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LEADING ARTICLE

Rational Use of Antibiotics

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Introduction

The discovery of Antibiotics is one of the most significant developments in the history of medicine. But the situation is changing over time and very rapidly changing over last few decades due to emergence of antimicrobial resistance (AMR). It is a global public health problem now a days which drew attention to physicians and all related caregivers, medical professional bodies, local and international health organization and even news media.[1,2] AMR has significant adversity including increased morbidity, mortality, increased resource utilization and higher cost of diagnosis and care.[3] Overuse of antibiotic at health facilities, poultry, dairy and other industries are important contributors for this scenario.[4] Unfortunately, newer antibiotics are not coming too frequently, rather the rate of introduction of new antibiotics is gradually decreasing. At the same time when very few antibiotics of existing classes are coming to the market, they are becoming resistant with in very short period of time, either due to over use or due to cross resistance.[5] That's why discovery of new antibiotics or combination of antibiotics with other molecules is not a reasonable solution, because those will not work for a long time and are also very expensive which are increasing the financial burden to the patients and patients' family.[5] So, it's clear that new or combination of antibiotics cannot show us any ray of light, rather preservation of available antibiotic resources by rational use could be the only remaining option.

AMR: How big is the problem?

AMR in microorganisms is a natural phenomenon and the development of resistance is a normal evolutionary process for microorganisms but it is being accelerated by the use or misuse of antibiotics in humans, animals and other industries.[6] The misuse of antibiotics includes inappropriate dose or wrong antibiotics which also include conditions that are not caused by a bacterial infection. In fact, each new antibiotic has been followed by the development of resistance with in very short period of time.[7] As a result, AMR is a serious threat to global public health that currently affects humans, animals and environmental health. It increases morbidity and mortality and is associated with high economic costs due to its health care burden. Infections with multidrug-resistant (MDR) bacteria also have substantial implications on clinical and economic outcomes.[2] It is estimated that that globally AMR leads to 700,000 deaths per year and losses of at least extra healthcare costs of EUR 1.5 billion per year.[8,9]

Causes of antimicrobial resistance

Important cause of AMR is indiscriminate use of antimicrobial agents in both humans and animals, specially at our part of the world, use of antibiotics without a prescription. A national study in Germany in 2011 showed, the prevalence of nosocomial infection has not changed since 1994, but the prevalence of antibiotic use has increased.[10] Up to half of ICU patients receiving empirical antibiotic therapy have no definitively confirmed infection, while de-escalation and shortened treatment duration are insufficiently considered in those with documented sepsis.[5] Irrational and inappropriate use of antibiotics in commercial chicken, aquaculture and animal production industries can also accelerate the antibiotic resistance process in humans and animals. During recent time, non-therapeutic usage of antibiotics in commercial chicken, fish and other livestock industries have raised significant concerns

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about the development of antibiotic resistance.[4,11,12]

Study found that poor knowledge of doctors regarding Antimicrobial Stewardship Program (ASP), non-existence of antibiogram of hospital and lack of rules for the safe use of antibiotics were the main driving factors associated with irrational antibiotic prescription practices and development of Antimicrobial resistance.[1] Physicians' antibiotic prescribing habits, attitudes and behaviors also vary before and after graduation where theoretical antibiotic knowledge is better in the pre-graduation period but doctors forget their theoretical knowledge of antibiotics over time and are unable to follow current developments after graduation. Sustainable education for antibiotic use for physicians after graduation can contribute positively to reduce of antimicrobial resistance rates and to increase awareness about the use of rational antibiotics.[3]

Rational use of antibiotics

Published data notably support the need for better identification of patients at risk of infection including Multi-drug resistant bacterial (MDRB) infection, more accurate diagnostic tools enabling a rule-in/rule-out approach for bacterial sepsis, an individualized reasoning for the selection of single-drug or combination empirical regimen, the use of adequate dosing and administration schemes to ensure the attainment of pharmacokinetics/pharmacodynamics targets, concomitant source control when appropriate, and a systematic reappraisal of initial therapy in an attempt to minimize collateral damage on commensal ecosystems through de-escalation and treatment-shortening whenever conceivable.[5] Although rational use of antibiotics is the mainstay of prevention of AMR, unfortunately even Doctors has misconceptions about the rational use of antibiotics.[1] Available evidences support that, reduction of unnecessary use of antibiotics can have a powerful impact upon antimicrobial resistance. Several biomarkers have been tried to guide the initiation and duration of antibiotic treatments for suspected bacterial infections. CRP-based algorithms and procalcitonin can be used safely to guide antibiotic-related decisions, thereby decreasing unnecessary antibiotic exposure. There are few more promising tools like Neutrophil CD64, serum amyloid A, transcriptomics, metabolomics and proteomics which may come into clinical practice very soon.[13] Antibiotic checklist can also be promising tool to reduce unnecessary use of antibiotics in clinical practice.[14,15]

AMR and rational use of antibiotic: Is there any solution?

Several reports have been published in recent years that outline measures to reduce the consumption of antibiotics. A variety of actions have been proposed and tried locally and globally at different centers including global awareness campaigns, increasing financial resources for infectious diseases in the healthcare sector, the development of new antibiotics and policies aimed at the reduction of antibiotic use, anti-microbial stewardship program, regional local and hospital antibiotic policy, antibiotic check list etc. But considering the situation of increasing AMR and lack of new tool to combat the situation, infection prevention and control would be the primary target, rather than treating infection.[14,15] Reduction of antibiotics use without a prescription will have significant effect in controlling AMR. If necessary, local government must come forward with appropriate legislation and strict implementation.[16] Successful implementation of Antimicrobial Stewardship Program (ASP), development of guidelines for the use of antibiotics, strict legislation regarding use of antibiotics, active participation of healthcare professionals and awareness program among general public about the use of antibiotics could be important initial steps to establish rational use of antibiotics.[1]

Antimicrobial stewardship

Antimicrobial stewardship (AMS), an organizational or system-wide health-care strategy, is designed to promote, improve, monitor and evaluate the rational use of antimicrobials, to preserve their future effectiveness, along with the promotion and protection of public health. It also adopts systematic measures to optimize antimicrobial use, decrease unnecessary antimicrobial exposure and to decrease the emergence and spread of resistance. Implementing ASP in the ICU improves antimicrobial utilization and reduces broad-spectrum antimicrobial use, incidence of infections and colonization with multi-drug resistant bacteria (MDRB), antimicrobial-related adverse events and health care associated costs, all without increase in mortality.[2,5] ASP is a package of quality improvement initiative, requiring (1) an evidence-based, ideally bundled, change package, (2) a clear definition of goals, indicators, and targets, (3) a dynamic measurement and data collection system with

feedback to prescribers, (4) a strategy for building capacity, and (5) a plan to identify and approach areas for improvement and solve quality gaps.[5] Many developed countries, such as, Colombia, the United States (US), Australia, South Africa, and the United Kingdom (UK), have developed and successfully implemented different approaches to halt the spread of AMR.[1]

Conclusion

The use of antibiotics should not be random. It requires reflection and thought and should be based on rules. The correct diagnosis, the patient's condition, the location of the infection, the severity of the microbial cause sensitivities to antibiotics, the pharmacokinetics and pharmacodynamics of antimicrobials, the side effects and cost are the main elements which must be supported in every decision for their use. Local and regional guidelines with periodic revisions and recommendations for treatment of the common infections are necessary to orient rationale and appropriate use of antibiotics at root level and primary caregivers. Sustainable training for rational antibiotic use for physicians can contribute positively to reduce of antimicrobial resistance rates and to be more conscious about the use of rational antibiotics.

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