Original Article

Study Of Surgical Site Infections And Antibiotic Susceptibility Pattern Of Isolates At A Tertiary Care Hospital In Kishanganj, Bihar, India

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DOI: 10.47750/pnr.2023.14.S02.162

Abstract

Objectives: This present study was to evaluate the surgical site infections and antibiotic susceptibility pattern of isolates at a tertiary care hospital in Kishanganj, Bihar, India. **Methods:** Pus swabs/specimens were collected from infected surgical sites. All the specimens were inoculated onto blood and MacConkey's agar within two hours of collection. The agar plates were incubated at 37°C aerobically and were examined for the presence of any growth after 24 hours. Those plates showing no growth were incubated for another 24 hours. The isolates were identified by colonial morphology, Gram's stain and conventional biochemical tests. Antibiotic susceptibility pattern of the isolates was studied using Kirby Bauer method. Mueller Hinton agar (Difco) was used for antibiotic susceptibility testing. **Results:** Seventy-five organisms were isolated from the 100 specimens processed. 49 specimens yielded growth of single organism while two isolates were present in rest of the thirteen cases. The most common pathogen isolate was, Staphylococcus aureus (50.67%), followed by Pseudomonas aeruginosa (18.66%), Escherichia coli (12%), Klebsiella pneumoniea (6.66%), Acinetobacter baumannii (4%), and (2.66%) Streptococcus pyogenes, Citrobacter diversus, and Proteus mirabilis including miscellaneous gram negative rods. **Conclusions:** Staphylococcus aureus is the most common pathogens isolates from Surgical site infections. Hundred percent susceptibility of vancomycin is seen for Staphylococcus aureus and Streptococcus pyogenes. Cephalexin is also hundred percent susceptible for Streptococcus pyogenes. Imipenem, sulbactum ceftriaxone, ceftriaxone and piperacillin – tazobactum are more susceptible for gram negative rods.

Key words: Surgical site infection, Antibiotic susceptibility, Pathogens

INTRODUCTION

Postoperative SSI remains one of the most significant causes of morbidity among surgically treated patients. These patients incur higher costs due to longer hospitalizations, more nursing care, additional wound care, potential hospital admissions, and further surgical procedures. Identification of bacterial pathogens and the selection of an affective antibiotic against the organism are essential in successful management of bacterial infection [1].

It is clinically characterized as an infection that occurs within 30 days of surgery (or within a year if an implant is left in place after the procedure) and affects either the incision or deep tissue at the site of the surgery [2]. These infections can be superficial or deep incisional infections, or infections affecting organs or body spaces. SSIs are the most common infections associated with health care settings. They are associated with significant morbidity and over one-third of postoperative deaths have been reported to be linked to SSI [3, 4].

The extremely high efficacy of antimicrobial agents has proved to be a boon and curse. The double-edged sword has now many more edges; the sharpest is the development of resistance to antimicrobial agents [5]. Antibiotic therapy eradicates not only pathogenic organisms but also the protective normal flora [6]. As resistance towards antibiotics becomes more common a greater need for alternative treatments arises. However, despite a push for new antibiotic therapies there has been a continued decline in the number of newly approved drugs. Antibiotic resistance therefore poses a significant problem [7]. Therefore, the prophylactic regimen in patients undergoing surgery should include an agent effective against the most likely infecting organisms but need not eradicate every potential pathogen. The choice of antibiotic should be based on the local antibiogram [8]. Objectives of our study was to evaluate the surgical site infections and antibiotic susceptibility pattern of isolates at a tertiary care hospital in Kishanganj, Bihar, India.

MATERIAL & METHODS

This present study was conducted in Department of Microbiology, Mata Gujri Memorial Medical College and LSK hospital Kishanganj, Bihar during a period from Novemver 2021 to October 2022. Entire subjects signed an informed consent approved by institutional ethical committee of MGMC, Kishanganj was sought.

Patients had undergone different kinds of surgery including general surgery (n=58), Gynaecological/Obstetric surgery (n=32) and Orthopaedic surgery (n=10). Pus swabs/specimens were collected from infected surgical sites by standard technique using commercially available sterile stick swabs. The specimens were immediately transported to the Department of Microbiology, for bacteriological study. All the specimens were inoculated onto blood and MacConkey's agar within two hours of collection. The agar plates were incubated at 37°C aerobically and were examined for the presence of any growth after 24 hours. Those plates showing no growth were incubated for another 24 hours. The isolates were identified by colonial morphology, Gram's stain and conventional biochemical tests. Antibiotic susceptibility pattern of the isolates was studied using Kirby Bauer method9 . Mueller Hinton agar (Difco) was used for antibiotic susceptibility testing. Staphylococcus aureus ATCC 25932, Escherichia coli ATCC 25922 and Pseudomonas aeruginosa ATCC 27853 were included as control strains.

STATISTICAL ANALYSIS

Data was analysed by the using of simple statistical methods with the help of MS-Office software. All data was tabulated and percentages were calculated**.**

OBSERVATIONS

Most of our patients were young males (n=42). Rest were females (n=24). The age range was between 10-65 years.

Seventy-five organisms were isolated from the 100 specimens processed. 49 specimens yielded growth of single organism while two isolates were present in rest of the thirteen cases. The most common pathogen isolate was, Staphylococcus aureus (50.67%), followed by Pseudomonas aeruginosa (18.66%), Escherichia coli (12%), Klebsiella pneumoniea (6.66%), Acinetobacter baumannii (4%), and (2.66%) Streptococcus pyogenes, Citrobacter diversus, and Proteus mirabilis including miscellaneous GNRs.

Table.1. Showing the Pathogens isolated from Surgical site infections.

Organism	**No.**	**Percentage**
Staphylococcus aureus	38	50.67%
Escherichia coli	9	12%
Pseudomonas aeruginosa	14	18.66%

Klebsiella pneumonia	5	6.66%
Acinetobacter baumannii	3	4%
Proteus mirabilis	2	2.66%
Streptococcus pyogenes	2	2.66%
Citrobacter koseri	2	2.66%
Total	75	100%

In case of Staphylococcus aureus 29% of the isolates were found resistant to methicillin. Antibiotic susceptibility pattern of gram positive cocci (Staphylococcus aureus and Streptococcus pyogenes) to other antibiotics are shown in (Table 2).

Table.2. Showing the antibiotic susceptibility pattern (Percent sensitive) of Gram positive cocci.

Antibiotic	**Staphylococcus aureus %**	**Streptococcus pyogenes %**
Vancomycin	100%	100%
Amikacin	88.12%	-
Ciprofloxacin	67.32%	-
Cephalexin	57.43%	100%
Cotrimazole	47.54%	-
Gentamycin	43.14%	-
Methicillin	29.56%	-

In case of Pseudomonas aeruginosa only 31.43% isolates were gentamicin sensitive. Quite a few strains were also found resistant to piperacillin-tazobactum, ciprofloxacin and ceftazidime. Antibiotic susceptibility pattern of all the Gram negative rods (GNRs) studied is shown in (Table 3).

Table.3. Showing the antibiotic susceptibility pattern (Percent sensitive) of Gram negative rods (GNRs).

Antibiotic	Pseudomonas aeruginosa	Escherichia coli	Klebsiella pneumoniae	Miscelaneous GNRs
Imipenem	85.78%	74.23%	56.87%	56.78%
Amikacin	52.23%	56.23	43.12%	49.56%
Gentamycin	31.87%	38.45%	52%	58.87%
Ciprofloxacin	55%	42.23%	48%	30.65%
Ceftazidime	53.65%	52%	52%	52.43%

Ceftriaxone	71.65%	42.13%	63.65%	63.65%
Sulbactum ceftriaxone	76%	64%	44%	75.33%
Piperacillin – tazobactum	62.76%	73.44%	72.78%	66.54%

Imipenem was more susceptible to 85.78% Pseudomonas aeruginosa, 74.23% Escherichia coli, 56.87% Klebsiella pneumoniae and 56.78% Miscelaneous GNRs. Similarly, Sulbactum ceftriaxone was susceptible to 76% Pseudomonas aeruginosa, 64% Escherichia coli, 44% Klebsiella pneumoniae and 75.33% Miscelaneous GNRs.

DISCUSSIONS

Surgical site infections (SSI) still happen in both poor and rich countries [9,10]. Drugs such as antibiotics are important in the prevention and treatment of infectious diseases, and the management of patients with SSI, If it is caused by gram +ve or gram -ve organisms, the choice of an effective and appropriate antibiotic or regimen to fight them is very important [11, 12]. In this present study, 75 organisms were isolated from the 100 specimens processed. 53 specimens yielded growth of single organism while two isolates were present in rest of the thirteen cases. The most common pathogen isolate was, Staphylococcus aureus (50.67%), followed by Pseudomonas aeruginosa (18.66%), Escherichia coli (12%), Klebsiella pneumoniea (6.66%), Acinetobacter baumannii (4%), and (2.66%) Streptococcus pyogenes, Citrobacter diversus, and Proteus mirabilis including miscellaneous GNRs. Nandita Pal et al found that 23.3 percent of the samples had single isolates, whereas 36.7 percent had multiple isolates. Mama et al found that 91.6 percent of the samples had single isolates, while 8.4 percent had multiple isolates. They also found that 87.4 percent of the samples were culture positive, while 12.6 percent had no bacterial growth [13].

Most of the patients included in the study were young males with minimal predisposing factor. So the factors most probably operative in causing infections in our patients were related to the surgical team or surgical environment. Staphylococcus aureus is considered to be the leading pathogen in such post-surgical wound infections followed by the members of the Enterobacteriaceae [14]. But in our study the Pseudomonas aeruginosa was the second commonest isolate after Staphylococcus aureus. Otokunefor TV and Datubo-Brown DD also have found similar isolates in most of the patients included in their study [15].

In our present study, 29% Staphylococcus aureus of the isolates were found resistant to methicillin. MRSA infections cannot be treated by beta lactarnase resistant penicillins and not even by the cepha losporins [16]. Treatment of these infections is possible either by the Fluroquinolones (if the isolate is found sensitive) or by the vancomycin only [17]. More than 50% were sensitive to ceftriaxone and ciprofloxacin which are thus the minimal choice to treat Pseudomonas aeruginosa infections. Maximum sensitivity of Pseudomonas was seen to Imepenem, sulbactum-ceftriaxone and piperacillin tazobactum.. But an empirical treatment to be really effective against such isolates will have to include either amikacin or one of the carbapenems alone or in combination. Even the Escherichia coli, Klebsiella pneumonia and the other Gram negative isolates in our study are showing fairly high antibiotic resistance.

Antibiotic susceptibility results revealed that a high degree of resistance was seen for majority of the bacterial isolates. For gram positive bacteria vancomycin, amikacin, ciprofloxaxcin and cephalexin were found to be the most effective antibiotics. The degree of resistance was even higher among the gram negative bacteria and the commonly used drugs were found to be more resistant with an average resistance range from 50% to 100%. imipenem, sulbactum ceftriaxone, piperacillin-tazobactam, ceftriaxone, ceftazidime and amikacin were found to be the most effective antimicrobial agents [18,19]. The development and spread of resistant bacterial strains has emerged as a global problem. The appearance of multi drug resistant (MDR) strains over the past decades has been regarded as an inevitable genetic response to the strong selective pressure imposed by antimicrobial chemotherapy which plays a crucial role in evolution of antibiotic resistant bacteria.

Other previous studies showed a higher proportion of Gram positive organisms, specially S. aureus, associated with SSI in different countries [20, 21, 22, 23]. According to CDC, S. aureus, CoNS, and E. coli were the most prevalent organisms associated with surgical wound infections [24]. This difference in the pattern of distribution of bacterial isolates in different setups may be due to diversity of the study population and local antimicrobial use pattern which results in the emergence of pathogens that have the potential to resist antibiotics used currently [25].

In Ethiopia, multidrug resistant Acinetobacter species was isolated from 22.1% of the patients which is comparable to a study conducted by Bibi et al. (25.3%) [15]. This finding is again reported in previous studies in Pakistan, Vietnam, and Brazil [21, 27]. This is due to its environmental desiccation survival for weeks, a characteristic that promotes transmission through common hospital sources of contamination [28].

CONCLUSIONS

This present study concluded that the Staphylococcus aureus is the most common pathogens isolates from Surgical site infections. Hundred percent susceptibility of vancomycin is seen for Staphylococcus aureus and Streptococcus pyogenes. Cephalexin is also hundred percent susceptible for Streptococcus pyogenes. Imipenem, sulbactum ceftriaxone, ceftriaxone and piperacillin – tazobactum are more susceptible for gram negative rods.

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