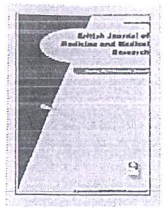
PUB-03/2015



British Journal of Medicine & Medical Research
5(10): 1213-1219, 2015, Article no.BJMMR.2015.137
ISSN: 2231-0614

SCIENCEDOMAIN *international*
www.sciencedomain.org

Prescribing Pattern of Antimicrobials in Patients during Post-Operative Period – An Observational Study

R. Revathi[1], N. Sarala[1*] and A. Bhaskaran[2]

[1]Department of Pharmacology, Sri Devaraj Urs Medical College, Sri Devaraj Urs Academy of Higher Education and Research, Tamaka, Kolar, Karnataka, India.
[2]Department of Surgery, Sri Devaraj Urs Medical College, Sri Devaraj Urs Academy of Higher Education and Research, Tamaka, Kolar, Karnataka, India.

Authors' contributions

This work was carried out in collaboration between all authors. This work was carried out in collaboration between all authors. Author RR performed review of literature, data collection, compiling, analysis and wrote the first draft of the manuscript. Author NS designed the study, wrote the protocol and edited the manuscript. Author AB was responsible for recruitment of patients and data collection. All authors read and approved the final manuscript. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/BJMMR/2015/11259
Editor(s):
(1) Anonymous.
Reviewers:
(1) Boulyana M., Paediatrics, Lille University, France.
(2) Eckart Haneke, Inselspital, University of Bern, Switzerland.
(3) Vijay Kumar, R. D. Dental Hospital & Research Centre, India.
(4) Anonymous, Gulu University, Uganda.
(5) Anonymous, Taif University, Saudi Arabia.
(6) Asrat Agalu Abejew, Department of pharmacy , Wollo University, Ethiopia.
Complete Peer review History: http://www.sciencedomain.org/review-history.php?iid=717&id=12&aid=6729

Original Research Article

Received 6th May 2014
Accepted 5th July 2014
Published 30th October 2014

ABSTRACT

Background: Understanding prescribing pattern of antimicrobials in postoperative period will provide data pertaining to efficacy of prophylaxis during post surgical period and economic burden faced by patients. This data will help local authorities formulate practical guidelines to ensure their rational prescription. Our aim was to evaluate the type and dosage schedule of antimicrobials used in post-operative patients and to estimate the cost of antimicrobials in these patients.
Materials and Methods: This is a prospective observational study conducted by the Department of

**Corresponding author: Email: n_sarala@rediffmail.com;*

Pharmacology at R.L. Jalappa Hospital and Research Centre attached to Sri Devaraj Urs Medical College between April and September 2013. All patients above the age of 18 years undergoing surgical procedures in the departments of Orthopedics, Surgery and ENT and hospitalised were included.

Results: There were 500 patients, 351 males and 149 females. The mean age and duration of stay was 43.15±16.8 years and 6.7±3.1 days respectively. Types of surgeries were, fracture fixation (31.8%), head and neck (18.2%), soft tissue - extremities (18.0%), abdominal (9.4%) and others (22.6%). All patients received antimicrobials prophylactically. 72% of the patients received antimicrobials for more than 24 hours. Commonly prescribed antimicrobials were cephalosporins (54.6%) and aminoglycosides (22.3%). The daily defined dose (DDD) /1000 patient days) was highest for aminoglycoside - amikacin (296.96±63.5).

Conclusion: All patients received prophylactic antimicrobials and more than seventy percent were continued with the antimicrobials in the post operative period to prevent surgical site infection. However use of third generation cephalosporins was extensive, which may result in the development of resistance to these agents in the near future.

Keywords: Antimicrobials; post-operative patients; daily defined dose.

1. INTRODUCTION

Antimicrobials are currently the most widely used category of drugs [1]. In India, guidelines have been implemented for appropriate use of antimicrobials through national health programmes. In 2011 the National policy for containment of antimicrobial resistance was launched in India. It aims to formulate antimicrobial policy's, educate prescribers in the rational use of these drugs and to implement infection control guidelines. It is however still in a rudimentary state and their recommendations are yet to be widely implemented [2]. Moreover antimicrobial prescription is largely based on the needs of individual patient, taking into account the type of surgical procedure patient will be subjected to, clinical condition and the causative micro-organisms.

During the postoperative period the prevalence of infection is high in the South East Asian region and therefore antimicrobials are frequently used empirically [3]. Risk factors for the development of surgical site infections include increasing age, presence of comorbidities (patients with an ASA score of 3 or more), obesity, smoking, wound classification (clean, clean contaminated, contaminated, dirty) and duration and complexity of the surgical procedure [4-7].

There is evidence to suggest that antimicrobials are prescribed inappropriately in 50% of patients. Un-warranted antimicrobial use leads to the emergence of multi drug resistant organisms which in turn increases morbidity, mortality and health care costs [8]. The World Health Organization (WHO) has prioritized the rational use of medications [9].

Pattern of antimicrobial use in patients during the post-operative period is lacking in our hospital we aim to evaluate the same, as this data will play an important role in formulating practical guidelines for their rational use.

2. MATERIALS AND METHODS

This is a prospective observational study, carried out by the Department of Pharmacology at R.L. Jalappa Hospital and Research Centre attached to Sri Devaraj Urs Medical College at Kolar between April and September 2013. The study was conducted after taking approval from the Institutional Ethics Committee and obtaining informed consent from patients participating in the study.

Patients aged above 18 years, of either gender, undergoing surgical procedures and receiving in-patient care in the departments of Orthopedics, Surgery and ENT were included in the study. Patients undergoing cardiothoracic, ophthalmological, pediatrics, obstetric and gynecological surgeries, and those undergoing surgery on day care basis were excluded.

The demographic data, diagnosis, type of surgery, dosage schedule of the antimicrobials used, duration of stay and the cost of treatment were recorded as per predesigned pro forma. The demographic data are expressed as mean ± SD. Quantitative data are expressed as percentages. The DDD/1000 patient days was calculated in accordance with WHO

Collaborating Centre for Drug Statistics Methodology guidelines [10].

3. RESULTS

Data of 500 patients admitted to the surgical wards during the study period was recorded. Out of which 351 (70.2%) patients males and the remaining 149 (29.8%) were females. Majority of them were agriculturists (54%), manual labourers (26%) and others (20%) by occupation. Their mean age was 43.1±16.8 years. Types of surgeries were, fracture fixation (31.8%), surgeries of head and neck (18.2%), soft tissue - extremities (18.0%), abdominal (9.4%) and others (22.6%). The antimicrobial prescription was decided by the treating surgeon and was based on standard dosing regimens.All 500 patients included in the study received antimicrobials prophylactically. 138 (28%) of them received antimicrobials for 24 hours. 202 and 160 of 362 (72%) patients underwent emergency and elective surgical procedures respectively, (126/160 patients had diabetes mellitus), but all of them received antimicrobials even after 24 hours.

Antimicrobials used were cephalosporins, aminoglycosides, fluroquinolones, nitroimidazoles, cotrimoxazole as represented in Fig. 1. Those used for prophylaxis were cephalosporins and metronidazole, the agents varied according to the surgical procedure as depicted in Table 1. Overall, 69 (13.8%) patients received one agent (cefotaxime being the most common), 258 (51.6%) received two antimicrobials (cefotaxime and amikacin) and 136 (27.2%) received three antimicrobials (cefotaxime, amikacin and ofloxacin). Cost of treatment for patients receiving one, two or three antimicrobial agents in US dollars was 7.22, 20.85, 39.54 for duration of seven days (mean duration of hospitalization was 6.7±3.1 days). The DDD/1000 patient days for the most commonly prescribed antimicrobials is shown in Fig. 2 (highest-amikacin 296.96±63.5).

4. DISCUSSION

A total of 500 patients were studied over a period of 6 months, majority of them were male and all of them received antimicrobials. This is concordant with findings from other studies [11,12]. Surgical site infection leads to an increase in administration of antimicrobials, cost of treatment and prolongs hospitalization [13-15]. Antimicrobial prophylaxis plays an important role in preventing infection at the surgical site. All patients undergoing operative procedures received antimicrobial prophylaxis in our study. Although antimicrobial prophylaxis is not recommended for clean surgical procedures in patients without risk factors for development of infection during the post-operative period, high rates of nosocomial infection in developing countries warrants that due measures are taken to prevent the same [16,17]. 202 patients underwent emergency surgical procedures with high possibility of contamination and 160 (78% were diabetics) patients underwent major elective surgical procedures requiring antimicrobials to prevent post-operative infection.

Selection of antimicrobial agent is done taking into consideration the site of surgery, spectrum, pharmacokinetic profile. The guidelines for prophylaxis are based on the evidence obtained from controlled cilinical trials [18]. These guidelines encourage the utilization of older narrow spectrum antimicrobials. In this study cephalosporins (cefotaxime and ceftriaxone) have been commonly used for prophylaxis which were continued postoperatively as the patients responded to the treatment.

Studies show that first generation cephalosporins: cefazolin and the second generation cephalosporins: cefuroxime, cefamandole and cefoxitin are effective as prophylactic agents. However, third generation such as ceftriaxone, cefotaxime, cefoperazone and cefoxime are not recommended for surgical prophylaxis since their use not only favors the emergence of multi drug resistant organisms but also increases cost of therapy [19,20]. But earlier reports from our institute suggest that the organisms are resistant to first and second generation cephalosporins [21,22]. We observed the use of antimicrobials was according to standard dosing regimens.

In the present study cefotaxime was the most commonly prescribed antimicrobial agent followed by amikacin and ofloxacin. A study by Shankar et al. [23] found ceftriaxone, amoxicillin and metronidazole to be used commonly. Das et al found amoxicillin + clavulinic acid, ciprofloxacin and clarithromycin being prescribed with highest frequency [24]. It has been recommended that appropriate policies for first line and empiric antimicrobial treatment be followed for suspected bacterial infection in post-surgical wards based on local sensitivity pattern [25].

Table 1. Types of surgical procedures and dosage schedule of prophylactic antimicrobials

Surgical procedure	Prophylactic antimicrobial	Dose	Frequency (times/day)
Fracture Fixation			
1. Upper limb 2. Lower limb 3. Mandible 4. Nasal bone 5. Vertebral body	Open reduction and internal fixation with dynamic compression plate or intramedullary nail, K wire fixation	Cefotaxime Metronidazole	1g 400mg	2 3
Exicision – (major)			
1. Tumours of head and neck 2. Goiter	Radical neck dissection with thyroidectomy, wide excision with mandiblectomy, local wide excision with functional lymph node removal	Cefazolin Metronidazole	2g 400mg	2 3
3. Breast tumours	Modified radical mastectomy	Ceftriaxone Metronidazole	2g 400mg	2 3
4. Tumours in the abdomen	Lower radical gastrectomy			
5. Gall bladder	Cholecystectomy			
Exicision – (minor)				
1. Thyroglossal cyst	Cyst resection	Cefotaxime	1g	2
2. Adenoids	Adenoidectomy			
3. Tonsils	Tonsillectomy			
4. Nasal polyps	Polypectomy			
5. Lipoma 6. Sebaceous cyst 7. Wrist ganglion	Excision			
8. Fibroadenoma	Excision of fibroadenoma	Ceftriaxone Metronidazole	2g 400mg	2 3
9. Prostate	Transurethral resection of prostate			
10. Appendix	Appendectomy			
11. Haemorroids	Haemorroidectomy			
12. Diabetic Foot	Wound debridement Below and above knee amputation	Ceftriaxone Metronidazole	2g 400mg	2 3

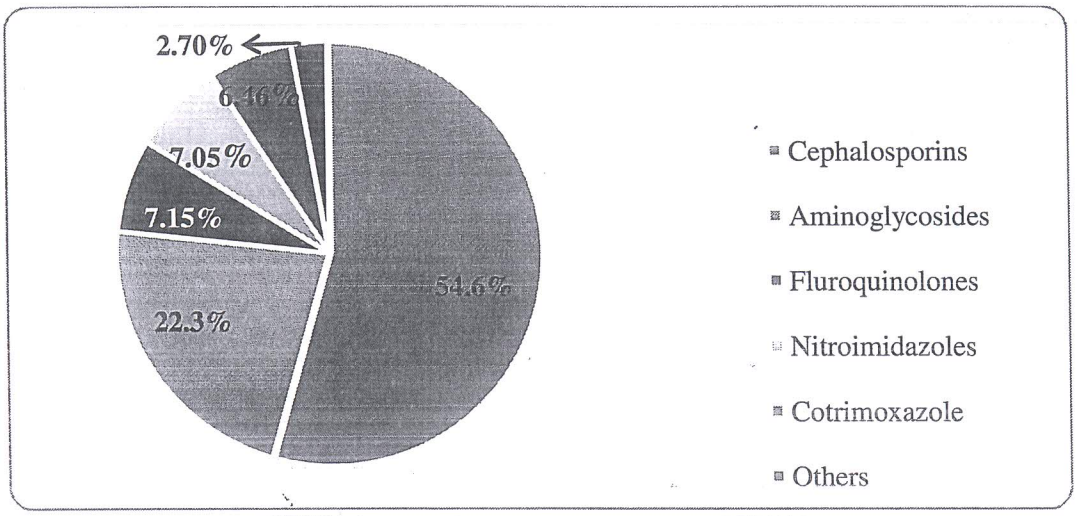


Fig. 1. Percentage of the different category of antimicrobial agents used

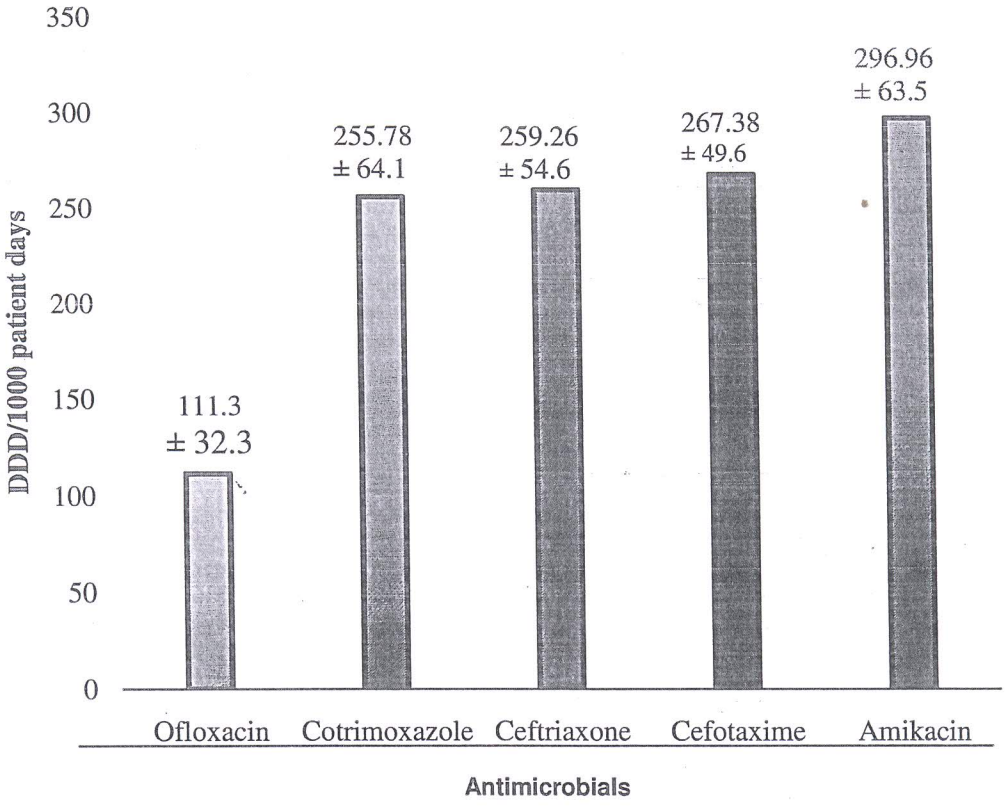


Fig. 2. Antimicrobials daily defined dose (DDD) per 1000 patient days

The average number of drugs prescribed is an important index to understand the utilization pattern of antimicrobial agents with varying spectrum of activity. It is recommended that the number of drugs per patient should be kept as low as possible to minimize the risk of drug interactions, development of bacterial resistance, and hospital costs [26]. Majority of patients in our

study received two antimicrobial agents. The most frequently used combination was cefotaxime and amikacin costing $ 20.85per patient per week. Shankar et al found this amount to be $ 32.5 per patient per week [23]. Cost containment is of vital importance in developing countries like India where the prevalence of infection is high and majority of the population belong to economically weaker sections of society.

The WHO- defines DDD as "the assumed average maintenance dose per day for a drug used for its main indication in adults". Expressing antimicrobial use as DDDs per 1000 patient-days facilitates the comparison of their use, irrespective of differences in formulation, composition and hospital census. In our study, amikacin was found to have the highest DDD/1000 patient days followed by cefotaxime and ceftriaxone. A study by Simpson et al established that ampicillin and ciprofloxacin had the maximum DDD/1000 patient days [27].

5. LIMITATIONS

Documentation of ASA scores would have enabled us to interpret our results in a better way. Only occupation of the patients has been documented and not the economic status. Focused evaluation of antimicrobial use in a particular surgical intervention would help us to generate data and evolve an antimicrobial policy.

6. CONCLUSION

All our patients received prophylactic antimicrobials and more than seventy percent were continued with the antimicrobials in the post operative period to prevent surgical site infection. However use of third generation cephalosporins was extensive, which may result in the development of resistance to these agents in the near future. The outcome of our study reveals that antimicrobials are being prescribed as per local sensitivity pattern. A situation may arise wherein choice of antimicrobials will be limited and cost of therapy may increase.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Wattal C, Joshi S, Sharma A, Prasad KJ, Oberoi JK. Prescription Auditing and Antibiotic Resistance Pattern at S.G.R.H., N. Delhi. Presentation at the XXVI National Congress of the IAMM, NIMHANS, Bangalore, 20th-22th Nov. 2002;776.
2. Ministry of Health & Family Welfare. National Policy for Containment of Antimicrobial Resistance – India; 2011. [Accessed on June 10, 2014]. Available:http://www.nicd.nic.in/ncdc_new/ab_policy.pdf.
3. Mandell GL, Douglas RG, Bonnett JE. In: Principles and Practice of Infectious Diseases. 2nd Ed. Wiley Medical Publications. Post-operative wound infections and prophylaxis; pp. 1985;1637–43.
4. Neumayer L, Hosokawa P, Itani K, El-Tamer M, Henderson WG, Khuri SF. Multivariable predictors of postoperative surgical site infection after general and vascular surgery: Results from the patient safety in surgery study. Journal of the American College of Surgeons. 2007;204(6):1178–87.
5. Scott JD, Forrest A, Feurstein S, Fitzpatrick P, Schentag JJ. Factors associated with postoperative infection. Infection Control and Hospital Epidemiology. 2001;22(6):847–51.
6. Cruse PJ, Foord R. A five-year prospective study of 23,649 surgical wounds. Archives of Surgery. 1973;107(2):206–10.
7. Kaye KS, Schmit K, Pieper C, Sloane R, Caughlan KF, Sexton DJ, et al. The effect of increasing age on the risk of surgical site infection. Journal of Infectious Diseases. 2005;191(7):1056–62.
8. Niederman MS. Appropriate use of antimicrobial agents: Challenges and strategies for improvement. Crit Care Med. 2003;31(2):608-16.
9. Laura Guimaraes Fonseca and Lucieni de Oliveira Conterno. Audit of antibiotic use in a Brazilian university hospital. The Brazilian Journal of Infectious diseases. 2004;8(4):272-80.
10. WHO Collaborating Centre for Drug Statistics Methodology. Guidelines for ATC classification and DDD assignment; 2010. Accessed on June 10th 2014. Available:http://www.whocc.no/atc/lists_of_new_atc_ddds_and_altera/alterations_in_atc_ddd/.
11. Kuster SP, Ruef C, Ledergerber B, Hintermann A, Deplazes C, Neuber L, et al. Quantitative antibiotic use in hospitals: Comparison of measurements,

literature review, and recommendations for a standard of reporting. Infection. 2008;36(6):549–59.
12. Horan TC, White JW, Jarvis WR, Emori TG, Culver DH, Munn VP, et al. Nosocomial infection surveil- lance. (MMWR) Morb Mortal Wkly Rep 1984;35(SS-I):17SS-29SS.
13. Haley RW, Culver DH, White JW, Morgan WM, Emori TG. The nationwide nosocomial infection rate: A new need for vital statistics. Am J Epidemiol. 1985;121(2):159-67.
14. Horan TC, Culver DH, Gaynes RP. Jarvis WR, Edwards JR, Reid CR. Nosocomial infections in surgical patients in the United States. Infect Control Hosp Epidemiol. 1993;14(2):73- 80.
15. Ahmed MI. Prevalence of nosocomial wound infection among postoperative patients and antibiotics patterns at teaching hospital in Sudan. North Am J Med Sci. 2012;4(1):29-34.
16. Allegranzi B, BagheriNejad S, Combescure C, Graafmans W, Attar H, Donaldson L, et al. Burden of endemic health-care-associated infection in developing countries: systematic review and meta-analysis. The Lancet. 2011;377(9761):228-241.
17. Pittet D, Allegranzi B, Storr J, BagheriNejad S, Dziekan G, Leotsakos A, et al. Infection control as a major World Health Organization priority for developing countries. Journal of Hospital Infection. 2008;68(4):285-292.
18. Bratzler DW, Dellinger EP, Olsen KM, Perl TM, Auwaerter PG, Bolon MK et al. Clinical practice guidelines for antimicrobial prophylaxis in surgery. Am J Health Syst Pharm. 2013;70(3):195-283.
19. Geroulanos S, Marathias K, Kriaras J, Kadas B. Cephalosporins in Surgical Prophylaxis. J Chemother. 2001;131(1):23-6.
20. Hecker MT, Aron DC, Patel NP, Lehmann MK, Donskey CJ. Antianaerobic Spectrum of Activity. Arch Intern Med. 2003;163(8):972-8.
21. Heethal J, Sarala N, Kumar TN, Hemalatha M. Pattern of antimicrobial use in caesarean section in a tertiary care hospital in rural south India. Int J Pharm Biomed Res. 2010;1(2):57-61.
22. Girish MB, Kumar TN, Srinivas R. Pattern of antimicrobials used to treat infected diabetic foot in a tertiary care hospital in Kolar. Int J Pharm Biomed Res. 2010;1(2):48-52.
23. Shankar RP, Partha P, Shenoy NK, Easow JM, Brahmadathan KN. Prescribing patterns of antibiotics and sensitivity patterns of common microorganisms in the Internal Medicine ward of a teaching hospital in Western Nepal: A prospective study. Ann Clin Microbiol Antimicrob. 2003;2:7-11.
24. Das BP, Sethi A, Rauniar GP, Sharma SK. Antimicrobial utilization pattern in outpatient services of ENT department of tertiary care hospital of Eastern Nepal. Kathmandu Univ Med J. 2005;3(4):370-5.
25. Dellit TH, Owens RC, McGowan JE Jr, Gerding DN, Weinstein RA, Burke JP et al. 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. 2007;1544(2):159-77 .
26. Stratton CW 4th, Ratner H, Johnston PE, Schaffner W. Focused microbiological surveillance by specific hospital unit: Practical application and clinical utility. Clin Ther. Suppl A: 1993;15:12–20.
27. Simpson GB, Das GD. Indian hospital drug use study shows need to improve prescribing. Essential Drugs Monitor. 2003;32:23.

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sciencedomain.org/review-history.php?iid=717&id=12&aid=6729