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Review Article

A GLIMPSE OF INFECTION AND RESISTANCE: A REVIEW

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ABSTRACT

Antibiotic resistance is a global phenomenon with ancient origins antibiotic resistance which is regarded as a priority threat by WHO. in fact antibiotic resistance is a an inevitable consequence of antibiotic use irrational use enhances the rate of antibiotic resistance the irrational use has made conventional methods for combating antibiotic resistance nonresponsive and had led to emergence of multiple drug resistant infections. This led to exploration of novel ways to fight antibiotic resistance. In spite of all these efforts antibiotic resistance is till a global threat and could be managed by rational use of drugs and methods weather conventional or novel methods. This review gives a glimpse of antibiotic resistance and the conventional and novel methods to fight it.

Keywords: antibiotic resistance, resistance, infection

INTRODUCTION

Infectious diseases were prevalent in prehistoric times which could be traced through evidences of small pox found in 3000 year Egyptian mummy and poliomyelitis in Ereb papyrus paintings.[1] In the past primitive tribes attributed the causes of diseases to linked diseases to magic/ nature and prayers were first attempts to treat them[2]. In Asian countries, herbal and traditional medicines are continuously being used against several ailments[3]. In India, Ayurveda a natural system of treatment has been practiced for more than 5,000 years.[4] Likewise traditional Chinese medicine originated in China at least 3,000 years ago and spread to overall throughout the east Asia. Besides these traditional Unani medicine, traditional Korean medicine and traditional, Native American medicine have also originated world wide long back ago. Synergy in all forms of traditional medicine is the use of medicinal plants in the treatment of disease and the maintaining health.[5]In pre antibiotic era infections as meningitis and endocarditis were fatal.[6]In golden age of antibiotic infection decreased but resistance emergence due to irrational use of antibiotics. Infectious diseases are presently the world's largest killer of people with India having its highest burden due to pneumonia, tuberculosis, diarrhoea, malaria, and measles causing higher usage of antibiotics[7] leading its irrational use and emergence of bacterial resistance presently a global problem also regarded as one of the 3 major problems for human health by WHO.[8] Factors of resistance are pathogen specific (virulence, transmissibility, survival fitness, previous trend), Prescriber specific (prescribing skill, knowledge path physiology pharmacokinetics, training)Patient Related (Self-medication, knowledge, adherence, OTC use) [9] Mechanism of resistance is of 2 forms biochemical including mutations, hydrolysing enzymes, efflux pumps and genetic covering conjugation, transformation, transduction.[10]Finally prevention of resistance can be done by prudent/ rational use of antibiotics[4], imparting awareness[11] , providing education[11], initiating hospital infection control programme[11]/hand washing[8],antibiotic rotation like mixing and cycling[12],maintaining house hygiene[11], promoting new antibiotics development[8], using combination therapy[13], vaccination[13], probiotics[13], trace elements (selenium, zinc)[13], phytochemicals[13], union therapy[14], apitherapy[15], photodynamic therapy[12]. Recent/Novel approaches includes use of viruses that can infect bacteria and also have antibacterial activity commonly known as pages. These are administered through oral, rectal, or iv routes and acts in 2 ways one lytic and other lysogenic major side effects of phage therapy include endotoxin release. Second novel approach is use of bacteriocins which are the bactericidal peptides having antibacterial properties. They interact with the cell membrane leading to change in its properties causing cell death. Secondly It may also bind to lipid-II facilitating transport of peptidoglycan subunit from cytoplasm to cell wall thus blocking cell wall synthesis causing cell death. Alternatively they can cause cell death by membrane de-energizing (IMF) or can also cause inhibition of amino acids uptake, exclusion potassium ions, cyto membrane depolarisation, cellular ATP hydrolysis and partial efflux. Advantages of bacteriocin therapy are easy degradation to nontoxic metabolites. Third strategy is using killing factors released by bacterial cells to kill sibling cells during starvation as an antibacterial. Chemically they are peptides and have been tested successfully against methicillin-resistant*S. aureus and S. epidermidis*. Fourth approach is using non antibiotics which are drugs used for non-infectious diseases but having microbial activities eg barbiturates, beta-adrenergic receptor antagonists, diuretic, antihistamines, mucolytic agents, non-steroid anti-inflammatory drugs, proton pump inhibitors and psychotherapeutic agents. These act by altering cell permeability, affect microbial efflux pump, cross membrane ion transport, cell energy transfer, membrane bound enzymes. Fifth approach is combining antibiotics with non-antibiotics eg penicillin and benzothiazine for MSRA advantage being the safety profile of non antibiotics is established side effect being dose for antibiotic use as compared to conventional use. Sixth approach is to target quorum sensing the microbial cell communication plays role in onset of virulence. Two mechanism are present one involving

signal detection through cytosolic transcription factor while other mediated by auto inducing signal detected through membrane receptor. Impairing this system can help to combat virulence of the microorganisms without imposing selection pressure. It enhances activity of antibiotics and restricts evolution of drug resistant strain.[16] Other strategy is aiming the CRISPR-Cas system, which is a part of the immune system in many bacteria for protecting bacteria from viruses. Another approach is using of silver which has property to weaken bacteria and making them more susceptible to antibiotics. In addition using silver in combination with existing antibiotics can increase their effectiveness. Next approach is developing a candidate drug that disarms bacteria instead of destroying. Researchers based at VIB are exploring ways to inhibit the pilus formation mechanism.[17] Presently recent explored novel approaches include modification of old antibiotics as B lactams, flouroquinoles, exploring microbial genome sequencing wherein bacterial genomes have given new targets for antimicrobials. Bioinformatics techniques based on open reading frames for identification of new targets especially for respiratory antibiotics. Combinational chemistry has wide role in antibiotic discovery requires screening of natural and synthetic compounds, exploring new targets like peptide deformylase ,non malvonate pathway, bacterial fatty acid synthesis[18], targeting non multiplying bacteria[19], advanced nano biomaterials[20], FimhInibitors[21], bacteriophages[22], antimicrobial peptides[23], Synthetic biology methods like recombinant engineering[24], and bacterial cell-cell signaling[22], I Chip methodology for novel antibiotics production[24],biosensor applications[25], stimuli-responsive nano antibiotics[26], anti-virulence therapy[22,27,28], reducing in the bacterial load by hemofilters[29], host-directed therapy[30], anti-adhesion[27] ,quorum quenching [22], bacterial small RNAs (sRNAs)[31], marine drugs like Pseudovibriospecies.[32], modulating human microbiota[33], using cow urine[34], Antibiotic Lysocin E screening by a silkworm model of bacterial infection.[35]and union therapy[14]. Finally antibiotic resistance is an inevitable consequence of antibiotic use and follows darwinism laws of evolution.[36] hence could be combated only by proper, rational and judicious use of antibiotics, novel methods, conventional methods or else it would become an uncontrolled threat globally.

CONCLUSION

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REFERENCES

1. Brachman PS. Infectious diseases—past, present, and future.International Journal of Epidemiology 2003; 32:684–686.
2. Zuskin E, Lipozencic J, Cvetkovic JP, Mustajbegovic J, Pucic NSB, Meniga IN. Ancient Medicine – a Review Acta Dermatovenerol Croat 2008;16(3):149-157.
3. Boire NA, Nicholas A, Riedel S, Parrish NM. Essential Oils and Future Antibiotics: New Weapons against Emerging 'Superbugs'?. Journal of Ancient Diseases & Preventive Remedies, 2013; 1(2)1-5.
4. Joshi, V, Joshi RP. Some Plants used in Ayurvedic and Homoeopathic Medicine. Journal of Pharmacognosy and Photochemistry 2013, 1(2), 269-275.
5. Prasad S, Tyagi AK. Traditional Medicine: The Goldmine for Modern Drugs. Advanced Techniques in Biology & Medicine. Advance Techniques in Biology and Medicine. 2015; 3:1.
6. Collignon P. Antibiotic resistance – what we need to do about it. Australian Infection Control. 2007; 12(4)116-17.
7. Ahmad A, Parimalakrishnan S, Mohanta GP, Patel I,Manna PK. A study on utilization pattern of higher generation antibiotics among patients visiting community pharmacies in Chidambaram, Tamilnadu at south India International Journal of Pharmacy. 2012; 2(3): 466-471.
8. Sekhri K. Antimicrobial resistance: understanding Solutions and future developments. International Journal of Pharma and Bio Sciences.2013; 4(2):338 – 343.
9. Olofsson SK, Cars O. Optimizing Drug Exposure to Minimize Selection of Antibiotic Resistance. Clinical Infectious Diseases 2007; 45:129–36.
10. Verraes C, Boxstael SV, Meervenne EV, Coillie EV, Butaye P, Catry B. etal. Antimicrobial Resistance in the Food Chain: A Review. International Journal of Environmental. Research and Public Health 2013; 10, 2643-2669.
11. Uchil RR, Kohli GS, Katekhaye VM, Swami, OC.Strategies to Combat Antimicrobial ResistanceJournal of Clinical and Diagnostic Research. 2014 Jul, Vol-8(7): ME01-ME04.
12. Duijn VB. Antibiotic rotation strategies to reduce antimicrobial resistance in Gram-negative bacteria in European intensive care units: study protocol for a cluster-randomized crossover controlled trial. Trials 2014; 15:277.
13. Ogbodo SO, Okeke AC, Ugwuoru CDC, Chukwurah EF. Possible Alternatives to Reduce Antibiotic Resistance. Life Sciences and Medicine Research, 2011, 24;1-9.
14. Kala K, Sodhi R K, Jain UK. Indian Council of Medical Research (ICMR), New Delhi, Sponsored 5th Annual International conference on "Bioinformatics and Proteomics Driven Biomarker Developments" on 7th and 8th April, 2017.
15. Basa B, Belay W, Tilahun A, Teshal.A. Review on Medicinal Value of Honeybee Products: Apitherapy. Advances in Biological Research 10 (4) 2016; 236-247.
16. Nigam A, Guptab D, Sharma A. Treatment of infectious disease: Beyond antibiotics Microbiological Research 2014; 169; 643–651.
17. Sandle T. Novel Methods to Address Antimicrobial Resistance. SOJ Microbiology & Infectious Diseases 2014.1-2.
18. Yoneyama H, Katsumata R. Antibiotic resistance in bacteria and its future for novel antibiotic development. Bioscience, Biotechnology, and Biochemistry 2006.70(5):1060-1075.
19. Coates ARM, Hu Y. Novel approaches to developing new antibiotics for bacterial infections. British Journal of Pharmacology 2007; 152, 1147–1154.
20. Sangiao ET, Holban AM, Gestal MC. Advanced Nano biomaterials: Vaccines, Diagnosis and Treatment of Infectious Diseases Molecules 2016; 21, 867.
21. Theriault N, Tillotson GS. New and alternative approaches to tackling antibiotic resistanceF1000 prime reports 2013; 1-9.
22. Auer J, Rahman KM. Fighting the Global Problem of Antimicrobial Resistance. Journal of Drug Design and Research.2015 2(3): 1018.1-5.
23. Krishnamurthy M, Moore RT, Rajamani S, Panchal RG. Bacterial genome engineering and synthetic biology: combating pathogens. BMC Microbiology. 2016;16:258.
24. Sherpa RT, Reese CJ, Aliabadi HM. Application of iChip to Grow "Uncultivable" Microorganisms and its Impact on Antibiotic Discovery . Journal of Pharmacy and Pharmaceutical Sciences. 2015; 18(3) 303 – 315.
25. Christ KR, Bendas G. Biosensor Applications in the Field of Antibiotic Research—A Review of Recent Developments. Sensors 2011, 11, 9450-9466.
26. Edson JA, Kwon YJ. Design, challenge, and promise of stimuli-responsive nano antibiotics. Nano Convergence. 2016 3:26:1-13.

27. Vale PF, McNally Wilson, LD, Kayla C. K, Popat, R., Maria R. etal. Beyond killing can we find new ways to manage infection? Evolution, Medicine, and Public Health 2016; 148–157.
28. Brannon JR, Hadjifrangiskou. M. The arsenal of pathogens and anti-virulence therapeutic strategies for disarming them.Drug Design, Development and Therapy 2016:10 1797-1806.
29. Opal SM. Non-antibiotic treatments for bacterial diseases in an era of progressive antibiotic resistance. Opal Critical Care. 2016; 20:397.
30. Tobin DM. Host-Directed Therapies for Tuberculosis. Cold Spring Harbour Perspectives in Medicine 2015.5:1-16.
31. Chan H, Ho J, Liu X, Zhang L, Wong SH, Chan MT. Potential and use of bacterial small RNAs to combat drug resistance: a systematic review. Infection and Drug Resistance2017:10 521–532.
32. Crowley SP, Gara FO, Sullivan OO, Cotter, PD. etal. marine *pseudovibrio* sp. As a novel source of antimicrobials. Marine Drugs.2014;*12*, 5916-5929.
33. Allen HK, Trachsel J, Looft T. and Thomas A. Casey. Finding alternatives to antibiotics. Annals of New York. Academy of Sciences. 2014; 1323, 91–100.
34. Randhawa GK, Sharma R. Chemotherapeutic potential of cow urine: A review. Journal of Intercultural Ethno pharmacology 2015; 4 (2), 181-186.
35. Hamamoto H, Sekimizu K. Identification of lysocin E using a silkworm model of bacterial infection Drug Discoveries & Therapeutics. 2016; 10(1):24-29.
36. Zhang, R, Eggleston, K, Rotimiand V. Zeckhauser, RJ. Antibiotic resistance as a global threat: Evidence from China, Kuwait and the United States. Globalization and Health 2006; 2:6.

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