

ANTIBIOTIC UTILIZATION AND PROPHYLAXIS STUDIES IN PEDIATRIC CARDIAC SURGERY IN A RURAL TERTIARY CARE HOSPITAL IN INDIA**Sohilkhan Riyazkhan Pathan^{1*} and Dr. Amit Kumar²**¹Shivam Pharmaceutical Studies and Research Centre, Gujarat Technological University, Gujarat, India.²Bhanubhai and Madhuben Patel Cardiac Center, Shree Krishna Hospital, Karamsad, Anand, India.***Corresponding Author: Sohilkhan Riyazkhan Pathan**

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ABSTRACT

The present study was conducted to assess the antibiotic utilization and prophylaxis pattern in patients of pediatric cardiac surgery. An observational retrospective study was conducted on 100 pediatric patients who had undergone cardiac surgery in 2017-18. All the data of the patients was received from the medical record department of the Shree Krishna hospital, a tertiary care hospital in rural area, in the state of Gujarat, India. After collecting all the data Descriptive statistic were used to depict profile of study participant and pattern of antibiotic usage. The use of antibiotic prophylaxis in pediatric cardiac surgery in the study group was 100%. In our study we found that 30% patients were started antibiotic before the day of surgery. Out of these patients 30% patients did not need antibiotics as per the institute protocol. Out of 100 patients 87% patients got first line drug as hospitals policy for prophylaxis (cefoperazone and sulbactam + Amikacin), 9% patients got drug piperacillin/tazobactam + Amikacin as they were septic. On base of clinical record and pre-operative investigations 22% patients were given these drugs irrationally. Another 4% patients got piperacillin/tazobactam + teicoplanin. In the last group one had received the higher antibiotics irrationally. Only 27% patients have had an appropriate duration of prophylaxis use. On further evaluation it was found that 40% patients received prophylaxis for more than 48 hours inappropriately. It implies that prolonged use of antibiotics was highly prevalent in our study group. Of the 100 patients, 45 patients were prescribed antibiotics at hospital discharge, again a high number. Out of these 45 patients, 73% patients had given Antibiotics rationally and 27% patients had given antibiotics irrationally. This study gives an important insight of antibiotics misuse in Pediatric cardiac surgical patients and more stringent measures are required to limit & curtail excessive use of antibiotics.

KEYWORDS: Antibiotic Prophylaxis, Pediatric Cardiac Surgery.**INTRODUCTION**

Antimicrobial prophylaxis, a very brief course of antibiotics initiated just before the start of surgical procedures is recommended to reduce postoperative infection.^[1] As a clean procedure, pediatric cardiac surgeries should have a lower risk for infection; however, given the severity of illness and prolonged stays ICU, infections remain an ongoing challenge. Antimicrobial prophylaxis in pediatric cardiac surgery takes numerous forms. Regimens vary greatly, from single-dose prophylaxis to continuing antibiotics until all chest tubes and central venous catheters have been removed.^[2] Antimicrobial prophylaxis vary usually in cardiac surgery from 24 hours to 48 hours antimicrobial prophylaxis. Antibiotic use in the perioperative period are well established adjuncts to reducing the incidence of infection^[2], however, the nature, timing, and duration of administration remain undetermined. Further, in the context of increasing attention to antimicrobial resistance predicated upon the overuse of antibiotics, addressing this issue is timely. pediatrics populations being

vulnerable to the majority of the illnesses, and the adverse effect of irrational use of antimicrobials being more serious among children than adults. If antibiotics used inappropriately, it leads to the emergence and worrying national and global trends of antimicrobial resistance. According to the WHO, the rational medicine use included the appropriate use of medicine, in the proper dose, for an adequate period of time, and at the lowest cost to the individuals and their community.^[3]

MATERIALS AND METHODS**Study Design**

This was an observational, retrospective based study conducted at Bhanubhai and Madhuben Patel Cardiac Center, Shree Krishna Hospital, Karamsad, a teaching hospital located in rural India. The study was conducted after getting approval from Institutional Ethics committee (IEC).

Study Population

Inclusion Criteria: Paediatric Patients (up to 14 years) who had undergone cardiac surgery at cardiac department of shree krishna hospital operated between January 2017 to February 2018.

Exclusion Criteria: Patients age more than 14 years.

Hospitals policy for antibiotic prophylaxis in pediatric cardiac surgery: Cefoperazone and sulbactam + Amikacin (intravenous route) should be started within 60 minutes before the start of surgery and Antibiotics should be continued after surgery for 48 hours only.

Procedure of the Study

It was a retrospective observational study so in our study informed consent was waived off by the ethics committee. An observational retrospective study was conducted on one hundred pediatric patients (<14 years) who had undergone cardiac surgery during January 2017

to February 2018. All the data of the patients was received from the medical record department of the hospital. Case report form was prepared in English. All the data that was received were filled in all the case report forms. Patients case report forms consisting of demography, surgery details, antibiotic details, hematology and infection details. Evaluation of the data of antibiotic utilization was done using standard treatment guidelines such as Indian council of medical research (ICMR) guidelines. Rationality of the antibiotic use was determined by clinical & laboratory criteria justifying deviation from prophylaxis protocol.

RESULTS AND DISCUSSION

Demographic & surgical characteristics of the study group were depicted in Table 1.8 patients were in the age group of <30 days (Neonates), 44 patients were in the age group of 30 days-1 year (infants), 30 patients were in the age group of 1 year-5 years while 18 patients were in the age group of 5 years-14 years (pediatrics).

Table. 1. Demographic and surgical characteristics.

Characteristics	Mean	SD	Median	Minimum	Maximum
Age (year)	2.39	3.29	0.9	1 (day)	14 (year)
Weight (kg)	8.14	5.72	5.93	1	28
Height (cm)	78.02	25.34	70	43	144
RACHS	1.85	0.74	2	1	4
Surgery duration (minute)	89.43	39.69	83	28	230
Duration of intubation (hours)	40.62	51.07	24	1	336
Pre-operative length of stay (days)	1.93	3.10	1	0	28
Total no. of hospital stay (days)	9.58	5.61	8	3	35
Length of ICU stay (days)	3.91	4.46	2	0	26

Table. 2. Gender wise distribution.

Gender	N=100
Male	55
Female	45

Out of 100 Patients weight of 58 patients was more than 5 kg and 36 patients were in the middle of 2.5 to 5 kg while only 6 patients weight was less than 2.5 kg.

In our study group, 30% patients were started on antibiotic preoperatively before the day of surgery. Out of these patients 30% patients did not have justification for antibiotics as per the institute protocol (Table 3). There was a total 10 different types of antibiotics utilized in patients before the day of surgery. Pattern of antibiotics used prior to surgery is depicted in table 3.

Table. 3. Preoperative Antibiotics.

Name of Antibiotics	n=100	Rational Antibiotic n(%)	Irrational Antibiotic n (%)
Cefoperazone and sulbactam+Amikacin	22	13 (59.09)	9 (40.9)
Piperacillin/Tazobactam + Amikacin	2	2 (100)	
Ciprofloxacin	1		1 (100)
Cefixime	1	1 (100)	
Amoxicillin clavulanate	1	1 (100)	
Meropenem	1	1 (100)	
Vancomycin and Levofloxacin	1	1 (100)	
Azithromycin	1	1 (100)	
Total Antibiotic used	54	35 (64.1)	19 (35.1)

All patients received antibiotics intra-operatively. The most common Antibiotic prophylaxis were Cefoperazone and sulbactam + Amikacin - 87 %, next was Piperacillin/tazobactam + Amikacin - 9% while Piperacillin/tazobactam + Teicoplanin - 4%, respectively (Table 4). Deviation from institute protocol was done in 13% of cases because of suspected or proven ongoing sepsis. However, on evaluating the medical records, 23% did not need alternate antibiotics. Probably they were clinically sick but not had bacterial infection.

Table 4. Parameters of Antibiotic Prophylaxis In pediatric cardiac surgery.

Parameters	Number (N=100)	Percentage (%)	Rational (%)	Irrational (%)
Choice of Antibiotic Prophylaxis				
Cefoperazone and sulbactam + Amikacin	87	87	87 (100)	
Piperacillin/tazobactam + Amikacin	9	9	7 (77.7)	2 (22.2)
Piperacillin/tazobactam + Teicoplanin	4	4	3 (75)	1 (25)

Only 27 patients received prophylaxis antibiotics for < 48 hours (table 5). 27 patients had sepsis justifying change/prolonged use of antibiotics. 6 had infection at surgical wound. No patients had mediastinitis or UTI (table 6).

Table 5. Duration of antibiotic prophylaxis (in hours).

Duration	N=100	%
Prophylaxis (≤48 hours)	27	27
Prolonged prophylaxis (>48 hours)	73	73

Table 6. Prolonged antibiotic used in sepsis, surgical site infection and no infection.

Duration	n=73	Percentage (%)	Rational n (%)	Irrational n (%)
Sepsis	27	37	27 (37)	
Surgical site infection	6	8.2	6 (8.2)	
Prolonged prophylaxis with no sepsis (>48 hours)	40	54.7		40 (54.7)

73 patients received prolonged antibiotics prophylaxis (>48 hours). While, 40 patients with no infection were on the prolonged antibiotic prophylaxis. These 40 patients (40% of study group) had irrational reason for prolong need, as per institute protocol.

Table 7 shows high use of fluoroquinolones (20% patients) which should be avoided or used as last resort in pediatric patients.^[4] Higher antibiotics were utilized postoperatively were Meropenem in 19 patients, Vancomycin in 2 patients, Colistin in 10 patients and Teicoplanin in 8 patients. These were given after culture report or on clinical suspicion of sepsis by treating intensivist. Cultures were positive in 8 patients among which 6 were multi-drug resistant implying high proportion of multi-drug resistant variants. There was 2 mortality in the study group, out of which one died because of septic shock with multi-organ dysfunction.

Table 7. Postoperative Antibiotics.

Name of Antibiotic	n=100	Rational Antibiotics (%)	Irrational Antibiotics (%)
Piperacillin/Tazobactam	5	3	2
Ciprofloxacin	20	17 (85)	3 (15)
Cefixime	19	18 (94.74)	1 (5.26)
Amoxicillin clavulanate	2	2 (100)	
Meropenem	21	21 (100)	
Vancomycin	2	2 (100)	
Azithromycin	1	1 (100)	
Colistin	10	10 (100)	
Teicoplanin	8	8 (100)	
Total Postoperative Antibiotic Used	88	82 (93.18)	6 (6.81)

Of the 100 patients, 45 patients were prescribed antibiotics at hospital discharge, again a high number (Table 8). Out of 45 patients, 73% patients had given Antibiotics rationally and 27% patients had given antibiotics irrationally. Here again, Fluoroquinolones was used in high proportion (23% of Discharged patients).^[4] One patient went discharge against medical advice to District Hospital and was advised to continue parenteral broad spectrum antibiotics.

Table. 8. Hospital Discharge of patients with Antibiotics.

Name of antibiotic	n=100	Rational of antibiotic (%)	Irrational of antibiotic (%)
Ciprofloxacin	23	15 (65.22)	8 (34.78)
Cefixime	17	14 (82.35)	3 (17.65)
Azithromycin	1	1 (100)	
Amoxicillin clavulanate	3	2 (66.67)	1 (33.33)
Meropenem Teicoplanin Colistin	1	1 (100)	
Total Antibiotic Prescribed at Hospital Discharge	45	33 (73.3)	12 (26.6)

Table. 9. Microorganisms isolated from patients blood culture.

Microorganism	n=8
Stenotrophomonas maltophilia	1
Enterococcus faecium (HLAR)	1
Klebsiella pneumonia	2
Acinetobacter baumani	1
Acinetobacter haemolyticus	1
Coagulase negative staphylococci	2

The results from this study demonstrated that the use of antibiotic prophylaxis in pediatric cardiac surgery in the study group was 100%.

Comparative analysis with other published studies showed widespread misuse of antibiotics. Apostolopoulou Eleni *et al.*^[5] evaluated 51 patients undergoing surgery operations. The use of antibiotic prophylaxis was misuse in 94% and overuse in 96%. In our study antibiotic prophylaxis was misuse in 40%.

Nairooz H. Al-Momany *et al.*^[6] evaluated adherence to antimicrobial prophylaxis guidelines. In 100% of patients the appropriate decision was made to use antimicrobial prophylaxis in concordance with guidelines; however only 1.7% of patients received the antibiotic of choice; 39.4% of patients received antimicrobial prophylaxis for a total duration of 48 hours or less inconcordance with guidelines, and for 58.9% of patients, duration was longer than recommended; 99.1% of patients received antimicrobial prophylaxis dose within 60 minutes prior to skin incision as recommended by guidelines, but 97.0% of patients received an unnecessary midnight dose of intravenous antibiotic the night before surgery Harbarth *et al.*^[7] compared 1502 patients having short periods of prophylaxis with 1139 patients receiving prophylaxis for more than 48 hours. They concluded that the maximum clinical benefit of prophylaxis is realized by 48 hours, with administration for more than 48 hours being ineffective in further reducing infection. In our study we found that only 27% patients have had an appropriate duration of prophylaxis use and 40% patients received prophylaxis for more than 48 hours inappropriately.

Following a systematic review of the literature by a Committee on Evidence based Medicine, the Society of Thoracic Surgeons currently recommends that antibiotic

prophylaxis should not be continued for more than 48 hours postoperatively.^[8]

In our study group we found that 100% patients had given antibiotic prophylaxis in concordance with institution protocol. Furthermore 27% of patients received antibiotic prophylaxis for a total duration of 48 hours in concordance with institution protocol, and for 73% of patients duration was longer than recommended, out of which 40% patients received prophylaxis for more than 48 hours inappropriately. In our study all the patients received an appropriate dose and appropriate timing before 60 minutes prior to skin incision. Moreover 30% patients were started antibiotic before the day of surgery. Out of these patients 30% patients received unnecessary antibiotics before the day of surgery.

Only 87% patients got first line drug as hospitals policy for prophylaxis. Others were given other broad spectrum antibiotics.

In our study group, 3 patients had surgery CPB (cardiopulmonary bypass) time more than 3 hours and 2 patients had surgery CPB time more than 2.5 hours so that they needed redosing of antibiotic prophylaxis during surgery but they were not given redosing prophylaxis.

In our study group, all the patients received appropriate dose of their antibiotics as per weight & creatinine clearance. All received antibiotic prophylaxis dose within 60 minutes prior to skin incision as recommended by institution guideline.

45% of patients were prescribed antibiotics at hospital discharge which is again a high number. Out of these 27% had no justification for continuation of antibiotics on discharge. Use of Fluoroquinolones on discharge is not justified in pediatric patients.^[4]

Similar finding of inadequate adherence to antibiotics prophylaxis for surgery (other than pediatric cardiac surgery) has been reported from India. We could not find any published Indian study regarding adherence of antibiotics prophylaxis protocol for pediatric cardiac surgery.

As it is a retrospective study some data discrepancy cannot be ruled out because the study was done from

hospital records (electronic and manual records). It is a retrospective single center study, so we cannot comment on the antibiotic use pattern before or after the study period. Neither can it be generalized to other health centers. Cost implication due to irrational use was not part of the study. This is a study of one year period. Longer duration of study will determine the actual utilization of antibiotics.

CONCLUSION

In this study group antibiotic prophylaxis was used in all cases. However there was significant misuse and overuse of antibiotics in pediatric cardiac surgery. This has been highlighted in various studies abroad but none has been published from India. This study highlight need of more stringent implementation of antibiotics prophylaxis protocol in pediatric cardiac surgery. Auditing & constant reinforcement is required to preserve the sensitivity of Antibiotics.

REFERENCES

1. Ai Ling Oh, Leh Min Goh, Nik Abdullah NikAzim, et al. Antibiotic usage in surgical prophylaxis: a prospective surveillance of surgical wards at a tertiary hospital in Malaysia. *J Infect Dev Ctries*, 2014; 8(2): 193-201.
2. Alphonso N, Anagnostopoulos PV, Scarpace S, et al. Perioperative antibiotic prophylaxis in paediatric cardiac surgery. *Cardiol Young*, 2007; 17: 12–25.
3. Hafte Kahsay Kebede, Hailay Abrha Gesesew, Tewodros Eyob Woldehaimanot, Kabaye Kumela Goro. Antimicrobial use in paediatric patients in a teaching hospital in Ethiopia. March 6, 2017.
4. Bradley JS, Jackson MA committee on infectious diseases. American Academy of pediatrics. The use of systemic and topical fluoroquinolones. *Pediatrics*, 2011; 128: e1034-45.
5. Apostolopoulou Eleni¹, Zikos Dimitrios², Georgoudi Aikaterini³ et al. The Impact of Irrational Perioperative Antibiotic Prophylaxis on the Nursing Workload. *Health Science Journal*, 2015; 9(1:4).
6. Nairooz H. Al-Momany, MSc; Amal G. Al-Bakri, PhD; Zeid M. Makahleh et al. Adherence to International Antimicrobial Prophylaxis Guidelines in Cardiac Surgery: A Jordanian Study Demonstrates Need for Quality Improvement. *J Manag Care Pharm*, 2009; 15(3): 262-71.
7. Harbarth S, Samore MH, Lichtenberg D, Carmeli Y. Prolonged antibiotic prophylaxis after cardiovascular surgery and its effect on surgical site infections and antimicrobial resistance. *Circulation*, 2000; 101: 2916–2921.
8. Society of Thoracic Surgeons Workforce on Evidence Based Surgery. Antibiotic Prophylaxis in Cardiac Surgery, Duration of Prophylaxis. 2005. Online. Ref Type: Report.
9. Lipika Parulekar . Rajeev Soman . Tanu Singhal, et al. How good is compliance with surgical antibiotic prophylaxis guidelines in a tertiary care private hospital in India? A prospective study. *Indian J Surg.*, January–February, 2009; 71: 15-18.
10. Rupinder Kaur, Mohd T. Salman, Narendra K. Gupta, Uma Gupta, Ali Ahmad, Vinod K. Verma Presurgical Antibiotic Prophylaxis Pattern In An Indian Tertiary Care Teaching Hospital *Jk Science*, April - June 2015; 17(2).