

## A STUDY OF POSTOPERATIVE WOUND INFECTION AMONG POST SURGICAL PATIENTS AT CALICUT MEDICAL COLLEGE, KERALA, INDIA

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**ABSTRACT: BACKGROUND:** Postoperative wound infections or surgical site infections (SSIs) are associated with increased morbidity and mortality as they can cause delay in recovery, increase length of stay and increased health care costs. This study was conducted to find out the prevalence and sensitivity pattern of surgical site infections among post surgical cases at Calicut Medical College. **METHODOLOGY:** The study was conducted for a period of one year from July 2007 to June 2008. Two swabs were collected from each site. One swab was used for direct smear examination after Gram staining and second swab was subjected to culture and antibiotic sensitivity testing by standard microbiological techniques. **RESULTS:** The total numbers of surgeries done during the one year period in three surgical units were 1902. The number of clinically suspected cases was 102 (5.36%). The study included 27 'clean', 32 'clean-contaminated', 13 'contaminated' and 30 'dirty' cases. Culture proven cases were 36 out of 102. Lowest infection rate was seen in clean (18.5%) surgery followed by clean-contaminated (37.5%), contaminated (38.5%) and dirty surgeries (47%). MRSA (Methicillin resistant Staphylococcus aureus) (83%) and multidrug resistant gram negative bacilli were predominant isolates. Alarming rate of resistance to ciprofloxacin, ceftazidime, ceftiofur and ampicillin were observed. **CONCLUSION:** The commonly used antibiotics for empiric treatment of post operative wound infections may not be effective. Development of a suitable antibiotic policy and surveillance is essential to reduce the postoperative wound infection rates.

**KEY WORDS:** surgical site infections; antibiotic susceptibility; India

**INTRODUCTION:** Postoperative wound infections or surgical site infections (SSIs) are associated with increased morbidity and mortality as they can cause delay in recovery, increase length of stay, increase health care costs by delaying discharge with associated increase in the need for investigations, treatment and nursing care.

Low rate of SSIs are directly related to education, awareness of the cause of infection and the introduction of practices that reduce risk.<sup>1</sup> According to WHO report 2002, prevalence rate of health care associated infection (HCAI) is 7.7% - 9% in developed countries and 10-11.8% in developing countries. The common HCAI as per CDC update 2007 is UTI (32%) followed by postoperative wound infections (22%), nosocomial pneumonia (15%) and nosocomial septicemia (14%).<sup>2</sup> Causative organisms of post operative wound infections are Staphylococcus aureus and Streptococcus pyogenes in clean surgery. E. coli, Klebsiella species, Pseudomonas species, Acinetobacter species, Staphylococcus aureus and Streptococcus species

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are usually found in abdominal and gynaecological surgeries. *E. coli*, *Proteus* species, *Klebsiella* species, *Pseudomonas* species and *Acinetobacter* species are associated with urological surgeries. Orthopedic surgeries commonly have infections with *Staphylococcus aureus* and Gram negative bacilli according to the data from the National Nosocomial infections surveillance system of the centres for disease control and prevention 2007(CDC)<sup>3</sup>.

So we planned to study the prevalence, bacteriological profile and susceptibility pattern of SSI associated pathogens in our hospital.

**MATERIALS AND METHODS:** The study was conducted in the Department of Microbiology, Medical College, Calicut for a period of one year from July 2007 to June 2008. Patients from three surgical units S1, S3 and S5 were subjected to the study. The total number of elective and emergency surgeries done during the one year period in the above three units was 1902, which included 1074 elective (major) and 828 emergency cases. One hundred and two cases of clinically suspected postoperative wound infection (Fifty nine elective and forty three emergency) from the above cases were studied in detail. The study included twenty seven 'clean', thirty two 'clean-contaminated', thirteen 'contaminated' and thirty 'dirty' cases. Samples were collected from patients using two sterile cotton swabs. One swab was used for direct smear examination after Gram staining. The second swab was subjected to culture and antibiotic sensitivity testing of the isolates by Stokes method for *Staphylococcus* species and Kirby Bauer method for Gram negative bacilli. The following antibiotic discs were used for sensitivity testing of Gram positive cocci: Penicillin (10 units), Erythromycin (15mcg), Gentamycin (10 mcg), Vancomycin(30 mcg), Cefazolin(30 mcg). Oxacillin screen agar was used for *Staphylococcus* species to rule out MRSA. For Gram negative bacilli Ampicillin (10 mcg), Gentamycin (10mcg), Cefazolin (30mcg), Ceftriaxone (30mcg), Amikacin (30mcg) and Ciprofloxacin (5mcg) were used for sensitivity testing. For *Pseudomonas* species Ceftazidime (30mcg) was also besides above mentioned antibiotics.

**RESULTS:** The overall prevalence of postoperative wound infections was 5.36% (102). Among 102 clinically suspected cases studied, bacteriologically proven surgical site infection was identified in 36 patients. The prevalence of culture positive infections was 35% (36/102) (Table1). Lowest culture positivity rate was seen in clean surgery (18.5%) followed by clean-contaminated (37.5%), contaminated (38.5%) and dirty surgeries (47%).

**Table 1: Prevalence of infections in various types of surgeries (n=102)**

	Category of surgery	No. of clinically suspected cases	No. of cases with proven infection	Prevalence of infection (%)
A	Clean	27	5	18.5
B	Clean-contaminated	32	12	37.5
C	Contaminated	13	5	38.5
D	Dirty	30	14	47

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Staphylococcus aureus was isolated from 18 cases, Escherichia coli from 15 cases and Enterobacter species from 2 cases. Klebsiella pneumoniae, Acinetobacter spp. and Serratia marcescens was isolated from one case each. Pseudomonas aeruginosa was isolated from 4 cases (Table 2).

**Table 2: Organisms isolated from infected wounds (n=42)**

Organisms	No. of isolates	% of isolation
Staphylococcus aureus	18	43
Escherichia Coli	15	36
Pseudomonas aeruginosa	4	9.5
Klebsiella Oxytoca	1	2.3
Enterobacter kobei	1	2.3
Enterobacter intermedius	1	2.3
Acinetobacter baumannii	1	2.3
Serratia marcescens	1	2.3

Out of 18 isolates of Staphylococcus aureus none were sensitive to penicillin and erythromycin. All isolates were sensitive to vancomycin. Fifteen isolates of S. aureus were found to be MRSA (Methicillin resistant Staphylococcus aureus). Of the total 24 gram negative bacterial isolates none were sensitive to Ampicillin. Interestingly 22 of these gram negative isolates were multi drug resistant (92%). Amongst Gram negative isolates fifteen were Escherichia coli. All the strains were resistant to ampicillin, cefazolin, ceftriaxone and ciprofloxacin. Amikacin had a sensitivity of 73.3% (Table 3). Figure 1 and 2 depicts prevalence of post operative wound infections.

**Table 3: Susceptibility pattern of the isolates in percentage (n=42)**

ANTIBIOTIC	S. aureus (18)	E.Coli (15)	Enterobacter spp. (2)	Pseudomonas aeruginosa (4)	Klebsiella spp. (1)	Serratia marcescens (1)	Acinetobacter spp. (1)
Penicillin	Nil	NT	NT	NT	NT	NT	NT
Erythromycin	Nil	NT	NT	NT	NT	NT	NT
Gentamicin	22.2	13.3	Nil	25	100	Nil	100
Ampicillin	NT	Nil	Nil	NT	Nil	Nil	Nil
Vancomycin	100	NT	NT	NT	NT	NT	NT
Cefazolin	22.2	Nil	Nil	Nil	Nil	Nil	100
Ceftazidime	NT	NT	NT	25	NT	NT	NT
Oxacillin	27.7	NT	NT	NT	NT	NT	NT
Piperacillin	NT	NT	NT	25	NT	NT	NT
Amikacin	NT	73.3	100	25	100	Nil	100
Ciprofloxacin	NT	Nil	50	25	Nil	Nil	100
Ceftriaxone	NT	Nil	Nil	NT	Nil	Nil	100

Abbreviations: NT - Not tested

**Table 4: Preoperative hospital stay and infection rate (n=102)**

Period of preoperative hospital stay	No.of cases	No.of cases infected	% of infection
1-3 days	61	18	29.5
4-7 days	16	5	31.2
7-14 days	15	7	43.7
>14 days	10	6	60
Total	102	36	35

**Table 5: Age of the patient & infection rate (n=102)**

Age group	No.of patients	No.of infection cases	Percentage
15-25	20	4	20
26-35	14	4	28.5
36-45	13	4	30.7
46-55	20	7	35
56-65	19	8	42.1
66-75	10	5	50
76-85	6	4	67
Total	102	36	35

**Table 6: Sex wise distribution of the patients with wound infection (n=102)**

No. of patients	Sex	No. of infection cases	Percentage
70	Male	25	36
32	Female	11	34.3
102	Total	36	35

**Fig.1: Prevalence of postoperative wound infection in the study group**

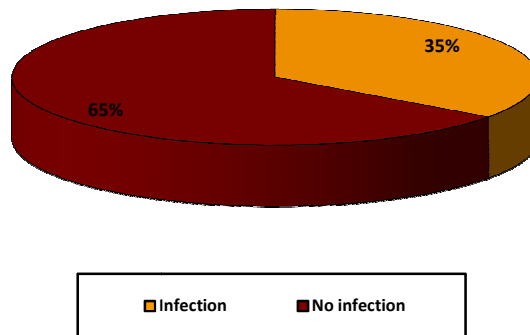


Fig: 2 prevalence of postoperative wound infection in different types of surgery

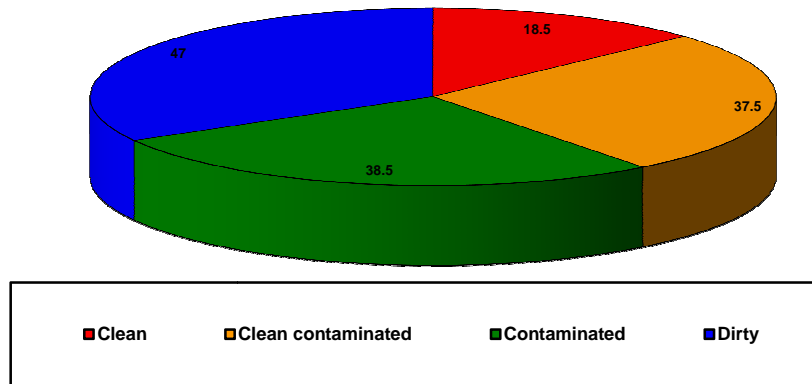
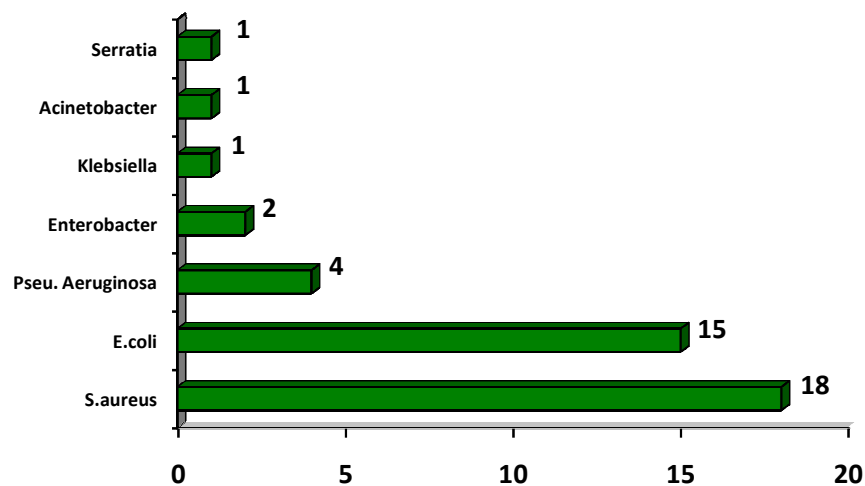


Fig.3: Organisms isolated from infected wounds



**DISCUSSION:** Charles D Ericsson also reports a rate of 1% for clean surgeries and 5 to 10% for ‘clean-contaminated’ cases.<sup>4</sup> An overall infection rate of 4.53% is reported by Yalcin et al in his study conducted at Cumhuriyet University Medicine Faculty Hospital in Turkey between January 1992 and December 1993.<sup>5</sup> According to a study the incidence of SSIs with regard to abdominal surgical sites and operating conditions for clean wounds is 1.5-3.7%, clean – contaminated is 3-4%, contaminated is 8.5% and dirty-infected wounds is 28-40%.<sup>6</sup>

The reported overall infection rates of postoperative wound infections from various centers show wide variation.<sup>7-9</sup> A prolonged preoperative hospital stay has been identified as an important risk factor in infection by many authors like Shanson, Timothy D Jacob and Yalcin et al. It promotes acquisition of multidrug resistant hospital strains.<sup>5, 10, 11</sup> The results of this study

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shows a high infection rate in association with a prolonged pre-operative stay in the hospital. (Table-4)

The infection rate of this study also shows an increase with age as observed in many other studies also (Table 5).<sup>10, 12, 13</sup> Male sex was identified as one of the risk factors of postoperative wound infection by Velasco E et al 1998 based on the study on 1205 patients over a period of 1 year at National Cancer Institute Hospital Brazil.<sup>14</sup> In the present study male patients had a slightly higher infection rate (36%) compared to females (34.3%)(Table 6).

In this study (eighteen) 43% of the isolates was *Staphylococcus aureus*, of which fifteen (83%) were MRSA. *Escherichia coli* accounted for fifteen cases (36%). This was followed by *Pseudomonas aeruginosa* four (9.5%), *Enterobacter* species two (4.6%), *Klebsiella pneumoniae* one (2.3%), *Acinetobacter* spp. one (2.3%) (Table 2 and Figure 3). Review of bacteriology of surgical wounds in different features reveal that the results are in accordance with the observations of the present study.<sup>10, 15-20</sup> Table 3 explains the susceptibility profile of the isolates. A prospective study of surgical site infections in a teaching hospital in Goa reported 79% of isolates were Gram negative and almost 64% demonstrated a high degree of antimicrobial resistance.<sup>20</sup> High degree of drug resistance was observed against ciprofloxacin, cefazolin, ceftriaxone and ampicillin.

**CONCLUSION:** The alarming rate of resistance to ciprofloxacin, cefazolin, ceftriaxone and ampicillin for major postoperative wound infections precludes the use of these commonly used antibiotics for empiric treatment of post operative wound infections. The type of surgeries, length of preoperative stay had an important role in determining the pattern of wound infection. Development of a suitable antibiotic policy is essential to reduce the postoperative wound infection rates. Establishment of proper surveillance programme is also essential.

**ACKNOWLEDGEMENTS:** Funding: None. I would like to express my sincere gratitude to Dr. Beena Philomina J., Associate Professor Department of Microbiology Calicut Medical College, Kerala for her contribution and support during this work and I express my sincere thanks to Dr. Raghuram V. Associate Professor, Community Medicine, KIMS Amalapuram, for his valuable suggestions during preparation of this manuscript.

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