ANTIMICROBIAL POLICY

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General principles of antimicrobial use

What are the causes of irrational use of antibiotics in a healthcare setting?

- Prescription of antibiotics for non-bacterial infections and polypharmacy
- Redundant antibiotics
- Not sending appropriate investigations to identify pathogen(s) prior to starting therapy
- Extended prophylactic therapy particularly in surgical prophylaxis
- Failure to narrow antibiotics when a causative organism is identified (No de-escalation)
- Continuing antibiotics without indication

What are the consequences of irrational use of antibiotics?

- Increased antimicrobial resistance
- Increased incidence of fungal infections
- Increased morbidity & mortality
- Increased cost & duration of hospital stay

How to reduce irrational use of antibiotics?

- Identify type of infection – Bloodstream, respiratory, urinary tract etc
- Location – OPD, IPD or ICU
- Send samples for appropriate cultures before starting antibiotics
- Initiate empiric antibiotic based on antibiogram & guidelines
- Knowing the common organisms involved and their susceptibility pattern
- Applying the pharmacokinetic and pharmacodynamic relationships of antibiotics
- Deescalate/ Escalate based on sensitivity
- Adjust antimicrobial dose according to renal & hepatic status
- Ensure right drug at right dose, route & duration
- Review the need of antibiotic on daily basis

- IV to oral shift once patient is stable
- To avoid redundant or double antibiotic coverage
- Prior to upgrading to higher antibiotics it is advisable to identify alternative causes of inadequate response such as incorrect dose, incorrect method of administration inadequate source control and inadequate control of confounding factors such as hyperglycemia

Categorisation of antibiotics

Access, Watch, Reserve (AWaRe) classification of antibiotics for evaluation and monitoring of use

Access	Watch	Reserve
Amikacin	Azithromycin	Aztreonam
Amoxicillin	Cefamandole	Cefiderocol
Amoxicillin/clavulanic-acid	Cefdinir	Ceftaroline-fosamil
Ampicillin	Cefepime	Ceftazidime/avibactam
Ampicillin/sulbactam	Cefixime	Ceftolozane/tazobactam
Benzathine-benzylpenicillin	Cefoperazone	Colistin_IV
Benzylpenicillin	Cefotaxime	Dalbavancin
Cefadroxil	Cefotetan	Dalfopristin/quinupristin
Cefalexin	Cefoxitin	Daptomycin
Cefazolin	Cefpodoxime-proxetil	Eravacycline
Chloramphenicol	Ceftazidime	Faropenem
Clindamycin	Ceftriaxone	Fosfomycin_IV
Cloxacillin	Ciprofloxacin	Iclaprim
Dicloxacillin	Clarithromycin	Imipenem/cilastatin/relebactam
Doxycycline	Delafloxacin	Lefamulin
Flucloxacillin	Doripenem	Linezolid
Gentamicin	Ertapenem	Meropenem/vaborbactam
Metronidazole_IV	Erythromycin	Minocycline_IV
Metronidazole_oral	Fidaxomicin	Omadacycline
Nafcillin	Fosfomycin_oral	Oritavancin
Nitrofurantoin	Imipenem/cilastatin	Plazomicin

Oxacillin	Kanamycin_IV	Polymyxin-B_IV
Procaine-benzylpenicillin	Kanamycin_oral	Polymyxin-B_oral
Spectinomycin	Levofloxacin	Tedizolid
Sulbactam	Levonadifloxacin	Telavancin
Sulfamethoxazole/trimethoprim	Meropenem	Tigecycline
Tetracycline	Minocycline_oral	
Tinidazole_IV	Moxifloxacin	
Tinidazole_oral	Netilmicin	
Trimethoprim	Norfloxacin	
	Ofloxacin	
	Pefloxacin	
	Piperacillin	
	Piperacillin/tazobactam	
	Rifabutin	
	Rifampicin	
	Spiramycin	
	Streptomycin_IV	
	Streptomycin_oral	
	Tazobactam	
	Tebipenem	
	Teicoplanin	
	Ticarcillin	
	Tobramycin	
	Vancomycin_IV	
	Vancomycin_oral	

Dosage guide for commonly used antimicrobial agents

Antibiotic	Adult dose	Renal modification
Acyclovir	PO 200 mg PO 5x/day 400 mg PO 5x/day 800 mg PO 5x/day 400 mg PO q12h IV Mucocutaneous 5 mg/kg IV q8h Immunocompromised: 6.2 mg/kg IV q8h HSV encephalitis or varicella zoster virus 10 mg/kg IV q8h (Tunkel et al 2008) Immunocompromised: 12.4 mg/kg IV q8h	CrCl 0-10: same dose q12h CrCl 11-25: same dose q8h CrCl 25-50: same dose q12h IV dose Mucocutaneous: CrCl 25-50: same dose q12h CrCl 10-24: same dose q24h CrCl <10: 2.5-3.1 mg/kg IV q24h HSV encephalitis: CrCl 25-50: same dose q12h CrCl 10-24: same dose q24h CrCl <10: 5-6.2 mg/kg IV q24h
Amikacin	15mg/kg	CrCl 60-90: 15mg/kg q24h CrCl 40-59: 15mg/kg q36h CrCl 20-39: 15mg/kg q48h
Aztreonam	1-2gmq8h	CrCl 30- <130: No adj CrCl 10-<30: 1gm Q12h CrCl <10: 1gm q24h
Anidulafungin	200mg D1 f/b 100mg q24h	No adjustment
Voriconazole	Oral - 400mg q12h 2 doses f/b 200mg q12h Iv- 6mg/kg q12h 2 doses f/b 4mg/kg q12h	No adjustment
Isavuconazole	Oral 200mg Q8h 6 doses f/b 200mg Q24H	No adjustment
Posaconzole	Oral 300mg 2 doses q12h doses f/b 300mg Q24H	No adjustment
Itraconazole	Oral 200 mg Q8H for 3 days f/b 200mg Q12H (In CNS involvement- MD- 200mg q8h)	No adjustment
Amoxicillin	250-100mg PO q8h	CrCl 10-30: same dose q12h CrCl <10: same dose q24h

		HD: Moderately dialyzable (20% to 50%); ~30% removed by 3-hour hemodialysis: 250 to 500 mg every 24 hours; administer after dialysis on dialysis days
Amoxicillin/clavulanate	500/125 mg PO q8h 875/125 mg PO q12h 1000/62.5 mg PO q12h	CrCl 10-30: 250/125 mg PO q12h CrCl <10: 250/125 mg PO q24h CrCl 10-30: 500/125 mg PO q12h CrCl <10: 500/125 mg PO q24h XR formulation NOT recommended with CrCl < 30
Amphotericin B **Liposomal AMB**	0.5-1 mg/kg IV q24h 3-5 mg/kg IV q24h 5-10 mg/kg IV q24h	No dose adjustment is necessary
Ampicillin/Sulbactam	1.5-3g IV q6h	≥30: 1.5–3.0 g q6-8h 15–29: 1.5–3.0 g q12h 5–14: 1.5–3.0 g q24h
Azithromycin	Oral 500 mg D1 f/b 500mg q24h Iv 500mg q24h (CAP) Oral 1gm q24h D1 f/b 500mg q24h (Enteric fever)	No dose adjustment is necessary
Caspofungin	Esophageal candidiasis: 70 mg IV loading dose, then 50 mg/day Invasive Candidiasis: 70 mg IV loading dose on day 1, followed by 50 mg IV daily thereafter	No dosage adjustment
Cefepime	1 g q8 to 12h (over 30 minutes)	CrCl >60: 1 g q12h CrCl 30-60: 1 g q24h CrCl 11-29: 500mg q24h CrCl <11 : 250mg q24h
Cefazolin	2gm iv q8h	CrCl >50: 1-2 gm q8h CrCl 30-<50: 1-2 gm 8-12h CrCl >10- <30: 500-1gm q12h
Cefoperazone/sulbactam	1-2 g (cefoperazone) every 12 hours; maximum daily dose: 4 g (sulbactam)	No doses adjustment in low doses Monitor for sulbactam
Ceftazidime	1 g IV q8h infused over 30 minutes Anti-pseudomonal dosing: 2 gm IV q8hr	CrCl >50: No adjustment necessary CrCl 31-50: 1 g q12h CrCl 16-30: 1 g q24h CrCl <15: 500 mg q24h
Ceftazidime - Avibactam	Iv 2.5gm q8h	CrCl >50- <130: No adjustment necessary CrCl>30-50: 1.25 g q8h

		CrCl>15-30: 0.94g q12h CrCl >5-15: 0.94g q24h CrCl >5: 0.94g q48h
Ceftazidime – Avibactam - Aztreonam	Iv 2.5gm q8h+ 1-2 gm q8hin a single infusion over 2 hours	Refer above
Ceftalozane- tazobactam	Iv – 1.5gm q8h (cUTI &c IAI) 3gm q8h infusion over 3 hours (VAP)	CrCl >50- 90: 1.5gm q8h CrCl 30-50: 750 mg q8h, 1.5gm q8h CrCl <10 -<15: HD dose
Ceftriaxone	1 to 2 g OD 1g BD (Meningitis)	No adjustment necessary
Cefuroxime	1.5 gm q8h	CrCl >30: No dosage adjustment necessary CrCl 10-30: 1.5 g q12h CrCl <10: 1.5 g q24h
Ciprofloxacin	400 mg BD	CrCl <30: same dose q24h CrCl <30: same dose q12 (for q8h regimen)-24h (for q12h regimen)
Clarithromycin	0.5-1 g PO q12h	CrCl <30: 50% PO q12h
Clindamycin	Oral 300mg q6h Iv- 600-900mg q8h	No adjustment necessary
Colistin	Based on CrCl & Colistin dose calculation	
Cotrimoxazole	Varies with indications (see section XIV of this chapter) High dose: 15-20 mg/kg q24h IV	CrCl >30: No dosage adjustment necessary. CrCl 15 to 30: Administer 50% of recommended dose. CrCl <15: Use is not recommended and is contraindicated.
Cloxacillin	Iv 2gm q4-6h	No adjustment necessary
Ceftaroline	Iv 600mg q8h (BSI) Iv 600mg q12h (CAP & SSI)	CrCl >50: No adjustment necessary CrCl>30-<50: 400 mg q12h/q8h CrCl>15-<30: 300mg q12h/q8h CrCl <15 : 200mg q12h/q8h
Doxycycline	Oral 100 mg q12h	No adjustment necessary
Daptomycin	6 mg/kg IV q24h	CrCL<30 same dose q48h HD: Dose as CrCl <30. Give after dialysis on dialysis days. CAPD: Dose as CrCl <30.
Erythromycin	Oral 250mg q12h (RF Secondary Px) 500 mg q8-6h (SSTI)	No adjustment necessary
Ertapenem	Iv 1gm q24h	No adjustment necessary
Fluconazole	Invasive candidiasis: 800 mg on Day1 and then 400 mg/day Esophageal/Oropharyngeal candidiasis: 400	CrCl 10-29: 800 mg (12mg/kg) loading dose then 50% of maintenance dose PO/IV q24h CrCl <10: 800 mg (12 mg/kg) loading dose then 25% of

	mg on Day1 and then 200 to 400 mg/day	maintenance dose PO/IV q24h CrCl <30: 50% PO/IV q24h
Flucloxacillin	Iv 2gm q4-6h Oral 500 mg q6h(mild to moderate infection) Oral 2gm q6h (Severe inc. osteomyelitis & endocarditis)	Reduce dose to half if CrCl <10
Fosfomycin	12 to 24 g q24h in 2 to 3 divided doses	Yes
Ganciclovir	IV Induction: 5 mg/kg IV q12h Maintenance 5 mg/kg IV q24h	Induction dose: CrCl 50-69: 2.5 mg/kg IV q12h CrCl 25-49: 2.5 mg/kg IV q24h CrCl 10-24: 1.25 mg/kg IV q24h CrCl <10:1.25 mg/kg IV 3x/week Maintenance dose: CrCl 50-69: 2.5 mg/kg IV q24h CrCl 25-49: 1.25 mg/kg IV q24h CrCl 10-24: 0.625 mg/kg IV q24h CrCl <10: 0.625 mg/kg IV 3x/week
Gentamicin	1.5-2.5 mg/kg IV q8h	CrCl 51-90: 60-90% IV q8-12 CrCl 10-50: 30-70% IV q12h CrCl <10: 20-30% IV q24-48h
Linezolid	Iv 600mg q12h	No adjustment necessary
Imipenem	500 mg IV q6h/ 1000 mg IV q8h	CrCl ≥90 mL/minute: No dosage adjustment necessary. CrCl ≥60 to <90 mL/minute: 500 mg every 6 hours CrCl ≥30 to <60 mL/minute: 500 mg every 8 hours CrCl ≥15 to <30 mL/minute: 500 mg every 12 hours CrCl <15 mL/minute: Do not administer imipenem and cilastatin unless hemodialysis is instituted within 48 hours.
Meropenem	1000 mg IV q8h infusion time: 3h	CrCl >50: No dosage adjustment necessary. CrCl 26 to 50: 1g q12h CrCl 10 to 25: 500 mg q12h CrCl <10: 500 mg q24h
Metronidazole	500 mg PO/IV q8h	No
Minocycline	IV: Initial: 200 mg for 1 dose; Maintenance: 100 mg q12h(maximum: 400 mg daily) Oral: Initial: 200 mg for 1 dose; Maintenance: 100 mgq12h ; more frequent dosing intervals may be used	IV:CrCl ≥80: No dosage adjustment necessary. CrCl <80: Do not exceed 200 mg/day Oral:Immediate release: CrCl ≥80: No dosage adjustment necessary. CrCl <80: Do not exceed 200 mg/day
Nafcillin	I.V infusion 500 mg every 4 h.	No

	For severe infections 1 g q4h	
Nitrofurantoin	Oral 100 mg q12h	CrCl 30-<60:C/I
Piperacillin/tazobactam	4.5 g q6h	For 3.375 g IV q6h renal dosing Traditional, 30 minute infusion CrCl 20-40: 2.25 g IV q6h CrCl <20: 2.25 g IV q8h For 4.5 g iv q6h renal dosing CrCl 20-40: 3.375 g IV q6h, CrCl <20: 2.25 g IV q6h
Polymyxin B	IV: Loading dose: 20,000 to 25,000 units/kg, followed by a maintenance dose of 12,500 to 15,000 units/kg every 12 hours	No adjustment
Teicoplanin	IV: 6 to 12 mg/kg q12h 3 to 5 doses. Maintenance: IV or IM: 6 to 12 mg/kg once daily to achieve targeted trough concentration	CrCl 30-80 mL/min): maintenance dose 6-12 mg/kg q48h CrCl <30 : 6-12 mg/kg q72h
Tigecycline	100 mg loading ng dose f/b 50 mg q12h	No dosage adjustment
Valganciclovir	Treatment, induction 900 mg PO q12h Treatment, maintenance 900 mg PO q24h	Treatment, induction CrCl 40-59: 50% PO same interval CrCl 25-39: 50% PO q24h CrCl 10-24: 50% PO q48h CrCl <10: Use is not recommended. Treatment, maintenance CrCl 40-59: 50% PO same interval CrCl 25-39: 50% PO q48h CrCl 10-24: 50% PO twice weekly CrCl <10: Use is not recommended.
Vancomycin IV	Standard: 15-20 mg/kg IV q8h or 500 mg q6h Consider loading dose in critically ill patients of 25 mg/kg x1dose	CrCl >90-<130 : 15-20 mg/kg q8h to q12h CrCl 50-90 : 15-20 mg/kg q12h CrCl 15-<50 : 10-15 mg/kg q24h CrCl <15 : 10-15 mg/kg q48h to q72h

INSTITUTE ANTIBIOGRAM 2022 -2023

- An antibiogram is an overall profile of an antibiotic susceptibility testing results of a specific microorganisms to a battery of antimicrobial drugs.
- CLSI recommends annual or quarterly revision of antibiograms

Antibiogram of isolated from Gram positive and negative organisms various samples in OPD setting:

Organism Gram positives	%Sensitivity									
	Cefoxitin /Ampicillin	Ciprofloxacin	Clindamycin	Erythromycin	Linezolid	Teicoplanin	Tetracycline	Cotrimoxazole	Vancomycin	High level Gentamicin
Staphylococcus aureus	47.3	17.7	50.4	9.5	**99.5**	**90**	**81.4**	76.2	**100**	--
Enterococcus faecalis	**89.7**	41.1	64.1	-	**100**	**95.8**	--	--	**95.5**	56.8

Organism		%Sensitivity													
	Amikacin	Cefotaxime	Cefepime	Ceftazidime	Ceftriaxone	Ciprofloxacin	Ertapenem	Imipenem	Levofloxacin	Meropenem	Minocycline	Piperacillin tazobacta	Cotrimoxazole	Fosfomycin	Nitrofurantoin
Escherichia coli	**86**	60	--	50	24	19	74	**89**	24	**92**	**100**	64	42	**97**	70
Klebsiella pneumoniae	58	42	--	20	22	20	62	67	34	71	--	42	41	--	--
Enterobacter aerogenes	75	58	--	--	50	36	--	**83**	**83**	**92**	**100**	42	50	--	--
Pseudomonas aeruginosa	67	--	71	68	--	--	--	**80**	**--**	**--**	**--**	**88**	--	--	--

Antibiogram of *Salmonella* isolates in OPD setting:

AMA	Salmonella Typhi	Salmonella Paratyphi A	Salmonella spp.
	n=5	n=0	n=13
Ampicillin	3 / 3 (100)	0 / 0 (0)	11 / 11 (100)
Azithromycin	5 / 5 (100)	0 / 0 (0)	0 / 0 (0)
Cefixime	0 / 1 (0)	0 / 0 (0)	0 / 0 (0)
Cefotaxime	0 / 0 (0)	0 / 0 (0)	1 / 1 (100)
Ceftriaxone	2 / 5 (40)	0 / 0 (0)	8 / 8 (100)
Ceftriaxone (Meningitis)	0 / 0 (0)	0 / 0 (0)	0 / 0 (0)
Ceftriaxone (Non-meningitis)	0 / 0 (0)	0 / 0 (0)	0 / 0 (0)
Chloramphenicol	3 / 4 (75)	0 / 0 (0)	12 / 12 (100)
Ciprofloxacin	0 / 5 (0)	0 / 0 (0)	0 / 11 (0)
Levofloxacin	0 / 1 (0)	0 / 0 (0)	0 / 0 (0)
Ofloxacin	0 / 0 (0)	0 / 0 (0)	0 / 0 (0)
Pefloxacin	0 / 1 (0)	0 / 0 (0)	3 / 6 (50)
Trimethoprim-sulfamethoxazole	5 / 5 (100)	0 / 0 (0)	11 / 11 (100)

Antibiogram of Enterobacteriaceae isolated from various samples in IPD setting:

AMA	Escherichia coli	Citrobacter freundii	Citrobacter koseri	Citrobacter spp.	Klebsiella pneumoniae	Klebsiella oxytoca	Klebsiella spp.	Klebsiella (Enterobacter) aerogenes	Enterobacter cloacae	Enterobacter spp.	Hafnia alvei	Serratia marcescens	Proteus mirabilis	Proteus vulgaris	Morganella morganii	Providencia rettgeri	Providencia stuartii
	n=1589	n=2	n=10	n=6	n=909	n=12	n=11	n=5	n=56	n=38	n=0	n=41	n=41	n=1	n=33	n=11	n=13
Amikacin	1091 / 1414 (77.2)	0 / 1 (0)	9 / 9 (100)	4 / 6 (66.7)	307 / 779 (39.4)	5 / 8 (62.5)	5 / 11 (45.5)	3 / 3 (100)	26 / 44 (59.1)	22 / 35 (62.9)	0 / 0 (0)	32 / 39 (82.1)	27 / 38 (71.1)	0 / 0 (0)	29 / 30 (96.7)	6 / 10 (60)	5 / 10 (50)
Cefazolin	0 / 1 (0)	0 / 0 (0)	0 / 0 (0)	0 / 0 (0)	0 / 1 (0)	0 / 0 (0)	0 / 0 (0)	0 / 0 (0)	0 / 0 (0)	0 / 0 (0)	0 / 0 (0)	0 / 0 (0)	0 / 0 (0)	0 / 0 (0)	0 / 0 (0)	0 / 0 (0)	0 / 0 (0)
Cefotaxime	621 / 1387 (44.8)	1 / 1 (100)	7 / 9 (77.8)	3 / 6 (50)	180 / 764 (23.6)	2 / 8 (25)	4 / 11 (36.4)	3 / 3 (100)	15 / 44 (34.1)	11 / 30 (36.7)	0 / 0 (0)	14 / 31 (45.2)	16 / 38 (42.1)	0 / 0 (0)	17 / 29 (58.6)	4 / 10 (40)	3 / 9 (33.3)
Ceftazidime	20 / 67 (29.9)	0 / 0 (0)	1 / 1 (100)	1 / 1 (100)	12 / 76 (15.8)	2 / 2 (100)	1 / 2 (50)	0 / 0 (0)	5 / 11 (45.5)	2 / 5 (40)	0 / 0 (0)	12 / 16 (75)	0 / 1 (0)	0 / 0 (0)	3 / 4 (75)	0 / 1 (0)	2 / 5 (40)
Ceftriaxone	46 / 354 (13)	0 / 0 (0)	3 / 3 (100)	0 / 0 (0)	22 / 236 (9.3)	2 / 2 (100)	2 / 5 (40)	2 / 2 (100)	8 / 18 (44.4)	5 / 10 (50)	0 / 0 (0)	5 / 6 (83.3)	6 / 12 (50)	0 / 0 (0)	8 / 13 (61.5)	1 / 6 (16.7)	3 / 3 (100)
Ciprofloxacin	165 / 1390 (11.9)	0 / 1 (0)	3 / 8 (37.5)	1 / 6 (16.7)	101 / 763 (13.2)	2 / 7 (28.6)	4 / 10 (40)	2 / 3 (66.7)	14 / 43 (32.6)	9 / 31 (29)	0 / 0 (0)	24 / 35 (68.6)	13 / 37 (35.1)	0 / 0 (0)	14 / 30 (46.7)	3 / 10 (30)	5 / 11 (45.5)
Ertapenem	71 / 147 (48.3)	1 / 1 (100)	0 / 0 (0)	0 / 0 (0)	24 / 86 (27.9)	1 / 1 (100)	0 / 1 (0)	0 / 0 (0)	1 / 4 (25)	3 / 5 (60)	0 / 0 (0)	0 / 1 (0)	0 / 0 (0)	0 / 0 (0)	4 / 4 (100)	0 / 0 (0)	0 / 0 (0)
Fosfomycin	665 / 680 (97.8)	0 / 0 (0)	7 / 7 (100)	0 / 0 (0)	138 / 181 (76.2)	1 / 1 (100)	6 / 7 (85.7)	2 / 2 (100)	4 / 4 (100)	3 / 4 (75)	0 / 0 (0)	1 / 1 (100)	5 / 5 (100)	0 / 0 (0)	0 / 4 (0)	3 / 4 (75)	0 / 1 (0)
Imipenem	1102 / 1412 (78)	1 / 1 (100)	9 / 9 (100)	5 / 6 (83.3)	361 / 777 (46.5)	6 / 8 (75)	6 / 11 (54.5)	2 / 3 (66.7)	31 / 44 (70.5)	20 / 35 (57.1)	0 / 0 (0)	30 / 39 (76.9)	32 / 38 (84.2)	0 / 0 (0)	22 / 29 (75.9)	5 / 10 (50)	7 / 11 (63.6)
Levofloxacin	117 / 817 (14.3)	0 / 1 (0)	5 / 6 (83.3)	1 / 4 (25)	105 / 506 (20.8)	1 / 3 (33.3)	3 / 6 (50)	2 / 3 (66.7)	20 / 37 (54.1)	12 / 23 (52.2)	0 / 0 (0)	25 / 32 (78.1)	11 / 29 (37.9)	0 / 0 (0)	12 / 23 (52.2)	1 / 8 (12.5)	5 / 10 (50)
Meropenem	1170 / 1426 (82)	1 / 1 (100)	9 / 9 (100)	5 / 6 (83.3)	370 / 797 (46.4)	5 / 8 (62.5)	6 / 11 (54.5)	3 / 3 (100)	34 / 45 (75.6)	27 / 35 (77.1)	0 / 0 (0)	29 / 38 (76.3)	34 / 38 (89.5)	0 / 0 (0)	27 / 29 (93.1)	5 / 10 (50)	9 / 11 (81.8)
Minocycline	7 / 11 (63.6)	0 / 0 (0)	0 / 0 (0)	0 / 0 (0)	3 / 14 (21.4)	0 / 0 (0)	0 / 0 (0)	0 / 0 (0)	1 / 3 (33.3)	1 / 2 (50)	0 / 0 (0)	0 / 1 (0)	0 / 0 (0)	0 / 0 (0)	0 / 0 (0)	0 / 0 (0)	0 / 1 (0)
Nitrofurantoin	598 / 660 (90.6)	0 / 0 (0)	7 / 7 (100)	0 / 0 (0)	75 / 278 (27)	1 / 1 (100)	3 / 9 (33.3)	1 / 2 (50)	2 / 4 (50)	1 / 7 (14.3)	0 / 0 (0)	0 / 2 (0)	0 / 9 (0)	0 / 0 (0)	0 / 3 (0)	0 / 5 (0)	0 / 1 (0)
Piperacillin-tazobactam	644 / 1407 (45.8)	1 / 1 (100)	8 / 9 (88.9)	4 / 6 (66.7)	195 / 776 (25.1)	4 / 8 (50)	4 / 11 (36.4)	2 / 2 (100)	26 / 44 (59.1)	13 / 35 (37.1)	0 / 0 (0)	21 / 32 (65.6)	31 / 37 (83.8)	0 / 0 (0)	27 / 30 (90)	4 / 10 (40)	5 / 11 (45.5)
Trimethoprim-sulfamethoxazole	229 / 636 (36)	0 / 0 (0)	7 / 7 (100)	0 / 0 (0)	83 / 272 (30.5)	1 / 1 (100)	5 / 9 (55.6)	2 / 2 (100)	3 / 4 (75)	2 / 8 (25)	0 / 0 (0)	2 / 2 (100)	4 / 12 (33.3)	0 / 0 (0)	6 / 9 (66.7)	2 / 7 (28.6)	1 / 1 (100)

Empiric antibiotics as per antibiogram : *Escherichia coli* – Fosfomycin, Meropenem, Nitrofurantoin, Polymyxins; *Klebsiella pneumoniae, Enterebacter spp*- Fosfomycin, Polymyxins; *Citrobacter spp*- Fosfomycin, Meropenem, Imipenem, Piperacillin tazobactam

Antibiogram of *Acinetobacter baumannii* & *Pseudomonas aeruginosa* isolated from various samples in IPD setting:

Susceptibility percentages of *Acinetobacter baumannii* isolated from different specimen (except faeces).

AMA	Blood	LRT	Superficial Infection	Deep Infection	CSF	Urine
	n=76	n=337	n=63	n=50	n=*12	n=*19
Amikacin	18/75 (24)	38/337 (11.3)	5/63 (7.9)	3/50 (6)	*0/12 (-)	*7/19 (-)
Cefepime	7/76 (9.2)	16/330 (4.8)	1/62 (1.6)	2/50 (4)	*0/12 (-)	*6/18 (-)
Ceftazidime	7/76 (9.2)	14/336 (4.2)	0/63 (0)	2/50 (4)	*0/12 (-)	*6/19 (-)
Imipenem	8/76 (10.5)	13/337 (3.9)	5/63 (7.9)	3/50 (6)	*0/12 (-)	*6/19 (-)
Levofloxacin	6/62 (9.7)	14/286 (4.9)	4/49 (8.2)	4/43 (9.3)	*0/12 (-)	*1/7 (-)
Meropenem	8/76 (10.5)	16/337 (4.7)	6/63 (9.5)	4/50 (8)	*0/12 (-)	*8/19 (-)
Minocycline	20/43 (46.5)	89/226 (39.4)	18/35 (51.4)	15/26 (57.7)	*4/9 (-)	*1/2 (-)
Piperacillin-tazobactam	10/76 (13.2)	23/335 (6.9)	2/63 (3.2)	3/50 (6)	*0/12 (-)	*7/19 (-)
Polymixin B	*0/0 (-)	*0/0 (-)	*0/0 (-)	*0/0 (-)	*0/0 (-)	*0/0 (-)

Susceptibility percentages of *Pseudomonas aeruginosa* isolated from different specimen (except faeces).

AMA	Blood	LRT	Superficial Infection	Deep Infection	CSF	Urine
	n=94	n=133	n=78	n=54	n=1	n=173
Amikacin	53/94 (56.4)	78/133 (58.6)	44/78 (56.4)	40/54 (74.1)	*0/1 (-)	101/173 (58.4)
Cefepime	63/90 (70)	63/120 (52.5)	39/69 (56.5)	39/50 (78)	*0/1 (-)	93/152 (61.2)
Ceftazidime	57/94 (60.6)	66/133 (49.6)	45/78 (57.7)	40/54 (74.1)	*0/1 (-)	99/173 (57.2)
Imipenem	67/94 (71.3)	72/133 (54.1)	57/78 (73.1)	42/54 (77.8)	*0/1 (-)	122/173 (70.5)
Levofloxacin	42/88 (47.7)	38/127 (29.9)	24/70 (34.3)	23/49 (46.9)	*0/1 (-)	45/143 (31.5)
Meropenem	66/94 (70.2)	69/133 (51.9)	54/78 (69.2)	40/54 (74.1)	*0/1 (-)	121/173 (69.9)
Minocycline	*0/0 (-)	*0/0 (-)	*0/0 (-)	*0/0 (-)	*0/0 (-)	*0/0 (-)
Piperacillin-tazobactam	65/94 (69.1)	80/132 (60.6)	59/78 (75.6)	45/54 (83.3)	*1/1 (-)	145/173 (83.8)
Polymixin B	*0/0 (-)	*0/0 (-)	*0/0 (-)	*0/0 (-)	*0/0 (-)	*0/0 (-)

Note: CRAB and DTR *Pseudomonas* – Empiric choice - Carbapenems; escalation as per culture and sensitivity report

Antibiogram of Gram positives isolated from various samples:

AMA	All Specimens		
	Sau	MSSA	MRSA
	n=477	n=207	n=270
Cefoxitin	186/443	178/178	8/265
	-42	-100	-3
Ceftaroline	46/55	*10/16	36/39
	-83.6	(-)	-92.3
Ciprofloxacin	77/451	46/200	31/251
	-17.1	-23	-12.4
Clindamycin	233/465	128/200	105/265
	-50.1	-64	-39.6
Daptomycin	*1/1	*0/0	*1/1
	(-)	(-)	(-)
Erythromycin	68/467	34/203	34/264
	-14.6	-16.7	-12.9
Linezolid	465/470	200/203	265/267
	-98.9	-98.5	-99.3
Oxacillin	*3/18	*3/3	*0/15
	(-)	(-)	(-)
Teicoplanin	27/30	*14/16	*13/14
	-90	(-)	(-)
Tetracycline	347/426	152/181	195/245
	-81.5	-84	-79.6
Tigecycline	*18/18	*8/8	*10/10
	(-)	(-)	(-)
Trimethoprim-sulfamethoxazole	364/467	157/202	207/265
	-77.9	-77.7	-78.1
Vancomycin	173/176	68/70	105/106
	-98.3	-97.1	-99.1

AMA	All Specimens (except urine)		Blood		Superficial Infection	Deep Infection
	Enterococcus faecium	*Enterococcus faecalis*	*Enterococcus faecium*	*Enterococcus faecalis*	*Enterococcus faecium*	*Enterococcus faecium*
	n=98	n=34	n=40	n=*17	n=*12	n=*14
Ampicillin	16/83	27/31	6/28	*11/14	*3/12	*2/13
	(19.3)	(87.1)	(21.4)	(-)	(-)	(-)
Daptomycin	*0/1	*1/3	*0/1	*1/3	*0/0	*0/0
	(-)	(-)	(-)	(-)	(-)	(-)
Fosfomycin	*1/1	*0/0	*1/1	*0/0	*0/0	*0/0
	(-)	(-)	(-)	(-)	(-)	(-)
Gentamicin_HL	29/83	22/31	15/28	*10/14	*3/12	*2/13
	(34.9)	(71)	(53.6)	(-)	(-)	(-)
Linezolid	88/93	33/34	35/37	*16/17	*11/12	*12/13
	(94.6)	(97.1)	(94.6)	(-)	(-)	(-)
Penicillin	6/28	*8/15	*5/14	*3/6	*1/2	*0/2
	(21.4)	(-)	(-)	(-)	(-)	(-)
Teicoplanin	49/72	23/27	28/38	*13/16	*4/6	*4/5
	(68.1)	(85.2)	(73.7)	(-)	(-)	(-)
Vancomycin	72/95	27/32	28/38	*11/15	*11/12	*10/14
	(75.8)	(84.4)	(73.7)	(-)	(-)	(-)

Effective antibiotics - **MSSA** -Antistaphylococcal penicillins, Cefazolin, Linezolid, Daptomycin; MRSA – Vancomycin, Daptomycin, Linezolid, Ceftaroline; *E.fecalis* – Ampicillin, Linezolid, Vancomycin, Teicoplanin; *E.faecium* –Daptomytcin, Vancomycin, Linezolid

Antibiogram of ICU of Blood and Respiratory isolates:

Blood – Gram negative and Gram positive isolates

E.coli

Drug	susceptible	Total patients	Susceptibility %
Pip taz	10	28	35.71%
ceftriaxone	1	29	3.4%
cefepime	8	29	27.58%
ciprofloxacin	0	23	0%
levoflox	0	12	0%
cotrimoxazole	4	24	16.6%
gentamycin	16	27	59.25%
colistin	26	26	100%
sulbactam	12	24	50%
amikacin	20	27	74.07%
imipenem	16	26	61.55%
meropenem	21	28	75%
Aztreonam	5	9	63%

Klebsiella pneumoniae

Drug	susceptible	Total patients	Susceptibility %
cefepime	3	33	9%
ceftriaxone	1	25	4%
Pip tazo	2	34	5.8%
ciprofloxacin	2	29	3.7%
cotrimoxazole	9	32	28%
sulbactam	2	33	6%
gentamycin	12	35	34.28%
amikacin	24	37	64.86%
meropenem	7	33	21.21%
imipenem	12	34	35.29%
colistin	32	32	100%

Pseudomonas

Drug	susceptible	Total patients	Susceptibility %
Colistin	11	11	100%
Ceftazidime	4	9	44.44%
Ciprofloxacin	5	10	50%
Gentamicin	7	12	58.33%
Imipenem	6	12	50%
Levoflox	6	11	54.54%
Meropenem	6	12	50%
Amikacin	6	12	50%
Pip tazo	4	12	33.33%
Cefepime	5	10	50%
aztreonam	3	5	60%

Acinetobacter baumannii

Drug	susceptible	Total isolates	Susceptibility %
ceftazidime	0	40	0%
gentamycin	1	41	2.4%
Pip tazo	0	44	0%
sulbactam	11	40	27.5%
meropenem	2	47	4.25%
amikacin	5	44	11.36%
cotrimoxazole	6	45	13.33%
colistin	44	46	95.65%
minocycline	22	43	51.16%
levoflox	5	35	14.28%
Ampi sulbactam	9	23	39.13%

MSSA

Drug	susceptible	Total patients	Susceptibility %
Penicillin	2	6	33.33%
Ciprofloxacin	4	7	57.14%
Levofloxacin	5	8	62.5%
Cefoxitin	8	8	100%
Erythromycin	3	8	37.5
Clindamycin	6	7	85.71
Gentamicin	8	8	100
Vancomycin	4	4	100
Linezolid	8	8	100
Teicoplanin	8	8	100
Cotrimoxazole	7	8	87.5

Enterococcus

Drug	susceptible	Total patients	Susceptibility %
linezolid	35	38	92.1%
teicoplanin	34	38	89.4%
vancomycin	35	39	89.74%
erythromycin	11	34	32.3%
levofloxacin	7	32	21.8%
gentamycin	6	28	21.42%
penicillin	11	35	31.42%
ciprofloxacin	8	36	22.22%
ampicillin	4	13	30.76%

Empiric antibiotic- All gram negative – Carbapenems; ID expert opinion to guide further management.
Ceftazidime avibactam (susceptibility not tested) and polymyxins – Not Empiric antibiotic of choice

Antibiogram of ICU of Blood and Respiratory isolates:

Blood – *Candida species*

Candida

Drug	susceptible	Total patients	Susceptibility %
Amphotericin B	48	53	90.56%
caspofungin	45	52	86.53%
fluconazole	38	50	76%
voriconazole	50	52	96.15%
micafungin	39	42	92.85%

Respiratory – Gram negative isolates

Klebsiella pneumoniae

Drug	susceptible	Total patients	Susceptibility %
Cefepime	13	54	24.07%
ceftriaxone	6	53	11.32%
levoflox	8	37	21.62%
ciproflox	4	24	16.66%
gentamycin	20	52	38.46%
cotrimoxazole	14	51	27.45%
sulbactam	13	41	31.7%
aztreonam	10	22	45.45%
amikacin	26	48	54.16%
meropenem	20	47	42.55%
imipenem	16	43	37.2%
colistin	50	50	100%
Pip tazo	15	47	31.91%

Acinetobacter baumannii

Drug	susceptible	Total isolates	Susceptibility %
ceftriaxone	3	157	1.9%
levoflox	20	162	12.34%
gentamycin	11	183	6.01%
piptazo	10	178	5.6%
sulbacatam	47	142	33.09%
ciproflox	9	135	6.6%
Imipenem	4	149	2.6%
Cefoperazone sulbactum	11	111	9.9%
meropenem	13	185	7.02%
Amikacin	9	165	5.04%
colistin	178	178	100%
minocycline	101	165	61.2%
cotrimoxazole	22	170	12.94%

Pseudomonas

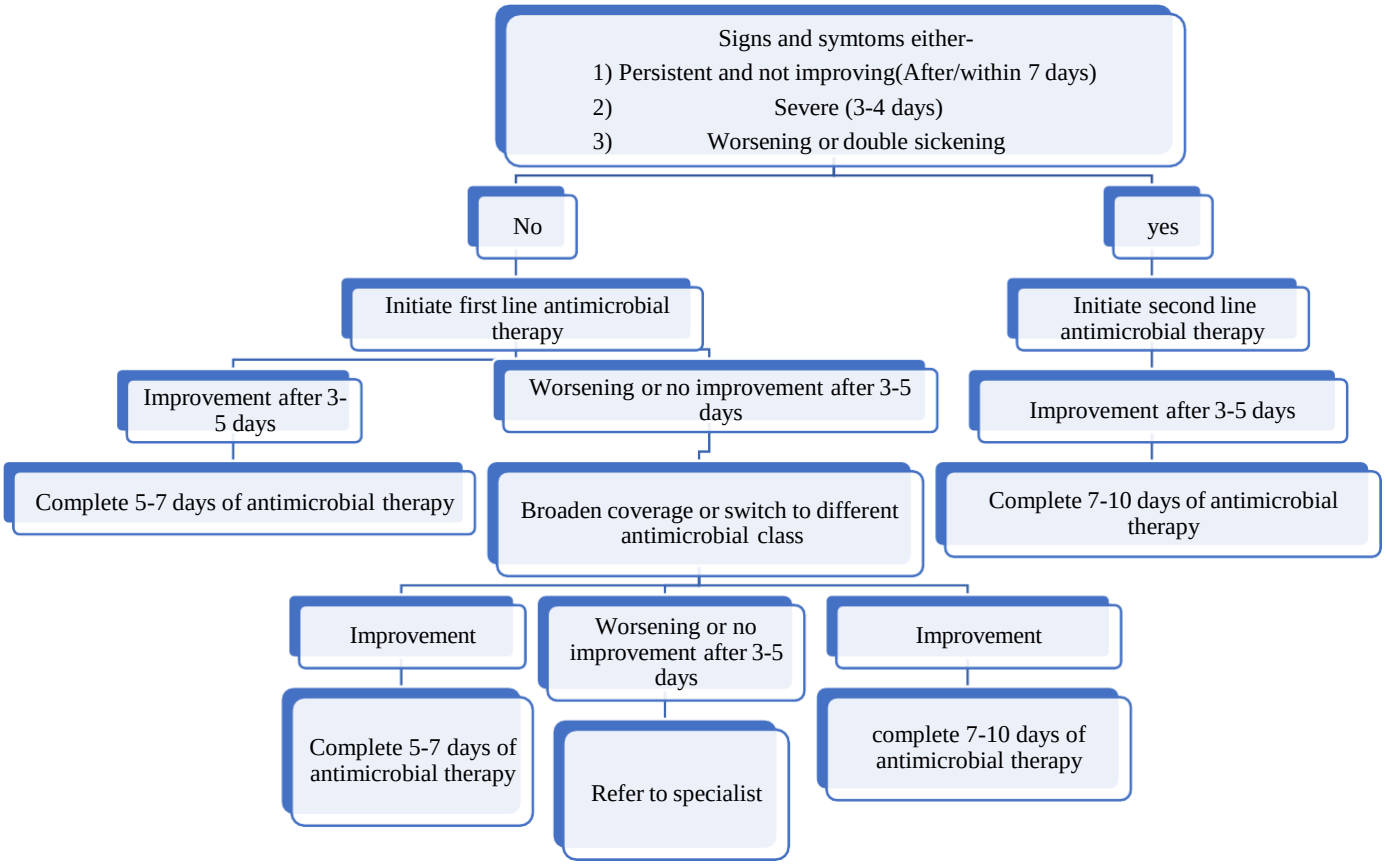
Drug	susceptible	Total patients	Susceptibility %
coistin	27	27	100%
ceftazidime	6	25	24%
ciprofox	8	26	30.76%
gentamycin	13	28	46.42%
Imipenem,	8	29	27.58%
levoflox	6	25	24%
meropenem	8	25	32%
amikacin	12	25	44.44%
Pip tazo	16	27	59.25%
cefepime	10	29	34.48%

Empiric antibiotic- All gram negative – Carbapenems; ID expert opinion to guide further management.
Ceftazidime avibactam (susceptibility not tested) and polymyxins – Not Empiric antibiotic of choice

Syndrome specific Antimicrobial therapy

UPPER AND LOWER RESPIRATORY TRACT INFECTIONS

1. Acute Bacterial Rhinosinusitis



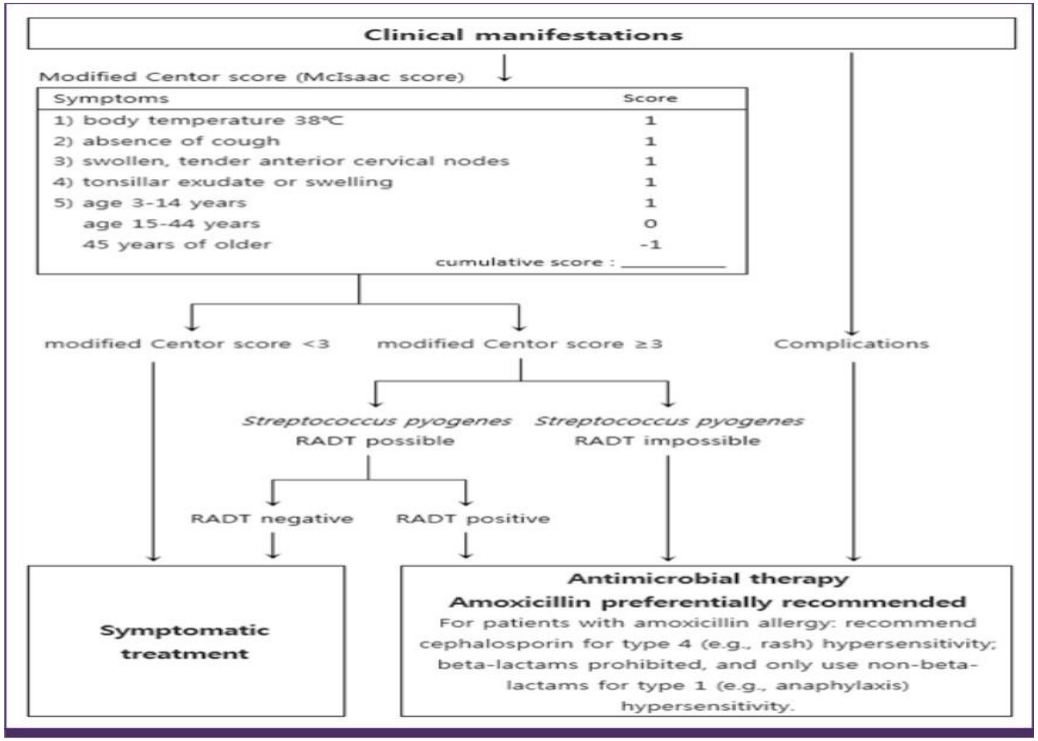
Algorithm showing the management of acute bacterial rhinosinusitis

Antibiotic therapy for ABRS

Preferred	Antibiotic		Dose		Duration
			Adult	Children	
First line	High doses of Amoxicillin Or Amoxicillin clavulanate[$*] OR Penicillin V OR Cephalexin		1000mg Q24H OR 500mg Q8H	50mg/kg(maximum 1000mg) once daily or 25 mg/kg 2- 3 times daily	5-7 days for adults In children 10-14 days
			500mg Q12H/Q6H	If Wt<27 kg 250mg Q12H/Q8H	
				If Wt >27kg 500mg Q12H/Q6H	
			500 mg Q12H/Q6H	20mg/kg Q12H/Q6H	
Alternate therapy In patient's allergic to penicillin	Type 4 Hypersensitivity (eg- Rash)	Doxycycline	200mg Q24H	In children > 8 years 1-2 mg/kg /dose Q12H	

Second line Regimen	**Antibiotic**	**Dose**		**Duration**
		Adult	Children	
Non-Type 1 penicillin allergy	Cefpodoxime + Clindamycin	200mg Q12H+ 300mg Q8H	200mg Q12H +10-25 mg/kg /day Q8H	5-7 days
In type 1 Penicillin allergy	Azithromycin	500mg Q24H	12mg/kg(maximum 500mg) Q24H	3 days
	Clarithromycin	250mg Q12H	7.5mg/kg (maximum 250mg)Q12H	5 days

2. Acute Pharyngitis



Empiric choice:

Sl no	Regimen	Antibiotic	Dose	Duration
1	1st Choice	Benzathine penicillin	1.2 million units Single dose	-
	In case of Type 4 allergy	Cefuroxime/ Cephalexin	500mg Q12H/ 20mg/kg	10 days
2	In case of Type 1 penicillin allergy	Clindamycin/ Azithromycin/ Clarithromycin	7mg/kg/dose Q8H(Max300mg)/ 500mg Q12H/ 500mg Q12H	10 days/5 days/10 days

[Note- Amoxicillin or Amoxycillin-clavulanate should not be used in suspected cases of Infectious mononucleosis

Definitive therapy:

Organism		**Antibiotic**	**Dose**	**Duration**
Streptococcus pyogenes	Without Penicillin allergy	Penicillin V(oral)/ Amoxicillin/ Benzathine Penicillin	250mg/ 50mg/Kg/ 1,20,000U	Q6H for 10 d/ Once daily 10 d/ 1 Dose
	With Penicillin allergy	Cephalexin/ Cefadroxil/ Clindamycin/ Azithromycin/ Clarithromycin	20mg/kg/dose 30mg/Kg 7mg/kg/dose 12mg/kg 7.5 mg/Kg/dose	Q12H for10d Once daily 10d Q8H for 10 d Once daily 5 days Q12H for 10 days

3. Otitis Media/Mastoiditis

1st line	Antibiotics	Dose	Duration
Preferred.	Amoxicillin high dose OR	80-90mg/kg/d	10 days
	Amoxyclav	80-90mg/kg/day+6.4mg/kg/din 2 divided dose	
Alternative	Cefuroxime	30mg/kg/d in 2 divided dose	10 days
	Cefpodoxime	10mg/kg/d in 2 divided dose	10 days
	Ceftriaxone	50mg/kg/IM or IV	3 days

Initial antibiotic	Substitute Antibiotics	Dose	Duration
Amoxicillin	Amoxicillin clavulanate	80-90mg/kg/day+6.4mg/kg/din 2 divided dose	10 days
Amoxicillin clavulanate	Ceftriaxone	50mg/kg/IM or IV	3 days
Ceftriaxone	Clindamycin	30-40mg/kg Q8H	

LOWER RESPIRATORY TRACT INFECTIONS

1. **Acute Bronchitis (Acute bacterial Exacerbation of chronic Bronchitis)**

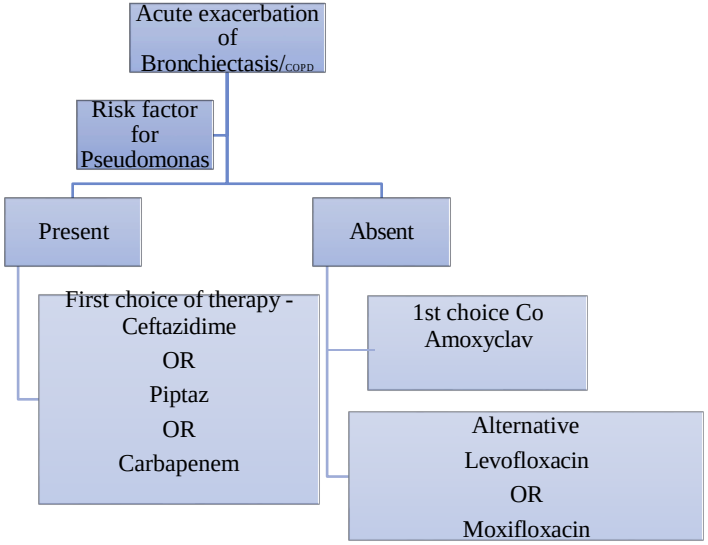
Acute bronchitis in normal healthy adults **should not treated with antibiotics**

When to start antibiotics? - If patients presents with prolonged not improving cough(14 days)

	Antibiotic	Dose	Duration
Empirical	Amoxyclav/Doxycycline^	625mgTDS/875mg Q12H/100mg BD	3- 5 Days
Alternative	Macrolide(Azithromycin/clarithromycin/ Erythromycin or Roxithromycin) Cotrimoxazole	500mg OD	10 days 14 days

[^- Recommended for children more than 8 years]

2. **Acute Exacerbation of COPD and Acute Exacerbation of Bronchiectasis**

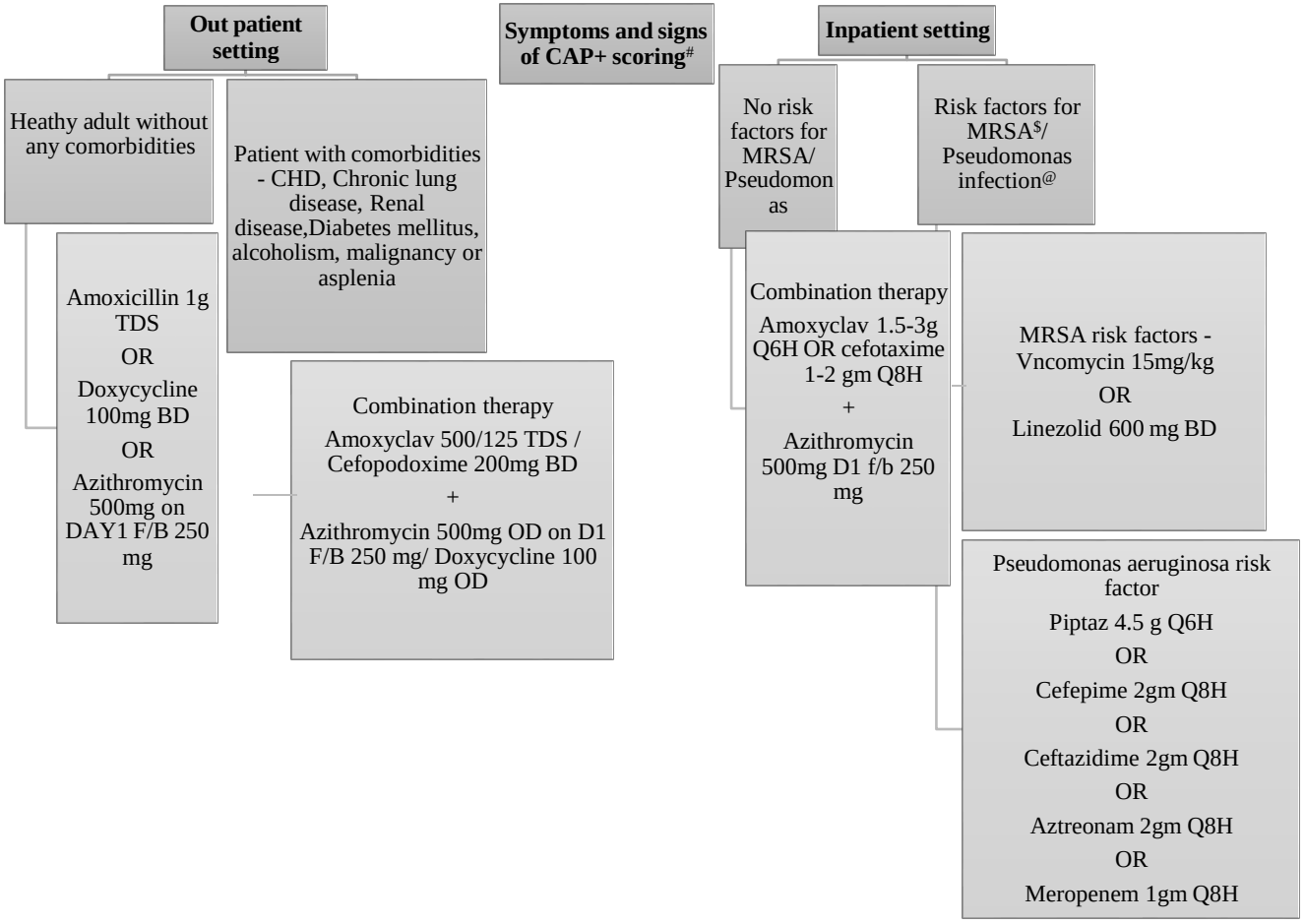


Risk factors for P. aeruginosa (At least 2)

1) Recent hospitalization
2) Frequent (>4 courses per year) or recent administration of antibiotics (last 3 months)
3) Severe disease (FEV1 <30%)
4) Previous isolation of Pseudomonas aeruginosa during an exacerbation or colonised by Pseudomonas aeruginosa

Treatment duration = 5-7 days

3. COMMUNITY ACQUIRED PNEUMONIA



Duration of therapy - 5to 7 days

4. Lung Abscess

Organism responsible	Empiric treatment	Dose	Duration	Alternative Antibiotic	dose	Duration	Surgical intervention
Anaerobes *HiB* *P.aeruginosa* *K. pneumoniae* *Acinetobacter species* *E.coli* *Legionella*	Clindamycin OR	600mg iv Q8H Then 300mg PO Q8H	Iv – till 5-21 days + Oral-28-48 days	Piptaz OR Meropenem	3.375 gm Iv Q6H	3 weeks*	Abscess >6cm OR If symptoms lasts >12 weeks
	Ampicillin Sulbactam	1.5-3gm iv Q6H					
S. aureus (MRSA)	Linezolid OR Vancomycin	600mg Q12H 15mg/kg BW Q12 H					

[*- Antibiotic duration is usually 3 weeks, but varies depending on patient's clinical response]

NOTE- Antibiotic has to be reviewed and modified if fever persists for more than 21 days or persistence of symptoms for more than 6 weeks even after adequate source control

Conditions for de-escalation- When the patient is afebrile, stable and tolerates oral diet.

Drug of choice for de-escalation – Amoxicillin clavulanate per oral

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5. Ventilator Associated Pneumonia

Empiric therapy

Empirical coverage for organism	Empiric treatment		Dose	Duration
Staphylococcus aureus	Linezolid Or Vancomycin		600 mg iv Q12H 15mg/kg(Loading dose-25-30 mg/Kg) iv	7 days
Pseudomonas aeruginosa (DOUBLE ANTIBIOTIC COVERAGE) Beta lactam based antibiotic + Fluoroquinolone or Aminoglycoside	Beta lactam-based antibiotics	Piperacillin tazobactam	4.5gm iv Q6H	
		Ceftazidime Or Cefepime	2gm iv Q8H	
		Imipenem Or Meropenem	500mg IV Q6H 1gm iv Q8H	
		Aztreonam	2gm iv Q8H	
		Ciprofloxacin Or Levofloxacin	400mg iv Q8H 750MG IV Q24H	
		Amikacin Or Gentamicin Or Tobramycin	15-20 mg/kg iv Q24H 5-7 mg/kg iv Q24H 5-7 mg/kg iv Q24H	

Definitive treatment

Organism	Definitive treatment		Dose	Duration
Staphylococcus aureus	Linezolid Or Vancomycin		600 mg iv Q12H 15mg/kg(Loading dose-25-30 mg/Kg) iv	7 days
Pseudomonas aeruginosa (DOUBLE ANTIBIOTIC COVERAGE) Beta lactam based antibiotic + Fluoroquinolone or Aminoglycoside	Beta lactam based antibiotics	Piperacillin tazobactam	4.5gm iv Q6H	
		Ceftazidime Or Cefepime	2gm iv Q8H	
		Imipenem Or Meropenem	500mg IV Q6H 1gm iv Q8H	
		Aztreonam	2gm iv Q8H	
		Ciprofloxacin Or Levofloxacin	400mg iv Q8H 750MG IV Q24H	
		Amikacin Or Gentamicin Or Or Tobramycin	15-20 mg/kg iv Q24H 5-7 mg/kg iv Q24H 5-7 mg/kg iv Q24H	
ESBL producing organism	Imipenem Or Meropenem		500mg IV Q6H 1gm iv Q8H	7 days
	Piperacillin tazobactam[$]		4.5gm iv Q6H	
	Cefepime[$]		2gm iv Q8H	
Acinetobacter species	Meropenem		2g iv Q8H 3hr	7 days
	Ampicillin sulbactam		9gm(6g ampicillin+3g sulbactam) iv Q8H over 4hours	
	Polymyxin		2.5mg/kg L.D over 2hrs Q12H, f/b1.5mf/kg i.v over 1 hourQ12H	

(L.D-loading dose)

CENTRAL NERVOUS SYSTEM INFECTIONS

General recommendations for treatment of CNS infections-

1. CNS infections are medical emergencies, empiric Antimicrobials should be administered with in 1 hour of arrival of the patient.
2. The recommended doses of Antibiotics are higher than usual because 10-20 folds concentration of antibiotics as compared to MIC of organism is needed for optimal results.
3. Once specific organism is identified the therapy should be modified accordingly with consideration of resistance profile.
4. Dexamethasone should be added in dose 0.15 mg/kg, 6 hrly for 4 days, ideally given 20 minutes before the first dose of antibiotic and **not after more than 4 hours** of antibiotics administration.
5. If no pathogen is identified then empiric therapy should be continued for 14 days and patient reviewed after that for further management. Alternative diagnosis should be considered.
6. If high suspicion of viral aetiology is present and bacterial or other infections are ruled out then continuation of only acyclovir may be considered for empiric therapy.
7. For Chronic CNS infections consider ID opinion for diagnostic workup and management.

Indian scenario-

1. Tuberculosis is the most common cause of all (Acute, subacute and chronic) forms of meningitis and meningoencephalitis in adults.
2. Most common bacterial cause is *S.pneumoniae* in adults and children while second most common cause in aduts is *N.meningitedes* and in children is *H.influenzae.*
3. Most common cause of Viral Meningitis/Encephalitis in India is *HSV1/2 and VZV* .

Approach to CNS infections -Algorithm

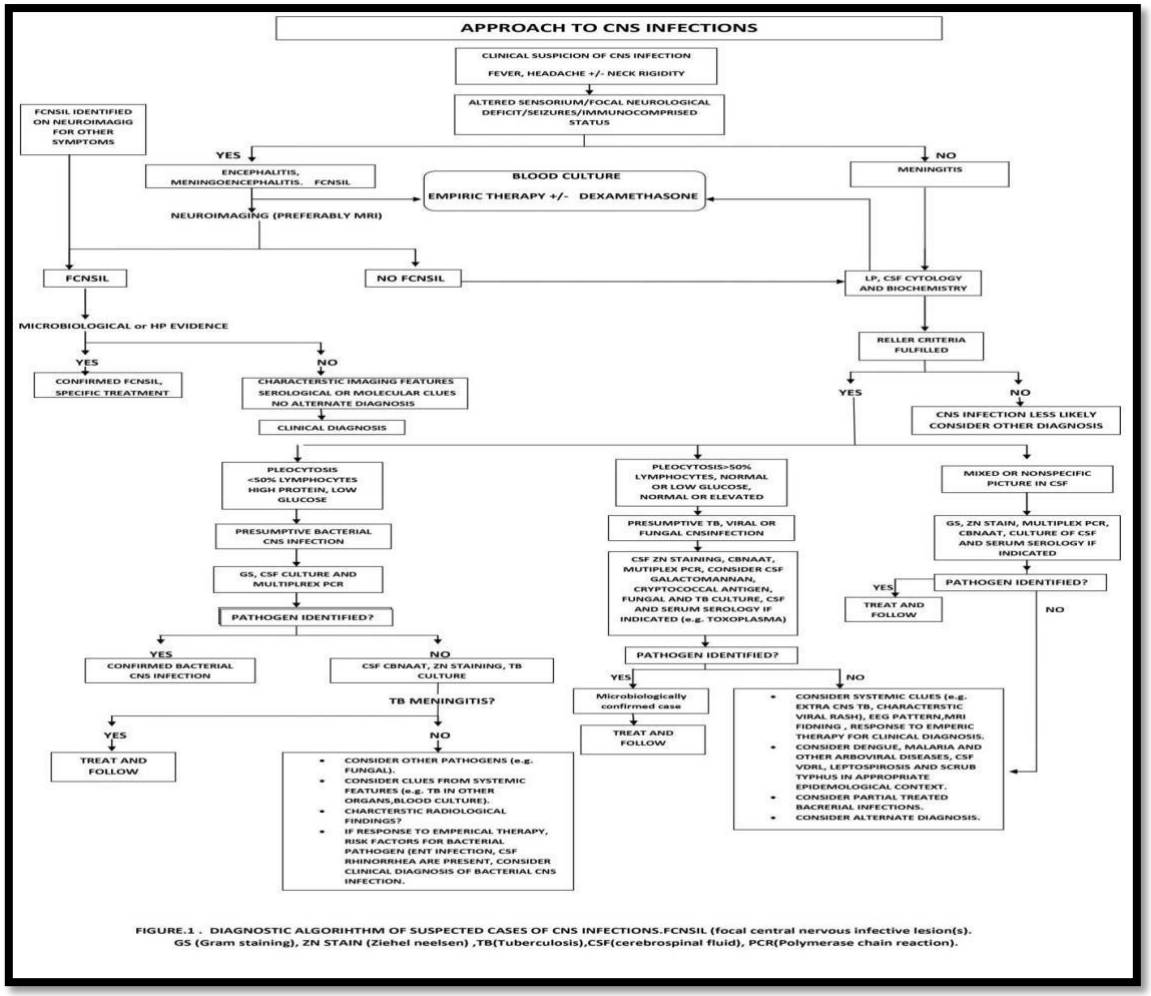

FIGURE.1 . DIAGNOSTIC ALGORIHTHM OF SUSPECTED CASES OF CNS INFECTIONS.FCNSIL (focal central nervous infective lesion(s). GS (Gram staining), ZN STAIN (Ziehel neelsen) ,TB(Tuberculosis),CSF(cerebrospinal fluid), PCR(Polymerase chain reaction).

Acute Meningitis - Common Etiological agents and Empiric treatment-

Profile	Pathogen	Empiric Treatment
<1 month	*Streptococcus agalactiae, Escherichia coli, Listeria monocytogenes, Klebsiella* species	Ampicillin plus Cefotaxime/Ceftriaxone or Ampicillin plus Gentamicin
1–23 months	*Streptococcus pneumoniae, Neisseria meningitidis, S. agalactiae, Haemophilus- influenzae, E. coli*	Vancomycin plus Ceftriaxone/Cefotaxime
2–50 years	*N . meningitidis, S. pneumoniae*	Vancomycin plus Ceftriaxone/cefotaxime
>50 years:	*S. pneumoniae, N. meningitidis, L. monocytogenes,* aerobic gram-negative bacilli	Vancomycin plus Ceftriaxone/cefotaxime plus Ampicillin
Basilar skull fracture	*S. pneumoniae, H. influenzae,* group A beta-hemolytic streptococci	Vancomycin plus Ceftriaxone/cefotaxime
Penetrating trauma	*Staphylococcus aureus,* coagulase-negative *staphylococci,* aerobic gram-negative bacteria.	vancomycin plus ceftazidime, or vancomycin plus meropenem
CSF Shunt/Drain or post Neurosurgical cases	*Staphylococcus aureus,* coagulase-negative *staphylococci,* aerobic gram-negative bacteria,*Propionobacterium acne*	vancomycin plus ceftazidime, or vancomycin plus meropenem
Viral etiology	HSV2/1, VZV, JEnV and other Arboviral , Enterovirus, Adenovirus, CMV	Acyclovir

Definitive treatment for CNS Infections –

Pathogen	Regimen	Alternative	Duration
S. pneumoniae Penicillin MIC <0.1 mg/mL 0.1–1.0 mg/mL > 2.0 mg/mL Cephalosporin (MIC >2 µg/mL)	Ampicillin Ceftriaxone Vancomycin plus Ceftriaxone Vancomycin plus Ceftriaxone	Ceftriaxone Cefepime/Meropenem Vancomycin plus Moxifloxacin/Levofloxacin Vancomycin plus Levofloxacin/ Moxifloxacin/	10-14 Days
Neisseria meningitidis Penicillin MIC >0.1 mg/mL 0.1–1.0 mg/mL	 Ampicillin Ceftriaxone	 Ceftriaxone Meropenem/Cefepime	7 Days
Listeria monocytogenes	Ampicillin	Co-trimoxazole ,Moxifloxacin, Meropenem,Linezolid	21 Days
H.influenzae β-Lactamase (-) β-Lactamase (+)	 Ampicillin Ceftriaxone, Cefotaxime	 Ceftriaxone/Cefotaxime Meropenem/Cefepime	7-10 Days
S. agalactiae	Ampicillin	Ceftriaxone, Cefotaxime	14-21 Days
***E. coli* other Enterobacteriaceae**	Ceftriaxone, Cefotaxime	Aztreonam, Meropenem, Cotrimoxazole, Moxifloxacin/Levofloxacin	21 Days
Pseudomonas aeruginosa	Cefepime or Ceftazidime	Aztreonam, ciprofloxacin Meropenem	21 Days
S.aureus* or *CONS Methicillin sensitive Methicillin resistant Vancomycin resistant	 Flucloxacillin Vancomycin Linezolid	 Vancomycin, Linezolid, DaptomycinLinezolid, Daptomycin Daptomycin, Rifampicin(combination)	>14 Days
Propionibacterium acne	Ampicillin	Ceftriaxone	10-14 Days

Daily Dosage and Frequency of antibiotics in patients with normal Liver and Renal functions.

Drug	Age: 7days	Age:8-28days	Infants and children	Adults
Amikacin	15–20 mg/kg (12)	30 mg/kg (8)	20–30 mg/kg (8)	15 mg/kg (8)
Ampicillin	150 mg/kg (8)	200 mg/kg (6–8)	300 mg/kg (6)	12 g (4)
Aztreonam	-	-	-	6–8 g (6–8)
Cefepime	-	-	150 mg/kg (8)	6 g (8)
Cefotaxime	100–150 mg/kg (8–12)	150–200 mg/kg (6–8)	225–300 mg/kg (6–8)	8–12 g (4–6)
Ceftazidime	100–150 mg/kg (8–12)	150 mg/kg (8)	150 mg/kg (8)	6 g (8)
Ceftriaxone …	-	-	80–100 mg/kg (12–24)	4 g (12–24)
Gentamicin	5 mg/kg (12)	7.5 mg/kg (8)	7.5 mg/kg (8)	5 mg/kg (8)
Meropenem	-	-	120 mg/kg (8)	6 g (8)
Moxifloxacin	-	-	-	400 mg
Flucloxacillin	75 mg/kg (8–12)	150–200 mg/kg (6–8)	200 mg/kg (6)	9–12 g (4)
Flucloxacillin	75 mg/kg (8–12)	150–200 mg/kg (6–8)	200 mg/kg (6)	9–12 g (4)
Penicillin G	0.15 mU/kg (8–12)	0.2 mU/kg (6–8)	0.3 mU/kg (4–6)	24 mU (4)
Rifampicin	-	10–20 mg/kg (12)	10–20 mg/kg (12–24)	600 mg (24)
Vancomycin	20–30 mg/kg (8–12)	30–45 mg/kg (6–8)	60 mg/kg (6)	30–45 mg/kg (8–12)
Metronidazole	15mg/kg loading then 20-25mg/kg(8)	15mg/kg loadingthen 30mg/kg(8)	30mg/kg(8)	7.5mg/kg(6)
Clindamycin	-	-	30-40mg/kg(6-8)	2400-4800mg(6)
Sulfadiazine	-	-	120-150mg/kg(6)	4-6g(6)
Trimethoprim sulfamethoxazole	-	-	15-20mg/kg(6-12) (TMP component)	10-20mg/kg(6-12) (TMP component)

Management of Brain Abscess

Predisposing condition, Aetiology and empiric therapy-

Predisposing condition	Common Pathogen	Empiric therapy
Otitis media/ mastoiditis	Anaerobic and aerobic *Streptococci, Bacteroids and Prevotella, Enterobacteriacea*	Metronidazole plus Ceftriaxone/Cefotaxime
Sinusitis	Anaerobic and aerobic *Streptococci, Bacteroids, Entrobacteriacea,S.aureus, Haemophilus spp*	Metronidazole plus Ceftriaxone/Cefotaxime
Dental infections	Mixed *Fusobacterium, Prevotella, Actniomycosis Streptococci, Enterobacteriacea*	Metronidazole plus Ceftriaxone/Cefotaxime
Penetrating Trauma/Post surgical	*S.aureus,Streptococci,Enterobacteriacea, Clostridium spp*	Vancomycin plus Ceftriaxone/Cefepime
Lung abscess/ Empyema Bronchiectasis	*Fusobacterium, Actniomycosis, Bacteroids, Prevotella, Streptococci, Nocardia*	Ceftriaxone plus Metronidazole plusCo-Trimoxazole
Bacterial Endocarditis	*S.aureus, Streptococci*	Vancomycin plus Cefepime/Meropenam
Congenital heart diseases	*Streptococci, Haemophilus spp*	Ceftriaxone/cefotaxime
Immuno-compromised states/HIV	*Nocardia,Mycobacterium,Toxoplasma,Mucorales Aspergillus,Listeria, Cryptococcus,, Candida*	ID consultation

Specific therapy and Duration :

Subdural empyema, Epidural abscess, Suppurative thrombophlebitis

Condition	Predisposing Factors	Common Pathogen	Management
Subdural empyema	Otorhinological infections,decubitus ulcers and paraspinal infections,Lumbar puncture, skull and spinal trauma, neurosurgical and spinal procedures,prexisting hemetoma, complication of meningitis, Injectable drug users, Infective endocarditis	Aerobic and anaerobic Streptococci, Staphylococci, aerobic gram negative, mixed infections	**Primarily Surgical with Empiric Ceftriaxone plus Metronidazole plus Vancomycin. Step-down to definite therapy on basis of gram stain and culture. Ceftazidime/Meropenam should be considered in empiric therapy if risk of resistant aerobic gram negative or Pseudomonal infection is suspected. Duration: 3-6 week**
Epidural Abscess	Oral and Otorhinological infections,decubitus ulcers and paraspinal infections,Lumbar puncture, skull and spinal trauma, neurosurgical and spinal procedures,prexisting	Aerobic and anaerobic Streptococci, Staphylococci, aerobic gram negative, mixed infections	**Combined Surgical and medical management Empiric therapy with Ceftriaxone plus Metronidazole plus Vancomycin.**
Suppurative Thrombophlebitis	**Oral, Facial and Otorhinological infections, as a complication of other CNS infections**	**Staphylococcus aureus (60-70%) specially following facial infections. Staphylococcus Streptococci, Anaerobes and Gram negative aerobes in cases with otorhinological infection.**	**Empiric therapy with Ceftriaxone plus Metronidazole plus Vancomycin With anticogulation for 7 days. Definite therapy can be started on basis of blood culture and pus culture from primary lesions. Duration:3-4weeks**

Organism	Standered Therapy	Alternative	Duration
Actinomyces spp	Ampicillin/ Penicillin	Ceftriaxone/clindamycin	**3 -12 months**
Bacteroides fragilis	Metronidazole	Clindamycin	**12-16 weeks**
Enterobacteriaceae	Ceftriaxone/ Cefotaxime	Aztreonam, Trimethoprim-Sulfamethoxazole, Fluoroquinolone, Meropenem	**12-16 weeks**
Fusobacterium spp.	Metronidazole	Clindamycin, Meropenem	**12-16 weeks**
Haemophilus spp.	Ceftriaxone/ Cefotaxime	Aztreonam, Trimethoprim-Sulfamethoxazole	**12-16 weeks**
Listeria monocytogenes	Ampicillin or PenicillinG	Trimethoprim-Sulfamethoxazole	**12-16 weeks**
Nocardia spp.	Trimethoprim-sulfamethoxazole or Sulfadiazine	Minocycline, Meropenem, Ceftriaxone/ Cefotaxime, Amikacin, Linezolid	**3 -12 months**
Prevotella spp	Metronidazole	Clindamycin, meropenem	**12-16 weeks**
Pseudomonas aeruginosa,	Ceftazidime or Cefepime	Aztreonam Fluoroquinolone, Meropenem	**12-16 weeks**
Staphylococcus aureus Methicillin-sensitive Methicillin-resistant	Flucloxaciliin Vancomycin	Vancomycin Trimethoprim-Sulfamethoxazole, Clindamycin	**12-16 weeks**
Streptococcus anginosus (milleri) group, other streptococci	**Ampicillin /Penicillin G**	**Ceftriaxone/ Cefotaxime, Vancomycin**	**12-16 weeks**

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GASTRO-INTESTINAL INFECTIONS

1. APPROACH TO EMPERIC THERAPY IN DIARRHEA PATIENTS

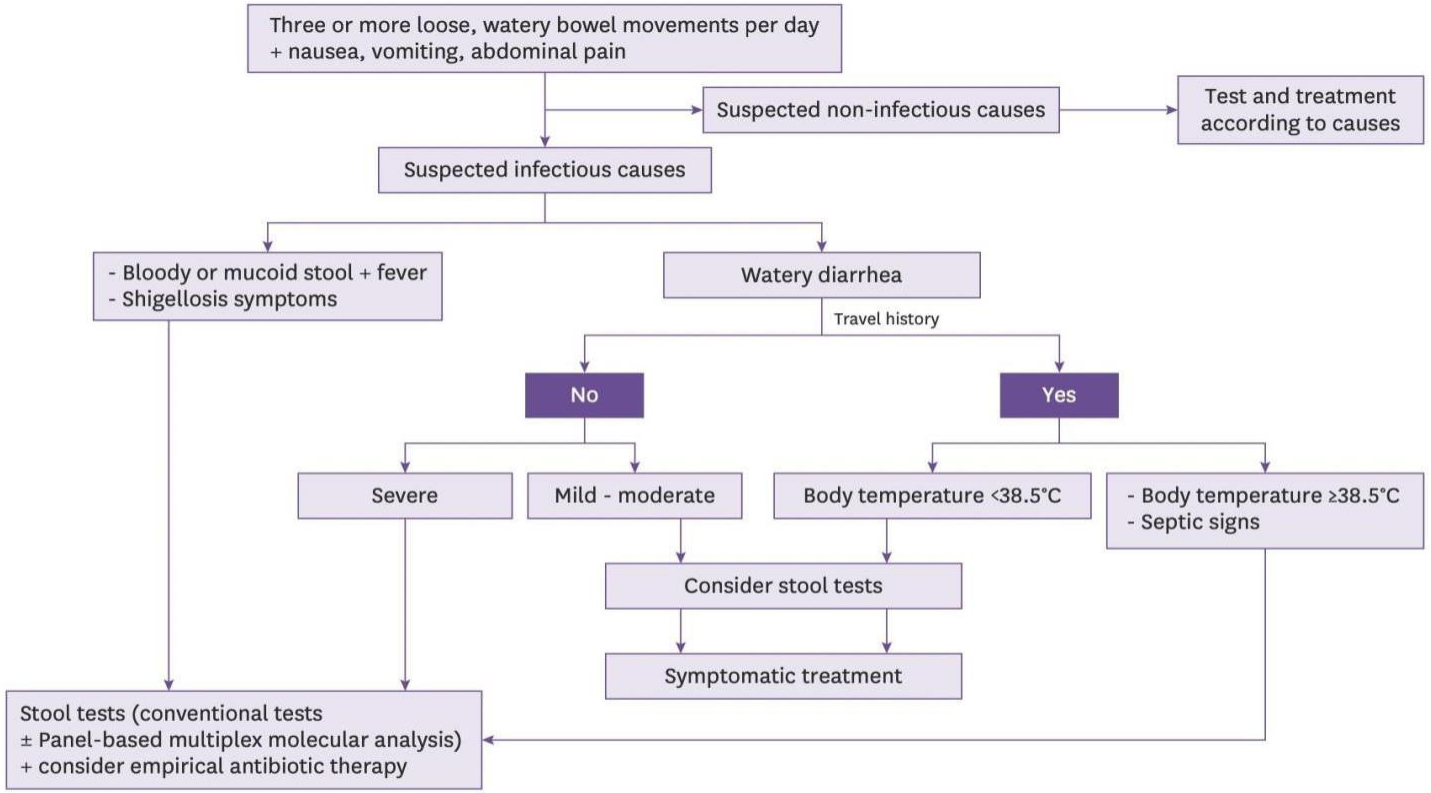

Figure 2. Algorithm for treatment of infectious diarrhea.
- Mild: Diarrhea is bearable, and the patient is capable of travelling or other activities as planned.
- Moderate: Diarrhea interferes planned travels or other activities.
- Severe: Diarrhea interferes with daily activities and prevents planned travels or other activities.

RECOMMENDATIONS FOR EMPIRIC ANTIBIOTICS:

Type of infection	Common organisms	Empiric therapy	Duration of therapy and comments (if any)
Acute gastroenteritis (AGE)	Viral ETEC (Enterotoxigenic E. coli) EPEC (Enteropathogenic E. coli) Non-typhoidal *Salmonella*	None	None Rehydration is essential
AGE due to food poisoning (Depending on the incubation period)			
1-6 hours	*Staphylococcus aureus* *Bacillus cereus*	None None	Ham, poultry, potato or egg salad, mayonnaise, cream pastries Fried rice
8-16 hours	*Clostridium perfringens* *B. cereus*	None None	Beef, poultry, legumes, Gravies Meats, vegetables, dried beans, cereals
>16 hours	*Vibrio cholerae ETEC* *EHEC* *Salmonella spp.* *Campylobacter jejuni* *Shigella spp.* *Vibrio parahaemolyticus*	None None None None None	Shellfish, water Salads, cheese, meats, Water Ground beef, roast beef, salami, raw milk, raw vegetables, apple juice Beef, poultry, eggs, dairy Products Poultry, raw milk Potato or egg salad, lettuce, raw vegetables Mollusks, crustaceans
Cholera	V. cholerae	Doxycycline 300 mg oral (6mg/kg, maximum 300 mg) OR Azithromycin 1gm Oral in children (20 mg/kg) and pregnant women (1gm) Alternative- Ciprofloxacin 500 mg Q12H	Single dose 3 days, Prompt rehydration

Bacillary dysentery	*Shigella spp., Campylobacter spp., Non-typhoidal Salmonella*	Ceftriaxone 2gm iv q24 hrly/ Cefixime 10-15 mg/kg/day OR Ciprofloxacin 500 mg Q12H OR Azithromycin 1gm Q24H (DOC for Campylobacter)	5 days 5 days 3 days 3 days Shiga toxin producing E. coli- no antibiotic recommended
Amoebic dysentery	*Entamoeba histolytica*	Metronidazole 400 mg Oral Q8H OR Tinidazole 2gm Oral Q24H	5 days 3 days
Giardiasis	*Giardia lamblia*	Metronidazole 250-500 mg Oral Q8H OR Tinidazole 2gm Oral	10 days Single dose
Antibiotic associated diarrhea	*Clostridiodes difficile*	Mild to moderate- Metronidazole- 400 mg Oral Q8H Severe and refractory- Vancomycin 125 mg Oral Q6H DOC- Fidaxomicin>Vancomycin, Alternative- bezlotoxumab (recurrent CDI episode within last 6 months) (IDSA)	10 days 10 days
Enteric fever (Outpatients)	*Salmonella* Typhi *Salmonella* Paratyphi A	Cefixime 20 mg/kg/day (maximum 400 mg per day) OR Azithromycin 500 mg Q12H	14 days 7 days
Enteric fever (Inpatients)	*Salmonella* Typhi *Salmonella* Paratyphi A	Ceftriaxone 2gm IV Q12H (Ceftriaxone to be changed to oral cefixime when patient id afebrile to finish total duration of 14 days) OR Azithromycin 500 mg Q12H	14 days 7 days

PATHOGEN SPECIFIC ANTIMICROBIAL THERAPY-

Indication	First choice	alternative	Comments/considerations
Bacteria			
Campylobacter	Azithromycin	Ciprofloxacin	
Clostridiodes difficile	Oral vancomycin	Fidaxomycin	Fidaxomycin (> 18 years) Metronidazole (1st- line children 2nd line- adults)
Non-typhoidal salmonella	Not indicated		Indicated for groups with increased risk of invasive infection – neonates, >50 years age with suspected atherosclerosis, Immunosuppressed patients, Cardiac disease(valvular or endovascular),Significant joint disease
Salmonella enterica **Typhi or Paratyphi**	Ceftriaxone or ciprofloxacin	Meropenem/azithromycin	
Shigella	Azithromycin or ciprofloxacin or ceftriaxone	Ampicillin or cotrimoxazole	Avoid fluoroquinolones if ciprofloxacin MIC ≥ 0.12 µg/mL
Vibrio cholerae	Doxycycline	Ciprofloxacin or Azithromycin or ceftriaxone	
Non-cholera Vibrio	Not indicated if non-invasive Invasive - Ceftriaxone PLUS Doxycycline	- Cotrimoxazole PLUS an Aminoglycoside	
Yersinia enterocolitica	Cotrimoxazole	Cefotaxime or ciprofloxacin	

Parasites			
Cryptosporidium spp	Nitazoxanide (HIV-uninfected, HIV-infected on cART)	Effective ART	
Cyclospora cayetanensis	Cotrimoxazole	Niazoxanide (limited data)	HIV infected patients require higher dose or longer duration of treatment
Giardia lamblia	Tinidazole Nitazoxanide	Metronidazole	Metronidazole is not FDA approved for management of giardiasis. Only to be used if no other option available.
Cystoisospora belli	Cotrimoxazole	Pyrimethamine/Ciprofloxacin Nitazoxanide	
Trichinella spp	Albendazole	Mebendazole	
Fungus			
Microsporidia	Albendazole- after initiation of cART and resolution of signs and symptoms	NA	

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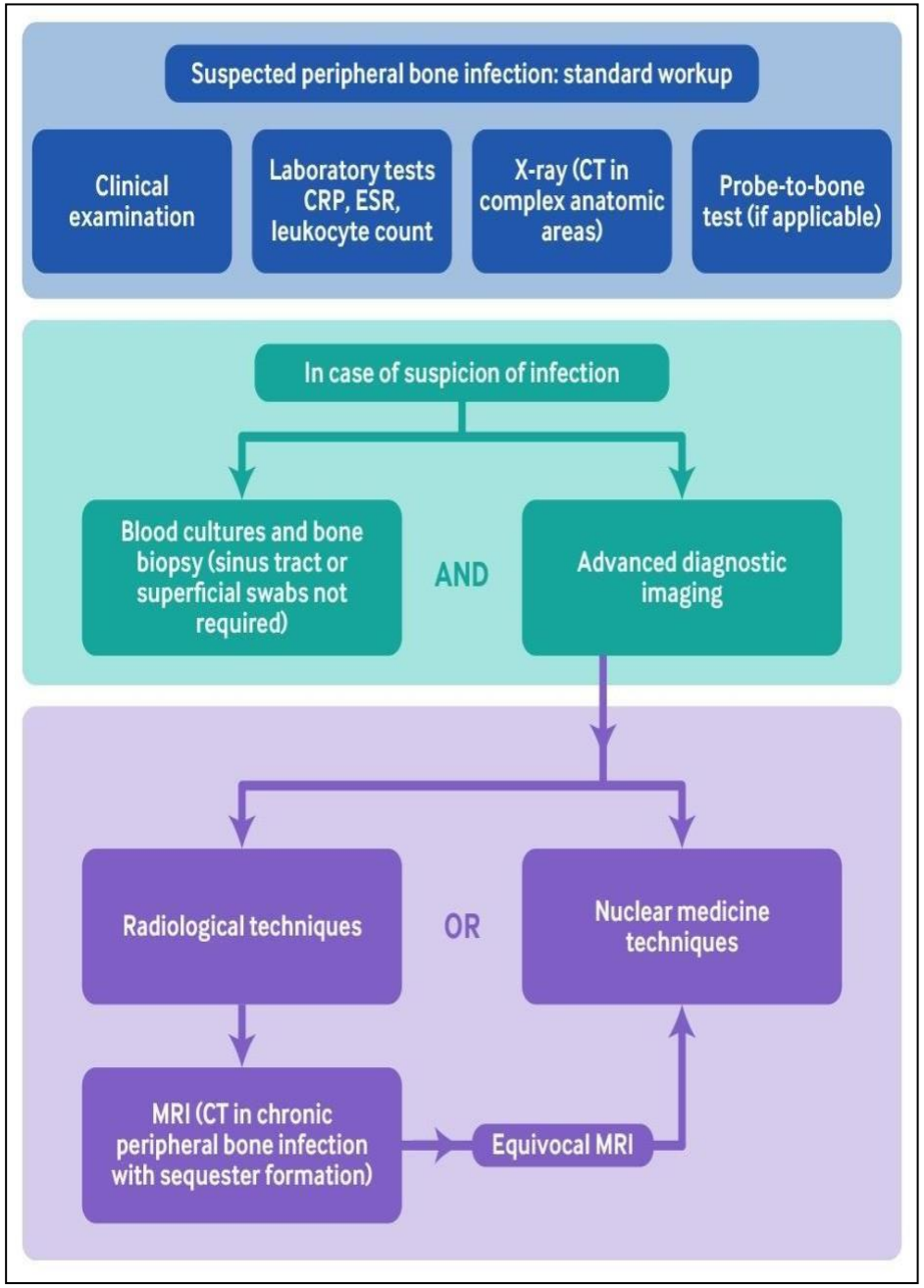
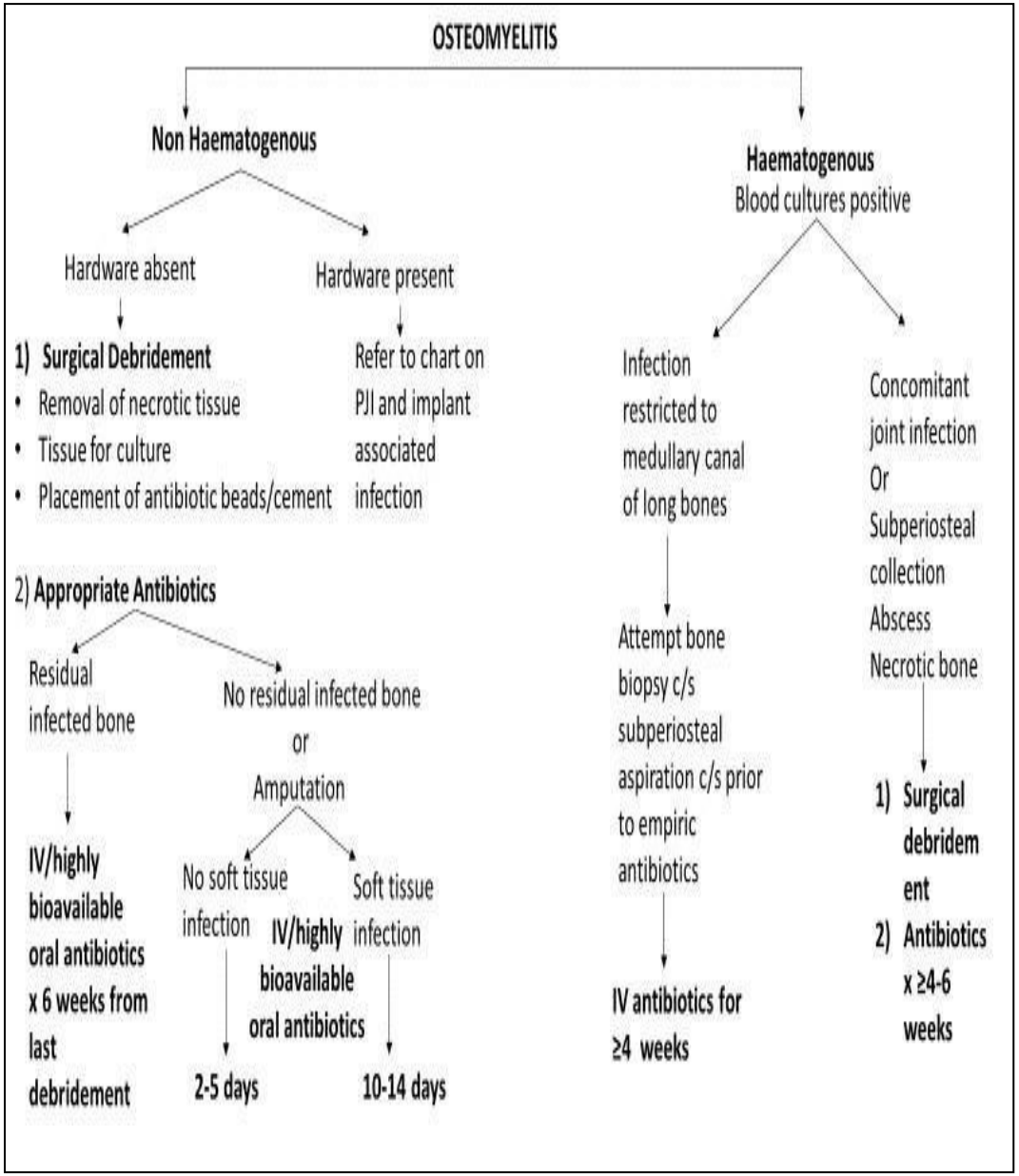
Bone and Joint Infections

Osteomyelitis

Age /Special groups	Common Organisms causing osteomyelitis
Infants	*S aureus* Group B streptococci Aerobic gram-negative bacilli (e.g., *Escherichia coli)* *Candida albicans*
Children 3 months up to 5 years:	*S aureus* *Kingella kingae* (increased incidence in children <4 years) *Group A streptococcus* *Streptococcus pneumoniae* *Haemophilus influenzae* (in those not immunised) *Pseudomonas* (due to foot puncture wounds
Children >5 years	*S aureus* *Group A streptococcus*
Adults	*S aureus* Coagulase-negative staphylococci Aerobic gram-negative bacteria Anaerobic gram-positive *Peptostreptococcus species*
Patients with intravascular devices	*S aureus* Candida species
Patients who misuse intravenous drugs	*S aureus* *Pseudomonas aeruginosa*
Patients with sickle cell disease	*S aureus*,*Salmonella* species
Others	*Brucella , Burkholderia pseudomallei* (melioidosis), and dimorphic fungal infections in endemic areas

Approach to Management





Suggested Empirical regimens for antimicrobial therapy of osteomyelitis

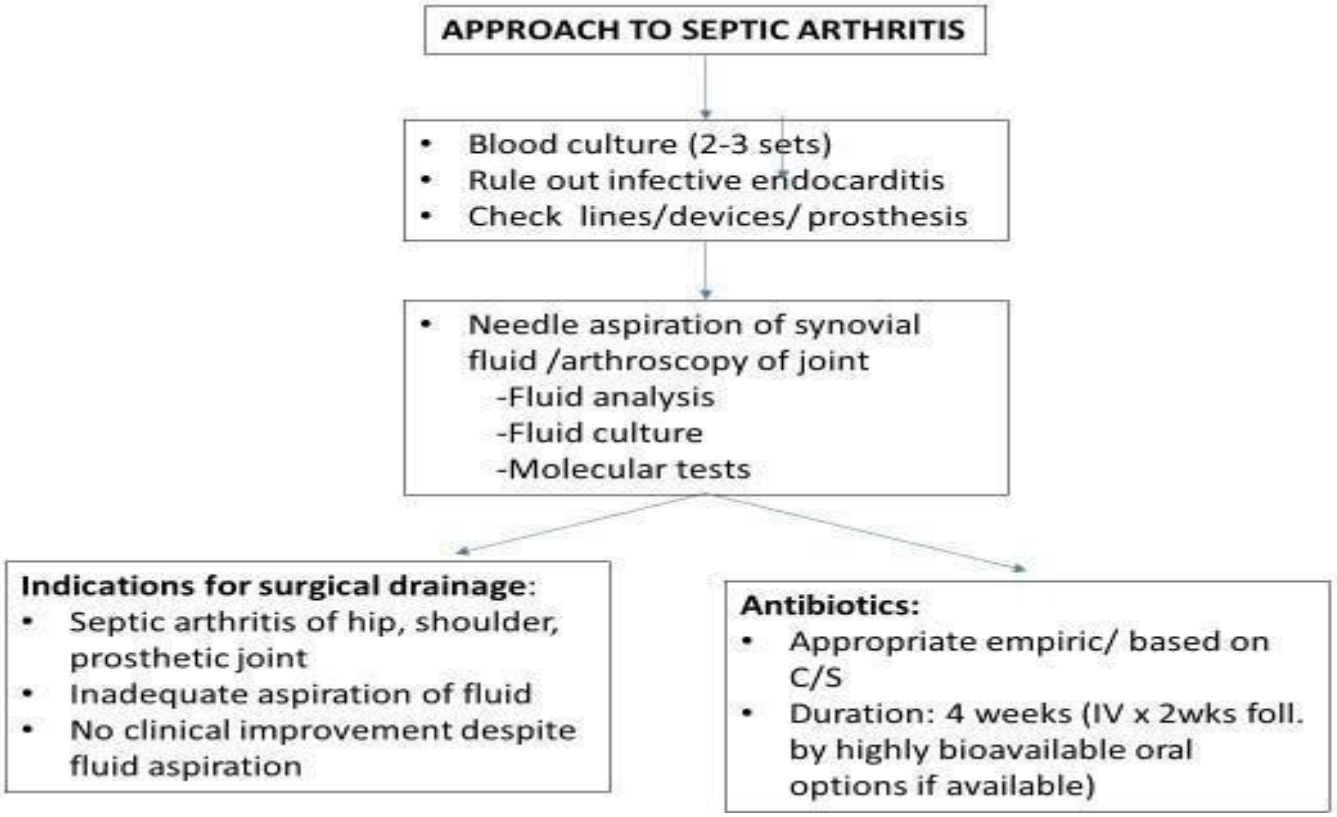
No	Organism	Empirical Antimicrobial regimens
1	Community onset	2.0 g Flucloxacillin or Nafcillin or Cloxacillin every 4 hours or 2.0 g cefazolin every 8 hours +/- [a]2.0 g ceftriaxone every 24 hours +/-[b]Clindamycin (10 mg/kg/dose upto 600 mg every 8 hours)
2	If Risk for MRSA infection -H/O previous MRSA infection -H/O Hospitalisation within 90days	1.0 g Vancomycin every 12 hours or400 mg Teicoplanin every 24 hours (First day every 12 hours) +/-[b]Clindamycin (10 mg/kg/dose up to 600 mg every 8 hours)
3	**Nosocomial or healthcare-associated and high risk for MDR –GNB organisminfection**	1.0 g Vancomycin every 12 hours or 400 mg Teicoplanin every 24 hours (First day every 12 hours) +[a]2.0 g Ceftazidime or Cefepime every 8 hours +/- [b]Clindamycin (10 mg/kg/dose upto 600 mg every 8 hours)

[a]Preceding bacteremia when associated with urinary tract infection or intra-abdominal infection, or in theimmunocompromised or elderly

[b] ≥ 2 systemic inflammatory response syndrome (SIRS)/ Septic shock/Necrotising lung/pleural space infection/Complicated skin/soft tissue/osteoarticular infectionwhich is multifocal and non-contiguous

Definitive Therapy for Osteomyelitis – As per Culture Reports

Septic arthritis of native joint

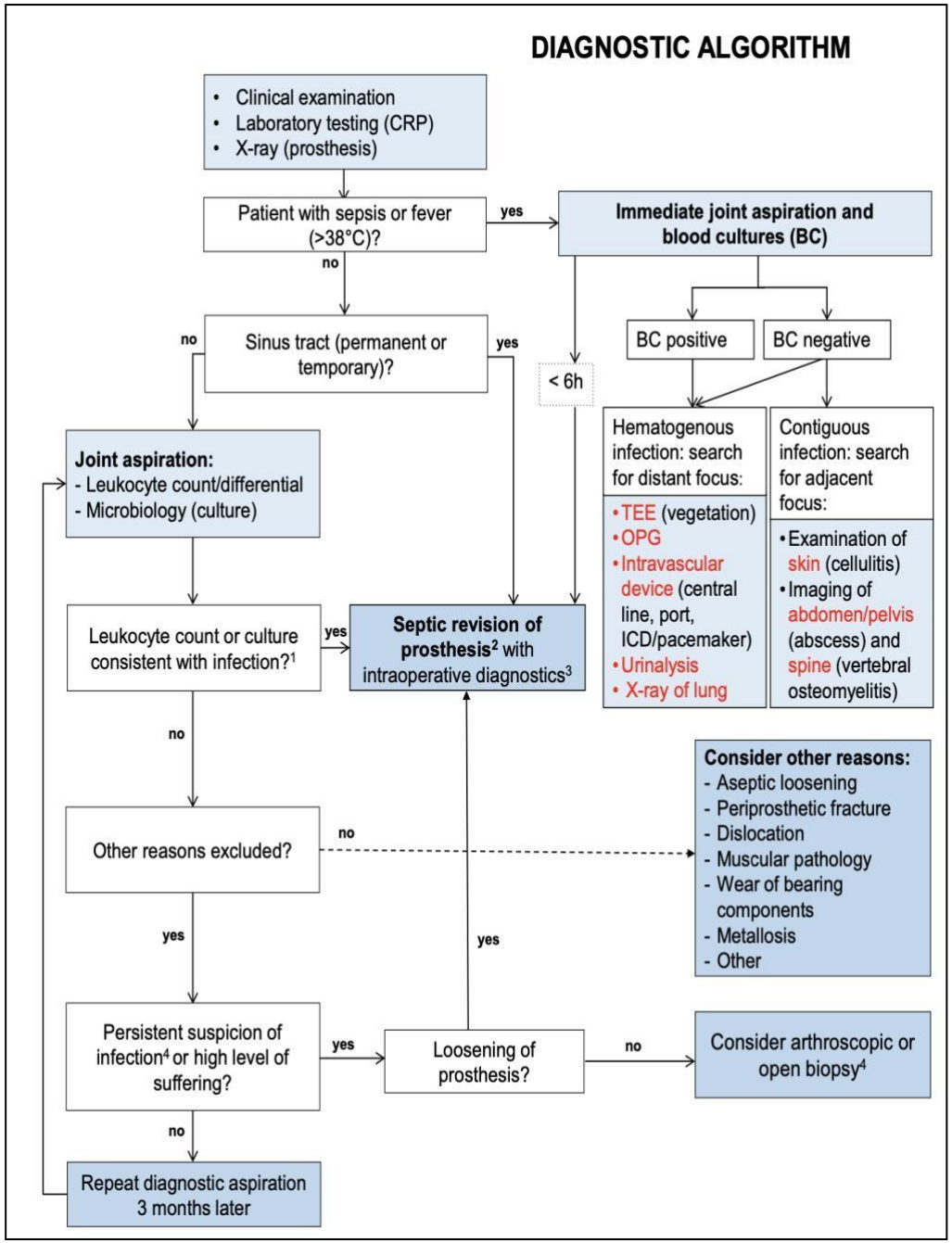


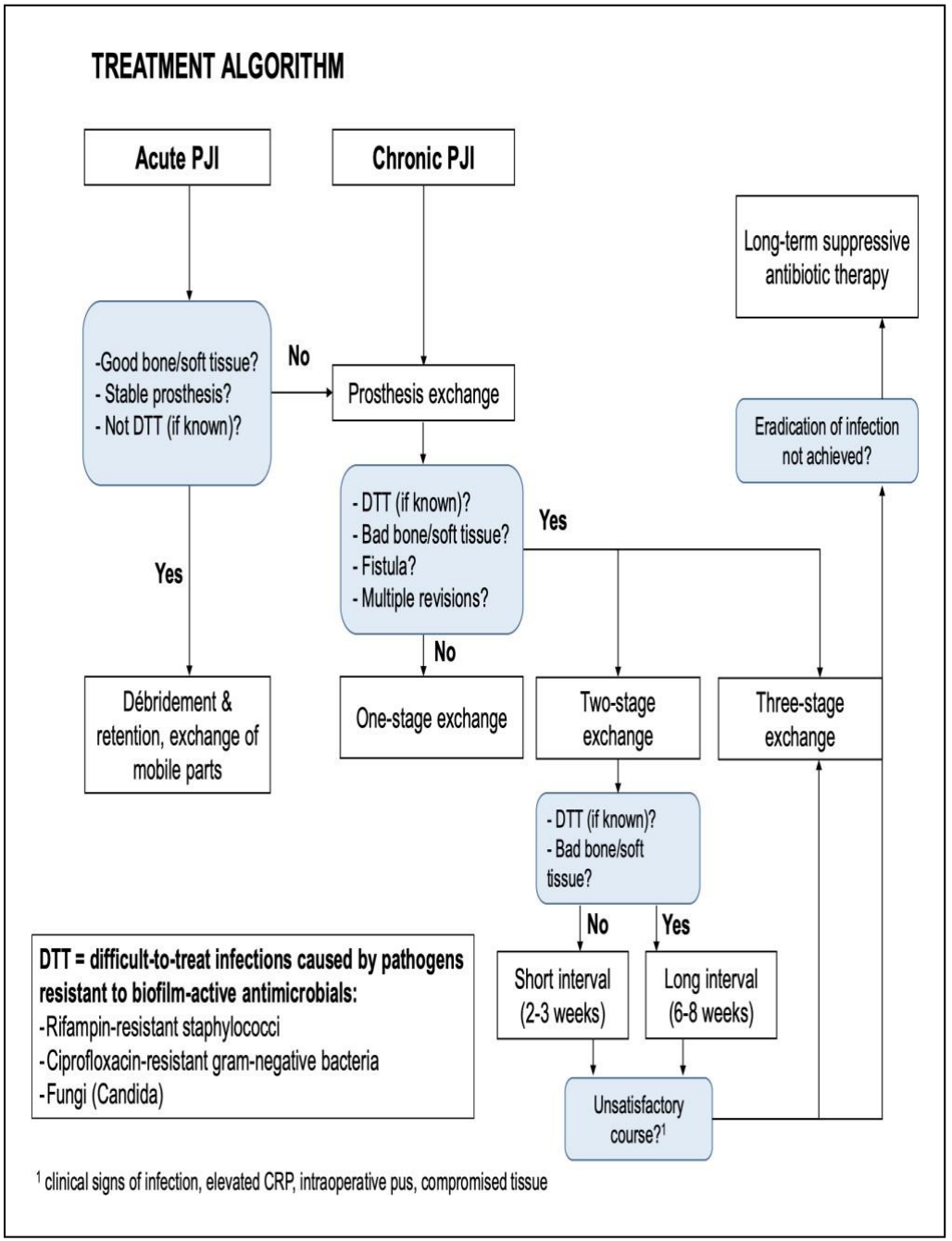
Selection of empirical antimicrobial agents for the treatment of septic arthritis according to risk factor

Risk factors	Antibiotics
No risk factor	2.0 g cefazolin every 8 hours or 1.0–2.0 g nafcillin every 4 hours or 3.0 g ampicillin/sulbactam every 6 hours *with/without gentamicin (5 mg/kg) *If anaphylactic history with penicillin: 1. 0 g vancomycin every 12 hours (trough concentration of vancomycin should be 15–20 μg/mL) or 400 mg teicoplanin every 24 hours (first day 400 mg; every 12-hours loading)
High-risk of gram-negative bacteria infection (elderly, recurrent urinary tract infection, recent abdominal surgery, immunocompromised)	2.0 g ceftriaxone every 24 hours *If allergic to ceftriaxone: 750 mg levofloxacin every 24 hours or 400 mg ciprofloxacin every 12 hours
High risk of methicillin resistant staphylococcus aureus (recent admission into a long-term care facility, foot ulcer)	1.0 g vancomycin every 12 hours (trough concentration of vancomycin should be 15–20 μg/mL) or 400 mg teicoplanin every 24 hours (first day 400 mg; every 12-hours loading)
Possible Neisseria gonorrhoeae (young adult, recurrent sexually transmitted infections, recent gonococcal infection)	1.0 g ceftriaxone every 24 hours (intravenous or intramuscular route)

Classification

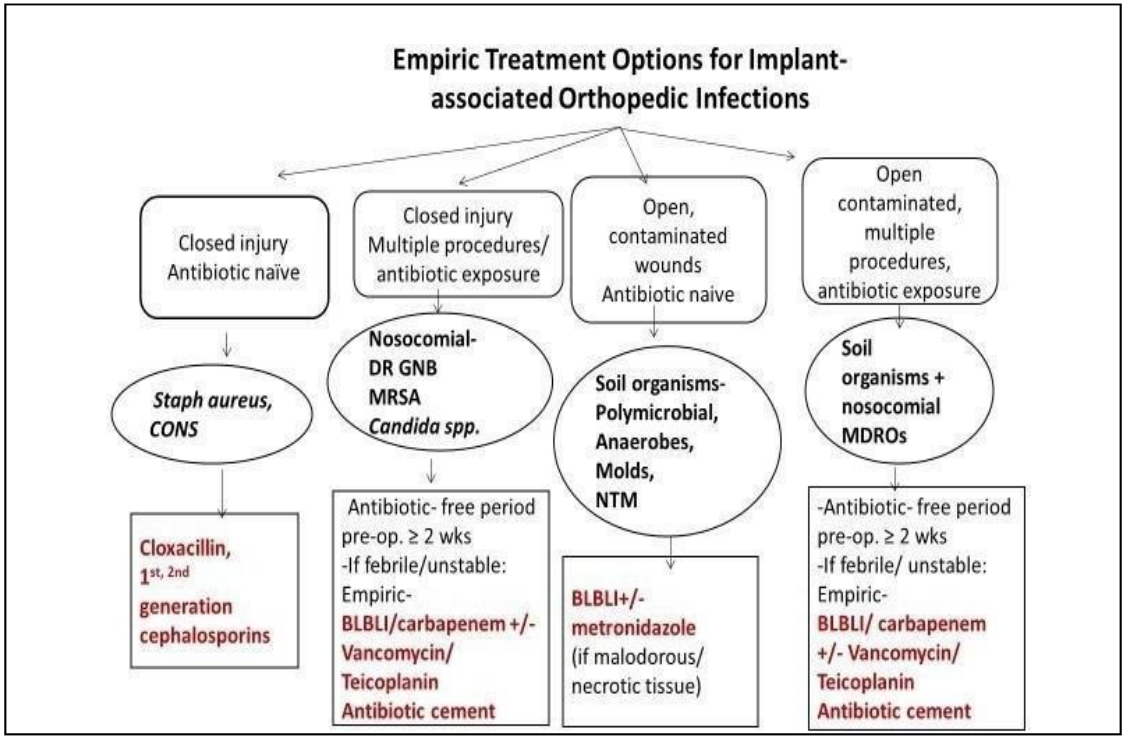
	Acute PJI (immature biofilm)	**Chronic PJI (mature biofilm)**
Perioperative	Early <4 weeks after surgery	Delayed (low-grade) ≥4 weeks after surgery (usually 3 months to 3 years)
Hematogenous or per continuitatem	<3 weeks of symptom duration	≥3 weeks of symptom duration
Clinical features	Acute pain, fever, red/swollen joint, prolonged postoperative discharge (>7-10 days)	Chronic pain, loosening of the prosthesis, sinus tract (fistula)
Causative microorganism	High-virulent: Staphylococcus aureus, gram-negative bacteria (e.g. Escherichia coli, Klebsiella, Enterobacter, Pseudomonas aeruginosa)	Low-virulent: Coagulase-negative staphylococci (e.g. Staphylococcus epidermidis), Cutibacterium (previously Propionibacterium) spp.
Surgical treatment	Débridement & retention of prosthesis (change of mobile parts)	Complete removal of prosthesis (exchange in one, two or more stages)


DIAGNOSTIC ALGORITHM
• Clinical examination
• Laboratory testing (CRP)
• X-ray (prosthesis)
Patient with sepsis or fever (>38°C)?
yes
Immediate joint aspiration and blood cultures (BC)
no
Sinus tract (permanent or temporary)?
no
yes
< 6h
BC positive
BC negative
Hematogenous infection: search for distant focus:
• TEE (vegetation)
• OPG
• Intravascular device (central line, port, ICD/pacemaker)
• Urinalysis
• X-ray of lung
Contiguous infection: search for adjacent focus:
• Examination of skin (cellulitis)
• Imaging of abdomen/pelvis (abscess) and spine (vertebral osteomyelitis)
Joint aspiration:
- Leukocyte count/differential
- Microbiology (culture)
Leukocyte count or culture consistent with infection?[1]
yes
Septic revision of prosthesis[2] with intraoperative diagnostics[3]
no
Other reasons excluded?
no
Consider other reasons:
- Aseptic loosening
- Periprosthetic fracture
- Dislocation
- Muscular pathology
- Wear of bearing components
- Metallosis
- Other
yes
yes
Persistent suspicion of infection[4] or high level of suffering?
yes
Loosening of prosthesis?
no
Consider arthroscopic or open biopsy[4]
no
Repeat diagnostic aspiration 3 months later


TREATMENT ALGORITHM
Acute PJI
Chronic PJI
Long-term suppressive antibiotic therapy
-Good bone/soft tissue?
- Stable prosthesis?
- Not DTT (if known)?
No
Prosthesis exchange
Eradication of infection not achieved?
Yes
- DTT (if known)?
- Bad bone/soft tissue?
- Fistula?
- Multiple revisions?
Yes
No
Débridement & retention, exchange of mobile parts
One-stage exchange
Two-stage exchange
Three-stage exchange
- DTT (if known)?
- Bad bone/soft tissue?
No
Yes
Short interval (2-3 weeks)
Long interval (6-8 weeks)
Unsatisfactory course?[1]
DTT = difficult-to-treat infections caused by pathogens resistant to biofilm-active antimicrobials:
-Rifampin-resistant staphylococci
-Ciprofloxacin-resistant gram-negative bacteria
-Fungi (Candida)
[1] clinical signs of infection, elevated CRP, intraoperative pus, compromised tissue

Empiric Antimicrobial therapy

- As per local antibiogram

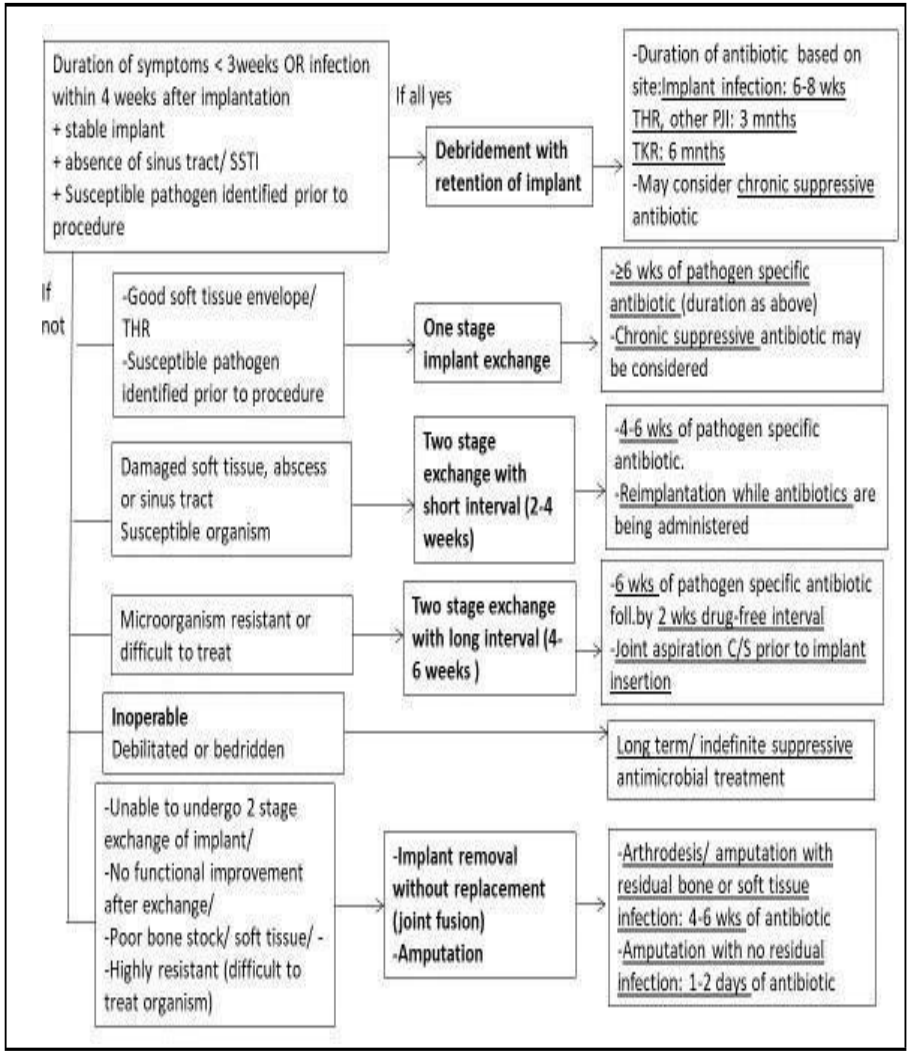


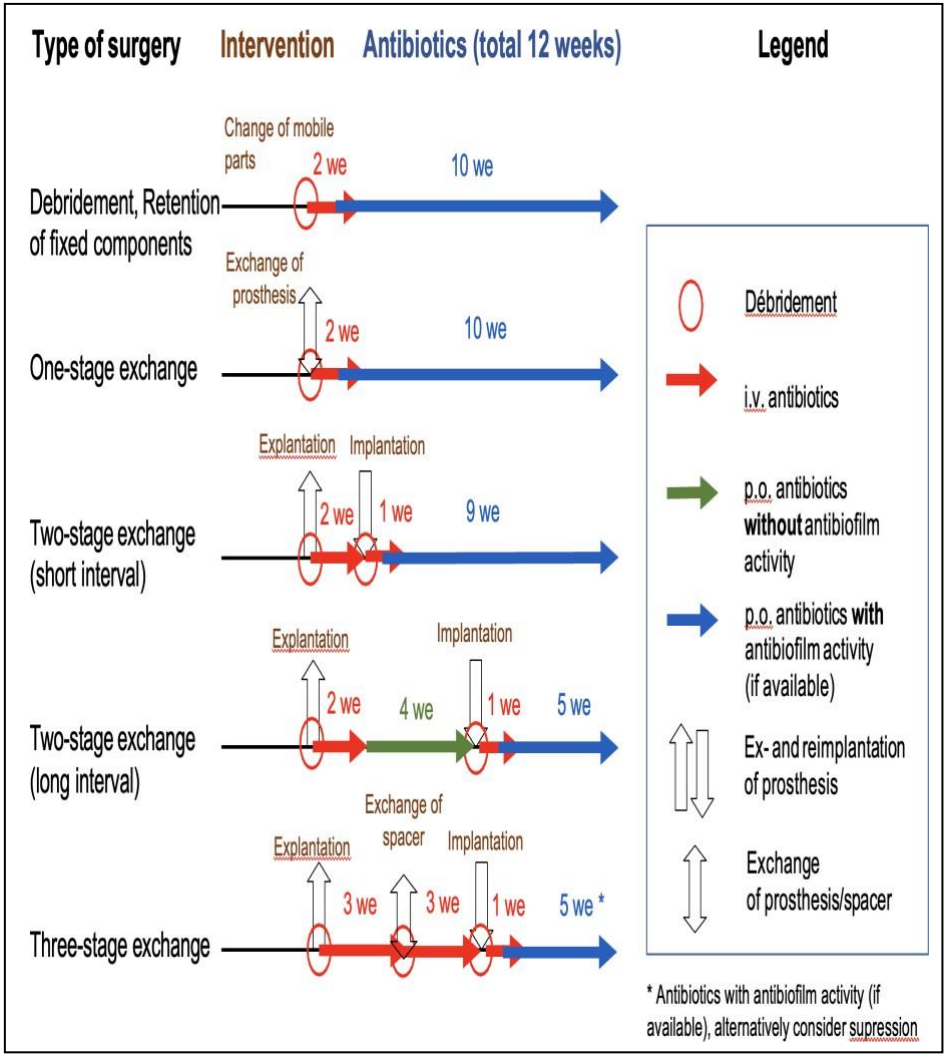
Pathogen-specific Antibiotics :

Organism	Drugs of Choice	Alternative Drugs		Remarks
MSSA	-Cloxacillin -Flucloxacillin -Cefazolin	-Ceftriaxone -Daptomycin		Rifampicin 300-450mg PO/day may be added in presence of hardware Possible antagonism with Betalactams. Best results if along with FQN (FQN use is unlikely in India due to widespread resistance)
MRSA	-Vancomycin -Teicoplanin	-Daptomycin - Linezolid		-Rifampicin 300-450mg PO/day (as above) -High dose of vancomycin used 15-20mg/kg q8-12h (max. 2g/dose) Monitor trough levels, renal function
B-hemolytic Streptococcus	-Penicillin G - Ampicillin -Ceftriaxone	Vancomycin (if immediate hypersensitivity to Pen)		Monitor vancomycin trough levels
Enterococcus spp. *Penicillinsusceptible* *Penicillin resistant*	-Penicillin G - Ampicillin Vancomycin -Teicoplanin	-Vancomycin -Teicoplanin -Daptomycin - Linezolid		-ID Consultation -May use BLBLI (piperacillin-tazobactam) for BLase producers - VRE to be treated as per individual susceptibility (daptomycin, linezolid) are options
Pseudomonas spp.	Ceftazidime Cefepime	Piperacillin-tazobactam Meropenem (for ESBL) Polymyxins		Ciprofloxacin 750mg BD – if susceptible Renal dose adjustment for colistin
Enterobacteriaceae	Beta-lactam based on in vitro susceptibility	Piperacillin-tazobactam Meropenem (for ESBL) Polymyxins		Ciprofloxacin 750mg BD – if susceptible Renal dose adjustment for colistin
Gram negative Anaerobes	Ampicillin +Sulbactam -Metronidazole			Metronidazole need not be added for additional anaerobic cover in presence of BLBLI/ carbapenems

Total duration of therapy: **12 weeks**, usually 2 weeks intravenously, followed by oral route.

Surgical intervention of PJIs





Organism	Antibiotic	Dosage	Chronic Suppression
MSSA	Cloxacillin/ Flucloxacillin Cephalexin	1000 mg TDS/QDS 1000 mg QDS	500 mg TDS 500 mg TDS
MRSA	Linezolid TMP-SMX Doxycycline	600 mg bd 800/160 mg BD 100 mg BD	Linezolid Difficult for a prolonged period 800/160 mg BD 100 mg BD
B- haemolytic Streptococcus	Cephalexin Amoxicillin	1000 mg QDS 500 mg QDS	500 mg TDS 500 mg TDS
Enterococcus spp.	Amoxicillin	500 mg QDS	500 mg TDS
Pseudomonas spp.	Ciprofloxacin	750 mg BD	500 mg BD
Enterobacteriaceae	CiprofloxacinTMP SMX Doxycycline	750 mg BD 800/160 mg BD 100 mg BD	500 mg BD 800/160 mg BD 100 mg BD

Drugs of Choice	Doses
Cloxacillin	2 g q4-6h
Flucloxacillin	2 g q4-6h
Cefazolin	2 g q8h
Ceftriaxone	2-4g q24h
Vancomycin	1 5mg/kg q12h
Teicoplanin	12 mg/kg q12h x 3 doses; foll. by 12 mg/kg/d
Daptomycin	8-10 mg/kg/d (MRSA)
Linezolid	600 mg q12h
Penicillin G	20-24mu/day (divided into 6 doses)
Ampicillin	2 g q4-6h
Ceftazidime	2 g q8h
Cefepime	2 g q 12h
Piperacillin tazobactam	4.5 g q6-8h
Meropenem	1g q8h
Polymyxin	15L IV loading dose, 5L IV q8h
Colistin	9 mU loading dose, 3mU IVq8h
Clindamycin	600-900 mg q8h
Metronidazole	500 mg q8h

Standard doses of antimicrobial agents

LOCAL ANTIMICROBIALS IN BONE CEMENT (PMMA)

(Additionally to systemic antimicrobial treatment)

Situation	Antimicrobials	Fixation cement	Spacer cement
		Dose: per 40 g PMMA cement Black: industrially admixed antimicrobials Red: manually admixed antimicrobials	
Standard situation • susceptible or unknown pathogen(s)	Gentamicin + Clindamycin	1 g 1 g	1 g 1 g (+2 g vancomycin)
Special situations • Oxacillin-/methicillin-resistant staphylococci (MRSE/MRSA) or enterococci	Gentamicin + Vancomycin or + Daptomycin	0.5 g 2 g 2 g	0.5 g 2 g (+2 g[a]) 3 g
• Vancomycin-resistant enterococci (VRE)	Gentamicin + Linezolid or Daptomycin or Fosfomycin-sodium[c]	0.5 g 1 g 2 g 2 g	0.5 (or 1 g)[b] 2 g 3 g 2-4 g
• Resistant gram-negative pathogens (e.g. *E. coli*, *Klebsiella*, *Enterobacter*, *Pseudomonas* spp.)	Gentamicin + Colistin[d] or Fosfomycin-sodium[c] or Meropenem or Ciprofloxacin[e]	0.5 g 5-10 Mio IU 2 g 2 g 2 g	0.5 (or 1 g)[b] 10-20 Mio IU 2-4 g 3 g 3 g
• Yeasts (*Candida* spp.) or molds (e.g. *Aspergillus* spp.)	Gentamicin + Amphotericin B liposomal[f] or Voriconazol	0.5 g 0.2 g[e] 0.2 g	0.5 (or 1 g)[b] 0.4 g[a] 0.4 g[a]

R**eferences:**

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SKIN & SOFT TISSUE INFECTIONS

Skin & soft tissue infections (SSTI), also called skin & skin structure infections refer to various infections that involve skin & underlying layers, ranging from simple skin abscesses to severe necrotising infections.

US FDA has introduced a new term for SSTI in 2018 – ABSSSI – Acute bacterial skin & skin structure infection. ABSSSI is defined as bacterial skininfection with a lesion size are >75cm^2 (area of redness, edema or induration)

Classification

There are diverse classification of SSTI based on clinical presentation & diseases severity.Based

on presentation (IDSA 2014) –

- Purulent (Abscesses, furuncles, carbuncles)
- Non-Purulent (erysipelas, cellulitis, necrotising fasciitis)

Based on severity (IDSA 2014)–

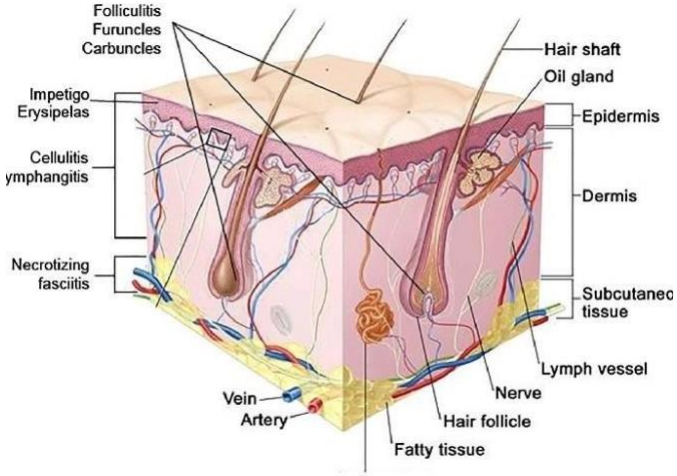
- Mild or uncomplicated SSTI – Only local symptoms (Simple abscesses, impetigo, furuncles). These can be managed by surgical incision alone with or without antibiotics
- Moderate – Local symptoms + comorbidities or systemic signs of infection (Fever, Tachycardia, RR>24 breaths/min, leucocytosis etc). These require surgical + systemic antibiotics
- Severe – Local symptoms + Systemic signs of sepsis These require significant surgical drainage & debridement with systemic antibiotics.

Based on presence of tissue necrosis (IDSA 2014): Necrotising vs non-necrotising infections

Based on management of SSTI (WSES 2015): Surgical site infections (SSI), Non necrotising & Necrotising SSTI

Based on anatomical tissue levels (WSES & SIS-E) :

- Superficial infections : Involves dermis & epidermis : Erysipelas, impetigo, folliculitis, furuncles & carbuncles
- Dermis & subcutaneous : Cellulitis
- Deep infections : Involves fascial or muscle planes – Fasciitis, myonecrosiPP



Principles of Management of SSTI Principles of Diagnosis:

- Swabs are poor quality specimens & MUST be avoided as far as possible
- Typical superficial skin infections like Impetigo, Ecthyma, folliculitis, furuncles, carbuncles, erysipelas & cellulitis don't require sending pus / blood culture routinely
- Cultures in these conditions are recommended when :
    - Malignancy on chemotherapy
    - Neutropenia
    - Severe cell-mediated immunodeficiency
    - Immersion injuries
    - Animal bites
    - Recurrent abscesses
    - Systemic illness
    - Who have failed initial antibiotics treatment
- Cultures – Blood, pus, or deep tissue biopsy (NO SWABS) should be sent in all cases of:
    - Necrotising fasciitis (including fournier gangrene)
    - Pyomyositis
    - Gas gangrene
    - Suspected Anthrax, Erysipeloid, Bacillary Angiomatosis, Glanders, Bubonic Plaque, Tularemia, NTM, Nocardia, Fungal infection

Principles of source control:

- Source control is the most important determinant of any infection including SSTI
- Source control in SSTI consist of:
    - Drainage of infected fluids/pus
    - Debridement of infected soft tissues
    - Removal of infected devices
        - Correction of any anatomical derangement
    - Re-debridement / Re-exploration (every 12-24h) if required until clear margin NSTI
- Surgical debridement MUST be done at the earliest within 6 hours (Early surgical debridement (within 6 hours) was associated with lower mortality(19%) when compared to delayed debridement after 6 hours (32%))

Principles of Antibiotic therapy:

- The goals of treatment of SSTI :
  - Reduce signs & symptoms
  - Eradicate the causative organism
  - Prevent recurrences & avoid complications
- Most SSTI occur in healthy normal skin, hence target organisms of antimicrobial therapy are aerobic gram positive cocci, specifically *S.aureus, streptococci.* Polymicrobial infections can occur in immunocompromised & certain risk factors, where gram negative & anaerobes can be expected tocause infection.
- Purulent Infections:
  - Mild purulent infections can be treated with I & D & do not require routine use of systemic antibiotics
  - Moderate infections require I & D followed by oral antibiotics
  - Severe infections warrant I & D & initial course of intravenous antibiotics followed by oral antibiotics when the patient is hemodynamicallystable
- Non purulent infections:
  - Mild non purulent infections Oral antibiotics
  - Moderate infections initial course of intravenous antibiotics followed by oral antibiotics when the patient is hemodynamically stable
  - Severe infections initial Surgical debridement followed by intravenous antibiotics
- Most of these elaborate exotoxin like Panton valentine leukocidin (PVL), hence addition of protein synthesis inhibitor (anti-toxin effect) like linezolid or clindamycin is preferred in serious necrotising infections
  Note: Clindamycin can be added for antitoxin effect even if resistance is present along with one other active agent & if patient is not on linezolid

- Most of the community acquired strains are MSSA, hence MRSA cover is not necessary in all patients.
- Patients at risk for MRSA Include :
  - Immunocompromised
  - Personal or household contacts with MRSA in past 12 months
  - Prior use of antibiotics for >5days in past 90 days
  - Who do not respond to first-line therapy
  - Prevalence of CA-MRSA >10%
- Antibiotics must be deescalated based on culture reports
- **Oral options for MRSA:** Cotrimoxazole**,** Doxycycline, Clindamycin, Linezolid, Minocycline
- **Intravenous options for MRSA:** Clindamycin, Cotrimoxazole, Vancomycin, Tigecycline, Linezolid, Daptomycin, Ceftaroline

Some of the common skin infections & their management

Type of Infection	Definition	When to suspect	Common organisms	Empiric treatment Outpatient	Empiric treatment Inpatient	Duration of therapy
Impetigo	Superficial skin infection caused by S.aureus & Streptococcus	They begin as erythematous papules that progress to vesicle → pustules → rupture → dried discharge → honey coloured crusts on erythematous base Healing generally occurs without scarring	Bullous impetigo → S.aureus (MSSA) MRSA → Rare Non-bullous impetigo → Streptococcus	Topical Mupirocin or Retapamulin twice daily can be considered Oral antibiotics : Dicloxacillin 250 mg qid Cephalexin 250 mg qid Risk of CA-MRSA: Doxycycline 250 mg qid po Clindamycin 300–400 mg qid po Amoxicillin-clavulanate 875/125 mg bid po Systemic antimicrobials should be used for infections during outbreaks of poststreptococcal glomerulonephritis to help eliminate nephritogenic strains of S. pyogenes from the Community		5 days
Ecthyma	Localised progression of impetigo into dermis caused by S.aureus & Streptococcus	Lesions begin as vesicles that rupture → erythematous ulcers with adherent crusts, often with surrounding erythematous edema	S.aureus & Streptococcus	Topical Mupirocin or Retapamulin twice daily can be considered Oral antibiotics : Choose one of the following: Dicloxacillin 250 mg qid Cephalexin 250 mg qid Doxycycline 250 mg qid po Clindamycin 300–400 mg qid po Amoxicillin-clavulanate 875/125 mg bid po		5 days - 7 days

		Main difference is Ecthyma usually heals with scarring			
Simple abscesses	collections of pus within the dermis and deeper tissues	Painful, tender, and fluctuant red nodules, often surmounted by a pustule and encircled by a rim of erythematous swelling	S.aureus -MC Can be polymicrobial – regional flora from adjacent skin or mucous membrane	Only Incision & drainage Conditions in Which Antibiotic Therapy is Recommended After Incision and Drainage: • Abscess in area difficult to drain completely • Associated comorbidities or immunosuppression • Associated septic phlebitis • Extremes of age • Lack of response to incision and drainage alone • Severe or extensive disease • Signs and symptoms of systemic illness	5 days (Only when indicated)
Inflamed Epidermal cyst	Cyst containing skin flora in cheesy keratinous material		S.aureus Peptostreptococcus Bacteroides species	Incision & drainage Topical Mupirocin or Retapamulin twice daily can be considered Oral antibiotics Choose one of the following: Dicloxacillin 250 mg qid Cephalexin 250 mg qid Doxycycline 250 mg qid po Clindamycin 300–400 mg qid po Amoxicillin-clavulanate 875/125 mg bid po	3-5 days
Folliculitis	Infections of hair follicle with inflammation limited epidermis	Lesions consist of small (2–5 mm), erythematous, sometimes pruritic papules often topped by a central pustule and a fine	S.aureus Rarely: Candida, Pseudomonas aeruginosa, Malassezia furfur, Pityrosporum ovale	Topical Mupirocin or Retapamulin twice daily can be considered Oral antibiotics : Choose one of the following: Dicloxacillin 250 mg qid Cephalexin 250 mg qid Doxycycline 250 mg qid po Clindamycin 300–400 mg qid po	3-5 days

		surrounding collar of desquamation		Amoxicillin-clavulanate 875/125 mg bid po	
Furuncles	Infections of hair follicle with suppuration extending through dermis or subcutaneous	Firm, tender, red nodule that soon becomes painful and fluctuant	S.aureus Rarely: Candida, Pseudomonas aeruginosa, Malassezia furfur, Pityrosporum ovale	Topical Mupirocin or Retapamulin twice daily can be considered Oral antibiotics : Choose one of the following: Dicloxacillin 250 mg qid Cephalexin 250 mg qid Doxycycline 250 mg qid po Clindamycin 300–400 mg qid po Amoxicillin-clavulanate 875/125 mg bid po	3-5 days
Carbuncles	Coalescent inflammatory mass with pus draining from multiple follicular orifices	Larger, deeper, indurated, more serious lesion, usually located at the nape of the neck, on the back, or on the thighs	S.aureus	Topical Mupirocin or Retapamulin twice daily Oral antibiotics : Choose one of the following: Dicloxacillin 250 mg qid Cephalexin 250 mg qid Doxycycline 250 mg qid po Clindamycin 300–400 mg qid po Amoxicillin-clavulanate 875/125 mg bid po	3-5 days
Recurrent abscess	Reappearance of abscess at the site of previous infection		S.aureus	Drained & cultured early & treated based on culture report Prompt search for local cases : Pilonidal cyst Hidradenitis suppurativa Foreign body Evaluation of neutrophil disorders Decolonisation with intranasal mupirocin, daily chlorhexidine washes & daily decontamination of personal items like towels, sheets & clothes	5-10 days

Erysipelas	Distinctive type of superficial cellulitis of the skin, with prominent lymphatic involvement	Painful lesion with a bright red, edematous, indurated (peau d'orange) appearance and an advancing, raised border that is sharply demarcated from the adjacent normal skin	Streptococcus spp., usually S. pyogenes. S. aureus rarely causes erysipelas CAMRSA is unusual	Choose one of the following: Amoxicillin-clavulanate 1 g every 8 h Cephalexin 500 mg every 6 h Trimethoprim and sulfamethoxazole 160/800–320/1600 mg every 12 h Minocycline 100 mg every 12 h Doxycycline 100 mg every 12 h Clindamycin 300 mg every 8 h	Choose one of the following: Cefazolin 2 g every 8 h Amoxicillin-clavulanate 1.2/2.2 gr every 8 h If risk of CA-MRSA is present: Vancomycin 25–30 mg/kg loading dose then 15–20 mg/kg/dose every 12 h Linezolid 600 mg every 12 h	5 days upto 7 days can be extended if symptoms persist
Cellulitis – Non purulent	Acute spreading bacterial infection involving subcutaneous tissue	Local signs of inflammation, such as warmth, erythema, pain, lymphangitis, and frequently systemic upset impact with fever and raised WBC	Streptococci, usually Streptococcus pyogenes Rarely S.aureus	Choose one of the following: Amoxicillin-clavulanate 1 g every 8 h Cephalexin 500 mg every 6 h	Choose one of the following: Cefazolin 2 g every 8 h Amoxicillin-clavulanate 1.2/2.2 gr every 8 h If risk of CA-MRSA is present : Vancomycin 25–30 mg/kg loading dose then 15–20 mg/kg/dose every 12 h Linezolid 600 mg every 12 h	5 days upto 7 can be extended if symptoms persist
Cellulitis - Purulent	Acute spreading	Local signs of inflammation,	Staphylococcus MRSA is rare	Choose one of the following:	Choose one of the following:	5 days

	bacterial infection involving subcutaneous tissue	such as warmth, erythema, pain, lymphangitis with pus discharge and frequently systemic upset impact with fever and raised WBC	Neutropenic & immunocompromised - GNB	Amoxicillin-clavulanate 1 g every 8 h Cephalexin 500 mg every 6 h Risk of CA-MRSA >10% : Trimethoprim and sulfamethoxazole 160/800–320/1600 mg every 12 h Minocycline 100 mg every 12 h Doxycycline 100 mg every 12 h	Vancomycin 25–30 mg/kg loading dose then 15–20 mg/kg/dose every 12 h Linezolid 600 mg every 12 h If GNB risk: Piperacillin/tazobactam 4,5 g every 6 h.	upto can be extended if symptoms persist
Perianal & perirectal abscesses	Pus collection in the perianal or perirectal space	Lower back pain, severe anal pain in the absence of a fissure, urinary retention), when the physical examination suggests a supra-elevator or inter-sphincteric abscess	Gram positive & gram negative	Incision & drainage Followed by Amoxicillin/clavulanate 1 g every 8 h Ciprofloxacin 500 mg every 8 h+ Metronidazole 500 mg every 8 h Risk of CA-MRSA: Minocycline 100 mg every 12 h Trimethoprim and sulfamethoxazole 160/800–320/1600 mg every 12 h	Incision & drainage Followed by Ceftriaxone 2 g every 24 h+Metronidazole 500 mg every 8 h Cefotaxime 2 g every 8 h+Metronidazole 500 mg every 8 h Piperacillin/tazobactam 4,5 g every 6 h Alternative: Ciprofloxacin 400 mg every 8 h+Metronidazole 500 mg every 8 h Risk of CA-MRSA:	5 days Can be extended upto 7-10 days if lack of symptom resolution

				Doxycycline 100mg every 12h If fistula tract is identified: Primary fistulotomy Or Draining seton	Vancomycin 25–30 mg/kg loading dose then 15–20 mg/kg/dose every 12 h Linezolid 600 mg every 12 h	
Burn wound infection	• Early initiation of dressings and effective topical antimicrobial therapy • Daily inspection of the wounds by a qualified surgeon or wound care expert • Early excision of all full thickness and deep partial thickness burns • Systemic antibiotic for infected wounds • Graft and coverage options		P. aeruginosa, Enterobacter, various other gram-negative bacilli, various streptococci, S. aureus, Candida, Aspergillus	Amoxicillin/clavulanate 1 g every 8 h Alternative Ciprofloxacin 500 mg every 12 h+Metronidazole	One of following intravenous antibiotics Ceftriaxone 2 g every 24 h+Metronidazole 500 mg every 8 h Cefotaxime 2 g every 8 h+Metronidazole 500 mg every 8 h Piperacillin/tazobactam 4.5 g every 6 h In patients at risk for CA-MRSA or who do not respond to first-line therapy add Vancomycin 25–30 mg/kg loading dose then 15–20 mg/kg/dose every 12 h Linezolid 600 mg every 12	5 Days Upto 7-10 days if lack of symptom resolution
Necrotising skin & soft tissue infection						

NSTI - are life-threatening, invasive, soft-tissue infections with a necrotizing component involving any or all layers of the soft-tissue compartment, from the superficial dermis and subcutaneous tissue to the deeper fascia and muscle
A rapidly progressive SSTI should be treated as anNSTI, from the beginning

Classification of NSTI
Based on anatomical location : Fournier's gangrene – NSTI of scrotum
Based on depth of infection :
Necrotising cellulitis – involving dermal & subcutaneous components
Necrotising fasciitis – Fascial component involvement
Necrotising myositis – Involvement of muscular components
Based on organism suspected:
NSTI Type 1 - polymicrobial
NSTI Type 2 – monomicrobial
NSTI Type 3 - Clostridial

How to differentiate NSTI from cellulitis?

Severe pain that seems disproportional to the clinical findings
Failure to respond to initial antibiotic therapy
Hard, wooden feel of the subcutaneous tissue, extending beyond the area of apparent skin involvement
Systemic toxicity, often with altered mental status
Edema or tenderness extending beyond the cutaneous erythema
Crepitus, indicating gas in the tissues
Bullous lesions
Skin necrosis or ecchymoses

Diagnosis

Variable	Score
CRP	
<150	0
>150	4
WBC	
<!5	0
15-25	1
>25	2
Hb	
>13.6	0
11-13.5	1

LRINEC score - Laboratory Risk Indicator for Necrotizing infection score

To predict the presence of NSTI

Score of >8 has 75% risk of NSTI

LRINEC score has poor diagnostic accuracy for NSTI,and a low score does not rule out the diagnosis

<10.9	2
Serum sodium	
>135	0
<135	2
Serum creatinine	
<1.6	0
>1.6	2
Serum glucose	
<180	0
>180	1

Imaging –

Ultrasound

loss of the normal tissue architecture to a “cobblestone” appearance

irregularity and thickening of the fascia

abnormal fluid collections along the fascia

evidence of gas in soft tissue

CT/MRI

fat stranding, fluid and gas collections that dissect along fascial planes, and gas in the involved soft tissues

fascial thickening and non-enhancing fascia suggestive of necrosis

Finger test

It is performed under local anaesthesia

A 2-cm incision is made down to the deep fascia

Positive test:

Minimal tissue resistance to finger dissection indicates

Absence of bleeding,

Presence of necrotic tissue, and/or murky and grayish (“dishwater”) fluid

Cultures – Both Blood (Paired) & Tissue cultures must be sent

Deep samples collected at the interface between healthy and necrotized tissues during initial debridement must be sent for cultures

Treatment

Adequate source control by debridement within 6 hours

Repeated schedules re-exploration

Empiric antibiotic

Broad-spectrum drugs, including anti-MRSA and anti-Gram-negative coverage

Antitoxin active antibiotics such as clindamycin or linezolid should be included

Descalation of antibiotic therapy based on clinical status, culture reports

Supportive measures

IVIG can be used in patients with streptococcal NSTI

Antibiotic therapy should be administered until further debridement is no longer necessary

Administration of antibiotics to optimise PK-PD by using higher frequency dosing, prolonged infusions and continuous infusions

Type of infection	Definition	When to suspect	Common organisms	Empiric treatment in stable patients	Empiric treatment in unstable patients	Duration of treatment
NSTI Type 1 (Polymicrobial)	Polymicrobial NSTI involving aerobic and anaerobic organisms.	NSTI associated with surgical procedures involving the bowel or penetrating abdominal trauma, with infections developed in damaged skin, such as decubitus ulcer or animal bites, with infections at the site of injection in injection drug users, or with a perianal, prostate or vulvovaginal abscess	Aerobic GNB, GPC like streptococcus, staphylococcus including MRSA	One of the following antibiotics Amoxicillin/clavulanate 1.2/2.2 g every 8 h Ceftriaxone 2 g every 24 h+Metronidazole 500 mg every 8 h Cefotaxime 2 g every 8 h+Metronidazole 500 mg every 8 h + Clindamycin 600–900 mg every 8 h	In unstable patients One of the following antibiotics Piperacillin/tazobactam 4.5 g every 6 h Meropenem 1 g every 8 h Imipenem/Cilastatin 500 mg every 6 h + Linezolid 600 mg every 12 h Or Vancomycin 25–30 mg/kg loading dose then 15–20 mg/kg/dose every 8 h Daptomycin 6–8 mg/kg every 24 h + Clindamycin 600–900 mg every 8 h	14 days After adequate surgical debridement
NSTI Type 2 (Monomicrobial)	Mono-microbial NSTI	community-acquired NSTI Typically occur in the limbs and affects healthy individuals, with often associated history of trauma	anaerobic streptococci S. aureus	Benzyl Penicillin 1.2 -2.4gm 6 hourly IV + Clindamycin 600–900 mg every 8 h Or Linezolid 600 mg every 12 h If risk of CA-MRSA: Vancomycin 25–30 mg/kg loading dose then 15–20 mg/kg/dose every 8 h Daptomycin 6–8 mg/kg every 24 h can be added with clindamycin		14 days After adequate surgical debridement

NSTI Type 3 (Gas gangren/ Clostridial myonecrosis)	Rapidly progressive life-threatening NSTI caused by clostridium or bacillus of healthy living tissue that occurs spontaneously or as a result of traumatic injury	Increasingly severe pain beginning within 24 h at the injury site is the first reliable clinical symptom The skin may initially appear pale, but quickly changes to bronze, then purplish-red. The infected region becomes tense and tender, and bullae filled with reddish-blue fluid appear. Gas in the tissue, detected as crepitus Signs of systemic toxicity	C. perfringens C. novyi, C. septicum, C. histolyticum, C. bifermentans, C. fallax, and C. sordellii	Emergent and aggressive & urgent surgical debridement Antibiotics Intravenous fluid resuscitation Hyperbaric oxygen (HBO) therapy is not recommended Piperacillin/tazobactam 4.5 g every 6 h Meropenem 1 g every 8 h Imipenem/Cilastatin 500 mg every 6 h + Vancomycin 25–30 mg/kg loading dose then 15–20 mg/kg/dose every 8 h Linezolid 600 mg every 12 h Daptomycin 6–8 mg/kg every 24 h	14 days After adequate surgical debridement
Fourniers gangrene	Severe type of NSTI involving the genital area and or perineum	insidiously or abruptly with fever and pain, erythema, and swelling in the genitalia followed by cutaneous	Polymicrobial – GNB - Pseudomonas, GPC – S.aureus, Streptococcus	Surgical source control as soon as possible Re-explorations should be repeated until the time when very little or no debridement is required Diverting colostomy or rectal diversion devices Antibiotic therapy One of the following antibiotics	5 Days Upto 7-10 days if lack of symptom resolution After adequate

		necrosis and crepitus The testes, glans penis, and spermatic cord are typically spared		Piperacillin/tazobactam 4.5 g every 6 h Meropenem 1 g every 8 h Imipenem/Cilastatin 500 mg every 6 h + One of the following antibiotics Linezolid 600 mg every 12 h Tedizolid 200 mg every 24 h or Another anti-MRSA-antibiotic as Vancomycin 25–30 mg/kg loading dose then 15–20 mg/kg/dose every 8 h Teicoplanin LD 12 mg/kg 12-hourly for 3 doses, then 6 mg/kg every 12 h Daptomycin 6–8 mg/kg every 24 h + Clindamycin 600–900 mg every 8 h	surgical debridement
Water & soil borne necrotising infections					
Aeromonas NSTI	Wound infection by A.hydrophila	NSTI after contact with fresh or brackish water, soil, or wood	A.hydrophila	Ciprofloxacin 400mg IV every 24h Levofloxacin 750mg every 24h Alternative: Trimethoprim-Sulfamethaxazole 8-10mg/kg IV divided doses every 6 hours Ceftriaxone 2g IV every 24 hours	Based on clinical response
Vibrio NSTI	serious wound infection caused by V.vulnificus	NSTI after consumption of contaminated fish and shellfish, and skin exposure to contaminated seawater	V.vulnificus occasionally Vibrio alginolyticus, non–serogroup O1 Vibrio cholerae, and Vibrio parahaemolyticus	Doxycycline 100mg IV/PO every 12 hours Minocycline 100mg IV/PO every 12 hours Alternative: Ciprofloxacin 400mg IV every 24h Levofloxacin 750mg every 24h	Based on clinical response
Pyomyositis	Presence of pus within	recent blunt trauma to or vigorous	S.aureus Rarely	One of the following: Vancomycin 25–30 mg/kg loading dose then 15–20 mg/kg/dose every 8 h	Based on clinical response

	individual muscle group	exercise of the involved area or a local primary dermatologic process with Fever, localized muscle pain and stiffness, without erythema swelling, and tenderness	Group A streptococci Gram-negative bacilli Fusobacterium necrophorum Clostridia	Teicoplanin LD 12 mg/kg 12-hourly for 3 doses, then 6 mg/kg every 12 h Immunocompromised patients or severe disease One of the following in addition to MRSA cover: Piperacillin/tazobactam 4.5 g every 6 h Meropenem 1 g every 8 h Imipenem/Cilastatin 500 mg every 6 h	
Mesh infection	Infection of mesh hernioplasties	indolent and present chronic pain at the site of mesh & very rarely local signs of inflammation	S.aureus including MRSA, S. epidermidis and streptococci and Gram-negative bacteria including Enterobacteriaceae.	Complete surgical removal of the mesh is suggested to reduce the risk of infection recurrence or severe complications, such as visceral adhesions and fistulae	ID opinion
Erysipeloid	cutaneous infection caused by Erysipelothrix rhusiopathiae zoonosis acquired by handling fish, marine animals, swine, or poultry One day to 7 days after exposure, a red maculopapular lesion develops, usually on fingers or hands. Erythema spreads centrifugally, with central clearing A blue ring with a peripheral red halo may appear, giving the lesion a target appearance		Erysipelothrix rhusiopathiae a thin, pleomorphic, non-spore-forming gram-positive rod Intrinsically resistant to vancomycin, teicoplanin, and daptomycin	Penicillin 500 mg every 6 h Amoxicillin 500 mg every 8h	7-10 days
Glanders	Ulcerating nodular lesions of the skin and mucous membrane, is caused by the aerobic gram-negative rod Burkholderia mallei.		Burkholderia mallei	Ceftazidime Gentamicin Imipenem Doxycycline Ciprofloxacin Based on sensitivity	Based on clinical response

Scarlet fever syndromes					
Scalded skin syndrome	SSSS is the most severe and systemic manifestation of infection with S. aureus strains producing an exfoliative exotoxin	It is characterized by abrupt onset fever, skin tenderness, and a scarlatiniform rash with widespread bullae and exfoliation	S.aureus	Vancomycin 25–30 mg/kg loading dose then 15–20 mg/kg/dose every 12 h + Clindamycin 600-900 mg/kg every 12h	>14 days
Toxic shock syndrome	Acute febrile illness with a generalized scarlatiniform eruption &	Criteria for diagnosis : hypotension (shock), functional abnormalities of three or more organ systems, and desquamation in the evolution of the skin lesions In Clostridial TSS → Leukemoid reaction with WBC >50000 Absence of fever	S. aureus (pyogenic toxin-producing strains), S. pyogenes Clostridium sordelli	Penicillin G 18-20 million units per day divided every 4-6 h or Vancomycin 25–30 mg/kg loading dose then 15–20 mg/kg/dose every 12 h + Clindamycin 600-900 mg every 12h or Linezolid 600mg ever 12h IVIG can be used if streptococcal TSS is confirmed 1g/kg on day 1 f/b 0.5mg/kg on days 2 & 3	>14 days

Definitive treatment

Organism	1st line treatment	Adult dose	Pediatric dose beyond neonatal period
Streptococcus	Penicillin plus clindamycin	2–4 million units every 4–6 h IV 600–900 mg every 8 h IV	60 000–100 000 units/kg/dose every 6 h IV 10–13 mg/kg/dose every 8 h IV
MSSA	cloxacillin	1-2g every 4h IV	50mg/kg/dose every 6h
	Flucloxacillin	1-2g every 4h IV	50mg/kg/dose every 6h
	Cefazolin	1g every 8h IV	33mg/kg/dose every 8h
MRSA	Vancomycin	25–30 mg/kg loading dose then 15–20mg/kg/dose every 12 h IV	15 mg/kg loading dose then15mg/kg/dose every 12 h
	Daptomycin	25–30 mg/kg loading dose then 15–20 mg/kg/dose every 12 h IV	5-10mg/kg over 30 min every 24h
	Linezolid	600mg every 12h	10mg/kg every 8 h
	With clindamycin	600–900 mg every 8 h IV	20-40 mg/kg/day divided dose every 8h
Clostridium species	Clindamycin plus Penicillin	600–900 mg every 8 h IV 2–4 million units every 4–6 h IV	60000-100 00 units/kg/dose every 6 h IV
Aeromonas hydrophila	Doxycycline plus ciprofloxacin or ceftriaxon e	100mg every 12h IV 400mg every 12h IV 2g every 24h IV	Not recommended for children but mayneed to use in life-threatening situations
Vibrio vulnificus	Doxycycline plus Ceftriaxone Or Cefotaxime	100mg every 12h IV 1g every 12h IV 2g every 12h IV	Not recommended for children but mayneed to use in life-threatening situations

Sexually transmitted infections

Prostatitis

Treatment for Acute Prostatitis

Uncomplicated with High risk for STD (<35yrs)	Ceftriaxone 500mg IV 1 dose or Cefixime 400mg PO followed by Doxycycline 100mg BD 14 days
Uncomplicated with Low risk for STD (>35yrs)	Levofloxacin 500-750mg IV/PO OD Ciprofloxacin 500-750mg PO or 400mg IV BD TPM - SMX 1 DS PO BID Duration 4-6 weeks
Complicated (systemic symptoms/ Obstruction, anomaly like)	Inj Piperacillin-Tazobactam 4.5gm IV QID Inj.Meropenem 1gm IV BD
Chlamydia(+)	Tab.Azithromycin 1gm q/weekly for 4 weeks
Epididymo - orchitis	Usually treatment duration 10 - 14 days

Regimens for antimicrobial therapy for chronic bacterial prostatitis

Antimicrobial	Daily dose	Duration of therapy	Comments
TPM-SMX DS	1 bid	2-3 months	
Fosfomycin	3gm OD	2 - 3 months	
Doxycycline	100 mg b.i.d	10 days	Only for C. trachomatis or mycoplasma infections
Azithromycin	500 mg once daily	3 weeks	Only for C. trachomatis infections

Metronidazole	500 mg t.i.d.	14 days	Only for T. vaginalis infections

Vaginitis

Treatment regimens for the most common causes of vaginitis		
Vulvovaginal candidiasis	Bacterial vaginosis	Trichomoniasis
Topical azole or Fluconazole 150 mg orally, single dose	Metronidazole 400 mg P.O TDS for 7 days or Metronidazole 0.75% gel one full applicator (5 g) intravaginally dailyfor 5 days or Clindamycin 2% cream, one full applicator (5 g) intravaginally at bedtime for 7 days†	Metronidazole 2g orally, single or divided dose on the same day Or Tinidazole, 2 g orally, single dose

Diagnosis Treatment of Genital Ulcers

Types	Symptoms	Diagnosis	Treatment
HSV	Usually multiple vesicular lesions that rupture and become painful, shallow ulcers Constitutional symptoms, lymphadenopathy in first-time infections	Definitive:culture or PCR testing of ulcer scraping or vesicle fluid Presumptive: typical lesions and any of the following Previously known outbreak Positive Tzanck smear of ulcer scraping (Exclusion of other causes of ulcers) 4 fold increase in acute and convalescent antibody titer results (in a first-time infection)	First episode Acyclovir , 400 mg orally tds for 7 to10 days, or 200 mg orally 5 times daily for 7 to 10 days Valacyclovir 1,000 mg orally bd for seven to 10 days Recurrent episode Acyclovir, 400 mg orally tds for 5 days,or 800 mg orally bid for five days,or 800 mg orally tds for 3 days, or 200 mg orally 5 times daily for 5 days Valacyclovir, 500 mg orally bd for 3 days or 1gm orally once daily for 5 days Suppressive therapy Acyclovir, 400 mg orally bd or 200 mg orally tds Valacyclovir, 1gm OD Valacyclovir, 500 mg orally once daily, if fewer than 10 outbreaks per year

Syphilis (primary)	Single, painless, well- demarcated ulcer (chancre) with a clean base and indurated border Mild tender inguinal lymphadenopathy	darkfield microscopy or DFA testing of a chancre or lymph node aspirate or Positive result on serologic nontreponemal testing (VRDL/RPR) that is confirmed with a positive result on serologic treponemal testing (FTA absorption or TPA)	Penicillin G benzathine, 2.4 million units IM in a single dose .
Chancroid	Small, shallow, painless, genital or rectal papule or ulcer; no induration Unilateral, tender inguinal or femoral Lymphadenopathy. ulcerative proctitis;	Definitive: C.trachomatis serotype L1, L2, or L3 culture from clinical specimen Or IFA demonstrating inclusion bodies in leukocytes of an inguinal lymph node (bubo) aspirate or Microimmunofluorescence positive for LGV strain of C. trachomatis Presumptive: Clinical suspicion Community prevalence Exclusion of other causes	Doxycycline, 100 mg orally bid for 21 days Erythromycin base, 500 mg orally qid for 21 days Pregnant or lactating women: erythromycin, 500 mg orally qid for 21 days
Granuloma inguinale (donovanosis)	Persistent, painless, beefy-red (highly vascular) papules or ulcers. May be hypertrophic, necrotic, or sclerotic. No lymphadenopathy. May have Subcutaneous granulomas	Definitive: Intracytoplasmic Donovan bodies on Wright stain or Positive result with Giemsa stain or biopsy of granulation tissue	Treatment should continue until lesions have healed Doxycycline, 100 mg orally bd for at least 21 days Azithromycin, 1 g orally once weekly for at least 21 days Erythromycin base, 500 mg orally qid for 21 days

Urethritis

Urethritis is a disease that presents primarily with pain on urination and urethral discharge.

Common symptoms - urgency, frequency, hesitancy. It diagnosis after ruling out UTI

Treatment regimen for urethritis

Pathogen	Antimicrobial	Dosage & Duration of therapy	Alternative regimens
Gonococcal Infection	Ceftriaxone Azithromycin	1 g i.m. or i.v.*, SD 1g p.o., SD	Cefixime 400 mg p.o., SD plus Azithromycin 1 g p.o.,SD
			In case of cephalosporin allergy: Gentamicin 240 mg i.m SD plus Azithromycin 2 g p.o., SD Fosfomycin trometamol 3 g p.o. on days 1, 3 and 5
			In case of azithromycin allergy, in combination withceftriaxone or cefixime: Doxycycline 100 mg b.i.d, p.o., 7 days
Non-Gonococcal infection **(non-identified** **pathogen)**	Doxycycline	100 mg b.i.d, p.o., 7 days	Azithromycin 500 mg p.o., day 1, 250 mg p.o., 4 days
Chlamydia trachomatis	Azithromycin Or Doxycycline	1.0-1.5 g p.o., SD	

		100 mg b.i.d, p.o., for 7 days	
Mycoplasma genitalium	Azithromycin	500 mg p.o., day 1, 250 mg p.o., 4 days	
Ureaplasma urealyticum	Doxycycline	100 mg b.i.d, p.o., 7 days	Azithromycin 1.0-1.5 g p.o., SD
Trichomonas vaginalis	Metronidazole Tinidazole	2 g p.o., SD 2 g p.o., SD	Metronidazole 500 mg p.o., b.i.d., 7 days

Persistent non-gonococcal urethritis

After first-line doxycycline	Azithromycin plus	500 mg p.o., day 1, 250 mg p.o., 4 days
	Metronidazole	400 mg b.i.d. p.o., 5 days

Urinary tract infections

The most common organisms isolated in urine as per ICMR data (Jan 2020 - Dec 2020)

Organism	Percentage
E. coli	51.2
K. pneumoniae	17.9
Pseudomonas	7
E. fecalis	5.7
E. feacium	4.9
Proteus mirabilis	1.8
Staph. aureus	1.7
Enterococcus spp.	1.4
Acinetobacter	1.2
Enterobacter cloacae	1.1

When/ which patient need to send for urine culture
Irrespective of all symptomatic patient with UTI need to sent for urine routine & Urineculture before starting Antibiotic 1st dose. If patient already on urinary catheter with >10-14 days need to replace and send it.
When/ which patient need to send for blood culture
All patients with complicated UTI/ Pyelonephritis before starting Antibiotic 1st dose.

Antimicrobial therapy for uncomplicated cystitis (Oral)

Preferred to all including (ESBL/CRE)	Daily dose	Duration of therapy
Nitrofurantoin macrocrystal prolonged release	100mg b.i.d	5 days
Nitrofurantoin monohydrate/ macrocrystals	100 mg q.i.d	5 days
Fosfomycin trometamol	3g Single Dose	Single
Alternative	**Daily dose**	**Duration of therapy**
Cefpodoxime	200 mg b.i.d	10 days
Cephalexin	500mg bid	5-7 days
Amoxycillin - Clavulanate	875/125 bid	5-7days
Cotrimoxazole	800/160 bid	3 days
Fosfomycin	3gm p.o	Single dose
Pivmecillinam	400mg bid	3 – 7 days
Ciprofloxacin	250mg bid	3 days
Levofloxacin	250mg OD	3days

Empirical oral antimicrobial therapy in uncomplicated pyelonephritis

Narrow spectrum organism/ Non resistance	Daily dose	Duration of therapy
Cefixime	200mg b.i.d	10 – 14 days
Cefpodoxime	200 mg b.i.d	10 – 14 days
Cephalexin	500mg bid	10 – 14 days
Ceftriaxone	1gm bid	10 – 14 days
Cefipime	2gm bid	14 days
Amoxycillin - Clavulanate	875/125 bid	14 days
Alternative option		
Cotrimoxazole	800/160 bid	14 days days
Fosfomycin	3gm p.o every 3rd day	3 dose
Ciprofloxacin	250mg bid	14 days
Levofloxacin	250mg OD	14 days

Empirical IV antimicrobial therapy in uncomplicated Pyelonephritis

1. ***First-time patient came to hospital, no antibiotic exposure***
2. **Recent antibiotic exposure < 6 months, Narrow spectrum organism/ Nonresistance**

Cefotaxime	**2 g t.i.d**
Ceftriaxone	1-2 g q.d
Cefepime	2gm bid
Amoxycillin - Clavulanate	875/125 bid
Recent antibiotic exposure < 6 months, ESBL producer	
Alternative option	
Cotrimoxazole	800/160 bid
Fosfomycin	6gm tid
Ciprofloxacin	250mg bid
Levofloxacin	250mg OD

Definitive therapy for Pyelonephritis

Cefotaxime	**2 g t.i.d**
Ceftriaxone	1-2 g q.d
Cefipime	2gm bid
Amoxycillin - Clavulanate	875/125 bid
ESBL producer	
Piperacillin/tazobactam	4.5 gm q.i.d
Cefoperazone Sulbactum	1.5gm bid
Amoxycillin sulbactum	3gm tid
Alternative option	
Cotrimoxazole	800/160 bid
Fosfomycin	6gm tid
Ciprofloxacin	500mg bid
Levofloxacin	500mg od

AmpC producer		
Meropenem	1gm tid	
Alternative option		
Cotrimoxazole	800/160 bid	14 days days
Fosfomycin	6gm tid	10-14 days
Ciprofloxacin	500mg bid	14 days
Levofloxacin	500mg od	14 days

CRE producer		
MBL producer		
Ceftazidime Avibactam + Aztreonam	1.5gm tid 1gm tid	
Inj.Colistin		
Non MBL producer		
Ceftazidime Avibactam	1.5gm tid	
Alternative option		
Cotrimoxazole	800/160 bid	14 days days
Fosfomycin	6gm tid	10-14 days
Ciprofloxacin	500mg bid	14 days
Levofloxacin	500mg od	14 days

CRAB	
Inj.Colistin	9 million units STAT followed by 4.5 million units BD

Gram Positive Isolates

E.fecalis/Faecium	
Pencillin sensitive/ Pencillin resistant cystitis / VRE(cystitis)	T.Nitrofurantoin 100mg QID T.Nitrofurantoin (macrobid) 100mg BD Fosfomycin 3g single dose
Pencillin sensitive (cystitis)	Amoxicillin 1g BD
Pencillin sensitive (systemic)	Inj. Ampicillin 2gm IV Q4H/ Inj.Pencillin 3M IU Q4H
Pencillin resistant	Inj.Vancomycin 1gm TDS Inj.Teicoplanin 6mg/Kg Q24H
VRE Severe	T.Linezolid 600mg BD

Staphylococcus aureus	
MSSA(oral)	T. Cephalexin 500mg QID T.Flucloxacillin 500mg q6H T. Dicloxacillin 500mg QID
MSSA(IV)	Cefazolin 1-2gm IV Q4-6H Flucloxacillin 1gm IV q4-6H
MRSA(mild)	T.clindamycin 500mg tid T.Cotrimoxazole 800mg BD
MRSA (severe)	Inj.Vancomycin 1gm TDS Inj.Teicoplanin 6mg/Kg Q24H
VRSA	T.Linezolid 600mg BD

Duration of Antibiotics	
Uncomplicated pyelonephritis/	10 – 14 days
Complicated Pyelonephritis	14 days or until clinical, microbiological cure

Obstetrics & Gynaecology infections

Case definitions

a. **Puerperal sepsis**: Defined as "Infection of the genital tract occurring between rupture of membranes or labour and the 42nd day postpartum with 2 or more of the following":

- 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)

✓ Intraamniotic infection(IAI)/Chorioamnionitis:It is a clinically detectable infection of amniotic fluid and fetal memnranes during pregnancy

✓ Postpartum Endometritis(PPE): Postpartum infection of the uterus,the most common cause of puerperal fever,is designated endomyometritis.

✓ Refractory Postpartum fever of undetermined origin:It includes septic pelvic thrombophlebitis(SPT) and Drug fever.

b. **Pelvic inflammatory disease (PID):** Comprises inflammatory disorders of the upper genital tract, including endometritis, salpingitis, tubo-ovarian abscess, or pelvic peritonitis. The symptoms include fever, pelvic pain, dyspareunia and abnormal vaginal discharge. The diagnosis of PID would be likely in the presence of features listed below:

1. Sexually active young women
2. Symptoms of pelvic or lower abdominal pain
3. Presence of cervical motion tenderness or uterine tenderness or adnexal tenderness on clinical examination
4. No other cause identified for the above symptoms and signs

c. **Vaginitis & cervicitis**: It comprises a spectrum of inflammatory disorders of the lower female genital tract characterized by vaginal discharge, odour, pruritus, and dyspareunia.

Antibiotic Prophylaxis regimens in Obstetrics & Gynaecology:

SR no.	Clinical condition / procedure	Common pathogens	Preferred AMA	Alternate AMA	Comments
1.	Vaginal delivery: For GBS (Group B Streptococcus) prophylaxis in women who do not know their GBS status in the following situations: Preterm labour (< 37 wks) Prolonged rupture of membranes (>18 hrs) Fever during labour or chorioamnionitis History of the previous baby with GBS infection Bladder or kidney infection due to GBS	Group B Streptococci	Ampicillin 2 gm IV initial dose followed by 1gm IV 4-6 hourly till delivery	Cefazolin ; 2 g IV followed by 1 g 8 hourly till delivery If allergic, Vancomycin 1 gm IV 12 hourly till delivery	Not recommended routinely for normal vaginal delivery Delivery is considered akin to drainage of an abscess as the fetus and placenta is removed which are the nidus of infection
2.	3rd or 4th degree Perineal tear	Gram positive S. aureus, Gram negative Enterobacteria ceae , Anaerobes	Single dose I.V cefazolin 1 gm plus metronidazole 500 mg	I.V cefuroxime 1.5gm plus metronidazole OR Amoxicillin-clavulanic acid 1.2 gm If allergic, clindamycin 600mg	Prophylaxis is considered to prevent adverse outcomes arising from infection e.g. fistulas
3.	Preterm pre-labour rupture of membranes	Gram positive GBS Gram negative: Enteric gramnegative bacilli, Ureaplasma, mycoplasma Anaerobes (including G.vaginalis	Ampicillin (2 g IV followed by 1 gm 4-6 hourly for 48 hours) – oral Amoxycillin (500mg 8 hourly for 5 days) + Azithromycin (500mg OD for 7 days)		

4.	Caesarean delivery	Gram Positive aerob es:GBS, Staphylococci, Enterococci	Single dose Cefazolin (2gm IV) +Azithromycin(500 mg) The dose is 3gm of cefazolin if the patient is >100kg	If allergic, single dose clindamycin (600-900mg IV)+ Gentamicin (1.5mg/kg IV)	
5.	Rescue cervical encirclage	Vaginal flora	Single dose Inj Ampicillin 2 gm i.v		To prevent ascending infection from vaginal flora to exposed membranes
6	Hysterectomy (AH ,pelvic urinary VH, laparoscopic) and surgeries for organ prolapse and/or stress incontinence		Cefazolin 2 gm IV single dose (The dose is 3gm if the patient is >100kg)	Cefuroxime (1.5 g IV single dose) +/- Metronidazole (500mg) If allergic Clindamycin 600 mg +Gentamicin (1.5mg/kg IV)	In AH & LH, the vagina is opened at end of procedure & exposure to vaginal flora is brief. In VH, there is greater colonisation of the surgical site. In AH for cancer with resection of upper vagina, there may be colonisation with anaerobes In such cases, metronidazole 500mg iv may be added If BV is suspected, oral metronidazole 500mg BD for 7 days is given, beginning at least 4 days preop.
7.	Laparoscopy (uterus and/or vagina not entered)/Hysteroscopy/Ectopic pregnancy	Skin commensals: *S. aureus*	**Cefazolin** 2gmIV single dose	Cefuroxime 1.5 g IV single dose If allergic, use clindamycin 600 mgi.v	No prophylaxis needed for missed/incomplete abortion
8	Induced abortions	*Chlamydia,N.gonorrohoeae*	Azithromycin 1gm orally + Metronidazole 800mg orally at time of abortion	Doxycycline (100 mg orally twice daily for 7 days, starting on the day of abortion) + Metronidazole (800 mg orally at the time of abortion)	No prophylaxis needed for missed/incomplete abortion

9.	**HSG**	Chlamydia, Neisseria gonorrhoeae	**Doxycycline** 100 mg orallybefore the procedure		Doxycycline continued twice daily for 5 days if there is a historyof PID or fallopian tubes are dilated at the procedure
Antibiotic regimens in Female pelvic infection					
S no.	Clinical condition / procedure	Common pathogens	PreferredAMA	AlternateAMA	Comments
1.	**Puerperal sepsis / Septic abortion / Chorioamnionitis/PPE** Fever temp. 38.5°C(101.3 F) Lower abdominal pain Uterine Tenderness Leucocytosis	Gram positive: *Streptococci (A, B, D), S.aureus Gram negative: E.coli, Enterobacteriaceae including Klebsiella, Enterobacter, Citrobacter, Pseudomonas aeruginosa, Proteus mirabilis, Gardnerella vaginalis, Bacteroides Clostridium perfringens, Anaerobes*	Inj. **Piperacillin-tazobactam** Inj. 4.5 gm IV 6 hourly X 7-14 days (Duration of antibioticwill depend on clinical response and lab parameters)	**Clindamycin** (600-900mg IV 8 hourly)+ **Gentamicin**(60mgIV 8 hourly**)** **+/-Ampiciliin** 2gm f/b 1gm 4-6 hrly(if Enterococcal super infection suspected) If the patient is inseptic shock, consider **Imipenem** 1gm 6 hrly/**Meropenem**1gm 8 hrly +/- Amikacin 15mg/kg24 hrly +/- Vancomycin to cover MRSA	Usually polymicrobial
2	**Pelvic Inflammatory disease (mild to moderate)**	N. gonorrhoeae, C. trachomatis and anaerobes.E.	Cefixime (400 mg orally STAT) + Metronidazole (400 mg tds X 14 Days) +	Ceftriaxone 500mg im/iv stat dose or tab Levofloxacin 500mgOD for 14 days plus Cap.Doxycycline 100mg BD 14 days with	-

	Fever, pelvic pain, dyspareunia and abnormal vaginal discharge	coli, Bacteroides GBS, GAS, S. aureus	Doxycycline (100 mg bd X 14 Days)	Tab.Metronidazole 500mg BD 14 days	
3	**Pelvic Inflammatory disease** (severe) eg tubo- ovarian abscess, pelvic abscess		I.V Ceftriaxone 1gm OD PLUS Tab. Doxycycline 100mg BD plus IV Metronidazole 500 mg 12 hrly	I.V Cefoxitin 2gm 6 hrly PLUS Tab Doxycycline 100mg .BD OR Clindamycin 900mg iv 8 hrly PLUS Gentamicin 3-5 mg/kg 24 hrly +/- Ampicillin 1 gm 4-6 hrly (in case of tubo- ovarian abscess) OR Piperacillin- tazobactam 4.5 gm IV 6 hourly (for severely ill patients)	An attempt should be made to obtain cultures and deescalate based on that. Duration is two weeks but can be extended depending upon the clinical situation. Antibiotics may be altered after obtaining culture reports of pus/or Blood
4	**Vaginal candidiasis** Vaginal/vulvar irritation,bruning, pruritis, Cheesy white discharge,erythem a	*C. albicans, C. glabrata, C. tropicalis*	Tab Fluconazole 150 mg stat OR local Clotrimazole 100mg 2 vaginal tabs for 2 days at bed time	Miconazole 200mg 1tab bed time for 3 days Clotrimazole,1 % cream, or Miconazolev2% cream at bedtime for 7 days	In pregnancy, diabetes –topical azole cream 7-14 days Recurrent infections: 150 mg Fluconazole on day 1,4,7 then weekly for 6 months
5	**Vaginal trichomoniasis** Burning,dysuria,p ruritis,Copious ,Foamy Vaginal Discharge, purulent,	*T. vaginalis*	Metronidazole 400 mg BD, orally X 7 day Or 2gm stat dose for male partner	Cap. Tinidazole 2gm stat dose	Partner treatment essential
6.	Bacterial vaginosis Copius,thin,milky vaginal discharge	Overgrowth of anaerobes (*Gardnerella vaginalis)*	Metronidazole 400 mg BD, orally X 7 day OR Metronidazole gel 0.75%OD For 5 days OR clindamycin 2% Cream for 7days	Secnidazole 2 gm oral, single dose OR Tab .Tinidazole 1gm OD for 5 days OR Cap.clindamycin 300mg BD for 7 days	Refrain from sexual activity or use condoms during the treatment. Clindamycin cream is oil-based and might weaken latex condoms

Infective Endocarditis

Infective endocarditis (IE) is one of the rare, but potentially fatal inflammation of the endothelial surface of the heart or intra-cardiac devices like the prostheticvalves.

IE can be further classified based on the

- Side of the heart affected– Left, Right, Both
- Duration of symptoms– Acute, subacute & chronic
- Type of valve involved – Native or prosthetic
- Etiology – Bacterial, Fungal, Non-bacterial
- Type of acquisition – Community or Hospital-acquired

When to suspect IE?

- A febrile illness and a murmur of new valvular regurgitation
- A febrile illness, a pre-existing **at-risk cardiac lesion*** and no clinically obvious site of infection
- A febrile illness associated with any of:
  - Predisposition and recent intervention with associated bacteraemia
  - Evidence of congestive heart failure
  - New conduction disturbance
  - Vascular or immunological phenomena: embolic event, Roth spots, splinter haemorrhages, Janeway lesions, Osler's nodes
  - A new stroke
  - Peripheral abscesses (renal, splenic, cerebral, vertebral) of unknown cause
- A protracted history of sweats, weight loss, anorexia or malaise and an at-risk cardiac lesion
- Any new unexplained embolic event (e.g. cerebral or limb ischaemia)
- Unexplained, persistently positive blood cultures
- Intravascular catheter-related bloodstream infection with persistently positive blood cultures 72h after catheter removal

*At risk cardiac lesions:

- Valvular heart disease with stenosis or regurgitation

- Valve replacement
- Structural congenital heart disease, including surgically corrected or palliated structural conditions, but excluding isolated atrial septal defect, fully repairedventricular septal defect or fully repaired patent ductus arteriosus, and closure devices that are judged to be endothelialized
- Previous infective endocarditis
- Hypertrophic cardiomyopathy
- IVDU

Investigations

Echocardiography

Echocardiography places a pivotal role in diagnosis, and management as well as in determining the prognosis of IE. Trans-thoracic echo (TTE) must be performed atthe earliest in all patients suspected of IE. Tran-oesophageal echo (TOE) is preferred in patients with Prosthetic valves, and non-diagnostic TTE. (Figure 1) Repeat TTE/TOE must be planned after 5-7 days if the clinically high suspicion & initial screen is negative.

The sensitivity of NVE & PVE for vegetations by TTE is 70% & 50% & by TOE is 96% & 92% respectively.Other

imaging modalities

- Multi-slice computed tomography (MSCT)
- Magnetic resonance imaging (MRI)
- Nuclear Imaging (SPECT/CT & PET)

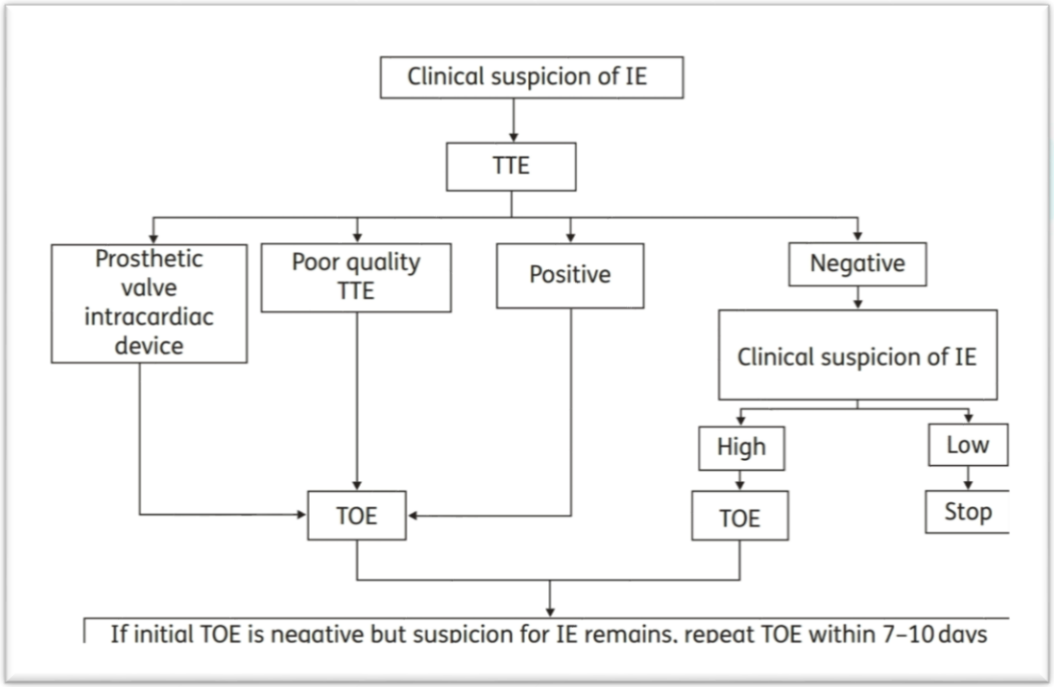


Figure 1

Microbiological Investigations

- Blood cultures remain a cornerstone of the diagnosis of IE cases and should be taken before starting treatment in all cases. (Figure 2)
- At least 3 sets of blood cultures, each containing around 10ml of blood from peripheral veins (Avoid central line) & must be sent for both aerobic &anaerobic incubation.
- Serology & PCR can be sent in patients with culture-negative endocarditis (Table 2)
- Samples from resected or excised heart valves must be sent for culture & histological examination. Culture-negative endocarditis consider performing broad-range bacterial PCR & sequencing

Diagnosis - Modified Dukes criteria

Principles of antibiotic treatment of IE

- The primary goal of antibiotic therapy is to sterilize the vegetation
- The vegetations in IE pose a unique difficulty in the management of IE:

- High bacterial load
- Biofilm
- Low microorganism metabolic activity
- Antibiotic penetration into vegetation

- Hence regimen containing prolonged, parenteral & bactericidal agent is preferred
- Inoculum effect: the antibiotics fail to act in high bacterial densities. This is seen in β-lactams & glycopeptide, to a lesser extent by fluoroquinolones &aminoglycosides
- The addition of aminoglycoside has synergistic bactericidal activity with β-lactams
- Prolonged, parenteral antibiotics are necessary in all cases of IE
- In NVE it is reasonable to treat for 4-6 weeks, while PVE requires a longer duration of therapy (≥6 weeks)
- The total duration of therapy must be counted from the 1st day when the blood culture was negative
- If surgical resection was performed, & the vegetation shows growth, it is reasonable to repeat the entire duration of antibiotics
- The addition of Gentamicin or Rifampicin is not recommended in the treatment of Staphylococcal NVE
- In PVE, it is recommended to add Rifampicin (Anti-biofilm effect) & gentamicin. The duration of therapy for gentamicin is 2 weeks, while rifampicin should be continued for 6 weeks.

Whether to initiate Empiric Antibiotic for IE?

- The choice of empiric therapy depends on the type of IE (Acute, subacute/Chronic), the clinical condition of the patient (hemodynamically stable or in sepsis),NVE/PVE, risk factors (based on history & previous illness), healthcare or community-onset
- Haemodynamically stable patients not on any antibiotic require no empiric therapy. Investigate for the cause by sending appropriate blood cultures & then treatbased on the blood culture report
- Haemodynamically stable patients who have been treated with prior antibiotics, consider stopping empiric antibiotic treatment (up to 5-7 days) & appropriateblood cultures off antibiotics & then treat based on blood culture report
- Haemodynamically unstable patients or high-risk patients (immunocompromised, ECHO showing abscess, heart failure, etc.) including those in sepsis
- Empiric therapy is based on underlying risk factors, which are enumerated in Table below:

Risk factor	Empirical coverage
IDU	*S aureus, including community-acquired oxacillin-resistant strains, Coagulase-negative staphylococci, β-Hemolytic streptococci, Fungi ,Aerobic Gram-negative bacilli, including Pseudomonas aeruginosa Polymicrobia*
Indwelling cardiovascular medical devices	*S aureus, Coagulase-negative staphylococci, Fungi, Aerobic Gram-negative bacilli, Corynebacterium sp*
Genitourinary disorders, infection, and manipulation, including pregnancy, delivery, and abortion	*Enterococcus sp, Group B streptococci (S agalactiae), Listeria monocytogenes Aerobic Gram-negative bacilli, Neisseria gonorrhoeae*
Chronic skin disorders, including recurrent infections	*S aureus, β-Hemolytic streptococci*
Poor dental health, dental procedures	*VGS, Nutritionally variant streptococci - Abiotrophia defectiva Granulicatella sp Gemella sp, HACEK organisms*
Alcoholism, cirrhosis	*Bartonella sp, Aeromonas sp, Listeria sp, S pneumoniae, β-Hemolytic streptococcus*
Early (≤1 y) prosthetic valveplacement	*Coagulase-negative staphylococci, S aureus, Aerobic Gram-negative bacilli Fungi, Corynebacteriumsp, Legionella sp*
Late (>1 y) prosthetic valve placement	*Coagulase-negative staphylococci, S aureus, Viridans group streptococci Enterococcus species, Fungi, Corynebacterium sp*
Dog or cat exposure	*Bartonella sp, Pasteurella sp, Capnocytophaga sp*
Contact with contaminated milk or infected farm animals	*Brucella sp, Coxiella burnetiid, Erysipelothrix sp*

AIDS	*Salmonella sp, S pneumoniae, S aureus*
Pneumonia, meningitis	*S pneumoniae*
Solid organ transplantation	*S aureus, Aspergillus fumigatus, Enterococcus sp, Candida sp*
Gastrointestinal lesions	*S gallolyticus (bovis), Enterococcus sp, Clostridium septicum*
Burn	*S aureus, Aerobic Gram-negative bacilli, including P aeruginosa, Fungi*
Diabetes mellitus	*S aureus, β-Hemolytic, streptococci, S pneumoniae*

Situation	Antimicrobial	Comments
NVE – Indolent presentation	Stable ⍰ Ideally no antibiotics	
NVE, hemodynamically unstable (no risk factors for *Enterobacteriaceae, Pseudomonas)*	**Community acquired -**Ampicillin 2g q4h or Ampicillin sulbactam 3g q6h with Gentamicin 1mg/kg q12h **Healthcare acquired -** Vancomycin 1g q12h + Gentamicin 1mg/kg q12h OR	Ciprofloxacin if Nephrotoxicity is an issue
NVE, hemodynamically unstable AND risk factors for multi-resistant *Enterobacteriaceae*, *Pseudomonas*	Vancomycin 1g q12h + Meropenem 2g q8h Or Cefepime 2g q8h	
PVE pending blood cultures or with negative blood cultures	Vancomycin 1g q12h + Gentamicin 1mg/kg q12h + Rifampicin 300-600mg q12h	

Specific Treatment of IE

Organism			NVE	PVE
Staphylococcus aureus				
MSSA	Flucloxacillin 2 g every 4–6 h iv Nafcillin 12g over 24 h Cloxacillin 12g over 24 h	Use q4h regimen if weight >85 kg	4-6 weeks	Add Rifampicin + Gentamicin (>2 weeks) Total duration >6 week
MRSA	Vancomycin 30mg/kg IV divided 24 h OR Daptomycin 8-12mg/kg q24		4-6 weeks	Add Rifampicin + Gentamicin (>2 weeks) Total duration >6 week
***Streptococcal* endocarditis (Other than *Abiotrophia and Granulicatella* spp. (NVS)**				
Penicillin MIC ≤0.125 mg/L	Benzylpenicillin 1.2g q4h IV Ceftriaxone 1g q12h	2 weeks Benzyl penicillin + Gentamicin Ceftriaxone + Gentamicin	4-6 weeks	Add Gentamicin (>2 weeks) Total duration >6 weeks
Penicillin MIC >0.125 to ≤0.5 mg/L	Benzyl penicillin (4-6 weeks) + Gentamicin (2 weeks)		4-6 weeks	Add Gentamicin (>2 weeks) >6 weeks
Penicillin MIC >0.5 mg/L	Ceftriaxone 1g q12h + Gentamicin 1mg/kg		4-6 weeks	Add Gentamicin (>2 weeks) >6 weeks
	Vancomycin 30mg/kg IV divided 24 h+ Gentamicin 1mg/kg	Teicoplanin + Gentamicin	4-6 weeks	Add Gentamicin (>2 weeks) >6 weeks
Organism			NVE	PVE
Enterococcus				
Penicillin - S **Aminoglycoside- S**	Ampicillin 2g q4h + Gentamicin or Penicillin + Gentamicin	If risk of Nephrotoxicity use Ampicillin + Ceftriaxone	4-6 weeks	>6 weeks

Penicillin – S Aminoglycoside - R	Ampicillin + Ceftriaxone 2g q24h	Ampicillin monotherapy >6 weeks	4-6 weeks	>6 weeks
Penicillin – R Aminoglycoside - S	Vancomycin + Gentamicin	Teicoplanin + Gentamicin	4-6 weeks	>6 weeks
VRE	Daptomycin 8-12mg/kg / Linezolid 600mg q12h	Consult ID opinion	>6 weeks	>6 weeks
		HACEK		
Non Betalactamase	Ceftriaxone 2g q24h OR Ampicillin 2g q4h		4-6 weeks	>6 weeks
Beta-lactamase	Ampicillin – Sulbactam 3g q6h		4-6 weeks	>6 weeks
		Non HACEK GNB		
Enterobacteriacae		Based on susceptibility Consult ID opinion	4-6 weeks	>6 weeks
Pseudomonas		Based on susceptibility Consult ID opinion	4-6 weeks	>6 weeks

Indications for Surgery in Infective Endocarditis

Heart failure
Aortic or mitral IE with:
1. Severe acute regurgitation or valve obstruction causing refractory pulmonary oedema/shock (emergency).
2. Fistula into a cardiac chamber or pericardium causing refractory pulmonary oedema/shock (emergency).
3. Severe acute regurgitation or valve obstruction and persisting heart failure or echocardiographic signs of poor haemodynamic tolerance (urgent).
4. Severe regurgitation and no heart failure (elective).
Uncontrolled infection
1. Locally uncontrolled infection including abscess, false aneurysm, enlarging vegetation (urgent).
2. Persisting fever and positive blood culture for ≥10 days after commencing appropriate antimicrobial therapy (urgent).
3. Infection caused by fungi or multiresistant micro organisms (urgent/elective).
Prevention of embolism
1. Aortic or mitral IE with large vegetations (>10 mm) resulting in one or more embolic episodes despite appropriate antibiotic therapy (urgent).
2. Aortic or mitral IE with large vegetations (>10 mm) and other predictors of complicated course like heart failure, persistent infection or abscess (urgent).
3. Isolated very large vegetations >15 mm (urgent).

Intra-Abdominal Infections (IAI) And Abscesses (IAA)

Intra-abdominal infections:

Definition- Infection of any of the organs or organ spaces in the abdominal cavity such as, lower part of esophagus, stomach, small and large intestine, colon, rectum, gall bladder and spleen.

Classification:

Broadly they can be either complicated or uncomplicated.

- Uncomplicated IAI- Intramural infection contained within a single organ (stomach, gall bladder, intestine etc) without anatomic disruption.
- Complicated IAI- clinical conditions in which infection has extended beyond the hollow organ into the peritoneal cavity, resulting in abscess or peritonitis.

Can be community acquired (CA-IAI) or hospital acquired (HA-IAI).

HA-IAI: If the patient previously has stayed in hospital for 2 days or longer or has undergone an abdominal procedure in last 90 days.

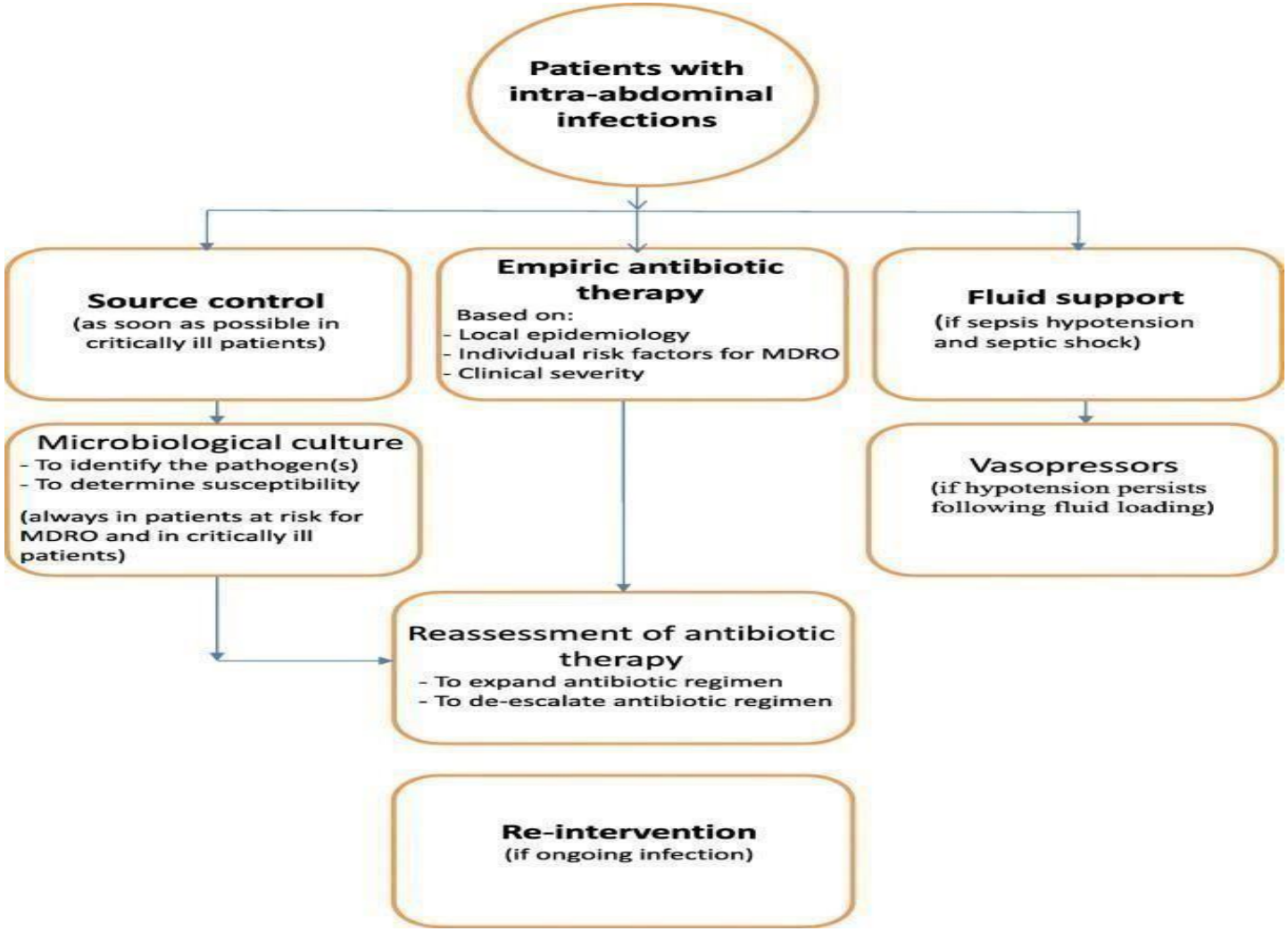
CA-IAI: If the above risk factors are absent.

Investigations:

To look for possible source of infection:

- Laboratory markers- TLC, CRP, Procalcitonin
- Intra-operative culture (pus or tissue, not the swab)
- Blood culture
- Imaging- As required

Approach to management of IAI:



Recommendations for empiric antibiotics:

Type of infection (definition)	Common organisms	Empiric therapy		Duration of therapy and comments (if any)
		CA-IAI, Mild to moderate	CA-IAI, severe/ HA-IAI	
Extra-billiary source				
▪ Appendicitis ▪ Diverticulitis ▪ Bowel perforation with peritonitis	E.coli, Klebsiella, Bacteroides spp.	Cefuroxime 1.5g Q8H Or Ceftriaxone 2g Q24H Or Cefotaxime 2g Q8H PLUS Metronidazole 500 mg Q8H In beta-lactam allergy: Ciprofloxacin 400 mg Q12H PLUS Metronidazole 500 mg Q8H	Piperacillin/Tazobactam 3.375 g Q6H With high risk of ESBL: Meropenem 1g Q8H Or Imipenem/cilastatin 500 mg Q6H or Tigecycline 100 mg LD then 50 mg Q12H (not active against Pseudomonas aeruginosa and as a carbapenem sparing strategy) +/- Anti-enterococcal coverage if high risk for Enterococcal infection[1] +/- Anti-fungal antibiotic in high risk of invasive candidiasis (Candida score >=3)[1]	Mild to moderate or uncomplicated IAI (after adequate source control): 4 days Complicated/severe IAI: • 7-14 days • Guided by clinical response • Consider ID consult
Biliary source				
▪ Cholecystitis ▪ Cholangitis	Enterococcus spp., E. coli, Klebsiella,	Ceftriaxone 2g Q24H or Cefotaxime 2g Q8H PLUS Metronidazole 500 mg Q8H	Piperacillin/Tazobactam 6 g/0.75 g loading dose then 4 g/0.5 g IV Q6H High risk of ESBL Enterobacteriaceae :	▪ Uncomplicated (with adequate sourcecontrol)- ≤ 24 hours ▪ Non-operative (uncomplicated)- 5 days ▪ Complicated: 7-14 days • Delayed clinical response

	Bacteroides spp	In beta-lactam allergy: Ciprofloxacin 400 mg Q8/12H PLUS Metronidazole 500 mg Q8H	Tigecycline 100mg loading dose then 50mg Q12H OR Ertapenem 1g Q24H OR Meropenem 1g Q8H (Only in patients with septic shock) OR Imipenem/cilastatin 500 mg Q6H (Only in patients with septic shock) +/- Anti-enterococcal coverage if high risk for Enterococcal infection[1]	OR Inadequate source control- Consider IDconsult
Peritonitis				
Spontaneous Bacterial Peritonitis SBP as defined by presence of ≥ 250 neutrophils in peritoneal fluid	E. coli, Klebsiella, Streptococcus pneumoniae, Enterococcus, Enterobacteriaceae, Staphylococcus,	Cefotaxime 2g IV Q8H OR Ceftriaxone 1gm IV Q12H Beta-lactam allergy: Ciprofloxacin 400mg IV Q12h	Piperacillin/Tazobactam 3.375 gm iv Q6H Or Meropenem 1g IV Q8H	5-7 days Treatment to be tailored based on cultureresults from peritoneal fluid

	Pseudomonas.			
Secondary peritonitis Secondary to intra-abdominal abscess or GI perforation	Enterobacteriaceae (E. coli, Klebsiella spp.), Bacteroides (colonic perforation) ,Anaerobes	Piptaz 3.375 gm iv Q6H Or Cefoperazone- Sulbactam 3gm IV Q12H	In very sick patients, Meropenem 1gm IV 8hourly Or Imipenem/cilastatin 1g IV 8hourly Or Ertapenem 1gm IV OD Additional anti-fungal coverage[1] PLUS Additional Enterococcus coverage- Vancomycin 25-30 mg/kg LD, then 15-20 mg/kg/dose Q8H OR Teicoplanin: 12 mg/kg Q12H for 3 doses (LD), then 12 mg/kg Q24H	▪ Adequate source control: 4 days post-procedure ▪ Gastroduodenal perforation operated within 24h or traumatic bowel perforations repaired within 12hrs or Ischemic, non-perforated bowel:: Discontinue antibiotics within 24h ofsurgery ▪ Associated gram-negative bacteremia:7 days ▪ If inadequate source control or persistent signs of infection, considerID and surgical consultation
Tertiary peritonitis (or persistent peritonitis) ▪ Peritonitis occurring >48 hours after seemingly successful	Enterobacteriaceae (E. coli, Klebsiella spp.), Enterococci, Bacteroides (colonic	No risk of MDROs- Piperacillin/Tazobactam 6 g/0.75 g loading dose then 4 g/0.5 g IV Q6H	Risk of MDROs- Meropenem 1g Q8H +/- Ampicillin 2 g Q6H or	

surgical source control of secondary peritonitis or in criticallyill or immunocompromised patients. ▪ Often a/ wMDROs.	perforation), anaerobes		Imipenem/cilastatin 500 mg Q6H (Only in patients with septic shock) Or Tigecycline 100mg loading dose then 50mg Q12H +/- anti-fungal coverage in case of high risk of invasive candidiasis +/- In suspected VRE add– Linezolid 600 mg Q12H Or Tigecycline 100 mg LD, then 50 mg Q12H	
CAPD peritonitis	S. aureus (MSSA, MRSA), coagulase-negative Staphylococcus, Enterobacteriaceae	Cefazolin- 1-2 g every 8 h PLUS a third-generation cephalosporinsuch as ceftazidime: 2 g IV Q8H Or Ceftriaxone: 1 g IV Q12 h Or cefotaxime: 1-2 g Q6-8H In case of beta-lactam allergy- Ciprofloxacin: 400 mg Q12H Or Levofloxacin: 750 mg Q12H	Critically ill patient/ high risk of MRSA: Vancomycin (instead of cefazolin) PLUS a carbapenem.	Without exit- site or tunnel infection: 14days. With exit-site or tunnel infection: catheterremoval and antibiotic for up to 21 days In fungal infections, the catheter should beremoved immediately.

Interstitial oedematous acute pancreatitis		No antibiotics		
Necrotizing pancreatitis		No antibiotics		
Suspected infected pancreatic necrosis, Infected pseudocyst; pancreatic abscess (Infected necrosis should be suspected in patients with worsening clinical trajectory and/or signs of infection (increasing leukocytosis, fevers) or CT imaging demonstrating presence of gas within necrosis.	Enterobacteriaceae, Enterococci, S. aureus, S. epidermidis, Anaerobes ,Candida spp.	Piperacillin-tazobactam 4.5g IV Q8H extended infusion Or Cefoperazone-Sulbactam 3 gm IV Q8H	Meropenem 1 gm iv Q8H OR Imipenem+cilastatin 1gm IV Q8H In very sick patients: Add anti-fungal and anti-enterococcal coverage[1]	Duration is clinically guided and based on source control For 7-10days

[1]Anti-fungal coverage -Add caspofungin 70 mg LD, then 50 mg OD or, fluconazole 800 mg LD f/b 400 mg Q24H, Anti-enterococcal coverage- add Ampicillin 2 gQ6H (if patient is not getting piptaz or imipenem/cilastatin or tigecycline)

Intra-Abdominal Abscesses-

Is an intra-abdominal collection of pus or infected material and is usually due to a localized infection inside the peritoneal cavity. It can involve any intra-abdominal organ or can be located freely within the abdominal or pelvic cavities, including in between bowel loops

Recommended empiric antibiotics

Community acquired, mild to moderate severity	Cefuroxime 1.5 gm Q8H OR ceftriaxone 1-2 gm iv Q12-24 H OR Cefotaxime -2 gm iv Q6-8 H + Metronidazole 500 mg iv Q8-12 H Beta lactam allergy: Ciprofloxacin 400 mg Q12H OR Levofloxacin 750 mg iv Q 8-12H Plus Metronidazole 500mg Iv Q 8-12H	Upto 5 days

Community acquired, Severe or Hospital-acquired	Piperacillin/tazobactam: 3.375 g intravenously Q6H Or Meropenem 1gm TDS or Imipenem Cilastatin 500mg -1gm iv q6-8hrly Additional *Enterococcus* coverage (if patient is not getting piptaz); Ampicillin 2gm iv q4-6hrly or Vancomycin 15-20mg/kg iv q8-12 hrly or Linezolid 600mg iv q12hrly or Daptomycin 8-12mg iv q24hrly or Tigecycline 100mg iv LD F/B 50mg q12hrly Additional Antifungal thearpy; Fluconazole 400-800mg/day iv Caspofungin 70mg iv D1 F/B 50mg every 24 hrs Adjunctive MRSA Coverage Vancomycin 15-20mg/kg iv q8-12 hrly	7-10 days
Liver abscess	Ceftriaxone 2gm IV Q24H OR Piperacillin-tazobactam 4.5g Q6H PLUS Metronidazole 750 mg Q6h	Upto 4 to 6 weeks Amoebic serology & stool examination (for ova/cyst/trophozoites) are to be senton the same day. Fluid/pus microscopy & cultures Add Diloxanide furoate 500 mg Q8H for 10days in case of amoebic liver abscess.
Splenic abscess	<3-cm single abscess- percutaneous drainage Multiple abscesses or single abscess > 3 cm-splenectomy with adjunctive antibiotics	Patients undergoing splenectomy should be vaccinated against encapsulated organisms (Streptococcus pneumoniae, Haemophilus influenzae, Neisseria meningitidis).

SEPSIS AND SEPTIC SHOCK

Clinical Entity	Definition
Infection	Invasion of normally sterile tissue by organisms resulting in infectious pathology
Bacteremia	The presence of viable bacteria in the blood
Sepsis	Life-threatening organ dysfunction caused by a dysregulated host response to infection as evidenced by the organ dysfunction (Increase of two or more points in the SOFA score)
Septic Shock	Septic shock is defined as sepsis that has circulatory, cellular, and metabolic abnormalities that are associated with a greater risk of mortality than sepsis alone. Clinically, this includes patients who fulfil the criteria for sepsis who, despite adequate fluid resuscitation, require vasopressors to maintain a mean arterial pressure (MAP) ≥65 mmHg andhave a lactate >2 mmol/L (>18 mg/dL).
Multi Organ Dysfunction syndrome (MODS)	Multiple organ dysfunction syndrome (MODS) refers to progressive organ dysfunction in an acutely ill patient, such that homeostasis cannot be maintained without intervention. It is at the severe end of the severity of illness. Spectrum of both infectious (sepsis, septic shock) and noninfectious conditions (eg, pancreatitis)
Quick SOFA (qSOFA)	One point assigned to each Respiratory rate ≥22/minute, Altered mentation and Systolic blood pressure ≤100mmHg. Score more than 2 indicates poor prognosis and sepsis.
HOUR-1 BUNDLE	Initial (1 hour) resuscitation for sepsis and septic shock: 1) Measurelactate level. 2) Obtain blood cultures before administering antibiotics. 3) Administer broad-spectrum antibiotics. 4) Begin rapid administration of 30mL/kg crystalloid for Hypotension or lactate ≥4 mmol/L. 5) Apply vasopressors if hypotensive during or after fluid Resuscitation to maintain a mean arterial pressure ≥ 65 mmHg.

Initial evaluation of common sources of sepsis

Suspected site	Symptoms/signs	Initial microbiologic evaluation
Upper respiratory tract	Pharyngeal inflammation plus exudate ± swelling and lymphadenopathy	Throat swab for aerobic culture and Molecular testing
Lower respiratory tract	Productive cough, pleuritic chest pain, consolidative auscultatory findings	Sputum of good quality, rapid influenza testing, urinary antigentesting (eg, pneumococcus, legionella; not recommended in children),Molecular testing (PCRs) quantitative culture of protected brush or bronchoalveolar lavage
Urinary tract	Urgency, dysuria, loin, or back pain	Urine culture and microscopy showing pyuria
Vascular catheters: arterial, central venous	Redness or drainage at insertionsite	Culture of blood (from the catheter and a peripheral site),
Indwelling pleural catheter	Redness or drainage at insertion site	Culture of pleural fluid (through catheter)
Wound or burn	Inflammation, edema, erythema, discharge of pus	Gram stain and culture of draining pus, wound culture not reliable
Skin/soft tissue	Erythema, edema, lymphangitis	Culture blister fluid or draining pus, Debridment tissue
Central nervous system	Signs of meningeal irritation	CSF cell count, protein, glucose, Gram stain, and culture, Molecular tests
Gastrointestinal	Abdominal pain, distension, diarrhea, and vomiting	Stool culture for Salmonella, Shigella, or Campylobacter; detection of Clostridium difficile toxin

Intra-abdominal	Specific abdominal symptoms/signs	Aerobic and anaerobic culture of percutaneously or surgically drained abdominal fluid collections
Peritoneal dialysis (PD) catheter	Cloudy PD fluid, abdominal pain	Cell count and culture of PD fluid
Genital tract	Women: Low abdominal pain, vaginal discharge Men: Dysuria, frequency, urgency, urge incontinence, cloudy urine, prostatic tenderness	Women: Endocervical and high vaginal swabs onto selective media Men: Urine Gram stain and culture
Bone	Pain, warmth, swelling, decreased use	Blood cultures, MRI, bone cultures at surgery or by interventional radiology
Joint	Pain, warmth, swelling, decreased range of motion	Arthrocentesis with cell counts, Gram stain, and culture

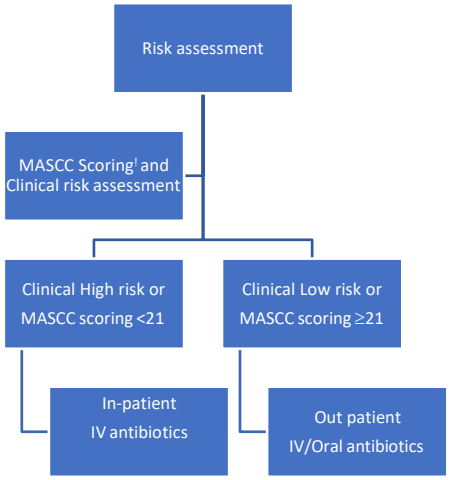
Empiric Antimicrobial Treatment for cases with sepsis or septic shock-

Profile	IV Antibiotic
Sepsis with or without shock Low risk of MDR organism	Meropenem 1 to 2 gm q 8H (2-3hrs infusion)
Sepsis with or without shockHigh risk of MDR organism (Broad spectrum antibiotic use or hospitalisation in past 90 days,previous infection with MDR organism	Meropenem 1 to 2Gm q 8H (2-3hrs infusion) plus Amikacin 15mg/kg q 24 hrs
Sepsis with or without shock withrisk of MRSA infections(History of MRSA infection/colonisation, Recent (90 days) IV antibiotics/hospitalisation, History of recurrent skin infections or chronic wounds, presence of invasive devices, hemodialysis, Very severe illness)	Add Vancomycin (15-20mg/kg q12 hrs) or Teicoplanin (12mg/kg q 12 hrs for 4 doses then 12 mg/kg q 24 hrs) to above regimen
Risk for fungal infections Immunocompromised state, multiple site candida colonisation, Totalparentral nutrition, Broad spectrum antibiotics use , GI surgery or perforation, severe burns, very severe illness	Add Caspofungin 70 mg loading dose then 50 mg q 24 hrs

Febrile Neutropenia

Definition	It is the documentation of single oral temperature ≥38.3 deg C/ 101deg F or a temperature of ≥38.0 deg C/ 100.4deg F sustained over a 1 hour period and ANC of <500 cells/µl.
Initial assessment (within the initial 15 minutes) – to triage the patient.	Based on clinical features, expected duration of neutropenia and formal scoring- (MASCC scoring)
Baseline Investigations to send	CBC with differential Platelet count C reactive protein Serum Creatinine Blood urea Nitrogen Serum Electrolytes Hepatictransaminases Total Bilirubin Coagulation screen Serum Lactate Blood culture – 2 sets atleast One from Central line and another from peripheral venous prickOR Two blood cultures from separate venipuncture, if no central venous catheterUrinalysis and Urine culture Other suspected site – culture if clinically indicated Chest X ray – If Respiratory signs and symptoms present

Assessment of Risk



Empirical Therapy of Patients – without risk factors

	Empirical		First line	Additional antibiotic
Empirical coverage for Gram positive and Gram negative				
Antibiotic	Inpatient-		Cefepime/ Piperacillin tazobactam/ Meropenem or Imipenem cilastatin	If 1) Complications develops- eg- Hypotension and pneumonia 2) Antimicrobial resistance is suspected or proven- Aminoglycoside Vancomycin@
	Outpatient		Ciprofloxacin + Amoxicillin clavulanate	Alternate- Ciprofloxacin+ Clindamycin

Empirical Therapy of Patients – with risk factors

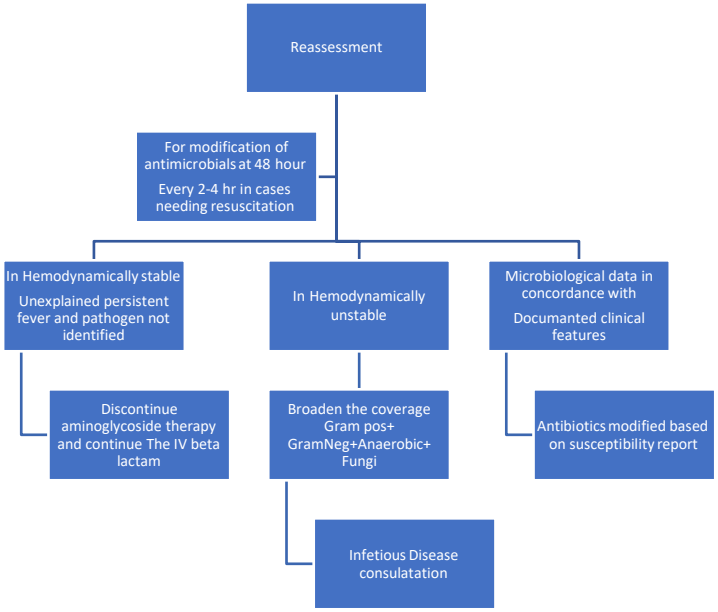
Risk Factor – These are the antibiotic of choice in case of Previous Infection or with the mentioned organisms or treatment in a hospital with high rates of endemicity		
Organism Identified	First line	Alternative treatment
MRSA	Vancomycin	Linezolid / Daptomycin
VRE	Linezolid	Daptomycin
ESBL GNB	Carbapenem	
Carbapenamse producing Organisms	Polymyxin/Colistin	Tigecycline
Immediate Type Hypersensitivity	Ciprofloxacin+ Clindamycin Or Aztreonam + Vancomycin	

Reassessment /Revision of antimicrobials

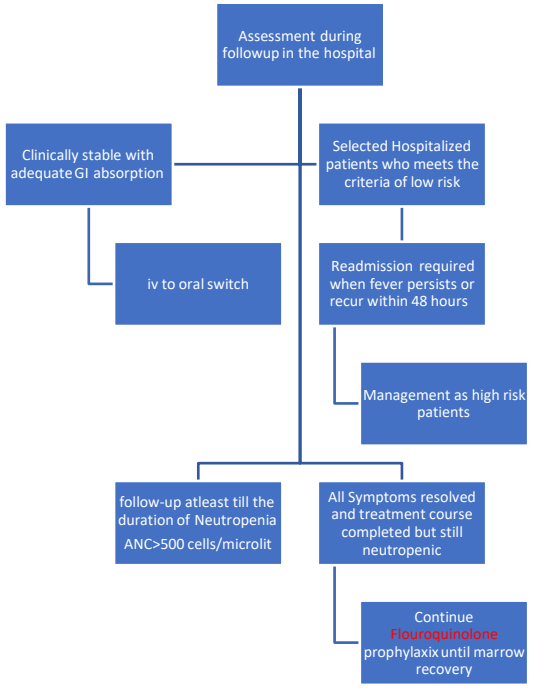
When to do the reassessment after initiating antibiotics?

- After 48 hours of initiating the empirical antibiotics
- Worsening of clinical condition-eg: Unexplained persistentfever
- Culture results shows evidence of infection with susceptibility report

Algorithm for further management



In High-risk Patient



In Low-risk Patient

In Suspected specific focus of Infection in febrile Neutropenia – In High Risk patients

Condition	Risk factor	Investigation	Mx- First line	Alternative
Catheter Related Blood stream Infection	Central iv line in-situ	Blood culture from Central line and peripheral venous prick Diagnosis if DTP is > 2 hours.	Inj Vancomycin Note- Central line should not be removed unless a laboratorydocumentation of CRBSI is available	Teicoplanin Once daily as a line lock
Catheter related Infection in CentralNervous System			Catheter can be retained if the patient is hemodynamically stable	
Special situations in Catheter related Infection	Tunnel infection, Pocket Infection, Persistent bacteremia despite adequate antibiotics	Local examination + Blood culture[%]	Catheter should be removed+ systemic antibiotic iv Vancomycin	Teicoplanin
Note- Catheter removal is indicated in Atypical mycobacterial infection and candidemia, Pseudomonas aeruginosa Line infection caused by Staphylococcus aureus- It is indicated to remove the line, In view of metastatic spread of infection and further treatment with iv Vancomycin and follow-up blood culture after 48 hours.				
Pneumonia	*Pneumocystis jirovecii* infection In Prior corticosteroid therapy, Use of Immunosuppressants after organ TPL(exposure to purine analogues), - high RR + desaturates readily off oxygen		High dose cotrimoxazole therapy	

	Invasive Aspergillosis Infection Patients with AML during remission induction ChT Allogenic HSCT receiving prior conditioning ChT	HRCT scan- to look for features like nodules with halos or Ground glass change. Serum Galactomannan If any infiltrate found, BAL should be taken	IV Voriconazole	IV Liposomal amphotericin B
Vesicular lesions/suspected viralinfection	Herpes Zoster Cytomegalovirus Infection	Aspirate from the lesion – Tzanck smear/PCR	Aciclovir	Ganciclovir should be substituted only when thereis high suspicion of CMV infection
Suspected meningitis/Encephalitis	Gram positive Gram Negative Listeria Monocytogenes	Lumbar puncture- Cytology Aerobic Culture Biochemistry	Meropenem +Ampicillin+ Vancomycin	High dose ACICLOVIR is added if CSF analysis+ clinical features are s/o Viral Encephalitis
Cellulitis	Gram positive cocci (especially Staphylococcus aureus-MRSA)		IV Vancomycin	Linezolid Or Daptomycin
Intra-abdominal or pelvic sepsis	Intestinal flora(esp.-Anaerobic organisms)		IV Metronidazole Note- If the initial anaerobic coverage with piperacillin tazobactam/Meropenem Was not given	
Diarhoea	Clostridium difficile		Oral Vancomycin Or IV Metronidazole	

When to start empirical antifungal therapy?

If fever persists for more than 4-7 days after initiation of Broad spectrum antibiotics

+

no source of infection identified

+

Overall duration of Neutropenia is expected to be >7 days

Choice of antifungal for empirial antifungal therapy?

Echinocandin-Caspofungin- 70mg Loading dose followed by 50 mg Q24H.
OR

Micafungin100 mg daily OR

Anidulafungin 200mg loading followed by 100mg Q24H

Alternative- Lipid formulation amphotericin B 3-5mg/Kg
Fluconazole 800 mg Loading dose followed by 400 mg (as step down therapy in non-critically ill patients)

Investigations to send-

- Blood fungal culture at least 2, before initiating the antifungal therapy.
- Imaging studies- Chest and Sinus CT imaging
- Serology- Serum Galactomannan, Beta d- glucan
- Culture from other specific sites based on clinical features

Is empirical antiviral therapy required?

Routinely not recommended in the initial regimen

- Note- Treatment of the febrile neutropenic patient with Oseltamivir is advised in the setting of an outbreak of Influenza – like illness
- Routine treatment for RSV in patients with URTI is not recommended

Duration of Therapy		
If ANC > 500cells/ l Patient is asymptomatic Afebrile for 48 hours Blood cultures are negative		Antibacterials can be discontinued
If ANC <500cells/ l Patient has suffered no complicationsAfebrile for 5-7 days		Antibacterials can be discontinued (Except in High risk cases with Acute leukemia and following high-dose CHT – Antibacterials are continued for upto 10 days or until ANC > 500cells/ l)
Patients with persistent fever despite Neutrophil recovery		Infectious Diseases Opinion/Anti-fungal therapy should be considered
For CRBSI	due to Staphylococcus aureusPseudomonas aeruginosa Fungi Mycobacteria	The total duration of therapy is atleast 14 days with catheter removalaftersending followup blood culture
	Documented CRBSI due to Coagulase Negative Staphylococcus species	Catheter may be retained using systemic therapy with or without AntibioticLock therapy
	Complicated CRBSI In conditions like Deep tissue infection Endocarditis Septic Thrombosis Persistent Bacteremia /Fungemia>72 hours of receiving appropriateantimicrobials	Total duration of treatment is 4-6 weeks

Antibiotic Prophylaxis

When to start antibiotic prophylaxis?

In prolonged and profound neutropenia <10 cells/mmAnticipated Neutropenia duration>7 days

When to start Antifungal prophylaxis

Intensive chemotherapy for AML or MDS

If Prior invasive aspergillus infection documented in pre-engraftment allogenic/ autologous transplant recipients

Anticipated neutropenia >2 weeks

Choice of antifungal?

Posaconazole

When to start antiviral prophylaxis?

If HSV seropositive status documented in allogenic HSCT/leukemia induction- to give Acyclovir prophylaxis

Note-Treatment of HSV/VZV infection is initiated only when there is laboratory evidence of active infection

SURGICAL PROPHYLAXIS

Introduction

- Antibiotic prophylaxis should be administered for operative procedures that have a high rate of postoperative surgical site infection, or when foreign materials are implanted.
- Antibiotic given as prophylaxis should be effective against the aerobic and anaerobic pathogens most likely to contaminate the surgical site i.e., Gram-positive skin commensals or normal flora colonizing the incised mucosae

Classification of surgical wounds

Type of wound	Class I or Clean wounds	Class II or Clean-contaminated wounds	Class III or Contaminatedwounds	Class IV or Dirty wounds
Definition	Uninfected operative wounds in which no inflammation is encountered or no viscusis entered and the woundis closed primarily.	Operative wounds in which a viscus is entered under controlled conditions and without unusual contamination	Open, fresh accidental wounds,operations with major breaks insterile technique, or gross spillage from a viscus.	Old traumatic wounds with retained devitalized tissue, foreign bodies, or faecal contamination or wounds thatinvolve existing clinical infection orperforated viscus.
SSI rates[1]	1.3 to 2.9%	2.4 to 7.7%	6.4 to 15.2%	7.1 to 40.0%

Dosing and duration-

- Preoperative-dose timing: Optimal time for administration is within 60 minutes before surgical incision. this is a more specific time than the prior recommendation of administration at induction of anaesthesia
- Some agents, such as vancomycin and aminoglycosides, require administration over 1 to 2 hours; therefore, the administration of these agents shouldbegin within 120 minutes before surgical incision.
- Weight-based dosing is recommended; this includes a higher dose of cefazolin for obese patients (weight >120 kg).
- New recommendations are given for a shortened postoperative course. Most cases can be treated with a single dose. The duration should be no longerthan 24 hours post-operatively regardless if there are indwelling drains.
- Prolonged antibiotic prophylaxis beyond 48 hours is not only ineffective in reducing infections but increases antimicrobial resistance and the risk ofinfection with Clostridiodes difficile.
- Redosing: If the duration of the surgery exceeds 2 half-lives of the antimicrobial or there is excessive blood loss up to 1500 ml during surgery or haemodilution of up to 15 ml/kg, intraoperative redosing is needed to ensure adequate serum and tissue concentrations of the antimicrobial.

Route of administration

Parenteral administration (intravenous or intramuscular) is the preferred route for surgical antimicrobial prophylaxis

Recommended Doses and Redosing Intervals for Commonly Used Antimicrobials for Surgical Prophylaxis

Recommended Dose			Half-life in Adults With Normal Renal Function, hr	Recommended Redosing Interval (From Initiation of Preoperative Dose), hr
Antimicrobial	Adults adult (age 19 years or older)	Pediatric (age 1–18 years)		
Ampicillin–sulbactam	3g (ampicillin 2 g/ sulbactam 1 g)	50 mg/kg of the ampicillin component	0.8–1.3	2
Ampicillin	2g	50 mg/kg	1–1.9	2
Aztreonam	2g	30 mg/kg	1.3–2.4	4
Cefazolin	2 g, 3 g for pts weighing ≥120 kg	30 mg/kg	1.2–2.2	4
Cefuroxime	1.5 g	50 mg/kg	1–2	4
Cefotaxime	1g	50 mg/kg	0.9–1.7	3
Cefoxitin	2g	40 mg/kg	0.7–1.1	2
Cefotetan	2g	40 mg/kg	2.8–4.6	6
Ceftriaxone	2g	50–75 mg/kg	5.4–10.9	NA
Ciprofloxacin	400 mg	10 mg/kg	3–7	NA
Clindamycin	900 mg	10 mg/kg	2-4	6
Ertapenem	1g	15 mg/kg	3-5	NA
Fluconazole	400 mg	6 mg/kg	30	NA
Gentamicin	5 mg/kg based on dosing weight (single dose)	2.5 mg/kg based ondosing weight	2-3	NA
Levofloxacin	500 mg	10 mg/kg	6-8	NA

Metronidazole	500 mg	15 mg/kg Neonatesweighing <1200 g should receive a single 7.5- mg/kg dose	6-8	NA
Moxifloxacin	400 mg	10 mg/kg	8-15	NA
Piperacillin– tazobactam	3.375 g	Infants 2–9 mo: 80 mg/ kg of the piperacillin component Children >9 mo and ≤40 kg: 100 mg/kg of the piperacillin component	0.7-1.2	2
Vancomycin	15 mg/kg	15 mg/kg	4-8	NA
Oral antibiotics for colorectal surgery prophylaxis (used in conjunction with a mechanical bowel preparation)				
Erythromycin base	1 g	20 mg/kg	0.8-3	NA
Metronidazole	1g	15 mg/kg	6-10	NA
Neomycin	1g	15 mg/kg	2-3	NA

Recommendations for Surgical Antimicrobial prophylaxis

Type of Procedure	Common pathogens	Recommended Agents	Alternative Agents in Patientswithß-Lactam Allergy
Cardiac			
Coronary artery bypass Cardiac device insertion procedures(e.g., pacemaker implantation) Ventricular assist devices	Staphylococcus aureus,CONS	CefazolinOR cefuroxime	ClindamycinOR vancomycin
Thoracic			
Noncardiac procedures, including lobectomy, pneumonectomy, lung resection, and thoracotomy Video-assisted thoracoscopic surgery	Staphylococcus aureus; CoNS; Streptococcus pneumonia; gram-negative bacilli (GNB)	CefazolinOr Ampicillin– sulbactam	Clindamycin,OR Vancomycin
Gastro-duodenal			
Procedures involving entry into lumen of gastrointestinal tract(bariatric, pancreatico-duodenectomy)	GNB; Streptococci; Oropharyngeal anaerobes (e.g.,Peptostreptococci)	Piperacillin-Tazobactam or Cefoperazone-sulbactam	Clindamycin or vancomycin + aminoglycoside or aztreonam
Procedures without entry into gastrointestinal tract (anti-reflux, highly selective vagotomy) for high-risk patients	GNB; Streptococci; Oropharyngeal anaerobes (e.g.,Peptostreptococci)	Piperacillin-Tazobactam or Cefoperazone-sulbactam	Clindamycin or vancomycin + aminoglycoside or aztreonam
Laparoscopic procedure			
Elective, low-risk	GNB; Anaerobes	None	None
Elective, high-risk		Or ceftriaxone or ampicillin– Sulbactam or Amoxycillin- clavulanate	Clindamycin or vancomycin + aminoglycoside or aztreonam or Metronidazole + aminoglycoside

Appendectomy for uncomplicated appendicitis	GNB; Anaerobes	Cefazolin+ metronidazole	Clindamycin + aminoglycoside or aztreonam OR Metronidazole + aminoglycoside
Small intestine			
Non-obstructed	GPC, GNB; Anaerobes	Cefazolin	Clindamycin + aminoglycoside or aztreonam
Obstructed	GPC, GNB; Anaerobes	Cefazolin + metronidazole	Metronidazole + aminoglycoside
Hernia repair (hernioplasty andherniorrhaphy)	GPC, GNB; Anaerobes	Cefazolin	Clindamycin OR vancomycin
Colorectal	GPC, GNB; Anaerobes	Cefazolin + metronidazole OR ceftriaxone + metronidazole OR ertapenem	Clindamycin + aminoglycoside or aztreonam OR metronidazole +aminoglycoside
Head and neck			
Clean with placement of prosthesis (excludes tympanostomy tubes)	Staphylococcus aureus; streptococci; oropharyngeal anaerobes (e.g., peptostreptococci)	Cefazolin OR cefuroxime	Clindamycin
Clean-contaminated cancer surgery		Cefazolin + metronidazole, OR Cefuroxime + metronidazole, OR Ampicillin–sulbactam	Clindamycin
Other clean-contaminated procedures with the exception of tonsillectomy and functional endoscopic sinus procedures		Cefazolin + metronidazole, OR Cefuroxime + metronidazole, OR Ampicillin–sulbactam	Clindamycin
Neurosurgery			
Elective craniotomy and cerebrospinal fluid-shuntingprocedures	Staphylococcus aureus; CoNS	Cefazolin	Clindamycin OR vancomycin
Implantation of intrathecal pumps			
Cesarean delivery		Cefazolin	Clindamycin + aminoglycoside

Hysterectomy (vaginal or abdominal)	Gram-negative bacilli; enterococci; group B streptococci; anaerobes	Cefazolin OR Ampicillin- sulbactam	Clindamycin or vancomycin + aminoglycoside Or Metronidazole + aminoglycoside
Ophthalmic	S. aureus; CoNS; streptococci; GNB	Topical fourth-generation topical fluoroquinolones (gatifloxacin or moxifloxacin) given as 1 drop every 5–15 min for 5 doses Addition of cefazolin 100 mg by subconjunctival injection or intracameral cefazolin 1–2.5 mg or cefuroxime 1 mg at the end of procedure is optional	None
Orthopedic			
Clean operations involving hand, knee, or foot and not involving implantation of foreign materials	Staphylococcus aureus; CoNS; GNB	None	None
Spinal procedures with and withoutinstrumentation		Cefazolin	Clindamycin OR vancomycin
Hip fracture repair			
Implantation of internal fixation devices (e.g., nails, screws, plates, wires)			
Total joint replacement			

Urologic			
Lower tract instrumentation with riskfactors for infection (includes transrectal prostate biopsy)	S. aureus, GNB	Prophylaxis based on pre- operative urine culture susceptibility pattern- Cefazolin, Cotrimoxazole	Aminoglycoside with or without clindamycin
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])	Clindamycin OR vancomycin
Involving implanted prosthesis	S. aureus, CONS, GNB	Cefazolin ± aminoglycoside, OR cefazolin ± aztreonam OR ampicillin–sulbactam	Clindamycin ± aminoglycoside or aztreonam OR vancomycin ± aminoglycoside or aztreonam
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])	Aminoglycoside with or without clindamycin
Clean-contaminated		Cefazolin + metronidazole	Aminoglycoside + metronidazole OR clindamycin

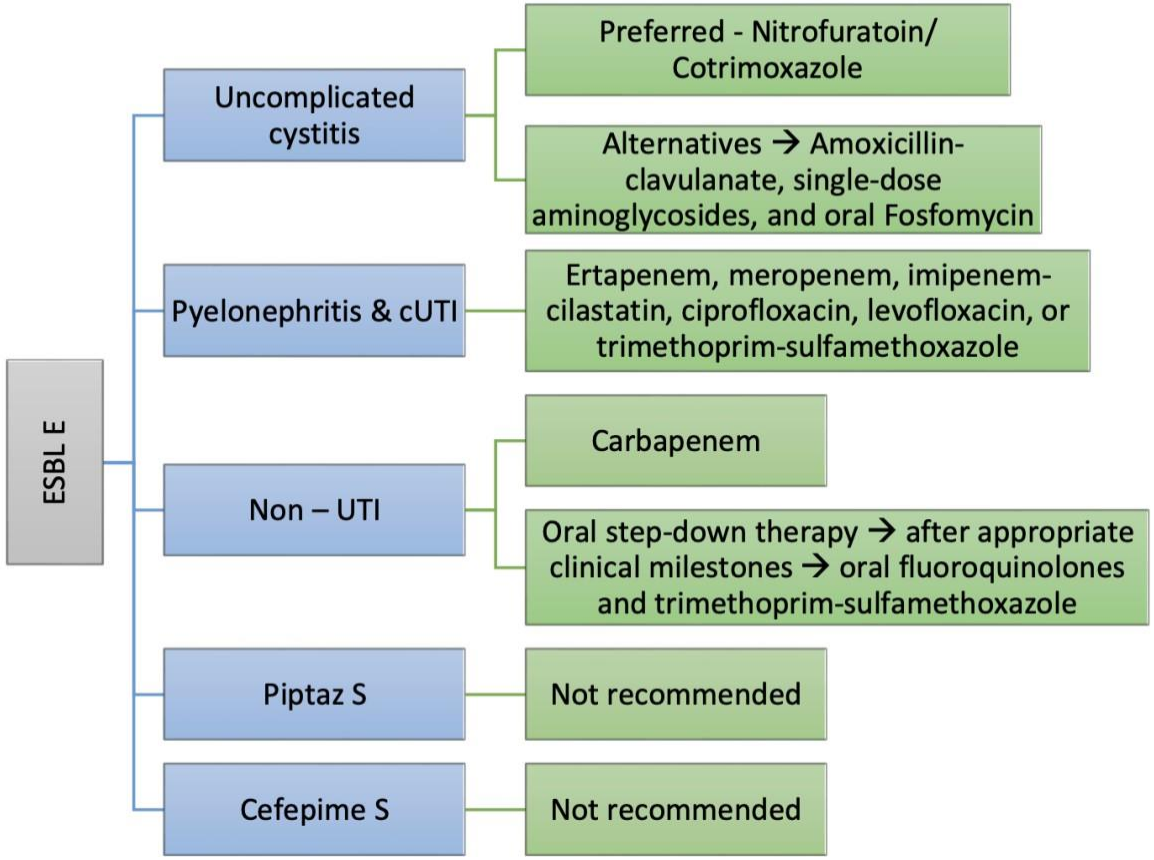
Vascular			
Heart, lung, heart– lung transplantation	Staphylococcus aureus; CoNS	Cefazolin	Clindamycin OR vancomycin
Heart transplantation		Cefazolin	Clindamycin OR vancomycin
Lung and heart–lung transplantation		Cefazolin	Clindamycin OR vancomycin
Liver transplantation		Piperacillin–tazobactam, OR cefotaxime + ampicillin	Clindamycin or vancomycin + aminoglycoside or aztreonam
Pancreas and pancreas– kidney transplantation		Cefazolin ± Fluconazole (for patients at high risk of fungal infection [e.g., those with enteric drainage of the pancreas])	Clindamycin or vancomycin + aminoglycoside or aztreonam
Plastic surgery		Cefazolin	Clindamycin or vancomycin + aminoglycoside or aztreonam
Clean with risk factors or clean-contaminated		Cefazolin + ampicillin–sulbactam	Clindamycin Or vancomycin

Treatment of multi-drug resistant organisms

When to suspect different Beta-lactamases?

Antibiotics	ESBL	Amp C	Carbapenamase	CRO
Ampicillin	R	R	R	R
Cefoxitin	S	R	R	R
Ceftriaxone	R	R	R	R
Cefepime	S	S	R	R
Piperacillin + Tazobactam	S	R	R	R
Cefoperazone +sulbactam	S	R	R	R
Meropenem	S	S	R	R
Colistin	I	I	I	R

Treatment options for ESBL *Enterobacterales*



Treatment options for 3GCepRE/ESBL Enterobacterales

3GCepRE/ESBL	
BSI and severe infection	Carbapenem Oral stepdown – Levofloxacin Cotrimoxazole
Low-risk, non-severe infections	Piptaz Amoxi-clav Quinolone Cotrimoxazole
Uncomplicated cystitis	Nitrofurantoin Cotrimoxazole single-dose aminoglycosides Oral Fosfomycin
cUTI in patients without septic shock	Aminoglycosides (Short course) IV Fosfomycin
Pyelonephritis & cUTI	Not to be given Doxycycline Oral Fosfomycin Nitrofurantoin

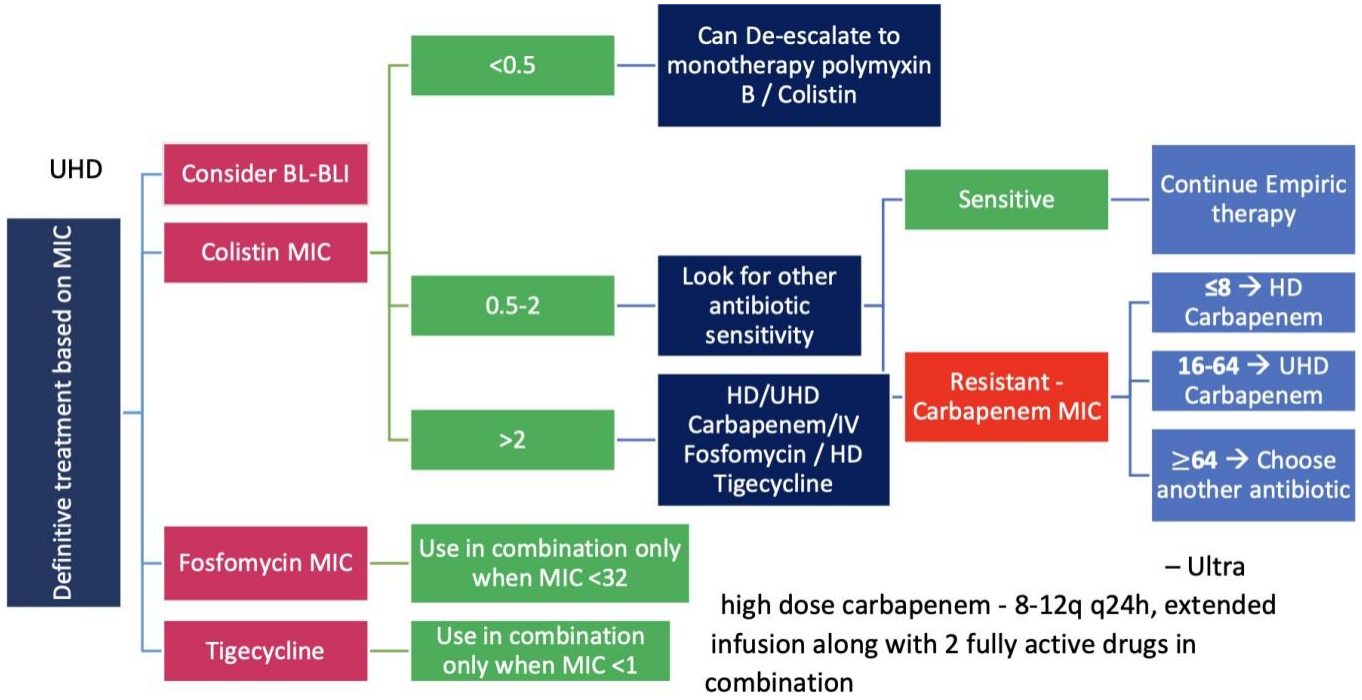
Treatment Options for Amp-C

- Fluoroquinolones
- Aminoglycosides
- Trimethoprim-sulfamethoxazole (TMP-SMX)
- Tetracycline
- Non-beta-lactam antibiotics
- Cefepime – (If MIC ≤2 mcg)
- Carbapenems
- Newer BL-BLI (Restrict use in AmpC)
- Ceftriaxone or ceftazidime is not recommended in treatment of Amp-C due to high risk of Clinically significant inducible Amp C production, even if it appears S in vitro

Availability of Ceftazidime – Avibactam

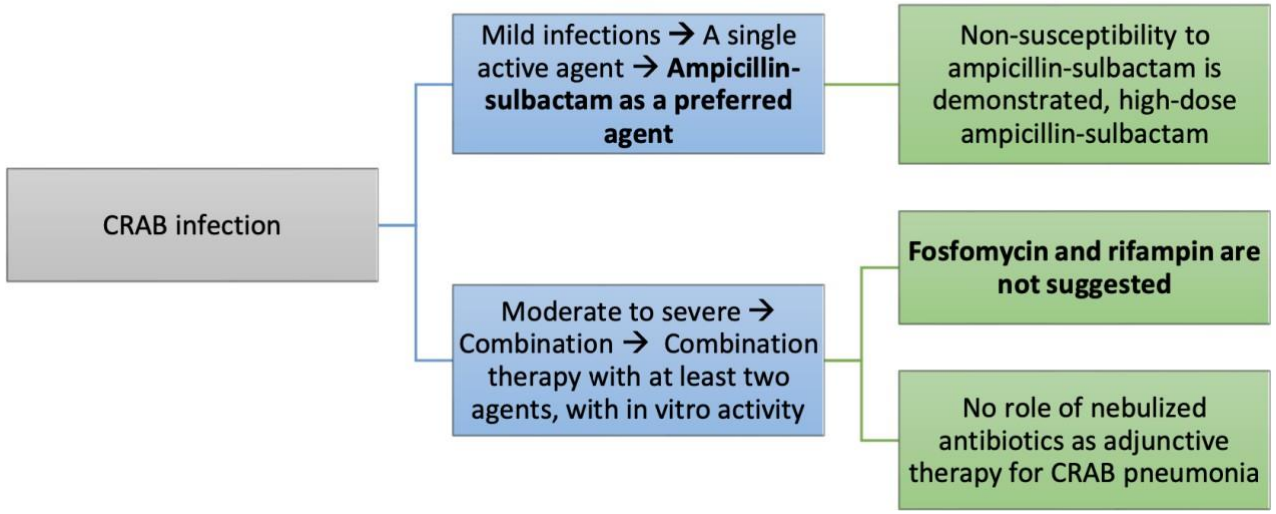
Uncomplicated cystitis	Pyelonephritis and cUTI	Other Infections
• Trimethoprim-sulfamethoxazole • Nitrofurantoin • Single dose of an aminoglycoside • Fosfomycin - Only in *E.coli* • Ciprofloxacin • Levofloxacin	• Ceftazidime-avibactam • No oral Fosfomycin • Colistin	• Non MBL - Ceftazidime-avibactam • MBL Producer - Ceftazidime-avibactam plus aztreonam • OXA-48-like–producing - Ceftazidime-avibactam • Intra-abdominal Infection - High dose tigecycline Eravacycline

Definitive Therapy in case of non-availability of Ceftazidime – avibactam



UHD – Ultra high dose carbapenem - 8-12q q24h, extended infusion along with 2 fully active drugs in combination

Carbapenem Resistant *Acinetobacter baumannii*



Mild infections include- Urinary tract, skin and soft tissue, tracheitis

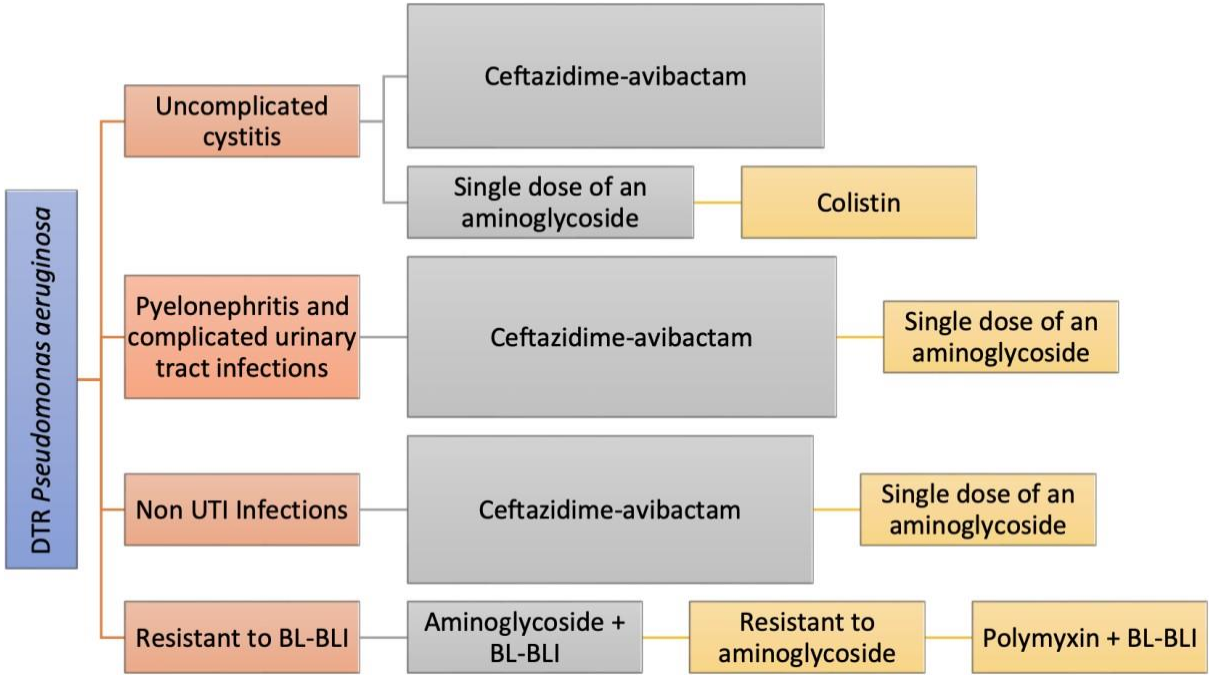
What combination is required to treat CRAB?

- Incase suspectibility is demonstrated, Combination therapy with at least two agents, with in vitro activity
- One of the drug in the combination must always include Ampicillin-sulbactam
- High dose Ampicillin-Sulbactam - 9g IV q8h over 4 hours OR 27g IV q24h as a continuous infusion is recommended even when isolate is not susceptible to ampicillin-sulbactam
- Incase of MDR, triple drug therapy is recommended
- Triple-combination therapies: ID consultation
    - Meropenem, ampicillin-sulbactam, and minocycline
    - Meropenem, ampicillin-sulbactam, and polymyxin B
- No role of Meropenem- Polymyxin B combination if meropenem MIC >8

- High-dose, extended-infusion meropenem (2g q8h over 3-4 hours)

Carbapenem Resistant or Difficult to treat Pseudomonas aeruginosa

- DTR is defined as P. aeruginosa that exhibits non - susceptibility to all of the following: piperacillin-tazobactam, ceftazidime, cefepime, aztreonam, meropenem, imipenem-cilastatin, ciprofloxacin, and levofloxacin.
- Piperacillin-tazobactam, Cefoperazone-sulbactam, Polymyxin (either one of it) can be used in the treatment carbapenem resistant Pseudomonas providedits sensitive.
- The Carbapenem resistance in Pseudomonas aeruginosa is mediated by other mechanisms of (Eg: Porin channels & Efflux pump) & less due to production of carbapenemases in Pseudomonas.



EYE INFECTIONS

SL NO	Infection/ Syndrome	Features	Organisms	Empirical	Dose	Route	Duration	Course of Treatment
1.	**Preseptal Cellulitis^**	Infection of the superficial eyelid & periorbital structures anterior to the orbit	*Staph. aureus* *Strep. pyogenes* *Strep pneumoniae* *H.influenzae* MRSA% (uncommon)	Cefuroxime OR Amoxycillin clavulanic acid OR Clindamycin Or Cefpodoxime Cotrimoxazole	30 mg/kg/dose 30mg/kg/dose - 10mg/kg/day 400 mg 1-2 DS (160/800)	Oral oral	Q12H Q8H Q12H Q12H	 7 days
2.	**Orbital cellulitis &**	It is a bacterial infection of the soft tissues of the orbit posterior to the orbital septum	S aureus, MRSA S pneumoniae, S pyogenes, Streptococcus anginosus, non-typable H influenzae, M. catarrhalis anaerobes	cefotaxime /Ceftriaxone + Vancomycin	50mg/kg 20-35mg/kg L.D f/b 15-20mg/Kg	i.v i.v	Q6H Q12H	2-3 weeks If there is destruction of bone- then duration is 4 weeks
4	**Stye/Hordeolum!**	Self-limiting						
5	**Bacterial keratitis**	Corneal opcity or infiltrate in association with red eye,	Staphylococcus Streptococcus Other Gram positive	Topical cephalosporin- fortified cefazolin or Vancomycin+ aminoglycoside				10-14 days(fortified) Followed by non-fortified

		photophobia, foreign body sensation.	Bacillus, cutibacterium spp Gram negative - Pseudomonas, Hemophilus, Moraxella Enterobacteriaceae Proteus, serratia, Enterobacter, citrobacter	Ciprofloxacin/ofloxacin/levofloxacin Monotherapy with Moxifloxacin or gatifloxacin		topical		until resolution
5	**Neonatal conjunctivitis**		Neisseria gonorrhoea, Chlamydia$	Ceftriaxone Or Erythromycin Or Azithromycin syrup	50mg/kg 50mg/kg/d 10mg/kg/d		Single dose Q6H Once daily	 14 days
6	**Bacterial conjunctivitis (adult)**		Staphylococcus aureus, Streptococcus pneumoniae, - Haemophilus spp, Moraxella spp Corynebacterium diptheriae Neisseria spp, Enteric gram negative rods	Chloramphenicol Or ciprofloxacin /Moxifloxacin eye drops	0.5% drops		Q6H	5 days 7-10 days
7	**Hyperacute bacterial conjunctivitis**			Ceftriaxone	Refer above			
8	**Endophthalmitis**		Organisms varies as per risk factors ,	Intravitreal Vancomycin+ Ceftazidime * Vitrectomy	1mg 2.25mg	Single dose 24-48 hours after another intravitreal injection and follow-up clinically		

						ID consultation required

FootNotes:

%- In Pre-septal cellulitis, when the patient does not respond to antibiotics after 48 hours post assessment, after traum- MRSA coverage is needed &- In orbital cellulitis, when intracranial extension- anaerobic coverage is needed

^- When to shift to oral antibiotics

In case of Clinical improvement Antibiotic of choice

1. Cephalexin 20mg/kg/dose bd (max 500mg / dose)

2. Amoxycillin & clavulanic acid (total dose) 30mg/kg/dose (max 625mg) tds

3. In Penicillin allergy-
    - Erythromycin 10 mg/kg/dose qds or 20mg/kg/dose bd (max 500mg / dose) or
    - Roxithromycin 4mg/kg/dose bd (max 150mg /dose) if able to swallow tablet

!- If there is skin erythema, lesion is draining or conjunctivitis or blepharitis is present.

$- For neonatal chlamydial conjunctivitis, if erythromycin or tetracycline ointment is applied to conjunctival surface within 1 hour after delivery, the chance of developing chlamydial conjunctivitis is almost zero.

*In fulminant cases, vitrectomy is done with the antibiotic coverage

EAR INFECTIONS

S No	Infection/Syndrome	Features	Organisms	Empirical	Dose	Duration	Treatment duration
1	Acute Otitis Externa	Infection of the External auditory canal or the auricle or both	S. aureus Group A streptococcus Pseudomonas aeruginosa	Ciprofloxacin /dexamethasone Or Gentamicin @ 0.3% /Hydrocortisone1%	2- 4 drops 2- 4 drops	Twice a day Q6H /Q8H and night	7 days 7-10 days
2	Invasive otitis externa/ Malignant otitis externa	Infection involving air canal and surrounding tissues involving temporal and surrounding bones	Pseudomonas aeruginosa	Ceftazidime Or Cefepime Or Piperacillin tazobactam + Gentamicin Or tobramycin	2g	Q8H	4-6 weeks (with topical therapy)
4	Acute otitis media	It is an acute illness defined by moderate to severe bulging of the TM or new onset otorrhea due to acute otitis externa with acute signs of	S. pneumoniae H. influenzae M. catarrhalis (UN COMMON Staph aureus Group A streptococci (H/o Previous hospitalization)	Amoxicillin clavulanate Or Ceftriaxone Or Cotrimoxazole Or	90mg/kg/d 50mg/kg/d i.m	Once daily	3 days

		illness and signs and symptoms of middle ear inflammation	Gram negative bacilli MRSA	Azithromycin/Clarthromycin Or Cefixime			
5	Mastoiditis	It refers to suppurative infection of mastoid ear cells Acute-Symptoms of Less than 1 month	S. pneumoniae H. influenzae S. aureus Gram negative enteric bacilli	Ceftriaxone Or Cefotaxime + Metronidazole	2g 750mg	Iv once daily Iv Q8H	2 weeks

@ - Contraindicated in Tympanic membrane perforation