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Surgical Site Infections: Bacteriological Profile and Antibiogram with Special Reference to MRSA in A Tertiary Care Centre in Western Uttar Pradesh

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Abstract:* *Background: *Surgical site infections (SSI) account for around 15% of all nosocomial infections. In the recent years there has been a growing prevalence of Gram negative organisms as a cause of serious infections in many hospitals. In addition irrational use of broad spectrum antibiotics and resulting antimicrobial resistance has further deteriorated the condition in this regard.* ***Aim:*** *The study aimed to identify bacterial etiology of surgical site infections and their antibiogram in an attempt to develop comprehensive treatment protocol.* ***Materials And Methods****: The study was conducted in the department of Microbiology, School of Medical Sciences and Research, Sharda Hospital and University, Greater Noida, over a period of one year from January 2014 to December 2014. The pus samples were collected from all postoperative patients with the evidence of surgical site infections. These were cultured on blood agar and MacConkey agar plates. The growing organisms were identified by standard techniques available. Antibiotic sensitivity testing was performed on Mueller Hinton agar using antibiotics from different classes including beta lactams, glycopeptides, aminoglycosides, macrolides and fluoroquinolones.* ***Results:*** *A total of 83 isolates of various organisms were isolated from different samples of pus. The various organisms isolated were Staphylococcus aureus (31.33%), Pseudomonas aeruginosa (28.92%), E.coli (15.66%), Coagulase negative Staphylococcus (6.02%), Enterococcus (2.41%), Klebsiella pneumoniae (4.82%), Proteus mirabilis (3.61%) and Acinetobacter sp. (7.23%). 53.85% isolates of Staphylococcus aureus were found to be methicillin resistant. Vancomycin was the most effective drug for Gram positive organisms and imipenem for the Gram negative organisms. Drugs from other classes were more or less resistant to the isolated organisms.* ***Conclusion:*** *The inappropriate and prolonged use of antibiotics should be avoided as this leads to development of resistant micro organisms which are even more difficult to get rid of.*

Key Words: *Surgical site infections, Nosocomial infections, Methicillin Resistant Staphylococcus aureus*

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I. Introduction:

Infection at or near surgical incisions within 30 days of an operative procedure, dubbed *surgical site infection*, contributes substantially to surgical morbidity and mortality each year. Surgical site infection (SSI) accounts for 15% of all nosocomial infections and, among surgical patients, represents the most common nosocomial infection [1]. It results from microbes thriving in the surgical site because of poor preoperative preparation, wound contamination, improper antibiotic selection, or the lack of ability of an immunocompromised patient to fight against infection. These infections are common and range in severity from minor, self-limiting, surface infections to severe diseases requiring all the resources of modern medicine [2].The usual presentation of infected surgical wound can be characterized by pain, tenderness, warmth, erythema, swelling and pus formation [3, 4]. Postsurgical infection leads to increased length of postoperative hospital stay, drastically escalated expense, higher rates of hospital readmission, and jeopardized health outcomes. They are also known as "The Silent Killer: Nosocomial Infections" [5]. Bacteriological studies have shown that SSIs are universal and the etiological agents involved may vary with geographical location, between various procedures, between surgeons, from hospital to hospital or even in different wards of the same hospital [6]. In the recent years there has been a growing prevalence of Gram negative organisms as a cause of serious infections in many hospitals. In addition irrational use of broad spectrum antibiotics and resulting anti microbial resistance has further deteriorated the condition in this regard. The problem gets more complicated in developing countries due to poor infection control practices, overcrowded hospitals and inappropriate use of antimicrobials [7].

II. Aim:

The aim of study was to identify bacterial etiology of surgical site infections and their antibiogram in an attempt to develop comprehensive treatment protocol.

III. Materials And Methods:

The study was conducted in the department of Microbiology, School of Medical Sciences and Research, Sharda Hospital and University, Greater Noida, over a period of one year from January 2014 to December 2014. All postoperative patients with the evidence of surgical site infections in various wards (orthopaedics, general surgery, gynaecology, ENT and ICUs) were included in the study. The pus was collected using sterile cotton swabs or was aspirated and was transported immediately to the laboratory. The samples were processed according to the standard procedures available including Gram staining and culture on blood agar and MacConkey agar plates which were incubated at 37˚C for 48 hours [8]. The growing organisms were identified by standard techniques available. Ambiguous results were confirmed by automated VITEK 2-compact system (BioMerieux, France) following the manufacturer's instructions. Antibiotic sensitivity testing was performed on Mueller Hinton agar using antibiotics from different classes including beta lactams, glycopeptides, aminoglycosides, macrolides and fluoroquinolones as per the CLSI guidelines.

Detection of methicillin resistant *Staphylococcus aureus:*

Methicillin resistant *Staphylococcus aureus* was detected by disc diffusion test using cefoxitin (30μg) disc on Mueller–Hinton Agar. Any strain showing the inhibition zone of ≤19 mm was taken to be methicillin resistant *Staphylococcus aureus* as per the CLSI guidelines [9].

Staphylococcus aureus ATCC 25923, *Escherichia coli* ATCC 25922, *Klebsiella pneumoniae* ATCC 700603, *Pseudomonas aeruginosa* ATCC 27853 and *S.aureus* ATCC 29213 (MRSA) were used as the control strains for AST. All dehydrated media, reagents and antibiotic discs were procured from Hi Media Laboratories Pvt. Ltd., Mumbai, India.

IV. Results:

A total of 83 isolates of various organisms were isolated from different samples of pus. The wardwise distribution of these samples is shown in figure 1.

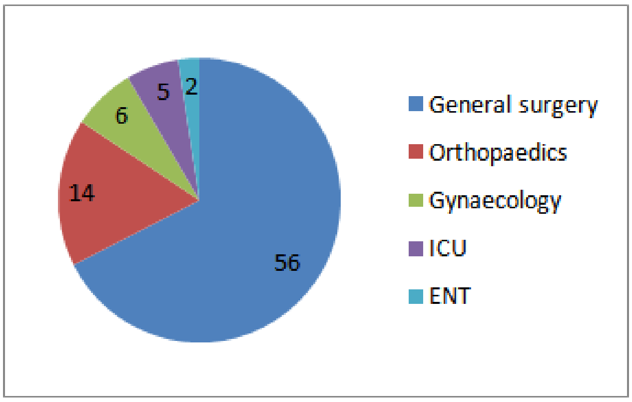

Fig.1 Ward wise distribution of samples (n=83)

Males (73.49%) were more commonly affected than females (26.50%) with the sex ratio of male: female being 2.8:1 as shown in figure 2.

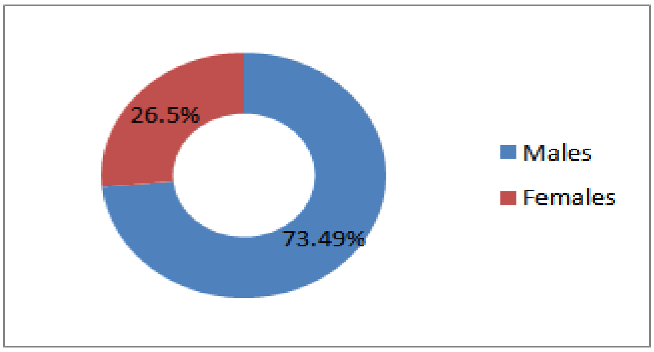

Fig.2 Sex wise distribution of bacterial isolates

Among the bacterial isolates, Gram negative organisms accounted for 50 (60.24%) and Gram positive for 33 (39.76%) isolates. Table 1 shows the bacteriological profile of isolated organisms with *Staphylococcus aureus* (31.33%), *Pseudomonas aeruginosa* (28.92%) *and E.coli* (15.66%) being the predominant ones. Other organisms isolated were Coagulase negative Staphylococcus (6.02%), Enterococcus (2.41%), *Klebsiella pneumoniae* (4.82%), *Proteus mirabilis* (3.61%) and Acinetobacter sp. (7.23%).

Table 1 Bacteriological profile of surgical site infections (n=83)

Organism	**No. of isolates**	**Percentage (%)**
S.aureus	26	31.33
CONS	5	6.02
Enterococcus	2	2.41
E.coli	13	15.66
K.pneumoniae	4	4.82
Proteus mirabilis	3	3.61
P.aeruginosa	24	28.92
Acinetobacter	6	7.23

Out of 26 isolates of *Staphylococcus aureus*, 14 (53.85%) were found to be methicillin resistant as shown in figure 3.

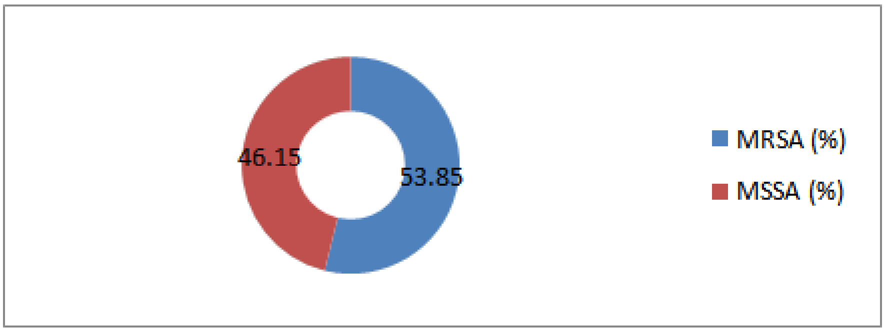

Fig.3 Distribution of Methicillin Resistant *Staphylococcus aureus*

Antibiotic sensitivity pattern of Gram positive organisms showed vancomycin (100%) and levofloxacin (96.15%, 80%,100%) as the most sensitive drugs for *S.aureus*, CONS and Enterococcus respectively whereas penicillin was found to be least sensitive. Other sensitive drugs were linezolid for *S.aureus* (96.51%) and *Enterococcus* (100%) and teicoplanin i.e. 92.30% for *S.aureus.* CONS was found to be completely resistant to linezolid and teicoplanin. Gentamicin and erythromycin showed moderate sensitivity for *S.aureus* and CONS whereas *Enterococcus* was resistant to gentamicin. This has been shown in table 2.

Table 2 Antibiotic sensitivity pattern of Gram positive bacteria

Antibiotics	*S.aureus* (%)	CONS (%)	Enterococcus (%)
Penicillin	23.08	0	0
Ampicillin	NT	NT	0
Ciprofloxacin	NT	NT	0
Levofloxacin	96.15	80	100
Chloramphenicol	NT	NT	0
Gentamicin	69.23	80	0
Linezolid	96.51	0	100
Cefoxitin	46.15	0	NT
Erythromycin	69.23	80	NT
Clindamycin	73.08	0	NT
Vancomycin	100	100	100
Teicoplanin	92.3	0	NT

NT = Not tested

Gram negative organisms were found to be most sensitive to imipenem (100%) and gentamicin i.e. 92.31% and 100% for *E.coli* and *Proteus* respectively whereas *Klebsiella* was completely resistant to gentamicin. Levofloxacin was another sensitive drug but cephalosporins were quite resistant. *Proteus* was found to be sensitive to most of the drugs. Antibiotic sensitivity pattern of Gram negative bacteria has been shown in table 3.

Table 3 Antibiotic sensitivity pattern of Gram negative bacteria

Antibiotics	*E.coli* (%)	*Klebsiella* (%)	*Proteus* (%)
Amoxicillin/clavulanic acid	0	0	100
Amikacin	61.54	50	100
Tobramycin	69.23	50	100
Gentamicin	92.31	0	100
Levofloxacin	84.62	50	100
Tetracycline	23.08	50	66.67
Ticarcillin	7.69	0	33.33
Cefotaxime	15.38	0	33.33
Ceftriaxone	7.69	0	66.67
Ceftazidime	23.08	0	0
Cefepime	7.69	0	0
Aztreonam	7.69	0	33.33
Imipenem	100	100	100

In case of non fermenters also, imipenem was the most sensitive drug i.e. 79.17% for *P.aeruginosa* and 100% for Acinetobacter whereas aztreonam was found to be the least sensitive drug. Amikacin and cefotaxime were other sensitive drugs to which *P.aeruginosa* showed moderate sensitivity whereas Acinetobacter was 100% sensitive as shown in table 4.

Table 4 Antibiotic sensitivity pattern of Non fermenting Gram negative bacteria

Antibiotics	*P.aeruginosa* (%)	*Acinetobacter* (%)
Ceftaziime	20.83	0
Aztreonam	4.17	33.33
Levofloxacin	58.33	100
Gentamicin	41.67	0
Piperacillin	20.83	NT
Piperacillin/Tazobactam	50	NT
Ticarcillin	54.17	NT
Ticarcillin/Clavulanic acid	54.17	0
Tobramycin	20.83	0
Amikacin	70.83	100
Cefotaxime	NT	0
Cefepime	NT	0
Imipenem	79.17	100

V. Discussion:

Despite the advances in surgical techniques and better understanding of the pathogenesis of wound infection, management of SSIs remains a significant concern for surgeons and physicians in a health care facility. Patients with SSIs face additional exposure to microbial populations circulating in a hospital set up which is always charged with microbial pathogens. The unrestrained and rapidly spreading resistance to the available array of antimicrobials further contributes to the existing problem [7].

In the present study, a total of 83 isolates of various organisms were isolated from different samples of pus obtained from different wards, maximum being from the ward of general surgery.

On observing the gender statistics, it was found that out of 83 isolates, 73.49% were from males while 26.50% were females, hence a male predominance was seen which is in agreement with other studies done by Negi et al., Sasikumari et al. , Prasanna Gupta and Tarso et al., who also showed male predominance [7,10,11,12].

The bacteriological profile showed S.aureus (31.33%), as the predominant organism followed by Pseudomonas aeruginosa (28.92%) and E.coli (15.66%). This was in agreement with a study done by More et al. and Khyati et al. who also showed similar results [13,14]. Infection with S.aureus is most likely associated with endogenous source as it is a member of skin and nasal flora and also with contamination from hospital environment, surgical instruments or from hands of healthcare workers [7]. Special interest in S.aureus is mainly due to emergence of its resistance to methicillin.

In the present study, out of 26 isolates of S.aureus, 14 (53.85%) were methicillin resistant and 12 (46.15%) were methicillin sensitive. This is comparable to the studies done by Kaye et al. and Khyati et al. who reported 58.2% and 48.78% of MRSA respectively [15,14]. However, this is in contrast with the study conducted by Negi et al. and Aggarwal et al. who reported a lower incidence of MRSA i.e. 15.7% and 10% respectively [7,16].

In our study, we found vancomycin, linezolid and teicoplanin as the most sensitive drugs for Gram positive organisms and penicillin as the least sensitive drug which is in agreement with other studies done by Negi et al., Sasikumari et al. and Khyati et al. who also reported similar results [7,10,14].

In the present study, Gram negative isolates showed maximum sensitivity to imipenem i.e. 100% which correlates with the study done by Sasikumari et al. and More et al. [10,13]. Similar results have also been shown by

Sonawane et al. [17]. Other sensitive drug was levofloxacin. However, cephalosporins were found to be quite resistant which holds in agreement to the findings of More et al. and Kakati B et al. [13,18]. We also observed that the non fermenters were most sensitive to imipenem which has also been reported in studies done by Budhani et al., Sasikumari et al. and Domingo et al. [19,10,20].

VI. Conclusion

Despite the modern surgical and sterilization techniques and the use of prophylactic antimicrobials, surgical site infections still continue to pose an important clinical challenge. MRSA continues to be the main threat in healthcare setting. To establish the most suitable empirical treatment for the patients, it is important to know the microbial epidemiology of each institution. The information obtained from this study allows a better understanding of the microbial etiology of surgical site infections in our hospital which may have epidemiological and therapeutic implications. Using the results of this study, an initiative for establishing improved hospital antimicrobial policy and antimicrobial prescribing guidelines can be undertaken. Also the inappropriate and prolonged use of antibiotics should be avoided as this can lead to the development of resistant micro organisms which are even more difficult to get rid of.

References:

[1]. Watanabe A, Kohnoe S, Shimabukuro R, et al. Risk factors associated with surgical site infection in upper and lower gastrointestinal surgery. Surg Today. 2008;38:404–412.

[2]. Budhani D, Kumar S, Sayal P, Singh S. Bacteriological profile and antibiogram of surgical site infection/ post-operative wound infection. Int J Med Res Rev 2016;4(11):1994-1999.

[3]. Ahmed MI. Prevalence of nosocomial wound infection among postoperative patients and antibiotics patterns at teaching hospital in Sudan. N Am J Med Sci. 2012;4(1):29–34.

[4]. Mulu W, Kibru G, Beyene G, Datie M. Postoperative nosocomial infections and antimicrobial resistance patterns of bacterial isolates among patients admitted at FelegeHiwot Referral Hospital, Bahirdar, Ethiopia. Ethiop J Health Sci. 2012;22(1):7–18.

[5]. Dryden MS. Skin and soft tissue infection: microbiology and epidemiology. Int J Antimicrob Agents. 2009 Jul;34 Suppl 1:S2-7.

[6]. Owens CD, Stoessel K. Surgical site infections: epidemiology, microbiology and prevention. J Hosp Infect. 2008;70(Suppl 2):3–10.

[7]. Vikrant Negi, Shekhar Pal,Deepak Juyal, Munesh Kumar Sharma, and Neelam Sharma. Bacteriological Profile of Surgical Site Infections and Their Antibiogram: A Study From Resource Constrained Rural Setting of Uttarakhand State, India. J Clin Diagn Res. 2015 Oct; 9(10): DC17–DC20.

[8]. Mackie and McCartney Practical Medical Microbiology, Tests for the identification of Bacteria,14th Edition, Delhi: Elsevier Publication 2006:131-150.

[9]. CLSI. Performance standards for antimicrobial susceptibility testing; twentieth informational supplement CLSI document M100–S20 Wayne, PA: Clinical and Laboratory Standards Institute 2010.

[10]. Sasikumari O, Sreekumary P K, Jayalekha B. The bacterial profile of surgical site infection occurring within one week after surgery in a tertiary care centre. J Acad Clin Microbiol 2016;18:86-90

[11]. Prasanna Gupta. A study of Post-Operative wound infection among post Surgical patients at Calicut Medical College, Kerala, India JMEDS, 2012.

[12]. Paulo De Tarso Oliveira E Castro, André Lopes Carvalho, Stela Verzinhasse Peres, Milene Mitsuyuki Foschini, Afonso Dinis Costa Passos. Surgical-site infection risk in oncologic digestive surgery. Braz J Infect Dis 2011;15.

[13]. S.R.More, C.D.Kale, S.N.Shrikhande, V.S.Rathod and Kasturi.Interntional Journal of Advanced Research 2015;3(11):1060-1066

[14]. Khyati Jain, Nilesh Shyam Chavan, S.M. Jain. Bacteriological profile of postsurgical wound infection along with special reference to MRSA in central india, indore. Int J Intg Med Sci 2014;1(1):9-13.

[15]. Kaye KS, Anderson DJ, Sloane R, Chen LF, Choi Y, Link K, et al. The effect of surgical site infection on older operative patients. J Am Geriatr Soc. 2009;57(1):46–54.

[16]. Aggarwal A, Khanna S, Arora U, Devi P. Correlation of beta-lactamase production/methicillin resistance and phage pattern of *Staphylococcus aureus*. Indian J Med Sci. 2001;55(5):253–256.

[17]. Jyoti Sonawane, Narayan Kamath, Rita Swaminathan, Kaushal Dosani. Bacterial Profile of Surgical Site Infections and their Antibiograms in a Tertiary Care Hospital in Navi Mumbai. Bombay Hospital Journal 2010;52(3).

[18]. Barnali Kakati, Ashish Kumar, Pratima Gupta PK Sachan, Bhaskar Thakuria. Surgical site abdominal wound infections: Experience at a north Indian tertiary care hospital. Journal, Indian Academy of Clinical Medicine 2013;14(1):13-19.

[19]. Budhani D, Kumar S, Sayal P, Singh S. Bacteriological profile and antibiogram of surgical site infection/post-operative wound infection. Int J Med Res Rev 2016;4(11):1994-1999.

[20]. Domingo KB, Mendoza MT, Torres TT. Catheter related urinary tract infections: incidence, risk factors and microbiological profile. Phil J Microbial Infect Dis 1999;8(4):133-138.

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