



A STUDY TO COMPARE THE EFFECT OF PRE-OPERATIVE SINGLE DOSE ANTIBIOTIC PROPHYLAXIS AND CONVENTIONAL ANTIBIOTIC COVERAGE IN CLEAN AND ELECTIVE SURGERIES

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ABSTRACT

Background: The objective of the study was to compare the effectiveness of pre operative single dose antibiotic prophylaxis and conventional antibiotic coverage in clean and elective surgeries. Surgical site infection is defined as the development of microorganisms in a surgical incision site within the skin and subcutaneous fat, musculo-fascial layers or an organ or cavity. Surgical site infection is a common health care associated infection that causes significant postoperative morbidity and mortality. This study aims to compare the effectiveness of single dose pre operative antibiotic prophylaxis to prevent surgical site infections in suitable surgical patients in the interest of promoting cost effective surgical practice as well as reducing the development of bacterial resistance to antimicrobial agents.

Methods: This comparative prospective study was conducted on 100 individuals admitted to SVRRGGH, TIRUPATI, with the diagnosis requiring clean elective surgeries like inguinal hernia (all types undergoing mesh repair), hemi/total thyroidectomy and others for a period of one year . They were divided into 2 groups .Group A (receive single dose of inj.ceftriaxone 1gm just before skin incision) and Group B (receive post operative inj Ceftriaxone for 5 days. In this study, the surgical site infections is assessed following surgery.

Results: The occurrence of surgical site infection is comparatively less in the study group (those who received pre operative antibiotic prophylaxis) than that of the control group (multiple dosing of post operative antibiotic treatment).

CONCLUSION: The effectiveness of pre operative antibiotic prophylaxis is more than multiple post operative antibiotic treatment in preventing surgical site infection.

Keywords: Surgical site infection, pre operative antibiotic prophylaxis, wound healing.

INTRODUCTION

The Centre for Disease Control and Prevention (CDC) defines surgical site infection (SSI) as the development of microorganisms in a surgical incision site within the skin and subcutaneous fat (superficial), musculo-fascial layers (deep), or an organ or cavity(1). Surgical site infection is a common health-care-associated infection that causes significant postoperative morbidity and mortality. The introduction of antibiotics in the twentieth century resulted in significant

improvements in surgical outcomes. Several surgical centres in many countries have adopted the practise of using a “single dose pre-operative prophylactic antibiotic(s)” to prevent surgical site infections in suitable surgical patients in the interest of promoting cost-effective surgical practise as well as reducing the development of bacterial resistance to antimicrobial agents(2).

With the fear of developing wound infection after surgery we used to administer antibiotics for a period of 7-10days even in clean and clean contaminated cases. This is not only expensive but also lead to hospital acquired infection and resistance to not only that particular antibiotic but also other antibiotics of the same group. There is no evidence that administration of postoperative doses of an antimicrobial agent provides additional benefit, and this practice should be discouraged as it is costly and is associated with increased rates of microbial drug resistance.(3)

It is important to emphasize that surgical antibiotic prophylaxis is an adjunct to, not a substitute for, good surgical technique. Numerous clinical studies have clearly shown that appropriately timed “single shot” prophylaxis is as effective multiple-dose prophylaxis(4).

Keeping in view the value of prophylactic antibiotics in world literature, this study was undertaken to evaluate as its place in the hospital to minimize great economic loss both in cost and staff-working hours, to the person as individual and the nation as a whole. Surveillance of surgical site infections has been shown to be an effective preventive measure(5).

To produce a clinically and statistically significant improvement in SSI rates, a multidisciplinary team is required. Strategies for preventing SSI aid in lowering the patient’s risk, morbidity, mortality, length of hospital stay, and cost savings for healthcare institutions(6). Antimicrobial prophylaxis is one of these measures that has been shown to be effective in reducing the risk of surgical site infections.(7)

This study aimed to fill that lacunae and there by aid the gradual shift away from over reliance on antibiotics in prevention of SSI especially clean and clean contaminated wound, so that we can prevent rapidly development of resistance against antibiotics, prolonged hospital stays and drug induced complications(8).

The aim of study was to assess the efficacy and advantages of single dose preoperative antibiotic administration versus conventional postoperative antibiotic therapy in preventing wound infection, to study the bacteriology of wound infection and to study cost efficacy of both regimens.(9)

Material and methods

This is a hospital based prospective study conducted in the department of General Surgery for a period of one year from June 2021 to June 2022. The eligible 100 subjects were divided into 2 groups.

Group A - who are receiving pre operative antibiotic prophylaxis.

Group B - those who are receiving multiple doses of post operative treatment.

Inclusion criteria

1. Both male and female patients above 18 years of age.
2. Patients undergoing all clean, elective surgeries.

Exclusion Criteria:

1. Emergency cases.
2. Patients with hernia complications.
3. Patients with prior infection at surgical site.
4. Patients taking steroids.
5. Patients with severe co- morbid illness.
6. Immunocompromised status.

FOLLOW UP:

The surgical site was inspected daily from 2nd postoperative day onwards based on the following criteria for SSI.

SSI SURVEILLANCE CRITERIA:

1. Evidence of purulent discharge.
2. Evidence of erythema, if present, noting its extent beyond the wound edges.
3. A wound which has been left opened and left to heal by secondary intention.
4. Wound dehiscence.

If there was no occurrence of SSI, sutures were removed on 7th Post op day at discharge. In patients who have SSI, culture and sensitivity test was done and appropriate antibiotics were given. If patient has wound gapping, thorough wound debridement done following which secondary suturing done.

DATA COLLECTION AND ANALYSIS

Following data were collected,

1. Patient demographic profile.
2. Clinical type in case of hernia, hydrocele, fibroadenoma, goitre and varicose vein.
3. Biochemical parameters.
4. ASA grade.
5. SSI and its management (additional antibiotic).
6. Hospital stay.

STATISTICAL ANALYSIS:

Analysis of data were done with prime objective to state that if single dose preoperative CEFTRIAXONE is therapeutically and cost effectively more beneficial than multiple antibiotics received post operatively in reducing SSI in elective clean class 1 surgical cases.

Differences between groups in distribution of parameters were tested using CHI-SQUARE TEST and P value <0.05 was considered statistically significant.

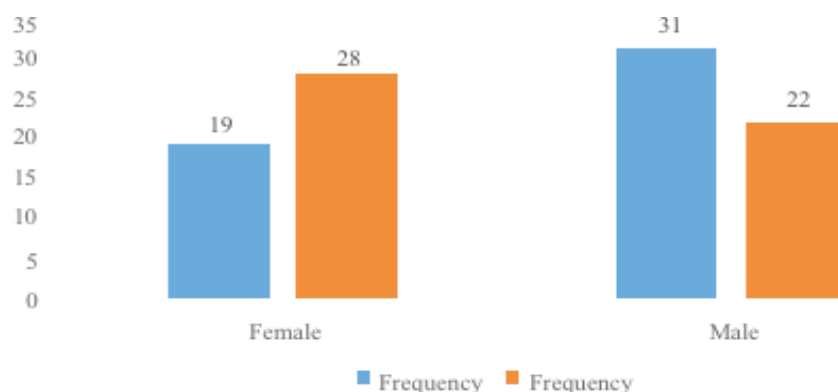
RESULTS

In the current study, total patients were divided into two groups one was control group and other one was study group. Among study group 38% and 62% female and male respectively. Among control group 56% and 44% female and male respectively.

Table-1: Distribution of study population according to Sex

S.No	Sex	Frequency		Total
		Study Group	Control Group	
1	Female	19	28	47
2	Male	31	22	53
3	Total	50	50	100

In the current study, 47% and 53% Female and male respectively



Distribution of study population according to Age

- In the current study, among control group average age was 41.98 ± 12.82 years and among study

group average age was 41.84 ± 11.99 years.

Table-2: Distribution of study population according to Age

S.No	Age	Frequency		Total
		Control Group	Study Group	
1	<21	3	1	4
2	21-30	7	10	17
3	31-40	11	9	20
4	41-50	16	22	38
5	51-60	11	4	15
6	61-70	2	4	6
	Total	50	50	100

Distribution of study population according to Diagnosis

- In the current study, among control group majority were diagnosed with fibroadenoma (22%) and least common diagnosis was Multinodular goitre (6%).
- Among study group commonest diagnosis was inguinal hernia 30% and least common diagnosis was Multinodular goitre (6%), Epigastric hernia (6%)

Table-3: Distribution of study population according to Diagnosis

S.No	Diagnosis	Frequency		Total
		Control Group	Study Group	
1	Epigastric Hernia	4	3	7
2	Fibroadenoma	11	9	20
3	InguinalHernia	10	15	25
4	MNG	3	3	6
5	Solitary thyroid nodule	5	5	10
6	Umbilicalhernia	3	6	9
	Total	50	50	100

Distribution of study population according to type of surgery under gone

- In the current study, among control group majority were under gone open meshplasty surgery (34%) and least common performed surgery was subtotal thyroidectomy 6%. Among study group commonest surgery performed was open meshplasty surgery (48%) and least common performed surgery was subtotal thyroidectomy 6%

Table-4: Distribution of study population according to type of surgery under gone

S.No	Surgery	Frequency		Total
		Control Group	Study Group	
1	Excision and biopsy	11	9	20
2	Hemi Thyroidectomy	5	5	10
3	Open mesh plasty	17	24	41
4	subtotal Thyroidectomy	3	3	6
5	Trendeleburg operation	14	9	23
	Total	50	50	100

Distribution of study population according to duration of hospital stay

- In the current study, among control group average hospital stay was 6.2 ± 3.2 days and among study

group average hospital stay was 5.1 ± 2.16 days. The above table clearly says that study group has less days of hospital stay comparing with control group hospital stay.

Table-5 : Distribution of study population according to duration of hospital stay

S.No	Duration of Hospital stay	Frequency		Total
		Control Group	Study Group	
1	<6	23	31	54
2	6-7	15	10	25
3	8-9	2	8	10
4	10-11	4	0	4
5	12-14	6	1	7
	Total	50	50	100

Distribution of study population according to post-operative pain

- In the current study, among control group 30% and 70 had post-operative pain and no pain respectively. Among study group, 12% and 88% had post-operative pain and no pain respectively. There is a significant difference between control group and study group and the P value was 0.027.

Table-6: Post-operative Pain

S.No	Post Operative Pain	Frequency		Total	P Value
		Control Group	Study Group		
1	Present	15	6	19	P=0.02
2	Absent	35	44	81	
	Total	50	50	100	X ² =4.88

Distribution of study population according to post-operative fever

- In the current study, among control group 22% and 78 had post-operative fever and no fever respectively. Among study group, 6% and 94% had post-operative fever and no fever respectively.

Table-7: Post-Operative fever

S.No	Post-Operative Fever	Frequency		Total	P value
		Control Group	Study Group		
1	Present	11	3	14	P=0.021
2	Absent	39	47	86	
	Total	50	50	100	X ² =5.31

Distribution of study population according to SSI

- In the current study, the control group had received multiple dosing of antibiotics post operatively. The study group received a single dose of Inj CEFTRIAXONE preoperatively. On comparison, it was found that the study group had a highly significant reduction in the occurrence of SSI compared to the control group.

Table 8 : Distribution of study population according to SSI

S.No	SSI	Frequency		Total	P Value
		Control Group	Study Group		
1	Present	13	3	16	P=0.05
2	Absent	37	47	84	
	Total	50	50	100	X ² =10.98

DISCUSSION

The primary aim of prophylactic antibiotics is to reduce the infection and thereby reduce morbidity and mortality(10). It is used to reduce the number of microbes that enter the tissue or body cavity

before initiation of certain specific types of surgical procedures. For the effective use of antibiotic against the pathogens, it should be selected as least toxicity.

A single dose of antibiotic should be given intravenously 30-60 min preoperatively. If operation lasts longer than 4 hours or more, a second dose should be administered(11). Use of single dose and multiple dose antibiotic depend on the outcome of surgery and the surgeon himself. When consequences of infection would be usually severe, use of antibiotic is appropriate. Increasing evidence shows that a single preoperative dose of SAP may be non inferior to the additional post operative multiple doses for the prevention of SSI.

A Total 100 Patients were included in the study and divided in to control Group and study group. Control Group received multiple dosing of antibiotics post operatively. The study group received a single dose of Inj.Ceftriaxone preoperatively. On comparison, it was found that the study group had significant reduction in the occurrence of SSI compared to control group. All study population are clean wound. This proves the point that a single dose of antibiotic preoperatively is much more effective than multiple postoperative dosing in control of surgical site infection.

Distribution of study population according to Diagnosis

In the current study, among control group majority were diagnosed with fibro adenoma (22%) and least common diagnosis was Multinodular goitre 6%. Among study group commonest diagnosis was inguinal hernia 30% and least common diagnosis was Multinodular goitre 6%, Epigastric hernia 6%.

Distribution of study population according to type of surgery undergone

In the current study, among control group majority were under gone open mesh plasty surgery (34%) and least common performed surgery was subtotal thyroidectomy 6%. Among study group commonest surgery performed was open mesh plasty surgery (48%) and least common performed surgery.

Subramanyam G et al(12) reported Hernioplasty was the most common surgery performed in about 50 cases. Thyroidectomy was the next common in about 17 cases. Among the study population who underwent clean elective surgeries, surgical site infection was seen in 3 cases and 97 cases had no infection. All three cases who acquired surgical site infection were male patients more than 50 years old, 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.

Distribution of study population according to duration of hospital stay

In the current study, among control group average hospital stay was 6.2 ± 3.2 days and among study group average hospital stay was 5.1 ± 2.16 days. This is correlated with other studies. Alex Franklin et al(13) 33reported that the mean hospital stay was 5.96 days in the control group where as it was 3.52 days in the study group.

Naveen et al(14) reported that “the number of patients who had a long duration of hospital stay was significantly higher ($p=0.0004$) in the control group than the study group.

Post operative Pain for study group and Control group.

Among control group 30% and 70 had post-operative pain and no pain respectively. Among study group, 12% and 88% had post-operative pain and no pain respectively. There is a significant difference between control group and study group and the P value was 0.027.

Post-Operative pus culture

All the patients with wound discharge in the study had pus culture and sensitivity done. The predominant grown organism was staph aureus. In the current study, among control group 20% and 80 had post-operative pus culture positive and negative respectively. Among study group, 8% and 92% who had post-operative pus culture positive and negative respectively. There is a significant difference between control group and study group and the P value was 0.13.

CONCLUSION

1. Antibiotic prophylaxis is widely accepted and recommended for surgery as a means of reducing postoperative infectious morbidity.
2. A single dose of antimicrobial prophylaxis will be effective in reducing postoperative infection. Proper aseptic precautions during surgery, sterilisation of the operating room, correction of anaemia before surgery, not after, so that tissue can carry more oxygen and benefit from prophylactic antibiotics
3. As a result, a single dose prophylactic antibiotic will be effective in reducing postoperative infection if the following measures are taken in addition
4. Proper aseptic precautions during surgery
5. The operation theatre must be sterilised properly.
6. Correction of anaemia should be done prior to surgery, not after, so that tissue can carry more oxygen and benefit from prophylactic antibiotics.
7. Improving the patient's nutritional status and raising awareness about personal hygiene.

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REFERENCES

1. Centers for Disease Control and Prevention. Surgical Site Infection (SSI) event web site. Available at: <https://www.cdc.gov/nhsn/pdfs/pscmanual/9pscscsscurrent.pdf>. Accessed November 20, 2020.
2. Cooper L, Sneddon J, Afriyie DK, Sefah IA, Kurdi A, Godman B, Seaton RA. Supporting global antimicrobial stewardship: antibiotic prophylaxis for the prevention of surgical site infection in low- and middle-income countries(LMICs): a scoping review and meta-analysis. *JAC Antimicrob Resist*. 2020 Oct 5;2(3):dlaa070. doi: 10.1093/jacamr/dlaa070. PMID: 34223026; PMCID: PMC8210156.
3. Leuva HL, Khambholja JR, Nayak KK, Shah RC. Role of antibiotics in clean surgeries: prophylaxis v/s. conventional. *Guj Med J*. 2014;69:96-8.
4. Tartari, E., Weterings, V., Gastmeier, P. et al. Patient engagement with surgical site infection prevention: an expert panel perspective. *Antimicrob Resist Infect Control* 6, 45 (2017). <https://doi.org/10.1186/s13756-017-0202-3>
5. Reichman DE, Greenberg JA. Reducing surgical site infections: a review. *Rev Obstet Gynecol*. 2009 Fall;2(4):212-21. PMID: 20111657; PMCID: PMC2812878
6. Van Middendorp JJ, Sanchez GM, Burrige AL. The Edwin Smith papyrus: a clinical reappraisal of the oldest known document on spinal injuries. *Eur Spine J*. 2010 Nov;19(11):1815-23. doi: 10.1007/s00586-010-1523-6. Epub 2010 Aug 10. PMID: 20697750; PMCID: PMC2989268.
7. Schultz GS, Chin GA, Moldawer L, et al. Principles of Wound Healing. In: Fitridge R, Thompson M, editors. *Mechanisms of Vascular Disease: A Reference Book for Vascular Specialists* [Internet]. Adelaide (AU): University of Adelaide Press; 2011. 23. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK534261/>
8. Grey, J.E. and Harding, K.G. (2006) *ABC of Wound Healing*. BMJ Books. Blackwell, Oxford
9. Guo S, Dipietro LA. Factors affecting wound healing. *J Dent Res*. 2010 Mar;89(3):219-29. doi: 10.1177/0022034509359125. Epub 2010 Feb 5. PMID:20139336;PMCID: PMC2903966.

10. Kathju S, Nistico L, Hall-Stoodley L, Post JC, Ehrlich GD, Stoodley P. Chronic surgical site infection due to suture-associated polymicrobial biofilm. *Surg Infect (Larchmt)*. 2009 Oct;10(5):457-61. doi: 10.1089/sur.2008.062. PMID: 19811056; PMCID: PMC2956523.
11. E. Patchen Dellinger, 52 – Surgical Site Infections, Editor(s): Elaine C. Jong, Dennis L. Stevens, Netter's Infectious Diseases, W.B. Saunders, 2012, Pages 295-298, ISBN 9781437701265, [https://doi.org/10.1016/B978-1-4377-0126-1\(https://www.sciencedirect.com/science/article/pii/B9781437701265000525\)](https://doi.org/10.1016/B978-1-4377-0126-1(https://www.sciencedirect.com/science/article/pii/B9781437701265000525))
12. Nasir, Abdulrasheed et al. "Surgical site infection." *Nursing standard (Royal College of Nursing (Great Britain))* : 1987) 28 16-18 (2013): 23 .
13. Gottrup F, Melling A, Hollander DA. An overview of surgical site infections: aetiology, incidence and risk factors. *EWMA journal*. 2005 Sep;5(2):11-5
14. Rubin RH. Surgical wound infection: epidemiology, pathogenesis, diagnosis and management. *BMC Infect Dis*. 2006 Nov 27;6:171. doi: 10.1186/14712334-6-171. PMID: 17129369; PMCID: PMC1687193.