic conjunctivitis may also require topical steroid eye drops (Topical steroids in short pulses-(1-2 weeks or longer):Lower potency steroids - Loteprednol/ Fluorometholone) Duration: Topical mast cell stabiliser eye drops are given for from a few days to at least 4-6 weeks depending on resolution of symptoms and signs	Topical glucocorticoids for refractory symptoms: Prednisolone acetate 1%/ Prednisolone sodium phosphate 1% Duration: Few days to weeks (For 3-4 weeks with gradual shifting to a steroid sparing agent), depending on resolution of clinical signs	NSAIDS and antihistamines to be considered as first line agents in milder cases. Opinion with ENT specialist/pulmonologist to be taken in view of accompanying systemic symptoms.
Bacterial Conjunctivitis: starts commonly with one eye then both eyes stick with mucopurulent discharge	Chloramphenicol eye drops 6 hrly for 5 to 7 days Or Gentamicin 0.3% 6 hrly for 5 days Intensive instillation every 15 to 30 minutes until symptoms and signs are reduced, and then gradually taper	Ciprofloxacin eye drops q12h for 5-7 days Or Gatifloxacin 0.3% eye drops Dose: 1-2 drops every 2h during the first 2 days, then every 4-8hrs Duration: 7 days	Lid hygiene. Protective glasses Patient education regarding likelihood of transmission to others. If Contact lens associated & *Pseudomonas* spp. keratoconjunctivitis suspected- Gentamicin 14 mg/ml 1 drop 1 hrly or Tobramycin fortified e/d 1.3 % 1 drop 1 hrly (Contact lens solution to be sent for microbiological

			testing with cultures). Duration: 15 days. Steroid use with antibiotics is controversial as studies report mixed results in reducing corneal scarring. Conjunctival swab to be sent for Gram stain and culture.
Ophthalmia neonatorum	Ceftriaxone 50 mg/kg IM single dose	Azithromycin 20 mg/kg OD x 3 days	For prevention of both chlamydia and gonococcal ophthalmia: Erythromycin 0.5 % eye ointment / tetracycline 1% eye ointment to be applied in both eyes soon after birth. Conjunctival swab for Gram stain/ culture to be sent. Parents to be tested for evidence of Gonorrhoea.
Trachoma	Tetracycline 1 % eye ointment Or Erythromycin 0.5 % eye ointment + Azithromycin 20 mg/kg/dose in a child or Azithromycin 1g single dose in adult.	Adult: Doxycycline 100 mg BD for 21 days Or Tetracycline 250 mg QID for 14 days	India has been declared trachoma free by WHO in 2024. Ceftriaxone not to be given in neonates receiving calcium containing fluids. Avoid in infants with hyperbilirubinemia. Wherever NAAT confirmation is not possible, treat for both

			Chlamydia and Gonococcus.
Viral Conjunctivitis (commonly both eyes together with watery discharge)	Antibiotics should not be routinely prescribed. Eyelid hygiene should be explained. Lubricating eye drops. Antibiotics administered if there is evidence of secondary bacterial infection: Gentamicin eye drops 0.3 % w/v QID for 1week May add - Topical Ganciclovir 0.15% gel 1 drop 5 times a day for 3 days and then 3 times daily for 1 week in severe cases	Acyclovir 800 mg PO 5 times a day for 7 to 10 days Or Famciclovir 500 mg PO 3 times a day	Inform patients about ways to maintain hygiene to prevent transmission of infection to others.
Bacterial Keratitis	Size of ulcer <3 mm and not involving centre visual axis: Moxifloxacin eye drops 1 hrly for first 48hrs and then reduce as per response Size of ulcer >3 mm or involving centre visual axis or non-resolving keratitis on single antibiotic within 48 hours: Cefazolin eye drops 5% 1 hrly Or Tobramycin eye drops 1.3% 1 hrly	Size of ulcer <3 mm and not involving centre visual axis: Gatifloxacin eye drops Or Levofloxacin eye drops Or Besifloxacin eye drops Or Ceftazidime eye drops 5% 1 hrly	Oral fluoroquinolones (Ciprofloxacin/ Moxifloxacin) maybe added in corneal ulcers over 5 mm in size or >50% deep accompanied with limbal involvement/ perforated ulcer or following keratoplasty. Corneal scrapings to be sent for microbiological testing (Gram stain/ KOH/cultures). Once the culture results are available after 48 to 72 hours, the treatment must be switched to targeted antibacterial therapy. Duration of therapy: Few

			weeks to months, depending on resolution of signs and symptoms until ulcer heals.
Viral Keratitis **HSV is the most common cause of viral keratitis**			
Epithelial	Eye ointment Acyclovir 3% 5 times per day for 2 weeks	Topical Ganciclovir 0.15% gel 1 drop 5 times a day for 3 days and then 3 times daily for 1 week	Oral antiviral needed if associated stromal/endothelial involvement or in recurrent episodes. Diagnosis predominantly clinical.
Stromal	Tab. Acyclovir (10-20 mg/kg/day in 5 divided doses in < 18 years; 30 mg/kg/day in 5 divided doses for > 18 years) 400 mg 5 times per day for 2 weeks Eye drop Prednisolone acetate 6 times per day along-with eye drop Moxifloxacin QID Eye drop Homatropine 2 % TDS	Tab. Valacyclovir 1g TDS or 60 mg/kg/day in 2 to 18 years in 3 divided doses	
Endothelial	Tab Acyclovir 400 mg 5 times per day for 2 weeks Eye drop Prednisolone acetate 6 times per day along with eye drop Moxifloxacin QID Eye drop Homatropine 2 % TDS		
VZV (Varicella Zoster Ophthalmicus/Herpes zoster ophthalmicus)	Tab Acyclovir 800 mg 5 times in a day for 2 weeks Eye drop: Ciprofloxacin/Gentamicin QID (Antibiotics to be administered if evidence of secondary bacterial infection)	Tab Valacyclovir 1g TDS for 2 weeks Eye drop Moxifloxacin QID	
Fungal Keratitis: Aspergillus, Fusarium, Candida species	Natamycin: first line treatment *For filamentous fungi:* Natamycin 5% Eye drops half hrly for the first two days after which it is reduced to one drop every hour. Further reduction based on response to treatment. Based on response to treatment and clinical course over 48-72		Diagnosis based on clinical presentation, history of trauma with vegetative matter. Corneal scraping to be sent for Gram stain/KOH test with

	hours and no results coming on culture, decision to add another topical antifungal agent is to be taken. In resistant cases or poor response to Natamycin-Voriconazole to be used alone or in combination with Natamycin. For *Candida spp., Aspergillus spp., Scedosporium spp., Fusarium spp.,* and *Paecilomyces spp.:* Voriconazole eye drops (1 mg/ml) q1h, then tapered over 4-6 weeks Amphotericin B 0.15% eye drops (Good activity against *Aspergillus* and *Candida)* : initially q1-2h, then tapered over 4-6 weeks. (For cases not responding to topical Natamycin, first line choice for Candida) Atropine 1% eye ointment or Homatropine eye drops 2 % BD to be added as cycloplegics Duration: 4 weeks Corneal scraping to be sent at presentation Debridement- Every 48 hours Systemic antifungal therapy: Large corneal ulcers reaching the limbus, severe deep keratitis or if ulcer is associated with scleritis/endophthalmitis or patients being considered for keratoplasty: Oral fluconazole 200 mg OD Or Voriconazole 200 mg BD for 4 to 6 weeks		culture/sensitivity .

For common etiological agents of conjunctivitis, see Annexure B.11.1.1 and for common etiological agents of keratitis, see annexure B.11.1.2

Additional Information:

- Eye discomfort caused by inflammation or infection of the conjunctiva of viral or bacterial conjunctivitis can be alleviated by applying cold compresses to the affected eyes.

- Trachoma is a form of chronic *Chlamydia* conjunctivitis. It is the leading cause of preventable blindness in the world.

References:

1. Azari AA, Arabi A. Conjunctivitis: A Systematic Review. J Ophthalmic Vis Res. 2020 Aug 6;15(3):372-395. doi: 10.18502/jovr. v15i3.7456.
2. Cabrera-Aguas M, Khoo P, Watson SL. Infectious keratitis: A review. Clin Exp Ophthalmol. 2022 Jul;50(5):543-562. doi: 10.1111/ceo.14113.
3. Koganti R, Yadavalli T, Naqvi RA, Shukla D, Naqvi AR. Pathobiology and treatment of viral keratitis. Exp Eye Res. 2021 Apr; 205:108483. doi: 10.1016/j.exer.2021.
4. *The WHO AWaRe (Access, Watch, Reserve) antibiotic book. Geneva: World Health Organization; 2022. Licence: CC BY-NC-SA 3.0 IGO.Available from: https://www.who.int/publications/i/item/9789240062382*

11.2 *Endophthalmitis*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Acute postoperative endophthalmitis (within 6 weeks of surgery)	Intravitreal antibiotics: Vancomycin 1 mg/0.1 ml (0.1 ml) intravitreal with Ceftazidime 2.25 mg/0.1 mL (0.1 ml) /intravitreal Amikacin 0.4 mg/0.1 ml (0.1 ml); instead of Ceftazidime if Penicillin allergy. + Systemic antibiotics: Vancomycin (15-20 mg/kg every 12 hrly) 1g IV BD and Amikacin (15 mg/kg q24h) 240 mg IV TDS Or Vancomycin 1 g IV BD and Ceftazidime 2g IV q8h + Topical antibiotics: Fortified Tobramycin 1.3% with fortified Cefazolin 5% eye drop 1 hrly to be reduced according to response Duration: 2 weeks	Intravitreal Piperacillin-tazobactam (250 µg/0.1 ml) repeated in 48 hours with Amikacin 7.5 mg/kg initial dose followed by 6 mg/kg every 12 hrly Or Piperacillin- tazobactam; If creatinine clearance > 40 ml/min and is normal - 3.375 IV q6hr for 7 to 10 days Or Meropenem + Moxifloxacin eye drops 0.5% in hrly or two hrly frequency	**Post Surgical:** *Staphylococcus epidermidis*, (60-70%), *Staphylococcus aureus*, *Streptococcus* & *Enterococcus* (5-10%) Gram negative Bacilli (-5%) *Propionibacterium acnes* (delayed disease) **Post- traumatic:** *Staphylococcus* species, *Streptococcus* species, *Bacillus cereus*. Vitreous tap/ Aqueous tap or vitreous biopsy to be sent for microbiological testing prior to administration of the first dose of intravitreal injection. Vitrectomy improves retinal oxygenation, reduces the inflammatory load within the eye, provides specimens for diagnostic evaluation, allows direct inspection of the

			retina, allows definitive treatment, reduces the load of infection, and reduces the severity of the disease, and accelerates visual rehabilitation. Corticosteroids topical maybe added based on response to treatment. Homatropine 2%/ atropine 1% are essential part of treatment to relieve ciliary spasms and preventing synechiae formation.
Chronic post-cataract surgery endophthalmitis (after 6-week of surgery)	Intravitreal ceftazidime (2.25 mg/0.1 ml) And Intravitreal vancomycin (1 mg/0.1 ml) + Topical Vancomycin (50 mg/ml) and Amikacin (20 mg/ml) every 4 hrly /Ceftazidime or Cefazolin Duration: few weeks depending on resolution of signs and symptoms	Intravitreal Piperacillin-tazobactam (250 µg/0.1 ml) repeated in 48 hours + Intracameral Moxifloxacin 500 mcg/0.1 ml- in select cases	The decision for systemic treatment may be taken in consultation with the ophthalmologist. Vitreous humor sample to be sent for microbiological testing: Gram stain/ cultures with prolonged incubation for slow growing organisms. PCR to be done if cultures are negative.
Endogenous/ Hematogenous (bacteraemia any source)	Intravitreal antibiotics: (Inj Vancomycin + Inj Ceftazidime) along with Systemic antibiotics Systemic antibiotics: Inj Ceftazidime 2 g IV q8h + Inj Vancomycin 1 g IV q12h Duration: Systemic antibiotics given for 7 to 10 days or more depending on culture reports and based on resolution of clinical signs.		*Streptococcus pneumoniae, Staphylococcus aureus*, Group B Streptococcus, *Klebsiella pneumoniae, Neisseria meningitidis* Endocarditis is the source in 40% of cases. Systemic antibiotics are mandatory in treatment of endogenous/hematogenous endophthalmitis. Appropriate cultures (Blood culture/urine culture etc) to be sent for microbiological

			testing before initiation of antibiotics.
Fungal Endophthalmitis (Usually endogenous)	Intravitreal antifungal therapy: Amphotericin B (5 micrograms/0.1 ml (0.1 ml) Or Voriconazole 100 micrograms/0.1 ml (0.1 ml) Empiric systemic antifungal therapy- *Candida* suspected/confirmed: Fluconazole- Loading dose of 800 mg (12mg/kg) then 400-800 mg (6-12 mg/kg) daily Or Voriconazole – 400 mg loading dose (6 mg/kg) PO/IV q12h for 2 doses, then 200 mg (4 mg/kg) PO/IV q12h Duration: IV 10 days (range 2-90 days); PO 76 days (range 2-232 days). Systemic antifungal treatment typically lasts 4 to 6 weeks or longer, depending on the clinical response and presence of other organ involvement, with serial		Duration is dependent on resolution of eye lesions. *Candida spp.*: 4-6 weeks. *Mucorales*: if spreads to eye- needs systemic treatment. Refer to ROCM. Appropriate cultures (Blood culture/urine culture etc) to be sent for microbiological testing before initiation of antifungals.

	examinations to assess treatment response.		

For common etiological agents of endophthalmitis, see Annexure B.11.2

Additional Information:

- Viruses usually do not cause suppurative inflammation of the eye or endophthalmitis.

References:

1. Endophthalmitis Durand, M.L.Clinical Microbiology and Infection, Volume 19, Issue 3, 227 – 234. Available from: https://theretinainstitute.org/endophthalmitis
2. Sharma Aditya; Madan, Siddharth; Beri, Nitika. An Approach to Endophthalmitis. Delhi Journal of Ophthalmology 33(3): p 180-185, Jul–Sep 2023. | DOI: 10.4103/DLJO.DLJO_146_23
3. The WHO AWaRe (Access, Watch, Reserve) antibiotic book. Geneva: World Health Organization; 2022. Licence: CC BY-NC-SA 3.0 IGO.*Available from: https://www.who.int/publications/i/item/9789240062382*

11.3 *Periocular infections (Eyelid infections, Orbital cellulitis)*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with Dosage and Duration)	Comments
Periorbital/preseptal cellulitis	Oral Amoxicillin with clavulanic acid 90/6.4 mg /kg/day BID If age <2 years: 10 days If age >2 years: 5-7 days Or Oral cotrimoxazole 5 mg/kg per day for 5 to 7 days Systemic antibiotic therapy is administered for 5 to 7 days but may be extended if cellulitis persists.	Clindamycin (10mg/kg/dose {max 600 mg/dose}) with ciprofloxacin (Oral) 500 mg BD for 5 to 7 days or until resolution of inflammation	
Uncomplicated orbital cellulitis	Oral antibiotics to be considered: First-line: Amoxicillin-clavulanate (IV) Or IV Ceftriaxone. If > 7 years add clindamycin / metronidazole (500mg q8h for adults and 30 mg/kg per day in divided doses for children) along with Ceftriaxone. MRSA or an at-risk population: Clindamycin should be considered as initial treatment. Children over 40kg: Give adult dosage. Analgesics such as NSAIDs and	Clindamycin 300mg q8h Or Trimethoprim-Sulfamethoxazole 1-2 DS tab BD Alternative: Ciprofloxacin If no intracranial involvement switch to oral Amoxicillin with clavulanic acid or clindamycin + ciprofloxacin	Periorbital cellulitis is an infection of the eyelid or skin around the eye. Common microorganisms: *Streptococcus pneumoniae, Hemophilus influenzae, Staphylococcus aureus,* Gram Negative bacilli post trauma. Antibiotic therapy ranges from a total of at least 2 to 4 weeks. Surgery may be needed to drain the abscess or relieve pressure in the space around the eye.

Type of Infection	First Line (with Dosage and Duration)	Alternative (with Dosage and Duration)	Comments
	Paracetamol to be used.		
Complicated (With intracranial extension)	Vancomycin 15 to 20 mg/kg per day IV every 8 to 12 hours + Ceftriaxone 2 g IV per 12hrs Duration: at least 2 to 3 weeks or until the resolution of inflammation. Clindamycin 15mg/kg (max 600 mg) IV/oral 8 hrly x 7-10 days Or Tab Cotrimoxazole (8/40mg/ml) 4.20 mg/kg (max 320/1600mg) BD x 7-10 days		Surgery is almost always indicated in patients with intracranial extension of the infection.

For common etiological agents of orbital cellulitis, see Annexure B.11.3.1 and for preseptal cellulitis, see Annexure B.11.3.2

Additional Information:

- *Aspergillus* infection of the orbit occurs in patients with severe neutropenia or other immune deficiencies, such as HIV infection.

References:

1. A.A. Gordon and P.O. Phelps, Management of pre-septal and orbital cellulitis for the primary care physician, Disease-a-Month, **https://doi.org/10.1016/j.disamonth.2020.101044**,
2. Kanski's clinical ophthalmology, a systemic approach 10th edition, pg 124,125

11.4 *Retinitis*

Most common etiological agent for retinitis is Cytomegalovirus (CMV)

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
CMV	Induction: intravenous Ganciclovir 5 mg/kg every 12 hours for 14 to 21 days & Maintenance phase 5 mg/kg/d Or Valganciclovir induction therapy consists of 900 mg BD, followed by 900 mg/d for maintenance.	Intravitreal injection of Ganciclovir 2.5 mg/0.05 ml weekly for 2 to 3 weeks Or Foscarnet 2.4 mg/injection administered twice weekly for 2 to 4 doses with concurrent systemic therapy	In all cases of infective retinitis, the antimicrobial should be initiated first, followed by steroids. Initiating steroids in the presence of infective retinitis or panuveitis without antimicrobial coverage may result in severe ocular damage and could be life-threatening if systemic disease is present.
Acute retinal necrosis	Difluprednate, a topical corticosteroid Periocular or Intraocular glucocorticoid injections Valganciclovir 900 mg BD for induction phase of 3 weeks followed by maintenance dose of 900 mg OD and then long term for 3 to 6 months + low dose aspirin		

For common etiological agents of infectious retinitis, see Annexure B.11.4

Additional Information:

- Patients presenting with posterior uveitis and no evidence of an underlying etiology should undergo a chest radiograph to evaluate for pulmonary sarcoidosis or infections such as tuberculosis. In addition, affected patients should undergo serology to rule out syphilis.

12. Respiratory Tract Infections

12.1 *Bronchitis*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Acute bronchitis	No antibiotics	Bronchodilators if wheezing	If cough persists for more than 2 weeks, exclude TB and pertussis.

For common etiological agents of Acute Bronchitis. see Annexure B.12.1

12.2 *Bronchiolitis*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Bronchiolitis	Antibiotics not recommended. Nebulisation with bronchodilators.		

For common etiological agents of Bronchiolitis, see Annexure B.12.2

12.3 Infective exacerbation of asthma/COPD

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Infective exacerbation*	Tab Amoxicillin-clavulanate 1g BD Or Tab Cefuroxime 500 mg BD Or Tab Cefpodoxime 200 mg BD	Inj Ceftriaxone 2g IV OD	Most commonly caused by viral respiratory infections. Antibiotics should be considered only if there is increased dyspnoea, increased sputum volume and increased sputum purulence [Anthonisen criteria] Duration of therapy: 3-5 days

For common etiological agents associated with Infective exacerbation of asthma/COPD, see Annexure B.12.3

Additional Information:

*Symptoms of infective exacerbation are:

- Fever
- Sputum purulence

- Worsening bronchospasm
- Worsening oxygenation

References:

1. Normansell R, Sayer B, Waterson S, Dennett EJ, Del Forno M, Dunleavy A. Antibiotics for exacerbations of asthma. Cochrane Database Syst Rev. 2018 Jun 25;6(6):CD002741. doi: 10.1002/14651858.CD002741.pub2. PMID: 29938789; PMCID: PMC6513273.
2. Siddiqi A, Sethi S. Optimizing antibiotic selection in treating COPD exacerbations. Int J Chron Obstruct Pulmon Dis. 2008;3(1):31-44. doi: 10.2147/copd.s1089. PMID: 18488427; PMCID: PMC2528209.
3. American Thoracic Society / European Respiratory Society Task Force. Standards for the Diagnosis and Management of Patients with COPD [Internet]. Version 1.2 http://www.thoracic.org/go/copd

12.4 *Infective Exacerbation of Bronchiectasis*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
OPD	Tab Amoxicillin-clavulanate 1g BD for 5-7 days	Tab Cefuroxime 500 mg BD for 5-7 days	Symptoms of infective exacerbation include fever and sputum purulence. Sputum culture is recommended for targeted therapy. Duration may be prolonged to 14 days if very slow improvement in symptoms. Avoid empiric use of fluoroquinolones. Use only as targeted therapy (after culture result) and after ruling out TB.
IPD	Inj Piperacillin-tazobactam 4.5g IV q6h for 5-7 days Or Inj Cefoperazone – sulbactam 3g IV BD for 5-7 days	Inj Meropenem 1g TDS Or Inj Imipenem-cilastatin 500mg q6h for 5-7 days	

For common etiological agents associated with Infective exacerbation of bronchiectasis, see Annexure B.12.4

Reference:

1. Polverino E, Goeminne PC, McDonnell MJ, et al. European Respiratory Society guidelines for the management of adult bronchiectasis. Eur Respir J 2017; 50: 1700629 [https://doi.org/10.1183/13993003.00629-2017].

12.5 *Community Acquired Pneumonia*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Without comorbidities: OPD management	Amoxicillin 1g q8h for 5-7 days	Azithromycin 500mg OD /Clarithromycin 500mg BD daily Or Doxycycline 100mg BD Duration: 5-7 days	Duration of therapy is 5-7 days, but longer duration of therapy may be considered in patients with bacteremic pneumonia, S. *aureus* pneumonia, *Legionella* pneumonia, lung abscess, empyema or other complications. If clinical stability criteria are achieved [ie absence of fever for 48 hours, hemodynamically stable, no evidence of lung abscess/synpneumonic effusion], antibiotics may be stopped by day 5.
With comorbidities – OPD management	Amoxicillin-clavulanate 1g BD + Doxycycline 100mg BD/ Azithromycin 500mg daily Duration: 5-7 days	Cefuroxime 500 mg BD / Cefpodoxime 200 mg BD + Azithromycin 500 mg daily /Doxycycline 100mg BD Duration: 5-7 days	
Inpatient ward	Ceftriaxone 2g OD IV + Azithromycin 500 mg daily /Doxycycline 100mg q12h Duration: 5-7 days	Cefotaxime 1-2 g TDS IV Or Amoxicillin-clavulanate 1.2g q8h + Azithromycin 500 mg daily Or Doxycycline 100mg q12h Duration: 5-7 days	
Inpatient ICU	Ceftriaxone 2g OD IV + Azithromycin 500 mg daily Or Doxycycline 100mg q12h Duration: 5-7 days	Cefotaxime 2g TDS IV Or Piperacillin-tazobactam 4.5g IV q6h + Azithromycin 500 mg daily Or Doxycycline 100mg q12h Duration: 5-7 days	Add MRSA agent if Necrotizing pneumonia preceding Influenza infection MRSA agents to be considered: Vancomycin 25 mg/kg IV stat followed by 15mg/kg q8-12h Or Teicoplanin 400 mg twice daily for 3 doses and then 10mg/kg OD Or Linezolid 600 mg BD PO or IV (after TB is excluded)
Inpatient ICU with risk factors for *Pseudomonas aeruginosa*	Piperacillin-tazobactam 4.5g IV q6h + Azithromycin 500mg daily Or	Imipenem / Meropenem + Azithromycin 500mg daily Or	Risk factors for *Pseudomonas* infections include: Structural lung disease like bronchiectasis, healthcare exposure or antibiotics in the last 90 days, immunocompromised. Add MRSA agent if

	Doxycycline 100mg q12h Duration: 7 days	Doxycycline 100mg q12h Duration: 7 days	Necrotizing pneumonia preceding Influenza infection

For common etiological agents of community acquired pneumonia, see Annexure B.12.5

Additional information:

- If Pneumonia not resolving in 2 weeks – rule out TB

References:

1. Sharma BB, Singh V. Indian pneumonia guidelines. *Lung India*. 2012;29(4):307-308. doi:10.4103/0970-2113.102793
2. Metlay JP, Waterer GW, Long AC, et al. Diagnosis and Treatment of Adults with Community-acquired Pneumonia. An Official Clinical Practice Guideline of the American Thoracic Society and Infectious Diseases Society of America. *Am J Respir Crit Care Med*. 2019;200(7):e45-e67. doi:10.1164/rccm.201908-1581ST
3. Treatment Guidelines for Antimicrobial Use in Common Syndromes. 2nd edition. ICMR. 2019. New Delhi (Accessed on 2nd April, 2025). Available from: https://www.icmr.gov.in/icmrobject/custom_data/pdf/resource-guidelines/Treatment_Guidelines_2019_Final.pdf

12.6 *Lung Abscess*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Primary lung abscess* (In patients with previously healthy lungs and no underlying structural lung disease)	Inj Clindamycin 600mg IV q8h Or Inj Amoxicillin-clavulanate 1.2g IV q8h	Inj Piperacillin-tazobactam 4.5g IV q6h Or Cefoperazone-sulbactam 3g IV q12h	Consider source control in the form of drainage. Change to targeted therapy as per culture results of pus/ sputum / BAL. Switch to oral as and when patient is stable and able to take orally. Treat for 4-6 weeks.
Secondary Lung Abscess (in patients with conditions causing obstruction of airways: eg: malignancies)**	Inj Piperacillin-tazobactam 4.5g IV q6h Or Cefoperazone-sulbactam 3g IV q12h	Imipenem- cilastatin 500 mg IV q6h Or Meropenem 1g IV q8h	Change to targeted therapy as per culture result of pus/ sputum / BAL. Treat for 4-6 weeks.

For common etiological agents of lung abscess, see Annexure B.12.6

*Primary Lung abscess: due to aspiration of oropharyngeal secretions - dental/periodontal infection, para nasal sinusitis, altered states of consciousness, necrotizing pneumonia or in immunocompromised patients

**Secondary Lung abscess: due to bronchial obstructions (by tumor, foreign body or enlarged lymph nodes), with coexisting lung diseases (bronchiectasis, infected pulmonary infarcts), spreading from

extrapulmonary sites-hematogenous (abdominal sepsis, infective endocarditis, septic thromboembolism) direct spread (broncho-oesophageal fistula, subphrenic abscess)

References:

1. Kuhajda I, Zarogoulidis K, Tsirgogianni K, et al. Lung abscess-etiology, diagnostic and treatment options. *Ann Transl Med*. 2015;3(13):183. doi:10.3978/j. ISSN.2305-5839.2015.07.08
2. Kuhajda I, Zarogoulidis K, Tsirgogianni K, Tsavlis D, Kioumis I, Kosmidis C, Tsakiridis K, Mpakas A, Zarogoulidis P, Zissimopoulos A, Baloukas D, Kuhajda D. Lung abscess-etiology, diagnostic and treatment options. Ann Transl Med. 2015 Aug;3(13):183. doi: 10.3978/j. ISSN.2305-5839.2015.07.08. PMID: 26366400; PMCID: PMC4543327.

12.7 *Para-pneumonic pleural effusion/empyema*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Para-pneumonic effusion or empyema	Ceftriaxone 2g OD IV Or Inj Amoxicillin-clavulanate 1.2g IV TDS Duration: 4 weeks	Piperacillin-tazobactam 4.5g IV q6h Duration: 4 weeks	Add MRSA agent: Vancomycin or Teicoplanin or Linezolid (use only if TB is excluded) if suspected as per comments in pneumonia section. Pleural fluid needs to be sent for microbiological analysis and/or direct inoculation in automated blood-culture bottles for better diagnostic yield. Change to targeted therapy based on pleural fluid cultures. Antibiotics to continue for 4 weeks. Pleural drain or ICD may be needed if pleural effusion is persistent. Surgical intervention in empyema is usually by video-assisted thoracotomy (VATS). When the evacuation of the cavity or lung expansion is not achieved with VATS, an

			open-thoracotomy is indicated.

For common etiological agents of empyema, see Annexure B.12.7

References:

1. Sharma BB, Singh V. Indian pneumonia guidelines. *Lung India*. 2012;29(4):307-308. doi:10.4103/0970-2113.102793
2. Metlay JP, Waterer GW, Long AC, et al. Diagnosis and Treatment of Adults with Community-acquired Pneumonia. An Official Clinical Practice Guideline of the American Thoracic Society and Infectious Diseases Society of America. *Am J Respir Crit Care Med*. 2019;200(7):e45-e67. doi:10.1164/rccm.201908-1581ST
3. Treatment Guidelines for Antimicrobial Use in Common Syndromes. 2nd edition. ICMR. 2019. New Delhi (Accessed on 2nd April, 2025). Available from: https://www.icmr.gov.in/icmrobject/custom_data/pdf/resource-guidelines/Treatment_Guidelines_2019_Final.pdf

13. Toxin-mediated Syndromes

13.1 *Botulism*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Botulism	No role of antibiotics for food borne or intestinal Botulism		Botulism is a serious medical emergency that requires immediate treatment. Botulinum antitoxins to be administered as soon as possible, this can neutralize botulinum toxin and prevent further damage. It works best when given early in the illness, but it can't reverse paralysis that has already happened.

For common etiological agents of botulism, see Annexure B.13.1

Reference:

1. CDC. Treatment of Botulism. April 17, 2024. Available from: https://www.cdc.gov/botulism/treatment/index.html

13.2 *Diphtheria*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Diphtheria	Crystalline penicillin (for cases) and Erythromycin (for contacts/less severe cases etc.) halts the bacterial growth, but cannot alter the toxic systemic impacts of the toxin. The drugs of choice are: Crystalline penicillin IV 1.5 lakh Units/Kg/day divided 6 hrly or in adults 20 lakh units 6 hrly for 14 days. Doses as high as 40 lakh units 6hrly have been used in exceptional circumstances. Erythromycin 40mg/kg/day divided 6 hrly, or in adults 500mg 6hrly orally after food for 14 days. Diphtheria antitoxin used in a single intravenous empirical dosage is the mainstay of treatment. Diphtheria antitoxin is given as IV infusion after test dose as per vial instructions. Dose is dependent on degree of general	Adult: Erythromycin 500 mg 4 times a day for a 2-week duration For paediatric: Erythromycin 40-50mg/kg/day in 4 divided doses times a day for a 2-week duration. Azithromycin 10 to 12 mg/kg OD for 7 days may be used instead of Erythromycin. For contacts: Erythromycin 40mg/Kg/day	The clinical manifestations of *C diphtheriae* infection are diverse and depend on factors such as the anatomical site of infection, the immune status of the host, and the production and systemic distribution of toxins. In suspected cases of diphtheria, antitoxin should be administered urgently based on clinical judgment without waiting for laboratory confirmation.

	toxicity of the patient, site and size of membrane, and duration of illness <table><tr><td>Pharyngeal/laryngeal disease < 2days duration</td><td>20000-40000 Units</td></tr><tr><td>Nasopharyngeal disease</td><td>40000-60000 Units</td></tr><tr><td>Extensive disease/>3days duration/bullneck + (respiratory distress hemodynamic instability)</td><td>80000-120000 Units</td></tr></table>	divided 6hrly or 250mg 6hrly after food for 10 days	After recovery patient should be given full course of DT vaccination.

For etiological agent of Diphtheria, see Annexure B.13.2

References:

1. The Epidemiology and Prevention of Vaccine-Preventable Diseases. 14th edition. CDC. Available from:https://www.cdc.gov/pinkbook/hcp/tableofcontents/index.html?CDC_AAref_Val=https://www.cdc.gov/vaccines/pubs/pinkbook/downloads/dip.pdf

13.3 *Tetanus*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Tetanus	500 international unit (IU) single dose of HTIG (human tetanus immune globulin) PLUS Metronidazole 500 mg IV q6h for 7 to 10 days. Or Penicillin G 2-4 million units q4h for 7 to 10 days	Doxycycline 100mg q12h for 7-10 days	Treatment includes tetanus immunoglobulin, antibiotic therapy, neuromuscular blockade, and supportive care for respiratory complications, autonomic instability, and muscle spasms. Antispasmodics such as benzodiazepines, baclofen, vecuronium, pancuronium and propofol have been used based on the clinical scenario. $MgSO_4$ should be used in case of autonomic instability. Clinical condition should be assessed by Ablett score.

For etiological agent of Tetanus, see Annexure B.13.3

References:

1. Guidance on the management of suspected tetanus cases and the assessment and management of tetanus-prone wounds. UK Health Security Agency. 2024. Available from: **h**ttps://www.gov.uk/government/publications/tetanus-advice-for-health-professionals/guidance-on-the-management-of-suspected-tetanus-cases-and-the-assessment-and-management-of-tetanus-prone-wounds#clinical-management

2. Rodrigo C, Fernando D, Rajapakse S. Pharmacological management of tetanus: an evidence-based review. Crit Care. 2014 Mar 26;18(2):217. doi: 10.1186/cc13797. PMID: 25029486; PMCID: PMC4057067.

13.4 *Toxic shock syndrome*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Toxic shock syndrome (TSS) is a rare, life-threatening condition with high grade fever, hypotension, rash, organ failure	Penicillin Crystalline (24 million unit /day) + Clindamycin 900mg 8h Duration: 7-10 days	Cefazolin (1-2mg 8h) + Clindamycin 600-900 mg IV q8h Or Vancomycin 15mg/kg IV q8h Duration: 7-10 days	TSS can be cause by *Staphylococcus aureus*, streptococcus (Group A) or rarely by *Clostridium Sordellii.* It may not be possible to pinpoint the etiological agents based on clinical syndromes, but presence of a deep-seated foci (like blunt trauma) or clear signs of skin soft tissue infection are more in favour of TSS caused by Group A Streptococcus. Presence of a minor superficial skin infection or history of use of vaginal tampons can give clue to TSS caused by *Staphylococcus aureus*. Blood cultures, culture and gram stain from an infected site are needed to attain microbiological diagnosis

For etiological agent of Toxic Shock Syndrome, see Annexure B.13.4

Additional Information:

- TSS is a toxin-mediated disease that is caused by toxin-producing streptococci or *S. aureus.* Staphylococcal TSS is likely to cause vomiting, diarrhoea, myalgia, elevated creatine kinase, mucositis, hepatic damage, thrombocytopenia, and confusion. The staphylococcal TSS rash is more likely to desquamate, particularly on the palms and soles, between 3 and 7 days after onset.

References:

1. Stanford Guidelines on Antimicrobial Therapy 2024.
2. Allen JM, Surajbali D, Q Nguyen D, Kuczek J, Tran M, Hachey B, Feild C, Shoulders BR, Smith SM, Voils SA. Impact of Piperacillin-Tazobactam Dosing in Septic Shock Patients Using Real-World Evidence: An Observational, Retrospective Cohort Study. Ann Pharmacother. 2023 Jun;57(6):653-661. doi: 10.1177/10600280221125919. Epub 2022 Sep 25. PMID: 36154486; PMCID: PMC10433263.
3. Atchade E, De Tymowski C, Grall N, Tanaka S, Montravers P. Toxic Shock Syndrome: A Literature Review. Antibiotics (Basel). 2024 Jan 18;13(1):96. doi: 10.3390/antibiotics13010096. PMID: 38247655; PMCID: PMC10812596

14. Bite wound infections

14.1 *Animal (Dog/cat/monkey/Human)*

Animal Bite	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
			Any bite or suspected bite from mammal requires Rabies prophylaxis.
Animal bite – breach in skin/open wound			Bites deeper than superficial, so thorough irrigation under local anaesthesia is needed, and the wound should be left open.
Cat, dog, bat, racoon, horse, pig, rat	Amoxicillin-clavulanic acid 625mg q8h for 3 to 5 days	Cefuroxime 500mg q12h Or Doxycycline 100mg q12h for 3 to 5 days	
Camel, Bear, Alligator	Inj Piperacillin-tazobactam 4.5g q8h for 5 to 7 days		
Monkey	Valacyclovir/Acyclovir for 7 days		Herpes virus simiae has to be covered
Human Bite	Early [Not yet infected]: Amoxicillin-Clavulanic acid 625mg q8h for 3 to 5 days	Late [Signs of infection present]: Inj Ampicillin-Sulbactam 1.5g q6h Or Inj Piperacillin-tazobactam 4.5g q8h for 3 to 5 days	

For common etiological agents associated with infections after human and animal bites, see Annexure B.14.1

Additional Information:

- Patients should be encouraged to get an updated tetanus vaccination.

References:

1. Who animal bite fact sheet https://www.who.int/news-room/fact-sheets/detail/animal-bites
2. *WB Health National Rabies Control Programme 2019.*
3. Centers for Disease Control and Prevention. Rabies. http://www.cdc.gov/rabies/medical_care/index.html. Accessed June 19, 2013.
4. Oehler RL, Velez AP, Mizrachi M, Lamarche J, Gompf S. Bite-related and septic syndromes caused by cats and dogs [published correction appears in *Lancet Infect Dis*. 2009;9(9):536]. *Lancet Infect Dis*. 2009;9(7):439-447.
5. Morgan M, Palmer J. Dog bites. *BMJ*. 2007;334(7590):413-417.
6. Fleisher GR. The management of bite wounds. *N Engl J Med*. 1999;340 (2):138-140.

14.2 *Insect Bites*

Treatment is generally supportive and includes removal of sting, cleaning the area with soap and water, local application of ice, topical steroids, and pain management. Antibiotics are rarely needed for insect bites, but they can be prescribed if the bite becomes infected.

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Insect bite with possible subsequent secondary infection	Amoxicillin-clavulanate 625mg q8h for 3-5 days (based on clinical response)	Azithromycin 500mg OD for 3-5 days	Prevention against insect bites needs the use of effective insect repellents which can significantly reduce the likelihood of bites from mosquitoes and ticks etc. Removal of ticks within 24 hours of their attachment may also decrease the risk of tick-borne diseases

Vectors associated with bites: Insects, Hymenoptera (bees, wasps, etc), mosquitoes, bedbugs, fleas, lice, beetles, caterpillars and moths etc

Reference:

1. Juckett G. Arthropod bites. Am Fam Physician. 2013 Dec 15;88(12):841-7. PMID: 24364549. Available from: https://pubmed.ncbi.nlm.nih.gov/24364549/

15. Burn wound infections

15.1 *Minor Burn Wounds*

Types of Burn	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
First-degree burns	Pour cool, running tap water over the burn. Don't apply ice or ice pack. Apply aloe vera gel or thin layer of petroleum jelly. Protect area from the sun.		

Additional Information:

- First-degree burns are mild (like most sunburns). The upper layer of skin (epidermis) turns red and is painful but doesn't typically blister.

References:

1. Church D, Elsayed S, Reid O, Winston B, Lindsay R. Burn wound infections. Clin Microbiol Rev. 2006 Apr;19(2):403-34. doi: 10.1128/CMR.19.2.403-434.2006. PMID: 16614255; PMCID: PMC1471990.
2. Lu J, Yang M, Zhan M, Xu X, Yue J, Xu T. Antibiotics for treating infected burn wounds. Cochrane Database Syst Rev. 2017 Jul 3;2017(7):CD012084. doi: 10.1002/14651858.CD012084.pub2. PMCID: PMC6483291.
3. Greenhalgh DG. Management of burns (2019).NEJM:380; 24, 2349-2359. Available from https://www.nejm.org/doi/full/10.1056/NEJMra1807442
4. Anne M Lachiewicz, Christopher G Hauck, David J Weber, Bruce A Cairns, David van Duin, Bacterial Infections After Burn Injuries: Impact of Multidrug Resistance, *Clinical Infectious Diseases*, Volume 65, Issue 12, 15 December 2017, Pages 2130–2136, https://doi.org/10.1093/cid/cix682

15.2 *Major burn wounds*

Type of Burn	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Second-degree burns	For wound care: Silver sulfadiazine 1% water-soluble cream, is a combination of sulfadiazine and silver with antimicrobial efficacy lasting up to 24 hours. Silver nitrate (0.5% aqueous) is applied		Burn treatment varies depending on the cause and severity. All burns should be kept clean and proper bandages/dressing should be applied, depending on the severity of the wounds. Treating the patient's pain is key: inadequate control can interfere with wound care.

	with occlusive dressings but does not penetrate eschar and it depletes electrolytes, and stains the local environment, broad spectrum, may cause methemoglobinemia Mafenide acetate, available both as an 8.5% water-soluble cream and a 5% aqueous solution, is among the most commonly employed topical agents. The cream is applied twice a day and has the advantage that it does not require a dressing to adhere to wounds. Mafenide has excellent tissue penetration, including eschar. Systemic antimicrobial therapy is only indicated for patients with proven burn wound infection or sepsis (culture proven).		
Third-degree burns: It can be life-threatening		Mupirocin is a topical treatment of choice for MRSA infections, Gram-positive microbes, and intranasal carriage, inhibits wound healing by a half-life of 2 days, should not be used for longer than 10 days to prevent development of resistance	Excise adherent necrotic tissue initially and debride all necrotic tissue. Change the dressing daily (twice daily, if required) or as often as necessary to prevent seepage through the dressing or when the wounds are more exudative. Second degree deep burns are managed by Tangential excision and grafting preferably within 5-7 days of sustaining burn injury. For full thickness burns, burn wound excision is done followed by coverage with autograft or allograft/ dermal substitutes when there is paucity of donor autograft. Tranexamic acid (TXA) can potentially reduce blood loss and transfusion requirements associated with burn surgery.

For common etiological agents associated with infections after burns, see Annexure B.15.1

Additional Information:

- Second-degree burns: Affect epidermis and part of dermis. The patient may experience pain, redness, swelling and blistering. Second degree can again be classified as second degree superficial which involves epidermis and the papillary dermis and Second-degree deep burns which involves the deeper reticular dermis as well.
- Third-degree burns: affect epidermis and dermis. The burn also destroys hair follicles and sweat glands. Because third-degree burns damage nerve endings, you probably won't feel pain in the area of the burn itself, rather adjacent to it. Burned skin may be black, white or brown with a leathery appearance.
- **Consider Lund & Browder's chart for burn wound estimation**.
- Burns greater than 20% surface area (adult), greater than 10% (child) or any burn occurring in the extremes of age are considered serious.
- Management of major burns: Airways, oxygen inhalation, securing central venous line, adequate and proper Fluid Resuscitation, pain relief with analgesia and sedation, isolation of

patient, NG Tube, foleys catheter & H2 receptor antagonists, Tetanus prophylaxis, Care of burn wound and operative management as necessary & other supportive measures etc.

- Patient's energy and protein requirements will be extremely high due to the systemic hypermetabolic response with gluconeogenesis, insulin resistance and protein catabolism, heat loss, infection and demands of tissue regeneration. If necessary, feed the patient through a nasogastric tube to ensure an adequate energy intake (up to 6000 kcal a day). Consultation with dietician and nutritionist is necessary for each burn patient to ensure adequate calorie intake according to Curreri Formula:

  Adult- 25 kcal/Kg+ 40kcal X %TBSA

  Children- 60kcal/ Kg + 35 kcal X % TBSA

- Gastroparesis is common, and prokinetic agents such as metoclopramide is helpful in promoting gastric emptying.
- Protein and multivitamin supplements are indicated for these patients. Serum prealbumin levels are checked every 3 days to monitor nutritional status.
- Anaemia and malnutrition prevent burn wound healing and result in failure of skin grafts.
- Systemic antibiotics are generally in early post burn period.
- Fever is not a useful sign of an infection, as it may persists due to burn per se.
- Systemic antibiotics can be initiated in proven septicaemia or can be given empirically as per hospital antibiograms for suspected sepsis awaiting culture results.

References:

1. Lu J, Yang M, Zhan M, Xu X, Yue J, Xu T. Antibiotics for treating infected burn wounds. Cochrane Database Syst Rev. 2017 Jul 3;2017(7):CD012084. doi: 10.1002/14651858.CD012084.pub2. PMCID: PMC6483291.
2. WHO, Burn Management. https://www.who.int/docs/default-source/integrated-health-services-%28ihs%29/csy/surgical-care/imeesc-toolkit/best-practice-safety-protocols/burn-management.pdf
3. Barajas-Nava LA, López-Alcalde J, Roqué i Figuls M, Solà I, Bonfill Cosp X. Antibiotic prophylaxis for preventing burn wound infection. Cochrane Database Syst Rev. 2013 Jun 6;2013(6):CD008738. doi: 10.1002/14651858.CD008738.pub2. PMID: 23740764; PMCID: PMC11303740.

16. Dental Infections

16.1 *Odontogenic tooth infections*

Odontogenic tooth Infection
Infection of the alveolus, jaws, or face originating from a tooth or from its supporting structures

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Gingivitis	Not required	Not required	Since it is a localized and superficial infection, it requires oral hygiene maintenance and scaling of teeth (only in few cases).
Periodontitis	Metronidazole 400mg q8h	If the local treatment and 5 days course of Metronidazole 400mg q8h is not effective surgical treatment is required. In very few cases: Amoxicillin 1g q8h may be advised.	Local treatment (scaling of teeth, pocket treatment) and removal of causative agent. In case patient is diabetic, adequate glycemic control will help in improving.
Complicated (severe infections, immunocompromised/ neutropenic etc) eg Ludwig's Angina, Odontogenic Sinusitis, Cavernous Sinus Thrombosis, Brain Abscess etc.	Metronidazole 400mg q8h + Amoxicillin 1g q8h may be advised.	Amoxicillin- clavulanic acid 1g q12h	Removal of cause of the complication will help. (improving immune status and neutrophil counts)

For common etiological agents associated with Odontogenic tooth infections, see Annexure B.16.1

Additional information:

- Apart from gingiva, the infections involving pulp may reach via tooth root to the jaw bone and can cause peri-apical infections. However, all pulp infections should be treated by doing root canal treatment and debridement. In rare cases when peri-apical infection spreads to other soft tissue planes and cause systemic symptoms like fever, malaise and extensive swelling then they can be treated with systemic antibiotics.

References:

1. Tahmasebi, E.; Keshvad, A.; Alam, M.; Abbasi, K.; Rahimi, S.; Nouri, F.; Yazdanian, M.; Tebyaniyan, H.; Heboyan, A.; Fernandes, G.V.O. Current Infections of the Orofacial Region: Treatment, Diagnosis, and Epidemiology. *Life* 2023, *13*, 269. Available from: https://doi.org/10.3390/life13020269
2. https://my.clevelandclinic.org/health/treatments/antibiotics-for-tooth-in

17. Infections in Immuno-compromised hosts

17.1 *Febrile neutropenia syndrome*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Hemodynamically stable	Piperacillin-tazobactam 4.5g IV q6h Or Cefoperazone-sulbactam 3g IV q12h	Meropenem 1g IV q8h Or Imipenem 500mg IV q6h	If blood cultures are negative, patient is haemodynamically stable but still febrile, blood culture should be repeated & alternate cause of fever should be looked for (fungal/viral). Continue broad-spectrum antibiotics until the patient is afebrile for at least 3 days.
Hemodynamically unstable	Meropenem 1g IV q8h + Vancomycin 25 mg/kg loading and 15 mg/kg q8h/12h + Inj Polymyxin B (15-20 lakhs units IV stat, followed by 7.5-10 lakhs IV q12h	Imipenem 500mg IV q6h	Consider adding Caspofungin if fungal infection is a consideration (persistent fever with negative cultures) Ceftazidime-avibactam +/- aztreonam is a reserve drug to be used as targeted therapy after susceptibility reporting for CR Klebsiella. Resistance among E coli and Pseudomonas is common and it is inactive against Acinetobacter, so it is not recommended for empiric use.

For common etiological agents of Febrile neutropenia syndrome, see Annexure B.17.1

For patients with Febrile neutropenia syndrome following points should be considered:

1. **When to add glycopeptides?**

- Haemodynamic instability or other evidence of severe sepsis, septic shock or pneumonia.
- Colonisation with MRSA or penicillin-resistant *S. pneumoniae.*
- Suspicion of serious catheter-related infection *e.g. chills or rigours with infusion through catheter and cellulitis around the catheter exit site.*
- Skin or soft-tissue infection at any site.
- Positive blood culture for gram-positive bacteria, before final identification and susceptibility testing is available.

2. **When should empirical colistin or polymyxin B be added in febrile neutropenic patients?**

- Haemodynamic instability.
- Colonisation with carbapenem-resistant gram-negative bacteria.
- Previous infection with carbapenem-resistant gram-negative bacteria.
- GNB in blood, sensitivity pending, persistent fever with haemodynamic instability.

3. **When to start Empirical Antifungal Therapy:**

- Empirical antifungal therapy is not advised unless patient is unstable, use of CT chest and fungal biomarkers like serum Galactomannan and serum beta D glucan is encouraged.
- Febrile after 72 hrs of antibiotic therapy.

Additional information:

- Unexplained persistent fever in the otherwise stable patient doesn't require a change in empirical antibiotic regimen. Continue the regimen till ANC is >500 cells/mm3.
- If glycopeptide has been started as a part of empirical regimen, STOP after 48 hrs, if no evidence of gram-positive infection.
- Antibiotic therapy in febrile neutropenia can be stopped if patients are afebrile for 3 days, provision for close observation is present and culture negative irrespective of ANC recovery.
- Shifting to oral antibiotics during neutropenia can be done if stable and susceptibility to the oral drug has been demonstrated.

References:

1. Freifeld AG, Bow EJ, Sepkowitz KA, Boeckh MJ, Ito JI, Mullen CA, et al. Infectious Diseases Society of America. Clinical practice guideline for the use of antimicrobial agents in neutropenic patients with cancer: 2010 update by the Infectious Diseases Society of America. Clin Infect Dis. 2011 Feb 15;52(4): e56-93. doi: 10.1093/cid/cir073. PMID: 21258094.
2. Averbuch D, Orasch C, Cordonnier C, Livermore DM, Mikulska M, Viscoli C, et. al. ECIL4, a joint venture of EBMT, EORTC, ICHS, ESGICH/ESCMID and ELN. European guidelines for empirical antibacterial therapy for febrile neutropenic patients in the era of growing resistance: summary of the 2011 4th European Conference on Infections in Leukemia. Haematologica. 2013 Dec;98(12):1826-35. doi: 10.3324/haematol.2013.091025. Erratum in: Haematologica. 2014 Feb;99(2):400. PMID: 24323983; PMCID: PMC3856957.

17.2 *Infections in Solid Organ Transplant recipients*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Immediate post-operative fever (first 48 hours) without hemodynamic instability	Close observation without any change of antimicrobials Duration: 48 hours		Rule out non-infectious causes, hematoma, DVT, transfusion fever, etc.
Surgical site infection	Treatment based on hospital antibiogram and type of surgery and modify as per culture results		

For common etiological agents of Infections in SOT recipients, see Annexure B.17.2

17.3 *Infections in Asplenia*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Acute onset undifferentiated fever	Ceftriaxone 2g IV q 12h Duration: 7 days	Cefotaxime 2g IV q8h Or Amoxicillin-clavulanic acid 1.2g IV q8h Duration: 7 days	Consider following the approach in acute undifferentiated fever section
Community acquired sepsis	Refer to section on community onset sepsis		

For common etiological agents of Infections in Asplenia patients, see Annexure B.17.3

Additional Information:

- Patient education, vaccination and antibiotic chemoprophylaxis are recommended for all individuals with asplenia to prevent infections.

References:

1. Grace M. Lee; Preventing infections in children and adults with asplenia. *Hematology Am Soc Hematol Educ Program* 2020; 2020 (1): 328–335. doi:
2. Tahir F, Ahmed J, Malik F. Post-splenectomy Sepsis: A Review of the Literature. Cureus. 2020 Feb 6;12(2):e6898. doi: 10.7759/cureus.6898. PMID: 32195065; PMCID: PMC7059871.
3. Davidson RN, Wall RA. Prevention and management of infections in patients without a spleen. Clin Microbiol Infect. 2001 Dec;7(12):657-60. doi: 10.1046/j.1198-743x.2001.00355. x. PMID: 11843905.

17.4 *Invasive Fungal Infections*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Invasive Candidiasis	Echinocandins (caspofungin, anidulafungin, or micafungin) are recommended as first-line agents Micafungin 100 mg IV daily/ Anidulafungin loading dose 200 mg, then 100 mg daily/ Caspofungin loading dose 70 mg, then 50 mg daily	Liposomal Amphotericin B 3–5 mg/kg daily	Repeat culture to be done to look for clearance of candidemia, by 3rd day of antifungal treatment. **Duration of therapy**: 14 days of antifungal therapy is recommended after the first negative blood culture post antifungal therapy. Central venous catheters (CVCs) should be removed as early as possible when the source is presumed to be the CVC. Transition from echinocandin to fluconazole is recommended after 5–7 days amongst patients who have isolates that are susceptible to fluconazole, who

			are clinically stable, and in whom repeat cultures while on antifungal therapy are negative.
Invasive aspergillosis	Voriconazole (6mg/kg X 2 doses Followed by 4 mg/kg q12h) Or Isavuconazole 200mg TDS for 6 doses and 200mg OD	Posaconazole 300 mg twice on day 1, followed by 300 mg OD Or Liposomal Amphotericin B 3 to 5 mg/kg/day OD	Duration is 6-12 weeks but prolonged treatment may be required depending on the site of infection and resolution of symptoms. Therapeutic Dose Monitoring (TDM) of voriconazole/posaconazole is recommended.
Mucormycosis	Liposomal Amphotericin B: 5 to 10 mg/kg/day OD (concomitant administration with other nephrotoxic drugs should be avoided)	Isavuconazole 200mg TDS for 2 days and 200mg OD Or Posaconazole 300 mg twice on day 1, followed by 300 mg OD	Surgical debridement at the earliest to the extent possible Amphotericin deoxycholate (1-1.5mg/kg/day) is an alternative option to liposomal amphotericin B, though less preferred due to increased adverse events. Nephrotoxicity may be reduced by prehydration with Normal Saline and by administering Amphotericin B deoxycholate at rate 0.08mg/kg/hour. Duration of therapy for mucormycosis is difficult to define, but in general 2 weeks, after complete surgical debridement is advised. If complete surgical debridement is not done or not possible then therapy should be continued till radiological resolution.

For common etiological agents of Invasive Fungal Infections in immunocompromised hosts, see Annexure B.17.4

References:

1. Peter G. Pappas, Carol A. Kauffman, David R. Andes, Cornelius J. Clancy, Kieren A. Marr, Luis Ostrosky-Zeichner, et al, Clinical Practice Guideline for the Management of Candidiasis: 2016 Update by the Infectious Diseases Society of America, *Clinical Infectious Diseases*, Volume 62, Issue 4, 15 February 2016, Pages e1–e50, https://doi.org/10.1093/cid/civ933
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- **Bone Marrow Transplant (BMT) pre-engraftment and post-engraftment prophylaxis is tabulated below:**

BMT pre-engraftment		
Antifungal prophylaxis	Posaconazole 300mg BD for 1 day and then 300mg OD (for Allogenic HSCT) Fluconazole 200mg OD (for Autologous HSCT)	This may be administered IV/oral. Blood levels may be monitored if TDM monitoring facilities are present. If posaconazole is contraindicated then alternative agents include liposomal Amphotericin or an echinocandin. **Duration:** typically given till engraftment; but may be prolonged if used as secondary prophylaxis or concomitant GVHD
Antiviral prophylaxis	Acyclovir 400mg BD	Continued in the post-transplant period for 6 months for autologous and 1 year for allogeneic BMT.
CMV management	Letermovir prophylaxis is the preferred approach for allogenic HSCT hosts. If prophylaxis not feasible, follow pre-emptive strategy. **Haplo and MUD (Matched Unrelated Donor) transplant:** CMV viral load is done; plasma or whole blood First CMV viral load at Day 14, then every 7-14 days depending on risk. **Matched sibling transplant:** First CMV viral load at Day 28.	Consider pre-emptive therapy if 2 consecutive viral loads (CMV viral load 1000-10,000 copies/ml) are showing an upward trend suggesting possibility of progression to CMV disease. Start pre-emptive anti-CMV therapy if CMV viral load is high (>1000 copies/ml). Start definitive therapy of CMV disease (any viral load) with Ganciclovir or Valganciclovir. Note: CMV disease may occur without detectable CMV viremia. Treatment response assessment once every 2 weeks: clinically as well as based on CMV PCR. Autologous transplant: no CMV surveillance is needed.

	If CMV viral load is negative then repeat viral loads are sent based on risk stratification of the underlying disease and previous treatment received. **For patients on GVHD treatment**: CMV viral load once every 2 weeks.	
Prophylaxis for bacterial infections is not advised in Indian settings as there are high resistance rates to fluoroquinolones among Enteric GNBs (like *E. coli and Klebsiella spp*.) as per ICMR and NCDC data on AMR surveillance.		
Antibiotic + PCP prophylaxis	Stable and engrafted patient: Cotrimoxazole double strength (960 mg) one tab three times a week or one tab three times a week + *Penicillin 400 mg orally q12h for 1 year Or Amoxicillin 500 mg 12 hrly* for 1 year	*Penicillin prophylaxis in those patients who have not taken Pneumococcus, Haemophilus and Meningococcal vaccination. Penicillin prophylaxis in those with splenectomy or those with sickle cell anemia to be continued till 14 years.
Antifungal prophylaxis	Posaconazole IV or oral: Loading dose of 300 mg BD on the first day, then 300 mg OD thereafter.	Needed in case of secondary prophylaxis or if concomitant GVHD (Grade 3-4). Choice of posaconazole/ liposomal amphotericin B or echinocandins based on oral medication tolerability, requirement of mold active prophylaxis, intolerance to azoles (liver function derangement, hallucination, drug interaction), and presence of GVHD. Blood levels of posaconazole can be monitored if TDM facilities are present. Till Day +90 (3 months post HSCT) but may prolong if presence of acute GVHD.

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- **Recommendations of treatment of infections in BMT settings is tabulated below:**

Clinical Condition	Empirical Antimicrobial Agents	Alternate Antimicrobial Agents	Comments
Community acquired pneumonia (CAP)	Piperacillin-tazobactam 4.5g IV q 6h + Azithromycin 500 mg daily and / or Doxycycline 100mg q12h Duration:7 days	Imipenem 1g stat and 500mg q6hrly Or Meropenem 1g q8h + Azithromycin 500 mg daily Or Doxycycline 100mg q12h	If possible, send respiratory samples for PCR etiological diagnosis. Add MRSA agent if Necrotizing pneumonia preceding Influenza infection Vancomycin 25 mg/kg IV stat followed by 15mg/kg q 8-12h Or Teicoplanin 400 mg twice daily for 3 doses and then 8-10mg/kg OD Or Linezolid 600 mg twice daily PO or IV (after TB is excluded) Work up for opportunistic infections.
Skin and soft tissue infection	Piperacillin-tazobactam 4.5g IV q 6h + Teicoplanin 400 mg twice daily for 3 doses and then 8-10mg/kg OD Or Vancomycin 25 mg/kg IV stat	Necrotizing fasciitis: Meropenem 1g q8h + Teicoplanin 400 mg twice daily for 3 doses and then 8-10mg/kg OD Or Vancomycin 25 mg/kg IV stat followed by 15mg/kg q 8-12h	For MRSA coverage consider use of Teicoplanin/Vancomycin. Consider the use of clindamycin where anti-toxin activity is desired (e.g. necrotizing fasciitis).

	followed by 15mg/kg q 8-12h Duration: 5-7 days	+/- Clindamycin 600-900mg q8h	
Herpes simplex	Acyclovir 400mg TDS	Tab Famciclovir 500mg BD for 7 days	Dose and Duration of therapy depends on organ involvement.
Varicella or disseminated zoster or localized zoster	Acyclovir 800mg five times a day Duration: 7 days	Tab Valacyclovir 1g TDS	Intravenous therapy is recommended in all severe and complicated cases.
CMV reactivation or disease (colitis, pneumonitis, hepatitis, retinitis, encephalitis)	Ganciclovir 5mg/kg BD or Valgancyclovir 900mg BD	Foscarnet (if available) in case of treatment failure	Treat till resolution of clinical symptoms and signs or resolution of viremia (2 negative viral load reports at 14 days interval). In case of treatment failure with Ganciclovir, foscarnet is the drug of choice.
***Pneumocystis jirovecii* pneumonia**	Co-trimoxazole 15-20 mg/kg of TMP component in divided doses	Clindamycin 600mg IV q8h + Primaquine 15mg BD	**Duration of therapy**: 21 days. Corticosteroids to be considered as an adjunctive therapy in hypoxic patients along with antimicrobial therapy against PCP.

Additional information:

- Anti MRSA antibiotics to be used in presence of cavitating / necrotizing pneumonia / post influenza pneumonia

References:

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18. Healthcare Associated Infections

18.1 *Fever in ICU*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Fever in ICU can be due to infective or non-infective causes. Empiric therapy for HAI would depend upon the infectious syndrome, organism prevalent in the unit, local resistance pattern	For empirical antibiotic recommendations – refer to respective sections / tables as per suspected site of infections		Common infectious causes include ventilator-associated pneumonia, catheter-related bloodstream infections, catheter associated urinary tract infections, surgical site infections, and hospital onset bacteremia from any other source. Draw two sets (each set having 1 aerobic and 1 anaerobic bottle) of blood cultures, from two different sites before starting treatment with antimicrobials. De-escalation should be done once the culture reports are available.

For common etiological agents of fever in ICU, see Annexure B.18.1

18.2 *Invasive Candidiasis*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Invasive candidiasis	Echinocandins (caspofungin, anidulafungin, or micafungin) are recommended as first-line agents, regardless of the underlying disease. Micafungin 100 mg IV daily Or Anidulafungin loading dose 200 mg, then 100 mg daily Or Caspofungin loading dose 70 mg, then 50 mg daily Or Fluconazole PO/IV 800mg (12 mg/kg) loading dose, then 400 mg (6 mg/kg) daily (can choose fluconazole if patient is stable and azole resistant candida (like C. *glabrata, C. auris and C. krusei*) are not commonly seen in particular health care facility	Liposomal Amphotericin B 3–5 mg/kg daily	Transition from echinocandins to fluconazole is recommended after 5–7 days among patients who have isolates that are susceptible to fluconazole, who are clinically stable, and in whom repeat cultures on antifungal therapy are negative.

For common etiological agents of Invasive Candidiasis, see Annexure B.18.2

References:

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18.3 *Hospital-acquired pneumonia or Ventilator associated pneumonia*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
VAP	Piperacillin-tazobactam 4.5g IV q6h Or Cefoperazone-sulbactam 3g IV q12h	Meropenem 1g IV q8h Or Imipenem 500 mg IV q6h	All hospital onset infections; should be managed as per hospital antibiograms; these recommendations are general especially for places where there is no antibiogram (it is highly recommended to generate antibiograms). Change the empiric regimen based on susceptibility testing. **Duration of therapy** is 7 days
VAP in patients with recent exposure to BL-BLI / Carbapenems	Meropenem 1g q8h Or Imipenem 1g Stat and 500mg IV q6h Polymyxin B 15-20 lakhs units IV stat, followed by 7.5-10 lakhs IV q12h Or Colistin 9MU IV stat, then 4.5 MU IV q12h	Fosfomycin 4g IV q6h Or Tigecycline 200mg stat and 100mg IV BD Or Minocycline 200mg IV BD as add-on therapy to those mentioned in 1st column (based on local antibiogram)	Combination of Ceftazidime-avibactam 2.5 g iv q8h + Aztreonam 2 g IV q8h is discouraged for empiric use as there is resistance reported to this in *E.coli* and *Pseudomonas spp.*; it is intrinsically resistant to *Acinetobacter baumannii.* Targeted therapy should be used as sensitivity testing results of specimens from lower respiratory tract are available. **Duration of therapy** is 7 days

For common etiological agents of VAP, see Annexure B.18.3

Additional Information:

- It is recommended that all hospitals regularly generate and disseminate a local antibiogram, ideally specific to their intensive care population.

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18.4 *Central Line-Associated Bloodstream Infection (CLABSI)*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
CLABSI without previous antibiotic exposure and stable	Piperacillin- tazobactam 4.5g iv q6h Or Cefoperazone-sulbactam 3g iv bd + Inj Vancomycin (15 mg/kg IV q8–12h) Or Inj Teicoplanin (400mg IV every 12h for 3 doses followed by 400mg IV q24h)	Meropenem 1g iv q8h Or Imipenem -cilastatin 500 mg IV q6h + Inj Vancomycin 1g iv bd Or Inj Teicoplanin (400mg IV every 12h for 3 doses followed by 400mg IV q24h)	All hospital onset infections; should be managed as per hospital antibiograms; these recommendations are general and especially for places where there is no antibiogram (it is highly recommended to generate antibiograms). Blood culture should be obtained prior to initiation of antibiotic therapy. Paired blood samples, drawn from the catheter and a peripheral vein, should be sent for culture, and the bottles should be appropriately marked to reflect the site from which the samples were

			obtained. If a blood sample cannot be drawn from a peripheral vein, it is recommended that 2 blood samples should be drawn through different catheter lumens. Catheter removal is advised. Duration of therapy is 7-10 days (depending on pathogen).
CLABSI with recent exposure to carbapenems or BL-BLIs exposure and / or unstable	Meropenem 1g q8h Or Imipenem 1g Stat and 500mg IV q6h + Polymyxin B 15-20 lakhs units IV stat, then 7.5-10 lakhs IV q12h or Colistin 9MU IV stat, then 4.5 MU IV q12h Add candida cover (echinocandins) if local antibiograms suggest incidence of candida in CLABSI	Fosfomycin 4g IV q6h as add-on therapy to those mentioned in 1st column (based on local antibiogram)	All hospital onset infections; should be managed as per hospital antibiograms; these recommendations are general and especially for places where there is no antibiogram (it is highly recommended to generate antibiograms). Target therapy based on susceptibility testing results. Combination of Ceftazidime-avibactam 2.5g IV q8h + Aztreonam 2g IV q8h is discouraged to be used empirically as there is resistance reported to this in *E.coli* and *Pseudomonas spp.*; it is intrinsically resistant to *Acinetobacter baumannii.* **Duration of therapy** is 7-10 days (depending on pathogen).

For common etiological agents of CLABSI, see Annexure B.18.4

Additional information:

When to add empirical CRO cover?

- Haemodynamic instability.
- Colonisation with carbapenem resistant gram-negative bacteria.
- Previous infection with carbapenem resistant gram-negative bacteria.
- GNB in blood, sensitivity pending, persistent fever with haemodynamic instability.

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18.5 *Antibiotic Associated Diarrhoea*

Discontinuation of antibiotics is encouraged in patients with Antibiotic Associated Diarrhea.

Send stool sample for *Clostridium difficile* – Glutamate Dehydrogenase (GDH) and Toxin Detection by ELISA or RDT (or PCR if available).

Management:

Oral vancomycin 125mg QID

Add IV Metronidazole 500 mg TDS if toxic megacolon or ileus or hypotension is present

References:

1. Stuart Johnson, Valéry Lavergne, Andrew M Skinner, Anne J Gonzales-Luna, Kevin W Garey, Ciaran P Kelly, Mark H Wilcox, Clinical Practice Guideline by the Infectious Diseases Society of America (IDSA) and Society for Healthcare Epidemiology of America (SHEA): 2021 Focused Update Guidelines

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18.6 *Catheter associated urinary tract infection (CAUTI)*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
***CAUTI*- not severely ill**	Fosfomycin 3g stat PO Await culture, remove catheter if possible	Amikacin 15 mg/kg single dose	All hospital onset infections; should be managed as per hospital antibiograms; these recommendations are general and especially for places where there is no antibiogram (it is highly recommended to generate antibiograms). Target antibiotics as per culture reports **Duration: 3-5 days** (if catheter removed/changed)
CAUTI – Severely ill	Piperacillin-tazobactam 4.5g IV QID Or Meropenem 1g IV TDS	Cover for CRO* if patient recent exposed to BL-BLI / Carbapenems *Colistin 9MU IV stat, then 4.5 MU IV q12h Or *Fosfomycin 4g IV q6h In combination with a carbapenem (meropenem/imipenem) Duration: 3-5 days (if catheter removed/changed)	

For common etiological agents of CAUTI, see Annexure B.18.5

Additional information:

- Catheter colonization is common and in absence of symptoms does not require treatment.
- Removal of indwelling catheter is recommended.

References:

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18.7 *Intra-abdominal infection*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Tertiary Peritonitis	Imipenem-cilastatin IV 500 mg QID Or Meropenem 1g IV TDS	Cover for CRO* if patient recently exposed to BL-BLI / Carbapenems Polymyxin B 15-20 lakhs units IV stat, then 7.5-10 lakhs IV q12h Or Colistin 9MU IV stat, then 4.5 MU IV q12h Or Fosfomycin 4g IV q6h OR Tigecycline 200mg stat and 100mg IV BD In combination with a carbapenem (meropenem/imipenem)	All hospital onset infections; should be managed as per hospital antibiograms; these recommendations are general and especially for places where there is no antibiogram (it is highly recommended to generate antibiograms) **Duration: 5-7 days** (if source reduction is being done) Add Candida cover (Fluconazole or Echinocandin) if risk factors for candida present

For common etiological agents associated with Hospital acquired intra-abdominal infections, see Annexure B.18.6

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19. Neonatal Infections

19.1 *Neonatal Infections*

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
Possible serious bacterial infection, PSBI (community acquired)	Amoxicillin • 20-40 mg/kg/dose PO* q8h **Or** Ampicillin • ≤34 weeks GA* and ≤7 days PNA*: 50 mg/kg/dose IV q12h • ≤34 weeks GA and ≥8 to ≤28 days PNA: 75 mg/kg/dose IV q12h • >34 weeks GA and ≤28 days PNA: 50 mg/kg/dose IV q8h) **AND** Gentamicin • < 37 weeks PMA*: 5 mg/kg/dose IV q48h • 37 to <40 weeks PMA: 5 mg/kg/dose IV q36h • ≥40 weeks PMA: 5 mg/kg/dose IV q24h **Duration of treatment**: • If culture-negative: 5-7 days • If culture positive: 7-14 days	**In case of meningitis:** Ampicillin (dose as mentioned in left-hand side column) **AND** Cefotaxime • <1-week PNA: 50 mg/kg/dose IV q 12h • 1-4 weeks PNA: 50 mg/kg/dose IV q8h • >4 weeks PNA: 37.5 mg/kg/dose IV q6h **Duration of treatment**: • 21 days	Consider PSBI if any one of the following signs is present: • Not able to feed since birth or stopped feeding well (confirmed by observation) • No movement or movement only on stimulation • Convulsions • Fast breathing (60 breaths per minute or more) in infants younger than 7 days of age • Severe chest in-drawing • Fever (≥ 38.0 °C) • Low body temperature (< 35.5 °C) Signs are nonspecific.
Possible serious bacterial infection (possible hospital acquired/community with high AMR, e.g., >10% prevalence of ESBL), without meningitis	Amikacin • <30 weeks PMA and ≤7 days PNA: 15 mg/kg/dose over 30 minutes slow IV q48 h • <30 weeks PMA and >7 days PNA or 30-36 weeks PMA and ≤7 days PNA: 15 mg/kg/dose over 30 minutes slow IV q36 h	Meropenem • <32 weeks GA and <14 days PNA: 20 mg/kg/dose IV q 12h • < 32 weeks GA and ≥ 14 days PNA: 20 mg/kg/dose IV q 8h • ≥ 32 weeks GA: 30 mg/kg/dose IV q8h	Do not mix amikacin with Piperacillin-tazobactam due to Y – site incompatibilities. Since *in vitro* response to teicoplanin is much better and being less nephrotoxic, it may replace vancomycin which requires mandatory TDM's

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
	• 30-36 weeks PMA and >7 days PNA or ≥37 weeks PMA: 15 mg/kg/dose over 30 minutes slow IV q24 h **AND** (Piperacillin-tazobactam • ≤ 30 weeks PMA: 100 mg/kg/dose IV infusion over one hour q8h • >30 and ≤ 35 weeks PMA: 80 mg/kg/dose IV infusion over one-hour q6h • >35 and ≤ 49 weeks PMA: 80 mg/kg/dose IV infusion over one hour q4h **Or** Ciprofloxacin (may be avoided in neonates because of concerns of arthropathy) 10 mg/kg/dose IV q12 h) **Duration of treatment**: • If culture-negative: 5-7 days If culture positive: 7-14 days	In case of high rates of MRSA, **ADD** Teicoplanin • 10 mg/kg/dose IV q 12 h for 3 doses, then 10mg/kg/day IV/IM q 24 h **Duration of treatment**: • If culture-negative: 5-7 days • If culture positive: 7-14 days • If treating for possible MRSA, prefer 14 days	
Meningitis	Cefotaxime (dose as mentioned above) **Duration of treatment**: • 21 days	Ampicillin (dose as mentioned above) **AND** Cefepime • < 36 weeks GA and <30 days PNA: 30-50 mg/kg/dose IV q 12 h • ≥ 36 weeks GA and < 30 days PNA: 50 mg/kg/dose IV q 12h	May avoid aminoglycosides for meningitis due to poor CSF penetration

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
		If ESBL prevalence is > 10%: Meropenem (dose as mentioned above) **Duration of treatment**: • 21 days	
Conjunctivitis	**Bacterial:** Tobramycin or gentamicin • Ophthalmic drops—q6-8h **Duration of treatment:** • 7 days **Viral**: ***Mild to moderate:*** No antiviral agent. Only supportive care. ***Severe***: *HSV conjunctivitis*: Acyclovir • 20 mg/kg/dose IV q8h **AND** Trifluridine • 1% topical eyedrops q 2-3h **Or** Ganciclovir gel • 0.15% topical q2-3h *Adenovirus conjunctivitis*: No specific antiviral agent *CMV conjunctivitis* (extremely rare): • treat underlying systemic disease with IV ganciclovir **Duration of treatment**: • 14 days • 21 days if disseminated or CNS HSV disease		
Superficial infections (omphalitis,	**Mild** Cloxacillin	Clindamycin	

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
superficial abscesses)	• 25-50 mg/kg/dose PO* q6h **Duration of treatment:** • 5-7 days **Severe** Cloxacillin • ≤7 days of PNA and <2 kg: 25 mg/kg/dose IV q12h • ≤7 days of PNA and <2 kg: 25 mg/kg/dose IV q8h • 7-28 days PNA and < 2 kg: 25 mg/kg/dose IV q8h • 7-28 days PNA and > 2 kg: 25 mg/kg/dose IV q6h **AND** Gentamicin (Dose as mentioned above) **Duration of treatment:** • 7-10 days	• <4 weeks PNA: 15-20 mg/kg/day IV 6-8 hrly No dosing recommendation for preterm neonates **AND** Gentamicin (Dose as mentioned above) **Duration of treatment:** 7-10 days	
Tetanus Neonatorum	Tetanus Immunoglobulin • 6,000 IU* IM* once **AND** Metronidazole • < 34 weeks PMA: 15 mg/kg LD* followed by 7.5 mg/kg/dose q12h • 34 to 40 weeks PMA: 15 mg/kg LD followed by 7.5 mg/kg/dose q8h • > 40 weeks PMA: 15 mg/kg LD followed by 7.5 mg/kg/dose q6h	Alternative to metronidazole is penicillin G (less preferred as it may worsen spasms) • 50,000 IU/kg/dose IV q 6-8h	India was declared free of maternal and neonatal tetanus on 15th May, 2015.
Oro-cutaneous candidiasis	**Localised** ***Cutaneous*** *Term and late preterm infants* Clotrimazole • 1% ointment locally q 8-12h ***Oral***	**Widespread (burn like) or cutaneous candidiasis [term or preterm]** Fluconazole (dose mentioned in the left-hand side column) **Or**	

Type of Infection	First Line (with Dosage and Duration)	Alternative (with dosage and Duration)	Comments
	• 2% nystatin suspension after every feed **Or** • 1% clotrimazole suspension after every feed **Duration of treatment**: 7-10 days and 48 hours after lesions have cleared *Preterm infants (especially extremely preterm)* Fluconazole • 12 mg/kg/dose q24 h **Or** Amphotericin B • 1 mg/kg/dose q24h **Duration of treatment:** • 14-21 days	Amphotericin B (dose mentioned in the left-hand side column)	
Disseminated or CNS HSV infection	Acyclovir • 20 mg/kg/dose IV q 8 h **AND** Post treatment for CNS disease, suppressive regimen • Acyclovir 300 mg/m^2/dose PO q8h **Duration of treatment**: • for the IV regimen: 21 days • for the oral suppressive therapy post-treatment: 6 months		***Went to suspect?*** *HSV CNS infection*: focal neurological deficits, profound encephalopathy and CSF picture which is not typical of bacterial meningitis *Disseminated HSV infection*: severe sepsis-like syndrome with severe liver dysfunction (markedly raised aminotransferases)

*PO-per oral; GA- gestational age; PMA-postmenstrual age; PNA-postnatal age; IM-intramuscular; IU-international units; LD-loading dose.

For common etiological agents of neonatal infections, see Annexure B.19

Additional Information:

1. For prevention of Neonatal Infections, the following points are recommended:
    - Use basic hygiene and cleanliness during delivery

- Special attention to cord and eye care
- Exclusive breast feeding
- Strict procedures for hand-washing for all staff and family members, before and after handling babies
- Avoid incubators (wherever possible encourage 'Kangaroo Care')
- Remove IV line when no longer needed
- Avoid unnecessary blood transfusions
- Strict sterility for all procedures such as injections
- Biomarkers (C-reactive protein, procalcitonin,) may be used adjunctively in the diagnosis and management of neonatal infection.

2. Note on antifungal prophylaxis in VLBW babies:
   - Fluconazole 3 or 6 mg/kg 2 times per week iv or orally in ALL neonates <1000 g in NICUs with high frequency of IC
   - Fluconazole 3 or 6 mg/kg 2 times per week iv or orally in NICUs with a lower incidence of IC (i.e. <2%) for neonates: (a)with birth weight <1000 g,(b)who have risk factors (i.e. central venous catheters, third-generation cephalosporins and carbapenems) for the development of IC (B-II)
   - *Decision for prophylaxis is on an individual basis

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ANNEXURE A: Antimicrobials with anaerobic coverage

Note on use of antimicrobial agents with Anaerobic coverage:

Antimicrobial drugs with anaerobic activity:

a. Amoxicillin-clavulanate
b. Ampicillin-sulbactam
c. Cefoperazone-sulbactam
d. Clindamycin*
e. Doripenem
f. Ertapenem
g. Imipenem
h. Meropenem
i. Metronidazole
j. Piperacillin-tazobactam
k. Ticarcillin-clavulanate
l. Tigecycline

Points to consider while using antimicrobial agents with anaerobic activity:

1. The combined use of two antimicrobials with anaerobic cover mentioned above is unnecessary and should be avoided to prevent additional toxicity.
2. Exceptions to (1) are:
   a. *Clostridioides difficile* infection
   b. Amoebic colitis or Amoebic liver abscess

***- Clindamycin:**

Not active against Gram –negative anaerobes, so should not be used for infections where Gram-negative anaerobes are suspected (eg: intra-abdominal infections)

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ANNEXURE B: Common Etiological Agents of Infections

B.1. Cardiovascular Syndromes

Annexure no.	Title	Etiology	Reference
B.1.1	Infective endocarditis	*Staphylococcus aureus* Viridans Streptococci Other Staphylococci HACEK organisms (*Haemophilus species, Aggregatibacter species, Cardiobacterium hominis, Eikenella corrodens, and Kingella kingae*) *Streptococcus gallolyticus subspecies gallolyticus* **Health care–associated IE:** most commonly caused by *S. aureus*, Coagulase-negative Staphylococci (CoNS), and Enterococci	Harrison's Principles of Internal Medicine Table 57-5 Pg 1023-1024
B.1.2	Myocarditis	**Infective:** Viral (coxsackie A, adenovirus, HIV, hepatitis C) Spirochetal (*Borrelia burgdorferi*—Lyme disease) Rickettsial (Q fever) Parasitic (Rare) (*T. cruzi*—Chagas' disease, trypanosomiasis, toxoplasmosis) Bacterial (Rare):Diphtheria Fungal (with systemic infection)	Harrison's Principles of Internal Medicine Table 259-4 Pg 1959
B.1.3	Pericarditis	Viral (Coxsackievirus A and B, Echovirus, Herpesviruses, Mumps, Adenovirus, Hepatitis, HIV) Pyogenic (Pneumococcus, *Streptococcus spp.*, *Staphylococcus spp.*, *Neisseria spp., Legionella spp., Chlamydia spp.*) Tuberculous Fungal (*Histoplasma capsulatum, Candida spp., Blastomyces spp.*) Other infections (syphilitic, protozoal, parasitic)	Harrison's Principles of Internal Medicine Table 270-1 Pg 2019
B.1.4	Acute Rheumatic Fever	It is a sequalae of infection with Group A streptococci, certain M-serotypes (particularly types 1, 3, 5, 6, 14, 18, 19, 24, 27, and 29)	Harrison's Principles of Internal Medicine Pg 2767

B.2. Central Nervous System infections

Annexure no.	Title	Etiology	Reference
B.2.1	Brain abscess	**In immunocompetent individuals:** *Streptococcus spp*. (anaerobic, aerobic, and viridans) Enterobacteriaceae (*Proteus spp., Escherichia coli, Klebsiella spp*.) Anaerobes (e.g., *Bacteroides* spp., *Fusobacterium* spp.) Staphylococci **In immunocompromised hosts***:* *Nocardia spp.* *Toxoplasma gondii* *Aspergillus* spp. *Candida* spp. *Cryptococcus neoformans* In India and East Asia, mycobacterial infection (tuberculoma) remains a major cause of focal CNS mass lesions.	Harrison's Principles of Internal Medicine Pg 1117
B.2.2	Encephalitis	**Immunocompetent patients:** Viral: Japanese encephalitis virus, Herpes simplex virus, Chandipura virus (Telangana, Maharashtra, Gujarat, Odisha, Bihar), Nipah virus (West Bengal, Kerala), Enteroviruses, Dengue, Influenza A (H1N1) (H3N2), Kyasanur forest disease (KFD), Rabies, Chikungunya,West Nile (Assam, Kerala), Zika virus Bacterial: *Mycobacterium tuberculosis, Orientia tsutsugamushi* (Scrub typhus), *Leptospira* spp. (Assam, Kerala), *Neisseria meningitides* Parasitic: *Plasmodium falciparum, Naegleria fowleri* **Immunosuppressed patients**: Viral: HIV, EBV, CMV, Parvovirus B19, Human herpes virus 6 **Unvaccinated children:** Viral*:* Measles, Mumps, Rubella (clusters), Chickenpox (clusters) Bacterial: *Streptococcus pneumoniae* (~1%), *Haemophilus influenzae* (<1%) Newer agents: *Viral:* SARS-CoV-2 (direct or autoimmune-mediated)	Tandale BV, Narang R, Vijay Kumar G, Jain M, Tomar SJ, Deshmukh PS. Infectious Causes of Acute Encephalitis Syndrome in India - Decadal Change and the Way Forward. Indian Pediatr. 2023 Sep 15;60(9):709-713. Epub 2023 May 30. PMID: 37260063. Available from: https://www.indianpediatrics.net/sep2023/709.pdf
B.2.3	Meningitis	Bacterial: *Streptococcus pneumoniae* *Neisseria meningitidis* Group B Streptococci *Listeria monocytogenes* *Haemophilus influenzae* type b	Harrison's Principles of Internal Medicine Pg 1100-1101

Annexure no.	Title	Etiology	Reference
B.2.4	Healthcare-Associated Ventriculitis and CSF shunt infections	Bacterial: Staphylococci (MSSA, MRSA) *Propionibacterium acnes* *Streptococcus pneumoniae* *Pseudomonas aeruginosa* *Haemophilus influenzae* Extended spectrum β-lactamase-producing Gram-negative bacilli *Acinetobacter baumannii* Other Enterobacteriaceae Fungal: *Candida* spp. *Aspergillus* spp.	2017 Infectious Diseases Society of America's Clinical Practice Guidelines for Healthcare-Associated Ventriculitis and Meningitis Pg 52. Available from: https://academic.oup.com/cid/article/64/6/e34/2996079

B.3. Febrile Syndromes

Annexure no.	Title	Etiology	Reference
B.3.1	Acute undifferentiated fever	Rickettsial agents: *R. conorii* *R. rickettsii* *R. akari* *R. felis* *R. prowazekii* *R. typhi* *Orientia Tsutsugamushi* *Coxiella burnetii* *Rochalimaea quintana*	Harrison's Principles of Internal Medicine Table 187-1, Pg 1432
		Leptospirosis: The Leptospira serovars predominantly present in India are *L.andamana, L.pomona, L.grippotyphosa, L.hebdomadis, L.semoranga, L.javanica, L.autumnalis, L.canicola*	https://ncdc.mohfw.gov.in/wp-content/uploads/2024/05/National-Guidelines-Diagnosis-Case-Management-Prevention-control-of-leptospirosis.pdf
		Malarial parasites: *Plasmodium vivax, P. falciparum, P. ovale, P. malariae*	MALARIA DRUG POLICY
		Other etiological agents: Bacterial: *Staphylococcus aureus* *Streptococcus pyogenes* *Pseudomonas aeruginosa* other Gram-negative bacteria Fungal: *Candida albicans* Viral: Herpes simplex virus	Rerucha CM, Ewing JT, Oppenlander KE, Cowan WC. Acute Hand Infections. Am Fam Physician. 2019 Feb 15;99(4):228-236. PMID: 30763047.
B.3.2	Enteric fever	Salmonella Typhi Salmonella Paratyphi A Salmonella Paratyphi B	Harrison's Principles of Internal Medicine
B.3.3	PUO	Bacterial: *Mycobacterium tuberculosis* (extrapulmonary TB)	Harrison's Principles of Internal Medicine Chapter 20 table 20-2Pg 146

Annexure no.	Title	Etiology	Reference
		Occult abscesses (hepatic, pelvic, splenic – polymicrobial) Infective endocarditis (*Staphylococcus aureus*, *Streptococcus viridans,* HACEK group) Brucellosis: *Brucella spp.* Typhoid fever (Salmonella Typhi/Paratyphi) Leptospirosis - *Leptospira interrogans* Rickettsial infections {*R. conorii, O. tsutsugamushi* (Scrub typhus)} Q fever: *Coxiella burnetii* Whipple's disease: *Tropheryma whipplei* <u>Viral:</u> Epstein–Barr Virus (EBV) Cytomegalovirus (CMV) HIV (Acute retroviral syndrome and AIDS-associated infections) Hepatitis B and C viruses Dengue, Chikungunya, Zika viruses COVID-19 (long-fever variants) Measles, mumps, rubella (in certain populations) <u>Parasitic:</u> Malaria:*Plasmodium spp. (P. vivax, P. falciparum)* Visceral leishmaniasis (Kala-azar): *Leishmania donovani* Toxoplasmosis:*Toxoplasma gondii* Schistosomiasis: *Schistosoma spp.* Amoebic liver abscess: *Entamoeba histolytica* <u>*Fungal:*</u> *Histoplasma capsulatum* Candidiasis (deep-seated): *Candida spp.* *Cryptococcus neoformans* <u>*Other Zoonotic / Vector-borne Diseases:*</u> Relapsing fever - *Borrelia spp.* Tick-borne diseases – *Anaplasma spp., Ehrlichia spp.* Rat-bite fever – (*Streptobacillus moniliformis, Spirillum minus*)	

Annexure no.	Title	Etiology	Reference
		Melioidosis - *Burkholderia pseudomallei*	
B.3.4	Sepsis Syndrome	Gram negative bacteria: *Escherichia coli* *Klebsiella pneumoniae* *Pseudomonas aeruginosa* *Acinetobacter spp.* Gram-positive bacteria: *Staphylococcus aureus* Coagulase Negative Staphylococci *Enterococcus spp.* Fungal: *Candida spp.*	Harrison's Principles of Internal Medicine 21st Edition Pg 2242

B.4. Gastrointestinal Syndromes

Annexure no.	Title	Etiology	Reference
B.4.1	Infectious Oesophagitis	**Immunocompromised patients:** *Candida spp.* Herpesvirus Cytomegalovirus (CMV) **Immunocompetent (rare):** Herpes simplex Virus *Candida albicans*	Harrison's Principles of Internal medicine, Pg 2432
B.4.2	Acute Gastroenteritis	Bacterial: *Bacillus cereus* *Staphylococcus aureus* *Clostridium perfringens* *Vibrio cholerae* Enterotoxigenic *E. coli* *Klebsiella pneumoniae* *Aeromonas species* Enteropathogenic *E. coli* Enteroadherent *E. coli* Haemorrhagic *E. coli* *Clostridium difficile* *Salmonella spp* *Campylobacter* *Aeromonas spp* *Vibrio parahaemolyticus* *Yersinia spp* *Shigella spp* Enteroinvasive *E. coli* Parasitic: *Giardia lamblia* Cryptosporidiosis *Entamoeba histolytica* Helminths Viral:	1.Harrison's Principles of Internal medicine, Pg 300 2.Diagnosis and Management of Complicated Intraabdominal Infection in Adults and Children: Guidelines by the Surgical Infection Society And the Infectious Diseases Society of America 3. Infect Chemother. 2019 Jun;51(2):217-243 https://doi.org/10.3947/ic.2019.51.2.217 pISSN 2093-2340·eISSN 2092-6448

Annexure no.	Title	Etiology	Reference
		Rotavirus Norovirus	
B.4.3.1	Infections of Liver, Gall Bladder and Biliary tract	**Liver abscess** Bacterial: *Escherichia coli* *Klebsiella pneumoniae* *Enterococcus faecalis* *Staphylococccus aureus* *Streptococcus spp.* Parasitic: *Entamoeba histolytica* *Ascaris lumbricoides* *Fasciola hepatica* *Clonorchis sinensis* *Fasciolopsis busci* Fungal: *Candida spp.* *Aspergillus spp*.	Kozielewicz DM, Sikorska K, Stalke P. Liver abscesses – from diagnosis to treatment. Clin Exp Hepatol. 2021 Dec;7(4):329–36.
B.4.3.2	Infections of Liver, Gall Bladder and Biliary tract	**Acute cholangitis & cholecystitis:** Bacterial: *Escherichia coli (25%-50%)* *Klebsiella species (15%-20%)* *Enterococcus spp* *Staphylococcus spp* *Streptococcus spp* *Enterobacter spp (5%-10%)* *Pseudomonas aeruginosa* *Proteus spp* Anaerobic bacteria (*Bacteroides fragilis* and *Clostridium perfringens* can also cause acute cholangitis, particularly in patients with previous biliary surgery and in the elderly population) Fungal: *Candida spp.* Parasitic: *Clonorchis sinensis* *Opisthorchis viverrini* *Opisthorchis felineus* *Ascaris lumbricoides*	1. Ahmed M. Acute cholangitis - an update. World J Gastrointest Pathophysiol. 2018 Feb 15;9(1):1-7. 2. Rupp C, Bode K, Weiss KH, Rudolph G, Bergemann J, Kloeters-Plachky P, Chahoud F, Stremmel W, Gotthardt DN, Sauer P. Microbiological Assessment of Bile and Corresponding Antibiotic Treatment: A Strobe-Compliant Observational Study of 1401 Endoscopic Retrograde Cholangiographies. Medicine (Baltimore). 2016 Mar;95(10):e2390.
B.4.4	Appendicitis	In early stages of infection, the overgrowth is mainly aerobic organisms, but as the disease progresses, it transitions to a mix of aerobic and anaerobic bacteria. Members of family Enterobacteriaceae including *Escherichia coli*, *Bacteroides*	Bhangu, A., Søreide, K., Di Saverio, S., Assarsson, J. H., & Drake, F. T. (2015). Acute appendicitis: modern understanding of pathogenesis, diagnosis, and management. The Lancet, 386(10000), 1278–1287

Annexure no.	Title	Etiology	Reference
		fragilis, Fusobacterium spp, Streptococcus spp.	
B.4.5	Diverticulitis	Acute diverticulitis involves micro- or macro-perforation with translocation of commensal bacteria across the colon mucosal barrier, sometimes resulting in frank infections, including abscess formation and peritonitis. Bacterial: *Bifidobacterium spp.* Enterobacteriaceae family *Clostridium spp.*	Strate LL, Morris AM. Epidemiology, Pathophysiology, and Treatment of Diverticulitis. Gastroenterology. 2019 Apr;156(5):1282-1298
B.4.6	Peritonitis	**Primary Peritonitis**- Bacterial: *Escherichia coli* Streptococci Enterococci Pneumococci **Secondary Peritonitis** – Bacterial: Gram-negative bacilli, particularly *E. coli* *Bacteroides fragilis*	Harrison's Principles of Internal medicine, Pg 1055, 1056
B.4.7	Splenic abscess	Bacterial: *E.coli* *Streptococcus spp.* *Staphylococcus aureus* *Klebsiella spp* *Burkholderia pseudomallei* *Pseudomonas aeruginosa* *Bacteroides fragilis* Polymicrobial infections may be seen.	1. Sreekar H, Saraf V, Pangi AC, Sreeharsha H, Reddy R, Kamat G. A retrospective study of 75 cases of splenic abscess. Indian J Surg 2011; 73:398–402. 2. Singh AK, Karmani S, Samanta J, et al. . Splenic abscess in a tertiary care centre in India: clinical characteristics and prognostic factors. ANZ J Surg 2021; 91:1819–25. 3. Harrison's Principles of Internal medicine, Pg 1055, 1056

B.5. Urinary Tract Infections

Annexure	Title	Etiology	Reference
B.5.1	Acute Cystitis and acute pyelonephritis	Bacterial: *E. coli* *Klebsiella spp* *Proteus spp* *Enterococcus spp* *Citrobacter spp* *Pseudomonas spp*	Harrison's Principles of Internal medicine, Pg 1071

		Staphylococcus saprophyticus (frequent isolation from younger women)	

B.6. Gynaecological and Reproductive Organ Infections and STDs

Annexure	Title	Etiology	Reference
B.6.1	Genital Ulcers Non-Herpetic Ulcers	*Treponema pallidum* (Syphilis) *Chlamydia trachomatis* serovars L1–L3 (Lymphogranuloma venereum) *Haemophilus ducreyi* (Chancroid) *Klebsiella granulomatis* (Donovanosis)	National Technical Guidelines on STI and RTI 2024 Pg 33
B.6.2	Anogenital Warts	Human Papilloma Virus type 6 & 11	National Technical Guidelines on STI and RTI 2024 Pg 91
B.6.3	*Septic abortion*	*Infections are polymicrobial* Bacterial: *Staphylococcus aureus* Group A & B streptococcus *Escherichia coli* *Clostridium perfringens* *Peptostreptococcus spp.*	Udoh A, Effa EE, Oduwole O, Okusanya BO, Okafo O. Antibiotics for treating septic abortion. Cochrane Database Syst Rev. 2016 Jul 1;7(7):CD011528. doi: 10.1002/14651858.CD011528.pub2. PMID: 27364644; PMCID: PMC6458041.
B.6.4	Vaginitis & *Cervicitis*	**Vaginitis:** Parasitic *Trichomonas vaginalis* (Trichomoniasis) Fungal: *Candida albicans* (Candidiasis) Bacterial: *Gardnerella vaginalis* *Mobiluncus spp.* *Mycoplasma hominis* *Ureaplasma spp*. Other fastidious and uncultivated anaerobes e.g., *Bacteroides spp*. (Bacterial vaginosis) **Cervicitis:** Bacterial: *Neisseria gonorrhoeae* *Chlamydia trachomatis* *M. genitalium* Parasitic: *Trichomonas vaginalis* Viral:	National Technical Guidelines on STI and RTI 2024 Pg 39

Annexure	Title	Etiology	Reference
		Genital herpes (especially primary HSV-2 infection)	
B.6.5	Epididymo-Orchitis	Bacterial: *N. gonorrhoeae* *C. trachomatis* *M. genitalium* Enteric organisms *(E. coli)*	National Technical Guidelines on STI and RTI 2024 Pg 73
B.6.6	Pelvic Inflammatory Disease	*Bacterial:* *Neisseria gonorrhoeae* *Chlamydia trachomatis* *Mobiluncus spp.* *Mycoplasma hominis* *Gardnerella spp.* Anaerobic bacteria (*Bacteroides sp.)* Gram-positive cocci	National Technical Guidelines on STI and RTI 2024 Pg 47
B.6.7	Prostatitis	Bacterial: *E.coli* *Pseudomonas aeruginosa* *Enterococcus spp.* *Proteus spp.* *Klebsiella spp.* *Enterobacter spp.* *Neisseria Gonorrhea* *Chlamydia trachomatis* Fungal: *Candida spp.*	Khan, F. U., Ihsan, A. U., Khan, H. U., Jana, R., Wazir, J., Khongorzul, P., … Zhou, X. (2017). *Comprehensive overview of prostatitis. Biomedicine & Pharmacotherapy, 94, 1064–1076.*
B.6.8	Puerperal sepsis	Bacterial: **Aerobes:** Gram-positive cocci: Group A, B, and D streptococci *Enterococcus spp.* *Staphylococcus aureus* *Staphylococcus epidermidis* Gram-negative bacteria: *Escherichia coli* *Klebsiella spp.* *Proteus spp.* Gram-variable: *Gardnerella vaginalis* Others: *Mycoplasma spp.* *Chlamydia spp.* *Neisseria gonorrhoeae*	Williams OBSTETRICS 2 4 T H E D I T I O N. Pg 683

Annexure	Title	Etiology	Reference
		Anaerobes: *Peptostreptococcus spp.* *Peptococcus spp.* *Clostridium spp.* *Bacteroides spp.* *Fusobacterium spp.* *Mobiluncus spp*.	
B.6.9	Urethral discharge syndrome	Bacterial: *Neisseria gonorrhoeae* *Chlamydia trachomatis* *Mycoplasma genitalium* Parasitic: *Trichomonas vaginalis*	National Technical Guidelines on STI and RTI 2024 Pg 33
B.6.10	Chorio-amnionitis	Polymicrobial infections are detected in 70% infections with clinical chorioamnionitis and intraamniotic infections: Bacterial: *Ureaplasma spp.* *Gardnerella vaginalis* *Mycoplasma hominis* *Staphylococcus aureus* Group B Streptococcus *E. coli* *Pseudomonas spp.* *Enterococcus spp.* *Fusobacterium spp.* Fungal: *Candida spp.*	Jung, Eunjung et al. Clinical chorioamnionitis at term: definition, pathogenesis, microbiology, diagnosis, and treatment. American Journal of Obstetrics & Gynecology, Volume 230, Issue 3, S807 - S840

B.7. Ear, Nose & Throat Infections

Annexure	Title	Etiology	Reference
B.7.1	Rhinitis/ Common cold	*Viral*: - The most common viral causes of nonspecific URIs are Rhinoviruses (over 100 serotypes) Coronaviruses Parainfluenza virus Respiratory syncytial virus Influenza virus Adenovirus (57 serotypes) Metapneumovirus Bocavirus	Harrison's Principles of Internal Medicine Pg 248

Annexure	Title	Etiology	Reference
B.7.2	Laryngitis/Laryngopharyngitis/ URTI	Viral: Rhinovirus Influenza Parainfluenza RSV Human metapneumovirus Enterovirus Adenovirus Ebstein Barr virus Bacterial: *Streptococcus pyogenes* *Pneumococcus* *Moraxella spp.* *H. influenzae* *S. aureus* *Mycoplasma spp*.	Harrison's Principles of Internal Medicine Pg 253 (Table 35-3), 255
B.7.3	Sinusitis	*Viral:* Rhinovirus Adenovirus Influenza and Parainfluenza virus *Bacterial:* *S. pneumoniae* *H. influenzae* *M. catarrhalis* *Staphylococcus aureus* *Porphyromonas spp.* Enterobacteriaceae Fungal: Mucorales fungi *Aspergillus spp.*	Harrison's Principles of Internal Medicine Pg 251 – 252 Aring AM, Chan MM. Current Concepts in Adult Acute Rhinosinusitis. Am Fam Physician. 2016 Jul 15;94(2):97-105. PMID: 27419326.
B.7.4	Acute Otitis Media	Viral: Respiratory syncytial virus Rhinoviruses Enteroviruses Coronaviruses Influenza virus Adenoviruses Human metapneumovirus Bacterial: *Streptococcus pneumoniae*	Harrison's Principles of Internal Medicine Pg 249

Annexure	Title	Etiology	Reference
		Nontypeable *Haemophilus influenzae* *Moraxella catarrhalis*	
B.7.5	Otitis externa	Bacterial: *Pseudomonas aeruginosa* *Staphylococcus aureus* Fungal: *Aspergillus spp.* *Candida spp.*	Harrison's Principles of Internal Medicine Pg 249
B.7.6	HEAD AND NECK ABSCESSES *(peritonsillar/parapharyngeal and retropharyngeal abscess)*	Bacterial: **Virulent invasive pathogens** *Streptococcus pyogenes* *S. aureus* *H. Influenzae* **Facultative anaerobes** Viridans group streptococci *H. parainfluenza* *Moraxella catarrhalis* *Eikenella corodans* *Cutibacterium acnes* Mycobacterium species other than tuberculosis. **Obligate anaerobes:** *F. necrophorum* *Prevotella spp.* *Bacteroides fragilis* *Porphyromonas spp.*	Orzell S, Suryadevara A. Pharyngitis and Pharyngeal Space Infections: fever, sore throat, difficulty swallowing. Introduction to Clinical Infectious Diseases. 2018 Oct 15:53–66.

B.8. Oral Cavity, Head & Neck Infections

Annexure	Title	Etiology	Reference
B.8.1	Oropharyngeal Candidiasis	*Candida albicans* (most common) *C. glabrata* *C. guillermondii* *C. krusei* *C. lusitaniae* *C. parapsilosis*	Hellstein JW, Marek CL. Candidiasis: Red and White Manifestations in the Oral Cavity. Head Neck Pathol. 2019 Mar;13(1):25-32.

B.9. Skin and Soft Tissue infections

Annexure	Title	Etiology	Reference
B.9.1	Acute paronychia	Bacterial: *Staphylococcus aureus* *Streptococcus pyogenes* *Enterococcus spp.*	Relhan, Vineet; Bansal, Anuva. Acute and chronic paronychia revisited: A narrative review. Journal of Cutaneous and Aesthetic Surgery 15(1):p 1-16, Jan–Mar 2022. | DOI: 10.4103/JCAS.JCAS_30_21

Annexure	Title	Etiology	Reference
		Klebsiella pneumoniae *Fusobacterium species* *Peptostreptococcus spp.* *Porphyromonas spp.* *Prevotella spp.* *Pseudomonas aeruginosa* <u>Fungal:</u> *Candida albicans*	
B.9.2	Impetigo	<u>Bacterial:</u> *Staphylococcus aureus* *Streptococcus pyogenes*	Harrison's Principles of Internal Medicine Pg4466
B.9.3	Cellulitis	<u>Bacterial:</u> *Staphylococcus aureus* *Staphylococcus pyogenes* Group A Streptococci *Pseudomonas spp.*	Harrison's Principles of Internal Medicine Pg 4468
B.9.4	Necrotizing fasciitis	**Type 1:** Polymicrobial (Anaerobic streptococci and aerobic Gram-positive and Gram-negative bacteria **Type 2**: Beta hemolytic streptococcus A, *Staphylococcus aureus* **Type 3**: *Vibrio spp., Clostridium spp*, Gram-negative bacteria **Type 4*:*** *Candida spp.* and zygomycetes	Guliyeva G, Huayllani MT, Sharma NT, Janis JE. Practical Review of Necrotizing Fasciitis: Principles and Evidence-based Management. Plast Reconstr Surg Glob Open. 2024 Jan 19;12(1):e5533. doi: 10.1097/GOX.0000000000005533. PMID: 38250213; PMCID: PMC10798703
B.9.5	Primary pyomyositis	<u>Bacterial:</u> *Staphylococcus aureus* Group A Streptococcus *Streptococcus pneumoniae* Gram – negative enteric bacteria	Dennis L. Stevens, Alan L. Bisno, Henry F. Chambers, E. Patchen Dellinger, Ellie J. C. Goldstein, Sherwood L. Gorbach, Jan V. Hirschmann, Sheldon L. Kaplan, Jose G. Montoya, James C. Wade, Practice Guidelines for the Diagnosis and Management of Skin and Soft Tissue Infections: 2014 Update by the Infectious Diseases Society of America, *Clinical Infectious Diseases*, Volume 59, Issue 2, 15 July 2014, Pages e10–e52, https://doi.org/10.1093/cid/ciu296
B.9.6	Folliculitis	<u>Bacterial:</u> *Staphylococcus aureus*	Lin HS, Lin PT, Tsai YS, Wang SH, Chi CC. Interventions for bacterial folliculitis and boils

Annexure	Title	Etiology	Reference
		Klebsiella spp. *Enterobacter spp.* *Proteus spp.* *Pseudomonas aeruginosa* Fungal: *Malassezia furfur*	(furuncles and carbuncles). Cochrane Database Syst Rev. 2021 Feb 26;2(2):CD013099. doi: 10.1002/14651858.CD013099.pub2. PMID: 33634465; PMCID: PMC8130991.
B.9.7	Diabetic foot infections	Bacterial: *Gram positive:* *Staphylococcus aureus* *Enterococcus fecalis* *Streptococcus pneumoniae* *Streptococcus agaliticae* *Staphylococcus epidermidis* Gram negative aerobes: *E.coli* *Pseudomonas aeruginosa* *Klebsiella spp* *Acinetobacter baumanii* *Enterobacter cloacae* Gram negative anaerobes: *Bacteroides fragilis* *Fusobacterium spp.*	Jneid, J.P. Lavigne, B. La Scola, N. Cassir,The diabetic foot microbiota: A review,Human Microbiome Journal,Volumes 5–6,2017,Pages 1-6, ISSN 2452-2317

B.10. Musculoskeletal Infections

Annexure	Title	Etiology	Reference
B.10.1	Acute osteomyelitis	Bacterial: *Staphylococcus aureus* Streptococci *Escherichia coli* *Pseudomonas aeruginosa*	Harrison's Principles of Internal Medicine Pg 3936
B.10.2	Chronic osteomyelitis	Bacterial: *Staphylococcus aureus* (most common) *Mycobacterium tuberculosis* Gram negative bacteria Coagulase negative staphylococci Anaerobes Streptococci Enterococci *Polymicrobial infections are also seen.*	Ahmed Barakat, William HK. Schilling, Sunil Sharma, Enis Guryel, Richard Freeman,Chronic osteomyelitis: a review on current concepts and trends in treatment,Orthopaedics and Trauma,Volume 33, Issue 3,2019,Pages 181-187,ISSN 1877-1327,

Annexure	Title	Etiology	Reference
B.10.3	Gas gangrene	*Clostridium perfringens* *Clostridium septicum* *Clostridium novyi* *C.tertium* *Clostridium sordelli*	Harrison's Principles of Internal Medicine Pg 1222
B.10.4	Septic arthritis	**Infants**: Group B streptococci Gram-negative enteric bacilli *S. aureus* **Children <5 years**: *S. aureus* *Streptococcus pyogenes* **Young adults and adolescents**: *N. gonorrhoeae* **Adults**: *S. aureus* Gram-negative bacilli Pneumococci β-hemolytic streptococci—particularly groups A and B but also groups C, G, and F	Harrison's Principles of Internal Medicine Pg 1041
B.10.5	Skin and soft tissue injuries	Wound infections are often polymicrobial. Bacterial: Aerobic bacteria *Staphylococcus aureus* *Escherichia coli* *Pseudomonas aeruginosa* *Enterobacter cloacae* *Klebsiella spp.* *Streptococcus spp.* *Enterococcus spp.* *Proteus spp.* Anaerobic bacteria *Peptostreptococcus spp.* *Prevotella spp.* *Porphyromonas spp.* *Bacteroides spp.*	Maillard JY, Kampf G, Cooper R. Antimicrobial stewardship of antiseptics that are pertinent to wounds: the need for a united approach. JAC Antimicrob Resist. 2021 Mar 25;3(1):dlab027.
B.10.6	Orthopedic implant	*Bacterial:* *Staphylococcus aureus* *Staphylococcus epidermidis*	Ihtisham Ul Haq, Taj Ali Khan, Katarzyna Krukiewicz, Etiology, pathology, and host-impaired immunity in medical implant-

Annexure	Title	Etiology	Reference
	associated infections	*Propionibacterium acnes* *Enterococcus faecalis*	associated infections, Journal of Infection and Public Health, Volume 17, Issue 2, 2024, Pages 189-203, ISSN 1876-0341, https://doi.org/10.1016/j.jiph.2023.11.024.
B.10.7	Surgical site infections	Bacterial: *Staphylococcus aureus* Coagulase negative Staphylococcus *Enterococcus faecium* and *E. fecalis* *Escherichia coli* *Pseudomonas aeruginosa* *Enterobacter spp.* *Klebsiella spp.*	Bucataru A, Balasoiu M, Ghenea AE, Zlatian OM, Vulcanescu DD, Horhat FG, Bagiu IC, Sorop VB, Sorop MI, Oprisoni A, Boeriu E, Mogoanta SS. Factors Contributing to Surgical Site Infections: A Comprehensive Systematic Review of Etiology and Risk Factors. Clin Pract. 2023 Dec 28;14(1):52-68.

B.11. Ocular Infections

Annexure	Title	Etiology	Reference
B.11.1.1	Conjunctivitis	Viral: Adenoviruses Herpes simplex virus Varicella zoster Enterovirus Bacterial: *Staphylococcus spp.* *H. influenzae* *Streptococcus spp.* *Moraxella catarrhalis* Gram-negative intestinal bacteria Ophthalmia neonatorum *Chlamydia trachomatis*	Azari AA, Arabi A. Conjunctivitis: A Systematic Review. J Ophthalmic Vis Res. 2020 Aug 6;15(3):372-395. doi: 10.18502/jovr.v15i3.7456.
B.11.1.2	Keratitis	Bacterial: *Staphylococcus spp.* *Staphylococcus aureus* *Pseudomonas aeruginosa* Viral: HSV type 1 CMV VZV EBV Adenovirus Fungal: *Candida spp.* *Fusarium spp.* *Aspergillus spp.* Parasitic:	1. Cabrera-Aguas M, Khoo P, Watson SL. Infectious keratitis: A review. Clin Exp Ophthalmol. 2022 Jul;50(5):543-562. doi: 10.1111/ceo.14113. 2. Koganti R, Yadavalli T, Naqvi RA, Shukla D, Naqvi AR. Pathobiology and treatment of viral keratitis. Exp Eye Res. 2021 Apr;205:108483. doi: 10.1016/j.exer.2021.

Annexure	Title	Etiology	Reference
		Acanthamoeba spp.	
B.11.2.1	Acute Endophthalmitis	Bacterial: Coagulase Negative Staphylococci *Staphylococcus aureus* Beta-hemolytic Streptococci *S.pneumoniae* Alpha – haemolytic streptococci including *S.mitis* and *S.salivarius* *Pseudomonas Aeruginosa* Fungal: *Candida spp.* *Aspergillus spp.* *Fusarium spp.*	ESCRS Guidelines for Prevention and Treatment of Endophthalmitis Following Cataract Surgery: Data, Dilemmas and Conclusions 2013
B.11.2.2	Chronic Endophthalmitis	Bacterial: *Propionibacterium acnes* *Corynebacterium spp.* *S.epidermidis*	ESCRS Guidelines for Prevention and Treatment of Endophthalmitis Following Cataract Surgery: Data, Dilemmas and Conclusions 2013
B.11.2.3	Endogenous Endophthalmitis	Bacterial: *Staphylococcus aureus* *Streptococcus spp.* Gram Negative bacilli (Eg., *Klebsiella spp.)* Fungal: *Candida spp.* *Aspergillus spp.* *Fusarium spp.*	Endophthalmitis Durand, M.L.Clinical Microbiology and Infection, Volume 19, Issue 3, 227 – 234.
B.11.3.1	Orbital cellulitis	Bacterial: *Streptococcal spp.* *Staphylococcus aureus* *H. influenzae* *Propionibacterium spp.* *Bacillus spp.* *Bacteroides spp.* *Peptostreptococcus spp.* *Fusiobacterium spp.*	Yadalla D, Jayagayathri R, Padmanaban K, Ramasamy R, Rammohan R, Nisar SP, Rangarajan V, Menon V. Bacterial orbital cellulitis - A review. Indian J Ophthalmol. 2023 Jul;71(7):2687-2693. doi: 10.4103/IJO.IJO_3283_22.
B.11.3.2	Preseptal cellulitis	Bacterial: *Staphylococcus spp.* (majority of infections) *Streptococcus spp.* (majority of infections) *Haemophilus influenzae* *M. catarrhalis* *Peptostreptococcus spp.*	1. A.A. Gordon and P.O. Phelps, Management of preseptal and orbital cellulitis for the primary care physician, Disease-a-Month, https://doi.org/10.1016/j.disamonth.2020.101044 2. KANSKI'S

Annexure	Title	Etiology	Reference
		Bacteroides spp. **Immunocompromised hosts** Fungal: Mucormycosis and Aspergillosis	Clinical Ophthalmology A Systematic Approach Tenth Edition.Pg 124-125
B.11.4	Infectious retinitis	Viral: Cytomegalovirus VZV HSV Type 1 & 2 Fungal: *Candida albicans* *Aspergillus spp.* Parasitic: *Toxoplasma gondii* *Toxocara canis* Others: *Treponema pallidum* *Bartonella henselae* (uncommon)	Yachna Ahuja, Steven M. Couch, Raymund R. Razonable, Sophie J. Bakri. Infectious retinitis: a review Available from: https://www.retinalphysician.com/issues/2008/novdec/infectious-retinitis-a-review/

B.12. Respiratory Tract Infections

Annexure	Title	Etiology	Reference
B.12.1	Acute bronchitis	Viral: Rhinovirus Enterovirus Influenza A and B Parainfluenza Coronavirus Human metapneumovirus, Respiratory Syncytial Virus Adenovirus Bacterial: Atypical bacteria *Mycoplasma pneumoniae* *Chlamydia pneumoniae* *Bordetella pertussis*	Kinkade S, Long NA. Acute Bronchitis. Am Fam Physician. 2016 Oct 1;94(7):560-565. PMID: 27929206.
B.12.2	Bronchiolitis	*In adults, symptomatic acute infectious bronchiolitis (without pneumonia) is uncommon, but can be caused by pathogens, such as:* Viral: Influenza virus	Aparna C. Swaminathan, John M. Carney, Tina D. Tailor, and Scott M. Palmer. Overview and Challenges of Bronchiolar Disorders.Ann Am Thorac Soc Vol 17, No 3, pp 253–263, Mar 2020

Annexure	Title	Etiology	Reference
		Respiratory syncytial virus Rhinovirus Adenovirus Parainfluenza virus Human Metapneumovirus <u>Bacterial:</u> *M. pneumoniae* *Haemophilus influenzae* *Streptococcus pneumoniae*	DOI: https://doi.org/10.1513/AnnalsATS.201907-569CME
B.12.3	COPD	<u>Viral:</u> Human rhinovirus subtypes A and C RSV Coronavirus Influenza and Parainfluenza virus <u>Bacterial:</u> *Haemophilus influenzae* *Streptococcus pneumoniae* *Moraxella catarrhalis* *Pseudomonas aeruginosa* *Chlamydia pneumoniae*	1. Harrison's Principles of Internal Medicine Pg 2189 2. Papadopoulos NG, Christodoulou I, Rohde G, Agache I, Almqvist C, Bruno A, et al. Viruses and bacteria in acute asthma exacerbations – A GA^{2}LEN-DARE systematic review. *Allergy* 2011; 66: 458–468. 3. WHO AWARE guidelines Pg 165
B.12.4	Infective Exacerbation of Bronchiectasis	**Most common:** <u>Bacterial:</u> *Haemophilus influenzae* *Pseudomonas aeruginosa*	Harrison's Principles of Internal Medicine Pg 2175

Annexure	Title	Etiology	Reference
B.12.5	Community acquired pneumonia	**Outpatients:** Bacterial: *Streptococcus pneumoniae* *Mycoplasma pneumoniae* *Haemophilus influenzae* *C. pneumoniae* *Viral:* Respiratory viruses **Non-ICU hospitalized patients:** Bacterial: *S. pneumoniae* *M. pneumoniae* *Chlamydia pneumoniae* *H. influenzae* *Legionella spp.* Viral: Respiratory viruses **ICU patients:** Bacterial: *S. pneumoniae* *Staphylococcus aureus* *Legionella spp.* Gram-negative bacilli *H. influenzae* Viral: Respiratory viruses	Harrison's Principles of Internal Medicine Table 126-1. Pg 1010
B.12.6	Lung abscess	**Primary lung abscess**: Bacterial: *Bacteroides spp.* *Prevotella spp.* *Peptostreptococcus spp.* *Streptococcus milleri* Microaerophilic Streptococci **Secondary lung abscess**: Bacterial: *Staphylococcus aureus* Enterobacterales *Pseudomonas aeruginosa* *Streptococcus pyogenes* *Hemophilus influenzae* type b *Nocardia spp.* Actinomyces Anaerobic bacteria (*Fusobacterium spp*., or Streptococci)	Harrison's Principles of Internal Medicine Table 127-1. Pg 1020

Annexure	Title	Etiology	Reference
		Legionella spp. Fungal: Mucorales *Aspergillus spp.* *Pneumocyctis jirovecii* *Cryptococcus spp.*	
B.12.7	Empyema	Bacterial: *Staphylococcus aureus* *Streptococcus pyogenes* *Streptococcus pneumonie* Viridans streptococci group *Pseudomonas spp.* *Klebsiella spp.* Enterobacteriaceae *Acinetobacter spp.* *Infections may be polymicrobial in nature with involvement of both aerobic and anaerobic in nature.*	Foley, Sean P. F., and John Scott Parrish. 2023. "Pleural Space Infections" *Life* 13, no. 2: 376. https://doi.org/10.3390/life13020376

B.13. Toxin-mediated Syndromes

Annexure	Title	Etiology	Reference
B.13.1	Botulism	Anaerobic bacterium *Clostridium botulinum*. Other Clostridium species: *Clostridium butyricum* *Clostridium baratii*	Harrison's Principles of Internal Medicine Pg 1215 https://www.cdc.gov/botulism/treatment/index.html
B.13.2	Diphtheria	Toxigenic strains of *Corynebacterium diphtheriae*. Other Corynaebacterium species: *Corynebacterium ulcerans* *Corynebacterium pseudotuberculosis*	Harrison's Principles of Internal Medicine Pg 1203
B.13.3	Tetanus	Most common: *Clostridium tetani* May be complicated by: *Staphylococcus epidermidis* *Staphylococcus aureus* *Propionibacterium acnes* *Pseudomonas aeruginosa* *Acinetobacter baumanii*	Harrison's Principles of Internal Medicine Pg 1211
B.13.4	Toxic shock syndrome	***Staphylococcus aureus*** Toxic shock syndrome toxin 1 enterotoxins B **Group A Streptococcus pyogenes** Streptococcal pyrogenic exotoxins (SpE)A,B and C	Harrison's Principles of Internal Medicine Pg 1183 Atchade E, De Tymowski C, Grall N, Tanaka S, Montravers P. Toxic Shock Syndrome: A Literature Review. Antibiotics (Basel). 2024 Jan 18;13(1):96. doi:

		Streptococcal superantigen A	10.3390/antibiotics13010096. PMID: 38247655; PMCID: PMC10812596.

B.14. Bite Wound Infections

Annexure	Title	Etiology	Reference
B.14.1	Human and animal bites wound infections	**Dog bite** *Staphylococcus aureus* *Pasteurella multocida* Anaerobes *Capnocytophaga Canimorsus* **Cat Bite** *P. multocida* *S. aureus* Anaerobes **Human & monkey bites** Viridans streptococci *S. aureus* *Haemophilus influenzae* Anaerobes *Eikenella corrodens* **Rodent bites** *Streptobacillus moniliformis* *Leptospira spp.* *P. multocida* **Aquatic animal bites** *Aeromonas hydrophila* marine *Vibrio spp. (Vibrio vulnificus)*	Table 141-1 Harrison's Principles of Internal Medicine Pg 1127

B.15. Burn Wound Infections

Annexure	Title	Etiology	Reference
B.15.1	Burn wound infections	<u>Bacterial:</u> *Staphylococcus aureus* *Streptococcus pyogenes* *Pseudomonas aeruginosa* Coagulase negative Staphylococcus *Enterococcus spp*. *E.coli* <u>Fungal:</u>	Church DElsayed SReid O, Winston B, Lindsay R. 2006. Burn Wound Infections. Clin Microbiol Rev 19:. https://doi.org/10.1128/cmr.19.2.403-434.2006

		Candida spp.	

B.16. Dental Infections

Annexure	Title	Etiological agents	Reference
B.16.1	Odontogenic infections	*Odontogenic infections are polymicrobial, consisting of **various facultative anaerobes**, such as:* *S. mitis* *S. sanguinis* *S. salivarius* *S. anginosus* *S. viridans* group AND **Strict anaerobes:** Anaerobic cocci *Prevotella spp.* *Fusobacterium spp.*	Tahmasebi, E.; Keshvad, A.; Alam, M.; Abbasi, K.; Rahimi, S.; Nouri, F.; Yazdanian, M.; Tebyaniyan, H.; Heboyan, A.; Fernandes, G.V.O. Current Infections of the Orofacial Region: Treatment, Diagnosis, and Epidemiology. *Life* 2023, *13*, 269. Available from: https://doi.org/10.3390/life13020269

B.17. Infections in Immuno-Compromised hosts

Annexure	Title	Etiology	Reference
B.17.1	Febrile neutropenia syndrome	Bacterial: Enterobacteriaceae *Pseudomonas spp.* *Staphylococcus spp.* *Streptococcus spp.* Fungal: *Candida spp*. Molds Viral: Respiratory viruses HSV VZV	Villafuerte-Gutierrez P, Villalon L, Losa JE, Henriquez-Camacho C. Treatment of febrile neutropenia and prophylaxis in hematologic malignancies: a critical review and update. Adv Hematol. 2014;2014:986938.
B.17.2	**Title:**Infections in Solid Organ Transplant patients		
Time interval	**<4 weeks of transplant**	**1-6 months after SOT**	**>6 months after SOT**
	Bacterial: Methicillin Resistant *Staphylococcus aureus* (MRSA) Vancomycin resistant Enterococcus (VRE) *Pseudomonas spp.* Fungal:	**With PCP and Antiviral prophylaxis(CMV and HBV):** Viral: Bk Polyoma virus nephropathy Hepatitis C Virus	Fungal: *Aspergillus spp.* Atypical moulds *Mucor spp.* Bacterial: *Nocardia spp.* *Rhodococcus spp.*

	Candida spp. (non albicans) *Aspergillus spp.* <u>Viral:</u> Herpes Simplex Virus LMCV	Adenovirus Influenza <u>Fungal:</u> *Cryptococcus neoformans* <u>Bacterial:</u> *M.tuberculosis* *C.difficile* colitis **Without prophylaxis, following agents in addition to above:** <u>Viral:</u> Herpesviruses(HSV, VZV, CMV,EBV) Hepatitis B Virus <u>Bacterial:</u> *Listeria spp.* *Nocardia spp.* <u>Parasitic:</u> *Toxoplasma spp.* *Leishmania spp.* *Strongyloides spp.* *T.cruzi*	<u>Viral:</u> CMV Colitis/Retinitis HBV/HCV HSV Encephalitis JC Polyoma Virus
B.17.3	**Title**	**Etiology**	**Reference**
	Infections in Asplenia	<u>Bacterial:</u> *Streptococcus pneumoniae* *Neisseria meningitidis* *Haemophilus influenzae* type b *Pseudomonas aeruginosa* *Capnocytophaga canimorsus* *Bartonella spp.* <u>Parasitic:</u> *Babesia spp*.	Lee GM. Preventing infections in children and adults with asplenia. Hematology Am Soc Hematol Educ Program. 2020 Dec 4;2020(1):328-335. doi: 10.1182/hematology.2020000117
B.17.4	Invasive Fungal Infections in Immuno-Compromised	*Aspergillus spp.* *Candida spp.* **Mucormycosis**: *Apophysomyces spp.* *Basidiobolus spp.* *Conidiobolus spp.* *Cunninghamella spp.* *Mucor spp.* *Lichtheimia (Absidia) spp.* *Rhizomucor spp.*	https://www.who.int/publications/i/item/9789240060241

		Rhizopus spp. *Saksenaea spp.* *Syncephalestrum spp*.	

B.18. Healthcare Associated Infections

Annexure	Title	Etiology	Reference
B.18.1	Fever in ICU	**Pathogens isolated from blood:** <u>Fungal:</u> *Candida albicans* *Candida tropicalis* *Pichia kudriavzevii* *Nakaseomyces glabrataa* *Candida parapsilosis* <u>Bacterial:</u> *Enterococcus faecium* *Staphylococcus aureus* *Klebsiella pneumoniae* *Pseudomonas aeruginosa* *Escherichia coli* **Pathogens isolated from urine:** *Fever in ICU patients can be due to an underlying UTI. Presence of sign and symptoms of UTI and pyuria in urine analysis should be followed by a urine culture.* **Pathogens isolated from Respiratory tract:** <u>Viral:</u> Influenza virus Respiratory syncytial virus Adenovirus Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) Human metapneumovirus Seasonal coronaviruses Rhinovirus Parainfluenza virus Herpes simplex virus Cytomegalovirus Varicella-zoster virus Middle East respiratory syndrome coronavirus Sin Nombre virus Measles virus	O'Grady et al. Society of Critical Care Medicine and the Infectious Diseases Society of America Guidelines for Evaluating New Fever in Adult Patients in the ICU. Critical Care Medicine 51(11):p 1570-1586, November 2023. | DOI: 10.1097/CCM.0000000000006022

Annexure	Title	Etiology	Reference
B.18.2	Invasive Candidiasis	*Candida albicans* *C. glabrata* *C. parapsilosis* *C. tropicalis* *C. krusei* * Incidence of *Candida auris* is largely associated with infection control practices of hospital.	https://www.cdc.gov/candidiasis/hcp/clinical-overview/index.html
B.18.3	Ventilator Associated Pneumonia	Bacterial: *Klebsiella spp.* *Acinetobacter spp.* *Pseudomonas spp.* *E. coli* and other Enterobacteriaceae *Staphylococcus aureus*	Mathur P, Malpiedi P, Walia K, *et al.* Health-care-associated bloodstream and urinary tract infections in a network of hospitals in India: a multicentre, hospital-based, prospective surveillance study.Lancet Glob Health, 10 (2022), pp. e1317-e1325 **DOI:** 10.1016/S2214-109X(22)00274-1
B.18.4	CLABSI	Bacterial: *Klebsiella pneumoniae* *Acinetobacter spp.* *Enterobacter spp.* *Citrobacter spp.* *Proteus spp.* *Serratia spp.* *Burkholderia cepacia* complex *Stenotrophomonas maltophilia* *Staphylococcus spp.* *Enterococcus spp.* Fungal: *Candida spp. (unspeciated)* *C. albicans* *C. tropicalis* *C. parapsilosis* *C. auris* *C. haemulonii* *C. krusei* *C. glabrata*	Mathur et al; Indian Healthcare Associated Infection Surveillance Network collaborators. Health-care-associated bloodstream and urinary tract infections in a network of hospitals in India: a multicentre, hospital-based, prospective surveillance study. Lancet Glob Health. 2022 Sep;10(9):e1317-e1325. doi: 10.1016/S2214-109X(22)00274-1. PMID: 35961355
B.18.5	CAUTI	Bacterial: *Klebsiella pneumoniae* *Acinetobacter spp.* *Enterobacter spp.* *Citrobacter spp.* *Proteus spp.* *Serratia spp.* *Burkholderia cepacia* complex	Mathur et al ; Indian Healthcare Associated Infection Surveillance Network collaborators. Health-care-associated bloodstream and urinary tract infections in a network of hospitals in India: a multicentre, hospital-based, prospective surveillance study. Lancet Glob Health. 2022 Sep;10(9):e1317-e1325. doi:

Annexure	Title	Etiology	Reference
		Stenotrophomonas maltophilia *Staphylococcus spp.* *Enterococcus spp.*	10.1016/S2214-109X(22)00274-1. PMID: 35961355
B.18.6	Hospital acquired intra-abdominal infections	In all HA-IAIs, causative pathogens are less predictable; thus, peri-operative cultures are routinely indicated	Sartelli, M., Catena, F., Abu-Zidan, F.M. *et al.* Management of intra-abdominal infections: recommendations by the WSES 2016 consensus conference. *World J Emerg Surg* 12, 22 (2017). https://doi.org/10.1186/s13017-017-0132-7

B.19. Neonatal Infections

Annexure	Title	Etiology	Reference
B.19.1	*Meningitis*	Bacterial: *Escherichia coli* *Klebsiella pneumoniae* *Streptococcus agalactiae* *Listeria monocytogenes*	Indian Academy of Pediatrics (IAP). STANDARD TREATMENT GUIDELINES 2022 Pg 4
B.19.2	Conjunctivitis	Bacterial: *Chlamydia trachomatis* *Neisseria gonorrhoeae* Coagulase-negative Staphylococcus Alpha-hemolytic Streptococcus *Haemophilus influenzae* *Streptococcus pneumoniae* *Staphylococcus aureus* *Pseudomonas spp.* *Escherichia coli* Viral: Herpes simplex Adenovirus Enterovirus	Indian Academy of Pediatrics (IAP). STANDARD TREATMENT GUIDELINES 2022 Chapter 68 Pg 3-4

Annexure	Title	Etiology	Reference
B.19.3	Superficial infections - Omphalitis	<u>Bacterial:</u> *Staphylococcus aureus* *Streptococcus pyogenes* *Streptococcus agalactiae* *E.coli* *Klebsiella spp.* *Enterococcus spp.* *Enterobacter spp.*	Kaplan RL, Cruz AT, Freedman SB, Smith K, Freeman J, Lane RD, Michelson KA, Marble RD, Middelberg LK, Bergmann KR, McAneney C, Noorbakhsh KA, Pruitt C, Shah N, Badaki-Makun O, Schnadower D, Thompson AD, Blackstone MM, Abramo TJ, Srivastava G, Avva U, Samuels-Kalow M, Morientes O, Kannikeswaran N, Chaudhari PP, Strutt J, Vance C, Haines E, Khanna K, Gerard J, Bajaj L. Omphalitis and Concurrent Serious Bacterial Infection. Pediatrics. 2022 May 1;149(5):e2021054189. doi: 10.1542/peds.2021-054189. PMID: 35441224.
B.19.4	*Cutaneous candidiasis*	*Candida albicans* and other *Candida spp.*	1. Nelson Textbook of Pediatrics. Pg 3219 2. Harrson's Principles of Internal Medicine Table 57-5 Pg 380
B.19.5	Viral Infections	Adenovirus CMV Enteroviruses Parechoviruses Hepatitis B virus HSV HIV Parvovirus Rubella virus VZV	1. Nelson Textbook of Pediatrics. Pg 912. 2. Santos RP, Tristram D. A practical guide to the diagnosis, treatment, and prevention of neonatal infections. Pediatr Clin North Am. 2015 Apr;62(2):491-508. doi: 10.1016/j.pcl.2014

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