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Original Research Article

Assessment of rational use of antibiotics in surgical prophylaxis and post- operative cases at district hospital Gulbarga

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ABSTRACT

Background: Postoperative wound infections are the major cause of morbidity in surgical patients. The use of pre and peri-operative antibiotics, with sound and appropriate principles of prophylaxis are applied can result in a reduced risk of postoperative infection. Although the principles of antimicrobial prophylaxis for surgical procedures have been well defined for many years, inappropriate and excessive use of antimicrobials for this purpose remains widespread.
Methods: This was a prospective study conducted on the inpatients undergoing surgical procedures. ASHP (American Society of Health System Pharmacists) and SIGN (Scottish Intercollegiate Guidelines Network) guidelines were used as the standard guideline.
Results: Of the total 150 procedures reviewed, 130 procedures were entered in the analysis. Of these procedures, the rate of totally compliant prescriptions was 28.46%. Totally in 93 (71.53%) patients, the antibiotic prophylaxis was found to be inappropriate. In 36 (27.70%) patients, indication for antibiotic prophylaxis was not proper and in total 38 (44.19%) patients, where antibiotic prophylaxis was justified and given, proper antimicrobial agent was not used.
Conclusions: Instead of existence of the written guidelines for antimicrobial surgical prophylaxis there are significant deviations from the recommendations in current clinical practice. Adherence of antibiotic prophylaxis to these guidelines is needed to be evaluated routinely in clinical practice.

Keywords: Antibiotic prophylaxis, Nosocomial infections, Surgical site infections

INTRODUCTION

Infection is defined as an invasion of the tissue by pathogenic microorganism. A pathogenic organism is one that can establish itself in a host tissue, multiply and result in tissue damage usually due to release of toxic substances.[1] Surgical site infections are the second most common cause of nosocomial infections. Up to 2% - 5% patients undergoing clean extra-abdominal operations and up to 20% undergoing intra-abdominal operations will develop an SSI.[2,3] The rate of infection vary according to the procedures, less than 3 infections per 100 for clean procedures; up to 4 per 100 for clean contaminated procedures and up to 9 per 100 for grossly contaminated procedures. Advances in infection control have been spectacular but infection is still the major limitation of surgical horizon.

Administration of prophylactic antibiotics in certain surgical procedures can decrease post-operative infections, decrease the length of hospital stay and reduce the overall cost of care. The use of pre and peri-operative antibiotics has become an essential component of the standard of care in virtually all surgical procedures and has resulted in a reduced risk of post-operative infection when sound and appropriate principles of prophylaxis are applied. But inappropriate and excessive use of antibiotics for this purpose leads to increase in hospital costs, ineffectiveness and/or a decline in susceptibility of bacteria. Therefore, an important quality measure of surgical care is the assessment of appropriate antibiotic policy.

METHODS

The prospective study was carried out in the District hospital Gulbarga, Karnataka, India, a tertiary health care hospital. The patients posted for general surgical procedures were followed from the time of admission to the time of surgery and from the end of surgery to the time of discharge. All the information regarding the patients admission status were noted and the history was collected from the patient's progress record, treatment chart and patient's history records. The demographic data collected includes the patient's age, sex and weight.

The past medical and medication history data collected includes the patient's previous allergies, co-morbidities and the drugs received previously. All the data regarding the surgery status, kind of surgery, timing of surgery, administration of antibiotic, choice of antibiotic, timing of antibiotic administration and administration with frequency and the dose of antibiotic administered were gathered from the treatment chart, anaesthesia record, operation record and preoperative checklist. Patient was then followed for the rest of the period of hospital stay, for their present condition and wound status after the surgery. For each surgery a specific classification to the surgical wound was assigned using a standard classification system described in ASHP or SIGN guidelines. And on the basis of the category of wound the practice of antimicrobial prophylaxis was assessed.

RESULTS

A total of 150 patients, undergoing surgical procedure, were reviewed during the study. 20 patients who underwent minor surgeries and with preexisting abscess or pus were excluded from the study. Out of 130 patients included for the study, 78 were males and 52 number of patients were females. Patient of all age groups were included in the study. With the highest number of 52 (40%) patients from the 41-60 years age group and only 1 (0.76%) patient from 80-100 year age group (Table 1).

Table 1: Demographic characteristics of the patients.

Age	No of cases	Percentage
0 - 20	19	14.6
21 - 40	42	32.30
41 - 60	52	40.00
61 - 80	16	12.30
81 - 100	1	00.76
Total	**130**	**100**

Total 130 surgical procedures were included during study were distributed in various surgical specialities, 31 (23.84%) Hernia repair, 22 (16.92%) urologic surgery, 35(26.92%) appendectomy, 12 (9.23%) gastroduodenal and biliary tract surgery, 8 (6.15%) breast surgery, 9 (6.92%) head and neck surgery, 6 (4.61%) colorectal surgery and 7 (5.38%) vascular surgery.(Table-2)

Table 2: Distribution of cases in various surgical specialities.

Type of surgery	No. of cases	Percentage
Hernia repair	31	23.84
Appendectomy	35	26.92
Urologic surgery	22	16.92
Gastroduodenal and biliary tract surgery, 8 (6.15%)	12	9.23
Breast surgery, 9 (6.92%)	8	6.15
Head and neck surgery, 6 (4.61%)	9	6.92
Colorectal surgery	6	4.61
Vascular surgery	7	5.38

Table 3: Timing of antibiotics.

Timing of antibiotics	No .of patients	No. of infections	Percentage
antibiotic prophylaxis within 2 hours prior to surgery	33	0	0
antibiotic prophyalxis more than 2 hrs before surgery	40	21	52.50
did not received preoperative prophylactic dose	29	13	44.82
received antibiotic prophylaxis intraoperatively	13	4	30.76

Initial data analysis revealed that, out of 130 total surgical procedures, in 115 patients antibiotic prophylaxis was justified. While only 86 (74.78%) patients received the preoperative antibiotic prophylaxis and 29 (25.21%) patients did not received any preoperative antibiotic prophylaxis. In 15 patients antibiotic prophylaxis was not justified in spite of, 7 (46.67%) patients got the preoperative antibiotic prophylaxis and 8 (53.33%) patients did not. Among 130 patients in our study 38 (29.23%) surgical wound infections were detected. None of the patients of 33 patients, who received antibiotic prophylaxis within 2 hours prior to surgery, developed surgical wound infections. Among the 40 patients who received the antibiotic prophyalxis more than 2 hours before surgery, surgical wound infection developed in 21 (52.50%) of patients. Among the 29 patients who did not received preoperative prophylactic dose, in 13 (44.82%) patients surgical wound infection was developed. Patients who received antibiotic prophylaxis intraoperatively, surgical wound infection were developed in 4 (30.76%) patients out of 13 patients.

DISCUSSION

Antibiotics are the most commonly prescribed drugs in Indian hospitals, and approximately one-third of prescriptions are for antimicrobial prophyalxis. As a result, appropriate prophylaxis should be viewed as an important issue. But the inappropriate and excessive use of antibiotics for surgical prophylaxis is a worldwide problem. One study found that the cost of inappropriate antibiotic prophylaxis is approximately 10 times higher than the values expected. Thus a cost effective preoperative antibiotic prophylaxis protocol is needed.[4]

About 5 percent of all patients who have undergone surgery have postoperative wound infection. Factors that have a proven or probable influence on the frequency of wound infections are the use of antibiotic prophylaxis; the duration of surgery; the defence mechanisms of the host; the use of ultraclean air in the operating room; the patient’s temperature in the operating room; the use of supplemental oxygen; diabetes mellitus; the use of blood transfusion etc.[5]

Classification of surgical wounds[6,7,8]

The National Research Council developed a standard classification of surgical wounds in 1964. This classification identified four basic categories of wound contamination and the resultant postoperative infection rate that is expected within each category.

Clean (2%) elective (not urgent or emergency), primarily closed; no acute inflammation or transection of gastrointestinal, oropharyngeal, genitourinary, biliary, or tracheobronchial tracts; no technique break (e.g., elective inguinal herniorrhaphy).

Clean-contaminated (<10%) urgent or emergency case that is otherwise clean; elective, controlled opening of gastrointestinal, oropharyngeal, biliary, or trcheobronchial tracts, minimal spillage and/or minor technique break, reoperation via clean incision within 7 days; blunt trauma, intact skin, negative exploration (e.g., vagotomy and pyloroplasty).

Contaminate (20%) acute, nonpurulent inflammation; major technique break or major spill from hollow organ; penetrating trauma <4 hour old, chronic open wounds to be grafted or covered (e.g., acute, nonperforated, nongangrenous appendicitis).

Dirty (40%) purulence or abscess; preoperative perforation of gastrointestinal, oropharyngeal, biliary, or tracheobronchial tracts; penetrating trauma >4 hour old (e.g., perforated appendicitis with abscess).

Widespread use of current antibiotics has resulted in the emergence of many multi-resitant bacterial pathogens.[9] Compliance with the principles of appropriate antibiotic prophylaxis for surgical procedures should be strictly reviewed and the performance of audits should be part of the routine activity of infection control teams.[10]

Out of 130 patients included in our study in 115 (88.46%) patients the prophylaxis was justified and necessary before the surgery and in 15 (11.53%) patients prophylaxis was not necessary. Compare to other study where 91% of patients got the prophylactic antimicrobial agents, when prophylaxis is justified, our study revealed that only 74.48% of patient received the prophylaxis where the prophylaxis was needed. The reason behind this may be lack of awareness and agreement on the general guidelines that which surgeries require prophylaxis or which does not.

We assessed three different criteria (antimicrobial agent, timing and duration) of the appropriateness of prophylaxis in the 86 patients in which prophylaxis was justified and provided, and one criteria (dosage) in 48 patients in which prophylaxis was justified and the proper antimicrobial agent was given. Comparing with the standard guidelines, most of the observed misuse and inappropriateness were directed towards improper agent, timing of administration and duration of antibiotic prophylaxis. We used ASHP and SIGN guidelines as reference.

Prophylaxis with the broad spectrum antibiotics is not recommended because it leads to the unacceptable increases in hospital costs and emergence of resistant bacteria and superinfections without increase in the effectiveness.[11] Fluroquinolones or fourth or third generation cephalosporins should not be prescribed. First generation cephalosporins like Cefazolin is the best agent for surgical prophylaxis. But in our study only 48 (41.73%) of patients comply with these recommendations for proper antimicrobial agent. Rest of the patients who received inappropriate drug, most of them received the or third or fourth generation cephalosporins). Out of which most of patients were getting fluoroquinolones, which may be responsible for development of microbial resistance. This simply reflects the non-adherence to these recommendations or either the less availability of these guidelines.

From a set of carefully controlled experiments in laboratory animals, it was shown that time of drug administration, blood supply of tissue to be challenged and appropriateness of the antimicrobial spectrum were the three crucial factors. Delay in antibiotic administration beyond the third hour after bacterial contamination consistently failed to reduce the size of control infectious lesion.[12]

Timing of antimicrobial prophylaxis is the most important factor for the prevention of surgical infections. 2 hour time period prior to surgery for antibiotic prophylaxis is considered as optimal period. During the study we found that only 46 (40%) patients had evidence of receiving timely antibiotic prophylaxis that is within the 2 hours prior to surgery.[13] While 69 (60%) of patients did not received the antibiotic timely before surgery. Of these, 40 (34.78%) patients had documentation of receiving antibiotic more than 2 hour before surgery and 29 (25.21%) patients did not received the preoperative antibiotic at all. These results reflect lots of variation in the timing of antibiotic administration, from those the recommended guidelines. Our study is consistent with numerous studies that show antibiotic timing as most common problem in surgical antibiotic prophylaxis.

The correlation between writing of the preoperative orders and the administration of these antibiotics was the major problem in some cases we identified. In most of the cases antibiotics were being administered in early morning by nursing staff irrespective of the surgery time. We identified an increasing proportion of patients who received antibiotics early, as the surgery time was delayed. Preoperative orders of antibiotic delivery may be written "on call to operation theatre". If antibiotics are being administered while shifting to the operation theatre and the surgical procedure is delayed subsequently, error in the actual administrating time before surgery occur and patient might not receive antibiotics dose timely. Adoption of method, such as the operation administering antibiotics, so that prophylaxis is received by patient just prior to incision, could virtually eliminate this problem.

Prophylactic antibiotic therapy is more effective when begun preoperatively and continued through the intraoperative period, with the aim of achieving therapeutic blood levels throughout the operative period. The antibiotic agent should be present in the tissues in sufficient concentration at the time of incision to overcome the bacterial load.

Totally 38 patients developed wound infections. Out of which (55.26%) wound infections were seen in those patients who were getting antibiotic prophylaxis more than 2 hours before surgery and (34.21%) wound infections were developed in those who did not received preoperative prophylactic antibiotic dose. Patients, where first antibiotic dose was given after the start of surgery were also found to develop wound infection, in (10.52%) patients. These data suggest that antibiotic levels in tissues are a determining factor in the prevention of infection.

There are abundant data to show that prolonged postoperative dosing of antimicrobials does not provide additional benefit. Thus, this indicates a misuse or overuse of antibiotics in surgical prophylaxis and this can be responsible for drastic development of microbial resistance. Bailly, et al. in a study found that in 70.8% of patient's duration was appropriate.

Our results are far below compared to this study. A study has shown that implementation of protocol on preoperative antibiotic prophylaxis reduced the prolonged duration of prophylxis from 78.6% to 4.2%. We find that in our hospitals the hospital environment and the length of postoperative stay to the hospital may be the factor that is why surgeons continued the antibiotic postoperatively for 5-6 days.

The implementation of a cost-effective perioperative antibiotic prophyalxis protocol was the result of multidisciplinary effort. The hospital pharmacist participated in education activities as part of discussion groups on the perioperative antibiotic prophylaxis protocol that involved all participants and in managerial actions that optimized the process of ordering, dispensing, administering, and documenting the perioperative antibiotic prophylaxis.[14]

Thus, to increase the quality of antimicrobial prophylaxis in surgery, efforts are needed to be put into developing guidelines and to facilitating logistics. But adherence to optimal and inappropriate guidelines may explain some of the deviation in practice. To evaluate this critical appraisal of the content of the guidelines is needed. These guidelines are need to be compatible with existing values among the target group and not be too controversial, to assure the adherence to these guidelines. There is need to understand the features of guidelines that relate to implementation of guidelines in decision making in daily practice. Audits of surgical prophylaxis may help hospitals identify barriers to guidelines adherence.

CONCLUSION

Compliance with the principles of appropriate antibiotic prophylaxis for surgical should be strictly reviewed. To promote the rational use of antibiotics in surgical prophylaxis, implementation of the evidence based guidelines and recommendations for antimicrobial surgical prophylaxis is strictly required. And adherence of the antimicrobial prophylaxis to these guidelines are need to be evaluated routinely.

Further similar type of surveys, educations at various levels (viz. house surgeons, residents, nurses and other health care professionals), should be conducted to emphasize and re-emphasize on the principles of antimicrobial surgical prophylaxis in the future. Overall outcome would be reduction in postoperative complications and development of microbial resistance.

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