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STUDY ON THE INCIDENCE OF POST OPERATIVE INFECTIONS IN CLOSED FRACTURES IN A TERTIARY CARE HOSPITAL

Sateesh Chandra P[1], Thulasiram K[2], Sreekanth Reddy B[2]

[1]Associate Professor, Department of Orthopaedics, Osmania Medical College/Hospital, Koti, Hyderabad, Telangana, India
[2]Assistant Professor, Department of Orthopaedics, Osmania Medical College/Hospital, Koti, Hyderabad, Telangana, India

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Corresponding Author:
Dr. Sreekanth Reddy B,
Email: sreekanth.bsr@gmail.com

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ABSTRACT

Background: To study the incidence of postoperative infection in closed fractures by evaluating effective usage of preoperative antibiotics and the role of sterile measures such as scrub suits, masks, sterile gloves, gowns, drapes, and operative theatre environment, in reducing surgical site infection. **Materials and Methods:** Prospective comparative study done to evaluate incidence of post-operative infections in closed fractures in a tertiary care centre in 100 patients who underwent elective surgeries for closed fractures for a period of 2 years in Orthopaedics and Traumatology Department. **Result:** Incidence of infection is not very high and did not show any statistically significant correlation between age, scrub time, spirit used with respect to incidence of infection. The incidence of infection by gram –ve bacteria was higher than that of gram +ve bacteria. Pathogens isolated are often resistant to commonly used antimicrobials. The actual incidence of infection could be significantly higher than that showed by the study as the patients were only followed up at 3 months and then at 6 months, after being discharged from hospital and not in between. **Conclusion:** Physicians and individual health care institutions must tailor routine prophylactic regimens based on carefully collected epidemiologic data regarding surgical wound infection.

INTRODUCTION

In 1862, Louis Pasteur's ingenious experiments into the nature of putrefaction were officially endorsed by the Paris Academy of Science. The endorsement signaled an end to the long-held belief that the exposure of organic material to air brought about the "spontaneous generation" of microorganisms, and the concepts of "sepsis" and "asepsis" became firmly established. A scant three years later, in what must be regarded as a paradigm of applied science, Joseph Lister demonstrated the incredible implications of antisepsis in his practice of Orthopaedic surgery. For the first time in recorded history, major surgical procedures could be performed with a reasonable expectation of primary wound healing and recovery. Essential enhancements for preventing and controlling wound "sepsis" were provided by the antibiotic revolution of the 1940s, ushering in the highly technical, highly invasive, and highly successful era of modern surgery. As noted by McDermott and Rogers1 the greatest impact of the antibiotic revolution may be related, in the long run, to its essential role in supporting the advancements of modern surgery. Indeed, surgery as we know it today would be impossible in an environment in which infection was likely or, once established, untreatable. The ancient Egyptians were the first civilization to have trained physicians to treat physical ailments. Medical papyri, such as the Edwin Smith papyrus (circa 1600 BC) and the Ebers papyrus (circa 1534 BC), provided detailed information of management of disease, including wound management with the application of various potions and grease to assist healing. Hippocrates (Greek physician and surgeon, 460-377 BC), known as the father of medicine, used vinegar to irrigate open wounds and wrapped dressings around wounds to prevent further injury. His teachings remained unchallenged for centuries. Surgical site infection (SSI), categorized under the broad term nosocomial infection, poses a significant problem to the healthcare system because it increases the chance of postoperative morbidity and mortality, prolongs hospital stay, and increases healthcare costs.[1–4] It has been shown that wound infection increases hospital stay by three to four times, and reduces the survival chance until discharge by up to four times.[5]

Again, such an increased stay in the hospital blocks beds and may triple or quadruple the associated costs.[6]

These infections are usually caused by exogenous and endogenous microorganisms, mostly aerobic and anaerobic bacteria that contaminate the operative wound during or after surgery. Moreover, SSI poses a greater threat to orthopaedic surgeries than various others because of the usage of metallic implants that harbour the pathogens thereby making the elimination of infection extremely difficult. Hence, the term Orthopaedic Device Related Infection (ODRI) has been introduced, and various studies have shown that a duration of at least one year needs to be elapsed before ruling out SSI when implants are used.[7]
The incidence of SSI varies between 1% in certain hospital settings in Europe and the USA to a very high value of 20% in parts of Asia and Sub- Saharan Africa.[8]
However, sufficient data about the incidence of SSI in specific orthopaedic settings in India is lacking. Since the majority of treatment in the Indian healthcare system is being provided by government institutions, it is crucial to analyse their incidence and contributing risk factors in a government institutional setup. Among orthopaedic surgeries, fixation of fractures contributes to a larger proportion of overall cases. Therefore, we aimed at analysing the incidence of SSI in closed fractures treated by surgical fixation in a tertiary medical centre in India.

MATERIALS AND METHODS

Prospective comparative study done to evaluate incidence of post-operative infections in closed fractures in a tertiary care centre, Hyderabad. Consists of 100 patients who underwent elective surgeries for closed fractures in Osmania General Hospital between August 2020 to September 2022 at Orthopaedics and Traumatology Department. The study is done with permission from ethical committee. Those who fulfilled inclusion criteria are invited into the study group. Informed consent was taken from all patients who are willing to participate in our study.
Inclusion Criteria: Patients aged18years and above, taken up for elective surgeries.
Exclusion Criteria: Immunocompromised patients, Patients on long-term corticosteroids, with open fractures, diabetes mellitus.
Third generation Cephalosporin, i.e.; Ceftriaxone and a combination of Ceftriaxone and Sulbactam were used for all the patients.
All patients received Injection Ceftriaxone 1 gm the day of the surgery. Aseptic precautions in the operation theatre. All routine aseptic precautions were taken like using autoclaved gowns, drapes, sterile gloves and instruments. Standard surgical scrub was done for 5 minutes before performing the operation.
The incision site was painted with 5% povidone iodine and spirit. The principles of surgery were followed in all cases such as minimum tissue handling and maintenance of adequate haemostasis. Drains were used whenever necessary. Skin closure was done with suture material or skin staples. Betadine ointment or Neosporin ointment was used to cover the suture/staples followed by adhesive dressing Injection Ceftriaxone was continued in the postoperative period. The wound was inspected for any evidence of infection starting from the 3rd day and then 12th post-operative day. Patients were followed up till discharge. For the patient who satisfied any of the criteria for wound infection, wound swab was sent to the clinical microbiology laboratory for routine culture methods.
The incidence rate was calculated for each wound separately. Collected data was analyzed by 't'-test and Chi-Square test. About 100 adult patients who were taken up for elective procedures, at Osmania General Hospital were evaluated and assessed preoperatively, intraoperatively and postoperatively for a period ranging 6 to 24 months.

RESULTS

Total of 100 patients were enrolled for this study, out of which 4 patients were found to have infection at the operative site on postoperative day 3. The overall incidence in this study was 4 %.

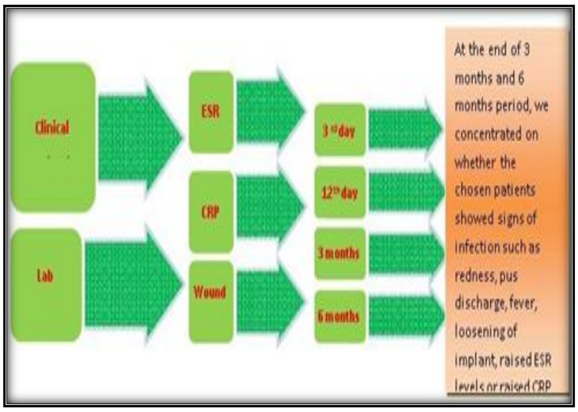

Figure-1: Flow chart for collection of data

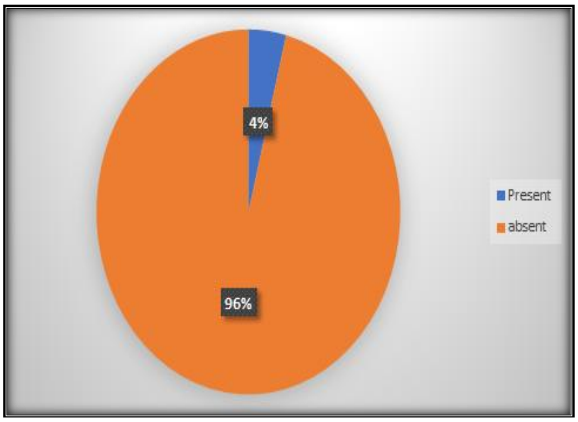

Figure 2: Overall incidence of wound infection in this study

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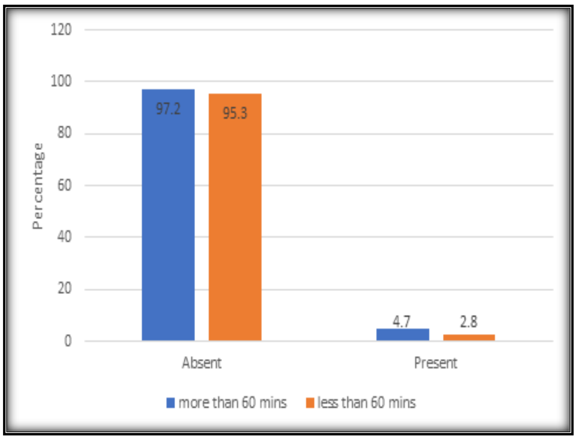

Figure 3: Incidence in relation to time of antibiotic administration and start of surgery

Of the 4 patients with infection, the earliest occurrence was on day 3 with three patients and one developed infection on day 12.

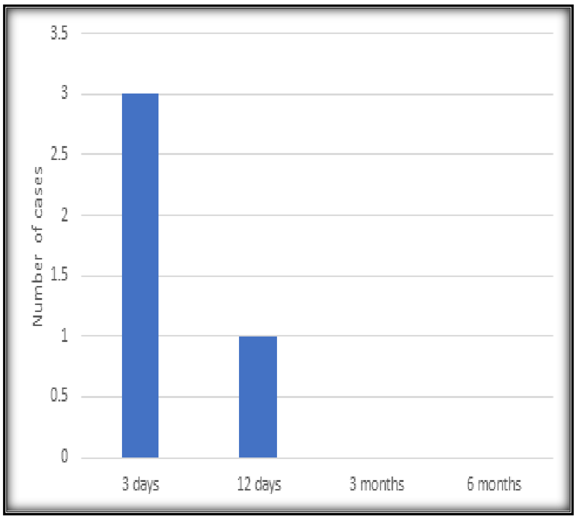

Figure 4: Incidence in relation to time of occurrence of infection

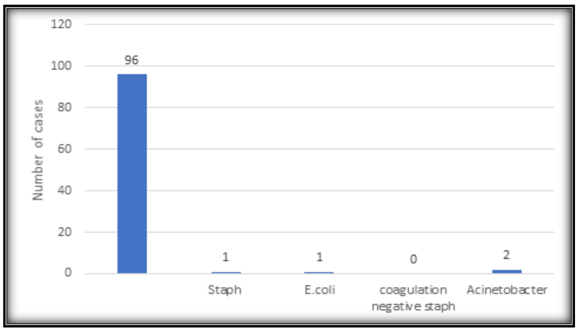

Figure 5: Incidence of infection in relation to organism isolated

Figure 6: Operated site showing signs of infection on day 3 following fixation of bimalleolar fracture

Figure 7: Operated site showing signs of infection on day 12 following humerus fracture fixation

Table 1: Distribution in relation to age and gender

Age in years	Infection		Total
	Absent	Present	
20 yrs and below	12(100%)	0	12(100%)
21 - 30	18 (94.7%)	1 (5.3%)	19 (100.0%)
31 - 40	13 (100.0%)	0	13 (100.0%)
41 - 50	24 (96.0%)	1 (4.0%)	25 (100.0%)
51 - 60	9 (100.0%)	0	9 (100.0%)
61 - 80	15 (88.2%)	.2 (11.8%)	17 (100.0%)
Above 80	5 (100.0%)	0 .0%	5(100.0%)
Total	96 (96.0%)	4 (4.0%)	100 (100.0%)
p value: 0.622, NS.			
Gender			
Female	32 (91.4%)	3 (8.6%)	35 (100.0%)
Males	64 (98.5%)	1 (1.5%)	65 (100.0%)
P value=0.239,NS.			

On analysis of incidence in relation to age for infection in this study, it was found that maximum incidence was in 41-50 age group (96%), the next largest group being 21-30 yrs (94%) and 61-80 yrs (88.2%) had least incidence. Female preponderance for infection which was found to be statistically not significant with p value 0.239.

Table 2: Incidence in relation to type of anaesthesia.

Type of anaesthesia.	Infection		Total
	Absent	Present	
BB	2 (100.0%)	0 (.0%)	2 (100.0%)
GA	40 (100.0%)	0 (.0%)	40 (100.0%)
LA	2 (100.0%)	0 (.0%)	2 (100.0%)
SA	52 92.9%)	4 (7.1%)	56 (100.0%)
Fishers exact test p value 0.279,NS.			

In this study, out of 56 patients with spinal anaesthesia, the incidence of infection was noted in 4 cases which is statistically not significant.

Table 3: Incidence in relation to hospital stay

Preop-stay infection	N	Mean	Std. Deviation	p	
Present	4.5000	4.12311	.872	.385	NS
Absent	3.0625	3.19807			
Postop-stay					
Present	7.7500	4.92443	1.494	.138	NS
Absent	10.6146	3.71447			

The mean preoperative stay in infected cases was 4.50 days, when compared to 3.06 days in non-infected cases which is statistically not significant.

The mean post-operative stay in infected cases was 7.75 days, when compared to 10.16 days in non-infected cases which is statistically not significant.

Table 4: Incidence in relation to duration of surgery

Duration below of surgery	Infection		Total
	Absent	Present	
Below one hour	11 (100.0%)	0	11 (100.0%)
1- 2hrs	57 (100.0%)	0	57 (100.0%)
Above 2hrs	28 (87.5%)	4 (12.5%)	32 (100.0%)
Total	96 (96.0%)	4 (4.0%)	100 (100.0%)
Fishers exact test p=0.0208, significant.			

Correlation between duration of surgery and incidence of infection in major surgeries was found to be statistically significant with p value 0.0208.

DISCUSSION

Of the 100 patients in this study, the overall incidence of surgical site infection in the study is 4%, which compares favourably with studies of Marston et al,[9] who reported 5% superficial and 0.25% deep infection in 413 replacements in ideal circumstances. The rate of postoperative wound infection without prophylactic antibiotic is high as compared to the use of prophylactic antibiotic. Recent international studies show further decline in the postoperative infection rate with prophylactic antibiotics which is 0.23%, 1.06%, 1.09% and 1.34%. In my study the advanced age (41-50 age group (96%), prolonged surgery time were responsible for infections as reported in other studies.[10] In this study, the overall incidence of postoperative infections in closed fractures aligns with earlier findings by Mangram et al,[11] who noted that even in "clean" orthopedic surgeries, the infection rate may range between 1% and 5%, depending on the type of fixation, surgical time, and comorbidities. In terms of the incidence of infection in relation to sex, there was marginal though statistically not significant higher incidence in females but no obvious or specific reason could be found to explain this. There was no correlation in terms of scrub time, chorhexidine used, spirit used and use of scrub brush. There was no significant correlation observed between the incidence of infection and type of anaesthesia used and thus not considered to be a major factor. There was no significant relationship noted between the incidence of infection and the length of hospital stay.

There was significant correlation noted between antibiotic administration and timing of surgery similar to guidelines stipulated by Woods RK, Dellinger EP et al.[12] Correlation between duration of surgery and antibiotic administration was found to be statistically significant with p value of 0.0208 which coincides with another study that stated that rate of infection was directly proportional to the length of the procedure where cases lasting one hour or less had a wound infection rate of 1.3% while that lasting for 2 hours or more it was 4%. This is comparable to my study, i.e; 4 cases (4%) got infected when procedures lasted more than 2 hours. 26 Literature shows that the timing of administration is critically important because the concentration of the antibiotic should be at therapeutic levels at the time of incision during surgical procedure, and ideally, for few hours post operatively (CDC1996). Study of the bacteriological profile shows most of the cases had single organism infection, the commonest organism isolated being Acinetobacter followed by Escherichia coli and Staphylococcus which is similar to organism profiles described in other studies.

The earliest occurrence of infection was on the third postoperative day. Correlation between duration of

surgery and time of antibiotic administration in relation to incidence of infection was found to be statistically significant, 4% infection present when there was a delay of more than 60 minutes. Literature shows that the risk of infection increases if there is a delay between starting of surgery and antibiotic administration. Most of the wound infections fell in Class II of the classification of surgical site infections which was statistically not significant. Garner et al,[13] proposed that patient-related factors such as malnutrition, smoking, and immune compromise significantly influence the postoperative infection rate, which should be carefully evaluated in preoperative planning. The current study's tertiary hospital setting may present a patient pool with higher comorbidity burden, potentially elevating infection risks.
Interestingly, recent literature by Whitehouse et al,[14] also suggests that infection rates may be higher in teaching hospitals due to procedural complexity and involvement of multiple surgical trainees, although this is mitigated by robust infection control protocols. If the current study observed infections clustered around specific fracture types or surgical techniques, that would parallel findings from Zimmerli et al,[15] who found that internal fixation in the femur and tibia, especially with intramedullary devices, carried a higher infection risk.
This study reinforces the necessity for Strict aseptic techniques, timely and appropriate antibiotic prophylaxis, early identification of patient comorbidities, Use of standardized surgical protocols and infection surveillance Implementing bundles like the WHO Surgical Safety Checklist has been shown to reduce postoperative infection rates significantly Haynes et al,[15] and such measures should be universally adopted in tertiary care settings.

CONCLUSION

Based on my prospective study of antibiotic prophylaxis, prophylactic regimens should be recommended for a wide variety of surgical procedures. There is marked variations in the spectrum of infecting pathogens and in the degree of antimicrobial resistance which exist among various hospitals. Moreover, variations in infecting pathogens and resistance patterns can and do occur over time within a given institution. Physicians and individual health care institutions must tailor routine prophylactic regimens based on carefully collected epidemiologic data regarding surgical wound infection.
Equally important, many surgical procedures are far from routine, and numerous variations in perioperative circumstances will dictate deviations from established prophylactic regimens. Early re-explorations for postoperative bleeding, a history of penicillin or cephalosporin allergy, trauma and other emergency surgery and existing preoperative infections of non-wound sites are important variables that may influence the choice and duration of perioperative prophylaxis. Studies are not available that can provide guidelines for such situations. A continuous assessment of failures of prophylaxis and a willingness to alter antiseptic and perioperative data are essential aspects of surgical wound prevention and antimicrobial prophylaxis.

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