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Short Communication

Education Section

Uniformity in Content and Delivery of Antimicrobial Component in Medical Curriculum: Need of the Hour

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ABSTRACT

The use of antibiotics has transformed the nature of medical practice substantially. Exponential increase in the migration of people has converted the whole world into a global village. As medical experts, we need to recognise that most of the infectious diseases are no longer limited to a geographical area and their spread is very fast in the modern world, and we have very few weapons to fight against it. Unfortunately, the over-reliance on the use of antibiotics in medicine and veterinary branches to tackle these infections has led to antimicrobial resistance.

Keywords: Antimicrobials, Antibiotic prescribing, Antimicrobial resistance, Undergraduate medical education

INTRODUCTION

The World Health Organisation defines Antimicrobial Resistance (AMR) as the ability of a microorganism (like bacteria, viruses, and some parasites) to stop an antimicrobial (such as antibiotics, antivirals and antimalarials) from working against it [1]. AMR increases the cost and complexity of treatment of a range of common infections, causing delays in effective therapy, or an inability to provide appropriate treatment. The predictable consequence of resistance is increased morbidity, prolonged illness, a greater risk of complications, and higher mortality rates [2].

Without effective antimicrobial treatment for infections, various success stories of modernised medicine, might not have been possible [3]. The battle against microbes requires united efforts across governments and society. If effective collaborative global approach across sectors is not adopted soon to fight this problem, then terrible complications would result in social, medical, and economic fronts [4]. The international scientific community has already urged policymakers to take collective action to address this threat.

THE PROBLEM

Globally, much of the problem of AMR stems from irrational use of medicines. Irrational use is multidimensional concept and includes over-prescription, under-prescription, prescription and dispensing of unnecessary antibiotic combinations. Rampant use of antibiotic combinations for want of quick results can lead to multiple adverse drugs reactions and AMR [2]. Inappropriate drug prescribing, dispensing and sale practices combined with failure to consume the drugs in appropriate dosage is highly prevalent. Medicines are being overused, underused or misused which ultimately is resulting in improper allocation of scarce resources. Practices such as polypharmacy, inadequate dosing, prescribing antimicrobials for viral infections, choosing injectables over oral formulations, failure to comply to the treatment guidelines, self-medication of prescription-only medication and non-compliance to dosing schedule are examples of irrational medicine use [5].

The WHO reports widespread resistance in *E. coli* to the fluoroquinolone group of antibiotics used for treatment of urinary tract infections. Infections caused by *Staphylococcus aureus* show increasing resistance to the first-line drugs. The mortality among people infected with Methicillin - Resistant *Staphylococcus aureus* (MRSA) is 64% higher than those infected with the non-resistant variant [1]. Antimicrobial resistance to carbapenem is increasing. Many gram-negative bacteria like *Escherichia coli, Pseudomonas aeruginosa, Acinetobacter, Klebsiella pneumoniae, Enterobacter, and Neisseria gonorrhoeae* are already showing trends of multi-antibiotic resistance [6].

Globally, 558 000 cases of multidrug-resistant (resistant to the 2 most powerful anti-TB drugs-isoniazid and rifampicin) or rifampicin-resistant tuberculosis (MDR/RR-TB) were estimated to have emerged in 2017. Around 3.5% of newly diagnosed and 18% of old TB cases are infected with Multi Drug Resistance (MDR) TB bacteria. Failure to treat patients with MDR-TB successfully has resulted in around 9.7% of the cases to suffer from Extensively Drug Resistant TB (XDR-TB), a form of tuberculosis that is resistant to at least 4 of the core anti-TB drugs [7].

The *Plasmodium falciparum* and *P. vivax*. species of the malaria parasite have exhibited resistance to currently available antimalarial drugs [8]. Resistance of *P falciparum* to Artemisinin-based combination therapies has been confirmed in five countries of the Greater Mekong region [1]. This poses a significant challenge to strategies for malaria control in the endemic regions.

As per the 2019 HIV drug resistance report, in 12 of 18 countries who participated in the global WHO surveys, the prevalence of pre-treatment drug resistance to Nevirapine (NVP) or Efavirenz (EFV) had exceeded 10%. Sub Saharan African countries participated the most in these surveys and the prevalence of Acquired Drug Resistance (ADR) to EFV and NVP ADR ranged from 50% in Eswatini to 97% in Uganda [9].

Resistance to the antiviral drugs like amantadine and rimantadine is emerging among the Influenza. Currently, the resistance to oseltamivir is low, however, concerted efforts are being directed towards monitoring of the drug susceptibility to curb resistance [1].

Medical Education and Healthcare Professionals

Appropriate use of antimicrobials is the cost-effective use of antimicrobials which maximises clinical therapeutic effect while minimising both drug-related toxicity and the development of antimicrobial resistance, as defined by 2001 WHO Global Strategy for containment of AMR [5]. One of the most important aspects of controlling resistance to microbes is by judicious use of antibiotics in clinical practice. The list of available antibiotics for use in clinical practice is increasing daily but there is hardly any novelty in their mechanism of action and so the threat of cross-resistance is becoming a reality. Encountering infections due to multidrug

resistant organisms in clinical practice is common these days. The selection and use of an appropriate antibiotic can control these infections from emerging and spreading. Prescribing antimicrobials is a major challenge for junior doctors. The WHO Global strategy includes several recommendations to promote rational use of antimicrobials, providing guidance that is valuable for prescribers, dispensers, hospitals and governments. One of the vital elements of the strategy includes educating prescribers and dispensers on appropriate use of antimicrobials [5]. The World Health Organisation advocates 12 key interventions to promote rational use of medicines. Of these, inclusion of problem-based pharmacotherapy training in undergraduate curricula and continuing in-service medical education as a licensure requirement strongly highlight the need for transforming the existing medical curricula and continuing professional development [10].

The key area of success in overcoming this challenge is to impart uniform, up to date, working knowledge on selection and use of antibiotics to the health care professionals. A novice healthcare professional should be competent to make the right decisions regarding the use of antibiotics at his level of practice. The foundation framework for incorporating issues related to AMR should enhance the skills of precise prescribing.

Majority of the medical universities take into account the local and national needs for design and implementation of their curricula. Recently, there has been a huge concern about 'safe' prescribing by doctors. In fact, current undergraduate curricula have not been able to successfully develop and nurture the knowledge, skills, and behaviour for graduates to "Prescribe drugs safely, effectively and economically" as stipulated by the General Medical Council's Tomorrow's Doctors standards [11]. Medical curricula can be classified as traditional, problem-based and case-based and each one of these lays varied emphasis on teaching and assessment of the topic of 'antimicrobials'. There needs to be interactive discussions with students about selection, dose, treatment time and alternatives with regards to the use of antibiotics. Though medical academics across the world agree that training the prescribers on rational use of antimicrobials is essential, the content and pedagogical approach on the global platform has not been uniform.

Evidence indicates that redesign in medical curriculum eliminates the problem of 'teaching in silos' and enhances the integration of scientific theory with clinical practice [11]. An integrated method of training in clinical pharmacology and therapeutics through a "context learning" approach is need of the hour.

As we are facing a global threat of antimicrobial resistance our armaments to tackle this problem should be uniform and not be limited by borders of nationality. It is important that all students pursuing health sciences courses understand the burden of AMR and is equipped with the information to tackle this threat. The emphasis, content, delivery method and assessment regarding antimicrobial knowledge should be uniformly developed and implemented by an apex body.

Today more emphasis is given on the molecular mechanism of action of drugs rather than selection and use of antibiotics. The perception towards the use of antibiotics should change over the time and interactive pedagogical techniques need to be utilised to empower students for rational drug use and 'safe' prescribing'. Studies have demonstrated the effectiveness of online learning tools in enhancing the awareness about AMR and improving antimicrobial prescribing [12,13]. In an effort to promote rational prescribing, the WHO advocates educational interventions like seminars and workshops during training and educational outreach after completion of training. A recent study by Laks M et al., reported effective use of a virtual learning environment inclusive of online simulations and real time discussions to promote the teaching and learning of antimicrobial stewardship [14]. Chin-Hong P et al., designed a spiral curriculum for medical students in years 2-4 to impart knowledge about antimicrobial stewardship by revisiting same concepts with increasing complexity. They found improved student perception of clinical acumen due to application of problem-solving and critical thinking skills [15]. A variety of learning styles are applicable for learning, but in line with the integrated approach, an inquisitive rather than a passive learning method should be adopted. Revisiting antibiotics in every year of the medical course with emphasis on the appropriate use of antibiotics in different clinical settings is a strategy that can help students achieve higher order skills. These efforts will help in developing a generation of doctors who are better equipped with skills to manage antimicrobial resistance in the future.

Clinicians should try to align the thinking process of junior health care professionals to match with the national and international guidelines for using antimicrobials. There should be a unified approach to the meaningful use of antimicrobials in practice. Development and delivery of this curriculum is a mammoth task and will require immense skills on the part of stakeholders and teachers of the delivery of knowledge. Communication is the holy grail of success in wars. Health care professionals need to communicate about the trends in infection control with their colleagues at local, national and international levels. Students need to be trained to communicate with their patients to educate them on antimicrobial use and the importance of adherence to prescribed treatments. Effective communication can take place if students are made aware of the various valid communication platforms through which they can seek reliable information when in difficulty. The emphasis on communication should be aligned with the principles of problem solving. Assessment of clinical and communication skills related to rational use of medicines is a significant aspect in delivery of this curriculum.

The stakeholders for the curriculum development should be prominent people from medical academia, private medical practitioners, policymakers and international health agencies from across the globe. The goal should be to "Think Sharp, Act Smart, Hit Precise and Ask in Difficulty". It is not important to know every aspect of the antimicrobials, but it is essential to know the exact evidence-based strategy to counter the threat of infection and AMR. There should be no room for error in the selection and use of antimicrobials at an empirical level by the junior physicians. Student-centric curriculum with the use of prescribing software and justification approach for selection of antimicrobials based on scientific evidence can be the way forward.

CONCLUSION(S)

Modern medicine is losing battle against microbes. To win this battle clinicians require to change the strategy towards the use of antibiotics and everything starts with the change in training. Now is the time to act right and change this long-overlooked area in the medical curriculum.

REFERENCES

[1] Antimicrobial resistance [Internet]. WHO 2017 [cited 2019 Oct 3]. Available from: https://www.who.int/en/news-room/fact-sheets/detail/antimicrobial-resistance.
[2] The evolving threat of antimicrobial resistance: Options for action [Internet]. Apps.who.int.2012 [cited 2019 October 2].
[3] Aslam B, Wang W, Arshad MI, Khurshid M, Muzammil S, Rasool MH, et al. Antibiotic resistance: A rundown of a global crisis. Infect Drug Resist. 2018;11:1645-58.
[4] What Exactly is Antibiotic Resistance? [Internet]. Centers for Disease Control and Prevention. 2018 [cited 13 September 2019]. Available from: https://www.cdc.gov/drugresistance/about.html.
[5] WHO Global Strategy for Containment of Antimicrobial Resistance. Geneva, 2001. Available from: https://www.who.int/drugresistance/WHO_Global_Strategy_English.pdf.
[6] Fair RJ, Tor Y. Antibiotics and bacterial resistance in the 21st century. Perspect Medicin Chem. 2014;6:25-64. Published 2014 Aug 28. doi:10.4137/PMC.S14459.
[7] MDR-TB 2018 Update [Internet]. World Health Organization; 2019 [cited 2019 November 9]; Available from: https://www.who.int/tb/areas-of-work/drug-resistant-tb/MDR RR_TB_factsheet_2018_Apr2019.pdf?ua=1.

[8] Drug resistance in the Malaria-endemic world Centers for Disease Control and Prevention [Internet]. Centers for Disease Control and Prevention; 2018 [cited 2019 November 11]. Available from: https://www.cdc.gov/malaria/malaria_worldwide/reduction/drug_resistance.html.
[9] HIV Drug Resistance Report 2019 [Internet]. Geneva, Switzerland: World Health Organization; 2019 [cited 2019 November 6]. Available from: http://file:///C:/Users/105876/Downloads/WHO-CDS-HIV-19.21-eng.pdf.
[10] Rational use of medicines [Internet]. World Health Organization. 2019 [cited 2019 October 3]. Available from: https://www.who.int/medicines/areas/rational_use/en/.
[11] Nazar H, Nazar M, Rothwell C, Portlock J, Chaytor A, Husband A. Teaching safe prescribing to medical students: Perspectives in the UK. Adv Med Educ Pract. 2015;6:279-95. DOI:10.2147/AMEP.S5617.
[12] Rocha-Pereira N, Lafferty N, NathwaniD. Educating healthcare professionals in antimicrobial stewardship: Can online-learning solutions help? J Antimicrob Chemother. 2015;70:3175-77.
[13] ReynaJ, Khanal S, Morgan T. Using online learning modules to fight against antibiotic resistance in Australia. In H. Carter, M. Gosper and J. Hedberg (Eds.), Electric Dreams. Proceedings ascilite. 2013:756-65.
[14] Laks M, Guerra CM, Miraglia JL, Medeiros EA. Distance learning in antimicrobial stewardship: innovation in medical education. BMC Med Educ. 2019;19:191. DOI:10.1186/s12909-019-1623-x.
[15] Chin-Hong P, Teherani A, Irby D, Schwartz B. An innovative 3-year medical student spiral curriculum in antimicrobial stewardship and infectious diseases. Open Forum Infect Dis. 2018;5(Suppl 1):S40.DOI:10.1093/ofid/ofy209.093.

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