IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 18, Issue 1 Ser. 13 (January. 2019), PP 75-79
www.iosrjournals.org

"Outcome of Prophylactic Antibiotic Therapy: A comparisonbetween Short Prophylactic Antibiotic Therapy (SPAT) and Prolonged Antibiotic Therapy (PAT)"

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Abstract: *Surgical Site Infection (SSI) is the most common postoperative complication causing increased morbidity, mortality, hospital stay and high cost of treatment. Many aseptic precautions are applied to prevent SSI. Use of prophylactic antibiotic is a recognized and worldwide acceptable means to prevent SSI in clean contaminated surgery. But antibiotic regimen is still controversial in place to place and hospital to hospital. Somewhere single dose is used but somewhere 3 doses (Short Prophylactic Antibiotic Therapy- SPAT) and 7 days conventional (Prolonged Antibiotic Therapy- PAT) dose is used. But which regimen is more acceptable is a matter of study. This interventional type of experimental study was carried out on 300 consecutive and purposive cases upon which clean contaminated surgery performed in Rajshahi medical college hospital from July 2010 to June 2012 for the period of 2 years. According to selection criteria, 300 patients of different diseases including chronic calculus cholecystitis, Recurrent Appendicitis, Benign prostatic hyperplasia (BPH), Ureteric calculus and GOO (Pyloric stenosis) are included and underwent surgery. Total cases were divided into two equal groups (n=150). One group received 3 doses of prophylactic antibiotic (SPAT) and the other group received 7 days conventional antibiotic therapy (PAT). Postoperatively all the cases were followed up for 1 month to detect the presence of surgical site infection (SSI). Total 7% (21) cases of SSI were found in 300 cases. Among 150 cases of SPAT group had SSI rate 7.3% and on the other hand 150 cases of PAT Group had SSI rate 6.66% which indicate a concept of almost equal efficacy of both two regimen of antibiotic therapy. Even in case of same operation (e.g. Open Cholecystectomy), SSI rate comparison between two groups of patients was also very similar. E.g. after open cholecystectomy (n=100), SPAT group (n=50) had SSI rate 4% and PAT group (n=50) had 6%. It was also observed that after elective appendicectomy, former group had SSI rate 7.27% and that in the latter group was 7.27%. Similarly comparative analysis was done regarding hospital stay and average cost of antibiotic. In this study it was found that average hospital stay of SPAT group was 4.42 days whereas that of PAT group was 6.15 days. Regarding the cost of antibiotic therapy SPAT group had to bear significantly less cost. Average cost of antibiotic of former group was 498.13 Tk. whereas that of later group was 1671.66 Tk. It is the practical picture of Rajshahi medical college hospital. ln many surgical units long term (7-10 days) antibiotic therapy is being used after clean and clean-contaminated surgeries without thinking its necessity, cost and hospital stay. This study may be evidence that only short prophylactic antibiotic of 3 doses (SPAT) probably can serve all the purposes of prolonged unnecessary costly regimen of antibiotic therapy.*

Key Words: *Outcome, Prophylactic Antibiotic Therapy, Prolonged Antibiotic Therapy (PAT), Comparison*

Date of Submission: 11-01-2019 Date of acceptance: 27-01-2019

I. Introduction

Postoperative infection is one of the most serious and common complication after surgery. It is associated with prolong hospital stay and results in increased medical cost. The purpose of antibiotic prophylaxis in surgical procedures is not to sterilize tissues but to reduce the colonization of microorganisms introduced at the time of operation to a level that, the patient's immune system is able to overcome the challenge[1]. All surgical wounds are contaminated by bacteria, but only a minority demonstrates clinical

infection. SSIs are a consequence of a summation of several factors; the inoculums of bacteria introduced into the wound during the procedure, the virulence of the contaminants, the micro environment of each wound, and the integrity of the patient's host defense mechanisms. Factors intrinsic to the patient, as well as those related to the type and circumstances of surgery, affect the incidence of infection[2,3].It should be noted that prophylactic antibiotics do not need to cover every possible pathogen that may cause infection. Decreasing the bacterial load will usually enable the patient's immunological defense to function adequately[2].The idea of a short term prophylactic antibiotic in at-risk abdominal surgery was first examined over a decade ago and there are now numerous studies in the literature. However, many trials have tested a short term prophylactic antibiotic against long course perioperative antibiotic therapy. Most studies have shown no significant difference between two regimens[4].Surgical site infection occurring in at least 5% of all patients undergoing surgery and 30-40% of patients undergoing abdominal surgery, depending on the level of contamination[4,5]. In the United Kingdom, length of stay in hospital is typically doubled and additional costs per patient have considerably increased with the slight variability depending on the type of surgery and the severity of the infection[5]. Risk of infection in developing countries is more than the developed countries due to malnutrition, anemia, poverty and environmental pollution; poor preoperative preparation, wound contamination, poor antibiotic selection, or the inability of an immune-compromised patient to fight against the infection. Contamination of the wound is present to some extent in all incisions thus adding significant morbidity and mortality[6]. Mainstay of management is prophylaxis which can be achieved by a variety of methods including use of antibiotics. Short courses of prophylactic antibiotics are as efficacious as long courses in preventing postoperative infection[7,8,9]. However over use of prophylactic antibiotics can lead to economic burden on our health system as well as development of resistance to the common organisms. Use of short term has proven to be effective in preventing wound infection[10,11].

Prophylactic antibiotic significantly reduces the incidence of surgical site infection up to four-fold. Many surgeons and institutions practice different regime of prophylactic antibiotic. Some of them use short term prophylaxis (SPAT) where as others prefer long course of prophylactic antibiotic (PAT). Although there is no doubt that use of prophylactic antibiotic significantly reduces the rate of SSIs, there is still debate regarding which regime is more acceptable. So study in this field is essential to determine the most acceptable regime of surgical prophylaxis. Some study has shown that short term surgical prophylaxis ismore convenient in perspective of SSI rate, cost-effectiveness and hospital stay. But in our practice long course of antibiotic is still being used although not supported by adequate data. This study may keep role to ascertain the most acceptable surgical prophylaxis which may be beneficial not only for the individual patient but also for the country.

II. Objectives

a) General Objective:

- To assess the efficacy between SPAT and PAT in case of clean contaminated surgery.

b) Specific Objectives:

- To make a comparison between SPAT and PAT in case of clean contaminated surgery regarding cost of antibiotics and hospital stay.
- To assess Individual efficacy of SPAT and PAT

III. Materials and methods

This interventional type of experimental study was carried out in the Department of Surgery, Rajshahi medical college hospital, Rajshahi during the period of July 2008 to June 2010 for a period of 2 years. IRC of RMCH approved the study protocol including the ethical clearance. According to selection criteria and after confirmation of the diagnosis 300 cases of both males and females of different diseases including Cholelithiasis, Appendicitis, BPH, Ureteric stones and GOO (Pyloric stenosis) were consecutively and purposively selected and underwent Clean-contaminated surgery. All these patients were kept under follow-up for one month after operation. During the follow-up period Incidence of Surgical Site Infections (SSIs) and other complications were observed, categorized and recorded in the data sheet for SPSS analysis. At preoperative evaluation decision was taken that either the patient would receive SPAT or PAT, Patients upon whom grossly contaminated or dirty surgery performed were excluded in this study. Emergency patients, old debilitated, patients with severe systemic co-morbidities, (e.g. Severe malnutrition, severe anemia, uncontrolled DM etc) and immunocompromised patients (Patients receiving radiotherapy chemotherapy, prolong steroid on immunosuppressive), pregnant mothers, patients with any active infection either acute or chronic (e.g. Pulmonary infection, urinary infection etc.) were also excluded. Data were collected in prescribed data sheet and was analyzed through standard statistical methods by using SPSS software, version 16.0 (statistical package for social science SPSS Inc. Chicago, USA).

IV. Results

Among 300 patients underwent clean contaminated surgery 150 were included in the SPAT group and remaining 150 were in the PAT group. SSI rate in the SPAT group was 7.33% whereas that in the PAT group was 6.66%. Difference between these two values was not significant ($p > 0.05$). Regarding the individual operations, SSI rates between these two groups was also compared and found no significant difference e.g. In Open cholecystectomy (N=100) patients SSI rates was 04% vs. 06% and similarly in Elective appendicectomy (N=110) patients SSI rates was 9.09% vs. 7.27% respectively.

Table 1: Comparison of SSI rates between SPAT and PAT group of patients (n=300)

Name of operations	Comparison of SSI rate	
	SPAT (n=1/2N)	PAT (n=1/2N)
Open cholecystectomy (N=100)	02 (04%)	03 (06%)
Laparoscopic cholecystectomy (N=28)	00 (00%)	01 (7.14%)
Elective appendicectomy (N=110)	05 (9.09%)	04 (7.27%)
Retropubic prostatectomy (N=26)	02 (15.3%)	01 (7.6%)
Ureterolithotomy (N=20)	01 (10%)	00 (00%)
Bilateral trancalvagotomy and gastrojejunostomy (N=16)	01 (12.5%)	01 (12.5%)
Total (N=300)	11 (7.33%)	10 (6.66%)

Table2: Comparison of Hospital Stay between SPAT and PAT group of patients (n=300)

Name of the Operations	Comparison of Hospital Stay (Days)	
	SPAT (n=1/2N)	PAT (n=1/2N)
Open cholecystectomy (N=100)	5.66	7.48
Laparoscopic cholecystectomy (N=28)	1.14	4.78
Elective appendicectomy (N=110)	3.22	5.00
Retropubic prostatectomy (N=26)	6.69	7.08
Ureterolithotomy (N=20)	3.40	4.00
Bilateral trancalvagotomy and gastrojejunostomy (N=16)	8.25	9.33
Total	4.42	6.15

Average Hospital Stayin the SPAT group was 4.42 days where as that in the PAT group was 6.15 days. Difference between these two values was significant ($p < 0.01$). Regarding the individual operations, hospital between these two groups was also compared and found significant difference e.g. In Open cholecystectomy (N=100) patients Hospital Stay was 5.66 days vs 7.48 days and similarly in Elective appendicectomy (N=110) patients Hospital Stay was 3.22 days vs 5.00 days respectively.

Table 3: Comparison of Cost of Antibiotic between SPAT and PAT group of patients (n=300)

Name of the Operations	Comparison of Cost of Antibiotic (BDT.)	
	SPAT (n=1/2N)	PAT (n=1/2N)
Open cholecystectomy (N=100)	468.00	1799.20
Laparoscopic cholecystectomy (N=28)	360.00	1671.42
Elective appendicectomy (N=110)	502.54	1528.36
Retropubic prostatectomy (N=26)	709.23	1972.30
Ureterolithotomy (N=20)	451.00	1440.00
Bilateral trancalvagotomy and gastrojejunostomy (N=16)	488.75	1661.25
Total	468.00	1799.20

Cost of Antibiotic is also a matter of consideration for patients. In this study average Cost of Antibiotic in the SPAT group was 468.00 BDT, whereas that in the PAT group was 1799.20 BDT. Difference between these two values was significant ($p < 0.01$). Regarding the individual operations, the cost between these two groups was also compared and found significant difference e.g. In Open cholecystectomy (N=100) patients the cost was 468.00 BDT. vs 1799.20 BDT and similarly in Elective appendicectomy (N=110) patients the cost was 502.54 BDT. vs 1528.36 BDT, Respectively.

V. Discussion

During the postoperative follow up of 300 cases a total of 21 (07%) surgical site infection (SSI) was found. 7.33% SSI found in SPAT group (n=150) and 6.66% in PAT group (n=150). Comparison of frequency of SSI in individual operations was found as open cholecystectomy= 04% vs 06%, Lap cholecystectomy= 00% vs. 7.14 %, Elective Appendicectomy= 9.09 % vs. 7.27%, Retropubic prostatectomy= 15.3% vs 7.6%, Ureterolithotomy= 10% vs 00% and Bilateral trancalvagotomy and gastrojejunostomy= 12.5% vs 12.5% respectively.A study conducted on 290 Cases at Mayo hospital Lahore and reported an infection rate of 8.39% in clean contaminated surgery[12]. Another study by Hemandez in Peru in 2005 and described SSI rates in clean contaminated surgery is 15.9%[13]. Masood ahmed et al conducted a study at Dow university of health science & civil hospital, Karachi on 100 cases at 2006 and reported that the rate of SSI was 19.4% in clean contaminated surgeries[14]. A study ofEgideShirimpaka at the university teaching hospital of Lusaka in 2007 showed no significant difference in the proportion of early postoperative surgical site infections between the two groups; One group receiving short term prophylactic antibiotic and another group long term antibiotic therapy. The rate of SSI in short term prophylactic group and long term antibiotic therapy group is 7.3% and 10.3% respectively[15]. Collectively total rate of SSI including both groups is 7.8%. This result is very similar to that of present study. Another study by P Thejeswi et al in 2012 among 300 cases showed that patient receiving short term prophylactic and long term antibiotic therapy were found to have SSI rate 2.66% and 4.66% respectively[16]. A study conducted by M Jawien et al in the Jagiellonian University Medical School, Krakow, Poland on 5140 Cases in 2002 and found that total SSI rates after short course of prophylactic antibiotic was 4.4%. on the other hand that after long course of antibiotic was 4.2%[17]. A study conducted by Tiono B G et al in 2006 at Sanglah General Hospital on 470 cases and showed that there is no difference of SSI risk between short prophylactic antibiotic and long term antibiotic therapy in elective appendectomy patients. They reported 5.5% SSI found in former group and 7.3% in later group[18]. Another study performed in Thailand by NongyaoKasatpibal et al in 2006 among 2139 elective appendicectomy patients. Here 90% patients received short antibiotic prophylaxis have SSI rates 2.1% and remaining patients received long term conventional antibiotic therapy with having SSI rate 2.2%[19].In this study average Hospital Stayin the SPAT group was 4.42 days where as that in the PAT group was 6.15 days. In Open cholecystectomy (N=100) patients Hospital Stay was 5.66 days vs. 7.48 days and similarly in Elective appendicectomy (N=110) patients Hospital Stay was 3.22 days vs. 5.00 days respectively. A study performed on 100 cases in 2012 by Sagheerahmed et al in Bahawalpul Victoria hospital. Here 50 cases operated by open cholecystectomy and rest of the 50 cases by laparoscopic cholecystectomy. They showed average post-operative hospital stay for open cholecystectomy is 5.66 days ranging from 2 to 7 days. Subrt Z et al conducted a study upon 250 elective appendectomies. In which 187 (75%) were done by laparoscopic approach, 63 (25%) by open procedure. The average hospital stay was 6.1 days in elective open appendectomies[63]

In case of open cholecystectomised patients, average cost of antibiotic of SPAT group was 468.00 (Tk.) where as that of PAT group was 1799.00 (Tk.). Per capita cost of antibiotic of uncomplicated patients of former group was 360 Tk. whereas those having SSI was 2160 Tk. On the other hand later group had to spend 1740 Tk. Per capita for uncomplicated and 3220 Tk. for complicated patients (SSI). Patients of former group having SSI were treated by local wound care and some of them required additional injectable antibiotic therapy which made the total cost significantly more. But in the latter group the cost of antibiotic is high by protocol. Moreover those having SSI, required extension of the antibiotic regimen. For that reason total cost was increased as high as 3220 Tk. per capita.

In case of elective appendicectomised patients, average cost of antibiotic of SPAT group was 502.54 (Tk.) where as that of PAT group was 1528.36 (Tk.). Per capita cost of antibiotic in uncomplicated patients of former group was 360 Tk. whereas that of later group was 1440 Tk. Those having SSI of former group had to spend 2320 Tk. And later group 2655 Tk. the patient those who were complicated by SSI, antibiotic regimen required to be changed. Even some patients required few additional dose of injectable antibiotic therapy which causes the total cost increased.

VI. limitations of the study

This was a single center study with small sample size. So, the study results can't reflect the scenario of the whole country**.**

VII. Conclusion

Postoperative infection is one of the most serious and common complication after surgery. It is associated with morbidity, mortality; prolong hospital stay and results in increased treatment cost. The purpose of antibiotic prophylaxis in surgical procedures is not to sterilize tissues but to reduce the colonization of microorganisms introduced at the time of operation to a level that, the patient's immune system is able to overcome the challenge. Antibiotic prophylaxis is one of important modalities in preventing surgical site

infection. Antibiotic prophylaxis administration significantly reduces the incidence of surgical site infection up to four-fold.Many surgeons and institutions practice different regime of prophylactic antibiotic to reduce the rate of SSIs. Some of them use short term prophylaxis (single dose or three dose) where as others prefer long course of prophylactic antibiotic (seven days or 5 days conventional). Although there is no doubt that use of prophylactic antibiotic significantly reduces the rate of SSI, there is still debate regarding which regime is more acceptable (short term or long course) in perspective of reducing the rate of SSI,morbidity, mortality, hospital stayand treatment cost. In the ground of this debate this study was performed and results showed that a little difference of efficacy between two regimens of antibiotic. It was found that total rate of SSI in the former group 7.3% and in the latter group 6.66%. This difference is insignificant because up to 10% of SSI in clean contaminated surgeries is acceptable worldwide.In the individual operation like elective appendicectomy, the SSI rate was found equal in both groups that was 7.27%. In perspective of hospital stay and cost of antibiotic therapy, the results of this study significantly supports the use of short term antibiotic prophylaxis instead of prolong use of antibiotic which is practically and widely practiced by many institutions in our country without supported by scientific data. So, this study may help to decide the use of regimen of prophylactic antibiotic thereby reducing not only SSI rate but also hospital stay and cost of antibiotic therapy which will be helpful for individual patient and the nation.

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Dr. Md. Mohibul Hassan. "Outcome of Prophylactic Antibiotic Therapy: A comparison between Short Prophylactic Antibiotic Therapy (SPAT) and Prolonged Antibiotic Therapy (PAT)". IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), vol. 18, no. 1, 2019, pp 75-79.