

INTRODUCTION

The devastating effects of rising antimicrobial resistance (AMR) are emerging all across the world¹⁻⁶. There may be variation in the pattern of resistance among different countries often experiencing different problems. Antibiotic resistance is also threatening the advances made in the management of infectious diseases and if actions are not taken, the future generation will have to pay very heavy economic and personal cost.

With progress in the level of living, many people have access to second and third line treatment. The mortality rate for infections caused by multi drug resistant organism is higher as also the cost of treatment. The problem of rising drug resistance is not limited to developed world. It is as bad or worse in developing countries. This variation is partially related to how liberally they use antimicrobials.

Even a small use of appropriate and limited use of antibiotics can lead to the emergence of drug resistance but if it is overused and misused like in India, the overall situation is much worse. The major problem in India is the availability of drug over the counter without physician prescription and over prescription of antibiotics². Another problem is that antibiotics are used for longer than prescribed. This situation becomes worse further by the availability of substandard drug entering the market. This happens because of poor control by the governmental authorities. The movement of individuals from one place to another creates new possibilities for antimicrobial pathogens to spread easily. These resistant strains share their genetic material with each other and create new resistance strain at a very fast speed.

Antimicrobial resistance not only increases the mortality, length of hospitalization, but it also increases health cost⁷. Methicillin resistance *Staphylococcus aureus*, extended spectrum beta lactamase producing bacteria have become a major problem all over the world. Multidrug resistant (MDR) and extended drug resistance (XDR) have become a major threat in the developing countries like india. The need to use antibiotics against these will ensure the spread and prevalence of these and future emerging multidrug resistant microorganism. Once developed the antimicrobial resistance can't be reversed. This has compelled the investigators and physicians to develop new drugs for difficult to treat MDR and XDR pathogens⁷.

It is estimated that by 2050, 10 million people will die of AMR every year. This will decrease 2-3.5% GDP. Antimicrobial resistance is also becoming a problem because very few novel antibiotics are being discovered

and pace has tremendously slowed down. On the other hand, the antibiotic use is rising⁸.

HOW DO THE MICROORGANISMS DEVELOP RESISTANCE?

Over the time the bacteria learn to survive antibiotics treatment. Usually the resistance is initiated with a mutation in genetic code or transfer of DNA between bacteria. They survive treatment if the mutations are favourable to them. Then they pass resistance to future generations.

THE PROBLEM

The problem is that the pace of development of antibiotic resistance is faster than the development of new agents to treat these resistant bugs. There is a great need to understand the evolutionary, molecular and ecological mechanism which controls the spread of AMR. So there is need to develop new strategies to tackle this menace of rising AMR. India has a great problem as infectious diseases are major cause of increase mortality. The situation is much worse for nosocomial infections where all antibiotics are becoming ineffective⁶.

The non human use of antibiotic is also contributing to the emergence of drug resistance⁹. There is enough evidences that resistant bacteria or their determinants might be passed from animals to humans directly or indirectly through food, environment and during animal husbandry. In some countries antimicrobials are used as growth promoters. Many predict that these could be return of preantibiotic era in some years¹⁰.

SUGGESTED MEASURES TO TACKLE RESISTANCE

“Chennai declaration” made after a joint meeting of medical societies of India¹ in 2012 recommended a roadmap to tackle antibiotic resistance. There are also major efforts by international countries in this regard. The fight has to be on multiple fronts which should include government, medical and social organizations and medical community. The health ministry need to formulate required policy to control AMR involving all stake holders, medical council of India and related associations. India needs practical policy and it should be done as early as possible but in a phased manner. The most important factor which will determine the success of this campaign is to create political support. The corrective steps can be taken to reduce AMR as also suggested by Chennai declaration.

- Adopt a strict policy of antibiotic use particularly of high end antibiotics to begin with.

- There is urgent need to stop over the counter sales. The government may do this but implementation of this would be greatly difficult so it is essential to equip the department with more manpower to ensure this.
- The easiest step which can be implemented is to control the use of antibiotics in the hospital. First of all it should be mandatory to have infection control team in every hospital. Infection control team should ensure the following;
 - Monitor all antibiotic use especially high end antibiotic use in the hospital.
 - Have a clear policy and monitor use of high end antibiotic based on current literature.
 - Monitor use of colistin and other newer antibiotic. After the first dose its use must be endorsed by monitoring team. It is even suggested to get second opinion to endorse usage of high end antibiotic which may not be practical always.
 - Hospital/pharmacist need to keep a record of higher end antibiotic usage like colistin, Tigecycline , fosfomycin for gram negative and targocid,linzolid,vancomycin for gram positive. Out of these it is most important to monitor colistin and its use very closely. Any new antibiotic introduced should be included in this list. Infection control committee should not only monitor the data every 3 months but also inform the surveillance data to the treating physicians.
- Microbiological laboratories must be stepped up and the number accredited laboratories should be expanded. We will have to find out the low cost diagnostic methods.
- National accreditation board of hospitals (NABH) may have a very significant role not only in implementing infection control directives but also antibiotic stewardship policy. The level of compliance NABH accredited hospitals to the antibiotic policy and infection control guidelines should be ensured.. NABH should insist on strict implementation of hospital antibiotic and infection control policy, during re-accreditation processes
- There is also need of national antibiotic resistance surveillance by india council of medical research and ministry of health as suggested Chennai declaration.
- Antibiotic stewardship policy should be followed in all hospitals.
- There is a need for launch a massive, global problem awareness campaign of antibiotic resistance as the problem of resistance is not understood in developing countries.
- World Health Organization should not only play an active role in tackling antibiotic resistance. but also co-ordinate initiatives in various countries, provide them technical and financial support. Since AMR is a global phenomenon so the efforts has to be without worrying about borders.
- There is a need to improve hygienic and spread of infection. Everyone access to clean water sanitation and encourage people to wash their hands.
- One of the important steps to be taken is to reduce the use of antibiotic in nonhuman use. 70% of medically useful antibiotics are actually sold for animal use. So it is important to restrict antibiotic sales for animals because lot of resistance comes from the overuse of antibiotic for animals.
- There is great need of rapid diagnostic test to reduce unnecessary use of antibiotics.
- There has to be long term attempt to improve the strength and emolument of people working in infectious diseases.
- The directorate of public health (DPH) / directorate of medical services (DMS) may have important role in implementing infection control and antibiotic stewardship policies in government hospitals and help in establishing district infection control committee.
- Since infectious diseases courses are available at very few places , Medical council should introduce infectious disease postgraduate degree course at large number of places to have large force to fight infections in the long term.
- Teaching faculty should be role models for appropriate antibiotic usage. Every efforts should be made to educate youngsters to follow infection control practices.
- There has to be global collation. A collaboration for joint guidelines and research as infection spread from one country to another.
- The pharmaceutical industries are not interested in doing research on antibiotics because the lack of great profit so the meaningful incentive are needed to promote antibiotic research by pharma.
- The threat of AMR is grave if is allowed like this we will have post antibiotic era similar to pre antibiotic era in which the treatment of minor infections,surgery, to major transplant will become extremely difficult. The cost of treatment will rise as we try to use expansive new antibiotic and increase in long time in hospitalization which will lead to extremely high costs.
- If we want people to survive more ,than a joint effort is needed on a continuation basis. Time to begin it is now.

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