Original Research Article

Microbiological and Antimicrobial Resistance profile of isolates from Surgical Site Infections: a study in a Tertiary Care Hospital

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Abstract:

Post-operative wound infections or surgical site infections (SSIs) cause critical health-related infections resulting in longer hospital stays, increased healthcare expenses, patient's discomfort and are likely to have an important role in the growth of antimicrobial resistance. Staphylococcus is the most common bacterial organism causing wound infections in hospitals. The present study was done to identify aerobic cultural isolates from post-operative infected wounds and to study the drug susceptibility profile of the bacterial isolates. Staphylococcus aureuswere the most commonly isolated bacteria followed byE. coli, K. pneumonia, Pseudomonas aeruginosa, Proteusmirabilis, and Acinetobacterbaumanii complex. The drug resistance susceptibility profile showed high rate of drug resistance to most commonly used drugs like gentamicin, ciprofloxacin and ceftriaxone.

Keywords:

Wound Infections, Surgical Site infections, Hospitals, Bacterial profile, Antibiotic drug resistance.

Introduction

Despite the advances made in asepsis and antisepsis, post-operative wound infection remains to be the feared final pathway for the surgical patients. The incidence of surgical site infections varies from as low as 2.5% to 41.9%. The pathogens isolated from infections differ depending upon the type of surgical procedure. Staphylococcus aureus has been reported as a major cause of community and hospital acquired infections (1). Infections caused by Staphylococcus aureus used to respond to Lactam and related group of antibiotics. However due to development of Methicillin resistant Staphylococcus aureus, treatment has become problematic. Post operative wound infections have been found to pose a major difficulty in the field of surgery. Advances in control of infection have not completely eradicated this problem because of increase of drug resistance (2). Surgical site infections (SSIs) cause critical health-related infections resulting in discomfort, resulting in patients' miserable state. Wound infections are a common type of infections that results in longer hospital stays, expressively increase the rate of medical care and are likely to have an important role in the growth of antimicrobial resistance (3). Generally these infections are artificial and can be treated with a routinecare and various antibiotics. Every hospital has its own bacterial flora which poses risk to the patients for acquiring infection during hospitalization. Microorganisms exhibit unique patterns of antimicrobial activity during a certain period of time. This approach helps the surgeons to control surgical site infections by knowing the resistance to antimicrobials (4). Since, Staphylococcus is the most common bacterial organism causing wound infections in hospitals and its incidence ranges from 30-70% in India (5). The importance of the detection of MRSA for treatment and epidemiological purposes is required (6). The present study was done to identify aerobic cultural

isolates from post-operative infected wounds and to study drug sensitivity pattern of the isolated aerobes. It was also done to study various pathogens isolated from surgical sites and their antibiotic pattern.

Material and methods

SELECTION OF CASE:100 culture positive post-operative wound infections cases from surgical wards of Tertiary care Hospital, Patiala was studied from a period of September 2021-October 2021. Samples were received from various Surgical Departments. They were processed in the Department of Microbiology GMC Patiala. The pus swabs were 1 stinoculated on Blood Agar and Mac Conkey Agar and then used for smear preparation. After aerobic incubation at 37oC the growth was identified from colony characters, Gram's staining and biochemical reactions.

DRUG SENSITIVITY: Nutrient Agar was used and antimicrobial sensitivity was studied by Disc diffusion method as described by Kirby and Bauer. Various drugs used were Ampicillin (10 microgram/ disc), Imipenam (10 microgram/ disc), Cloxacillin (10 microgram/ disc), Gentamicin (10 microgram/ disc), Vancomycin (30 microgram/ disc), Ceftriaxone (30 microgram/ disc), Clindamycin (30 microgram/ disc).

METHICILLIN RESISTANCE: 2 microgram Oxacillin disc on Nutrient Agar medium supplemented with 5% Sodium chloride was used. Plates were incubated at 30 ℃ instead of 37 ℃ instead for 24 -48 hours.

Result

Analysis of 100 bacterial strains responsible for surgical site infection showed that the most were gram-negative and some were gram positive(Figure 1). The incidence of infections was maximum in the age group of 30-49 years. Antibiogram reports showed that the most common bacteria were Staphylococcus (33.57%). Staphylococcus bacteria were classified into coagulase-negative or positive. We showed that coagulase-negative staphylococcus was responsible for 15% of infections and coagulase-positive staphylococcus40%(Staphylococcus aureus) and in total they were responsible for 55% of infections. Among gram negative organisms E. coli 21% followed by K. pneumoniae 11%, Ps. aeruginosa 9%, Proteus spp 3% and Acinetobacterspp – 1%.

Further, the antibiotic resistance of all the isolates was done. All isolates were resistant to Amoxycillin-clavulanic acid, Piperacillintazobactam, Erythromycin, Gentamicin, Ciprofloxacin, Ceftriaxone, Clindamycin, Vancomycin and Imipenam with varied percentage as shown in figure 2. Maximum resistant of all was seen to Ciprofloxac in and Ceftriaxone. Almost all the isolates including E. coli, K. aerogenes, P. aeruginosa and P. mirabilis, S. aureuswere resistant to Ceftriaxone. However, maximum sensitivity of all the isolates was to Imipenam. Among the isolates S. aureus, was resistant to Methicillin (20%) and was 100% sensitive to vancomycin. E. coli was more sensitive to amoxyclav and imipenam which accounts to 88.89% and 95.24% respectively (Figure 2).

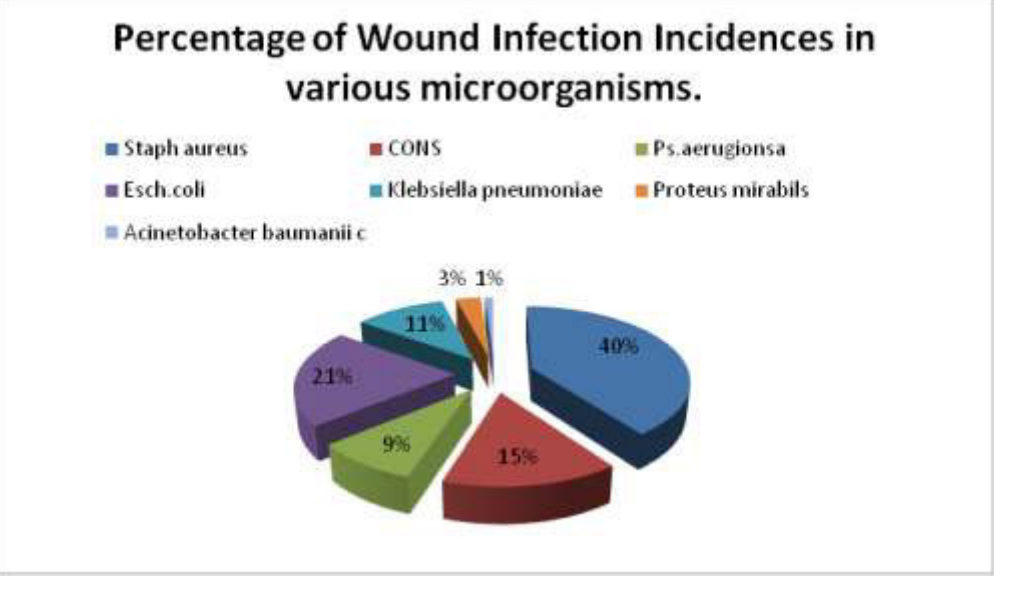
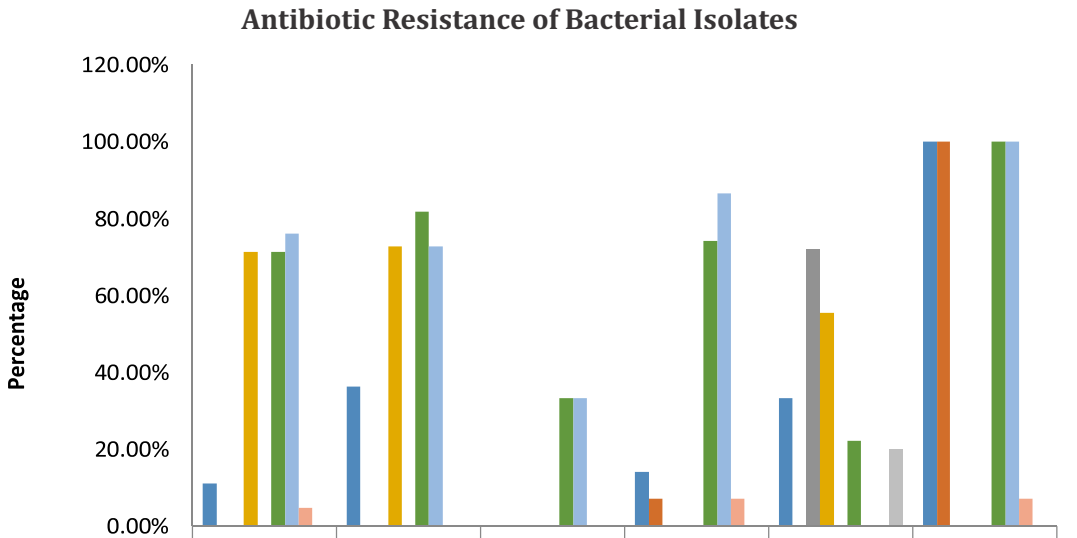
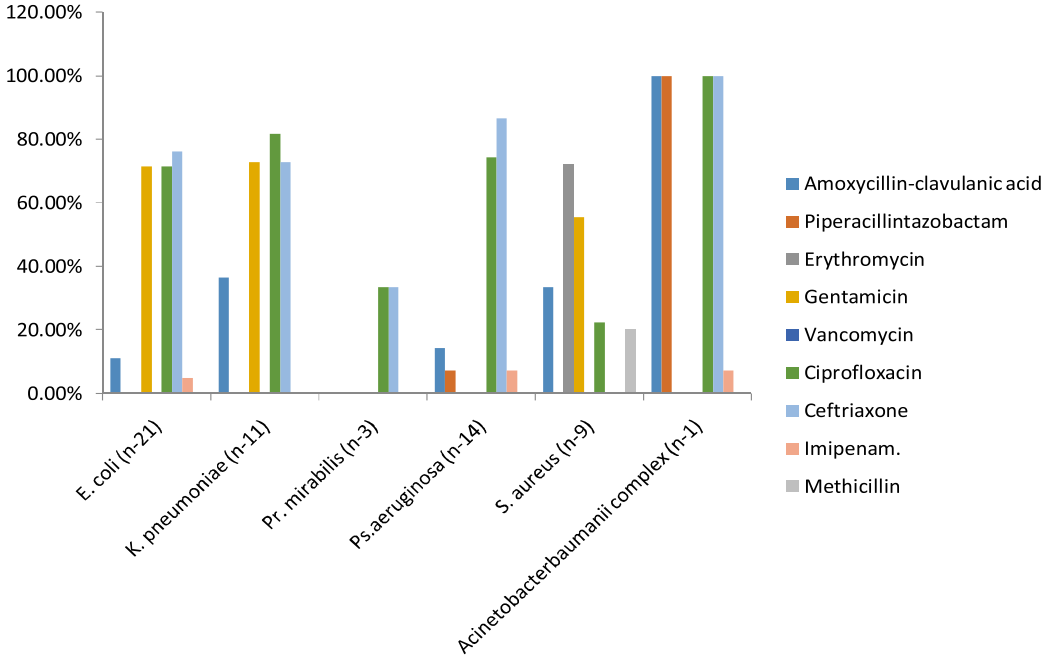


Figure 1: Percentage of Wound Infection Incidences in various microorganisms.



	E. coli (n-21)	K. pneumoniae (n-11)	Pr. mirabilis (n-3)	Ps.aeruginosa (n-14)	S. aureus (n-9)	Acinetobacterbaumanii complex (n-1)
Amoxycillin-clavulanic acid	11.11%	36.36%	0%	14.20%	33.33%	100%
Piperacillintazobactam	0	0	0	7.14%		100%
Erythromycin	0	0	0	0	72.22%	0
Gentamicin	71.42%	72.72%	0%	0	55.55%	0
Vancomycin	0	0	0	0	0%	0
Ciprofloxacin	71.42%	81.81%	33.33%	74.28%	22.22%	100%
Ceftriaxone	76.14%	72.72%	33.33%	86.67%	0	100%
Imipenam.	4.76%	0.00%	0.00%	7.14%	0.00%	7.14%
Methicillin	0.00%	0.00%	0.00%	0.00%	20.00%	0.00%

Figure 2: Percentage of Antibiotic Resistance of Bacterial Isolates



Discussion

In the present study, identification of aerobic cultural isolates from post-operative infected wounds was done to study drug sensitivity pattern of the isolated aerobes. The incidence of infections due to Gram Positive coccii.e of S. aureus was about 40% and CONS 15%. The Methicillin resistance pattern of isolated strains of Staphylococcus was observed to be 20%. In previously reported study, Staphylococcus aureus was found to be the common bacteria isolated from the wounds of surgical site infections and accounted for 33.83% (7). The possible cause of Staphylococous predominance is due to its existence in the skin as regular flora and can thus penetrate to profound site during surgical interventions (8).Incidence of MRSA isolation was broadly ranged from 15.7% - 63.5% as per previous data studied by Negi et al (12).

The current study reported that the most common isolate among Gram negative bacilli was Esch. coli 21% followed by K. pneumoniae 11%, P. aeruginosa 9%, Proteus spp 3% and Acineto-bacterspp 1%. The predominance of Gram negative bacteria in the existing study was in concord with findings from Tanzania and Ethiopia (9,10). As per CDC, (NNIS report, 1996)S. aureus, CoNS, and Esch. coli were the most prevalent organisms associated with surgical wound infections (11). Chaudhary et al, in 2017 showed that Staphylococcus aureus (47.4%) and Escherichia coli 20.60 % was common site infection out of 194 isolates 39.2% with multi drug resistant property (14).Another study by Mehrad et al, in 2015 reported that Pseudomonas aeruginosa and Acinetobacter species are the causes of hospital-acquired infections(15).

The maximumsensitivity of Gram negative isolates was to Amoxyclav and Imipenam. Almost all the Gram negative isolates i.e Esch. coli, K. aerogenes and Pr. mirabilis, were resistant to Gentamicin, Ciprofloxacin and Ceftriaxone. Similarly Gram positive isolates were resistant to Gentamicin and Erythromycin but were 100% sensitive to Vancomycin. The Methicillin resistant staph aureus were 100% sensitive to vancomycin. A recent study also reported that S. aureus and coagulase-negative staphylococcus was highly susceptible tovancomycin (16).Among non fermenters i.e Ps. aeruginosa and Acinteobacter baumanii complex the isolates showed less resistance to amoxyclav (14.2%), Piperacillin tazobactem (7.14%) and imipenam (7.14%) and showed high level of resistance to Ciprofloxacin (74.28%) and to ceftraixone (86.67%). The findings of the present study are similar to the studies done by Manyahi J and Mehrad B et al in which the prevalence of MDR for Esch. coli, A. baumannii and Pseudomonas spp. was 100% each(9,15).

The information gathered from the current study may help to control the infections and effective guidelines can be formed for antibiotic therapies in various surgical interventions. The most critical factors in the prevention of these surgical site infections is the proper technique of the surgeon and surgical team as reported by Nichols, 2001 and Ali et al, 2009(17, 18).The use of antibiotic prophylaxis before surgery has evolved greatly in the last 20 years as improvements in the appropriate choice of antibiotic agents have defined more clearly the value of this technique in reducing postoperative wound infections (19). The surgeon may also minimize the risk to the patient by giving attention to technical details and awareness of the operating room environment, and the selective use of antibiotic prophylaxis for appropriate patients (20).Beyond the finding of antibiotic resistance, the molecular mechanisms that underlie resistance can be explicated byspecific phenotypic and molecular methods.

Conclusion

Emergency surgical procedures carried the greatest risk with bacteria like staphylococcus species, Esch. coli, Klebsiell apneumoniae and Pseudomonas Spp. being the most common infecting organisms. Proper measures need to be undertaken to control infection rates by every available method; antibiotics alone may not be sufficient to win this war.

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