



## Antimicrobial Resistance in Children: How to Overcome?

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Antibiotic resistance is a type of drug resistance where a microorganism is able to survive exposure to an antibiotic. The primary cause of antibiotic resistance is genetic mutation in bacteria. However genes that confer resistance can be transferred between bacteria in a horizontal fashion by conjugation, transduction, or transformation. Thus a gene for antibiotic resistance which had evolved via natural selection may be shared. Evolutionary stress such as exposure to antibiotics then selects for the antibiotic resistant trait. Many antibiotic resistance genes reside on plasmids, facilitating their transfer. If a bacterium carries several resistance genes, it is called multiresistant or, informally, a superbug or super bacterium (1-4).

The prevalence of antibiotic resistant bacteria is a result of antibiotic use both within human medicine and veterinary medicine. The greater the duration of exposure the greater the risk of the development of resistance irrespective of the severity of the need for antibiotics. As resistance towards antibiotics becomes more common a greater need for alternative treatments arises. However, despite a push for new antibiotic therapies there has been a continued decline in the number of newly approved drugs. Antibiotic resistance therefore poses a significant problem. The era of antibiotics started at the end of last century has helped human beings enormously to conquer many infectious diseases, to control incidences of several such illnesses and to live a normal healthy life in spite of various infections. The 20<sup>th</sup> century heralded the triumph of humanity over infections. It started with Alexander Fleming discovering penicillin in 1928. Gradually the medical world was flooded with discovery of various antibiotics. At the same time, we have witnessed the discovery of several vaccines that helped us to limit and eradicate diseases. It as thought that infection, which was a great threat to humanity for several centuries, was finally triumphed over (1-3). However, as years were passing by the dream was being shattered. The organisms are becoming resistant to drugs. The development of resistance to multiple antibiotics is a serious consequence. Research produced newer antibiotics, but the organisms proved intelligent enough to circumvent them. Finally, a situation has come when we are facing a very tough challenge. This reality is due to multiple causes and we

have to share the blame too. It is imperative that antibiotic resistance is a direct consequence of antibiotic use. In spite of advocacy both continue to escalate. The problems to treat multidrug resistant typhoid fever (MDRTF), malaria, tuberculosis, methicillin resistant staphylococcus aureus (MRSA), penicillin resistant streptococcus pneumoniae, vancomycin resistant enterococci, etc are common these days. There are a number of factors responsible for it. Other infections like pneumonia caused by Streptococcus pneumoniae and Hemophilus influenzae, diarrheal diseases due to Shigella dysenteriae, various nosocomial infections caused by salmonella, Pseudomonas and Klebsiella are showing high level of resistance to various antimicrobials too. Even most of the known anti leishmania drugs are not effective now. The inappropriate and excess use of antimicrobials is most common cause of resistance. There are many mechanisms discussed for the development of bacterial resistance. (a) Inactivating enzymes which degrade the antibiotics, eg beta- lactamases, (b) alteration of bacterial cell membrane eg, resistance to imipenem by decreased permeability through the porin channels, (c) alteration of target site by structural modification eg, methicillin resistant Staphylococcus aureus (d) antibiotics efflux by active removal of antibiotics from bacterial cell eg, resistance to methicillin (3-8).

Self medication is very common in our country. It is also common practice to follow old prescriptions for the similar type of ailment but for a shorter period with suboptimal doses. Poor adherence of patient to provider, under treatment without completing the course due to poverty or some other personal causes are important factors contributing to antibiotic resistance. Prescribers are responsible for inadequate diagnosis, inappropriate drug selection, incorrect dose, duration and route of the selected antibiotic. Influence and promotional pressure of pharmaceutical companies on the prescriber and the dispenser is a definite problem. It is also seen that dispensers supply medicines without the doctor's prescription. Neither is there an appropriate strong law nor a harsh punishment to prevent them from such acts. Poor regulatory mechanisms of government's health system is also another contributing factor. There is lack of quality assurance due to so many lacunae in the system

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of health authority and regulatory bodies (1). Over promotion and malpromotion by drug industry personnel, forcing the medical practitioner to write a specified costly antibiotic for easily treatable infection, bribing doctors with costly gifts and sponsorship is known to every body nowadays. This unethical practice influences the doctor to prescribe unnecessary drugs. This will definitely end in drug resistance. It is also seen that there is non-medical use of antimicrobials as growth promoters in fodder of various animals like cows, buffaloes, etc. The problem of antibiotic resistance is a global problem. This problem has started generating consciousness of society and medical personnel. Restoring the sensitivity of the drug is not only important but prevention of development of resistance is also of great concern. Awareness is increasing in patients and doctors and various medical organizations are coming forward with their plan of action, which sensitize the members of their society towards this issue. Selection of antimicrobials with narrow spectrum, with properties of lesser tendency to develop resistance will be very helpful to combat this adverse outcome of antibiotic therapy. Optimal use of all antimicrobials should be there. All patients should be treated with the most effective, least toxic and least costly antibiotic for the precise duration of time needed to cure or prevent an infection. Drugs with a narrow antimicrobial spectrum or older antibiotics in addition to the judicious overall use of antibiotics should be encouraged. National protocols and guidelines for treating common infections should be circulated among doctors. The protocols should be updated at regular intervals and whenever necessary.

Selective removal or control of use of specific agents or classes of agents has been employed in many hospitals (9). Antibiotic cycling and scheduled antibiotic changes, also called as rotation of antibiotics should be encouraged. Combination antimicrobial therapy has been used successfully for Mycobacterium tuberculosis and has been proposed as strategy to reduce the emergence of bacterial resistance. Prevention of Horizontal transmission by hand washing is still considered the most important and effective infection control measure to prevent transmission of nosocomial pathogens. The use of gloves and gowns has also been shown to reduce transmission of specific bacterial pathogens particularly in NICU and ICU settings (10).

Adoption of WHO strategies and policies { Integrated Management Of Childhood Illnesses (IMCI), DOTS for tuberculosis, HIV/AIDS control program }, with use of vaccines and immunoglobulins to prevent and reduce the incidence of vaccine preventable infectious diseases which will in turn help in reduction of incidence of infectious diseases and reduced use of antimicrobials.

Antibiotic resistance surveillance is another tool to fight antimicrobial resistance. WHO has developed "global strategy for containment of antimicrobial resistance". Health education to be imparted to public and the quacks and practitioners, developing hospital antibiotic policy and research for new drugs and vaccines should be encouraged and antibiotic weaning should be discouraged. WHO on the eve of world health day released six point policy package to combat antimicrobial resistance. These measures in combination will definitely help in reduction of antibiotic resistance. 1) Commit to a comprehensive, financed national plan with accountability and civil society engagement. 2) Strengthen surveillance and laboratory capacity. 3) Ensure uninterrupted access to essential medicines of assured quality. 4) Regulate and promote rational use of medicines, including in animal husbandry, and ensure proper patient care. 5) Enhance infection prevention and control (IPC). 6) Foster innovations and research & development for new tools (11). The slogan released by WHO on World Health Day 2011 was

**"No Action Today, No Cure Tomorrow"** .

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