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Study Comparing Preoperative Intra-Incisional Antibiotic Infiltration and Prophylactic Intravenous Antibiotic Administration in Clean and Clean Contaminated Wound for Reducing Surgical Site Infection

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Abstract

Surgical site infections (SSIs) are among the most common causes of nosocomial infection and are associated with increased mortality and postoperative length of stay. The Centre for Disease Control and Prevention (CDC) categorizes wounds into four classes: clean, clean-contaminated, contaminated, and dirty-infected. Antibiotic prophylaxis involves the administration of antibiotics before, during, and sometimes after surgery to prevent SSIs. The timing of antibiotic administration is critical, with guidelines recommending that antibiotics be given within one hour before surgical incision to ensure adequate tissue levels at the time of incision. In summary, antibiotics reduce the bacterial load at surgical sites by directly killing or inhibiting bacterial growth, targeting specific pathogens, preventing biofilm formation, and clearing residual bacteria. These actions help lower the risk of surgical site infections and contribute to better patient outcomes following surgical procedures.

Keywords: Antibiotic, Bacterial Growth, Morbidity, Surgical Site Infections.

Introduction

Despite the advances made in asepsis, antimicrobial drugs, sterilization and operative techniques, post-operative surgical site infection continue to be a major problem. Post-operative surgical site infection seldom causes death, yet it does prove to be an economic burden on the Patient and health system and induce psychological trauma to the surgeon as it robs him of his

hours of dedicated work on operating table and good professional carrier.

During the past two decades, degree of surgical site infections has varied from time to time and place to place. Considering that surgical site infections is quite common in developing countries like ours. Surgical site infection (SSI) is one of the major causes of postoperative morbidity and mortality. Intravenous prophylactic antibiotic administration is widely used to prevent surgical site infection. Another technique is to give intra-incisional antibiotic; it has been proven to provide systemic cover by the absorption of the antibiotic from the incision site. This is primarily because the antibiotic gets fixed to the tissues along the incision and thus the antibiotic is present in a high concentration during time of maximum contamination by incision.

Aim of Study

To study the comparative effectiveness of pre-operative intraincision antibiotic infiltration and prophylactic parenteral antibiotic therapy in reducing surgical site infection

To detect the rate of postoperative Surgical Site Infection in General Surgery Department in S.S.G hospital, Vadodara considering only clean and clean contaminated surgery.

Materials and Methods

Type of study: Prospective Comparative Observational study

Place of study: General Surgery Department of SSG Hospital, Baroda Study starts from approval by institute ethic committee (29th SEPTEMBER 2023 to 30TH JUNE 2024)

Number of patients will be taken 116 in each group.

Sample size has been chosen by using Medcalc. Type 1 & Type 2 error selected are 0.05 & 0.2 respectively

Inclusion Criteria

Clean cases will include (Inguinal Hernioplasty, Excision of breast lump, lipoma excision)

Clean contaminated surgery (Open appendectomy, Open cholecystectomy)

Surgical procedures lasting for not more than 2 hours

Patients aged between 20-70 years will include in this study

Exclusion Criteria

Patients who were immuno-compromised (who were on prolonged steroid therapy, having cancer, on chemotherapy, diabetes mellitus, Auto Immune Disease)

Underage of 20 and above age 70

Patient not giving consent

Sample Size

The present study comprises of total 116 patients among which 58 were taken for intra-incisional and rest 58 taken for intravenous antibiotic. Patient was chosen alternate randomly

Sample Size Determination

Sample size determination done using medcalc calculator using following parameter and gained sample size was of 116.

Study Groups

Group 1: Prophylaxis by preoperative intra-incisional infiltration of the antibiotic. One gram of Cefotaxime diluted in 10 ml of distilled water will be infiltrated along the skin and the subcutaneous tissue in the proposed line of incision, 10 minutes before surgical incision.

Group 2: A single dose of 1 gram of Cefotaxime will be administered intravenously 20 minutes before the surgical incision.

Pre-Operative

• Informed consent taken

• Concerned consultant was informed regarding the inclusion of the case in the study with shaving of surgical site

• Group to get chosen alternate randomly

Intra-Operatively

• All patients were painted with 5% povidone iodine and cleaning with spirit, surgical field was draped properly and aseptic precautions followed.

GROUP A: Prophylaxis by preoperative intra-incisional infiltration of the antibiotic of 100 mg per cm infiltrate. [One gram of cefotaxime diluted in 10 ml of distilled water will be infiltrated along the skin and the subcutaneous tissue in the proposed line of incision, 10 minutes before surgical incision.]

Group B: Dose of 1 gram of cefotaxime will be administered intravenously 20 minutes before the surgical incision.

Post-Operatively

No antibiotic was given.

Analgesics and intravenous fluid as per advice given.

Surgical wound was inspected on D3, D7, and D14 for findings were noted in the chart.

Any other complaint like swelling, discharge, and erythema was enquired. Patient will be called on D90 to look for late surgical site infection in c/o meshplasty.

Statistical Analysis

Isolated erythema had considered as local site reaction.

SSI has been considered as one of the following finding pus discharge or wound dehiscence with or without erythema or swelling.

Data analysis done; null hypothesis was checked.

Medcalc software was used for data analysis.

Result and Analysis

Table: 1 Comparison of age between intravenous and intraincisional study population

	Intra-incisional	Intravenous	p-value
Age	43.55±11.57	44.59±10.61	0.6170

In the present study, we have not observed significant difference in mean age between Intra-incisional and Intravenous group. (p=0.6170)

Figure: 1 Age group Distribution

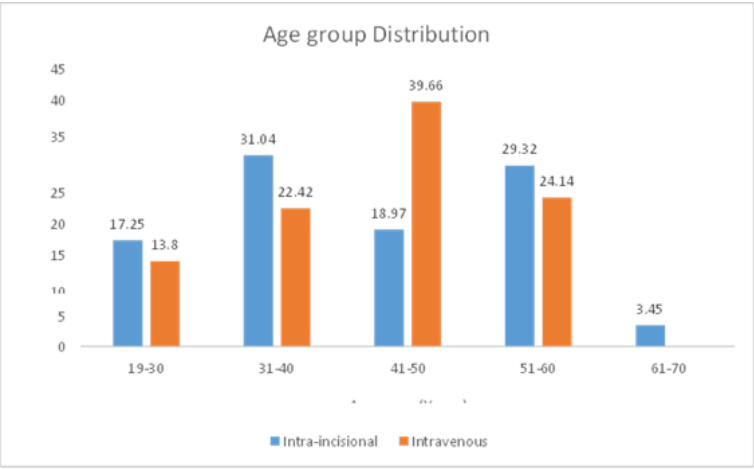

Table: 2 Comparison of development of SSI among two groups in different age group

Age group	Intra-incisional		Intravenous		Fisher exact test	Total
	Total Number	SSI Present (%)	Total Number	SSI Present (%)	p-value	
19-30	10	1(10%)	8	2(25%)	0.5588	18
31-40	18	4(22.2%)	13	2(115.3%)	1.00	31
41-50	11	2(18.1%)	23	6(26%)	1.00	34
51-60	17	1(5.8%)	14	2(14%)	0.5764	31
61-70	2	2(100%)	0	0(0)	0.00	2
Total	58	10(17.2%)	58	12(20.6)	0.8133	116

SSI in both group in all age group range is not statistically significant. (p= 0.8133)

Figure: 2 Age group Distribution of SSI

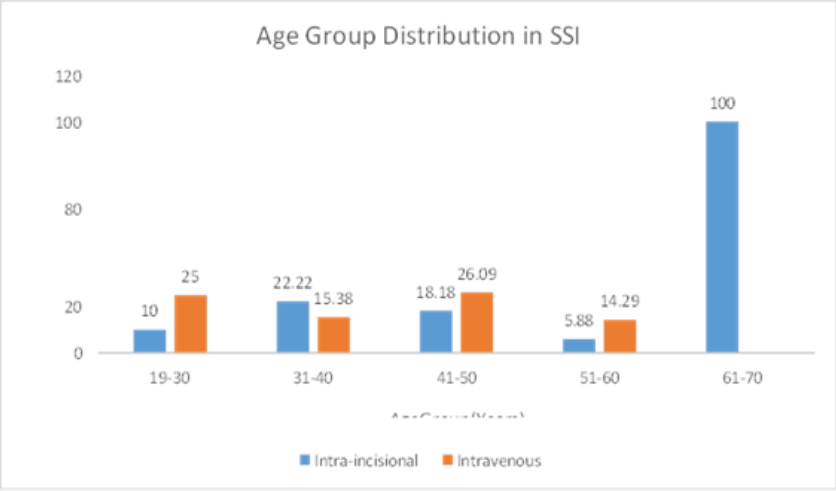

Table: 3 Genders

Gender	Intra-incisional	Intravenous	Total
Female	18(31.04)	12(20.69)	30
Male	40(68.97)	46(79.32)	86
Total	58(100)	58(100)	116
p-value:0.2030			

In Intra-incisional group 18 female and intravenous group 12 female In Intravenous group 40 male and intravenous groups 46 male were taken.

Figure: 3 Gender Distribution in group

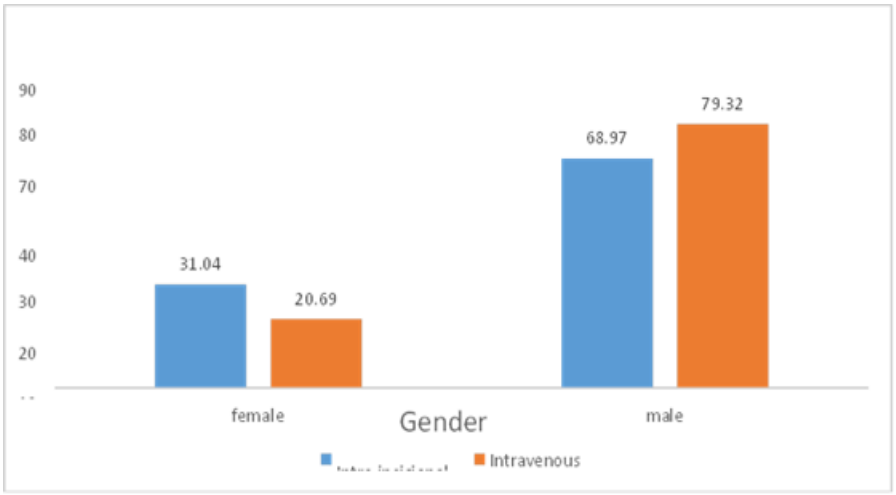

Table: 4 Body Mass Index

BMI group	Intra-incisional		Intravenous		Fisher Exact test
	Total case	SSI present	Total case	SSI present	p-value
<18.5	6	1(16.6%)	1	0(O)	1.00
18.5-24.9	38	8(21%)	36	8(22.2%)	1.00
25-29.9	10	0(0%)	13	3(23.O8%)	0.2292
>29.9	4	1(25%)	8	1(12.5%)	1.00
Total	58	10(17.2%)	58	12(20.69%)	0.8133

There is no statistically significant difference found in SSI among both groups in View of BMI.

Figure: 4 Intra-incisional groups

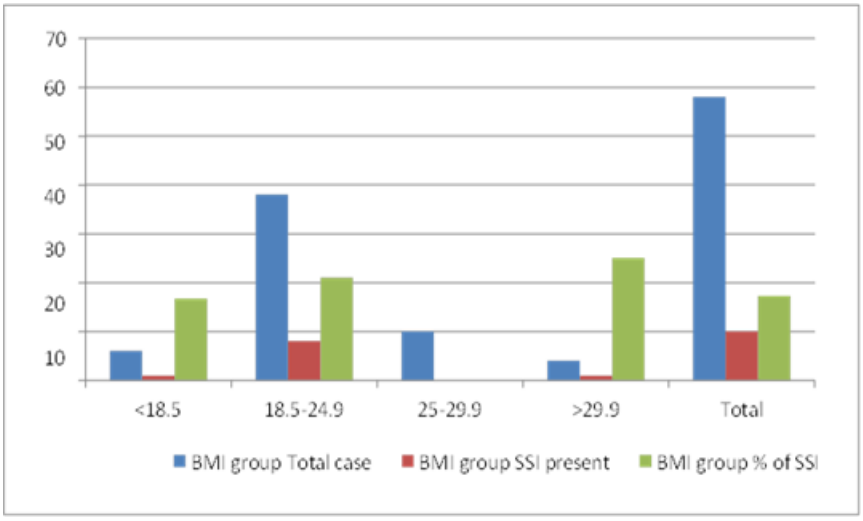

Figure 4 is graphically represented as BMI distribution with SSI in Intra-incisional group

Table: 5 SSI According To Operative Procedure

Surgery	Intra-incisional		Intravenous		Total
	No of case (%)	SSI present (%)	No of case (%)	SSI present (%)	
Appendectomy	1(1.73)	0(0)	3(5.18)	2(66.67)	4
Breast lumpectomy	8(13.8)	0(0)	11(18.97)	0(0)	19
Inguinal hernioplasty	24(41.38)	4 (16.67)	28(48.28)	4(14.29)	52
Lipoma excision	25(43.11)	6(24)	14(24.14)	6(42.86)	39
Open cholecystectomy	0(0)	0(0)	2(3.45)	0(0)	2
Total	58(100)	10 (17.24)	58(100)	12 (20.69)	116

Among 58 patients, Intra-incisional technique was used in following surgery: Appendectomy (1.73%), Breast lumpectomy (13.8%), inguinal hernioplasty (41.38%), and lipoma excision (43.11%). Out of these operated surgery patients, SSI was only observed in inguinal hernioplasty and lipoma excision. Among 58 patients Intravenous technique was used in following surgery: Appendectomy (5.18%), Breast lumpectomy (18.97%), inguinal hernioplasty (48.28%), lipoma excision (24.14%) and open cholecystectomy (3.45%). Out of these operated surgery patients, SSI was only observed in Appendectomy, Inguinal hernioplasty and lipoma excision.

Table: 6 Suturing Technique

Type of suturing technique	Intra- incisional	Intravenous	Total
subcuticular	8(13.8)	10(17.25)	18
Vertical mattress	50(86.21)	48(82.76)	98
Total	58(100)	58(100)	116

In the present study, 13.8% patients were sutured through subcuticular suture, and remaining 86.21% patients were sutured through vertical mattress suturing among intra-incisional therapy. In intravenous therapy, we took subcuticular and vertical mattress suture 17.25% and 82.76% respectively.

Table: 7 Comparison of symptoms on Day 3 follow-up

Day3	Intra-incisional		Intravenous		Fisher exact test(p- value)
	No	Yes	No	Yes	
Pus discharge	54(93.10)	4(6.9)	56(96.56)	2(3.45)	0.6791
Erythema	50(86.21)	8(13.8)	56(96.56)	2(3.45)	0.0941
Wound dehiscence	58(100)	0	58(100)	0	0.00
Swelling	51(87.94)	7(12.07)	56(96.56)	2(3.45)	0.1623

On the post operate Day 3 pus discharge, erythema, swelling were more seen in Intra-Incisional group as compared to Intravenous group. But it is not statistically significant. (p-value of pus discharge (0.6791), erythema (0.0941) and swelling (0.1623)

Table: 8 Comparison of symptoms on Day 7 follow-up

Day7	Intra-incisional		Intravenous		Fisher exact test (p-value)
	No	Yes	No	Yes	
Pus discharge	57(98.28)	1(1.72)	55(94.83)	3(5.17)	0.6183
Erythema	55(94.83)	3(5.17)	47(81.03)	11(18.97)	0.0256
Wound dehiscence	58(100)	0	56(96.56)	2(3.45)	0.4957
Swelling	56(96.56)	2(3.45)	50(86.21)	8(13.8)	0.0941

On the post operate Day 7 pus discharge, erythema, swelling, wound dehiscence were more seen in Intravenous group as compared to Intra-Incisional group. But pus discharge, swelling, wound dehiscence were not statistically significant. (P-value of pus discharge (0.6183), and swelling (0.0941), wound dehiscence (0.4957).Erythema is statistically significant. (0.0256)

Table: 9 Comparison of symptoms on Day 14 follow-up

Day14	Intra-incisional		Intravenous		Fisher exact test(p-value)
	No	Yes	No	Yes	
Pus discharge	57(98.28)	1(1.72)	54(93.10)	4(6.90)	0.3640
Erythema	56(96.56)	2(3.45)	54(93.10)	4(6.90)	0.6712
Wound dehiscence	58(100)	0(0)	55(94.83)	3(5.17)	0.2435
Swelling	58(100)	0(0)	57(98.28)	1(1.72)	0.5000

On the post operate Day 14 pus discharge, erythema, swelling, wound dehiscence were more seen in Intravenous group as compared to Intra-Incisional group. But it is not statistically significant. (P-value of pus discharge (p= 0.3640), erythema (0.6712) and swelling (0.5000), wound dehiscence (p= 0.2435)

Table: 10 Day 90 follow-up in patient operated for Hernioplasty

	Intra-incisional		Intravenous		
	No of case (%)	SSI Present (%)	No of case (%)	SSI Present (%)	x2 test (p-value)
Open Hernioplasty	24	0	28	0	0.812

In present study, we treated 24 cases of hernioplasty with intraincisional antibiotics, while 28 cases treated with intravenous antibiotics. In both no any surgical site infection was found on post operate day 90.

Table: 11 Management

Management	Intra- incisional	Intravenous
Regular dressing of non- infectious wound	48	45
Dressing and Oral Antibiotic	10	9
Secondary Closer	0	4
Total	58	58

From 58 each from groups, 48 in Intra-incisional and 45 in intravenous group had not any surgical site infection. Rest all had surgical site infection among which 4 in intravenous required secondary closer of wound. 10 in intra-incisional and 9 in intravenous groups required higher antibiotic and dressing.

Discussion

The present study investigated the differences in outcomes between intra-incisional and intravenous prophylactic antibiotic techniques. The primary focus was on the incidence of surgical site infections (SSI) and other related complications over various follow-up periods.

Age and Gender

Age and Gender Distribution The results indicate no significant difference in the mean age between the two groups (p=0.6170), nor in the age group distribution. This suggests that age was not a determining factor in the effectiveness of either prophylactic technique. Similarly, gender distribution did not significantly differ between the groups in terms of technique used (p=0.2030)

Body Mass Index

Body Mass Index (BMI) BMI did not significantly influence the choice of prophylactic technique This suggests that BMI, a commonly considered factor in surgical outcomes, might not be as critical in determining the effectiveness of the prophylactic method in preventing SSIs.

Type of Surgery and Suturing Technique

Type of Surgery and Suturing Technique for Different types of surgeries were associated with varying rates of SSI. Notably, SSIs were observed primarily in patients undergoing inguinal hernioplasty and lipoma excision, regardless of the prophylactic technique used.

Complications

Complications Observed Over the time and followed up with patients on days 3, 7, 14, and 90 post-operation. In the present study of Day 3 follow up, SSI was more found in intraincisional technique.

But pus discharge (p = 0.6791), erythema (p = 0.0941) and swelling (p= 0.1623) were not statistically significant. In the present study of Day 7 follow-up, SSI was more found in intravenous technique. But pus discharge (p = 0.6183), swelling (p = 0.0941) and wound dehiscence (p= 0.4957) were not statistically significant.

Erythema (p=0.0256) was significantly associated with Intravenous technique compared to other technique. In the present study of Day 14 follow-up, SSI was more found in intravenous technique. But pus discharge (p= 0.3640), wound dehiscence (p= 0.2435) , swelling (p=0.5000)and erythema (p=0.6712) were not statistically significant. DISCUSSION 47 In present study, we treated 24 cases of hernioplasty with intraincisional antibiotics, while 28 cases treated with intravenous antibiotics.

In both no any surgical site infection was found on post operate day 90. These results suggest that while early post-operative complications might differ between techniques, the long-term outcomes are similar. Systemic Complications Systemic complications were rare, with a small percentage of patients in the intravenous group experiencing diarrhoea.

Microbial Findings

The microbial analysis revealed that a variety of organisms, including Staphylococcus aureus and Klebsiella, were associated with SSIs in both techniques, but no significant differences were observed between the groups. This finding implies that while the type of bacteria causing SSIs is critical, the prophylactic

technique does not necessarily influence the type of organism that causes the infection.

Management

The management of SSIs varied, with most cases managed by dressing alone, and a few requiring more intensive interventions such as secondary closure, particularly in the intravenous group. Here findings align with those of Dogra et al. (2013), who also reported a lower rate of SSIs with intraincisional antibiotic infiltration.

However, the magnitude of reduction observed in our study was more pronounced, likely due to differences in sample size and surgical procedures, or the specific antibiotics used. The increased efficacy observed in our study compared to Patil & Uppin (2018)15 could be attributed to the use of a different antibiotic or variations in surgical techniques.

The shorter operative times in our cohort may have also contributed to the lower SSI rates. The findings suggest that intraincisional antibiotic infiltration could be a more effective strategy in reducing SSIs, particularly in settings where intravenous access is challenging or when targeting specific bacterial strains prevalent in surgical environments.

Conclusion

Overall, this study provides robust evidence supporting the use of intraincisional antibiotic infiltration as an effective measure for reducing SSIs, offering a potential improvement over the traditional intravenous route.

Overall, the study concludes that there is no significant difference in the effectiveness of intra-incisional versus intravenous prophylactic techniques in preventing SSIs The choice of prophylactic technique should therefore be based on other factors, such as patient preference or surgical convenience, as neither technique offers a distinct advantage in preventing SSIs.

Limitation and Recommendation

Limitation

1. The study was done in small number of group
2. Only class 1 and 2 wound classification group were taken, no dirty wound taken for study groups. So the efficacy is not researched over this class of wound.
3. Case of diabetes and immune-compromised patient had not taken. So, the further studies to be needed.

Future research areas may include

1. Exploring the potential use of cefotaxime in combination with other antibiotics or adjuvant to enhance efficacy, broaden the spectrum of activity, or combat resistant bacteria.
2. Studying the pharmacokinetics and pharmacodynamics of cefotaxime when delivered through different routes and formulations to optimize antimicrobial effectiveness while minimizing side effects.

It's essential for healthcare providers and researchers to stay informed about the latest developments in antibiotic usage, infection prevention, and emerging resistance patterns to guide clinical practice and contribute to the future of antimicrobial therapy.

POD 7 of Lipoma Excision Over Right Forearm With Use Of Intraincisional Antibiotic Tehnique (Clean Wound)

Pod 7 of Appendicetomy with Use of Intra-Incisional Antibiotic Tehnique (SSI)

POD 14 OF B/L Inguinal Hernia Repair with Use of Prophylactic Intravenous Antibiotic Technique

POD 14 of Right Inguinal Hernia Repair with Use of Prophylactic Intra-Incisional Antibiotic Technique (Clean Wound)

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