ORIGINAL ARTICLE

A Study of Postoperative Wounds Infections with Special Reference to Pseudomonas

Wanjare VS [1], **Wanjare SW** [2], **Akulwar SL** [3], **Tabhane MK** [4], **Rahule AS** [5]

[1]*Assistant Professor of Microbiology, GMC Nagpur*
[2]*Associate Professor of Microbiology, Seth GS Medical College Mumbai*
[3] *Professor of Microbiology, GMC Nagpur*
[4]*Associate Professor in Anatomy NKP Salve Institute of Medical Sciences, Nagpur*
[5]*Associate Professor of Anatomy, GMC Rajnandgaon*
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Abstract

Background: *For the last few decades, nature of wound infection has varied from time to time and place to place. In our region postoperative wound infections are common; however, their prevalence has not been well documented.* ***Material and Methods:*** *A total of 800 patients admitted in two surgical units, two gynecology and obstetrics units, one orthopaedics unit, one ENT unit, one ophthalmology unit and one plastic surgery unit of Government Medical College & Hospital Nagpur included in the study. A total of 24 strains of Pseudomonas aeruginosa were subjected to antibiotic sensitivity by disc diffusion technique.* ***Results:*** *116 (14.5%) cases were postoperatively infected. Most common organism was staphylococcus (26.51%) followed by Psedumonas (18.18%) and E coli (15.90%). 17 strains (70.83%) were sensitive to ceftriaxone, 13 strains (54.16%) showed sensitivity to gentamicin and only 8 strains (33.33%) were sensitive to Norfloxacin.* ***Conclusion:*** *Incidence of postoperative wound infection is high in the region. Many factors are behind it like wound contamination, old age, presence of drains and prosthesis, associated medical illness, overcrowding and the presence of multidrug resistant organisms. A combined effort should be taken to minimize the problem of postoperative would infection. Present study provides a baseline data about the post operative wound infection in the region.*

Keywords: *Postoperative wound infections, Pseudomonas, Surgical Infections.*

Address for correspondence: *Dr. Varsha S Wanjare, Assistant Professor of Microbiology, Government Medical College, Nagpur (MS), rahuleanil@yahoo.co.in, Mob: 9422153880*

Introduction

When a patient enters the specialized environment of modern hospital, he is exposed to both known and ill-defined hazards. The infectious hazards have been recognized for many years. Infection is encountered by all surgeons, who by the nature of their craft, invariably impair the first lines of host defense – the mucosal barrier – between environmental microbes and the host's internal milieu. The entrance of the microbes into host tissue is the initial requirement for infection. Surgical infections can be defined as infection that require operative treatment or result from operative treatment. Gilmore defined it as the presence of pus which discharges spontaneously or following opening of wound. [1] Wound infections and other postoperative infections continue to be a problem even though prophylactic antibiotics have reduced the risk. Postoperative wound infection seldom causes death, yet it does prove to an economic burden on the patient and the hospital administration because of prolonged convalescence, prolonged post-operative stay, additional expenditure, nursing care, and an unnecessary waste of time. For effective control of wound infection the data regarding the causative organisms, their antibiotic sensitivity pattern and their special characteristic must be made available. For the last few decades, nature of wound infection has varied from time to time and place to place like Khan et al [2] observed 20.20%, Agarwal et al [3] 49.50% while Anvikar et al [4] observed only

6.09%. In our region, postoperative wound infections are common; however, their prevalence has not been well documented. Hence the present study was undertaken to study the problem of postoperative wound infection specially Pseudomonas in our region.

Materials and Methods

A total of 800 patients admitted in various units of Government Medical College & Hospital Nagpur were included for the study. Various units included were two surgical units, two gynecology and obstetrics units, one orthopaedics unit, one ENT unit, one ophthalmology unit and one plastic surgery unit. A total of 442 males and 358 females were included in the study. Their age ranged from 5 to 72 years. All the cases were divided into two groups. In one group; planned (routine) operative cases and in another group emergency operative cases were kept. Each patient was followed from the time of admission till the date of discharge from the hospital. A total of 24 strains of Pseudomonas aeruginosa were subjected to antibiotic sensitivity by disc diffusion technique.

Results

Out of 800 cases, 116 cases were postoperatively infected. The overall infection rate in postoperative wounds was 14.5 %. Higher infection rate was observed in older age group ($p< 0.05$). In the age group of 40-49 years, the infection rate was 18.84% while in age group 50-59 years it was 26.51%. 18.91% infection was seen in 60-69 years age group while it was 22.58% in the age group of 70 and above (Table-1).

Infection rate was highest among dirty wounds 32.20% (38), while it was 3.85% (12) in clean wound, 9.72% (21) in clean contaminated wound and 29.22% (45) in contaminated wounds.

It was also observed that those wounds which had drains (Total 289 cases) developed infection 63 (21.79%) significantly more often than the wounds without drains 53 (10.37%, $x^2 = 18.76$; $p< 0.001$) and patients without preoperative antibiotic prophylaxis 74 (24.83%) develops infection more often as compared to patients under antibiotic coverage 42 (8.37 %). High infection rate was seen in bowel (38.46%), urological (25%) and orthopaedic surgeries (29%) while in clean surgeries like lower segment cesarean section (7.09%) and hernia (5.45%) it was low. In cataract and hydrocele surgeries not a single case of postoperative infection was observed.

Table I: Age wise distribution

Age Range	Total Cases	Infected Cases	%
0-9	72	07	9.72
10-19	92	08	8.69
20-29	125	06	4.80
30-39	136	15	9.68
40-49	138	26	18.84
50-59	132	35	26.51
60-69	74	14	18.91
Above 70	31	05	22.58
Total	**800**	**116**	**14.50**

Table 2: Microorganism isolated

Organisms	Percentage
Staphylococcus aureus	35 (26.51%)
Coagulase -ve Staphylococci	09 (6.81%)
Pseudomonas aeruginosa	**24(18.18%)**
Eischerichia coli	21 (15.90%)
Klebsiella pneumonia	15(11.36%)
Proteus mirabilis	06(4.54%)
Proteus vulgaris	03 (2.27%)
Citrobacter speices	03 (2.27%)
Beta haemolytic streptococci	05 (3.78%)
Bacteroides species	07 (5.30%)
Peptostreptococcus species	04 (3.03%)

A total of 132 strains of microorganisms are isolated from postoperative infected wound. The single infecting organisms were isolated from 100 cases and from the remaining 16 cases more than one organism were isolated (32 isolates). Aerobic bacterias were isolated in 97 cases (82.75%) as single organism while anaerobic bacterias found in only 3 cases (2.59%). Mixed aerobic and anaerobic bacterias were recovered from 8 cases (6.89%). 71 isolates (53.78%) of aerobic gram negative bacilli and 49 isolates of aerobic gram positive cocci (37.12%) were recovered from post-operative wound infection swabs. Staphylococcus aureus was the most frequently isolated organism 35 (26.51%)

followed by Pseudomonas aeruginosa 24 (18.18%) and E. Coli 21 (15.90%) table- 2. Out of 21 strains of E. coli, 18 (85.78%) showed sensitivity to cefotaxime followed by 13 strains (61.9%) being sensitive to gentamicin. 80% Kleb. pneumoniae strain were sensitive to cefotaxime while 88% of Proteus were sensitive to Cefotaxime (Table- 3).

Table- 3: Sensitivity pattern of Gram-negative isolates

Organism	Strains	Gentamicin	Ampicillin	Tetracycline	Cefotaxime
Esch. Coli	21	13(61.9%)	04(19.04%)	3(14.28%)	18(85.78%)
Kleb. Pneumoniae	15	9(60.00%)	03(20.00%)	02(13.33%)	12(80.00%)
Proteus species	9	6(66.67%)	02(22.22%)	01(11.11%)	08(88.89%)
Citrobacter species	3	02(66.66%)	…..	…..	02(66.66%)

Discussion

The problem of post-operative wound infection is seen in both developed as well as developing countries, despite the introduction of meticulous antiseptic regimen in surgical practice. The rate of infection at the incision following surgery depends on the skill of the surgeon and the degree of contamination at the time of operation. Contamination of the postoperative wound with subsequent infections can occur from either an endogenous or an exogenous source. Therefore, no matter how effective an infection control program may be, it is difficult to eliminate all post operative infections because many arise endogenously in patients whose immune defense mechanisms are impaired.

In the present study, post operative infection rate was 14.5% but Yalcin et al[5] observed it as low as 4.5% while Saha et al[6] observed as high as 31.37% and Ahmad et al[7] observed similar to our findings (14%). Low infection rates in developed countries may be due to vast differences in working conditions prevailing in these countries.[5] Anvikar AR et al (1999) in their prospective study of surgical wound found the post-operative wound infection of 6.09%. The study included only clean and clean-contaminated wounds. The high rate of post operative infections in the present study was probably due to the progressive trend towards the operating an older patients and performing more complicated procedures including operations on contaminated and dirty surgical sites. Higher rate of infection in elderly patients observed in the present study is in conformity with the findings of Khan et al.[2] The high infection rate among older patients may be due to longer pre-operative stay, longer duration of operation and carrier state of multi resistant Staphylococci. Reduced immunological efficiency at extremes of age may also play a part.[8]

We found high number of infection cases in contaminated and dirty wounds. The difference in the incidence of infection rate among various types of wounds is self-explanatory. Contaminated and dirty classes of wounds reflect the number of bacteria present at the operative site during the time of operation. Kowli et al[9] also reported the infection rate of 37.6% for clean cases as compared to 83.4% for unclean cases. Similar high degree association was also observed by Miles AA.[10]

In the present study, drain wounds developed infection more often than wounds without a drain. Khan et al[2] Agrawal[3] also found similar trends. Increase in wound sepsis in drain wound is probably due to the nature of operation. Drainage provides an outlet for collected serum and blood and prevents hematoma formation and thus it may diminish the risk of wound infection, but it is also true that the drainage communicates the tissue with the exterior for a longer period and may act as a pathway for pathogenic bacteria, thereby increasing the risk of infection. Leaper DJ et al[11] and Sawyer RG et al[12] also found higher rate of infection in drained wounds.

In the present study, significantly higher infection rate was observed in patients who did not receive preoperative prophylactic antibiotics in comparison to those who received them, ($p < 0.001$). Agrawal et al[3] reported that use of antimicrobial drugs in the pre-operative period destroys the susceptible organisms and then permit the colonisation in nasopharynx, lungs, wounds and gastrointestinal tract with resistant virulent organisms which may be responsible

for postoperative wound infection. To be most effective, antibiotics should be administered before operation in a manner that insures a tissue level at the time of incision and they should target pathogens commonly associated with the specific operation undertaken.[13]

We found high infection rates after Bowel surgeries (38.46%), Orthopedic surgeries (29%), Urological surgeries (25%), Cholecystectomy (21.05%) and Appendicectomy (18.18%). The high rate of infection after Bowel surgeries is constant with the known risk associated with abdominal operations and incision of the gastrointestinal tract. The most of these wound infection were treated with drainage and frequent dressings. Bielecki K et al[14] observed similar findings. In Urological surgeries, a large number of operations done were on vesical calculus. The high infection rate in these operations was mainly due to bacterial contamination from infected urine.[2] Most of the Orthopedic operations were performed on potentially contaminated wounds. In the present study, 100 cataract patients were observed postoperatively for the evidence of the infection. No ophthalmic complication occurred after cataract surgeries indicating strict aseptic precautions and prompt correction of associated conditions, mainly correction of lacrimal obstruction due to chronic dacryocystitis. Valenton M et al[15] observed that only 19 patients were infected following cataract surgery during long periods of 19 years.

From 132 isolates 71 (53.78%) were aerobic Gram negative bacilli, 49 (37.12%) aerobic Gram positive cocci and 11 (8.33%) isolates were anaerobic bacteria. Brook et aI[16] isolated 36% of aerobic bacteria, 16% of anaerobic bacteria, and mixed aerobic and anaerobic growth in 48% of cases. Rodrigo-Tapia JP et al[17] isolated 8% anaerobes from the post-operative wound infection. Among aerobic bacteria, isolation of Gram negative bacilli was more than Gram positive cocci. In recent years Gram negative bacilli have supplanted Gram positive cocci as the cause of majority of local wound infection. Saha SC et al[6] reported the predominant role of Gram negative organism in causation of post operative wound infection**.** Choojitv W et al[18] isolated 45.12% aerobic Gram negative bacilli and 19.5% aerobic Gram positive bacteria from surgical wound sepsis. Among Gram negative bacilli, Pseudomonas aeruginosa and E. coli were common. Pseudomonas aeruginosa is found to be commonest organism among Gram negative bacilli causing nosocomial infection. There were many studies showing the predominant role of Pseudomonas in causation of hospital acquired wound infection.[3] Oni AA et al[19] studied the pattern of bacterial pathogen in surgical wound infection. Pseudomonas and Klebsiella species emerged as the most important Gram negative organisms. Murthy R et al[20] showed 21% isolation of Pseudomonas species from post-operative wound swabs. Anvikar AR et al[4] and Emele FE et al[21] reported about 21% isolation of Pseudomonas aeruginosa from surgical wound infection. Among all studies Pseudomonas 4.04% detected (Agrawal et al (1984), 10.7% in (Yalcin AN et al (1995), 21.30% in(Anvikar AR et al (1999) and 18.18% in our study.

The antibiotic sensitivity of Pseudomonas aeruginosa showed 70.83% strains sensitive to ceftriaxone which was the most effective drug found in our study against Pseudomonal infection. Sensitivity to gentamicin was 54.16% which is in corroboration with the sensitivity range given by Emele FE et al[21]. The resistance of 44.84% strains to gentamicin in our hospital may probably due to the reason that gentamicin is routinely prescribed to our patients as it is easily available and inexpensive.

For the antibiotic sensitivity pattern of Gram negative isolates, the antibiotic used were gentamicin, ampicillin tetracycline and cefotaxime. In the present study 66.66% to 88.89% Gram negative isolates were susceptible to cefotaxime. About 61.9% to 66.66% isolates were sensitive to gentamicin. The high susceptibility of Gram negative isolate to cefotaxime in this study, proved the usefulness of cefotaxime in Gram negative infection.

It is seen from the above study that most of the organisms are resistant to commonly used antibiotics. It may be due to overuse of antibiotics resulting in selection of resistant strains. It is necessary to know the sensitivity of various pathogens in the post-operative wound infection as early as possible for two reasons: Firstly, to select the appropriate antibiotics, so as to avoid the emergence or overgrowth of resistant pathogens to currently use antimicrobial and secondly, these resistant

pathogens produced in turn, can cause cross infection to other post-operative wounds resulting in the problem of nosocomial infection.

Conclusion

Incidence of postoperative wound infection is high in the region. The infection rate was found to be 14.5%. A plethora of risk factors contributed to high incidence of postoperative wound sepsis. These factors are - wound contamination, old age, presence of drains and prosthesis, associated medical illness, overcrowding and the presence of multidrug resistant organisms. The postoperative wound infection directly and indirectly weakens the economy of patient, his family, hospital administrator and as such a Nation. A combined effort should be taken to minimize the problem of postoperative would infection. Present study provides a baseline data about the post operative wound infection in the region.

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