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BACTERIOLOGICAL PROFILE OF SURGICAL SITE INFECTIONS IN A TERTIARY CARE HOSPITAL IN CENTRAL INDIA

Clinical Microbiology

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ABSTRACT

Introduction: Surgical site infections (SSI) have significant effect on patients quality of life, loss of productivity since they are associated with considerable morbidity and extended hospital stay. SSI causes considerable financial burden to healthcare providers. The control of post-operative infections has become more challenging due to widespread bacterial resistance to antibiotics. So Present study was undertaken with **Aim and Objectives:** to identify and isolate different organisms from SSI in patients undergoing surgery in the departments of Surgery, Orthopaedics, Obstetrics and Gynaecology and to suggest effective antibiotics of the isolates which will help to reduce duration of stay in the hospital, morbidity and mortality. **Materials and Methods:** The present Cross sectional Retrospective study was conducted from January 2018 to December 2020 in the Department of Microbiology, Government Medical College Akola, tertiary care teaching hospital. Pus swabs and pus from abscess aspirated with sterile syringe were collected from patients with SSI under strict aseptic precautions and processed in laboratory by standard microbiological techniques. **Results:** Out of 204 patients, 166 (81.38%) samples were culture-positive while 38 samples (18.62%) showed no growth. The most frequent isolate was *Staphylococcus aureus*, which represented 54 (30.17%) of the total isolates, followed by *Pseudomonas aeruginosa* 44 (24.57%). 12 (22.22%) were found to be MRSA strains. 25% of MRSA strains were inducible clindamycin resistant. Extended spectrum beta lactamase production was observed in 7 (25%) of 28 *Klebsiella pneumoniae* isolates and in 6 (22.22%) of 27 *Escherichia coli* isolates.

Conclusion: The knowledge of the causative agents of postoperative infections will prove to be helpful in selection of empiric antimicrobial therapy, rationalizing the use of antimicrobials and guides in infection control measures in Healthcare institutions.

KEYWORDS

Surgical site infections, MRSA, ESBL, Antibiotics

1. INTRODUCTION

Surgical site infections (SSI) are defined as infections developing at the surgical site within time period of 30 days of surgery or within 90 days for breast, cardiac, joint surgeries including implants.[1] Infections that occur in the wound created by invasive surgical procedure are generally called Surgical site infections[2]. They represent infections of the tissues, organs, or spaces that are exposed by surgeons during an invasive procedure. About 80 to 90% of all Surgical site infections occur within 30 days after the operative procedure [3]. Despite the advances made in the field of asepsis, antimicrobial drugs, sterilization and operative techniques, surgical site infections continue to be a major problem in all surgical branches[4]. Surgical site infections are the third most commonly reported nosocomial infections and they account for approximately a quarter of all healthcare associated infections[2]. Globally SSI rate has varied from low of 2.5% to high of 41.9%[4]. SSI accounts for 14% of Healthcare-associated infections and are estimated to double the length of post-operative stay and significantly increase the cost of healthcare which can be related to re operation, extra nursing, interventions and drug treatment costs[2]. Besides increase in morbidity and mortality, they prolong hospital stay and increase bed occupancy rate. Globally, 7-12% of hospitalised patients end up with hospital acquired infections[5]. *Staphylococcus aureus* accounts to be the single most commonly encountered organism associated with Surgical site infection.[6]. Coagulase negative Staphylococci (CoNS) and Enterococci are other Gram positive organisms associated with SSIs. Others include Gram negative organisms such as *Escherichia coli*, *Pseudomonas aeruginosa, Klebsiella pneumonia* and *Proteus* species [7]. According to CDC NHSN (National Health Safety Network) 2018, SSIs remains substantial cause of morbidity, prolonged hospitalization and death. [8]

The present study was undertaken with aim and objectives to identify and isolate different organisms from surgical site infections in patients undergoing surgery in the departments of Surgery, Orthopaedics, Obstetrics and Gynaecology and to suggest effective antibiotics of the isolates which will help to reduce duration of stay in the hospital, morbidity and mortality.

2. MATERIAL AND METHODS:

The Study was Descriptive Hospital based Cross sectional study conducted in accordance with ICH-GCP (International Council for Harmonization - Good Clinical Practices) guidelines from November 2018 to October 2020. Total 204 patients with SSIs in General surgery, Orthopaedics , Obstetrics and Gynaecology wards satisfying inclusion and exclusion criteria were enrolled for the study. Pus swabs and Pus from abscess were collected under strict aseptic precautions and processed in laboratory using standard microbiological techniques. AST was performed using Kirby Bauer disc diffusion method using CLSI gidelines 2018[9]. MRSA and Inducible Clindamycin resistance were detected using Cefoxitin(Cx), Clindamycin(Cd) and Erythromycin (E) discs[10]. Extended Spectrum Betalactamases (ESBLs) were identified using Cefotaxime(CTX), Ceftazidime(CAZ) and Clavulanic acid(CAC) discs[11]. Metallo-betalactamases (MBLs) were detected using Imipenem (IPM) and EDTA (IPM-EDTA) discs[11]

3. RESULTS:

Out of Total 204 clinically diagnosed cases of Surgical Site Infectons, Males predominated 112 (54.90%) and 92(45.10%) were females with a male to female ratio of 1.21: 1 as shown in FigureNo.1. Maximum number of SSI patients were in the age group of 21-30 years.166 (81.38%) samples were culture positive and 38 (18.62%) samples yielded no growth. Among total 108 isolates of Gram negative bacteria, all were sensitive to imipenem (100%), followed by piperacillin/tazobactam (99.07%), ceftazidime (69.44%), amikacin (65.74%), gentamicin (53.70%), cefepime and cefotaxime (50%), amoxyclav (48.14%), cotrimoxazole (41.66%), ciprofloxacin (40.74%), tetracycline (25%) and ampicillin (0.92%) as explained in TableNo.1Out of total 71 Gram positive isolates, all (100%) were sensitive to vancomycin, followed by clindamycin (83.09%), linezolid (74.64%), gentamicin(67.60%), cotrimoxazole (60.56%), erythromycin (59.15%), tetracycline (53.52%), and penicillin (4.22%) in a descending order and shown in Table No.2. Among 54 strains of *Staphylococcus aureus*, 12 (22.2%) were methicillin resistant by cefoxitin disc diffusion test and out of 12 strains of MRSA, 7 (58.33%) were resistant to erythromycin. 2 (16.67%) were constitutive MLSB resistant, 3 (25%) were inducible MLSB resistant (inducible clindamycin resistant) and 2 (16.67%) belonged to MS phenotype. 5 (41.66%) strains were susceptible to both erythromycin and clindamycin and detailed in Table No.3. Out of 55 isolates of *Klebsiella pneumoniae* and *Escherichia coli* 13(23.63%) were ESBL producers as shown in Figure No.2

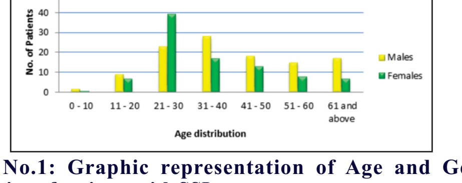

Figure No.1: Graphic representation of Age and Gender distribution of patients with SSI

Table No.1. Antibiotic sensitivity pattern of Gram negative organisms.

S.No	Organisms	Amp (%)	Gen (%)	Ak (%)	Cip (%)	Tet (%)	Cot (%)	Amc (%)	Cpm (%)	Caz (%)	Ctx (%)	Pit (%)	Ipm (%)	P value
1	*Pseudomonas Aeruginosa* Total no- 44	0 (0)	15 (37.5)	20 (50)	15 (37.5)	7 (17.5)	8 (20)	13 (32.5)	9 (22.5)	23 (57.5)	9 (22.5)	39 (97.5)	44 (100)	**0.155 NS**
2	*Klebsiella Pneumoniae* Total no- 28	0 (0)	19 (67.8)	22 (78.5)	14 (50)	7 (25)	17 (60.7)	16 (57.1)	18 (64.2)	21 (75)	17 (60.7)	28 (100)	28 (100)	**0.252 NS**
3	*Escherichia coli* Total no-27	0 (0)	15 (55.5)	20 (74)	10 (37)	6 (22.2)	15 (55.5)	14 (51.8)	19 (70.3)	21 (77.7)	21 (77.7)	27 (100)	27 (100)	**0.353 NS**
4	*Proteus mirabilis* Total no-8	1 (12.5)	5 (62.5)	5 (62.5)	4 (50)	5 (62.5)	3 (37.5)	6 (75)	5 (62.5)	5 (62.5)	4 (50)	8 (100)	8 (100)	**0.157 NS**
5	*Acinetobacter species* Total no-1	0 (0)	1 (100)	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (100)	0 (0)	1 (100)	1 (100)	**0.458 NS**
	Total- 108	**1 (0.92)**	**55 (50.92)**	**68 (62.96)**	**43 (39.81)**	**25 (23.14)**	**43 (39.81)**	**49 (45.37)**	**51 (47.22)**	**71 (65.74)**	**51 (47.22)**	**103 (95.37)**	**108 (100)**	
	P-Value	**0.03 Sig**	**0.14 NS**	**0.26 NS**	**0.75 NS**	**0.11 NS**	**0.01 NS**	**0.095 NS**	**0.0006 HS**	**0.27 NS**	**0.02 Sig**	**0.89 NS**	**NA**	

Amp -Ampicillin, Gen-Gentamicin, Ak-Amikacin, Cip-Ciprofloxacin, Tet-Tetracycline,Cot-Cotrimoxazole, Amc-Amoxyclav, Cpm-Cefepime, Caz-Ceftazidime, Ctx-Cefotaxime, Pit-Piperacillin/tazobactam, Ipm-Imipenem

Table No.2. Antibiotic sensitivity pattern of Gram positive organisms.

S. No	Organisms	P (%)	Gen (%)	Tet (%)	Cot (%)	Cd (%)	Lz (%)	E (%)	Van (%)	P Value
1	*Staphylococcus aureus*	3 (5.5)	38 (70.3)	31 (57.4)	32 (59.2)	44 (78.5)	38 (70.3)	32 (59.2)	54 (100)	**0.39 NS**
2	*Staphylocoocus Epidermidis* Total no- 15	0 (0)	10 (66.6)	7 (46.6)	10 (66.6)	13 (86.6)	14 (93.3)	9 (60)	15 (100)	**0.249 NS**
3	*Enterococcus species* Total no-2	0 (0)	0 (0)	0 (0)	1 (50)	2 (100)	1 (50)	1 (50)	2 (100)	**0.443 NS**
	Total- 71	**3 (4.22)**	**48 (67.60)**	**38 (53.52)**	**43 (60.56)**	**59 (83.09)**	**53 (74.64)**	**42 (59.15)**	**71 (100)**	
	P-Value	**0.61 NS**	**0.11 NS**	**0.23 NS**	**0.83 NS**	**0.72 NS**	**0.14 NS**	**0.96 NS**	**NA**	

Table No.3. Distribution of inducible clindamycin resistance among MRSA Isolates

S. No	Susceptibility pattern (Phenotype)	MRSA	Percentage
1	Erythromycin – S, Clindamycin –S	5	41.66
2	Erythromycin – R, Clindamycin –R (constitutive MLSB)	2	16.67
3	Erythromycin – R, Clindamycin –S D test positive (inducible MLSB)	3	25.00
4	Erythromycin – R, Clindamycin –S D test negative (MS phenotype)	2	16.67
	Total	**12**	**100**

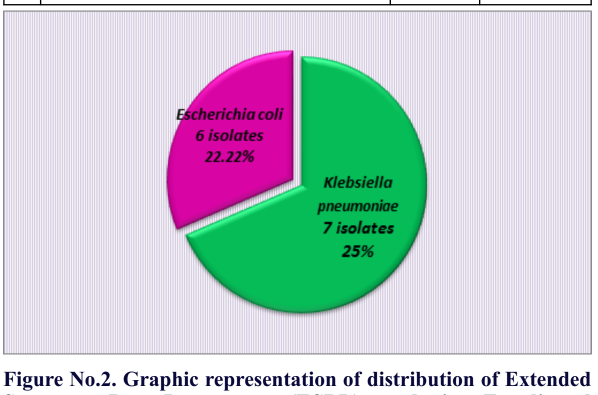

Figure No.2. Graphic representation of distribution of Extended Spectrum Beta Lactamases (ESBL) producing E coli and Klebsiella pneumoniae

4. DISCUSSION:

Most common bacteria isolated in the study was *Staphylocoocus aureus* (30.17%) followed by *Pseudomonas aeruginosa* (24.57%), *Klebsiella pneumoniae* (15.65%), *E. coli* (15.08%), *Staph epidermidis* (8.38%). Other bacteria isolated were *Proteus mirabilis* (4.47%), *Enterococcus species* (1.12%) and *Acinetobacter species* (0.56%).

This finding correlates with study of Giacometti A [12] and Murthy R [13] .Studies by Chia JYH [14], Twum-Danso K [15], Tran TS [16] and Kaplan NM [17] reported *Staphylococcus aureus* as most common organism causing SSI.

In studies by Kamat US [18], Thanni LO [19] and Masaadeh H A [20], *Pseudomonas* species were found to be the most common organisms causing SSI. According to Anvikar AR, *Klebsiella pneumoniae* (26.8%) was the most common organism.[21]

Nardo Pe et al observed high penicillin resistance among strains of *Staphylococcus aureus* (91%)[22] . According to Lilani SP, *Pseudomonas aeruginosa* exhibited 100% resistance to gentamicin. Other GNBs were 100% resistant to tetracycline followed by ampicillin (83.33%).[23]

Among 54 strains of *Staphylococcus aureus*, 12 (22.2%) strains were MRSA correlating with study by Boubaker, in which methicillin resistance was detected in 23.87% isolates by cefoxitin disc test [24]. According to Deotale V, 49.8% were methicillin resistant[25] and Anand KB reported among 50 strains of *Staphylococcus aureus* 32 were MRSA [26] and Matthews AA reported as 34.09%[27]. In the present study vancomycin (100%) was found to be the most sensitive antibiotic against MRSA followed by linezolid (66.6%) and clindamycin (58.3%) correlating with study by Rajaduraipandi K[28] . All MRSA isolates were resistant to erythromycin, gentamicin and penicillin in observations of Akpaka PE[29]

Out of 12 strains of MRSA, 7 (58.33%) were resistant to erythromycin. 3 (25%) were positive for inducible clindamycin resistance by D test, while rest of the isolates were negative for D test, out of which 2

(16.67%) were shown to have constitutive clindamycin resistance and 2 (16.67%) isolates were of MS phenotype correlating with Yilmaz G, according to whom 24.4% of MRSA isolates were positive for inducible clindamycin resistance. [30] Percentage of inducible clindamycin resistance was 15.65% and 30% in study conducted by Shenoy MS [31] and Gadepalli R [32] respectively.

Imipenem and piperacillin/tazobactam were found to be the most sensitive antibiotics in the study which is in accordance with Tsering DC [33]

5. CONCLUSION:

Presence of inducible clindamycin resistance among MRSA isolates indicates importance of identification of such strains using D test which helps in determining the true sensitivity of clindamycin in treatment of MRSA infections, which would otherwise lead to clinical therapeutic failure due to presence of inducible clindamycin resistance.

Microorganisms responsible for SSIs like *Klebsiella pneumoniae* and *Escherichia coli* have ability to produce Extended spectrum beta lactamase (ESBLs) resulting in limiting of therapeutic option. Among ESBLs producing isolates, imipenem and piperacillin/tazobactam were found to be the most sensitive antibiotics followed by amikacin and gentamicin. The presence of metallo beta lactamase producing *Pseudomonas aeruginosa* was not detected in the study and warrants further studies to detect their presence in hospital. Presence of MRSA and ESBL in the study calls for intensive infection control practices, and surveillance of infections must be encouraged.

Each hospital has its own unique microbial flora for which patients are at risk for acquiring infection during hospitalization. Hence epidemiological data being made available at that period helps surgeon in employing a logical approach towards control of surgical site infections. The essential knowledge of causative agents of postoperative infections will surely prove to be helpful in selection of empiric antimicrobial therapy, rationalizing the use of antimicrobials and guides in infection control measures in Healthcare institutions.

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Nil.

Conflict of Interest:-
No conflict of interest.

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