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Original Research Article

Study of surgical site infections and its antibiogram in a surgical ICU of a tertiary care hospital in south west Rajasthan

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ABSTRACT

Background: Surgical infections can be caused through two major sources: exogenous and endogenous bacteria. Surgical site infections (SSIs) is one of the most common complications encountered in surgery. SSI places a significant burden on both the patient and health system, thus a major cause of morbidity, prolonged hospital stay and increased health costs. Objective of this study was to identify and isolate various bacteria from wound infections in a surgical intensive care unit and to study their antibiogram.
Methods: Two wound swabs were collected from the wound and from a drop of aspirate, smear was made on clean glass slide and Gram staining was done for direct microscopic examination under oil immersion 100X objective to know various morphological types of bacteria and presence or absence of inflammatory cells. Second swab/drop of aspirate was used for culture by inoculating it on routine media like blood agar, nutrient agar and MacConkeys agar, incubated at 37° C for 24 hours aerobically.
Results: Out of 150 pus samples, 122 (81.3%) were culture positive for bacterial growth and no growth was observed in 28 (18.7%) cases. Out of 122 bacterial culture positive cases, 120 were monobacterial and 2 were poly bacterial. Out of 122 bacterial isolates; *E. coli* (32/26.2%) was the commonest followed by *P. aeruginosa* (32/24.5%).
Conclusions: The study concludes that variety of aerobic bacteria is responsible for surgical site infections with predominance of *Escherichia coli* followed by *Pseudomonas aeruginosa*.

Keywords: *Escherichia coli*, Monobacterial, *Pseudomonas aeruginosa*

INTRODUCTION

Infection is defined as invasion and multiplication of microorganisms in the body tissues, which may be clinically in apparent or result in local cellular injury because of competitive metabolism, toxins, intra-cellular replication or antigen antibody response.[1] This series of events lead to progressive tissue destruction and eventual host demise if left unchecked. The infection process begins with a disruption of the host mechanical barriers to microorganisms, the availability of microorganisms and colonization.[2] Wound infections can be caused through two major sources: exogenous and endogenous bacteria. The probability of wound infection largely depends on the patients systemic host defenses, local wound conditions and microbial burden.[3,4] Despite modern surgical techniques and the use of antibiotic prophylaxis, surgical site infection (SSI) is one of the most common complications encountered in surgery.[5] SSI places a significant burden on both the patient and health system. SSI is thus a major cause of morbidity, prolonged hospital stay and increased health costs.[6] Skin and soft tissue infections (SSTIs) may also contribute to longer hospital stays increase the cost of medical care and play an important role in development of antimicrobial drug resistance. Common examples of SSIs includes cellulitis, abscesses, impetigo, folliculitis, furuncle, carbuncle, necrotizing fasciitis, diabetic foot infections and surgical site infections. Complicated SSI may prove fatal and require hospitalization, intravenous antibiotics or surgery. An SSI is classified as complicated if the infection has spread to the deeper soft tissue, if surgical intervention is necessary or if the patient has co-morbid conditions Hence, this study could play a significant role in the early recognition of the problem and hence, there is need for early intervention for better management of wound infections.

METHODS

Type, duration and setting

It was a retrospective crossectional study. This study was done in Geetanjali Medical College and Hospital, Udaipur from October 2018- September 2019.

Ethical clearance

Ethical clearance from the Institutional Ethical committee was obtained.

Sample size

One hundred and fifty (150) of pus samples were taken. Isolation and identification of aerobic bacterial pathogens was done, from various departments like surgery, gastrooncology, gynecology and orthopedics.

Data collection

Wound swabs were collected as per the procedure described below.

Procedure

Two wound swabs were collected from the wound and from a drop of aspirate, smear was made on clean glass slide and Gram staining was done for direct microscopic examination under oil immersion 100X objective to know various morphological types of bacteria and presence or absence of inflammatory cells. Second swab/drop of aspirate was used for culture by inoculating it on routine media like blood agar, nutrient agar and MacConkeys agar, incubated at 37° C for 24 hours aerobically. [7-9] The plates were examined the next day for growth. Plates not showing any growth were further incubated at 37°C aerobically for another 24 hours. Plates not showing any growth after 48 hours on aerobic incubation were considered to be lacking aerobic bacterial pathogens. Smears were made, stained by Gram stain and examined under oil immersion microscope 100X objective.

Antibiotic sensitivity testing was performed on Mueller Hinton agar according to CLSI guidelines. MRSA was detected using cefoxitin (30 µg) disc and ESBL production in Gram negative bacteria was detected by using potentiated disc diffusion test (PDT).[8-10]

Inclusion criteria

All the swabs from patients, suspected of surgical site infections (post-surgery), for bacterial pus culture were obtained and sent to Microbiology department.

Exclusion criteria

Patients already on higher antibiotics even after surgery were excluded from the study.

RESULTS

Two hundred and thirty eight cases of pus samples were taken. Aerobic bacterial pathogens were isolated and identified from various departments like surgery, gastrooncosurgery, gynecology and orthopedics. Surgical wound swabs were 95 (63.3%) and non-surgical wound swabs were 45 (36.7%) in number. Pus discharge was collected from 150 patients were identified, out of which 90 (60%) were males and 60 (40%) were females. Cases of pus discharge came mainly from rural areas (107/87.7%) as compared to urban areas (15/12.7%).

Bacterial isolates

Out of 150 pus samples, 122 (81.3%) were culture positive for bacterial growth and no growth was observed in 28 (18.7%) cases as shown in Table 1. Out of 122 bacterial culture positive cases, 120 were monobacterial and 02 were poly bacterial. Out of 122 bacterial isolates; *E. coli* (32/26.6%) was the commonest followed by *P. aeruginosa* (30/24.5%).

Table 1: Distribution pattern of bacterial isolates (n=150).

Organisms	Total no. of cases
Escherichia coli	32
Pseudomonas aeruginosa	30
Staphylococcus aureus	24
Klebsiella pneumoniae	20
Citrobacter freundii	09
Proteus mirabilis	04
Enterococcus fecalis	03
E. coli + P. aeruginosa	01
E. coli+ Staph. aureus	01
No growth	28

Antibacterial susceptibility profile

Gram negative isolates like *Escherichia coli* showed its maximum susceptibility to Amikacin. *P. aeruginosa* isolates showed maximum susceptibility to doripenem and piperacillin tazobactum. Gram positive bacteria showed maximum susceptibility to Vancomycin. 33.3% of *S. aureus* isolates were MRSA and 34.3% of Gram negative isolates were ESBL producers as shown in Table 2.

Table 2: Antibiotic sensitivity pattern of bacterial isolates.

Antibiotics	Gram positive isolates n=27	Gram negative isolates n=65	Pseudomonas isolates n=30
Vancomycin (VA)	100%	-	
Clindamycin (CD)	26.5%	-	
Linezolid (LZ)	80.5%	-	
Erythromycin (E)	28.9%	-	
Ampicillin (AMP)	11.8%	-	
Amoxyclav (AMC)	32.9%	-	
Ceftriaxone (CTR)	53.5%	55.6%	61%
Cefoxitin (CX)	33.3%	-	
Cefotaxime (CTX)	-	44.4%	
Ceftazidime (CAZ)	-	38.9%	61.1%
Gentamicin (GEN)	71.2%	38.9%	33.3%
Amikacin (AK)	82.4%	72.2%	69.4%
Imipenem (IPM)	-	74.4%	86.1%
Meropenem	-	87.1%	86.7%
Doripenem	-	90.6%	91.4%
Piperacillin + Tazobactum (TZP)	-	66.7%	90.7%
Cefopodoxime (CPZ)	-	50%	-
Ciprofloxacin (CIP)	-	33.3%	36.1%
Netlimicin (NET)	-	-	44.4%
MRSA	33.3%	-	
ESBL producers	-	34.3%	

DISCUSSION

In the present study an attempt was made to study the bacteriological profile of wound infections and antimicrobial susceptibility pattern of the isolates. In this study along with the identification of aerobic bacterial organisms, changing pattern of antibiotic sensitivity with special reference to methicillin resistant *Staphylococcus aureus* (MRSA) and extended spectrum of beta lactams (ESBLs) were also identified.

It was observed that the commonest age group affected was 21-40 years which is correlated with the studies done by Malik et al and Afroz et al.[11,12] Males (70.1%) were affected more than females (29.9%).[13] This study was correlated with Rao et al which showed males (60%) more affected than females, Sowmya et al 66.6% and Malik et al.[11,13,14] 51.9% also showed the predominance of males over females probably because of their more exposure to life.

Monomicrobial etiology was more common 96.1%, than polymicrobial 3.8%. This study is correlated with Soumya et al 91.7% and Mehta et al, 70.4% wherein the monomicrobial etiology was more common than polymicrobial which may be due to the prior use of antibiotics.[14,15]

In the present study *Escherichia coli* 26.2% was the predominant organism followed by *Pseudomonas aeruginosa* 24.5%, *Staphylococcus aureus* 19.6%, *Escherichia coli* (26.2%) was the most predominant isolate which correlated with the other studies done Malik (30.1%), Mehta (38.3%), Rao (27.8%) and Suryawanshi et al (48.4%).[13-17]

Second most predominant organism in the present study was *Pseudomonas aeruginosa* 24.5% which correlated with the studies of Naik et al (20%), Malik et al (17.8%), Mehta et al (21.3%), Rao et al (18.5%) and Suryawanshi (17.52%).[11,13,15-17] In the present study, polymicrobial 2 cases included combination of *Escherichia coli* with *Pseudomonas aeruginosa* which correlates with the study of Anbumani et al.[18] Other polymicrobials included *Klebsiella pneumonia with Staphylococcus aureus* accounting for 37.5% cases.

Out of 24 *Staphylococus aureus* isolates, 08 (33.3%) were MRSA producers and remaining 16 (66.6%) were MSSA producers. The present study correlates with the study of Rajaduraipandi et al with 31%, Anupurba et al with 32% and Soumya et al with 27.5%, as MRSA producers.[14,19,20] Among 65 Enterobactericeae isolates, 34% were ESBL producers and 66% were Non-ESBL producers which correlated with the studies done by Mehta et al with 44.6% as ESBL producers.[15]

In the present study, vancomycin (100%) was the most sensitive antibiotic among all gram positive isolates which was correlated with the studies of Shriyan et al, Javed et al and Amatya et al.[21-23] Amikacin was the second most sensitive antibiotic to many gram positive as well as gram negative isolates accounting for 82.4%, which is correlated with the study of Shriyan et al 95% and Malik et al 90%.[11,21] Meropenem was the most sensitive drug among gram negative isolates accounting for 87.1% which was correlating with the study of Malik et al, Shriyan et al and Rao et al.[11,13,21]

Limitation of this study was that only bacterial samples were isolated where in fungal isolates could also be isolated for better understanding if surgical infections. In this study we could not isolate the various fungus which causes surgical site infections hence limiting the course of treatment for SSIs.

CONCLUSION

Wound infections are one of the most common hospital acquired infections, and are an important cause of morbidity and account for 70-80% mortality. Development of such infections represent delayed healing, cause anxiety and discomfort for patient, longer stays at hospitals and add to cost of healthcare services significantly. This study was carried out to determine the antibacterial susceptibility of bacteria isolated from wound infections as well as update the clinicians in the various antimicrobial alternatives available in the treatment of wound infections, thus helping to reduce the burden of infection on patients and in long term, it may reduce the cost of treatment. The study concludes that variety of aerobic bacteria is responsible for wound infection with predominance of *Escherichia coli* followed by *Pseudomonas aeruginosa*. Also there were mixed infections with different bacteria.

Antibiotic sensitivity pattern of the study revealed that amikacin was the most sensitive drug among both gram positive and gram negative isolates. Meropenem was the most sensitive drug among all gram negative isolates and vancomycin was the most sensitive drug among gram positive isolates. This study shows that the organisms are becoming resistant to commonly used antibiotics and also developing resistance to newer antibiotics.

What the study adds to the existing knowledge?

Newer aspect of this study

Nowadays automated methods of identification of the pathogen and antibiotic sensitivity are available which aids in quick results, thus reducing the time of treatment and helping the patients. More comprehensive studies are required from time to time to define the magnitude of problem and produce data for policy decision on optimal intervention modalities.

Vital use for formulation of antibiotic policy and implementation of antimicrobial stewardship programmes is need of the hour. Hospital must have an active antibiotic stewardship programme implemented. Further based on the antibiogram of hospital, antibiotic policy should be framed and followed. Such a treatment policy if followed will lead to reduction in mortality, morbidity and health care cost associated with wound infections.

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