ORIGINAL ARTICLE

SINGLE VERSUS 3-DOSE ANTIBIOTIC PROPHYLAXIS IN CLEAN AND CLEAN CONTAMINATED OPERATIONS

Abdul Rashid Surahio, Ashar Ahmad Khan, Main Usman Farooq, Iffat Fatima

Department of General surgery Al-Noor Specialist Hospital Holly Makkah, Saudi Arabia

Background: Infection is a great problem in surgery and is encountered by all surgeons by nature of their craft; they invariably impair the first line of host defence. Bacteria may enter the wound during or after the operation and may be of endogenous or exogenous origin. The objective of this study was to determine the effectiveness of preoperative antibiotic prophylaxis in reduction of postoperative wound infection in clean and clean contaminated procedures and to compare the cost of antibiotic prophylaxis in both groups. **Method:** This was a prospective study done on patients in General Surgery Department, Al-Noor Specialist Hospital, Holly Makkah, Saudi Arabia from 1st April 2006 to 30th March 2007. Total 400 patients were divided into 2 groups of 200 patients each: Group-A received single dose antibiotic prophylaxis, and Group-B received 3 doses of antibiotic therapy. Only clean and clean contaminated procedures were included and results were compared. **Results:** In Group A, clean procedures (Group-A1) were 110, and clean contaminated (Group-A2) were 90 patients. In clean procedure, rate of infection was 5 out of 110 (4.54%) and in clean contaminated procedures it was 3 out of 90 (3.33%). In Group B, in clean procedures (Group-B1), rate of infection was 7 out of 90 (7.77%), while in clean contaminated procedures (Group-B2) it was 9 out of 110 (8.18%) patients. Over all wound infection rate after single dose antibiotic prophylaxis was 4% in both procedures and 8% after 3-dose antibiotic therapy. **Conclusion:** Single dose antibiotic prophylaxis is as effective as 3-dose therapy in clean and clean contaminated procedures to prevent wound infection and is cost-effective.

Keywords: Surgical wound, Infection, Antibiotic prophylaxis, Clean, Clean contaminated procedure

INTRODUCTION

Infection remained a great problem in surgical practice. Infection is encountered by all surgeons by the nature of their craft; they invariably impair the first line of host defence.[1] Bacteria may enter the wound during or after the operation and may be of endogenous or exogenous origin. Endogenous source can be from mouth, skin, respiratory tract, gastrointestinal tract, biliary tract, perineum or genitourinary tract of the patient. Exogenous organisms came from surgeons, assistants, attending nursing staff, and breach in asepsis in operation theatre or in wards. Some organisms are air born. Organisms causing infection depends on the type of organism and number of that organism. Less than 10^5 organisms/ml is unlikely to cause wound sepsis. There are certain general factors affect the multiplication of bacteria included virulence of organism, age of the patient, diabetes mellitus, obesity, immunity of the patient, and concurrent disease. Some drugs like steroids, chemotherapeutic agents also decrease host defences.[2] Local factors in everyday practice causing inhibition of local defence mechanisms for cleaning bacteria are perhaps the most important cause of wound infection any thing that interferes with the ability of phagocytes to contact directly and kill bacteria potentates wound infection. Use of foreign bodies including sutures, drains or lack of accurate approximation of tissues, strangulation of tissues with sutures that are too tight and presence of any dead tissue, haematoma or seromas all increase the risk of infection. Most of these can be minimised by good surgical techniques.

Surgical infections remained a great problem and continue to consume a considerable portion of health care finances. Complete elimination of wound infection is not possible but a reduction of wound infection to minimum level could be possible in benefit of both patient comfort and resources used. Wounds have been classified in to 4 categories according to the theoretical risk of number of bacteria contaminating the wound, i.e., clean, clean contaminated, contaminated, and dirty.

Anything that reduces blood flow to the surgical incision as may be found in vascular occlusive states, hypovolemic shock, or with the use of vasopressors or vasoconstrictors either locally or systematically increases in tissue oxygen tension caused by either decreased blood flow or by systemic hypoxemia, increases the incidence and severity of infection this effect later noted to be further enhanced by administration of systemic antibiotics.[3]

The role of prophylactic antibiotics is well established but choice of drug and scheduled for different surgical procedures is still a matter of debate.[4,5] Nation-wise the cost of this excessive hospitalisation is likely to be more than 1.5 million per year. Ehrenkraz proposed that antibiotic prophylaxis for patients undergoing caesarean section could result in national annual saving for this category alone. On the other hand, inappropriate and indiscriminate use of prophylactic

antibiotics may increase cost through unnecessary drug use.[6,7]

Prophylactic antibiotics administration can reduce the incidence of postoperative wound infection. Prophylactic antibiotic therapy should be directed against the bacteria likely to contaminate the wound. Bacterial contamination is likely in traumatic wounds, when the intestinal tract has been entered as a result of trauma, elective operations on the intestine or colon, gastro-duodenal operation in which the patient has increased gastric flora, high risk biliary tract operations and gynaecologic operations.[8,9]

The antibiotic effective against the pathogens most likely to be encountered with least toxicity should be selected, and a single dose therapeutic antibiotic intravenously 30–60 minutes preoperatively given.[10] A second dose should be administered if operation lasts longer than 4 hours or twice the half-life of antibiotic used. Use of antibiotic is appropriate when infection is frequent or when consequences of infection would be unusually severe.[11]

The objective of this study was to determine the effectiveness of preoperative antibiotic prophylaxis in reduction of postoperative wound infection in clean and clean contaminated procedures and to compare the cost of antibiotic prophylaxis in both groups.

MATERIAL AND METHODS

This was a prospective study done on patients in Surgical Department of Al-Noor Specialist Hospital Holly Makkah, from 1st April 2006 to 30th March 2007. Total 400 patients were divided into 2 groups. Group-A with odd number received single dose antibiotic prophylaxis. Group-B with even number received 3 doses antibiotic therapy. Both these groups were further subdivided into 1 and 2 on the basis of procedure performed either clean or clean contaminated respectively. Only clean and clean contaminated procedures were included.

Data was collected on preformed Performa. Patients admitted for elective clean and clean contaminated procedures between the ages of 12 and 60 years irrespective of the gender were included. Patients below 12 and above 60 years of age or those with high risk of infection or patients with diabetes mellitus, congestive cardiac failure, renal failure, severe liver dysfunction, pregnancy, malnutrition and marked obesity were excluded. Patients on steroid or chemotherapy or patients with concurrent antimicrobial therapy, pre-existing infection with resistant organisms, and patients who underwent emergency surgery were also excluded from the study.

Detailed history was taken and examination, preoperative laboratory investigations like complete blood count, blood urea, serum creatinine, serum electrolytes, and blood sugar were done for all patients. ECG was also recorded for patients above 35 years. For clean operations, injection Amoxicillin + Calvalunic 1.2 gm was given, while injection Cefuroxime 1.5 gm for cholecystectomy, and injection Cefuroxime, 1.5 gm + Metronidazole 500 mg for gastrointestinal or colorectal operations were administered intravenously on induction. Wounds were seen on 1st postoperative day, time of discharge, 10th postoperative day and after one month. Stitches were removed on 10th postoperative day in outpatient department. Wounds were examined for erythema and discharge, and if there was discharge it was seen whether it involved single stitch focus, 1/3rd or more than 1/3rd of the wound. Pus was sent for culture and sensitivity using standard methods.

RESULTS

Total 400 patients were included in this study. Mean age of the patients was 35.5 years. Average preoperative hospital stay was 1 day in both groups and average duration of surgery was less than 60 minutes. Average stay in hospital for those who developed wound infection in Group-A was 3 days and in Group-B it was 6 days.

In Group A1, 5 out of 110 (4.54%) patients developed single stitch wound infection (pus discharge) after one week. In Group A2, 3 out of 90 (3.33%) patients developed infection at two stitch sites. In Group B-1, 7 out of 90 (7.77%) patients developed pus discharge from single stitch focus after one month and erythema involving less than ⅓ of wound after one week. In Group B2, 9 out of 110 (8.18%) patients developed wound infection out of them 3 developed pus discharge from single stitch focus after one week.

In Group A, 8 patients developed wound infection but culture was positive for Staphylococcus aureus sensitive to Cefuroxime, in two patients only. Infection resolved after 1 week by giving tablet Cefuroxime (250 mg) twice a day and daily wound dressing. The other patients whose wound was infected with negative pus culture, pus was drained and daily dressing done with antiseptic solution and wound healed in 10 days. In Group-B, 16 patients developed wound infection. Six patients had erythema with no pus discharge which resolved with dry dressing. Ten patients had single stitch focus infection. Pus was drained and culture showed Staphylococcus epidermoids sensitive to Amoxicillin + Calvalunic. A 625 mg tablet every 8 hourly was given for 1 week and daily dressing was done. Cost of single dose of Cepharadine (used in clean surgery) and Cefuroxime (used in clean contaminated surgery) was SR 85 and SR 185 respectively. Cost increased to SR 255 and SR 555 in clean and clean contaminated procedure when same antibiotic was used for 3 doses.

The results are tabulated in Table-1 to Table-4.

Table-1: Number of patients for different procedures and type of anaesthesia (n=400)

CHARACTERISTICS	Single dose	3-dose therapy
Clean procedures		
No. of patients	110	90
Average duration of surgery (min)	60	60
Shaving of operative site	25	28
General anaesthesia	100	77
Spinal anaesthesia	10	13
Clean contaminated procedure		
No of patients	90	110
Average duration of surgery (min)	60	60
Shaving of site	0	0
General anaesthesia	90	110
Spinal anaesthesia	0	0

Table-2: Surgical operations performed (n=400)

Operation	Group-A (n=200)	Group- B (n=200)
Hernioraphy	25	28
Thyroidectomy	15	16
Para umbilical hernia	12	16
Laparoscopic cholecystectomy	148	140

Table-3: Infections and cost of antibiotic prophylaxis (n=400)

Group	Sub-group	Number	Antibiotic Prophylaxis	Infections n (%)	Cost (SR)
A	A-1	110	Single Dose	5 (4.54%)	85
	A-2	90	Single Dose	3 (3.33%)	185
B	B-1	90	3-Doses	7 (7.77%)	255
	B-2	110	3-Doses	9 (8.18%)	555

Table-4: Culture and sensitivity of isolated organisms

Group	Number of Infections	Positive cultures	Organism	Sensitivity
A	8	2	Staph. aureus	Cefuroxime
B	16	10	Staph. epidermoids	Amoxicillin + calvalunic

DISCUSSION

Introduction of antibiotic therapy in middle of the 20th century fostered hope that surgical infection would be eliminated.[12] Basic benefit of antibiotic is reduction of bacterial contamination in wound. The prophylactic use of antibiotic for clean operations with foreign body implant and in all clean contaminated procedures.

The present generation of surgeons is facing increasing numbers of serious infections related to complex combination of factors including complicated and longer operations, and an increase in the numbers of geriatric patients. Postoperative infection rates in developing countries can reach astonishing levels. Prophylactic agents for clean operations, when hollow viscous is not entered, should cover skin flora. Keeping in mind, we selected ampicillin group Amoxicillin + Calvalunic. In clean contaminated procedures (gastrointestinal or biliary tracts were encountered), we should cover the *E. coli*, *Klabsilla*, and gut flora. So, we used second generation Cephalosporin (Cefuroxime 1.5 gm) for our study.

Antibiotic prophylaxis in surgery has been proven to be effective in many clinical trials. Chandrashekhar *et al*[13], and De Alba Romero *et al*[14] reported infection in 10.2% cases with and 31.4% without antibiotic prophylaxis. In another study done by Surahio AR[15] shows the rate of wound infection is less in patients with single dose antibiotic prophylaxis as compared to 5-day conventional antibiotic prophylaxis. Same trend were seen in our study.

In our study the rate of wound infection was less in patients with single dose antibiotic prophylaxis as compared to 3-dose conventional antibiotic prophylaxis.

In another study by Tariq[16] efficacy and safety of 3 doses of chemoprophylaxis was compared with conventional continuous antibiotics in clean general surgical procedures. Patients divide into two groups. Infection rate was higher (14%) in Group-II compared to Group-I (6%).

In our study also, wound infection rate was higher in group of patients who received 3 doses chemoprophylaxis than twice who received single dose of chemoprophylaxis.

Another study was done by Rashid *et al*[17] This was a prospective study done in patients undergoing clean surgical procedures. Patients were divided into two groups. One group did not receive any antibiotic while other group received antibiotic at the time of anaesthesia induction. Wound were examined 48 hours, 96 hours, 5th and 7th day for the signs wound infection.[18] In Group-A 4% patients developed wound infection and in Group-B also 4% patients developed wound infection. Different studies emphasise implementation of antibiotic prophylaxis protocol which will result in more appropriate choice of antibiotic timing and duration.[19]

In a study done in Deep South Centre for Effectiveness Research, Birmingham, USA it was concluded that to avoid the wound infection best results are achieved when prophylactic antibiotic given inside the operation room (on induction of anaesthesia as compared to the given out of the operation room).[20] A study from Japan by Kobayashi M[21] showed combination of oral and intravenous antimicrobial prophylaxis as superior to intravenous alone.

In another study done in Department of Surgery, School of Medicine, Hospital Colombia, it was reported that prophylactic antibiotic for mesh inguinal hernioplasty, prophylactic antibiotics use in patients submitted to mesh inguinal hernioplasty decreased the rate of surgical site infection by almost 50%.[22] In our study, the rate of wound infection was less in patients with single dose antibiotic prophylaxis compared to 3-dose antibiotic prophylaxis. Same trend was reported by Sevin[23] but they reported opposite results showing prophylactic antibiotic for 2 days superior to single dose prophylaxis. Another study Terai[24] from Japan

mentioned no significant differences between 1 day and 4 days group of prophylactic antibiotic in terms of wound infection. Interesting relation was mentioned between rate of wound infection and hospital stay by Manian[25] from USA. They showed rate of wound infection increased in hospital stay, same trend was seen in our study.

CONCLUSION

Single dose antibiotic prophylaxis is as effective as 3-dose conventional therapy in clean and clean contaminated procedures. It is cost effective and shorter hospital stay is required.

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Address for Correspondence:

Dr. Abdul Rashid Surahio, Consultant, Ghani Hospital, Qasimabad, Hyderabad, Pakistan. **Tel:** +92-22-2651537, **Cell:** +92-302-2631889

Email: a_surahio@yahoo.com