Chapter 7
Principles of Antibiotic Policies

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Key points

- Resistant bacterial strains are selected in hospitals due to the huge usage of antibiotics.
- To preserve the susceptibility of microorganisms, and postpone the development of resistance, antibiotics should be used rationally.
- If resistant bacteria develop in an environment where the specific antibiotic is used, they will become prevalent in that environment.
- Good antibiotic prescribing practices should be encouraged within hospitals.
- The microbiology laboratory service can assist clinicians to use targeted antibiotic treatment for patients.

Introduction

The discovery of antibiotics was a revolutionary event in the history of medicine that saved millions of lives. However their effectiveness has lessened because microorganisms develop resistance. A vicious cycle has been created, requiring new antibiotics which are invariably more expensive. Many medical services cannot afford such expensive agents, and so patients, especially in developing countries, will be denied appropriate treatment. To preserve susceptibility or at least postpone development of resistance, antibiotics should be used rationally. This is of prime interest to everyone – government, physicians and the public. Resistance can be delayed by measures aimed at better prescribing: education, guidelines and protocols, surveillance of antibiotic usage and bacterial resistance with regular feedback to physicians. Any such initiative must exist together with effective infection prevention and control.

Antibiotic resistance develops through the natural process of mutation. As bacteria multiply rapidly (sometimes once every 20 minutes), mutations can be expressed very quickly. If this happens in an environment where the antibiotic is commonly used, resistant strains of bacteria will be selected and become prevalent. Resistance can be transferred not only to their offspring, but to totally different bacteria. If this happens in a hospital with an inadequate infection prevention and control (IC) programme then the resistant bacteria may spread, and cause outbreaks.

Antibiotics affect normal human flora, which can become resistant and then act as a reservoir of resistance genes. This poses a unique problem in that treatment of one patient's infection may potentially affect all microorganisms in a certain population. Therefore narrow spectrum antibiotics should be used whenever possible. Antibiotics are also used extensively in veterinary medicine (for infections and as growth promoters) and agriculture, creating additional reservoirs of antibiotic resistant microbes that may infect humans.

Most authorities believe that excessive antimicrobial use is directly responsible for development of resistance, and that good antibiotic prescribing practices should be encouraged. Effective IC interventions should also be used, although mathematical models suggest that in

situations where there is both a high level of antibiotic resistance and a high antimicrobial consumption, control of antibiotic use provides the best solution.

The microbiology laboratory can assist clinicians to use targeted antibiotic treatment for particular patients, and reduce unnecessary antibiotic therapy. This can be undertaken through:

- Surveillance of bacterial resistance with regular feedback to prescribers.
- Restrict reporting of antibiotic sensitivities to narrow spectrum agents, only reporting second and third line antimicrobials when first-line will not work.

Antibiotic stewardship

Antibiotic stewardship programmes often help to modify prescribing practices of physicians, usually resulting in decreased use. However, few investigators have studied the outcomes, particularly in terms of the reduction of bacterial resistance.

Any programme should be well designed, and implemented through a mixture of voluntary, persuasive or restrictive means. Education is important, as is production and dissemination of guidelines. The programme should be audited regularly and feedback provided both to users and programme directors. If an audit indicates that voluntary methods are not working, restriction of certain classes of antibiotics may be necessary.

Antibiotic Guidelines

Antibiotic guidelines or policies demonstrate a commitment to rational and prudent use of antibiotics. If an antibiotic policy exists in a country, it means that government, medical society, and public are aware of the problem and committed to try to solve it. Policies should focus on using antibiotics with the narrowest spectrum, which are cheap, have minimal toxicity, and have the least impact on development of resistance.

National Antibiotic Policy

Antibiotic policy initiatives should start at the national level with

regulation of production and import of antibiotics as well as control of local production. Antibiotics should be prescribed only by medical doctors. The government has to ensure a sufficient quantity of essential antibiotics is available to meet local needs. Furthermore, it should ensure that every hospital has access to effective microbiology and infection prevention and control services. The national policy should include education on antibiotic use and misuse at both the graduate and postgraduate level. There should be written guidelines for the treatment of important community-acquired infections. In addition, the general population should be educated about the consequences of antibiotic misuse.

Hospital Antibiotic Policy

Hospitals should have guidelines and protocols for antibiotic use. Protocols may be ward specific, especially if there are special problems due to bacterial resistance – for example in oncology or intensive care wards.

Improper antibiotic prescribing in hospitals has been described as "too many patients receiving unnecessary broad spectrum antibiotics by the wrong route, in the wrong dose and for too long." Such practices often result from resistance among prescribers who believe that personal experience is more relevant than evidence-based recommendations, or view initiatives simply as excuses to cut costs. Physicians often question why they should not use any antibiotic. The answer is simple: antibiotics do not act on the patients, but on their microorganisms. Individual treatments can and do impact other patients through spread of resistance. In addition, infections happen in patients under the care of many different medical specialists, most of whom are not specially educated in infectious diseases.

An antibiotic policy requires a holistic approach including prioritisation by hospital administrators and involvement of multiple stakeholders as well as dedicating sufficient manpower and financial resources. Important initiatives are:

1. **The Antibiotic Committee** This committee can be either stand-alone or a part of the Drug and Therapeutics Committee. The members should be:

- doctors who prescribe antibiotics (specialists in infectious

diseases, intensive medicine, internal medicine, paediatrics, clinical pharmacology, surgery);

- nurses, especially in countries where they prescribe antibiotics;
- pharmacists (will provide data about antibiotic use);
- microbiologists (will provide data about bacterial resistance, as well as mechanisms and development of resistance);
- members of the hospital management;
- member of the Infection Control Committee (often, especially in small hospitals, this is the microbiologist).
- Others may be co-opted as needed.

2. **The antibiotic management team** Larger hospitals should have a team to advise on antibiotic use and audit prescribing. It could include infectious disease physicians, clinical pharmacologists, pharmacists, clinical microbiologists, and any doctors authorised to use reserve antibiotics. An antibiotic pharmacist (at least part-time) with the support of the Infection Control Doctor (ICD) is a minimum requirement for smaller institutions.

3. **Guidelines and protocols** Antibiotic Committees must prepare local guidelines / protocols for antibiotic use. Some hospitals prefer to issue guidelines that can be followed by physicians whereas others issue protocols with which physicians are expected to adhere. The areas most often covered by an antibiotic policy are:

- list of antibiotics in the hospital formulary - no antibiotic outside the list should be used.
- guidelines for empiric and targeted treatment of the most frequent infections, including dosage and duration of treatment; it usually contains first and second line therapy, and what to use for allergic patients.
- protocol for surgical prophylaxis (including stop-orders after 24 hours)
- protocol for evaluation of parenteral use of antibiotics, including stop-orders after 3-5 days (depending on severity of infection) and recommendation of sequential treatment.
- protocol for a reserve antibiotic, how to order, who can authorise its use (usually the microbiologist, ICD or infectious disease physician).

The guidelines and protocols should be developed after discussions with all the hospital physicians, and take into consideration their views on type of antibiotic, route of administration, dosing and duration of therapy. They will then be owned by everyone and easier to implement.

Antibiotics for surgical prophylaxis should vary according to the type of operation and particular epidemiological situation. Prophylactic antimicrobials should be different from those normally used to treat surgical infections.

The list of antibiotics available depends on a country's politics and funding of the health care system. The WHO recommends a list of essential antibiotics in the Model List for Essential Drugs, which is updated every two years. The most recent list (2005) includes 26 antibacterial antibiotics (18 on the basic list, 2 for sexually transmitted diseases, and six on the complementary list to be used for exceptionally severe healthcare-associated infections caused by resistant pathogens (ceftazidime, ceftriaxone, imipenem, sulphadiazine, clindamycin and vancomycin).

Antibiotics recommended in local guidelines/protocols should be chosen according to local bacterial resistance patterns. If a hospital does not have a microbiological service, regional or national resistance data can be used. If such data do not exist, then guidelines/protocols could be based on international resistance data, although this is least appropriate.

4. **Education** Correct use of guidelines/protocols requires education, especially of younger physicians. Further education should be planned as formal meetings, clinical rounds with antibiotic committee members or antibiotic management team, and formal lectures. Education must focus on new antibiotics, new methods of administration, and the influence on bacterial ecology. Education has to be provided by employees or an independent professional outside of the hospital. It must NOT be provided by individuals from the pharmaceutical industry. Drug company presentations require the endorsement of the Antibiotic Committee and should not be provided unless a committee member is present.

Microbiology laboratories should only test the recommended antibiotics. Only report first line antibiotics if an isolate is sensitive; if

resistant, add the second line antibiotic. This makes it less likely that second line antibiotics (usually broader spectrum, more toxic, more expensive) will be prescribed.

Feedback to clinicians on antibiotic use and cost as well as resistance on their wards is often the most effective educational tool for changing prescribing habits.

Control of Healthcare-Associated Infections

Resistant bacterial strains are selected in hospitals by excessive antibiotic use, but may also enter a hospital when patients come from another hospital, nursing home, or even the community. When patients are discharged, resistant strains leave hospitals. If hospital IC is effective, there is an equilibrium between introduced, selected and 'discharged' resistant strains and containment of resistance will be possible.

Effective infection prevention and control should decrease healthcare-associated infections, stopping outbreaks and decreasing transmission of pathogens. This will decrease antibiotic usage and reduce antibiotic pressure. Hence, there will be less selection of resistant strains. However it cannot stop the emergence of new resistance patterns, and so will only be successful in combination with effective antibiotic policies. Of course, poor IC leads to more infections, more antibiotic usage, more resistance, etc., and so a vicious cycle occurs.

Minimal Requirements for Hospital Antibiotic Policy

1. Antibiotic Committee producing a hospital formulary and guidelines for empiric and targeted therapy of infection in the particular setting.
2. Microbiology service - in the hospital or contracted out.
3. Surveillance of antibiotic consumption and antimicrobial resistance; regular feedback to prescribers.
4. Effective IC programme.
5. Education programme on antibiotic use and consequences of antibiotic misuse.

References and Further Reading

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