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ORIGINAL RESEARCH PAPER

Study on in-vitro sensitivity of the bacterial agents responsible for postoperative wound infection

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ABSTRACT

***Introduction**: The term post operative wound infection, also known by the term surgical site infection (SSI) is as old as the beginning of surgery. The majority of post operative wound infection (SSI) become apparent within 30 days of an operative procedure and most often between 5th and 10th post operative days. Extensive use of different antibiotic to cure the post operative sepsis is disadvantageous because it encourages colonization of the body by the organisms resistant to it while it becomes potential source of infection to other. **Materials and methods**: This was a hospital based observational, descriptive study carried out on 2685 SSI wound samples were included in the present study collected from General Surgery, Orthopedic, Obstetrics and Gynaecology Departments. **Results**: 65.8% of the cultured infected wounds were of monomicrobial etiology. Longer durations of surgery was associated with polymicrobial agents, Klebsiella, E.coli and Pseudomonas. Organisms might be transferred to the wound by prolonged contact with the operating staff and equipment, as airborne spread of the Gram negative organisms is rare. Most of the isolates were resistant to the commonly used antibiotics. **Conclusion**: It has also been suggested that organisms showing multi-resistant character to antibiotics are more virulent than others. Hence rationality in the use of specific antibiotics has become inevitable. Based on the above observations preventive and prophylactic measures a reducing the pre-operative stay to minimum, minimizing the length of operation, treating infection present at other sites on the patient, using a good surgical technique.*

***Keyword**: Surgical site infection (SSI); monomicrobial agents; polymicrobial agents; gram negative; antibiotics.*

INTRODUCTION

The term post operative wound infection, also now by the term surgical site infection (SSI)[1] is as old as the beginning of surgery. Studies of many workers show that the incidence is still alarming which frightens both surgeons and patients.[2,3] The majority of post operative wound infection (SSI) become apparent within 30 days of an operative procedure and most often between 5th and 10th post operative days. However, where a prosthetic implant is used, infection affecting the deeper tissues may occur several month after the operation.[4-6] Altimeter stated that the principal organisms of SSI were staphylococcus (both coagulase positive and negative) Escherichia coli, proteous, klebsiella, pseudomonas, bacteroides, streptococcus and Clostridium perfringens. Since last 25 year,[7-9] the incidence of wound infection due to gram negative organisms is increasing though, staphylococcal infection was more common earlier.[10]

Regarding the use of antibiotics, it was become quite apparent that extensive use of different antibiotic to cure the post operative sepsis is disadvantageous because it encourages colonization of the body by the organisms resistant to it

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while it becomes potential source of infection to other. Staphylococcus aureus one of the main causative organisms, has developed multi resistant character to antibiotics.[11-13] It has also been suggested that organisms showing multi-resistant character to antibiotics are more virulent than others. Hence rationality in the use of specific antibiotics has become inevitable.[14,15]

Therefore the author has aimed to study the in-vitro sensitivity of isolated bacterial agent responsible for postoperative wound infection (SSI) to different antibiotics.

MATERIALS AND METHODS

A total of 2685 SSI wound sample were included in the present study. It was carried out in the Department of, Microbiology, Gauhati Medical College and Hospital for a period of one year. The materials were obtained from patients in the General Surgery, Obstetrics & Gynaecology and Orthopaedic Departments of GMCH, who had undergone operations and had developed Signs and Symptoms of post-operative wound infections. Cases of clean and clean contaminated surgeries are included for the study whereas procedures in which healthy skin was not incised, such as opening of an abscess, burn injuries and donor sites of split skin grafts, contaminated and dirty surgeries are excluded from study samples.

Collection and transportation of material

The wounds were examined for suggestive signs/symptoms of infection in the post operative period, during wound dressing or when the dressings were soaked, until the patient was discharged from the hospital and also in the Out-patient department after discharge. All the specimens collected were transported immediately to the laboratory for further processing. The Nutrient broth and Robertson's cooked meat broth (RCMB) were incubated at 37°C.

Methods: The samples collected were processed as follows

a) Direct microscopic examination of gram stained smear. The smear was screened for pus cells, the gram reaction, morphology, arrangement and number of types of the organisms were noted.

b) Inoculation of the samples onto different culture media for aerobic and anaerobic onto plates of MacConkey agar and 5% Sheep blood agar organisms.

c) Preliminary identification.

d) Bio-chemical tests.

e) Antibiotic sensitivity.

RESULTS

The following results were made from the study.

Figure 1 Incidence of SSI

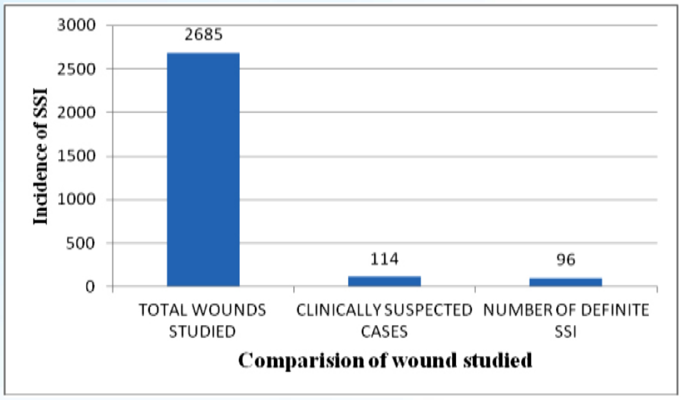

Figure 1 depicts out of the 2685 cases with surgical wounds, 114 cases (4.2%) were suspected to be clinically infected. Amongst 114 (4.2%) infected wounds, 96 (3.6%) were found culture positive and were considered definite cases of surgical site infection.

Table 1 Organisms isolated in 96 SSI

Organism	No.	%
Klebsiella species	35	22.3
Staphylococcus aureus	31	19.4
E.coli	24	15.3
Pseudomonas	20	12.7
Cons	18	11.5
Acinetobacter	07	4.5
Proteus species	07	4. 5
Diptheroids	05	3.4
Citrobacter	03	1.9
Enterococci	02	1.3
S.pyogenes	02	1.3
Candida	03	1.9
Total	157	100

Table 2 Direct microcopy and culture sensitivity

Direct microscopy	Microscopy Positive	Culture Positive
Pus cells + gpc	03	03
Pus cells + gnb	20	20
Pus cells + gpc + gnb	56	56
Few pus cells + no organism	19	06
No pus cells + no organism	16	11

Table 2 shows, on direct microcopy of the gram stained smears of 114 samples, pus cells and organism were seen in 79 samples. In smears from 19 wounds, few pus cells and no organisms were seen but 6 yielded growth on culture. In 16 specimens where no pus cells and no organisms were seen, 11 were culture positive.

Table 3 Pattern of isolates in 96 SSI

Culture Reveal	Name and number of organism								Total
One organism I54.2%)	Kleb. 16	Staph. 11	Cons. 8	E. Coli. 6	Acin. 4	Prot. 3	Pseudo 2	Dipth. 1	Citro. 2	52
Two organisms (45.8%)	Staph. & E.coli 5	Staph & kleb (6) staph(3) & Citro-(1)	Kleb & Pseudo (4) Kleb & prot (1)	Cons & Kleb (2)	Cons& e.coli (2) cons & pseudo (2)	Staph & Strepto (2) Staph & enter (1)	E.coli & kleb (2) citr & prot (1)	Pseud O & Candid a (2)	Acin & Enter (1)	32

The above table (**Table 3**) shows, out of 96 culture positive cases, 52 samples (54.2%) yielded monomicrobial isolates, Klebsiellas species were the predominant organisms isolated in 16 cases (16.70%). The other common monomicrobial isolates were staphylococci aureus in 11 cases (11.4%) and coagulate negative staphylococci in 8 cases (8.3%). 2 organisms were present in 44 cases (45.8%).

Table 4 Organisms isolated in wound types

Organism	Total	Clean		Clean Contaminated	
		No.	%	No.	%
Klebsiella sp.	35	11	31.4	24	68.6
Staph. Aureus	31	19	61.3	12	38.7
E. Col,	24	09	37.5	15	62.5
Pseudomonas	20	11	61.1	07	38.9
Cons	18	10	50	10	50
Acinetobacter	07	03	42.8	04	57.1
Proteus sp.	07	02	28.6	05	71.4
Diphtheroids	05	03	42.8	04	57.8
Citrobacter	03	04	20	04	80
Enterococci	02	02	100	00	00
Strepto.pyogenes	02	02	100	00	00
Candida	03	00	00	03	100
Total	157	72	-	85	-

Table 4 shows, in the clean operation which were infected, the gram positive cocci were the main causative agents in this study. Staphylococcus aureus was isolated in 19 cases (61.3%) and coagulase negative staphylococci in 10 cases (55.5%) of the clean procedures. The enteric grams negative bacilli were the predominant organisms in the clean contaminated operations. Of the 35 klebsiella species 24 (68.6%) and of the 24 E. coli isolates, 15 (62.5%) were cultured from clean contaminated procedures. The incidence of pseudomonas was the same in both types of risk classes. Candida abdicans was isolated in 3 samples, all of which were cultured from clean contaminated cases.

Table 5 Comparison of pattern of isolates with risk factors

Risk factors	Total	Monomicrobial		Polymicrobial	
		No.	%	No.	%
Risk class clean	38	29	76.3	09	23.7
Clean contaminated	58	23	39.6	35	60.4
Pre-operative	21	14	66.7	07	33.3
Hospitalization Upto 1 day 1 to 7 days	43	23	53.5	20	46.5
> 7 days Duration of surgery (Minutes): 0 to 60	32 46	15 30	46.8 65.2	17 16	53.2 34.8
61 to 120	33	15	45.4	18	54.6
> 121	17	07	29.5	10	70.5

Table 5 shows, the pattern of isolates were compared with rich factors. There was increased incidence of poly-microbial etiology in the clean contaminated wounds. In the clean cases 29 sample (76.3%) yielded.

Table 6 antibiotic sensitivity of gram positive isolate

Organism	No	Am		Cz		P		Do		G		Ak		Cf	
		No.	%	No.	%	No	%	No	%	No	%	No	%	No	%
S. Aurens	31	18	58.1	21	67.8	10	32.2	18	58.1	19	61.3	23	74.2	17	54.8
Cons	18	11	61.1	14	77.8	12	66.7	11	61.1	12	66.7	13	72.2	13	72.2
Diptheroids	05	04	80	05	100	04	80	05	100	05	100	05	100	04	80
S. Pyogenes	02	02	100	02	100	02	100	02	100	02	100	02	100	02	100
Enterococci	02	01	50	02	100	01	50	02	100	02	100	02	100	02	100

Table 6 shows, the gram positive isolates were tested against Ampicilhin (Am) Methicillin (Cz) Penicillin (P) Doxycycline (Do), Cefazolin (Cf), Gentamyin (G), Amikacin (Ak) and Ciprofloxacin (Ci) Oxacillin was included for Staph, aureus strains. The isolates were highly sensitive to Amikacin (>72.2%) and Cefazolin (>67.8%). Of the 31 staphylococci aureus isolates, only 10 (32.2%) were sensitive to Penicillin, 21 (67.7%) to Methicillin, 23 (74.2%) to Amikacin. Among the coagnlse negative stapthylococci least sensitivity were recorded to Ampicillin and Gentamycin (>61.1%)

DISCUSSION

In the present study of 114 clinically suspected SSI, 96 yielded aerobic bacterial growth accounting for a total of 157 organisms. Mono-microbial isolates were encountered in 52 (54.4%) of the wounds, 44 wounds (45.8%) yielded polymicrobial agents, Gram positive and Gram negative organisms were frequently involved in the mixed infections. Staphylococcus aureus and E.Coli were the commonest combination present in 7 cases (15.9%). Similar spectrum of organisms was observed by Giacometti, et al, who isolated 1060 bacterial strains from 614 individuals.[11]

In the present study, on direct microscopy 84.2% samples yielded growth on culture and this finding was in consistent with study of Anvikar et al.[12] Few pus cells and no organisms were seen in culture positive. This, may be probably due to low number of organisms which could not be detected by microscopy but, yielded growth on culture. Similar spectrum of organisms was observed by Giacometti, et al and Olson, et al.[16,17] Gram negative bacilli accounting for 61% of the isolates, as the principal offenders of surgical wound infection. Anaerobic organisms were not isolated on culture, probably because the patients were treated with prophylactic and therapeutic antibiotics against anaerobes. The clean wound category with no obvious source of contamination, 65.8% of the cultured infected wounds were of monomicrobial etiology. The isolates when compared with the duration of surgery, it was found that with longer durations of surgery, the wound was infected with polymicrobial agents. The incidence of Klebsiella, E.coli and Pseudomonas increased with longer durations of surgery. This suggests that the organisms might be transferred to the wound by prolonged contact with the operating staff and equipment, as airborne spread of the Gram negative organisms is rare.[15,18]

There is a change in the bacterial etiology of surgical infections from time to time. A century ago, the most feared and frequent pathogen was Streptococcus, twenty years ago the Coagulase positive staphylococcus was the principal offender, Gram negative bacilli are now replacing staphylococcus.[3,13,14]

The antibiogram pattern of the isolates shows that Klebsiella was most sensitive to Ceftriaxone (68.6%), Cephotaxime (62.8%) and Amikacin (62.8%). The percentage of sensitivity has shown a decline when tested for the other commonly used drugs. E.coli was found to be highly sensitive to Ceftriaxone and Amikacin with 83.3%, Cephotaxime and Ciprofloxacin with 75%. Multidrug resistance in case of Acinetobacter species was found to be much higher, probably because it was a hospital strain. This pattern of antibiotic sensitivity correlates with the study of Anvikar et al.[12] All the isolated staph aureus is found to be beta lactamase positive (100%). The resistance of the Staphylococcus aureus strains to Penicillin (68.8%) and Methicillin (25.8%) correlates with the study of Durmaz et al.[19]

CONCLUSION

The present that was conducted in Gauhati Medical College Hospital, Guwahati has enlighten the relationship between SSI, preoperative hospitalization and duration of surgery. There was increase in the incidence of infection, in patients with longer preoperative hospitalization and longer durations of surgery. There was an increase in poly-microbial etiological agents in these cases. Klebsiella was found to be the main etiological agent followed by E coli, Pseudomonas, Coagulase negative staphylococci etc. It was observed that the gram negative bacilli were the main offenders in clean contaminated operations, in patients with longer preoperative hospitalization and in surgeries with increased duration. Most of the isolates were resistant to the commonly used antibiotics. Based on the above observations preventive and prophylactic measures a reducing the pre-operative stay to minimum, minimizing the length of operation, treating infection present at other sites on the patient, using a good surgical technique. Encouraging efforts in reducing the known risk factors to a bare minimum in elderly patients. Antibiotic sensitivity test results for appropriate antibiotic therapy, to avoid emergence of resistant strains can be enhance to lower down the incidence of post operative wound infection (SSI).

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