Original Research Article

Antibiotic prescription pattern of cardiovascular thoracic surgery department in a tertiary care hospital of North Mumbai- A retrospective study

Swapnil Gautam[1,*], Dhaval Dalal[1], Suraj Purusottaman[1], Kinjal Patel[2], Madhuri Mahadik[3]

[1]Dept. of General Medicine, Bhaktivedanta Hospital & Research Institute, Maharashtra, India
[2]Dept. of Microbiology, Apoorva Diagnostics & Health care, Maharashtra, India
[3]Bhaktivedanta Hospital & Research Institute, Maharashtra, India

A R T I C L E   I N F O

A B S T R A C T

Introduction: Cardiovascular diseases are the most common cause of morbidity and mortality. Prevention of surgical site infection is the major concern in cardiac surgery because deep sternal infection leads to prolonged hospital stay, increased cost of treatment and even death. The cardiac surgeons have used many different therapeutic protocols for antimicrobial prophylaxis.

Aims & Objectives: The aim of this study is to evaluate the prescribing pattern of antibiotics in patients undergoing cardiovascular thoracic surgery (CVTS).

Material and Methods: A single centre retrospective study was conducted in the CVTS department from January 2017 to October 2018. The hospital has centralised electronic medical and laboratory record database that uses unique identification numbers. The data was obtained from medical record department of the hospital. All records including patient's age, gender, admission period, investigations performed, antibiotics advised during indoor stay and at discharge along with their administration routes, dosages and duration were noted. The pre-existing comorbidities and surgical intervention were also recorded.

Results: Among the total 86 patients reviewed, 88.84% were males with the mean age of 58.7 years. 87.21% of the patients received parenteral antibiotics, 98.83% received more than one antibiotic, either in oral or parenteral formulations. The most commonly used generic antibiotics were cefoperazone – sulbactam (69.77%), levofloxacin (59.30%), cefuroxime (25.58%), cefoperazone (11.63%) and amoxicillin – clavulanic acid (43.02%). While in admitted patients, beta lactam / beta lactamase inhibitors combination (98.83%), fluoroquinolones (69.77%), cephalosporins (34.88%), glycopeptides (3.49%) and carbapenem (2.33%) were used and on the other hand at the time of discharge, fluoroquinolones (43.02%), cephalosporins (32.56%) and beta lactam / beta lactamase inhibitors combination (39.53%) were prescribed. The indications for admission were Coronary artery bypass grafting (90.7%), Aortic valve replacement (5.81%), Mitral valve replacement (2.33%) and Dual valve replacement (1.16%). The most common associated comorbidities were ischemic heart disease (73.26%), diabetes mellitus (47.67%), hypertension (56.98), chronic kidney disease (5.81%) and chronic obstructive pulmonary disease (3.49%). The mean duration of usage of parenteral drugs was 5.20 days whereas it was 5.14 days for the oral drugs.

Conclusion: There was an irrational usage of antibiotics in patients undergoing surgery in the CVTS department. The prescription pattern varied according to the surgeon's preference or experience. This study strongly recommends the implementation of antimicrobial stewardship programme and written protocol driven antibiotics prescription.

For reprints contact: reprint@ipinnovative.com

1. Introduction

Selman Waksman introduced the term 'antibiotic' for any small molecule, produced by a microbe, with antagonistic properties on the growth of other microbes.[1] Over the years, there has been overuse and misuse of antibiotics leading to antimicrobial resistance, which has become a global health crisis. The antibiotics are unregulated and available over the counter without any prescription in many countries.[2] Studies have shown that treatment indication, choice of agent, or duration of antibiotic therapy is incorrect in 30% to 50% of cases.[3,4] The complications like antibiotic related diarrhoea and multidrug resistant hospital acquired infections happen because of excessive use of antibiotics.[5,6]

The antibiotic prescribing pattern of health care practitioners is one of the important determinant for the proper implementation of principles of the antimicrobial stewardship. These patterns determine the overuse and misuse of the antibiotics. There are multiple factors affecting these patterns such as pathogen resistance profiles, prescriber related factors and pharmaceutical industry influences.[7–9] Cardiovascular thoracic surgeries refers to operations on organs in the chest, including the heart, lungs and esophagus. Examples of thoracic surgery include coronary artery bypass surgery, heart transplant, lung transplant and removal of parts of the lung affected by cancer. Such surgeries uses advanced techniques and perioperative management have made great progress in recent years, but the incidence of infection after surgery has not been significantly reduced.[10,11] Postoperative infection is one of the severe complications after cardiovascular surgery. Therefore, antibiotics are routinely prescribed during the first 48 hours after cardiovascular surgery. However, there is a deficiency in effective method for early diagnosis of infection and to determine the need of antibiotics use after the first 48 hours.[12]

As per WHO, antibiotic use surveillance is an important strategy for controlling antibiotic resistance.[13] There should be continuous monitoring of antibiotic use and of prescribing patterns of the health care professionals. Hence, present study aimed to analyse the prescription patterns of the Cardiovascular Thoracic Surgeons of a tertiary care hospital.

2. Materials and Methods

A single centre retrospective study was conducted from January 2017 to October 2018 in the department of cardiovascular thoracic surgery (CVTS) at a 200-bedded tertiary care hospital. The hospital has centralised electronic medical and laboratory record database that uses unique identification numbers. Medical record department of the hospital is preserving all data files as digital copies.

* *Corresponding author.*
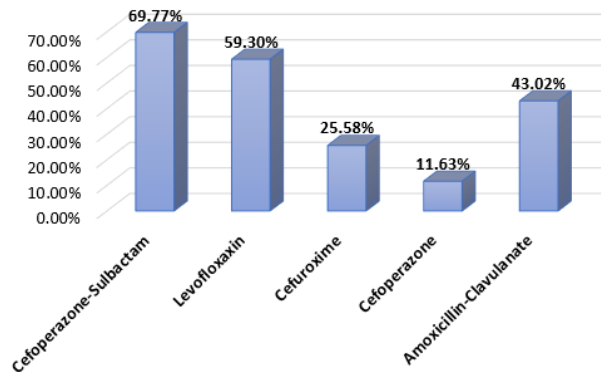 *E-mail address*: drswapgautam@gmail.com (S. Gautam).

Fig. 1: List of Generic antibiotics prescribed in patients of cardiovascular surgeries
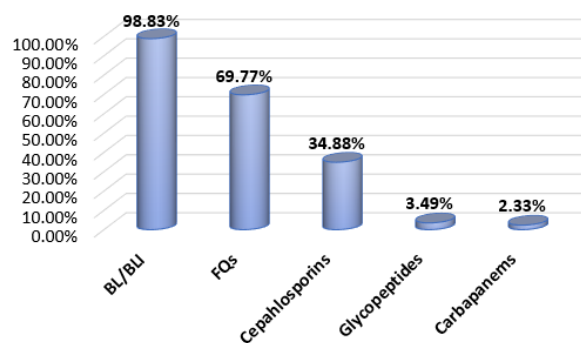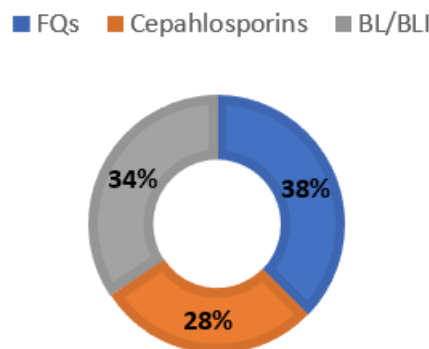

Fig. 2: Percentage of different group of antibiotics prescribed in admitted patients

FQs: Fluoroquinolones

Fig. 3: Percentage of different antibiotics prescribed at the time of hospital discharge of patients
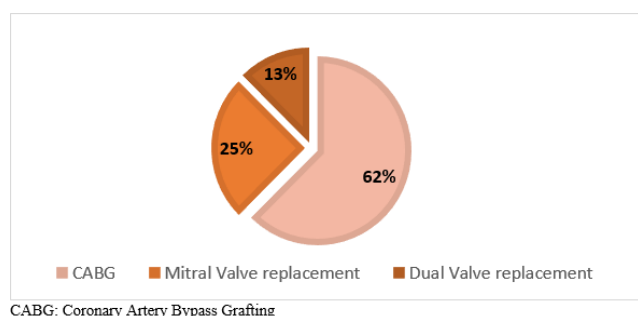
CABG: Coronary Artery Bypass Grafting

Fig. 4: Common indications at the time of patient's admission

IHD: Ischemic Heart Disease, HT: Hypertension, DM: Diabetes Mellitus, CKD: Chronic Kidney Disease, COPD: Chronic Obstructive Pulmonary Disease
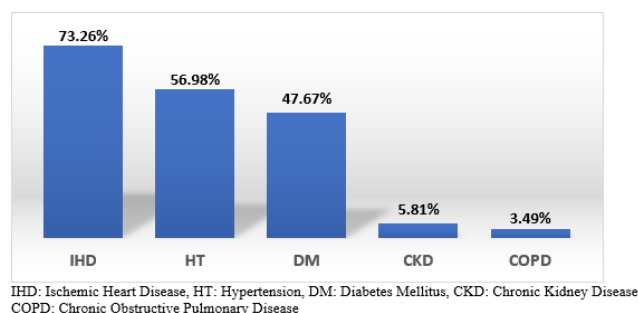
Fig. 5: Percentage of most common comorbidities of patients admitted at hospital for surgery

The records collected included age, sex, admission period, investigations performed, pre-existing comorbidities antibiotics advised during indoor stay and at discharge along with their routes, dosages and duration. The surgical intervention that the patient underwent were also recorded. The study was conducted after ethical clearance obtained from institutional ethics committee.

3. Results

Among the total 86 patients reviewed, 88.84% were males with the mean age of 58.7 years. Out of total, 87.21% of the patients received parenteral antibiotics. 98.83% received more than one antibiotic, either in oral or parenteral formulations.

The most commonly used generic antibiotics were cefoperazone – sulbactam (69.77%), levofloxacin (59.30%), cefuroxime (25.58%), cefoperazone (11.63%) and amoxicillin – clavulanic acid (43.02%).[Figure 1] While in admitted patients, beta lactam / beta lactamase inhibitors combination (98.83%), fluoroquinolones (69.77%), cephalosporins (34.88%), glycopeptides (3.49%) and carbapenem (2.33%) were used. [Figure 2] At the time of discharge, fluoroquinolones (43.02%), cephalosporins (32.56%) and beta lactam / beta lactamase inhibitors combination (39.53%) were prescribed. [Figure 3]

The indications for admission were Coronary artery bypass grafting (90.7%), Aortic valve replacement (5.81%), Mitral valve replacement (2.33%) and Dual valve replacement (1.16%). [Figure 4] The most common associated comorbidities were ischemic heart disease (73.26%), diabetes mellitus (47.67%), hypertension (56.98), chronic kidney disease (5.81%) and chronic obstructive pulmonary disease (3.49%). [Figure 5]

The mean duration of usage of parenteral drugs was 5.20 days whereas it was 5.14 days for the oral drugs.

4. Discussion

Cardiac surgery represents high operative and perioperative risk requiring professional staff and advanced equipment. Besides the diseases that require cardiac surgery, the perioperative period shows a variety of characteristic pathologies.[14] Amongst them, postoperative infection is a severe complication after cardiovascular surgery, which can significantly increase mortality and hospitalisation time.[15] Administration of surgical antimicrobial prophylaxis is an effective method to reduce the risk of infections.[16] Few studies indicated that taking antibiotics 30min before surgery and during the first 48 hours after surgery can effectively reduce the risk of infection.[17] Present study was a retrospective data collection only from the department of CVTS in a tertiary care hospital. Many point prevalence and cross sectional studies were published that highlights the antibiotic use in healthcare facility and in general public.[17–20]

It was observed that antibiotics were primarily used for surgical prophylaxis and treatment of infections which were generally hospital acquired. Out of total 86 patients reviewed, 87.21% of the patients received parenteral antibiotics. Similarly, Labi et al.[17] observed that significant proportion of patients receives parenteral antibiotics. Hence, it was concluded that parental route is preferred over other administration routes. It was noted in present study that 98.83% received more than one antibiotic, either in oral or parenteral formulations. Labi et al.[17] and Newman MJ et al.[21] also reported that majority of the patients received more than one antibiotics. However, requirement of more than one antibiotic should be considered based on patient's risk factors and probability of developing postoperative infections.

A beta-lactam antibiotic is indicated as a single antibiotic of choice for standard cardiac surgical prophylaxis. Based on availability and cost, it is reasonable to use cefazolin (a first-generation agent) as the cephalosporin for prophylaxis.[22] In present study, it was observed that most common antibiotics prescribed for the admitted patients were cefoperazone – sulbactam, levofloxacin, cefuroxime, cefoperazone and amoxicillin – clavulanic acid. Such usage of beta lactam / beta lactamase inhibitor along with fluoroquinolone should be an alarming signal.

To standardize the patient's management, it is very important to emphasize on documentation and written

protocols as per the surgeries. In present study, it was observed that well - documented written treatment protocol was absent. It must be emphasized that standard plan of care prevent chances of perioperative complications. Surgical site infections and particularly sternal and mediastinal infections have implications for significantly increasing both morbidity and mortality, as well as financial load on patients. The implementation of antimicrobial stewardship should be facilitated. Even at the time of discharge, an appropriate antibiotic should be prescribed for a shorter duration considering the patient's behaviour of stopping drugs after few doses and once they start feeling better.

Hence, the overuse and misuse of antibiotics should be avoided to prevent the development of antibiotic resistance. Limitation of the study was the sample size and short study duration that does not reflect the actual population and antibiotic prescription pattern in entire region. Moreover, a single center study conducted at a tertiary level hospital, may not accord with the data to other generalized hospitals.

5. Conclusion

There was an irrational use of cefoperazone – sulbactam and levofloxacin. It is strongly recommended that antimicrobial stewardship programme should be strengthen. There is a need for development of a drug formulary along with the written protocol driven prescription of antibiotics.

6. Source of Funding

None.

7. Conflict of Interest

None.

References

1. Clardy J, Fischbach MA, Currie CR. The natural history of antibiotics. *Curr Biol*. 2009;19(11):437–41. doi:10.1016/j.cub.2009.04.001.
2. Michael CA, Howes DD, Labbate M. The antimicrobial resistance crisis: causes, consequences, and management. *Front Public Health*. 2014;2:145. doi:10.3389/fpubh.2014.00145.
3. Office of Infectious Disease Antibiotic resistance threats in the United States; 2019. Available from: https://www.cdc.gov/drugresistance/biggest-threats.html.
4. Hecker MT, Aron DC, Patel NP, Lehmann MK, Donskey CJ. Unnecessary use of antimicrobials in hospitalised patients: current patterns of misuse with an emphasis on the antianaerobic spectrum of activity. *Arch Intern Med*. 2003;163(8):972–80. doi:10.1001/archinte.163.8.972.
5. WHO. Report on the burden of endemic health care associated infection worldwide, Geneva: World Health Organisation; 2011. Available from: https://apps.who.int/iris/handle/10665/80135.
6. Flanders SA, Saint S. Why does antimicrobial overuse in hospitalised patients persist? *JAMA Intern Med*. 2014;174(1):661–3.
7. Okeke IN, Laxminarayan R, Bhutta ZA, Duse AG, Jenkins P, O'brien. Antimicrobial resistance in developing countries. Part I: recent trends and current status. *Lancet Infect Dis*. 2005;5(8):481–93. doi:10.1016/S1473-3099(05)70189-4.
8. Holmes AH, Moore LS, Sundsfjord A, Steinbakk M, Regmi S, Karkey A. Understanding the mechanisms and drivers of antimicrobial resistance. *Lancet*. 2016;387(10014):176–87. doi:10.1016/S0140-6736(15)00473-0.
9. Lago JMV, Vazquez PL, Duran AL, Trunk MT, Figueiras A. Attitude of primary care physicians to the prescribing of antibiotics and antimicrobial resistance: a qualitative study from Spain. *Fam Pract*. 2012;29(3):352–60. doi:10.1093/fampra/cmr084.
10. Massart N, Mansour A, Ross JT. Mortality due to hospital-acquired infection after cardiac surgery. *J Thorac Cardiovasc Surg*. 2020;163(20):32486–93. doi:10.1016/j.jtcvs.2020.08.094.
11. Mazzeffi M, Gammie J, Taylor B. Healthcare-Associated infections in cardiac surgery patients with prolonged intensive care unit stay. *Ann Thorac Surg*. 2017;103(4):1165–70. doi:10.1016/j.athoracsur.2016.12.041.
12. Zhang HT, Han XK, Wang CS. Diagnosis of infection after cardiovascular surgery (DICS): a study protocol for developing and validating a prediction model in prospective observational study. *BMJ Open*. 2021;11(1):48310. doi:10.1136/bmjopen-2020-048310.
13. WHO. Antimicrobial Resistance Global Report on Surveillance. Geneva: World Health Organization; 2014. p. 1–101. Available from: https://apps.who.int/iris/handle/10665/112642.
14. Senst B, Kumar A, Diaz RR. Cardiac Surgery. *StatPearls*. 2021;Available from: https://www.ncbi.nlm.nih.gov/books/NBK532935/.
15. Jukic T, Ihan A, Stubljar D. Dynamics of inflammation biomarkers C-reactive protein, leukocytes, neutrophils, and CD64 on neutrophils before and after major surgical procedures to recognize potential postoperative infection. *Scand J Clin Lab Invest*. 2015;75(6):500–7. doi:10.3109/00365513.2015.1057759.
16. Bratzler DW, Dellinger EP, Olsen KM. Clinical practice guidelines for antimicrobial prophylaxis in surgery. *Am J Health Syst Pharm*. 2013;70(3):195–283. doi:10.2146/ajhp120568.
17. Torres SIB, Umscheid CA, Bratzler DW. Centers for disease control and prevention guideline for the prevention of surgical site infection. *JAMA Surg*. 2017;152(8):784–91. doi:10.1001/jamasurg.2017.0904.
18. Labi AK, Nkrumah NO, Nartey ET, Bjerrum S. Antibiotic use in a tertiary healthcare facility in Ghana : a point prevalence survey. *Antimicrob Resist Infect Control*. 2018;7:15. doi:10.1186/s13756-018-0299-z.
19. Voidăzan S, Moldovan G, Moldovan H. Knowledge, Attitudes And Practices Regarding The Use Of Antibiotics. Study On The General Population Of Mureş County. *Infect Drug Resist*. 2019;12:3385–96. doi:10.2147/IDR.S214574.
20. Alemkere G, Tenna A, Engidawork E. Antibiotic use practice and predictors of hospital outcome among patients with systemic bacterial infection: Identifying targets for antibiotic and health care resource stewardship. *PLoS ONE*. 2019;14(2):212661. doi:10.1371/journal.pone.0212661.
21. Newman MJ. Nosocomial and community acquired infections in Korle Bu teaching hospital. *West Afr J Med*. 2009;28(5):300–3. doi:10.4314/wajm.v28i5.55005.
22. Engelman R, Shahian D, Shemin R. The Society of Thoracic Surgeons practice guideline series: Antibiotic prophylaxis in cardiac surgery, part II: Antibiotic choice. *Ann Thorac Surg*. 2007;83(4):1569–76. doi:10.1016/j.athoracsur.2006.09.046.

Author biography

Swapnil Gautam, Consultant General Medicine

Dhaval Dalal, Head, Department of General Medicine

Suraj Purusottaman, Consultant General Medicine & Intensivist

Kinjal Patel, Consultant Microbiologist

Madhuri Mahadik, ICU Registrar