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Original Research Article

Surgical Site Infections: Organisms and their Antibiotic Susceptibility Pattern in Shri Shankaracharya Institute of Medical Science, Junwani, Bhilai (Chattisgarh)

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ABSTRACT

Background: Most of the wounds are colonized by aerobic and anaerobic microorganisms that are either endogenous or exogenous. Most of the time Gram positive Staphylococcus aureus is the major culprit in these infections. Surgical site infections (SSIs) are a frequent cause of morbidity following surgical procedures. The risk of developing SSIs is associated with factors, including operative procedure itself, such as wound classification, and patient-related variables, such as preexisting medical conditions.

Settings and Methods: Isolation, Identification and Antibiotic sensitivity was done from patients with signs and symptoms of surgical site wound infection.

Results: We included 324 surgery patients with signs and symptoms of wound infections with a span of seven months. Single bacterial pathogen was isolated from the 159 patients and multiple pathogens were identified from the 64 cases, 101 cases showed no growth. For study purpose we included only single isolated pathogen. There was high isolation of Staphylococcus aureus (98 patients 61.65%) followed by Escherichia coli (36 patients 22.64%). Staphylococcus aureus, Escherichia coli, Klebsiella pneumoniae were resistant to multiple antibiotics including third generation cephalosporins. Streptococcus sp., Pseudomonas aeruginosa were less resistant.

Conclusion: Infections were polymicrobial and multidrug resistant. Staphylococcus aureus is the commonest cause of surgical site infection. Also it highlights the need for effective surveillance and antibiogram guided antibiotic prescription to reduce drug resistance.

Keywords: Surgical Site Infections, Microorganisms, Staphylococcus Aureus, Antibiotic Susceptibility.

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INTRODUCTION

In spite of the progress in surgery, surgical techniques and antibiotic prophylaxis postoperative infections remain the commonest postoperative complications and one of the most frequently encountered nosocomial infections worldwide. The incidence of these infections has been estimated to be 15.45% and 11.32% by the Center for Disease Control and Prevention USA and the UK Nosocomial Infection Surveillance respectively.[1,2] Risk of wound infection varies with the type of surgery and surgical operations have been classified into, clean, clean-contaminated, contaminated and dirty. A clean wound is an incision through un-inflamed tissue in which the wound is primarily closed. In this wound type only closed drainage systems are used and there is no breach in aseptic technique and the viscus is not opened. A clean-contaminated wound is one which is created at emergency surgery and in which the un-inflamed upper gastrointestinal tract, normal gall bladder and urinary bladder are opened but there is no spillage of contents and there is minor break in aseptic technique. Contaminated wounds are traumatic wounds less than 6 hours old and wounds in which the inflamed upper gastrointestinal tract and obstructed urinary bladder are opened or spillage of contents occurs. In these wounds there are major breaks in sterile technique. Dirty wounds are associated with presence of pus and may include intra-peritoneal abscess formation or visceral perforation and traumatic wounds more than 6 hours old.[3,4] Microbial contamination and colonization of wounds is common to all wounds healing by secondary intention and has been thought to be a precondition to the formation of granulation tissue and stimulation of wound healing.[5] Surgical procedures may result in the production of pus, a white to yellow fluid comprised of dead WBCs, cellular debris, and necrotic tissues.[6] Wounds can be infected through three main sources; the surrounding skin, endogenous sources such as the nasal mucosa, gastrointestinal

tract and genitourinary tract, the sources of contamination and subsequent infection of a wound may include healthcare workers (HCW), patients and the inanimate environment.[7] Aerobic and anaerobic bacteria both have been implicated in wound infections which commonly occur under hospital environment and result in significant mortality, morbidity, hospitalization, and huge economic burden.[1]

The choice of treatment for post-surgical infections requires an understanding of the usual infectious flora, available antimicrobial agents and susceptibility patterns of the infecting organisms as these would be helpful in the selection of empiric antimicrobial therapy and also on infection control measures in the health institutions.[8,9]

Staphylococcus aureus is an opportunistic nosocomial pathogen, and one of the main organisms involved in the infection of surgical site wounds.[10] Rapid emergence of multidrug-resistant bacteria poses a serious threat to public health.[11] The inappropriate usage of antimicrobials in surgical perioperative prophylaxis is still a problem, and a close collaboration between surgeons and microbiologists is needed.[12.13]

Objective of this study is to characterize the bacteria and to determine their resistance to various antibiotics commonly used in chemotherapeutics.

MATERIAL AND METHODS

Study Site, Patients and Sample Collection

This study was carried out in the tertiary care hospital in central India in Chhattisgarh state. The study involves the isolation identification and antibiogram of the isolates identified from the patients with signs and symptoms of surgical site wound infection. Study was carried out from September 2016 to March 2017.

Patients included were operated patients from the hospital during study period. Patient Selection From the internal database of patients who had SSIs, prospectively maintained by the Infection Prevention and Control (IPAC) Subcommittee of the Institutional Clinical Practice Committee, we included patients (inpatient, ambulatory, or short-stay, or a combination) aged 18 years and older who had undergone surgery between September 1, 2016, and April 30, 2017. Cases are identified during surveillance of microbiology reports, re-admission diagnoses.

Total of 324 samples were collected from the surgery patients with signs and symptoms of wound infections with a span of seven months. Single bacterial pathogen was isolated from the 159 patients and multiple pathogens were identified from the 64 cases, 101 cases showed no growth. In this study we included only single isolated pathogen. There was high isolation of *Staphylococcus aureus* (98 patients 61.65%) followed by *Escherichia coli* (36 patients 22.64%), *Pseudomonas aeruginosa* (8 patients 5.03%), *Klebsiella pneumoniae* (7 patients, 4.40%) *Streptococcus sp*. (5 patients 3.14%) and other (5 patients 3.14%)

Methods for Isolation

Samples were processed in the microbiology lab of the hospital and identified according to the standard identification procedure

Antibiogram of Isolated Bacteria

Antibiotic susceptibility testing was determined by the Kirby–Bauer disc diffusion method according to CLSI guidelines.[14]

Table 1: Isolation of the bacteria

Organism	Number	%
Staphylococcus aureus	98	61.64
Streptococcus sp.	5	3.14
Escherichia coli	36	22.64
Klebsiella pneumoniae	7	4.40
Pseudomonas aeruginosa	8	5.03
Other (Citrobacter sp 2 Proteus sp 3)	5	3.14

Table 2: Antibiogram of the isolates: Gram negative isolates (antibiogram)

S. No	Antibiotics	*Escherichia coli*		*Klebsiella pneumoniae*		*Pseudomonas aeruginosa*	
		n=36	% resistant	n=7	% resistant	n=5	% resistant
1	Ampicillin	26	72.22	6	86.21	-	-
2	Amikacin	6	16.67	2	27.59	1	16.67
3	Gentamycin	19	52.78	3	37.93	2	40
4	Ciprofloxacin	16	44.44	4	52.17	1	25
5	Cefuroxime	19	52.78	5	69.57	0	0
6	Ceftazidime	20	55.56	5	75	3	66.67
7	Cephotaxime	19	52.78	5	68.97	-	-
8	Trimethoprim/Sulphamethoxazole	21	58.33	5	64.29	5	100
9	Nitrofurantoin	3	8.33	1	20		
10	Norfloxacin	23	63.89	4	50	5	100
11	Imipenem	4	11.11	1	16.67		
12	Meropenem	6	16.67	1	16.67	1	25
13	Ampicillin Sulbactum	16	44.44	5	69.57	-	-
14	Piperacillin	23	63.89	4	50	3	66.67
15	Piperacillin Tazobactum	-	-	-	-	2	40

Table 3: Gram positive isolates (antibiogram)

S. No	Antibiotics	*Staphylococcus aureus*		*Sterptococcus sp.*	
		n=98	% resistant	n=5	% resistant
1	Gentamycin	46	46.94	-	-
2	Ciprofloxacin	43	43.88	-	-
3	Trimethoprim/Sulphamethoxazole	49	50.00	2	40
4	Nitrofurantoin	10	10.20	-	-
5	Norfloxacin	45	45.92	-	-
6	Penicillin	74	75.51	1	20
7	Erythromycin	43	43.88	-	-
8	Oxacillin	37	37.76	-	-
9	Linezolid	1	1.02	-	-
10	Ofloxacin	42	42.86	-	-
11	Vancomycin	2	2.04	-	-
12	Teicoplanin	1	1.02	-	-

(- not tested for antibiotics)

RESULTS

Of all the 324 samples processed, single bacterial pathogen was isolated from the 159 patients and multiple pathogens were identified from the 64 cases, and no organism in 101 cases. In this study we included only single isolated pathogen. There was high isolation of *Staphylococcus aureus* (98 patients 61.65%) followed by *Escherichia coli* (36 patients 22.64%), *Pseudomonas aeruginosa* (8 patients 5.03%), *Klebsiella pneumoniae* (7 patients, 4.40%) *Streptococcus sp*. (5 patients 3.14%) and other (5 patients 3.14%). There was a predominant isolation of Gram positive bacteria (103, 64.77%) as compared to Gram negative bacteria (56, 35.22%). Of the total 98 isolates of *Staphylococcus aureus* 37.76% isolates were MRSA (methicillin resistant *Staphylococcus aureus*)

DISCUSSION

This study shows the causative organisms of postoperative wound infection and their antibiotic sensitivity pattern. It also shows that infections were polymicrobial and *S. aureus* and MRSA are major cause of surgical site infections in hospitalized patients followed by Escherichia coli. This reports were similar with study done by EO Akinkunmi et al.[15,16] Several other reports have implicated *Pseudomonas*, *Staphylococcus*, *Streptococcus*, *Klebsi ella* and *Escherichia coli* in surgical site wound infections.[17,18] Antibiogram results from the present study show that *E. coli* was more resistant to ampicillin, piperacillin, norfloxacin, cephalosporins, while being least resistant to amikacin, imipenem, and meropenem. *S. aureus* was highly susceptible to vancomycin (99%), linezolid (99%) and teicoplanin (99%), while it showed moderate resistance to ciprofloxacin, and azithromycin. Unlike some reports in which MRSA was associated with wound infections.[19,20] A high prevalence of aerobic bacteria were isolated. This is in accordance to other similar findings and confirms the importance of aerobes in surgical wound infections.[9,21]

Organisms causing nosocomial infections and surgical infections have changed over the years. Gram positive organisms were predominant organisms involved but now gram negative organisms are being isolated in increasing rate.[22] Even though the isolation of pseudomonas is less in this study but it indicates an epitome of opportunistic pathogen responsible for wide range of infections and lead to substantial morbidity and mortality.[23]

This study provides the evidence of high prevalence of antibiotic resistant bacteria in wound samples of patients collected from a tertiary care hospital environment. Our findings indicate the predominance of *Staphylococcus aureus* among the bacterial isolates. The prevalence and the antibiogram of bacteria infecting the surgical wound exhibit variable pattern according to geographical area, climatic conditions and socioeconomic status. High drug resistance in *Staphylococcus aureus, Escherichia coli and Klebsiella pneumoniae* isolates from the wound sample may point towards the incomplete treatment schedule, antibiotic misuse and antimicrobial resistance among health care workers. Updated knowledge of antibiotic susceptibility pattern and treatment for wound infections will help in designing appropriate dose regimen and help in reducing the expanding menace of the drug resistance thereby reducing the mortality and morbidity of the postoperative patients.

CONCLUSION

Surgical site infections were polymicrobial and multidrug resistant in tertiary care hospital. Staphylococcus aureus is the commonest cause of surgical site infection followed by Escherichia coli. Isolates exhibited high to moderate levels of resistance against different classes of antibiotics. This report may be considered while implementing empiric treatment strategies for wound infections. Quinolones, cephalosporins, and other higher antibiotics should be used with caution because of drug resistant threat in the management of surgical wound. There should be continuous monitoring and restricted use of unsupervised antibiotics.

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