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Original Research Article

A prospective study of single dose preoperative antibiotic cover in clean elective surgical cases- a single center study

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ABSTRACT

Background: Surgical site infection (SSI) is the third most common nosocomial infections occurring worldwide, thus leading to increasing cost, mortality and morbidity. The main objective was to know the incidence of SSI in clean surgical procedures carried out in the institute of MGMCRI and to determine various pathogens causing SSI.
Methods: This was a prospective observational study done on 100 patients in Department of General Surgery in MGMCRI, Puducherry from June 2015 to August 2017 who underwent clean surgical procedure. Preoperatively single done of injection cefazolin 1gm intravenous preparation was given 30 minus before the skin incision and patient were observed and followed up meticulously for the incidence of SSI and to determine the bacterial flora in the event of SSI.
Results: In our study a total of 100 patients were included. In our study a total of three out of 100 patients developed SSI which was around 3%.Out of the 3 patients who had SSI all were a male which is around 4.6% in our study. In relation to the distribution based on the age group more than 50 year of the age are most frequently associated with SSI in our study. The bacterial flora includes *staphylococcus aureus* which was isolated from one patient and *Klebsiella pneumonia* isolated from two patients who had surgical site infections.
Conclusions: This study concludes that single dose pre-operative antibiotic has advantage in prevention of SSI and it is cost effective for patient.

Keywords: Antibiotics prophylaxis, Cefazolin, Surgical site infection

INTRODUCTION

The most common problem in association with health care is surgical site infection. It constitutes around 20% of healthcare associated problems and accounts for about 5% risk of developing SSI in patients after surgery.[1] The occurrence of SSI varies to types of surgery performed. In specific to clean surgeries the incidence is up to 3%.[2]

SSI leads to the overall mortality and morbidity thus causes the overall increase in the hospital stay and increase in costs for the patients. Cephalosporins (cefazolin) are the first line drug for most surgeries, mainly targeting the likely organisms while avoiding broad-spectrum antimicrobial therapy leading to occurrence of antibiotic resistance.[3]

As per NICE 2008 guidelines the use of antibiotic prophylaxis for clean surgeries are recommended even in those patients whom prosthesis are not used. The above guideline considers the single dose preoperative antibiotics prophylaxis to be administered intravenously before the administration of anesthesia.[4]

Antibiotic prophylaxis for surgeries are established but there are newer indications for use in clean elective procedures such as mastectomy and herniorrhaphy and

being supported recently on the basis of large studies on the pharmaco-economics of infections.[5]

With the fear of developing wound infection after surgery many surgeons administer antibiotics for a period of 7-10 days even in clean surgeries. This causes economic burden for patients and leads to hospital acquired infection.[6]

Prolonged use of antibiotics causes serious adverse reactions and results in new strain of organisms which are resistant to antibiotics. Continuous antibiotic prophylaxis may results in masking infection which are established.[7]

This study purpose was to determine the effectiveness of single dose preoperative prophylactic antibiotic in clean elective surgeries with respect to preventing SSI.

METHODS

This was a prospective observational study, which was conducted at the Mahatma Gandhi Medical College and Research Institute Hospital, Pondicherry. After review and approval by the ethics study board of the hospital, informed consent was obtained, 100 consecutive patients posted for elective surgery in hospital were enrolled into study from November 2015 to June 2017.

Inclusion criteria

Patients aged 18 years above, who were admitted for elective surgery, having no evidence of infection with normal renal profile, coagulation profile, were included in study.

Exclusion criteria

Patients below 18 years and those who did not give informed consent, on antiretroviral drugs, on cortisone or other immunosuppressive drugs, with comorbidity like (hypertension, diabetes mellitus, asthma, bleeding disorder etc.), allergic to cephalosporin/β-lactam antibiotics, were excluded from study.

All patients had preoperative tests done (hemoglobin, renal function test, coagulation profile, chest X-ray, electrolytes cardiogram, blood sugar, and blood pressure). Surgeons/assisting personnel wore sterile gowns. Preparation the skin at the surgical site immediately before incision using an antiseptic povidone-iodine was done as per NICE guidelines (National Institute for Health and Clinical Excellence).

Antibiotic prophylaxis of injection cefazolin 1 gram intravenous preparation after test dose was given to the patients 30 minutes before the time of skin incision.

Surgical incision site was dressed using sterile dressing. On post-operative day 2 dressing was opened and surgical wound will be let open and on consecutive visit the surgical wound will be inspected by the surgeon for any evidence of SSI, which would be diagnosed as per CDC guidelines (The centers for disease control and prevention). Regular assessment of surgical site till suture removal and then on follow up visits. Post operatively all patients were followed up for a minimum of 30 days up to 1 year (CDC guidelines).

When infection was clinically suspected, the area around the surgical wound was cleaned. The exudates were collected from the depth of the wound using two sterile cotton swabs or pus collected in a syringe specimen collected were transported immediately to the laboratory for further processing. Broad spectrum antibiotics were started and then switched over to specific antibiotics when the report of pus culture and sensitivity came. Data were analyzed based on age, sex, type of surgery.

RESULTS

The various observations in my study are as follows:

Among a total of 100 patients, 64 were males and 36 were females (Figure 1). Among the study population, clean elective surgeries were more frequent in less than 50 years of age of which less than 30 years age group were predominant (Figure 2).

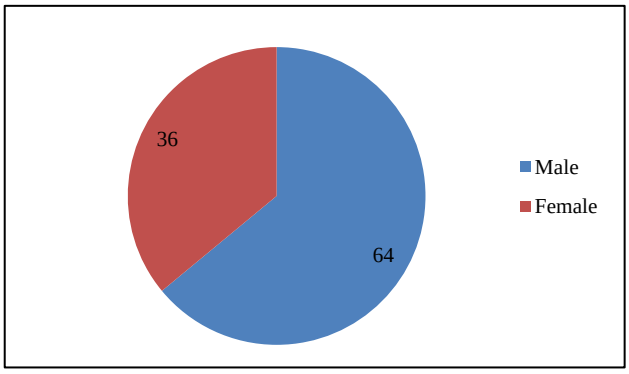

Figure 1: Sex distribution among study subjects.

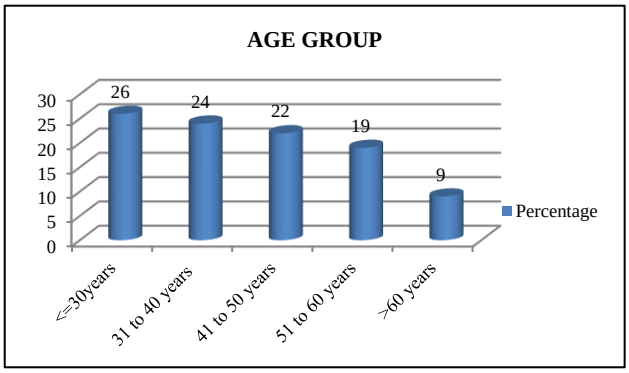

Figure 2: Age distribution among study subjects.

Hernioplasty was the most common surgery performed in about 50 cases. Thyroidectomy was the next common in

about 17 cases. Even among less than 30 years age group where surgeries were more common (26 surgeries), Hernioplasty was the most common surgery done in about 11 patients (Figure 3). Among the study population who underwent clean elective surgeries, surgical site infection was seen in 3 cases and 97 cases had no infection (Figure 4). All three cases who acquired surgical site infection were male patients more than 50 years old (Table 1). 3 out of 64 males developed SSI. Incidence of surgical site infection in relation to gender is 4.6% among males and 0% among females.

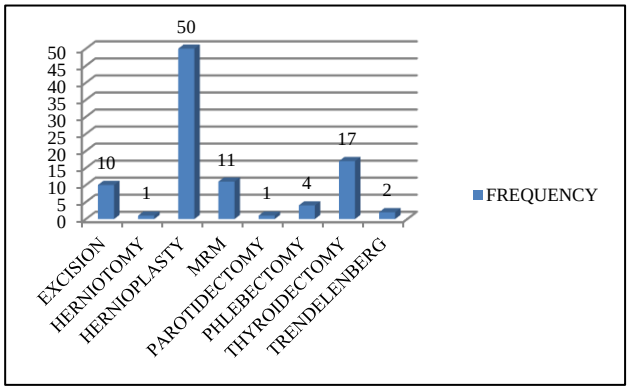

Figure 3: Distribution of types of surgery among study subjects.

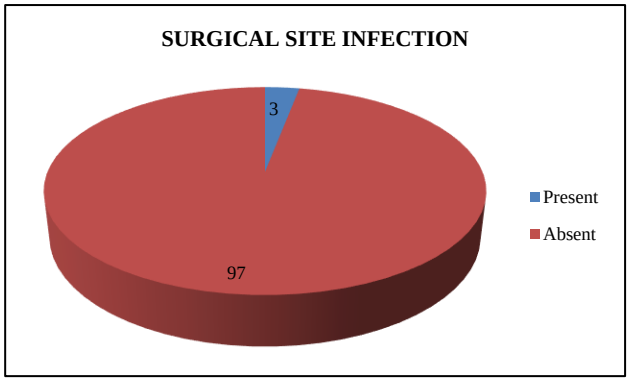

Figure 4: Incidence of SSI.

Table 1: Occurrence of SSI between different age groups.

Age group (yrs)	Total number	SSI	Percentage
≤30	26	0	0
31-40	24	0	0
41-50	22	0	0
51-60	19	2	10.5
>60	9	1	11

Among the 3 male patients who developed SSI, the percentage was 4.60% (Table 2). Among 50 patients who had undergone hernioplasty 3 patients developed SSI. Incidence of SSI in relation to the type of surgery that is hernioplasty was 6%. Two patients developed SSI on post-operative day 3 and one patient on Post-operative day 5. All were superficial infections and were managed with dressing and antibiotics if indicated by pus culture.

Table 2: Incidence of SSI in relation to gender.

Gender	Total number	SSI	Percentage
Male	64	3	4.6
Female	36	0	0

These patients were followed up for a period of one month. At 2 weeks follow up one patient had wound gaping whereas in other two patients surgical site was normal. At one month follow up, surgical site was normal in all three patients. Frequencies of various pathogens causing surgical site infection are *Staphylococcus aureus* in one patient and *Klebsiella pneumonia* in two patients (Table 3).

Table 3: Frequency of various pathogens causing surgical site infection.

Organisms isolated	No. of patients
Staphylococcus aureus	1
Klebsiella pneumonia	2

DISCUSSION

Surgical site infection remains the biggest threat to a successful surgery. Despite antibiotics, SSI is still an on-going burden for both the patients and the healthcare systems in terms relative to the morbidity, mortality, duration of stay and economic cost.

With great advancement in strict asepsis and hygiene followed during surgeries and in post-operative management there was a question of debate whether prophylactic antibiotics were really warranted in the clean surgical and clean contaminated surgical cases. This fact was also supported by a study done by Vaze et al who showed no statistical significant difference in post-operative wound infection among those who received single dose of prophylactic antibiotic to those without antibiotics.[8]

But however some hospitals were flooded with patients and innumerable number of surgeries happen and there are high turnover of patients, there are chances that even with utmost care there might be a risk of developing post-operative infections. A number of studies were done comparing placebo with prophylactic antibiotics and it was concluded that antibiotics do have a role in prevention of infection.[9]

The success of antibiotic prophylaxis depends on many factors like antibacterial spectrum of the drug, timing of initiation and the duration of therapy. The chosen drug should have targeted spectrum at the critical moment, at the correct site and in sufficiently high concentration to

prevent contamination of the field by microorganisms. Since we cannot predict the exact time when an infection might occur, the chosen drug must cover the entire site for a period of more time, hence antibiotics with a longer half-lives are preferred. There are several studies conducted on the choice of antibiotics and timing of use of antibiotics. Most of the studies are of opinion that first dose are given 30 to 60 minutes before the surgery and antibiotics with longer duration of action be selected.[10]

Chambers et al in 2001 in their study suggested that first generation cephalosporin, cefazolin was the drug of choice and preferred over second and third generation antibiotics for general surgical prophylaxis.[11]

In our study, a total of 100 patients who underwent various types of clean surgeries were included. Cefazolin with broader spectrum and longer half-life as single dose intravenously for prophylaxis. Our study showed that the commonest surgery performed was hernioplasty, in 50% of patients while compared to study conducted by Ranjan et al showed hernioplasty was the commonest surgery which was found in 27% of patients, with antibiotic prophylaxis.[12]

In general, the occurrence of SSI has been estimated as 5% and 20% for clean surgery and dirty surgery respectively. In our study we found an incidence rate of 3% similar to other studies like Rayamajhi et al, Suchithra et al, Kakati et al.[13-15]

Our study showed an increase in the occurrence of SSI in patients who are of age 50 years and above when compared to study conducted by Rayamajhi et al showed similar results of SSI in the patients of similar age groups.[15]

The study conducted by Alok et al showed the occurrence of SSI in patients of age 40 years and above. In our study, all patients who developed SSI were majority of males as like observed in study conducted by Rayamajhi et al in which there was predominance among males with incidence of 2.9%. Another study in India done by Kamat et al showed an incidence of 33.8% in males.[16] This fact can be also being due to the increased incidence of hernia in male population, contradicting the above finding a study done by Ranjan et al showed an increase in incidence of SSI among females with incidence rate of 25%. They attributed this increased incidence in females to anemia, poor nutritional factors and increased subcutaneous fat which may favor infection. This finding was also seen in a study done by Clark et al which showed an increased occurrence of wound infection among the females. Our study showed that all SSI was predominant in hernioplasty group. This was the common surgery performed similar to an observation by Ranjan et al.[12]

Our patients were followed up on POD3 and 5 and at 2 weeks and 1 month post-surgery. In our study SSI developed on post-operative day 3 compared to the study conducted by Madhu et al which showed SSI was noticed on POD 5 at first instance.[17] All patients in our study developed superficial SSI which is in contrast to the study conducted by Aufenacker et al where there was 0.3% incidence of deep infection.[18]

In many studies like Ranjan et al, Rayamajhi et al, Aufenacker et al the commonest organism found from SSI were staphylococcus aureus.[12,15,18] Our study showed that the common organism found from SSI were *Klebsiella pnuemonia*, which was found in two out of three total patients who had SSI in our study (Table 4).

Table 4: Incidence of SSI among different studies.

Study name	Total study patients (received single dose antibiotics)	Number of SSI	Incidence of SSI
Our study	100	3	3%
Ranjan et al[12]	100	10	10%
Madhu et al[17]	50	3	6%
Rayamajhi et al[15]	100	3	3%
Aufenacker et al[18]	504	8	1.6%
Ahn et al[19]	48	3	6.3%
Ali et al[20]	121	7	5.78%
Mehrabi et al[21]	237	6	2.53%

This study has some limitations. Only 100 cases were included in this study which is limited numbers. Randomized control trail will be effective in comparing the effectiveness of single dose preoperative antibiotic prophylaxis.

CONCLUSION

This study concludes that single dose pre-operative antibiotic which injection cefazolin has advantage in prevention of SSI and it is cost effective for patient who undergoing clean elective surgery. Most common bacteria isolated from surgical site infection constitute the normal flora of the skin. However, only a study with more sampling would validate our results.

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