Original article:

Short term antibiotic prophylaxis in surgical nosocomial wound infection

Dr Pradnya Deolekar , Dr Sandesh Deolekar , Dr Pramila Yadav , Dr Vikas Lal , Dr Aditya Oak

Department of Pharmacology, Dr D Y Patil Hospital, Nerul , Navi Mumbai , India
Corresponding author: Dr Pradnya Deolekar

Abstract:

Introduction: Short term antibiotic prophylaxis reduces the need for long term antibiotic treatment and therefore may contribute to reducing selection of antibiotic resistant bacteria .prospective observational study was carried out to examine whether short term antibiotic prophylaxis is efficacious in preventing post operative wound infection.

Aim: To find incidence of wound infection, and to compare efficacy of the four different antimicrobial combinations.

Results: The SSIrate in the Piperacilin – Tazobactum group was the least ie 1 (2.5%). The SSI was least in elective cases, laproscopic, minor cases, surgeries with short duration, and in first two of chronology. The predominant organism causing infection in the study was Pseudomonas aeruginosa.

Conclusion: The benefits gained from a preventive antibiotic program would include reductions in both morbidity and mortality.

Introduction

Surgical site Infections are one of the commonest amongst hospital acquired Infections. In India, incidence of post operative infections varies from 10-25% .There are very few studies been conducted in a public sector / government hospital taking into consideration the high operative load, the different bacteriological environment and lack of state of the art sterilization methods. Short term antibiotic prophylaxis reduces the need for long term antibiotic treatment and therefore may contribute to reducing selection of antibiotic resistant bacteria. To be effective, prophylactic antibiotics are to be carefully chosen according to the local presence and prevalence of antibiotic resistant bacteria. But there has been no uniformity or rationale in the choice of antibiotic for different surgeries, and the organisms expected to cause infection in a particular surgery not really always being covered by prophylactically administered antibiotic. This may result in an increased incidence of wound infection. Dangerous implication of this may lead to the development of a resistant bacterial community changing the entire ecology of the hospital.

Therefore this prospective observational study was carried out to examine whether short term antibiotic prophylaxis is efficacious in preventing post operative wound infection and the probable causes of failure, if any.

Aims and objectives of the study

1) To find out overall incidence of wound infection.
2) To compare efficacy of the four different antimicrobial combinations in preventing post operative wound infections.
3) To study sensitivity of isolated organisms to antimicrobials.

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4) To find out rate of failure, of antibiotic prophylaxis and relevant causes

Materials and Methods

This was a prospective study conducted in a teaching Hospital. The Inclusion criteria was: patients age 15 or above subjected to surgery under general or regional anaesthesia, for both elective and emergency surgeries. Exclusion criteria were— Patients with past medical history, allergy to study medication, Re explorations, Patients whose operative findings indicate the need for a prolonged course of antibiotic therapy (eg. severe faecal contamination of the peritoneal cavity), Patients who needed antibiotics for other indications not related to the primary, surgical condition (e.g. coexisting pneumonia) surgeries where primary closure was not done, patients who failed to comply with the allocated drug regimen, patients who were given additional antibiotics during the operation or post operatively, patients with mortality occurring earlier than fourteen days were excluded from the analysis , patient with comorbid condition which is likely to interfere with wound healing.

Selected patients admitted in general surgery ward was followed according to the protocol of this study. The relevant information was recorded during pre-operative, Intra operative and post – operative periods by using predesigned proforma. Post operatively patients received the following short term antibiotic prophylaxis.

Antibiotic prophylaxis schedule was as follows:

Clean :Single pre induction dose

Clean contaminated: Three doses

Contaminated: Three days

Dirty: Five days

Patients showing signs and symptoms of wound infection were given antibiotics for 5-7 days and were evaluated on day 3, day 5, day7 for any surgical site infection until discharge from the hospital. The status of wound dressing in terms of frequency and soakage was recorded. For SSI (Surgical site infection). The guidelines for prevention of Surgical Site Infection established by the CDC were used.

The choice of antibiotic combination administered were Cefoperazone + Sulbactam, Ceftriaxone +Sulbactam, Piperacillin+Tazobactam, Amoxycillin+Clavunate. Metronidazole was added to the antibiotic schedule in cases of obstructed and bleeding gastric pathologies and colonic surgeries.

Statistical Analysis:-

Student's test, chi square test, ANOVA, and paired t test. All the analysis were two sided, and differences with a P value that was <0.05 were considered significant.

Results

Demography:

The majority of surgical procedure were carried out in men 95(65%) as compared women 65(35%) and the mean age in men being 35 and 37.7 in females there was higher incidence of infection in females 7.2 %) as compared to males 5.7 % .

Surgeries:

Of the total number of surgeries(161), the most frequent operation was repair of various hernias, 42(26.1 %) then appendectomy 24 (15%) and cholecystectomy 21(13.1 %).

Table –1 The SSI in antibiotic regimes were as according to the following table

Antibiotic	No. of Patients	Infected	Percentage
Cefoperazone +Sulbactam	40	3	7.50%
Ceftriaxone +Sulbactam	40	3	7.50%
Piperacillin +Tazobactam	40	1	2.50%
Amoxycillin +Potassium Clavulanate	40	3	7.50%

Sulbactam, Of the ten SSIs three (7.5%) each were observed in the following groups. Cefoperazone-Ceftriaxone – Sulbactam, Amoxycillin – Clavunate and one (2.5%) was seen in Piperacillin–Tazobactam

Table -2 The SSI rate is according to the following table :

Type of Surgery	Infected (SSI)	Not Infected	Total	P-Values
Clean	2 (3.5%)	54 (96.4%)	56	o.oo3
Clean contaminated	3 (5.6%)	50 (94.3%)	53	0.034
Contaminated	4 (8.6 %)	42 (91.3%)	46	0.022
Dirty	1 (20%)	4 (80%)	5	0.oo1
Total	10	150	160	0.003

In this study the overall SSI rate was 6.2% (10/160). Surgical site infections occurred in 3.5% of the clean, 5.6% of clean contaminated, 8.6% 0f contaminated and 20% of the dirty wounds, Incidence of wound infection in the different categories of surgeries were progressively higher as the degree of contamination increased.

The incidence of wound infection in emergency cases 6(7.89%) was significantly higher than that in elective 4(4.76%) procedures.When the elective and emergency surgeries were divided into clean, clean- contaminated, contaminated and dirty wounds, the difference in infection rates were statistically significant with a p value o.o3.infected cases were more in emergency with clean contaminated and contaminated category.

None of the laproscopic surgeries showed wound infection while that comparable surgeries for similar pathology done by the open method showed a wound infection rate of 3(12%). This difference was statistically significant with a p value 0.02.

The Number of SSIs in major surgeries was 8 (7.2 %) and in minor was 2 (2.7 %). All the clean, clean contaminated, contaminated and dirty wounds were further subdivided into major and minor surgeries. There is no statistically significant difference between major and minor cases in the clean category and however in other groups i.e. clean contaminated, contaminated and dirty there was statistical difference with a ($p< 0.05$) between major and minor surgeries.

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Table –3: Major v/s Minor with Wound Classification

		Infected	Not Infected	P-Value
Clean	Major	1	39	0.06
	Minor	1	15	
Clean Contaminated	Major	2	41	0.05
	Minor	1	9	
Contaminated	Major	4	32	0.03
	Minor	0	10	
Dirty	Major	1	3	0.05
	Minor	0	1	

Duration of Surgery with wound classification

There was a progressive increase in the occurrence of wound infection with the increased duration of the surgery . The proportional increase in wound infection rates was statistically significant.p=0.004. The duration of surgery appeared to be a significant factor (P<0.05) in all groups of clean, clean-contaminated, contaminated and dirty cases.

Chronology of Surgery

The incidence of wound infection in the first two surgeries in the operation list was significantly less than for surgeries done later on in the list.(p=0.002). The chronology appeared to have significant (p< 0.05) relevance in all the wound category.

Table – 4 : Organisms causing wound infection

Organisms causing wound infection	**Number of Patients**
E coli	2
Klebsiella	2
Staphylococci	1
Pseudomonas	4
Proteus	1
Total	10

The predominant organism causing infection in the study was Pseudomonas aeruginosa 4 (40%) being responsible for nearly half the cases of wound infection encountered. Other common pathogens encountered were E coli 2 (20%), Klebsiella 2 (20%), Staphylococci 1(10%) and Proteus 1 (10%).

Discussion

Surgical technique, wound management and overall patient care are of great importance in minimizing the incidence of wound infection. Rigorously defined, prophylactic antimicrobial regimens are those given to the patients before, during, or after a

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diagnostic, therapeutic, or surgical procedure to prevent infectious complications.

Many different antimicrobial regimens are effective for preventing SSI. The optimal agent which is chosen must be effective against the organisms that are most likely to be encountered during the type of operation that is to be performed. Antibiotic prophylaxis should be safe, inexpensive, and bactericidal, and should preferably have a long half-life.

The antibiotic regimens used for prophylaxis were Cefoperazone _ Sulbactam, Ceftriaxone – Sulbactam, Piperacillin – Tazobactam and Amoxycillin – Clavunic acid. Because of their antimicrobial spectrum and relative lack of toxicity, Cephalosporins are the agents of choice for surgical procedures in which skin flora and the normal flora of the gastrointestinal and genitourinary tracts are the most likely pathogens.Third generation cephalosporins are more effective than first and second generation cephalosporins if all perioperative infectious complications are taken into consideration.

The next consideration is antibiotic prophylaxis is the duration for which antibiotics have to be administered .In this study subjects with clean wounds were given single pre induction dose, subjects with clean- contaminated where given 3 doses, for contaminated wounds prophylaxis was continued for 3 days and 5 days for dirty wounds. We investigated SSIs using shorter duration of prophylactic antibiotic medication had a significantly lower rate of SSIs (6.2%). These results are comparable with a number of well controlled prospective controlled studies, thereby validating the results of this study.[1]Numerous reports documented that routine prolongation of prophylaxis provides no additional protection against infections.[2]

Antibiotic prophylaxis given for long duration is more expensive than a short term prophylaxis. However, the bulk of evidence, including studies of various surgeries, suggest that short duration prophylaxis is equally effective as longer duration administration in preventing infection.[3] The infection rate in clean wound was 3.5% which is comparable with results of study done by Piero et. Al; were he recorded the infection rate of 3.6 %.[4]Other studies done by Katsumi Shigemura et.al; recorded SSI 3.875% for clean wounds,[5]and of 1-4 % by Weed H G et. al.[6]The rate of wound infection in clean contaminated cases in this study is 5.6% which is within range quoted in literature – 10%. Brusaferroet. Al. reported in the cohort study an SSI of 7.9%.[7]Another studies done reported infection rate of 5 to 15% in clean contaminated cases after receiving antibiotic prophylaxis.[6].The infection rates for contaminated wounds in the study is 8.6% which is much lower than results obtained in other similar studies, which quote an incidence of 15 – 20%.[8]

The incidence of wound infection in dirty cases is 20% which is well within the average of less than 40%. The infection rate quoted by Weed H G in his study is 25% for dirty wounds.[6]

The infection rate in Cefoperaone – Sulbactam group was 3 (7.5%). Administration of Sulbactam – cefoperazone before laparoscopic cholecystectomy suppressed the level of bacteria in the bile resulting in a significant reduction in complications induced by postoperative infection.

The infection rate in the Ceftriaxone – Sulbactam group was 3(7.5%). Administering Ceftriaxone as a single preoperative injection led to a dramatic savings, in terms of nursing efforts, time and cost of prophylaxsis per patient. The meta – analysis showed that Ceftriaxone is statistically superior to other antibiotics in preventing post-operative infections.[9] The infection rate in the Piperacilin –

Tazobactumgroup was 1 (2.5%). Single dose antibiotic prophylaxsis with Piperacillin – Tazobactam reduce the incidence of ERCP induced cholangitis in patients suspected of having either biliary tract stones or distal common bile duct stricture.[10]

The infection rate in the Amoxycillin – clavulanate group was 3 (7.5%).Short course prophylaxis with Amoxicillin – Clavulanate have restricted to two or three doses of antibiotics within first 24 hours following operation.

The incidence of wound infection in emergency cases 6(7.89%) was significantly higher than that in elective procedures 4 (4.76%). The apparently higher rate of wound infections in emergency surgeries was, therefore, because of a higher number of contaminated and dirty wounds in the emergency setting.

None of the laparoscopic surgeries were infected while comparable surgeries for similar pathology done by the open method had a wound infection rate of 3 (12%).

The number of SSIs in major surgeries was 9 (7.2%) and in minor was 1 (12.7%). This was probably because of a higher number of a clean procedures among the minor surgeries.

The duration of surgery appeared to be a significant factor in all groups. There was a higher rate of wound infection in surgeries lasting for more than 2 hours as compared to those of shorter duration.

The incidence of wound infection in the first two surgeries in the operation list was significantly less than for surgeries done later on in the list. The chronology appeared to have significant relevance in all categories of the wound. This was probably because of a conscious decision to take up clean cases earlier on in the list.

Our study shows that P.aeruginosa was most prevalent(40%) amongst all the pathogens isolated from the surgical wound. These results were in consistent with similar studies carried out by Anuparba and colleagues which showed P.aeruginosa was isolated in 37% of isolates[11]Oguntibegri and Nwobu in their study concluded it as 43.8%[12]and Hani and colleagues found a prevalence rate of 27.78%.[13]We therefore report it as a significant finding which is in agreement with that obtained in other hospitals.

The benefits gained from a preventive antibiotic program would include reductions in both morbidity and mortality. Additional advantages are a conservation of hospital bed space and the potential for great savings in money to be expended for individual patient care.

Conclusion

Post operative wound infections are the major source of infectious morbidity in the surgical patient. The use of perioperative antibiotics has become an essential component of the standard of care in virtually all surgical procedures and has resulted in a reduced risk of postoperative infection when sound and appropriate principles of prophylaxis are applied.

The present study was done to compare efficacy of the four different antimicrobial combinations in preventing postoperative wound infections, to study sensitivity of isolated organisms to antimicrobials and rate of failure if any. Analysis of the results showed that the all four antibiotic regimens reduce the incidence of all infective sequelae.Thisstudy suggest that Piperacilin – Tazobactum regime was found superior over the others.

This study points to the fact that short term antibiotic prophylaxis proves equally efficacious, more cost effective and importantly includes a short stay.

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