Antimicrobial Agents (Antibiotics)

10

Elisabeth Presterl, Magda Diab-El Schahawi,
Luigi Segagni Lusignani, Helga Paula, and Jacqui S. Reilly

Antimicrobial agents (antibiotics and antifungal agents) are active against bacteria or fungi. Antiviral agents are active against viruses. Commonly the antimicrobial agents work specifically against some types of bacteria, fungi or viruses. Thus, the diagnosis should be confirmed by microbiological testing, e.g. microscopy, culture and susceptibility testing, etc. However, when the patient is severely ill, there is no time to wait for the results. Then, immediate antimicrobial therapy, so-called empirical therapy, is administered which is based on evidence-based recommendations of expert medical societies ("guidelines").

Overuse of antimicrobial agents leads to development of bacterial resistance. Thus, antimicrobial agents, antibacterial agents in particular, should be used only when the infection is due to bacterial pathogens.

10.1 Antibacterial Agents

Antibiotic are produced classically by microorganisms, e.g. the fungus *Penicillium* produces penicillin, and acremonium produces cephalosporins. Penicillins and cephalosporins have a similar core structure, the beta-lactam ring. The compounds are the basis of many new antibiotics commonly used for treatment of infections. Other antibiotics are glycopeptides or aminoglycosides.

E. Presterl (✉) · M. Diab-El Schahawi (✉) · L. S. Lusignani · H. Paula
Department of Hygiene and Infection Control, Medical University of Vienna, Vienna, Austria
e-mail: elisabeth.presterl@meduniwien.ac.at; magda.diab-elschahawi@meduniwien.ac.at; luigi.segagnilusignani@meduniwien.ac.at; helga.paula@meduniwien.ac.at

J. S. Reilly
Glasgow Caledonian University, Glasgow, UK
e-mail: jacquelinereilly@nhs.net

E. Presterl et al. (eds.), *Basic Microbiology and Infection Control for Midwives*,
https://doi.org/10.1007/978-3-030-02026-2_10

Chemotherapeutics are antimicrobial compounds that are chemically produced. Examples are trimethoprim or quinolones.

The commonly used antibiotic classes are:

- Beta-lactam antibiotics (penicillins, cephalosporins, carbapenems)
- Quinolones
- Macrolides
- Glycopeptides

There are different modes of action for antibiotics:

- Inhibition of cross-linking of the cell wall components (beta-lactam antibiotics, glycopeptides)
- Inhibition of protein synthesis (aminoglycosides, macrolides)
- Interaction and inhibition of DNA transcription (quinolones)

Beta-lactam antibiotics are the most commonly used antibiotics. The most commonly used penicillins are penicillin V, piperacillin, amoxicillin and amoxicillin combined with clavulanic acid. The most commonly used cephalosporins are cefuroxime, cefamandole, cefoxitin, cefalexin, mecillinam, cefotaxime, ceftriaxone, cefepime and cefpirome and carbapenems are meropenem and imipenem. Beta-lactam antibiotics are well tolerated, and some can be used safely in pregnancy.

Other antibiotics are macrolides (erythromycin, azithromycin, roxithromycin, clarithromycin), clindamycin, fusidic acid, fosfomycin and oxazolidinones.

10.2 Antibiotics in Pregnancy

Generally, there are no prospective studies of the use of antibiotics in pregnancy. However, there are more than 50 years' experience in the use of some beta-lactam antibiotics in pregnancy as well as of macrolides erythromycin and josamycin. They are therefore classified as safe for use in pregnancy. For newer substances (e.g. oxazolidinone, fosfomycin), there is less experience. Tetracyclines, aminoglycosides and oxazolidinones must not be used in pregnancy.

When taking antibiotics during pregnancy, the advice of prescribing doctors and drug information must be observed.

10.3 Side Effects of Antimicrobial Agents

The most frequent are abdominal pain and diarrhoea caused by irritation of the intestinal flora, nausea and vomiting.

Rash is an occasional side effect. Antibiotic may sometimes act as a so-called hapten during a viral infection. This causes rash, but does not occur without virus infection. The most common form of allergy is an urticarial rash. This sort of rash has been distinguished from the allergy.

The most severe form of allergy is anaphylaxis. Anaphylaxis may occur with penicillins and cephalosporins. Anaphylaxis is a very rare, acute allergic reaction with very low blood pressure and respiratory distress. This emergency situation with shock and respiratory distress happens when antibiotics are intravenously administered.

Further Readings

Bennett JE, Dolin R, Blaser MJ. Mandell, Douglas and Benett's principles and practice of infectious diseases (Expert Consult Premium Edition–Enhanced Online Features and Print), 8th ed. Oxford: Elsevier; 2014. ISBN-10: 1455748013. ISBN-13: 978-1455748013.

Jorgensen JH, Pfaller MA, Carroll KC. The manual of clinical microbiology bundle (Print and Digital Edition), 11th ed. ASM Press: Chicago; 2015. ISBN-10: 1555817378. ISBN-13: 978-1555817374.