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Original Article

A STUDY ON BACTERIOLOGICAL PROFILE OF SURGICAL SITE INFECTION AND THEIR ANTIMICROBIAL SUSCEPTIBILITY PATTERN AT A TERTIARY CARE HOSPITAL IN TIRUPATI

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ABSTRACT

Objective: Surgical Site Infections (SSIs) are defined as infections apparent within 30days of an operative procedure and most often between the 5th and 10th postoperative days. It constitutes a major public health problem worldwide; It is one of the most common causes of nosocomial infection. They are responsible for increasing the treatment cost, length of hospital stays and significant morbidity and mortality. Despite the technical advances in infection control and surgical practices, SSI still continue to be a major problem, even in hospitals with most modern facilities**.** The present study conducted to isolate and identify microbes from pus samples collected from patients who were suspected for SSI and to determine their antimicrobial susceptibility profiles in a tertiary care hospital.

Methods: This is a cross-sectional study conducted in the Department of Microbiology, Sri Venkateswara Medical College, Tirupati for a period of 6 mo. A total of 390 various clinical samples were collected and processed. Isolates were tested for antibiotic susceptibility by a Kirby-Bauer disk diffusion method.

Results: Out of 390 pus/wound discharge samples processed, 132 (34%) samples were culture positive, among which 107 (81%) were Gram-negative bacilli and 25 (19%) were Gram-positive cocci. Male to female ratio was 2:1. Most common age group affected was>50yrs. Predominant isolates were Klebsiella pneumoniae (73.47%) followed by Pseudomonas aeruginosa (26.53%) and Staphylococcus aureus (17.4%). Gram-negative bacilli showed maximum susceptibility to Imipenam, Piperacillin-Tazobactam and Amikacin and Gram-positive cocci showed 100% to Linezolid, Vancomycin.

Conclusion: SSI remains to be a significant challenge for the surgeon's inspite of sterile surgical techniques and prophylactic use of antibiotics. Hospital infection control measures like hand hygiene, strict adherence to pre-operative measures, rational use of antibiotics and establishing active surveillance can reduce the prevalence of SSIs.

Keywords: Surgical site infections, Post-operative wound infection, Antibiotic susceptibility, Hospital infection control measures

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INTRODUCTION

Surgical Site Infections (SSIs) are defined as infections apparent within 30 d of an operative procedure and most often between the 5th and 10th postoperative days. However, where a prosthetic implant is used, SSIs affecting deeper tissues may occur several months after the operation [1]. Skin is a natural barrier against infection, any surgery that causes a break in the skin can lead to a post-operative infection. Surgical site infection is an important post-operative complication [2].

SSI constitutes a major public health problem worldwide; It is one of the most common causes of nosocomial infections [2]. They are responsible for increasing the treatment cost, length of hospital stays and significant morbidity and mortality. Despite the technical advances in infection control and surgical practices, SSI still continue to be a major problem, even in hospitals with most modern facilities [3]. It is reported that SSI accounts for 20% of all healthcare-associated infections and is associated to a 2-to-11-fold increase in the risk of mortality, with 75% of SSI-associated deaths directly attributable to the SSI [4].

In developing countries like India, the problem gets more complicated due to poor infection control, over-crowded hospitals and inappropriate use of anti-microbials [2]. Present study was conducted to isolate and identify microbes from pus samples collected from patients who were suspected for SSI and to determine the antimicrobial susceptibility profiles in a tertiary care hospital.

MATERIALS AND METHODS

This study was conducted for a period of 6 mo in a tertiary care hospital Tirupati after obtaining approval from the Institutional Ethics Committee. A total of 390 Pus/wound discharge samples were collected from the patients with suspected SSI after getting written informed consent. Samples were taken from the deepest portion of the wound by using two sterile cotton swabs under aseptic conditions, collected samples were transported to the Microbiology laboratory immediately and processed according to standard guidelines.

Samples were inoculated on blood agar and MacConkey agar under strict aseptic conditions and incubated at 37 °Cfor 18-24 h under aerobic conditions before being reported as sterile. Colonies obtained on blood agar and MacConkey agar were subjected to Gram staining and all Gram-positive cocci, Gram-negative bacilli/coccobacilli obtained were further identified by using a standard protocol for identification.

The characters assessed for isolation of organisms were motility, catalase test, oxidase test, indole test, methyl red test, Voges-Proskauer test, citrate test, urease test, Triple Sugar Iron test, Oxidative Fermentative test (O/F), Nitrate reduction test, Sugar fermentation tests.

Antimicrobial susceptibility testing was determined by the Kirby Bauer Disc Diffusion Method on Muller Hinton agar as per CLSI guidelines. Following Antibiotic discs were used: Ceftriaxone (30µg), Piperacillin-Tazobactam (100µg/10 µg), Aztreonam (30µg), Imipenem (10µg), Amikacin(30µg), Ciprofloxacin(5µg), Co-Trimoxazole(23.75µg/1.25µg), Carbenicillin(100µg), Ceftazidime-clavulanate(30µg/10µg), Amoxycillin-clavulanate(20µg/10µg), Vancomycin (30µg), Linezolid(30µg), Clindamycin(2µg), Erythromycin(15µg), Doxycycline(10µg), Tetracycline (30µg). Turbidity compared to 0.5 McFarland units were inoculated on MHA plates by lawn culture method and were incubated at 37 °C for 18-

24 h. Results were interpreted according to the measurement of zone sizes mentioned in the CLSI guidelines [6]. Control strains used were P. aeruginosa ATCC 27853, S. aureus ATCC 29213 and Escherichia coli ATCC 25922. Medias and antibiotic discs were obtained from HiMedia Labs, Mumbai, India.

RESULTS

A Total of 390 Pus/wound discharge samples were processed; among them 132 samples were culture positive, out of which the isolation rate was highest among males(65.9%) compared to females (34.1%) [fig. 1].

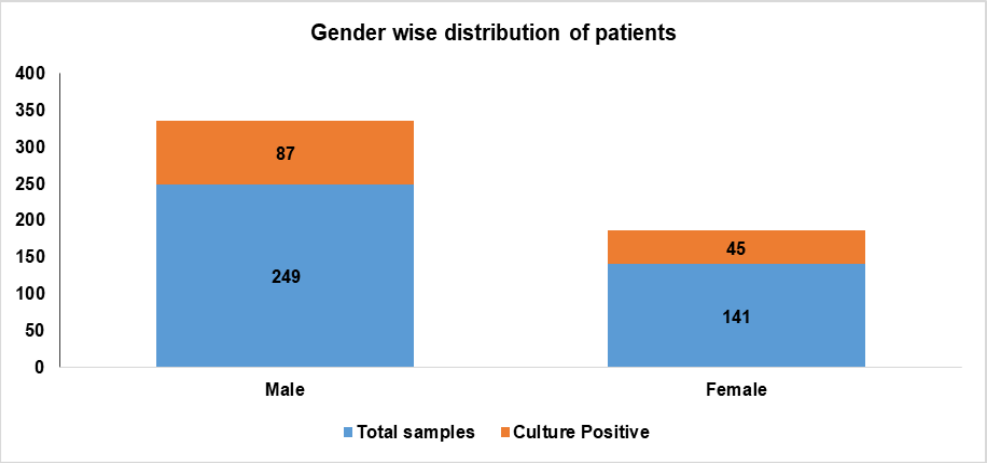

Fig. 1: Gender-wise distribution of patients, most common age group affected was 48-57 y (30%), followed by 58-67 y (25.8%), 38-47 y (16.7%), above 67 y (13.6%), 28-37 y (12.1%)and 18-27 y (9.1%) [fig. 2]

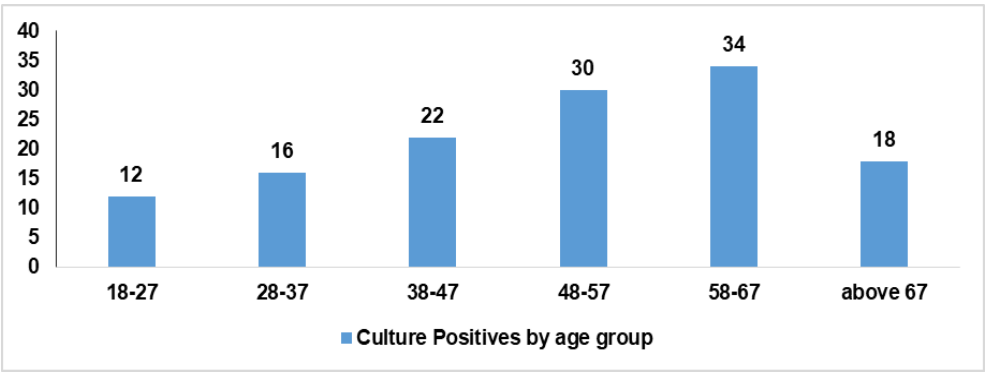

Fig. 2: Age-wise distribution of patients, majority of culture positives were from General surgery followed by Obstetrics and Gynecology, Orthopedics, ENT, Plastic surgery, Neurosurgery [fig. 3]

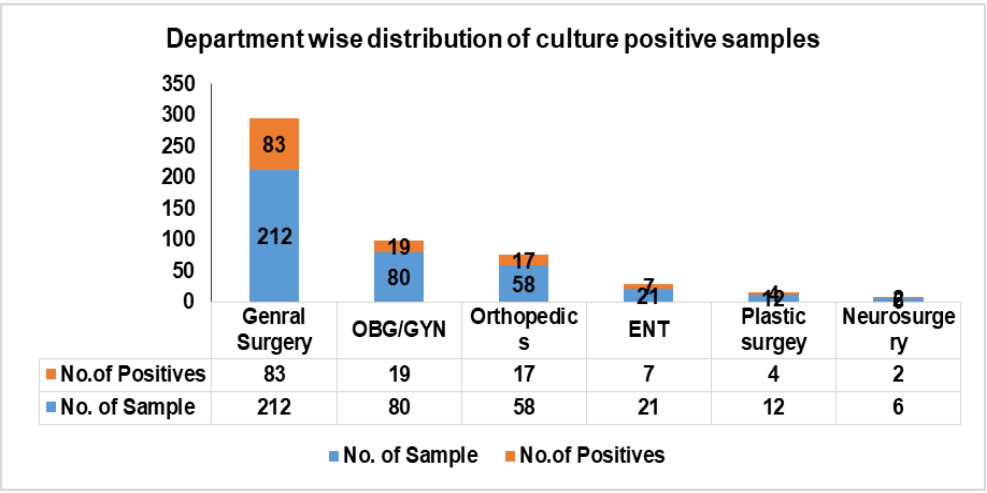

Fig. 3: Department-wise distribution of culture positive pus/discharge samples, klebsiella pneumoniae was the predominant isolate, accounting for about 28.8% followed by Pseudomonas aeruginosa (21.2%), Staphylococcus (8.57%), Escherichia coli (15.2%), Proteus mirabilis (9.8%), Acinetobacter baumannii (3.8%), Enterobacter (2.3%) and Enterococci (1.5%) [fig. 4]

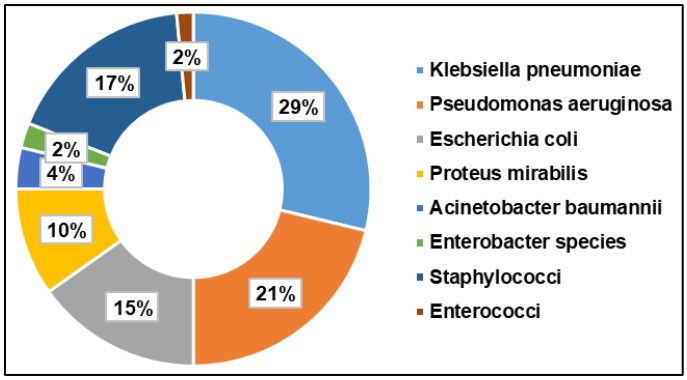

Fig. 4: Distribution of bacterial isolates among pus/wound discharge samples; the antibiotic susceptibility results are given in table 1. Gram-negative bacterial isolates showed maximum susceptibility to imipenam, piperacillin-tazobactam and amikacin, least sensitivity to cetriaxone and ciprofloxacin

Table 1: Antibiotic susceptibility patterns of g-negativebacterial isolates

S. No.	Organism	AK	CIP	CTR	COT	PIT	IMP	CAC	AT	CB
1	K. pneumoniae (n=38)	30(78.9%)	10(26.3%)	8(26.3%)	12(31.5%)	32(84.2%)	29(76.3%)	19(50%)	11(28.9%)	NT
2	P. aeruginosa (n=28)	18(64.2%)	18(64.2%)	3(10.7%)	4(14.28%)	26(92.8%)	19(67.8%)	7(25%)	12(42.8%)	17 (60.7%)
3	E. coli (n=20)	15(75%)	3(15%)	6(30%)	3(15%)	17(85%)	17(85%)	16(80%)	8(40%)	NT
4	P. mirabilis (n=13)	5(38.4%)	4(30.7%)	3(23.7%)	5(38.4%)	12(92.3%)	9(69.2%)	6(46.1%)	7(53.8%)	NT
5	A. baumannii (n=5)	3(60%)	2(40%)	0	0	5(100%)	3(60%)	3(60%)	1(20%)	NT
6	Enterobacter (n=3)	3(100%)	2(66.6%)	1(33.3%)	3(100%)	3(100%)	3(100%)	2(66.6%)	0	NT

The antibiotic susceptibility results are given in table 2. Gram-positive bacterial isolates showed 100% susceptibility to vancomycin and linezolid.

Table 2: Antibiotic susceptibility patterns of g-positive bacterial isolates

Organism	AK	CIP	AMC	E	CD	CX	VA	LZ	DO	TE	COT
S. aureus (n=23)	19(82.6%)	4(17.4%)	18(78.3%)	9(39.1%)	9(39.1%)	16(69.5%)	23(100%)	23(100%)	17(73.9%)	NT	NT
Enterococci (n=2)	NT	0	NT	0	NT	NT	2(100%)	2(100%)	NT	0	0

DISCUSSION

Surgical site infections are a significant concern in hospitals due to their impact on patient outcomes and healthcare costs. S Sis are leading cause of morbidity and mortality after surgery. They can lead to prolonged hospital stays, additional treatments and the need for follow-up care. The overuse of antibiotics to treat SSIs contributes to the growing problem of antibiotic resistance.

A total of 390 pus/wound discharge samples were tested out of which 132 samples were culture positive. The prevalence of SSIs in this study was 34%, which is in correlation with other studies (Prakash patel *et al.*) [7]. The occurrence of SSIs in developing countries has been reported to be around 2-40% [8]. In our study, the maximum rate of infection was from General surgery followed by Obstetrics and Gynecology, Orthopedics which is corresponding to the study by Nirupa *et al.* [9] and in contrast to the study by Ambreen shafaat khan *et al.* showed maximum from Orthopedics followed by Obstetrics and Gynecology and General surgery [5].

The predominance of male patients was seen in our study with male: female ratio of 2:1 which is similar to the study by Himanshu Narula *et al.* [8].

The patients with age of>50 years had higher rate of SSI (62.1%) in comparision to (11.3%) among the patients who were<30 years of age, which is in concordance with the study by Vikrantnegi *et al.* [10]. Age of the patient is an important factor for the development of SSIs due to low immunity, low healing rate and co-morbid illness like diabetes and hypertension etc [11].

In our study, predominance of Gram-negative bacilli were seen with 81%, correlating with the study by Mythiri B. A *et al.* [12]. This could be due to varied habitat of Gram-negative bacilli, including inanimate surfaces in hospitals, Multidrug resistance pattern and feasible contamination from intestinal tract during surgery [13]. This is also similar to other studies where Gram-negative bacilli were pre-eminent [14-16]. In the present study most frequently isolated organisms was Klebsiella pneumoniae (28.7%) followed by Pseudomonas aeruginosa (21.2%) and Staphylococcus aureus (17.4%), which is similar to the study conducted in Puducherry, India [17].

Gram-negative bacilli showed maximum susceptibility to Imipenam, Piperacillin-Tazobactam and Amikacin, for Staphylococcus aureus Linezolid, Vancomycin, Amikacin were found to be highly effective antibiotics. In our study majority of the organisms (79.5%) showed resistance to Ceftriaxone. This finding might be due to indiscriminate use of Ceftriaxone as Prophylaxis before surgery [10].

CONCLUSION

SSI remains to be a significant challenge for the surgeons in spite of sterile surgical techniques and prophylactic use of antibiotics. Hospital infection control measures like hand hygiene, strict adherence to pre-operative measures, rational use of antibiotics and establishing active surveillance can reduce the prevalence of SSIs.

ETHICAL APPROVAL

Lr. No.240/2024 (Institutional Ethics Committee, S. V. Medical College, Tirupati).

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Nil

AUTHORS CONTRIBUTIONS

All the authors have contributed equally

CONFLICT OF INTERESTS

Declared none

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