Editorial

Antimicrobial resistance: a growing problem

Kushlani Jayatilleke

Sri Jayewardenepura General Hospital, Nugegoda, Sri Lanka

Correspondence: kjayatilleke@gmail.com https://orcid.org/0000-0002-3931-6630

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Antimicrobials are a group of compounds when administered orally, parenterally (intravenous or intramuscular) or locally, will kill or inhibit the growth of microorganisms, such as bacteria, viruses and fungi. Antibiotics are a group of medicines which will kill or inhibit the growth of bacteria. Antibiotics are useful in treating and preventing bacterial infections which otherwise can lead to high mortality and morbidity. Transplant surgery, prosthetic joint implant surgery and many other surgeries as well as chemotherapy and other complex procedures in medicine will not be possible without effective antimicrobials.

Organism resistant to an antibiotic is one that is not inhibited or killed by an antibacterial agent at concentrations of the drug achievable in the body after normal dosage. Bacteria can develop antibiotic resistance by developing several mechanisms. Producing an enzyme which can destroy the antibiotics such as Extended Spectrum Beta Lactamase (ESBL) enzymes which can destroy cephalosporins including 3rd generation cephalosporins; changing the drug target molecule so that the antibiotics will not be able to bind to the organism; modifying the cell wall proteins so that it will prevent antibiotic entry into the organism; and activation of efflux pumps to pump the antibiotic out of the cell are some of these mechanisms.

Since the invention of penicillin in the 4th decade of the 20th century, many classes of antibiotics were invented for about three decades. As soon as these antibiotics were introduced for treatment, the resistance to these antibiotics started developing. Today, we see bacteria which are resistant to all available antibiotics causing infections. Due to many reasons, development of new antibiotics slowed down after 1960s. It is predicted that more than 10 million deaths in 2050 will be due to antibiotic resistance globally, overtaking the number of deaths due to cancer. Most of these deaths are predicted to occur in Asia.

Bacteria are part of the normal flora of humans as well as other animals, and they are also found in the environment. They grow and divide by binary fission and while doing so, they have a high tendency to have mutations in their genetic material. Such mutations may code for any of the mechanisms for antibiotic resistance. Therefore, in a population of bacteria, there would always be a few bacteria developing antibiotic resistance due to mutation. If this population is left without any intervention, the majority bacteria who do not have mechanisms for antibiotic resistance will be able to replace the antibiotic resistant bacteria with time. If this population is exposed to the antibiotic to which these bacteria became resistant to, then the bacteria that are sensitive to that antibiotic will die and the resistant mutant will be selected and now without any competition, this will multiply leading to a population of antibiotic resistant bacteria. This is how the use of antibiotics lead to development of antibiotic resistant bacterial populations. Therefore, if we reduce the use of antibiotics, we can reduce the antibiotic resistance in the bacteria. This is apparent when we compare the use of antibiotics and the rates of antibiotic resistance in different countries. Thus, the countries which have very restrictive policies on antibiotic prescription such as the United Kingdom has low levels of antibiotic consumption and low rates of antibiotic resistance compared to Sri Lanka. Performing the appropriate investigations on time to diagnose bacterial infections,

and thus avoid use of antibiotics for treating viral infections can help to reduce the misuse of antibiotics.

Another important factor about development of antibiotic resistance is that as the mutants who have mechanisms of resistance may have higher minimum inhibitory concentrations, it is important to achieve high concentrations of antibiotics to eliminate them. Use of low doses of antibiotics can select out resistant bacteria and lead to infections with antibiotic resistant bacteria. Therefore, using appropriate doses is extremely important to prevent the development of antibiotic resistance. The National Guidelines on Empirical and Prophylactic Use of Antimicrobials developed by the Sri Lanka College of Microbiologists along with other clinical colleges was published by the Ministry of Health in 2016, to guide rational use of antimicrobials.

Another important factor to consider is that antibiotic resistant bacteria and their genetic material can spread from one person to another directly or through other animals and the environment. Since most of the antibiotic resistant bacteria are prevalent in hospital environment, and healthcare associated infections are mostly caused by antibiotic resistant bacteria, infection prevention and control practices are highly recommended to control the problem of antibiotic resistance. Also, by preventing infections in the community by infection control measures such as hand hygiene and vaccination, we can reduce the need for antibiotics thus reducing antibiotic resistance.

World Health Organization has published a 'Global Action Plan on Antimicrobial Resistance'. This has recommended five objectives as follows:

1. Improve awareness and understanding of antimicrobial resistance through effective communication, education and training
2. Strengthen the knowledge and evidence-base through surveillance and research
3. Reduce the incidence of infection through effective sanitation, hygiene and infection prevention measures
4. Optimize the use of antimicrobial medicines in human and animal health
5. Develop the economic case for sustainable investment that takes account of the needs of all countries, and increase investment in new medicines, diagnostic tools, vaccines and other interventions

Based on the Global Action plan, the 'National Strategic Plan for Combating Antimicrobial Resistance in Sri Lanka 2017-2022' was published by the Ministry of Health with multi-sectoral involvement. Currently, awareness programmes are conducted all over the country to different categories including the general public. World Antibiotic Awareness Week falls this year from 18 - 24 November. Many activities are conducted in Sri Lanka to mark this week. Surveillance of antibiotic resistance and utilization is commenced, and the national antibiotic resistance data of 2018 have been submitted to Global Antimicrobial Resistance Surveillance System (GLASS) by the focal point for combating antimicrobial resistance (Deputy Director General of Laboratory Services, Ministry of Health). Development of National Guidelines on Infection Prevention and Control is under way while the Infection Control Manual published by the Sri Lanka College of Microbiologists is being updated. 'Red light antimicrobials' which are the antimicrobials which can only be prescribed with approval of a consultant clinical microbiologist, were identified and published as a circular by the Director General of Health Services in 2016. Activities are also ongoing in other sectors as one-health concept is very important to combat antimicrobial resistance.

Rational use of antimicrobials and the prevention and control of infections are the cornerstones of the programme for combating antimicrobial resistance. By implementing the National Strategic Plan and by continuing the efforts to implement all components recommended in the Global Action Plan on Antimicrobial Resistance, we should be able to control this problem.

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