Original Article

Aerobic Bacteriological Profile and their Antibiogram : A Study on Surgical Site Infection in a Tertiary Care Hospital in West Bengal

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Abstract

Background : This study is done to determine the Aerobic bacteriological profile of Surgical Site Infection and the antibiogram of different isolates in a Tertiary Care Hospital.

Materials and Methods : A retrospective review of 357 wound swab samples tested for antibiotic identification and susceptibility in the Microbiology Department of R G Kar Medical College & Hospital, Kolkata were included in this study during the period January, 2021 to December, 2022. Culture isolates were identified upto species level and sub-jected to in vitro antibiotic sensitivity testing following standard protocol.

Results : Out of 357 samples collected 88.2% samples were culture positive. The majority of isolates found as Klebsiella pneumoniae followed by Acinetobacter baumannii, MRSA, Pseudomonus aeruginosa, Enterococcus spp, Escherichia coli, Proteus mirabilis & MSSA. Antibiotic Susceptibility testing revealed that 54.3% samples showed wide resistance pattern requiring 2nd line antibacterial drugs for sensitivity testing, among which majority were Gram negative isolates. Among the Gram negative isolates shown wide resistance to commonly used antimicrobials like Piperacillin-tazobactum, 3rd generation cephalosporin, other BL-BLI combinations, Aminoglycosides, Monobactams, Macrolides, Fluoroquinolones and even carbapenems. Few isolates shown resistance to Polymyxin B also. Among the Gram positive isolates, No MRSA & MSSA isolates showed resistance to Vancomycin & Linezolid, Among the other MRSA major resistance found to Clindamycin, Roxithromycin, Ciprofloxacin and 100% are resistant to Cefuroxime and Ticarcillin-clavulenic acid. All MSSA isolates sensitive to Cefuroxime, Ticarcillin-clavulenic acid, Roxithromycin, Clindamycin, Van-comycin and Linezolide. No Enterococcus spp. isolates are resistant to Vancomycin, Linezolide & Ofloxacin, but resistance found against Netilmycin and Cefalexin.

Discussion : Surgical Site Infections are now an increasing entity as nosocomial infections. Majority of the isolates are Gram negative organisms showing wide range of antibiotic resistance. Comparatively, Gram positive isolates are more susceptible to antibacterial drugs.

Conclusion : The increasing resistance pattern to many regularly used antibiotics necessitates regular surveillance and monitoring of laboratory data and judicious use of antibiotics accordingly.

Key words : Surgical Site Infection (SSI), Bacteriological Profile, Antimicrobial Susceptibility, Tertiary Care Hospital.

Surgery has made great advances in the last century and postoperative wound infection is the most common complication faced by surgeon since the advent of surgery. A number of local factors such as haematomas, presence of foreign bodies like suture material or gauze thread, poor surgical technique, degree of contamination and also age, nutrition, hygiene and presence of other associated diseases play an important role in the etiology of postoperative wound infection. The incidence of Surgical Site Infection (SSI) differs widely between surgical procedures, hospitals, patients and between surgeons[1,2].

> ***Editor's Comment :***
> - The study gives insight into bacterial pathogens and their antibiotic susceptibility patterns isolated from Surgical Site Infection in a Tertiary Care Hospital.
> - Gram-negative bacteria are commonly associated with postoperative SSIs, with a predominance of Klebsiella pneumonia.
> - It is also observed from the study that microorganisms, both Gram positive and Gram negatives, show moderate to high level of resistance to different commonly used antimicrobials.

A Surgical Site Infection is an infection that develops as a direct result of an operative procedure. This is one of the most common causes of nosocomial infections associated with surgery, reported incidence rates of surgical site infection is around 2-20%[3].

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Surgical Site Infections are commonly responsible for increasing treatment cost along with lengthening of the hospital stay and associated with significant morbidity and mortality. Despite the technical advances in infection control and surgical practices, SSI still continues to be a major problem, even in hospitals with most modern facilities[4]. These infections are occurred either during the surgery (primary infection) or after the surgery (secondary infection) and usually caused by exogenous and/or endogenous micro organisms[2]. Majority of SSIs are uncomplicated and involving only skin and subcutaneous tissue but sometimes the infection can progress to deeper tissues leading to necrotizing infections. The usual presentation of infected surgical wound can be characterized by pain, redness, swelling, tenderness, and pus formation[5,6]. Incidence of SSIs are significantly depending on numbers of some important factors influencing the occurrence of the infection like invasiveness and virulence of the organism involved, physiological status of the wound tissue and the immunological status of the host etc.

The most commonly isolated bacterial pathogens in SSI are *Staphylococcus aureus*, Enterobacteriaceae, Coagulase Negative Staphylococcus (CoNS), Enterococcus and *Pseudomonas aeruginosa*[8]. Although, in the recent years, growing prevalence of gram negative organisms has been observed over the gram positive organisms as a cause of serious surgical site infections in many hospitals. The irrational and indiscriminate use of broad spectrum antibiotics which is resulting increasing incidence of Anti Microbial Resistance (AMR) has further deteriorated the condition in this regard. The problem gets more complicated in developing countries due to poor infection control practices, patient congestion in the hospital beds and inappropriate over the counter use of antimicrobials[9]. In such scenario, a working knowledge of the prevalence of organisms along with the prevailing antibiotic resistance/susceptibility pattern will be of great help. The present study was undertaken to determine the bacteriological profile and antibiogram of surgical site infections.

This study aimed to determine the incidence of SSIs and the prevalence of aerobic bacterial pathogens involved with their antibiogram.

Aims and Objectives

This study aimed to determine the Aerobic bacteriological profile of Surgical Site Infection and the antibiogram of different isolates in a tertiary care hospital in West Bengal during 2 years of observation; to analyse the trend in species distribution; and to examine in vitro susceptibility to common antimicrobial drugs.

Materials and Methods

A retrospective review of 357 wound swab samples collected from infected surgical sites and presented in the Microbiology department of R G Kar Medical College & Hospital, were included in this study during the period January, 2021 to December, 2022. Culture isolates were identified upto species level and subjected to in vitro antibiotic sensitivity testing following standard protocol.

SSIs are defined as infections occurring up to 30 days after surgery (or up to one year after surgery in patients receiving implants) and affecting either the incision or deep tissue at the operation site.

Samples were collected into sterile swabs, and growths were identified by different microbiological and biochemical methods and isolations were confirmed by: automated culture identification method by VITEC. Positive growths were diagnosed by isolation of different pathogenic gram positive or gram negative species. Drug sensitivity test was employed to determine the sensitivity of1st and 2nd line of antibiotics designated for Gram negative and gram positive isolates as per CLSI guidelines and hospital antibiotic susceptibility policy.

Results

Out of 357 samples collected 315 (88.2%) samples were culture positive. Among which 73.3% (231/315) caused by Gram negative organism and 26.6% (84/315) are caused by Gram positive organisms.

Majority of the culture positive isolates were identified as *Klebsiella pneumonia* ie, 24.8% (78/315) followed by *Acinetobacter baumannii* 21.9% (69/315), MRSA & *Pseudomonus aeruginosa*13.3% (42/315 each), *Enterococcus* spp. 11.4% (36/315), *Escherichia coli* 7.6% (24/315), *Proteus mirabilis* 5.7% (18/315) & MSSA 1.9% (6/315).

Among the gram negative isolates, 33.8% (78/231) are *Klebsiella pneumoniae*, 29.9% (69/231) are *Acinetobacter baumannii*, 18.2% (42/231) are Pseudomonus aerugenosa, 10.4% (24/231) are

Escherichia coli and 7.8% (18/231) are Proteus mirabelis isolates.

Among the Gram positive isolates, 57.1% (48/84) are *Staphylococcus aureus* and 42.9% (36/84) are *Enterococcus* isolates. Among the *Staphylococcus aureus* isolates 87.5% (42/48) are Methicillin resistant.

Among the all isolates, susceptibility of 54.3% (171/315) positive isolates were determined by 2nd line of antimicrobial drugs. Among the Gram negative isolates 71.4% (165/231) were determined by 2nd line of antimicrobial drugs, whereas only 7.2% (6/84) of total gram positive isolates were determined by 2nd line of antimicrobial drugs.

Among the Gram negative isolates 35.0% (81/231) are resistant to both Meropenem & Imepenem; separately 51.9% (120/231) are resistant to Imipenem and 69.1% (114/165, as second line drug) are resistant to Meropenem. 57.6% of gram negative isolates are resistant to aminoglycosides (133/231), 79.2% (183/231) are resistant to ceftriaxone, 53.7% (124/231) are resistant to Piperacillin-tazobactam, 83.6% (138/165) are resistant to cefoperazone-sulbactam and Ticarcillin-clavulenic acid, 66.2% (153/231) are resistant to Levofloxacin, 56.3% (130/231) are resistant to Tigecycline, 89.1% (147/165) are resistant to Lomefloxacin and Aztreonam, 96.4% (159/165) resistant to Azithromycin and 12 out of 147 isolates even showed resistant to Polymyxin B and all are *Acinetobacter baumannii*. isolates (Table 1).

Among the all Gram positive isolates no Vancomycin resistant *Enterococcus* (VRE) and Staphylococcus isolates (VRSA) were found. All Staphylococcus isolates are susceptible to Linezolids. Majority of resistance shown against Cefuroxime and Roxithromycin, both 87.5% (42/48), 100% gram positive isolates resistant to Ciprofloxacin, 62.5% gram positive isolates resistant to Clindamycin. 50% *Enterococcus* isolates are shown resistance to Netilmycin.

Among the individual antimicrobials and isolates, resistance to Imipenem shown among 73.9% (51/69) *Acinetobacter baumannii* isolates, 75.0% (18/24) *Escherichia coli* isolates, 38.5% (30/78) *Klebsiella pneumonia* isolates, 50.0% (9/18) *Proteus mirabilis* isolates and 28.6% (12/42) *Pseudomonus aeruginosa* isolates. Similarly 91.3% (63/69) *Acinetobacterbaumannii* isolates, 41.7% (10/24) *Escherichia coli* isolates, 53.8% (42/78) *Klebsiella pneumoniae* isolates, 66.7% (12/18) *Proteus mirabilis* isolates and

Table 1 — *Distribution of resistance among Gram negative Isolates*

Name of Antimicrobials	Proportion of resistant among Gram negative isolates
Imipenem	51.9% (120/231)
Aminoglycoside	57.6% (133/231)
Ceftriaxone	79.2% (183/231)
Piperacillin-tazobactam	53.7% (124/231)
Levofloxacin	66.2% (153/231)
Tigecycline	56.3% (130/231)
Meropenem	69.1% (114/165)
Cefoperazone-sulbactam	83.6% (138/165)
Ticarcillin-clavulenic acid	83.6% (138/165)
Aztreonam	89.1% (147/165)
Azithromycin	96.4% (159/165)
Lomefloxacin	89.1% (147/165)
Polymyxin B	8.2% (12/147)

14.3% (6/42) *Pseudomonus aeruginosa* isolates shown resistant to aminoglycosides; 100% isolates of *Acinetobacter baumannii* and *Klebsiella pneumonia* isolates shown resistant to Ceftriaxone, whereas 50.0% (12/24) *Escherichia coli* isolates, 33.3% (6/18) *Proteus mirabilis* isolates and 42.9% (18/42) *Pseudomonus aeruginosa* isolates shown resistant to Ceftriaxone. 73.9% (63/69) *Acinetobacter baumannii* isolates, 33.3% (8/24) *Escherichia coli* isolates, 61.5% (48/78) *Klebsiella pneumonia* isolates, 61.1% (11/18) *Proteus mirabilis* isolates and 14.3% (6/42) *Pseudomonus aeruginosa isolates* shown resistant to Piperacillin-tazobactam; 82.6% (57/69) *Acinetobacter baumannii isolates*, 100.0% (24/24) *Escherichia coli* isolates, 69.2% (54/78) *Klebsiella pneumoniae isolates*, 66.7% (12/18) *Proteus mirabilis* isolates and 14.3% (6/42) *Pseudomonus aeruginosa isolates* shown resistant to Levofloxacin; 60.9% (42/69) *Acinetobacter baumannii isolates*, 41.7% (10/24) *Escherichia coli* isolates, 38.5% (30/78) *Klebsiellapneumoniae isolates*, 66.7% (12/18) *Proteus mirabilis* isolates and 85.7% (36/42) *Pseudomonus aeruginosa isolates* shown resistant to Tigecycline (Table 2).

Among the second lines of antimicrobials, 81.0% (51/63) *Acinetobacter baumannii isolates*, 80.0% (48/60) *Klebsiella pneumoniae isolates*, 50.0% (9/18) *Proteus mirabilis* isolates and 25.0% (6/24) *Pseudomonus aeruginosa isolates* shown resistant to Meropenem; 100.0% (63/63) *Acinetobacter baumannii isolates*, 90.0% (54/60) *Klebsiella pneumoniae isolates*, 50.0% (9/18) *Proteus mirabilis* isolates and 50.0% (12/24) *Pseudomonus aeruginosa isolates* shown resistant to Cefoperazone-sulbactum; 90.5% (57/63) *Acinetobacter baumannii isolates*, 100.0% (60/60) *Klebsiella pneumoniae isolates*, 50.0% (9/18) *Proteus* *mirabilis* isolates and 50.0% (12/24) *Pseudomonus aeruginosa isolates* shown resistant to Ticarcillin-clavulenic acid; 100.0% *Acinetobacter baumannii isolates* and *Klebsiella pneumonia*isolates, 66.7% (12/18) *Proteus mirabilis* isolates and 50.0% (12/24) *Pseudomonus aeruginosa isolates* shown resistant to Aztreonum; 100.0% *Acinetobacter baumannii isolates, Klebsiella pneumoniae isolates* and *Proteus mirabilis* isolates shown resistant to Azithromycin alongwith 75.0% (18/24) *Pseudomonus aeruginosa isolates*; 100.0% *Acinetobacter baumannii isolates* and *Klebsiella pneumoniae isolates*, 66.7% (12/18) *Proteus mirabilis* isolates and 50.0% (12/24) *Pseudomonus aeruginosa isolates* shown resistant to Lomefloxacin; 19.0% (12/63) *Acinetobactar baumannii* isolates shown resistance to Polymyxin B, all other isolates (except *Proteus mirabilis* isolates, which are intrinsically resistant) are sensitive to this drug (Table 3).

Among the Gram positive isolates, 100.0% Methicillin resistant *Staphyloccus aureus* shown resistant to Cefuroxime and Ticarcillin-clavulenic acid; 88.1% (37/42) MRSA isolates resistant to Roxithromycin, 71.4% resistant to Clindamycin, 95.2% (40/42) resistant to Ciprofloxacin. All MRSA isolates sensitive to Vancomycin and Linezolide. All MSSA isolates sensitive to Cefuroxime, Ticarcillin-clavulenic acid, Roxithromycin, Clindamycin, Vancomycin and Linezolide, 66.7% (4/6) MSSA isolates resistant to Ciprofloxacin.

Among the *Enterococcus* isolates, all are sensitive to Vancomycin, Linezolide and Ofloxacin, 86.1% (31/36) resistant to Cefalexin, 58.3% (21/36) resistant to Netilmycin, 36.1% (13/36) resistant to Co-trimoxazole (Table 4).

Discussion

SSIs are defined as infections occurring up to 30 days after surgery (or up to one year after surgery in patients receiving implants) and affecting either the incision or deep tissue at the operation site. Despite improvements in prevention and invasion of newer antimicrobials, SSIs remain a significant clinical problem associated with substantial mortality and morbidity and impose burden on healthcare resources. Numerous patient-related and procedure-related factors influence the risk of SSI. The incidence of SSIs may be as high as 20%, depending on the surgical procedure. In SSIs, the responsible pathogens either exogenous from hospital environment or from healthcare workers or originate from the patient's endogenous flora. In this study 88.2% of samples tested are positive for any type of bacterial isolate. The current findings showed that approximately 73.3% of isolates detected as Gram-negative isolates, with a predominance of *Klebsiella pneumoniae*, paralleling a previous study[10] and study done by Kanwalpreet Kaur, Loveena Oberoi[11] and study done by Kameran M. Ali, *et al* in 2021[12]. Study by Pradeep MSS, Rao KVV, *et al*[13] also showed gram

Table 2 — *Distribution of resistance of Gram negative isolates to 1st line Antimicrobials*

Name of antimicrobials	Proportion of resistance among									
	Acinetobacter baumannii (n = 69)		*Escherichia coli* (n = 24)		*Klebsiella pneumoniae* (n = 78)		Proteus mirabelis (n = 18)		*Pseudomonus aeruginosa* (n = 42)	
Imipenem	73.9%	51	75.0%	18	38.5%	30	50.0%	9	28.6%	12
Aminoglycoside	91.3%	63	41.7%	10	53.8%	42	66.7%	12	14.3%	6
Ceftriaxone	100.0%	69	50.0%	12	100.0%	78	33.3%	6	42.9%	18
Piperacillin-tazobactam	73.9%	51	33.3%	8	61.5%	48	61.1%	11	14.3%	6
Levofloxacin	82.6%	57	100.0%	24	69.2%	54	66.7%	12	14.3%	6
Tigecycline	60.9%	42	41.7%	10	38.5%	30	66.7%	12	85.7%	36

Table 3 — *Distribution of resistance of Gram negative isolates to 2nd line Antimicrobials*

Name of antimicrobials	Proportion of resistance among							
	Acinetobacter baumannii (n = 63)		*Klebsiella pneumoniae* (n = 60)		*Proteus mirabelis* (n = 18)		*Pseudomonus aeruginosa* (n = 24)	
Meropenem	81.0%	51	80.0%	48	50.0%	9	25.0%	6
Cefoperazone-sulbactam	100.0%	63	90.0%	54	50.0%	9	50.0%	12
Ticarcillin-clavulenic acid	90.5%	57	100.0%	60	50.0%	9	50.0%	12
Aztreonam	100.0%	63	100.0%	60	66.7%	12	50.0%	12
Azithromycin	100.0%	63	100.0%	60	100.0%	18	75.0%	18
Lomefloxacin	100.0%	63	100.0%	60	66.7%	12	50.0%	12
Polymyxin B	19.0%	12	0.0%	0	x	x	0.0%	0

Table 4 — *Distribution of resistance of among Gram positive isolates*

Name of antimicrobials	Proportion of resistance among					
	MRSA n=42		MSSA n=6		Enterococcus n=36	
Cefuroxime	100.0%	42	0.0%	0	x	x
Ticarcillin-clavulenic acid	100.0%	42	0.0%	0	x	x
Roxithromycin	88.1%	37	0.0%	0	x	x
Clindamycin	71.4%	30	0.0%	0	x	x
Ciprofloxacin	95.2%	40	66.7%	4	x	x
Vancomycin	0.0%	0	0.0%	0	0.0%	0
Linezolide	0.0%	0	0.0%	0	0.0%	0
Cefalexin	x	x	x	x	86.1%	31
Ofoxacin	x	x	x	x	0.0%	0
Netilmycin	x	x	x	x	58.3%	21
Co-trimoxazole	x	x	x	x	36.1%	13

negative isolate as predominant isolates. Findings of our study regarding proportion of *Klebsiella pneumonia*, *Pseudomonus aeruginosa*, *Escherichia coli* and *Proteus mirabilis* is consistent with another study in 2020 by Narula H, Chikara G, *et al*[14]; although findings of *Staphylococcus aureus* as the most common organism isolated, accounting for 35.16% isolates in this study is not line of our majority isolate findings of our study. In any case, the variation in the distribution of SSI bacteria may be due to variations in the population studied (eg, co-morbidities, age, sex), predominance of nosocomial pathogens inhabiting in the operation theatres or post-operative wards, surgical procedures, asepsis maintained during surgical procedure, pre-operative, intra-operative & post-operative infection control measures taken and infection prevention policies alongwith geographical distribution, resistance patterns of the bacterial isolates in question; moreover, post-procedural contamination due to poor personal hygiene and localized outbreaks may be possible reasons for the differences reported[10,15,16].

Antibiotic profile results revealed that a high degree of resistance was found for the majority of Gram-negative bacterial isolates in this study and that commonly used drugs faced greater resistance; like Antibiotic profile results revealed that a high degree of resistance was found for the majority of Gram-negative bacterial isolates in this study and that commonly used drugs like Carbapenems, Aminoglycoside, Ceftriaxone, Piperacillin-tazobactam, Levofloxacin, Tigecycline, Cefoperazone-sulbactam, Ticarcillin-clavulenic acid, Aztreonam, Azithromycin, Lomefloxacin all showing greater than 50% of resistance. Among them Carbapenems, Aminoglycoside, Tigecycline, Cefoperazone-sulbactam were found to be the comperatively more effective antimicrobial agents. Polymyxin B was found to be the most effective antimicrobial agent. Others showing very high level of resistance. These findings are in consistent with the findings of a previous study conducted by Manyahi in 2012[17].

Among the individual bacteria *Acinetobacter baumannii* showed very high level of resistance against almost all types of drugs except Polymyxin B; making these pan drug resistant organism. *Klebsiella pneumoniae isolates* showed very high resistance to Meropenems, Ceftriaxone, Piperacillin-tazobactam, Levofloxacin, Cefoperazone-sulbactam, Ticarcillin-clavulenic acid, Aztreonam, Azithromycin, Lomefloxacin, Whereas Polymyxin B, Imipenem, Aminoglycoside and Tigecycline were found to be the most effective antimicrobial agent. *Pseudomonus aeruginosa isolates* showed comperatively lower resistance to Carbapenems, Aminoglycosides, Piperacillin-tazobactam, Levofloxacin. Whereas these showed higher resistance to Tigecycline, Azithromycin. Isolates of Escherichia coli and Proteus mirabilis also showed varied resistance to commonly used antimicrobials.

A possible explanation for the high levels of resistance recorded could be the occurrence of extended spectrum beta-lactamase (ESBL) and carbapenemase production in these strains[17] and due to increased rates of inappropriate and injudicious use of third generation cephalosporins and even carbapenems and aminoglycosides as surgical antimicrobial prophylaxis. Accordingly, in this study, the use of these prophylaxis for the prevention of SSI may have hampered the detection of third generation cephalosporins, carbapenems and aminoglycosides -susceptible Gram-negative bacteria.

Among the Gram positive isolates majority are Methicillin resistant *Staphylococcus aureus* (50%) followed by Enterococcus. These findings of prevalence of MRSA in SSIs are also in agreement with those of a previous study conducted by Baker AW, *et al*[18] and Pal S, *et al*[19]. In another study done by Bhatta DR, Adhikari A, *et al*[20] revealed 57.4% Gram positive isolates, among which *Staphylococcus aureus* was the most common organism with 65.3% were methicillin resistant *Staphylococcus aureus* isolates which was also in line of the findings of our study findings. Similar to the antibiogram profile of the gram negative isolates found in this study; gram positive isolates shown severe resistance to commonly used antibiotics. MRSA isolates shown more resistant to Cefuroxime, Ticarcillin-clavulenic acid, Roxithromycin, Clindamycin and Ciprofloxacin; whereas MSSA isolates are susceptible to these. Both MRSA & MSSA isolates are susceptible to Vancomycin and Linezolides. These finding is in line with the findings shown in the study by Pradeep MSS, Rao KVV, *et al*[13], Budhani D, Kumar S, *et al*[20] and Bhatta, DR, Adhikari A, *et al*[18]. *Enterococcus* isolates shown high resistance to Cephalexin, Ofloxacin, Netilmycin, whereas comperatively low resistant to Co-trimoxazole. *Enterococcus* isolates are all susceptible to Vancomycin and Linezolides. A possible explanation for the high levels of resistance recorded could be the occurrence of Extended Spectrum Beta-Lactamase (ESBL) production in these strains and inducible resistance produced by macrolides on lincosamides and increased rates of inappropriate and injudicious use of prescription of third generation cephalosporins and ciprofloxacins as surgical antimicrobial prophylaxis. Comparatively high susceptibility to Co-trimoxazole may be explained by the comparatively lower use of this drug today.

More broadly, the observed resistance to antibiotics in this study is an early warning sign since fluoroquinolones and third-generation cephalosporins are so far considered effective agents for the treatment of Gram-negative bacterial infections and Cefuroximes, macrolides and lincosamides for the treatment of Gram-positive bacterial infections. The development and spread of antimicrobial resistant bacterial strains have now emerged as global problems. The appearance of multidrug resistant strains over the past few decades has been regarded as an inevitable genetic response to the strong selective pressure imposed by antimicrobial chemotherapy, which plays a crucial role in the evolution of antibiotic-resistant bacteria[21].

Meanwhile, *Klebsiella pneumonia*, *Acinetobacter baumannii* and *Pseudomonus aeruginosa* strains isolated in the present study were found to be highly resistant against the commonly used antibacterials. This finding is consistent with the findings of the studies by Bansal D, Singh RR, *et al*[22], Walelign Dessie, *et al*[15], Kameran M, *et al*[12] and Kalina, *et al*[23], which also reported a predominance of multidrug resistance *Klebsiella pneumonia*, *Acinetobacter baumannii* and *Pseudomonus aeruginosa* strains following SSIs.

Conclusion

The study gives insight into bacterial pathogens and their antibiotic susceptibility patterns isolated from SSI in a tertiary care hospital. Gram-negative bacteria were commonly associated with SSIs, with a predominance of *Klebsiella pneumonia*. The rate of SSIs caused by GNB was high and the organisms were sourced mostly from the operation theatre, surgical wards or hospital environments rather than the patients themselves.

Surveillance of SSI along with feedback from surgeons will help to reduce the SSI rate and this surveillance system shall be developed in all hospitals alongwith development of perioperative antibiotics usage guidelines. From the present study it was observed that microorganisms, both gram positive and gram negatives became resistant to more commonly used drugs like fluoroquinolones, third generation cephalosporins even carbapenems. There are now left with very few reserve drugs for gram negative and gram positive organisms, which warrants the judicious use of these drugs and other drugs which are still shown less resistance like aminoglycosides and carbapenems; without which, these reserved drugs will also be resistant beyond use. Rational antimicrobial use and continuing surveillance of antimicrobial sensitivity tests at local level are very much necessary to reduce emergence and spread of resistant bacterial isolates. The practice of aseptic technique and maintenance of strict asepsis during and after surgery and adhere to effective methods of sterilisation and patient management should be the primary aspect rather than over reliance on antibiotics to reduce emergence and spread of antimicrobial resistance and multi drug resistant pathogens. It is also recommended that low or intermediate level antimicrobials like gentamicin and ciprofloxacin should be used in preference to second or third generation cephalosporins, carbapenems or higher aminoglycosides like amikacin or netilmycins for treatment of non-complicated postoperative surgical site infections alongwith avoidance of unnecessary use of pre-operative antibiotic prophylaxis with higher antibiotics. Moreover, specific timings of antibiotic administration, calculated drug dose in obese patients, role of anti MRSA prophylaxis etc. shall be followed judiciously. To conclude there is still much to learn about pathophysiology, prevention and surveillance of SSI and regular surveillance and monitoring of laboratory data and judicious use of antibiotics accordingly will be the mainstay to prevent SSI.

Limitation :

Limitations of the present study are mainly related to its retrospective nature with limited follow-up data.

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Conflict of Interest : None

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