REVIEW ARTICLE

ANTIBIOTIC RESISTANCE AND STEWARDSHIP IN THE CONTEXT OF COVID 19 PANDEMIC: A REVIEW

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ABSTRACT

The advancements in the field of medicine both in terms of drugs and equipment have played a vital role in improving the quality of life of man. Even when the judicious and wise administration of antimicrobials have reduced mortality and morbidity saving the lives of millions, the introduction and continuous use of antibiotics have put forward a serious concern of emergence of resistant strains. This review gives an insight into the concept of antibiotic resistance and stewardship the context of COVID 19 pandemic.

Keywords: Antibiotic resistance, antibiotic stewardship, Covid 19.

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INTRODUCTION

Antibiotics have drastically altered the healthcare system, bringing even the lethal infections under control. The last few decades have witnessed the advancements in medications and treatment modalities including cancer chemotherapy and organ transplants. Judicious and timely use of antimicrobials have reduced mortality and morbidity saving the lives of millions. The introduction and continuous use of antibiotics have put forward a serious concern of emergence of resistant strains.[1]

The worldwide impact of COVID 19 pandemic cases had an instantaneous and overwhelming impact on the healthcare system and society. The long-term consequences of COVID-19 on antimicrobial resistance have been a grave matter of concern because of elevated administration of antibiotics in patients infected with SARS-CoV-2.[2]

Presently, antibiotic resistance has become a worldwide problem with serious public health, clinical and economic impacts. The common causes of death reported in these cases are due to resistance to antibiotics used in lower respiratory tract infections, such as pneumonia, and blood and intra-abdominal infections.[3]

This review gives an insight into the concept of antibiotic resistance and antibiotic stewardship in the context of COVID 19 pandemic.

Antibiotic resistance

Definition

Antimicrobial resistance (AMR) is well defined as the development of resistance of microorganisms to an antimicrobial agent to which they were at first sensitive.[4]

AMR is defined as the resistance of bacterial, viral, parasitic and fungal microorganisms to antimicrobial medicines that were previously effective for treatment of infections.[5]

The substantial upsurge in the population of multidrug resistant strains which was prevalent globally resulted in its recognition as a major global health threat by World Health Organization (WHO) in 2014.[4]

Causes

It occurs naturally over time but is accelerated by multiple factors. The main etiological factors associated with antibiotic resistance include inadvertent use of antibiotics by public due to lack of awareness, self-medication, the inappropriate use of antimicrobial medicines in animal, food, agriculture and aquaculture sectors, lack of access to health services, including to diagnostics and laboratory capacity and antimicrobial residues in soil, crops and water.[4-6]

The lack of prevalence data on bacterial co-infection at the initial stages of the pandemic and the latent development of superinfections by the presence of numerous risk factors and long hospital stays, especially in critical ill patients, could significantly lead to higher antibiotic consumption in COVID-19 patients.[6] Antibiotic misuse along with a strained healthcare manpower and work force coupled with compromised immune system lead to antimicrobial resistance as a lasting consequence of the COVID-19 pandemic.[2]

Mechanisms of resistance

There are many mechanisms of resistance reported in bacteria. Among these, the major mechanisms are enzymatic inhibition, penicillin binding protein (PBP) modifications, porin mutations, efflux pumps, and target changes.[1]

AR in the context of COVID-19

Indications of Antibiotic Resistance (AR) in COVID cases

The usage of broad-spectrum antibiotics as a part of COVID-19 treatment was recommended when there exists an overlap of respiratory symptoms of bacterial community-acquired pneumonia with that of COVID-19. According to the latest WHO guidelines in November 2021, it states that antibiotics should not be prescribed for mild and moderate patients without a clinical suspicion of bacterial infection, but for severe patients, they recommend empirical antibiotic therapy to treat all likely pathogens.[7,8]

Specific causes of AR in COVID patients

It is reported that increased self-antibiotic medica-

tion, inadvertent and emperical antibiotic administration, and antibiotics prescribed by general practitioners were the risk factors of high levels of AR during COVID-19. The extreme apprehension and panic about the situation and the inappropriate use of antibiotics directly had an impact in accessing antibiotics without a prescription, principally low- and middle-income countries where exixts a weak system of antibiotic control.[9]

Prevalence of AR in COVID cases

Few studies indicated that it was due to suspected for-seen bacterial co-infections, antibiotics are widely prescribed for COVID-19 patients in spite of its viral nature.[2] Some studies state that even before the admission to hospitals, approximately 69% of COVID-19 patients used antibiotics (eg: ceftriaxone and azithromycin) with or without a practitioners' consent.[9]

About 64% of cases received antibiotics. Among the 72% of COVID-19 treated with antimicrobials, 8% of these them suffered from bacterial or fungal co-infection. Based on the findings of a meta-analysis, the prevalence of bacterial infection in COVID-19 was estimated to be approximately 8.6%.[2]

Trends of AR in COVID-19 cases

The most prevalent gram-negative AR bacteria were A. baumannii, K. pneumonia whereas the among gram-positive, S. aureus and E. faecium were the most resistant ones.[2]

Regarding the age of the patient, prescription pattern was found to be least for children and highest for elderly group. In the initial months, an increase in the consumption of amoxicillin-clavulanate, ceftriaxone or azithromycin was reported, while over the months the consumption of broad-spectrum antibiotics.[6] About the time trends, the highest prevalence of prescription was found in the initial days, followed by gradual reduction in later months. The highest prescribing rates were found in Southeast and East Asia with lowest Europe.[2]

Prevention of AR

Healthcare providers and common man require increased awareness regarding judicious use of antibiotics in pandemics as well as in normal situations. In this scenario, it is important the role of antimicrobial stewardship programs on supporting the optimal selection of empirical therapies and the rapid de-escalation of treatment once SARSCoV-2 infection is confirmed.[6]

Antibiotic stewardship programs aim at refining the appropriateness of antibiotic use associated with reduced antibiotic utilization, and decreased incidence of drug-resistant infections. Considering the patterns of antibiotic prescribing in COVID-19 helps to identify openings for interventions, and target antibiotic stewardship strategies to progress the quality and safety of antibiotic use.[2]

Antibiotic stewardship

The spectrum of infectious diseases is rapidly evolving. Emerging infectious agents present with a constellation of challenges. The highly virulent pathogens with increased resistance result in increased morbidity, mortality, and healthcare costs. It has been estimated that ten million people will die every year due to AMR by 2050.[10]

The current scientific literature emphasizes on reduction of inappropriate use of antimicrobials in all healthcare settings.1 In this context, the application of antibiotic stewardship programs play a vital role.

Definition

It is defined as "a coherent set of actions which promote using antimicrobials responsibly" based on the principle that antimicrobial treatments are limited resources and that inapt use can have serious adverse effects on the patient increasing morbidity and mortality.[11]

Stewardship describes the vigilant and accountable administration of something entrusted to one's care. The term antimicrobial stewardship was first applied by in 1996 by John McGowan and Dale Gerding and they suggested a causal association between antimicrobial agent use and resistance. Antimicrobial Stewardship (AMS) refers to the optimal selection, dosing, and duration of antimicrobial treatment resulting in the best clinical outcome with minimal side effects to the patients and minimal impact on subsequent resistance.[12,13]

Antimicrobial stewardship (AMS) defines a healthcare-system-wide approach to promoting and

monitoring the judicious use of antimicrobials to preserve their future effectiveness.[3] The term also indicates the monitoring the use of an antimicrobial through a standardized evidence-based approach, thereby reducing selection and spread of resistant germs and the adverse effects related to the use of antibiotics, and ultimately contain the costs.[3]

Goals of AMS

According to the Infectious Diseases Society of America (IDSA) and the Society for Healthcare Epidemiology of America (SHEA), the prime goal of AMS is to augment clinical outcomes for the patient and lessen consequences of antimicrobial use and antimicrobial resistance.[14]

The main goals include to work with healthcare practitioners encouraging to prescribe 5 "D"s of antimicrobial therapy, i.e right Drug, correct Dose, right Drug-route, suitable Duration, timely De-escalation to pathogen-directed therapy. Other goals comprise of preventing overuse of antimicrobial drugs, its misuse, and abuse, to reduce adverse effects related to antibiotics, to minimize development of resistance thereby reducing healthcare-associated cost.

Core elements of AMS

This includes

- Leadership commitment including formulation of formal statements aimed at improving the monitor of antimicrobial use, support education and training of staff related to stewardship, ardship activities.
- Accountability and drug expertise where formal training in infectious disease and AMS will be given for physicians.
- Action includes implementing related policies that supports optimal antibiotic use and utilizing precise interventions to restrict antibiotic use.
- Tracking and reporting comprise of keeping track of the evaluation of both policies and outcomes to assess the impacts of improvement efforts.
- Educating prescribers on regular updates of resistance to optimise in antimicrobial prescription.

Core members of stewardship team

In most situations, stewardship team include either an infectious disease physician or a pharmacist or at times both. Even a hospitalist with keen interest in infectious disease can offer his service. Generally, the infection preventionist is one of the active members of the team. Interdepartmental collaboration with microbiology laboratory, hospital epidemiology, and administration is extremely helpful in managing crisis. The hospital administration team when join hands with these members can effectively control the situation to a great extent. Apart from clinicians, pharmacy workers and nurses, the IT staff along with infection prevention team and epidemiologist help in tracking, monitoring and reporting antimicrobial resistance and its adverse effect trends.[16]

At the grass root level, individual patients can serve as a good antimicrobial steward by using antimicrobials sensibly. Patient participation can be ensured by advising them to take antibiotics only by prescription given by practitioner and inform them not to store leftover antimicrobials.[16]

Components of effective AMS

A chief component of effective and timely AMS is diagnostic stewardship, the process of prescribing and interpreting the results of diagnostic tests before initiating or continuing treatment. Use of rapid diagnostics enables early diagnosis and prompt treatment, leading to the use of precise and targeted antimicrobials, bypassing the misuse of empirical antimicrobials. To attain sustained stewardship, general public education has to be united with other AMS efforts including prospective audit and feedback (PAF), a peripheral, expert review of antibiotic therapy with their suggestions.

Apart from diagnostic stewardship, the other component is proper infection prevention and control. Averting the occurrence and spread of infections provide an effective antidote to inappropriate and unnecessary antibiotic prescriptions[16].

Conclusion

The increased prevalence of antibiotic resistance enforces the administration of antibiotic stewardship, especially in a country like India where prescription is not required for purchasing a drug. The objectives of antimicrobial stewardship are provision of better patient care, restricted antibiotic use, and availability of cost-effective health care.

REFERENCES

1. De Sousa Oliveira, K., de Lima, L. A., Cobacho, N. B., Dias, S. C., & Franco, O. L. (2016). Mechanisms of Antibacterial Resistance. Antibiotic Resistance, 19–35.
2. Langford BJ, So M, Raybardhan S, Leung V, Westwood D, MacFadden DR, Soucy JR, Daneman N. Bacterial co-infection and secondary infection in patients with COVID-19: a living rapid review and meta-analysis. Clin Microbiol Infect. 2020 Dec;26(12):1622-1629.
3. Costantino M, Conti V, Corbi G, Iannelli AA, Marongiu F, Torsiello M, Della Vecchia A, Sellitto C, Genovese A, Moccia G, Filippelli A, De Caro F. Impact and Value of Hospital Antibiotic Stewardship: Retrospective Pre-COVID-19-Pandemic Analysis. J Clin Med. 2022 Jul 29;11(15):4412.
4. Urban-Chmiel, R.; Marek,A.; St ˛epie ´n-Py´sniak, D.; Wieczorek, K.;Dec,M.; Nowaczek, A.; Osek, J. Antibiotic Resistance in Bacteria-A Review. Antibiotics 2022,11, 1079.
5. https://www.euro.who.int/-data/assets/pdf_file/0005/348224/Fact-sheet-SDG-AMR-FINAL-07-09-2017.pdf
6. Ruiz-Garbajosa P, Cantón R. COVID-19: Impact on prescribing and antimicrobial resistance. Revista Española de Quimioterapia. 2021;34(Suppl1):63.
7. Cong W, Stuart B, AIhusein N, Liu B, Tang Y, Wang H, Wang Y, Manchundiya A, Lambert H. Antibiotic Use and Bacterial Infection in COVID-19 Patients in the Second Phase of the SARS-CoV-2 Pandemic: A Scoping Review. Antibiotics. 2022 Jul 23;11(8):991.
8. Mayi BS, Mainville M, Altaf R, Lanspa M, Vaniawala S, Ollerhead TA, Raja A. A crucial role for antimicrobial stewardship in the midst of COVID-19. Journal of Microbiology & Biology Education. 2021 Mar 31;22(1):ev 22i1-2285.
9. Sulayyim HJ, Ismail R, Hamid AA, Ghafar NA. Antibiotic Resistance during COVID-19: A Systematic Review. International Journal of Environmental Research and Public Health. 2022 Sep 21;19(19):11931
10. de Kraker ME, Stewardson AJ, Harbarth S. Will 10 Million People Die a Year due to Antimicrobial Resistance by 2050? PLoS Med. 2016 Nov;13(11):e1002184.
11. Lakbar I, Delamarre L, Curtel F, Duclos G, Bezulier K, Gragueb-Chatti I, Martin-Loeches I, Forel JM, Leone M. Antimicrobial Stewardship during COVID-19 Outbreak: A Retrospective Analysis of Antibiotic Prescriptions in the ICU across COVID-19 Waves. Antibiotics. 2022 Oct 30;11(11):1517.
12. McGowan JE, Gerding DN. Does antibiotic restriction prevent resistance? New Horiz. 1996 Aug;4(3):370-6.
13. Gerding DN. The search for good antimicrobial stewardship. Jt Comm J Qual Improv. 2001 Aug;27(8):403-4.
14. Dellit TH, Owens RC, McGowan JE, Gerding DN, Weinstein RA, Burke JP, Huskins WC, Paterson DL, Fishman NO, Carpenter CF, Brennan PJ, Billeter M, Hooton TM, Society for Healthcare Epidemiology of America. 2007. Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America guidelines for developing an institutional program to enhance antimicrobial stewardship. Clin Infect Dis 44:159–177.
15. Shrestha J, Zahra F, Cannady Jr P. Antimicrobial Stewardship. https://www.ncbi.nlm.nih.gov/books/NBK572068/
16. Doron S, Davidson LE. Antimicrobial stewardship. Mayo Clin Proc. 2011 Nov;86(11):1113-23. doi:10.4065/mcp.2011.0358. PMID: 22033257; PMCID: PMC3203003