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Antibiotic resistance pattern and questionnaire regarding measures taken for its prevention in tertiary care hospital.

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ABSTRACT

Background

Antibiotics are medicines used to prevent and treat bacterial infections. Antibiotic resistance occurs, when bacteria change in response to the use of these medicines. Antibiotic resistance is the ability of a bacterium or other microorganisms to survive and reproduce in the presence of antibiotic doses that were previously thought effective against them. This study aims to evaluate resistant pattern in tertiary care hospital. Questionnaire based assessment of awareness of different measures taken for prevention of antibiotic resistance among health care workers.

Objective

To study antibacterial resistance pattern in tertiary care hospital with the help of culture sensitivity reports.
To study resistant pattern of bactericidal and bacteriostatic.
To identify antibacterial resistance pattern age wise, gender wise, region wise (taluka wise), indoor versus outdoor patient, and route wise.

Materials & methods

This is the prospective observational study conducted in tertiary care hospital, Pune. Total 200 patients blood culture sensitivity report was studied. Patient's demographic details were recorded. The patients excluded were long standing chronic disorders like diabetes, kidney failure, liver failure, rheumatic arthritis, G-6PD deficiency individual and immune-deficiency individual. Study included bactericidal and bacteriostatic, gender-wise, age-wise, route of administration (oral and parenteral), region-wise, inpatient-outpatient analysis. Questionnaire was prepared to study awareness of measures taken for prevention of antibiotic resistance in health care workers

Results

Among 200 observed cases, resistance found 42.26% in male, and 43.75% in female. Antibacterial resistance found to be 27.52% in bacteriostatic agents and 40% in bactericidal agents. Antibacterial resistance found to be 65% inpatients and 23% in outpatients. Antibacterial resistance found to be highest in age group of 50-60 years having 52% and lowest in 20-30 years having 33%.Antibacterial resistance region-wise was found to be highest in Junnar taluka (70%) followed Daund (58%) and least resistance was found in Khed (35%).

Conclusion

There is an urgent need to develop and strengthen antibiotic policy, standard treatment guidelines and national plan for containment of resistance. Measure should be taken by the government with monitoring and evaluation of the existing health care delivery system for both health care providers and consumers to improve drug use, should be undertaken simultaneously.

Keywords: Antibacterial resistance, Bacteriostatic, bactericidal resistance

INTRODUCTION

Antibiotics are medicines used to prevent and treat bacterial infections. Antibiotic resistance occurs when bacteria change in response to the use of these medicines. Antibiotic resistance is the ability of a bacterium or other microorganisms to survive and reproduce in the presence of antibiotic doses that were previously thought effective against them.[1] The origin of antibiotic resistance genes are unclear. There are many studies using clinical isolates, demonstrated susceptibility. Conjugative plasmids were present. Bacteria become antibiotic resistant.[2] Bacteria may infects humans or animals and the infections they cause are harder to treat than those caused by non-resistant bacteria.[3] The world urgently needs to change the way it prescribes and uses antibiotics. Antibiotics are chemical agents that prevent bacterial growth by stopping the bacterial cell from dividing (bacteriostatic) or by killing them (bactericidal).[4] So antibiotics are the integral part of medicines used to insure human and animal health. However, the wide spread use, misuse and overuse of antibiotics in human and animal has raised the concern about the development of resistant bacteria that possess a potential danger to animals and humans.[5] Antibiotic resistant microorganisms have been described as "nightmare bacteria" that "pose a catastrophic threat" to people in every country in the world.[6] Antibiotic resistant infections occur too often and with increasing frequency, interfering with the effective treatment of people [7] Irrational prescription by untrained or unskilled people leads to increase in resistance. In general practice, there are concerns about some common infections which are becoming difficult to treat an illness with antibiotic resistant bacteria which may take longer to resolve. [8] To preserve the effectiveness of antibiotics, it is critical to examine the uses of these drugs, in both humans and animals. [9] Self-medication and over-the-counter availability of antibiotics is serious issue. Measures should be taken to avoid over-the-counter availability of antibiotics. Lack of awareness among the common people to complete the dosage schedule is one of the leading causes of antibiotic resistance. Several new initiatives are being put in place to halt the alarming trend of resistance to antibiotics and to deal with the ever-increasing number of infections caused by resistant bacteria [10] Even if new medicines are developed, without behavior change, antibiotic resistance will remain a major threat. [11] Behavior changes must also include action to reduce the spread of infections through vaccination, hand washing, and good food hygiene. [12] Antibiotic resistance is rising to dangerously high levels in all parts of the world.[13] New resistance mechanisms are emerging and spreading globally, threatening our ability to treat common infectious diseases.[14] A growing list of infections –are becoming harder, and sometimes impossible, to treat as antibiotics become less effective.[15]

Antibiotics can be bought for human or animal use without a prescription, the emergence and spread of resistance is worsening. In countries without standard treatment guidelines, antibiotics are often over prescribed by health workers and veterinarians and over used by the public.[16]

MATERIAL & METHODS

This is the prospective observational conducted in tertiary care hospital, Pune. Total 200 patients blood culture sensitivity report was studied. Patients demographic details were recorded. The patients excluded were long standing chronic disorders like diabetes, kidney failure, liver failure, rheumatic arthritis, G-6PD deficiency individual and immune-deficiency individual. Study included bactericidal - bacteriostatic, gender-wise, age-wise, route of administration (oral, parenteral), region-wise, inpatient-outpatient analysis. Questionnaire was prepared to study measures taken for prevention of antibiotic resistance. Answer as yes or no were analyzed.

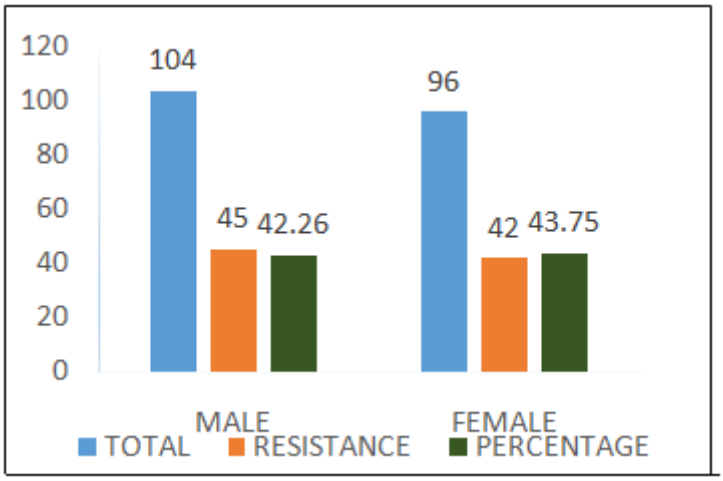
1. Whether you apply disinfectant on your hands in between patients?
2. Whether you wash your hands before examining patient?
3. Whether operation theaters are fumigated regularly?
4. Whether equipments used in hospital are sterilized with proper sterilization technique?
5. Whether duration of antibiotics is mentioned in prescription?
6. Whether antibiotics are used for prophylactic purpose?
7. Whether patient undergoes culture and sensitivity test before prescribing antibiotics?
8. Whether your hospital has antibiotic resistance surveillance team?
9. Whether you report antibiotic resistance to antibiotic resistance surveillance team?
10. Whether proper gap is maintained between dosages of antibiotics?
11. Whether you go through a culture sensitivity reports before changing antibiotics?
12. Whether your hospital has antibiotic policy?
13. Whether you practice antibiotic policy?
14. Whether you justify the antibiotic prescription in every case?
15. Whether antibiotic prescription audit is practiced in your hospital?

RESULTS

Among 200 observed cases 42.26% was male, and 43.75% was female. Indistinguishable resistance was observed on gender analysis. (Table no.1, Graph no.1).

Table no. 1 Gender-wise resistance pattern

Gender	Total	Resistance	Percentage
Male	**104**	**45**	**43.26%**
Female	**96**	**42**	**43.75%**

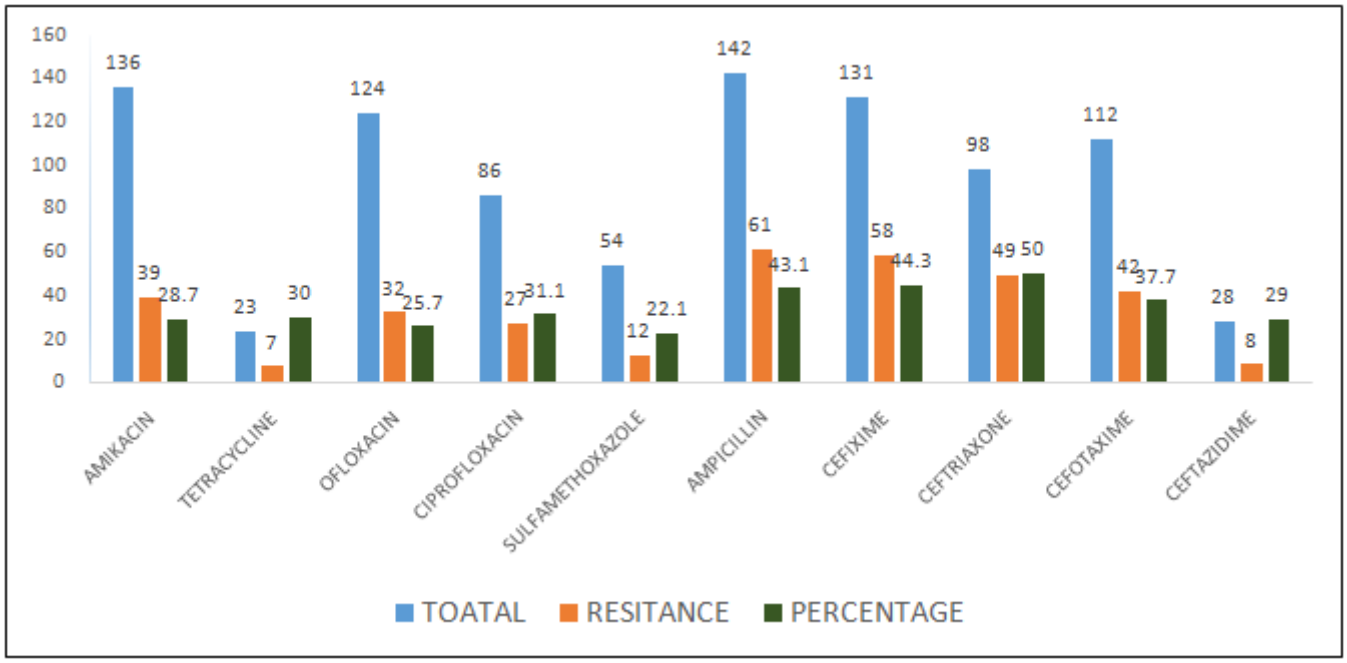


Graph no1 Gender-wise resistance pattern

Antibacterial resistance is bacteriostatic agents among which highest resistance was of Ciprofloxacin lowest of Sulphamethoxazole, and in bactericidal agents, in which highest resistance was found of ceftriaxone and lowest in ceftazidime (Table no.2a, Graph no.2a).

Table no.2a Antibiotic-wise resistance pattern

Antibacterial	Total	Resistance	Percentage
Amikacin	**136**	**39**	**28.7%**
Tetracycline	**23**	**7**	**30%**
Ofloxacin	**124**	**32**	**25.7%**
Ciprofloxacin	**86**	**27**	**31.1%**
Sulfamethoxazole	**54**	**12**	**22.1%**
Ampicillin	**142**	**61**	**43.1%**
Cefixime	**131**	**58**	**44.3%**
Ceftriaxone	**98**	**49**	**50%**
Cefotaxime	**112**	**42**	**37.7%**
Ceftazidime	**28**	**8**	**29%**

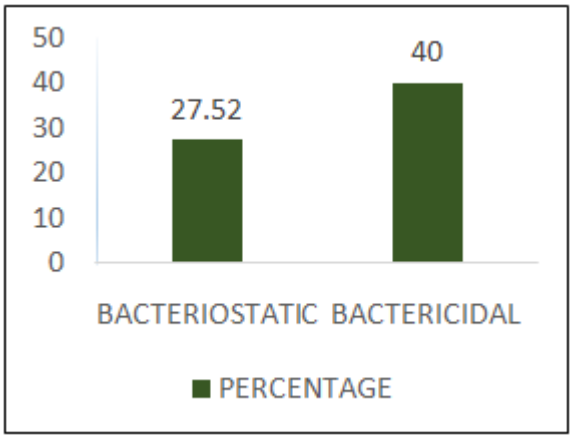


Graph no.2a Antibiotic-wise resistance pattern

Average percentage of the above 5 bacteriostatic and 5 bactericidal agents is calculated. The bacterial resistance is more common to bactericidal agents(40%) as compared to bacteriostatic agents(27.52%).(Table 2b, Graph no.2b)

Table no.2b Antibiotic-wise

Antibacterial	Percentage
Bacteriostatic	27.52%
Bactericidal	40%

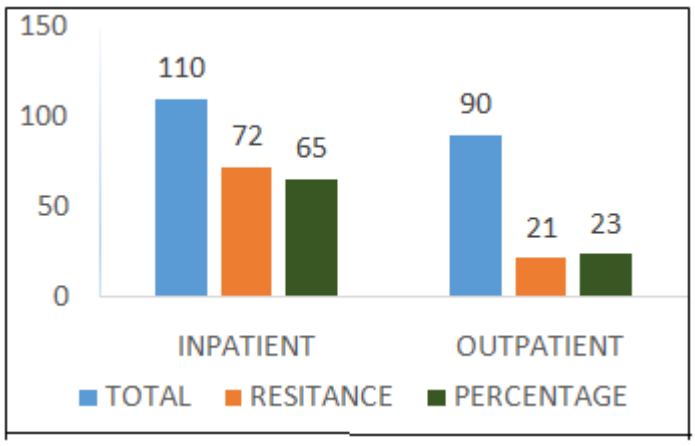


Graph no.2b Antibiotic-wise

Resistance found of inpatients was thrice of outpatients. (Table no.3 ,Graph no.3)

Table no.3 Inpatient and outpatient resistance pattern

Patient	Total	Resistance	Percentage
Inpatient	110	72	65%
Outpatient	90	21	23%

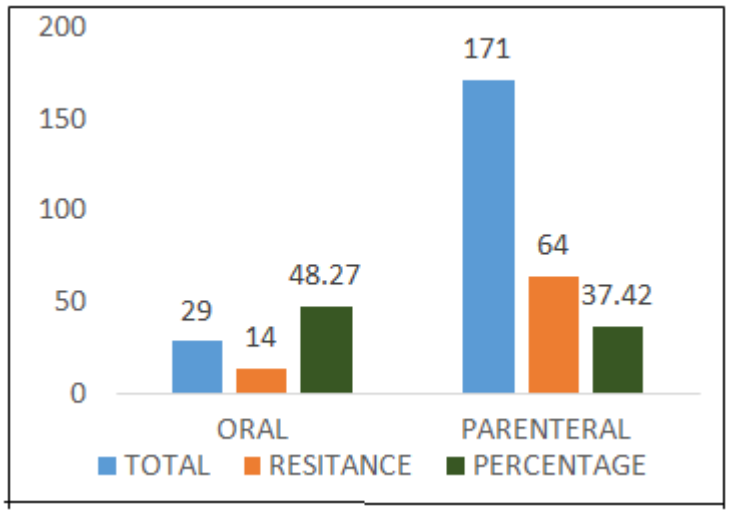


Graph no. 3 Inpatient and outpatient resistance pattern

Between oral and parenteral route of administration, resistance was more in oral (Table no.4, Graph no.4)

Table no.4 Route-wise analysis

Route	Total	Resistance	Percentage
Oral	**29**	**14**	**48.27%**
Parenteral	**171**	**64**	**37.42%**



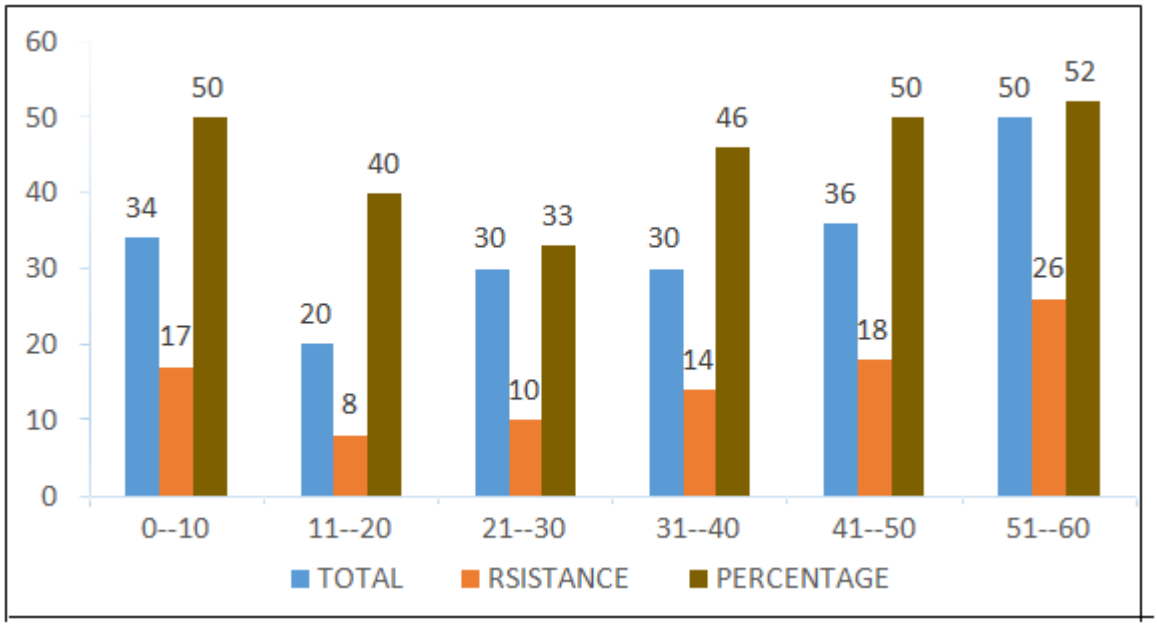
Graph no.4 Route-wise analysis

Resistance was observed to be more in age group of 50-60 years as compared to the other age groups(Table no.5, Graph no.5).

Table no.5 Age-wise analysis

Age (Years)	Total	Resistance	Percentage
0-10	**34**	**17**	**50%**
11-20	**20**	**8**	**40%**
21-30	**30**	**10**	**33%**
31-40	**30**	**14**	**46%**

41-50	**36**	**18**	**50%**
51-60	**50**	**26**	**52%**

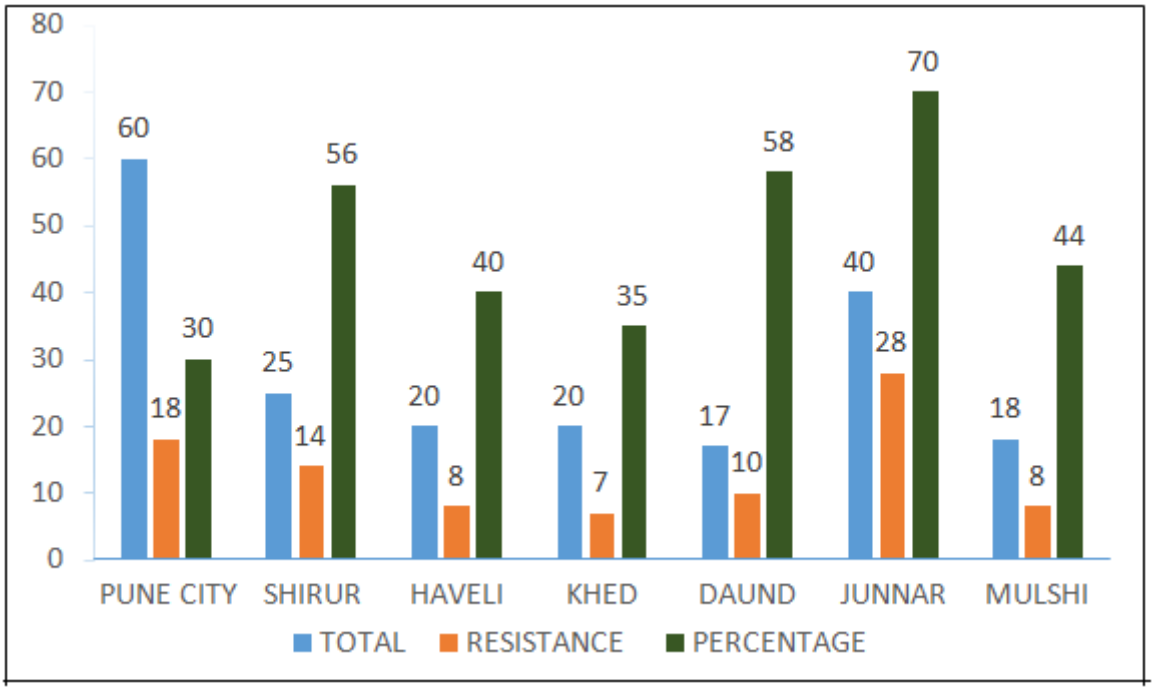


Graph no. 5 Age-wise analysis

In region-wise estimation percentage of resistant was seen in Junnar taluka was doubled of Khed. (Table no.6 ,Graph no.6).

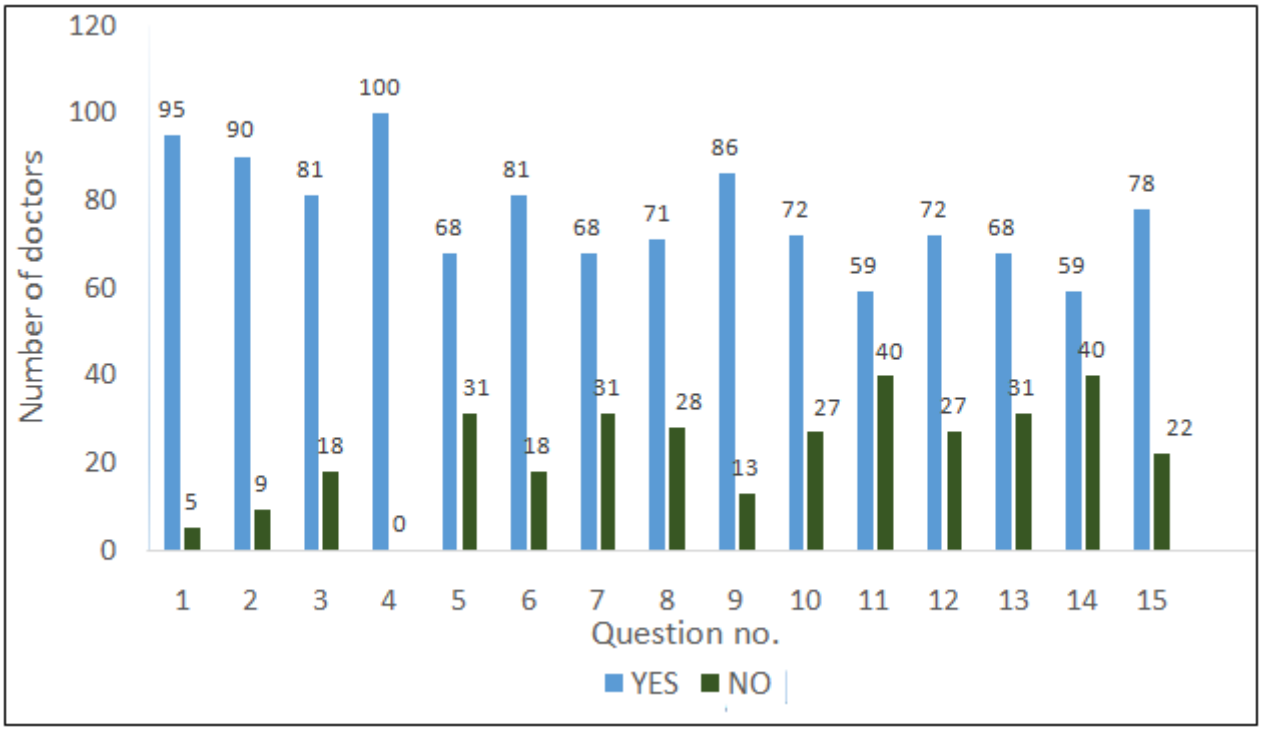
Table no.6 Region-wise analysis

Taluka	Total	Resistance	Percentage
Pune City	**60**	**18**	**30%**
Shirur	**25**	**14**	**56%**
Haveli	**20**	**8**	**40%**
Khed	**20**	**7**	**35%**
Daund	**17**	**10**	**58%**
Junnar	**40**	**28**	**70%**
Mulshi	**18**	**8**	**44%**



Graph no. 6 Region-wise analysis

In the questionnaire, the health care workers (HCW) have to answer in YES or NO. Few HCW had information about antibiotic policy conducted in their hospital. Many answered NO for the question regarding culture sensitivity report done before changing antibiotics. Some refused to justify the antibiotic prescribed. (Graph no.7)



Graph no.7 Questionnaire-based awareness about prevention of antibacterial resistance

DISCUSSION

Ceftriaxone is the most resistant antibiotic followed by cefixime. But in the study conducted by Vs, Sowmya et al., shows that ofloxacin was found as the most resistant antibiotic followed by levofloxacin[19]. Parenteral use of antibacterial produces less resistance(37.42%) compare to oral route (48.2%) these correspond to the study Revathy et al[18] . Antibacterial resistance was found highest in age group 50-60 years (52%)and lowest in the age group of 20-30 years(33%).This does not correspond to Revathy et al[18]. Antibacterial resistance was found 65% in inpatients

compared to 23% in outpatients. This corresponds to K.V. Ramnath et al [20] .

Antibiotic resistance is one of the biggest threats to global health, food security, and development today. Resistance can affect anyone, of any age, in any country. It occurs naturally, but misuse of antibiotics in humans and animals is accelerating the process. A growing number of infections – such as pneumonia, tuberculosis, gonorrhoea, and salmonellosis – are becoming harder to treat as the antibiotics used to treat them become less effective. Antibiotic resistance leads to longer hospital stays, higher medical costs and increased mortality.

When infections can no longer be treated by first-line antibiotics, more expensive medicines must be used. A longer duration of illness and treatment, often in hospitals, increases health care costs as well as the economic burden on families and societies.

Antibiotic resistance is putting the achievements of modern medicine at risk. Organ transplantations, chemotherapy and surgeries such as caesarean sections become much more dangerous without effective antibiotics for the prevention and treatment of infections.

WHO on 7th April 2011 World health day had theme COMBAT DRUG RESISTANCE which included "No action today no cure tomorrow".[22]

The “Global action plan on antimicrobial resistance” has 5 strategic objectives:

- To improve awareness and understanding of antimicrobial resistance.
- To strengthen surveillance and research.
- To reduce the incidence of infection.
- To optimize the use of antimicrobial medicines.
- To ensure sustainable investment in countering antimicrobial resistance.[21]

Presently there is no national program for prevention of drug resistance and there is inadequacy of quality assured laboratories, insufficient data analysis and dissemination, absence of national guidelines on antibiotic usage, no control on sale of these drugs for public consumption.

India, several initiatives are under way to address the problem. A national antibiotic policy is being prepared which highlights about the hospitals incorporating into their guidelines. The government is urging hospitals to get accredited with the National Accreditation Board for Hospitals and Health Care Providers which will result in practices relating to judicious use of antibiotics [22]. Though there are many interventional studies in developing countries very few studies have been conducted to improve the use of antimicrobials and evaluate the evidence of their effectiveness in India [22-24]. Before recommending a series of interventions, it will be necessary to investigate the relative effectiveness of different strategies in the Indian context [25] . Implementation and follow up of intervention research should be strengthened by health care planners, managers and practitioners to identify the most appropriate strategies to improve drug use and prevent the emergence of drug resistance.

CONCLUSION

Every person should take responsibility to prevent antibiotic resistance. Health care workers should be educated in medical field . Antibiotic should be prescribed rationally. Mixopathy should be banned. Doctors or nurses or pharmacists should explain the patient about the prescribed antibiotic and its complete dose regimen. There should be no communication gap between patient and health care worker. Patients should follow the instruction given by the health care worker. Self medication should be avoided. Patients should complete the dosage regimen prescribed. Over-counter availability of antibiotics should be under surveillance.

Hospital based study showed higher and varied spectrum of resistance in different regions. There exist lacunae in the structure and functioning of public health care delivery system. This leads to quantification of the problem and various determining factors related to antibiotic resistance. There is an urgent need to develop and strengthen antibiotic policy, standard treatment guidelines and national plan for containment of resistance. Measure should be taken by the government with monitoring and evaluation of the existing health care delivery system for both health care providers and consumers to improve drug use, should be undertaken simultaneously.

REFERENCES

1. World Health Organization (WHO). Tackling antibiotic resistance from a food safety perspective in Europe. WHO Library Cataloguing in Publication Data. Copenhagen, Denmark; 2011.
2. Clewell DB. Antibiotic resistance plasmids in bacteria. In:. Wiley Online Library. Available from: http://www.els.net/WileyCDA/ElsArticle/refId-a0001491.html.2014Top of Form [cited 3/7/2021].
3. Available from: https://www.who.int/news-room/fact-sheets/detail/antimicrobial-resistance [cited 3/7/2021].
4. Brunton LL. Chapter 42 / General Principles of Antimicrobial Therapy Section VIII / Chemotherapy of Microbial Diseases page no. Goodman and Gillman’s the pharmacological basis of therapeutics. 13th ed. Mcgraw-hill; 2017. p. 1096-109.
5. Landers TF, Cohen B, Wittum TE, Elaine L. Larson public health rep. Top of Form A review of antibiotic use in food animals: perspective, policy, and potential. 2012 Jan–Feb;127(1):4-22.
6. Prestinaci F, Pezzotti P, Pantosti A. FAntimicrobial resistance: a global multifaceted phenomenon. Pathog Glob Health. Oct 2015;109(7):309-18. doi: 10.1179/2047773215Y.0000000030, PMID 26343252.
7. Fymat AL. Antibiotics and Antibiotic Resistance. BJSTR;1(1). doi: 10.26717/BJSTR.2017.01.000117.
8. Available from: https://www.researchgate.net/publication/324824796. Review on antibiotic resistance and its mechanism of development review on antibiotic resistance and its mechanism of development [cited 3/7/2021].
9. Kumar SG, Adithan C, Harish BN, Sujatha S, Roy G, Malini A. Antimicrobial resistance in India: a review. J Nat Sci Biol Med. 2013 Jul;4(2):286-91.Bottom of Form. doi: 10.4103/0976-9668.116970, PMID 24082718.
10. Vs, Sowmya & S Shaji, Jerin & Hanumanthaiah. C & M, Kumaraswami & S, Apoorva & V S, Sowmya. Int J Pharm Sci Rev Res. 2021. Study of Antibiotic Ultilization and Resistance Pattern in Surgery Department in A Rural Tertiary Care Teaching Hospital;66:80-4. doi: 10.47583/ijpsrr.2021.v66i02.014.

11. Bhatia A, Kalra J, Kohli S, Kakati B, Kaushik R. Antibiotic resistance pattern in intensive care unit of a tertiary care teaching hospital. Int J Basic Clin Pharmacol. 2018;7(5):906-11. doi: 10.18203/2319-2003.ijbcp20181633.
12. Lin Z, Yuan T, Zhou L, Cheng S, Qu X, Lu P, Feng Q. Impact factors of the accumulation, migration and spread of antibiotic resistance in the environment. Environ Geochem Health. 2021 May;43(5):1741-58. doi: 10.1007/s10653-020-00759-0. PMID 33123928.
13. Zhang M, Cai Z, Zhang G, Zhang Y, Xue N, Zhang D, Pan X. Effectively reducing antibiotic contamination and resistance in fishery by efficient gastrointestine-blood delivering dietary millispheres. J Hazard Mater. 2021 May 5;409:125012. doi: 10.1016/j.jhazmat.2020.125012, PMID 33440322.
14. Towe CW, Srinivasan S, Ho VP, Bachmann K, Worrell SG, Perry Y, Argote-Green LM, Linden PA. Antibiotic resistance is associated with morbidity and mortality after decortication for empyema. Ann Thorac Surg. 2021 Jan;111(1):206-13. doi: 10.1016/j.athoracsur.2020.06.056. PMID 32857996.
15. Sorinolu AJ, Tyagi N, Kumar A, Munir M. Antibiotic resistance development and human health risks during wastewater reuse and biosolids application in agriculture. Chemosphere. 2021 Feb;265:129032. doi: 10.1016/j.chemosphere.2020.129032, PMID 33293048.
16. Lee GW, Ryu S, Park J, Lee EJ, Lee KJ, Tae J, Hwang Y, Kim DS. Changes of antibiotic prescribing pattern and its resistance to E. coli in South Korea: a 12-year retrospective observational study [sci rep:5658]. Sci Rep. 2021;11(1):5658. doi: 10.1038/s41598-021-84450-z, PMID 33707496, PMCID PMC7970963.
17. Alemayehu T, Ali M, Mitiku E, Hailemariam M. The burden of antimicrobial resistance at tertiary care hospital, southern Ethiopia: a three years' retrospective study. BMC Infect Dis. 2019;19(1):585. doi: 10.1186/s12879-019-4210-1, PMID 31277588.
18. saravanan R, Raveendaran V. Antimicrobial resistance pattern in a tertiary care hospital: an observational study. J Basic Clin Pharm. 2013;4(3):56-63. doi: 10.4103/0976-0105.118797, PMID 24808672.
19. Vs, Sowmya & S Shaji, Jerin & Hanumanthaiah. C & M, Kumaraswami & S, Apoorva & V S, Sowmya. Int J Pharm Sci Rev Res. 2021. Study of Antibiotic Ultilization and Resistance Pattern in Surgery Department in A Rural Tertiary Care Teaching Hospital;66:80-4. doi: 10.47583/ijpsrr.2021.v66i02.014.
20. Ramanath KV, Biswas P, Sunny R, John S. Study the antibiotic resistance pattern in a Tertiary Care Teaching Hospital. Int J Pharm Sci Res. 2019;10(2):819-29. doi: 10.13040/IJPSR.0975-8232.10(2).819-2.
21. WHO antibiotic resistance. Available from: https://www.who.int/news-room/fact-sheets/detail/antibiotic-resistance [cited 3/7/2021].
22. World Health Organization. WHO global strategy for containment of antimicrobial. Resistance. Available from: http://www.who.int/ emc [last accessed on Apr 16 2011].
23. Chatterjee P, Fleck F. Mobilizing political will to contain antimicrobial resistance. Bull World Health Organ. 2011;89(3):168-9. doi: 10.2471/BLT.11.030311, PMID 21379411.
24. World Health Organization. Interventions and strategies to improve the use of antimicrobials in developing countries: a review [cited Mar 20 2011]. Available from: http://www.whqlibdoc.who.int/hq/2001/who_CDS_CSR_DRS_2001.9.pdf.
25. Bhatia R, Narain JP. The growing challenge of antimicrobial resistance in the South-East Asia Region--are we losing the battle? Indian J Med Res. 2010;132:482-6. doi: 10.4103/0971-5916.73313, PMID 21149995.