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Study of the Incidence of Postoperative Wound Infection in Orthopaedic Surgery

Authors
Dr Zeeshan Jawed, Dr Rajesh Kumar, Dr Ajay Kumar Mahto,
Dr Himanshu Kumar Hemant, Dr Samar Hannan

Abstract
Infection at the surgical site can be devastating in individuals who have had orthopaedic surgery, as it can lead to a longer hospital stay and other consequences. A significant burden on the health-care system and patients in terms of mortality, morbidity. After silent bacteriuria, surgical site infections are the second most prevalent hospital acquired illness.

Methods: *Study conducted in the department of orthopaedics, Katihar Medical College & Hospital. During the study period July 2019 to July 2020. A total of 100 patients underwent elective Orthopaedic surgeries was included in the study. The incidence of postoperative wound infections and the toll it taken on Orthopaedic surgeries by evaluating the effectiveness of usage of preoperative and postoperative systemic antibiotics, the role of sterile measures such as scrub suits, masks, sterile gloves, gowns, drapes and operation theatre environments.*

Results: *The mean pre-operative stay in the SSIs Absent group was 3.05±0.94 days, compared to 1.16±0.40 days in the SSIs Present group, which is statistically significant (p = 0.05).The surgical site infection findings of gram positive & gram negative bacteria was isolated 2 (33.3%) cases had E. Coli and4 (66.7%) cases had Staphylococcus aureus respectively. Showed the sensitivity pattern of gram positive & Gram Negative bacteria. piperacillin and tazobactam were more sensitivity in respect of Staphylococcus aureus & E. Coli.*

Conclusion: *Furthermore, many surgical techniques are not standard, and a wide range of perioperative conditions will necessitate deviations from established preventive protocols. According to my prospective investigation of antibiotic prophylaxis, prophylactic antibiotic regimens should be provided for a wide range of surgical operations. The range of pathogenic bacteria and the degree of antibiotic resistance varied significantly amongst hospitals.*

Introduction

Many factors influence surgical wound healing and determine the risk of infection as well as the rate of infection.[1] The amount of bacterial load is the most significant risk factor,[2] but this risk has been lowered because to contemporary surgical procedures and the use of prophylactic antibiotics.

Many studies have published infection rates in the four surgical classes (clean, clean-contaminated, contaminated, and dirty wounds), but most literature refers to Cruse and Foord's work as a baseline for infection rates.[3] Prior to the widespread use of prophylactic antibiotics, infection rates for clean wounds were 1-2 percent, 6-9 percent for clean-contaminated wounds, 13-20 percent for contaminated wounds, and about 40% for dirty wounds.[4] Infection rates in the most polluted groups have dropped dramatically after the advent of routine prophylactic antibiotic usage. Clean 2.1 percent, clean-contaminated 3.3 percent, contaminated 6.4 percent, and unclean 7.1 percent infection rates were recorded in the US National Nosocomial Infection Surveillance (NNIS) system hospitals.[5] However, depending on the type of operation performed, there is a lot of fluctuation in each class.[6] The surgical technique utilised can have an impact on the infection rate in a variety of ways, such as skin preparation, shaving, and wound closure.

Various bacteria colonise the skin, but Staphylococcus aureus accounts for up to 50% of them. As a result, preoperative preparation should be carried out. The use of a preoperative wash with chlorhexidine has been proven to reduce the bacterial count on skin by 80-90 percent, resulting in less preoperative wound contamination.[7] The impact on SSI incidence, on the other hand, has been more difficult to prove, and it's likely that prolonged washing releases organisms from deeper layers of the skin.

Aims & Objectives

To study the incidence of postoperative wound infections and the toll it takes on Orthopaedic surgeries by evaluating:

- The effectiveness of usage of preoperative and postoperative systemic antibiotics.
- To assess the efficacy of surgical asepsis (surgeons hand scrub, alcohol based agents, antibiotics and shaving) in Orthopaedic surgeries.

Materials & Methods

Type of Study: a prospective study

Place of Study: Study conducted in the department of orthopaedics, Katihar Medical College & Hospital.

Study Period: From July 2019 to July 2020.

Study Population: A total of **100** patients underwent elective Orthopaedic surgeries was included in the study. The incidence of postoperative wound infections and the toll it taken on Orthopaedic surgeries by evaluating the effectiveness of usage of preoperative and postoperative systemic antibiotics, the role of sterile measures such as scrub suits, masks, sterile gloves, gowns, drapes and operation theatre environments, in reducing the surgical site infection and in assessing the efficacy of surgical asepsis (that is surgeons hand scrub, antibiotics used prior to surgery, shaving prior to surgery and use of antibiotics prior to surgery) in Orthopaedic surgeries.

Inclusion Criteria

- Patients aged 18 years and above
- Elective surgeries (major or minor procedures).

Exclusion Criteria

- Immune compromised,
- Patients on long term corticosteroids,
- Immunosuppressive treatment
- Patients with open fractures needing external fixation devices.

In the operating room, aseptic precautions are taken.

All standard aseptic procedures were followed, including the use of autoclaved gowns, drapes, sterile gloves, and equipment. Prior to the operation, a standard surgical scrub was performed for 5 minutes.

Operative

The incision site was painted with spirit and 5 percent povidone iodine. In all cases, surgical principles such as minimal tissue manipulation and maintaining appropriate haemostasis were followed. When drains were required, they were used. Suture material or skin staples were used to close the wound. The suture/staples were covered with betadine ointment or Neosporin ointment, followed by an adhesive dressing.

Care after surgery

Injection In the postoperative period, ceftriaxone was continued. Starting on the third day and continuing until the 12th post-operative day, the wound was examined for any signs of infection. Patients were monitored until they were discharged. A wound swab was sent to the clinical microbiology laboratory for routine culture procedures for patients who met any of the criteria for wound infection.

Statistical analysis

Data was checked for accuracy and completeness then coded and entered into (Statistical Package for the Social Sciences) version 19.0 for analysis. The results presented in frequency tables, cross tabulations and figures. Categorical data are presented as frequency with percentages. Continuous data with normal distribution are presented as mean with standard deviation. *U* t test & Chi-square test has been used to find the significance of study parameters on categorical scale between two groups. A *p*-values <0.05 were considered significant.

Results

Distribution of surgical site infection among study population(n=100)

Surgical site infection	No of cases	Percentage
Present	06	06
Absent	94	94
Total	100	100

We have found in table **No 1.** Total of 100 patients were enrolled for this study, out of 100 cases, 6 cases were found to have infection at the operative site on postoperative day 5. The overall incidence in this study was 6 %.

Age distribution according to incidence

Age group	SSIs Absent		SSIs Present		Total (n=100)	
	No	%	No	%	No	%
18-20	37	100.0	00	00	37	100.0
21-40	31	96.9	01	3.1	32	100.0
41-60	20	83.3	04	16.7	24	100.0
>61	06	85.7	01	14.3	07	100.0
Total	94	94.0	06	6.0	100	100.0
Mean & SD Value	32.91±15.21		50.33±13.29		33.96±15.61	
p Value	0.375(NS)					

It was found incidence in relation to age the maximum number of cases had postoperative infection present among 41-60 years of age group i.e. 4(16.7%) out of 24 cases. And another 1 case present in each group i.e. 21-40 &>60 years of age, respectively. The mean age of SSIs absent group was 32.91±15.21& SSIs present was 50.33±13.29, the average mean age of both groups was 33.96±15.61. There was no significant different in age, p value was 0.375.

Incidence in relation to sex

Sex	SSIs Absent		SSIs Present		Total (n=100)	
	No	%	No	%	No	
Male	64	97.0	02	3.0	66	100.0
Female	30	88.2	04	11.8	34	100.0
Total	94	94.0	06	6.0	100	100.0
Statistical Analysis	Chi-square- 3.0353 P Value- 0.08(NS)					

Incidence in relation to sex females was predominantly high in SSIs present cases. i.e. 11.8%(4cases). Whereas male were 3.0 % (2 cases) respectively. In between the groups the chi-square value was 3.0353 and p value was 0.08(NS).

Incidence in relation to hospital stay

Hospital stay	SSIs Absent		SSIs Present		p Value
	Mean	SD	Mean	SD	
Pre-operative Stay	3.05	±0.94	1.16	±0.40	0.05
Post- Operative stey	8.93	±1.62	18.33	±3.01	0.01

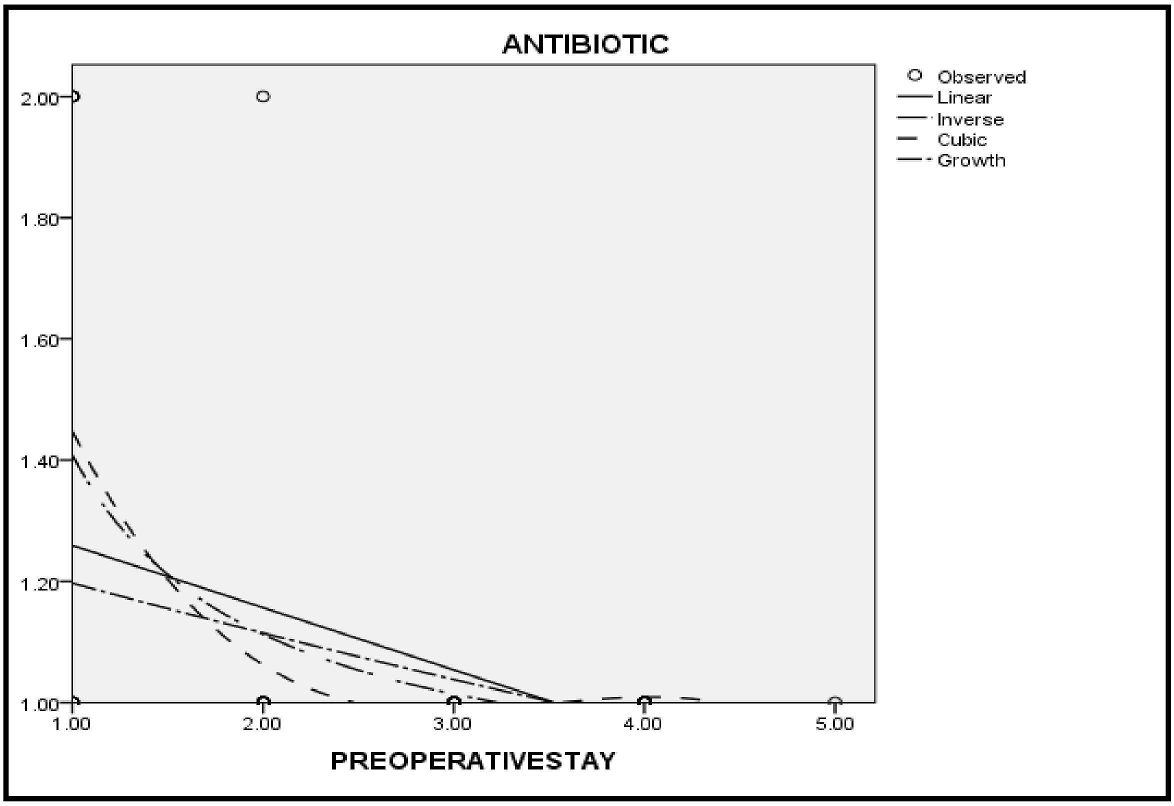
The mean pre-operative stay in the SSIs Absent group was 3.05±0.94 days, compared to 1.16±0.40 days in the SSIs Present group, which is statistically significant (p = 0.05).

In contrast, the SSIs present group spent more time in the hospital than the SSIs absent group. In both groups, the mean and Sd value of hospital stay were 18.33±3.01 and 8.93±1.62, respectively, which were statistically significant. 0.01 was the p value.

Correlation between time of antibiotic administration and Pre-Operative stay

Correlations		
	PRE –OPERATIVE STAY	Antibiotic Administration
Pearson Correlation	1	-.440**
p Value		<0.0001
No cases	100	100
**. Correlation is significant at the 0.01 level (2-tailed).		

Correlation between time of antibiotic administration and Pre-Operative stay

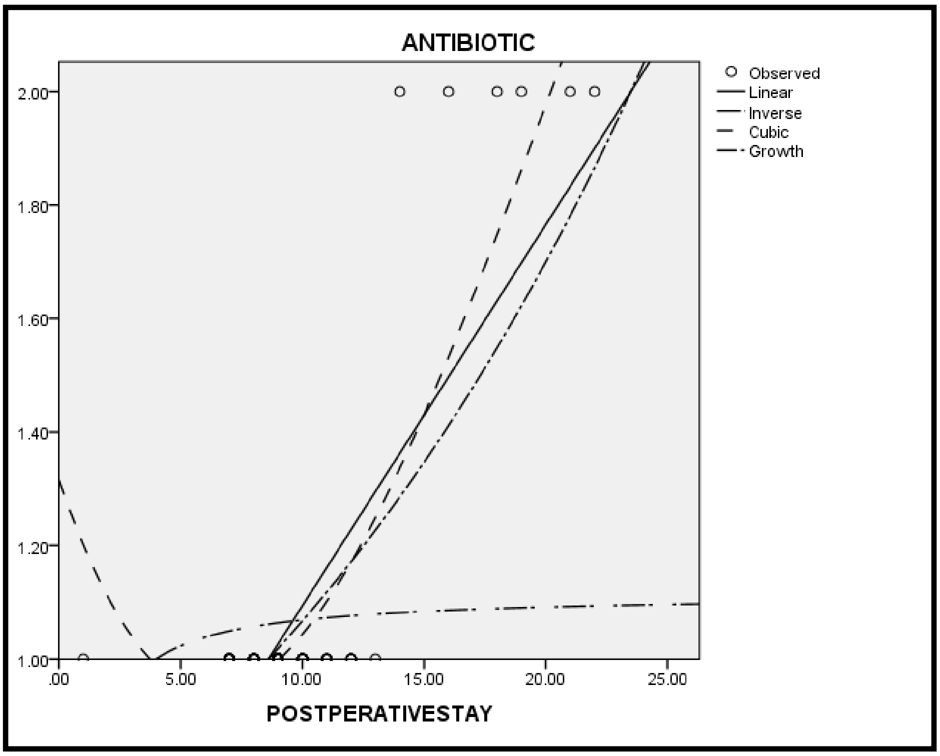


We have found the significant negative Correlation between time of antibiotic administration and Pre-Operative stay, the r value was -.440** and p value was <0.0001.

Correlation between time of antibiotic administration and Post-Operative stay

Correlations		
	POST –OPERATIVE STAY	ANTIBIOTIC ADMINISTRATION
Pearson Correlation	1	.795**
p Value		<0.0001
No cases	100	100
**. Correlation is significant at the 0.01 level (2-tailed).		

Figure: 8. Correlation between time of antibiotic administration and Post-Operative stay



We have found the significant positive Correlation between time of antibiotic administration and Post-Operative stay, the *r* value was .795** and p value was <0.0001.

Surgical Wound Classification Grades (I–IV) as Defined by the CDC (n=4)

Wound Classification	No of Cases	Percentage
Class-I(Clean)	02	33.3
Class-II(Clean Contaminated)	03	50.0
Class-III(Contaminated)	01	16.7
Class-IV(Dirty Infected)	00	00
Total	06	100

We have found according to CDC classification, 50% cases were Class-II (Clean and Contaminated) category, 33.3% cases were Class-I & 16.7% casses were Class-III categories.

Organism Isolated.

Organism Isolated	No of Cases	Percentage
Staphylococcus aureus	04	66.7
E. Coli	02	33.3
Total	06	100

The surgical site infection findings of gram positive & gram negative bacteria was isolated 2 (33.3%) cases had *E. Coli* and 4 (66.7%) cases had *Staphylococcus aureus* respectively.

Sensitivity pattern of gram positive bacteria

Antimicrobial agents	*Staphylococcus aureus (n=4)*		
	S	I	R
Gentamycin (GEN)	4	0	0
Nitrofurantion (NIT)	2	2	0
Ciprofloxacin (CIP)	0	0	4
Teicoplanin (TEI)	0	4	0
Cefoxitin (CX)	0	2	2
Tetracyclin(TE)	2	4	0
Vancomycin (VA)	4	2	0
Piperacillin	6	0	0
Tazobactam	6	0	0

S= SENSITIVE, **I**= INTERMEDIATE, **R**= RESISTANT

This was done by the KIRBY-BAUER Disc Diffusion Method according to the Clinical Laboratory Standards Institute (CLSI guide lines)

Sensitivity pattern of gram negative bacteria

Antimicrobial agents	*Escherichia coli (n=2)*		
	S	I	R
Gentamycin (GEN)	1	1	0
Nitrofurantion (NIT)	1	1	0
Ciprofloxacin (CIP)	2	0	0
Amoxy+Clavulanic (AMX)	0	0	2
Imipenem (IPM)	2	0	0
Amikacin (AK)	1	1	0
Co-Trimoxazole (COT)	2	0	0
Ceftazidime (CAZ)	0	0	2
Cefepime	2	0	0
Piperacillin	2	0	0
Tazobactam	2	0	0

S= SENSITIVE, **I**= INTERMEDIATE, **R**= RESISTANT

This was done by the KIRBY-BAUER Disc Diffusion Method according to the Clinical Laboratory Standards Institute (CLSI guidelines)

Discussion

The current study found a 6.0% incidence rate of surgical site infections. More persons in the operating theatre, contaminated or filthy wounds, and dirty wounds were all determined to be independent risk factors for surgical site infections.

The 41-60 year old age group had the most postoperative infections, accounting for 4 (16.7%) of the 24 cases. There was one more in each age group, 21-40 and >60. The SSIs missing group averaged 32.91±15.21, while the SSIs present group averaged 50.33±13.29; both groups averaged 33.96±15.61. The age difference was 0.375, not significant.

Females were overrepresented in SSI cases. p = 0.08.

The largest incidence of SSIs was found in Spinal Anaesthesia, with 5 instances (8.1 percent). Also, 3.3% (1) of cases required general anaesthesia.

The groups did not differ statistically. In this case, the values were 1.3574 ±0.507.

Our study's incidence rate was higher than that of orthopaedic patients in wealthy nations,[8] but also higher than several emerging nations.[9] The CDC classed 50% of cases as Class-II (Clean and Contaminated), while 25% were classified as Class-I and Class-III. Other studies found greater incidence rates stratified by wound class.[10]In our study, dirty, unclean, and trauma-related wounds may have contributed to surgical site infections. In contrast, increasing surgical site infection rates of clean wounds can be explained by a lack of financial resources, outdated equipment, inadequate operating room ventilation, and infection control methods. Many countries use the NNIS index as a predictor of surgical site infections, despite the fact that certain research found no link between the two.[11] Our study found a strong connection between the NNIS score and surgical site infections.

The mean preoperative stay for the SSIs Absent group was 3.05±0.94 days, compared to 1.160.40 days for the SSIs Present group (p = 0.05).

The SSIs present group was in the hospital longer than the SSIs missing group. The mean and standard deviation of hospital stays were 18.33±3.01 and 8.93±1.62, respectively. p = 0.01.

The growing tendency of short-stay hospitalisation causes the majority of surgical site infections.[12] Compared to the SSIs missing group, the current group took the longest to operate. This compares to 147.50 minutes for the SSIs present group. SSIs absent taken 72.45 min. We found big variances between the participants. P = 0.004

Staphylococcus aureus and gramme negative bacteria were the most common causative agents in previous study.[10]Whilemupirocin was effective in reducing Staphylococcus aureus nasal carriage, it did not reduce surgical site infections. [13] In this study, E. Coli infected 2 (33.3%) patients and Staphylococcus aureus infected 4 (66.7%).

Increasing the operating room population can increase surgical site infection rates by 1.5 to 3.8 times.[14]Our operating rooms are outdated and poorly ventilated. The use of ultra-clean air systems and exhaust-ventilated clothing is recommended in joint prosthesis surgeries since air is a major source of infection transmission. Reducing the number of individuals in the operating room, for example, may have a comparable impact. As our study showed, the conventional wound classification is an important predictor of surgical site infection. The ASA score is known to be a strong predictor of surgical site infection, and our findings match with prior studies. [15]

The latest study confirmed the well-known fact that shaving can increase infection risk, and the CDC advised against shaving before surgery or shaving soon before surgery, preferably using electric clippers.[16]

Our findings support prior research showing an infection after surgery prolongs inpatient stay.[17]

The study has some flaws. It may not account for seasonal variations due to its short duration. During the winter, the hospital population's demographics (such age) may change. A single phone call within 30 days following the procedure could be insufficient to monitor surgical site infections. Because the median total hospital stay was 28 days, we infer that the number of postoperative surgical site infections was low, as postoperative infections usually occur within 4 weeks of surgery. The study's power was insufficient to determine the influence of less prevalent characteristics due to the small patient population; hence, a larger patient population would be desirable.

Conclusion

My prospective study of antibiotic prophylaxis recommends prophylactic antibiotic regimens for several surgical procedures. The variety of pathogenic bacteria and drug resistance varies greatly amongst hospitals. Also, within a single institution, infections and resistance patterns might evolve over time. Physicians and health care institutions must develop routine preventative regimens based on comprehensive epidemiologic data on surgical wound infection.

And many surgical procedures and postoperative conditions require deviations from established preventive protocols. Allergy to penicillin or cephalosporin, trauma and other emergency operations, and preoperative infections of non-wound areas may influence the decision and duration of perioperative prophylaxis. There are no studies that can help in these cases. Surgical wound prevention and antimicrobial prophylaxis require continual monitoring of prophylaxis failures and perioperative data changes.

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