Antimicrobial therapy

Antimicrobial Therapy refers to the use of agents, such as antibiotics, antifungals, antivirals, and antiparasitics, to treat infections caused by microorganisms, including bacteria, fungi, viruses, and parasites. The primary goals of antimicrobial therapy are to eradicate the causative pathogen, minimize harm to the host, and prevent the development of antimicrobial resistance. Here's a general overview:

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1. Types of Antimicrobials - **Antibiotics**: Target bacteria (e.g., penicillin, ciprofloxacin). - **Antifungals**: Target fungi (e.g., fluconazole, amphotericin B). - **Antivirals**: Target viruses (e.g., oseltamivir, remdesivir). - **Antiparasitics**: Target parasites (e.g., metronidazole, ivermectin).

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2. Principles of Antimicrobial Therapy - **Empirical Therapy**: Initiated before the exact pathogen is identified, often based on clinical judgment and epidemiological data. - **Targeted Therapy**: Based on the identification of the pathogen and its susceptibility profile. - **Prophylactic Therapy**: Used to prevent infections, particularly in high-risk populations or surgical settings. - **Combination Therapy**: Employing multiple agents to broaden the spectrum, achieve synergistic effects, or prevent resistance.

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3. Pharmacokinetics and Pharmacodynamics - **Absorption, Distribution, Metabolism, and Excretion**: These factors determine how the antimicrobial reaches and maintains therapeutic levels at the site of infection. - **Concentration-Dependent Killing**: Efficacy increases with drug concentration (e.g., aminoglycosides). - **Time-Dependent Killing**: Efficacy relies on maintaining levels above the minimum inhibitory concentration (MIC) for an extended period (e.g., beta-lactams).

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4. Resistance and Stewardship - **Antimicrobial Resistance (AMR)**: A critical challenge where pathogens no longer respond to treatments due to misuse or overuse of antimicrobials. - **Antimicrobial Stewardship Programs (ASP)**:

1. Ensure the appropriate selection, dosage, and duration of therapy.
2. Monitor resistance trends.
3. Educate healthcare providers on responsible use.

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5. Key Considerations in Antimicrobial Therapy - **Host Factors**: Age, immune status, renal/hepatic function, allergies. - **Pathogen Factors**: Susceptibility patterns, virulence. - **Drug Factors**: Side effects, drug interactions, cost, and formulation.

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6. Examples of Guidelines - **Community-Acquired Pneumonia (CAP)**: Empiric therapy often includes beta-lactams combined with macrolides or respiratory fluoroquinolones. - **Sepsis**:

Broad-spectrum antibiotics initiated promptly, later narrowed based on cultures. - **Tuberculosis**: Long-course therapy with multiple agents like isoniazid and rifampin to prevent resistance.

Postoperative intracranial neurosurgical infections (PINI) complicate < 5% neurosurgeries. Scarce attention was dedicated to the extension and characteristics of its antimicrobial management considering their high morbidity, not negligible mortality, delayed hospital stay and increased healthcare costs.

They analyzed retrospectively (2014-2023) 162 PINI from eight Spanish third-level academic hospitals.

Elective clean craniotomies after tumor or vascular causes were the leading procedures. Epidural abscess (24.7%), scalp infections (19.8%), postsurgical meningitis (16.7%) and cranioplasty infections (16.7%) were the most frequent PINI. Gram negative bacteria (38.6%) and Staphylococcus spp (28.6%) were the predominant isolates. Overall 85.2% patients underwent pus drainage, mostly by craniotomy (40.3%). Interestingly 34% were already receiving antibiotics for extracranial infections before developing PINI while 16.8% did not receive pre-operative antibiotic prophylaxis. In total 77.2% patients started a combined intravenous (IV) antimicrobial therapy, of which 85.2% switched after 5 days to a second-line IV antibiotic regimen, in 41.3% cases combined, after pus culture results, for a median of 21 days. Overall 61.1% patients continued on oral antimicrobials after hospital discharge, 30.3% as a combined regimen, for a median of 42 days. Complete cure was obtained in 81.5% cases, while 11.1% relapsed, 7.4% failed to cure and 6.8% died after PINI complications. In the multivariate analysis oral antimicrobial therapy after hospital discharge ($p = 0.001$) was significantly associated with PINI cure with no effect on survival.

They conclude that an extended 6 weeks sequential IV and oral antimicrobial therapy in addition to neurosurgical correction increases PINI cure rate with no effect on survival [1)]

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Asensi V, Vázquez-Fernández C, Suárez-Díaz S, Asensi-Díaz E, Carrasco-Antón N, García-Reyne A, Panero I, Muñoz MV, Guerra JM, Arístegui J, Sepúlveda MA, García-Calvo X, Dueñas C, Biosca M, Chiminazzo V, Collazos J. Extended sequential intravenous and oral antimicrobial therapy improves cure rate in postoperative intracranial neurosurgical infections: a Spanish multicenter retrospective study. BMC Infect Dis. 2024 Nov 26;24(1):1345. doi: 10.1186/s12879-024-10204-7. PMID: 39587499.