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Aerobic bacteriological profile of post operative wound infection in tertiary care hospital, Bhopal

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Abstract

Surgical wound infections remains one of the most important post operative complications accounting for 10 to 20% of the hospital cost. In most post operative SSI the causative pathogens originates from normal flora of patients skin, mucous membrane or hollow viscera. SSI can cause considerable mortality and morbidity. Wide spread use of antibiotics leads to major problem of MDR organisms contributing to longer stay in hospitals. Hence the present study was carried out to determine the incidence of surgical wound infection with antibiogram.

Introduction

Wound infection are one of the most common hospital acquired infections causing considerable morbidity mortality [1].

The sepsis in modern surgery continuous to be the significant problem for health care practitioners across the globe [2].

Surgical wound infection remains one of the most important post operative complications, accounting for 10 to 20 % of the hospital cost [3].

Despite the advances made in asepsis, anti microbial drugs, sterilization and operative techniques. Surgical site infection continues to be major problems in all branches of surgery in hospital [4].

The common causative agents are Staphylococcus aureus, pseudomonas aeruginosa, Escherchia coli and klebsiella [5].

Complicated surgical procedures have a grave impact increasing duration of hospitalization and cost of hospitalization [6].

Wide-spread use of antibiotics leads to major problem of multi drug resistance organism contributing to morbidity and mortality [7].

The center for disease control and prevention (CDC) had pointed out that, " The most important measure for preventing the spread of nosocomial bacterial pathogens is effective hand washing". Most guideline recommends hand washing before and after contact with patients, before invasive procedure and after contact with contaminated inanimate objects (Garner et al,1996) [8].

After the general use of modern antibiotic therapy for 60 years, clinical experience and bacteriological studies have shown that the overall incidence of infection in the surgical patient has not decreased and many related problems are still present. This is because we have a wide variety of surgical procedures to treat different conditions, which were not available 10 to 20 years ago. Advanced medical science, has given the knowledge to practice the various preventive measures to control the routinely encountered types of infection, but other types of infection have taken their place [9].

Wide spread and indiscriminate use of antibacterial agents in hospitals had led to the progressive development of resistance to penicillin and many of the other antibiotic agents, by a large variety of important bacteria concentrated in the hospital environment. These virulent organisms have shown the potential to become pathogenic in patients weakened by disease, injury, metabolic conditions, surgery and other debilitating factors [10,11].

Hence the present study is carried out to determine incidence of surgical wound infection with the resistance pattern of the organisms which is helpful in selecting antimicrobial therapy for formulating infection control measures.

Material and Methods

The present study was conducted in the department of Microbiology peoples medical college and tertiary care hospital, Bhopal during the period from September 2013 to August 2014. 150 samples were collected from admitted patients of post operative wounds of various wards.

Inclusion Criteria

All post operative wounds of elective and emergency surgeries with sign of inflammation serous, sanguineous or purulent discharge, soaked dressings on gaping wound will be included in the study. All clean, clean- contaminated, contaminated, dirty type of wound will be included in the study (CDC Criteria).

Exclusion Criteria

1. Refusal to participate in study
2. Patient undergoing reoperation
3. Patient who were falling to come for a follow-up to 30 days since the day of operation.

Wound infection was diagnosed if any one of the following criteria were fulfilled:

a. Serous or non- purulent discharge from the wound,

b. Pus discharge form the wound

c. Serous or non- purulent discharge form the wound with signs of inflammation(oedema, redness, warmth, increased local temperature, fever ≥ 38°C, tenderness) [12].

Swabs were obtained from wounds and were processed without delay using standard microbiological methods.

Wound class was considered as clean, clean contaminated, contaminated and dirty as per center disease control classification. This classification is based on the extent of intra- operative contamination.

The data collected includes age and sex of patients, Diabetes, preoperative hospital stay, details of timing of antimicrobial prophylaxis, type of surgery (emergency and elective surgery), duration of surgery, presence and absence of drains, the wound classes.

According to the criteria of cutting and harding 13. wounds were considered infected and samples were collected from these infected wounds taking all aseptic precautions and then transported to the laboratory without delay.

Methodology

Swabs were collected form discharge of post operative wound. All the wound swabs were subjected to gram staining followed by inoculation in 5% sheep agar and Maconkey media. They were incubated aerobically at 37 degree Celsius for 24 hours and the colony characters were studied, Organisms were confirmed by following biochemical tests.

For gram positive cocci- catalase test, coagulase test, bile esculin test was done.

Lactose fermenting gram negative bacilli and non lactose fermenting bacilli were differentiated on maconkey agar (Non lactose fermenting) gram negative bacilli were tested by oxidase test. Both lactose fermenting and non lactose fermenting isolates were subjected to indole test, MR test, Urease test , Citrate test VP test, Nitrate test and (TSI) Sugar fermentation test, Motility was done by hanging drop method.

Antimicrobial susceptibility testing of all isolates was performed by Kirby baurs disc diffusion method as per CLSI guidelines [14]. Antibiotic discs were obtained from high media company. Turbidity of suspension was compared with 0.5 Macferlands standards [15].

Control strains used in study were-

- Escherichia coli ATCC 25922
- Staphylococcus aureus ATCC 25923
- Pseudomonas aeruginosa ATCC 27853

Results

- In the present study out of 1380 surgeries studied, the overall percentage of surgical wound infection was 10.8 % (**Table 1**)

Table 1: Showing percentage of the total infected cases

Total Surgeries	Total infected cases	Percentage (%)
1380	150	10.80

- Out of 150 infected cases 123 cases were culture positive while 23 were culture negative. ($Z \geq 1.96$) value was significant (**Table 2**)

Table 2: Showing culture positive cases and sterile cases

No. of infected cases	Growth	Sterile
150	127	23

- The percentage of infected wounds following emergency surgeries was 11.9 % followed by elective surgeries of 9.1%, but this rise was insignificant (P=0.110) (**Table 3**)

Table 3: Percentage of infection in type of surgeries

Type Surgery	Surgeries performed	No of infected cases	% Infection
Emergency	856	102	11.9
Elective	524	48	9.1
Total	**1380**	**150**	**100**

Maximum percentage of infection was seen in emergency surgeries 11.9% as compared to elective surgeries 9.1%. The difference was not statistically significant Chi square = 2.55, (P=0.110)

- The percentage of infected wound according to type of surgery was hight in dirty type (IV) surgeries i.e 29.06 % followed by contaminated type (III) surgeries with was 26 % & clean surgeries was 8% and clean contaminated surgeries was 7.05% ($p \leq 0.0001$) value was Significant (**Table 4**)

Table 4: Showing percentage of infection according to wound class

Wound class	Surgeries performed	No of infected cases	% infection
Clean	175	14	8
Clean Contaminated	964	68	7
Contaminated	69	18	26
Dirty	172	50	29.06
Total surgeries	**1380**	**150**	**100**

There was significant association between type of wound with infection Chi Square= 91.3 ($P \leq 0.0001$) According to study high percentage of infection was found in Dirty and Contaminated type of wound.

- The pathogens isolated were Staphylococcus aureus 22 (17.3%) Enterococcus 3 (2.36%), E coli 37 (29.1.%). pseudomonas aeruginosa 35 (27.5%, klebsiella pneumoniae 17 (13.3%), Acinetobacter species 5 (3.9%), Proteus mirabilis 5 (3.9) & citrobacter species 3 (2.3%) (**Table 7**)

Table 7: Frequency of various pathogens

Organisms	No of Isolates	%
E coli	37	29.1
Pseudomonas aeruginosa	35	27.5
Staphylococcus aureus	22	17.3
Klebsiella pneumonia	17	13.3
Acinetobacter spp	5	3.9
Proteus Mirabilis	5	3.9
Citobacter spp	3	2.3
Enterococcus	3	2.3
Total	**127**	**100**

-The percentage of infectivity was highest in incision & drainage (I & D) surgeries 95(28.4%) followed by ORIF i.e 87(25.2%) surgeries followedby debridement surgeries 67(23.8%) (**Table 9**)

Table 9: Percentage of infections in various surgeries

Total no. of Surgeries performed	Total no of surgeries infected	% infection
L.S.C.S. (313)	17(5.43)	5.43
Hystectomy (190)	9(4.7)	4.7
Hernioplasty (140)	10(7.1)	7.1
Cholecystectomy (140)	3	2.1
Laporatomy (82)	14	17.01
Appendictomy (140)	10	7.1
I & S (95)	27	28.42
Debridement (67)	16	23.8
ORIF (87)	22	25.2
Cytolithiotomy (30)	3	10
Amputation (45)	7	15.5
Craniotomy (22)	2	9.09
Other (29)	10	34.4
Total (1380)	**150**	

Highest percentage of infection was found in I & D surgeries (28.4%) , as compare to other surgeries. This difference was significant p?

- Staphylococcus aureus strains were 100% sensitive to Linezolid Vancomycin followed by cefoxitin 80% and Ceftazidime Claculanic acid 62% Staphylococcus aureus were 80% resistant to erythromycin and azithromycin folloed by ciprofloxacin 60% (**Table 13**)

Table 13: Antibiotic sensitivity pattern of gram positive isolates

Antimicrobials	Staphylococcus aureus N = 22		Enterococcus N= 3	
	No	%	No	%
Amoxyclav	13	60	2	66.6
Erythromycin	5	20	1	33.3
Ciprofloxacin	9	40	2	66.6
Ampicillin/ Sulbactum	11	50	2	66.6
Cefoxitin	17	80	1	33.3
Vancomycin	22	100	3	100
Linezolid	22	100	3	100
Clindamycin	13	60	1	33.3
Azithromycin	5	20	1	33.3
Cetazidime/ Clauvanic Acid	14	62	2	66.6

-Klebsiella pneumoniae were 98% sensitive to Colistin followed by Cefepime/ tazobactum 93% (**Table 14**)

Table 14: Showing antibiotic sensitivity pattern of gram negative isolates

Antibiotics	Pseudomonas Aeruginosa N =35		Escherichia coli N = 37		Klebsiella Pneumonae N 17		Acinetobacter Spp. N= 5		Citrobacter Spp. N = 3		Proteus mirabilis N = 5	
	No	%	No	%	No	%	No	%	No	%	No	%
Amikacin	11	32	26	73.5	9	56.3	1	20	3	100	2	60
Amoxyclav	18	53	7	20.6	1	7.8	2	40	3	100	5	100
Cefotaxime	6	19.1	8	23.5	3	23	4	80	1	33.3	5	100
Imipenam	30	87	36	98	12	75	4	80	3	100	5	100
Piperacillin Tazobactum	35	100	25	70	10	60	3	60	3	100	5	100
Cerftariaxone	25	72.2	11	30	3	16	1	20	3	100	1	20
Ceftazidime Claculanic Acid	27	77.6	29	79	15	90	4	80	3	100	5	100
Tobramycin	14	42	32	87	12	72	2	40	3	100	3	60
Colistin	21	60	27	65	16	98	2	40	2	66.6	3	60
Polymixin B	28	80	27	78	12	78	4	80	3	100	4	80
Ciprofloxacin	16	46	2	6	2	12	3	60	2	66.6	3	60
Cefipime/ Tazobactum	14	42	3	9	15	93	4	80	3	100	5	100

Discussion

Out of 1380 surgeries studied 150 were infected surgeries which included 1230 normal surgeries. Overall percentage of surgical wound infection in the present study was 10.8%. This was in agreeement with overall infection rate which ranged from 6.09 to 38.7%. 4.19, Infection rate in Indian hospital is much higher than other countries for instances USA it is 2.8 % & in European countries it is 2.6% & 9.5% higher infection rate in Indian hospital is due to poor setup of our hospitals and also due to lack of attention towards basic infection control measures. The overall infection rate varies from surgeon to surgeon, hospitals to hospitals, one procedure to another and from one patient to another patient and also depends on location of surgeries, bacterial load in tissues and integrity of host defenses [16].

Percentage of infective wounds in our studies is more in emergency surgeries 11.9% followed by elective surgeries was 9.1. This was similar to finding from study by patel sachin et al., satyanarayan v et al [17,18].

In our study by statistical analysis by chi square test the difference between emergency and elective surgeries regarding percentage of infection was not significant (P+ 0110).

Higher rate of infection in emergency surgeries may e because of insufficient pre operative preparation and more frequency of contaminated or dirty wound in emergency in surgeries.

In our study percentage of infected wound was higher in dirty type surgery i.e. 29.06% followed by contaminated surgery 26% followed by clean 8% and then clean contaminated i.e. 7%. These results were similar to study by anvikar et al and Olsen Marry et al. [18-22]. In our study on statistical analysis there was significant association between type of wound with infection (chi square = 91.3) ($p \leq 0.0001$).

In our study the percentages of infected cases with hospital stay ≥ 7 days was 25.3% followed by 4.05% in hospital stay ≤ 7 days [23].

In our study difference was statistical significant $p \leq 0.001$ by chi square test. Longer hospital stay leads to colonization with antimicrobial resistant organisms effects patient's susceptibility to infection by lowering host resistant or by providing increased after opportunity for ultimate bacterial colonization [12,17,20,23].

We found that out of total post operative infective cases 92 were males (61.3%) followed by 58 females (38.6%) . Thus in our study males were prone to SSI7,101. On comparison of percentage of infection on between males and females by statistical analysis by z rest (z1.96) was significant.

In our study maximum percentage of culture positive infected cases were in age group 0f 21 to 30 (26.7% followed by age group 30 to 40 (25.1%). [24].

In our study E. coli was the commonest organism isolated i.e. 37 (29.1) followed by pseudomonas aeruginosa 35 (27.5%) followed by staphylococcus aureus 22 (17.3). This was similar to the study by shittu et al and Patel sachin et al. [17,22].

Staphylococcus aureus were 100% sensitive to vancomycin and Llinezolid followed by Cefoxitin 80 % and clavulanic acid 62%, Staphylococcus aureus showed maximum resistance to Erythromycin 80% followed by Ciprofloxacin 60% [25]. Enterococcus is 100% sensitive to Vancomycin and Llinezolid and showed maximum resistance to Erythromycin followed by Cefoxitin.

Amongst the gram negative E coli was 98% sensitive to Imipenam followed by tobramycin 87% followed by ceftazidime / Clavulanic acid 79% then Polymyxin B 75% E coli strains showed maximum resistance to ciprofloxacin 94 % folowed by Amoxyclave 79.5%. [26].

Pseudomonas aeruginosa strains were 100% sensitive to Piperacillin tazobactum and were 80.9% resistant to Cefotaxime followed by Amikacin 68%.

Klebsiella pneumoniae were 98% sensitive to Colistin followed by Cefepime/ tazobactum 93%. Klebsiella pneumoniae were maximum resistant to Amoxy/ clave (7.8%)

The percentage of infectivity was hight in incision & drainage (I & D) surgeries 27(28.4%) followed by ORIF I.e 87 (25.2%) surgeries followed by debridement surgeries 67 (23.8). Highest percentage of infectivity was in I & D surgeries. This was similar to study by Mahesh CB, shiv Kumar et al. [4].

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