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Aerobic Bacterial Profile of Post-Operative Wound Infections and their Antibiotic Susceptibility Pattern

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A B S T R A C T

Post-operative wound infections remain a serious problem in spite of modern standards of pre-operative preparation, antibiotic prophylaxis and operative technique. This study was undertaken to Isolate aerobic bacterial pathogens from clinically suspected post-operative wound infections and to determine their antibiogram. Samples that were sent to Microbiology laboratory from clinically suspected cases of post-operative wound infections were processed further. The bacteria isolated on aerobic culture were identified to the species level by standard biochemical tests. Antibiotic sensitivity testing, phenotypic identification of MRSA and ESBL producers were done as per CLSI guidelines. Overall incidence of post-operative wound infection was 1.7%. Majority of the patients (53.66%) presented with SSI during the post-operative period of 3-10 days. 49 samples showed culture positivity out of 82 infected cases. S.aureus was the predominant isolate (73.47%) followed by *E.coli*, *K.pneumoniae*, *P.aeruginosa* and *P.mirabilis*. MRSA accounted for 22.22%. All the S.aureus isolates were sensitive to Linezolid and Vancomycin. 75% of Enterobacteriaceae produced ESBL among which 66.67% were *E.coli* and 33.33% were *K.pneumoniae*. Marked resistance of isolates to commonly used antibiotics indicates the need for judicious use of these drugs to prevent the emergence of multi drug resistant strains. Proper infection control measures and a sound antibiotic policy are necessary to reduce post-operative wound infections.

Keywords

Antibiotic Susceptibility Pattern, Post-Operative Wound Infections, Aerobic Bacteria

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Introduction

Post-operative wound infections or Surgical Site Infections (SSI) are defined as infections occurring within 30 days after operation for superficial incisional SSI and for operations without implant in place; within 1 year if implant is in place (as per CDC guidelines 1999). However the recent guideline states that infections occurring within 90 days (if implant is in place) are considered as SSI for deep incisional SSI and organ space SSI (CDC 2015 guidelines). Post-operative wound infections are one of the health care associated infections which account for 22% of HCAI, and are second most common HCAI (Gupta, 2012). In India, the SSI incidence varies from 4.04% to 30% (Bangal *et al.*, 2014). Three major factors contribute to post-operative wound infection: a) degree of microbial contamination of the wound during surgery, b) duration of operative procedure, c) host factors (age, obesity, malnutrition, diabetes, carrier state *i.e.*, chronic Staphylococcal carriage, immunosuppression, anaemia, renal failure, radiation etc) (Beilman *et al.*, 2015, Barie, 2012).

Microbiology of SSI depends on the nature of surgery, incision location and body cavity/hollow viscous entry during the procedure. Skin flora is responsible for most of the SSI as they are inoculated into the incision during operation (Barie, 2012).

Most common appearance of SSI is between the 5th and 10th day after operation (Verma *et al.,* 2012). Post-operative wound infections can be caused through exogenous or endogenous bacteria (Shanthi *et al.,* 2012).

As per the data obtained from the National Nosocomial Infections Surveillance System of the CDC 2007, *Staphylococcus aureus* and *Streptococcus pyogenes* are the most common causative agents in clean surgery.

The common organisms associated with abdominal and gynaecological surgeries are *Escherichia coli*, *Klebsiella* species, *Pseudomonas* species, *Acinetobacter* species, *Staphylococcus aureus* and *Streptococcus* species.

Urological surgeries commonly have infections with *Pseudomonas* species and *Acinetobacter* species. *Staphylococcus aureus* and gram negative bacilli are commonly found in infections of Orthopaedic surgeries (Gupta, 2012).

Post-operative wound infections are associated with considerable morbidity and mortality, substantial health care costs, delayed recovery and prolonged stay in hospital by a median of 2 weeks.

There is risk of acquiring SSI even after discharge and the incidence is 2%. Also, these patients are more likely to be readmitted to the hospital (Kitembo *et al.,* 2013).

Increase in multidrug resistant microorganisms is causing a serious therapeutic problem for surgeons. Hence it is necessary to know the prevalent organisms and their antibiogram for early initiation of the treatment (Bibi *et al.,* 2012). Though it is not possible to eliminate post-operative wound infections, they can be reduced to a minimal level which could benefit the patient as well as the medical resources used (Shanthi *et al.,* 2012).

This study was undertaken to study the aerobic bacterial profile of post-operative wound infections and to determine their antibiotic susceptibility pattern.

To isolate the aerobic bacterial pathogens from clinically suspected post-operative wound infections and also to determine their antibiogram.

Materials and Methods

This study was conducted in the department of Microbiology in a tertiary care hospital in Mangaluru, from October 2013 to March 2015. The material for the study was obtained from the samples (of patients with signs and symptoms of post-operative wound infections) that were sent to the department of Microbiology from various surgical units.

Inclusion criteria

1. Age > 18years; 2. Surgical procedures performed within any of the following designated surgical services: General surgery, Orthopaedics, Obstetrics and Gynaecology (OBG) 3. Exudate samples from Surgical Site Infection

Exclusion criteria

1. Age < 18 years; 2. Surgical procedures performed in departments other than general surgery/orthopaedics/OBG; 3. Infected burn wounds; 4. Stitch abscess; 5. Episiotomy wound infection.

Methods of processing

Direct microscopic examination of the gram stained smear. Sample inoculation onto plates of MacConkey agar and 5% sheep blood agar by rolling over the agar and streaking from primary inoculum using a sterile bacteriological loop. The plates were then incubated aerobically at 37˚C for 24 hours and if there was no growth, it was further incubated for 48 hours. Any growth on the media was further identified to the species level using relevant biochemical tests.

Antibiotic susceptibility testing was done on Mueller Hinton Agar using Kirby Bauer's disc diffusion method, according to CLSI guidelines.

Phenotypic identification and detection of Methicillin Resistant *Staphylococcus aureus* (MRSA) and Extended Spectrum Beta Lactamase (ESBL) producers as per CLSI guidelines.

All the *Staphylococcus aureus* isolates were screened for mecA-Mediated Oxacillin resistance using the surrogate marker cefoxitin (30 µg).

Quality control

S. aureus ATCC 25923 – mecA negative
S. aureus ATCC 43300 – mecA positive

Screening test for detection of inducible clindamycin resistance

All the Staphylococcal isolates were screened for detection of inducible Clindamycin resistance by disk diffusion method by placing Erythromycin (15 µg) and Clindamycin (2 µg) which were placed 15–26 mm apart. Presence of a D-zone (flattening of the inhibition zone adjacent to Erythromycin disk) indicated that the isolate had inducible resistance to Clindamycin.

Detection of Extended Spectrum Beta Lactamase (ESBL) production

This method was performed for *Escherichia coli* and *Klebsiella* pneumoniae isolates in our study.

Screening test

Initial screen test was done by disk diffusion method on Mueller Hinton Agar (MHA). The test colony suspension of turbidity of 0.5 Mc Farland was lawn cultured onto MHA and Ceftazidime 30 µg and Cefotaxime 30 µg disks were placed. It was then incubated 37˚C, ambient air, for 16-18 hours. Ceftazidime zone of ≤22 mm and Cefotaxime zone of ≤27 mm were considered to be positive for ESBL screening. Quality control strain: *Klebsiella* pneumoniae ATCC 700603

Phenotypic confirmatory test

Confirmatory test for ESBL production was carried out by Disk Diffusion method. The test colony suspension of turbidity of 0.5 Mc Farland was lawn cultured onto MHA and following antimicrobial disks were placed: Ceftazidime 30µg; Ceftazidime-clavulanate 30/10µg; Cefotaxime 30µg; Cefotaxime-clavulanate 30/10 µg. It was then incubated at 37˚C, ambient air, for 16-18 hours. A ≥ 5 mm increase in a zone diameter for either antimicrobial agent tested in combination with clavulanate v/s the zone diameter of the agent when tested alone was confirmed for ESBL production.

Results and Discussion

Incidence of post-operative wound infection (Table 1)

A total of 4,829 surgeries were performed during the study period in the department of Orthopaedics (2,290), Obstetrics and Gynaecology (873) and Surgery (1,666).

Eighty two of these patients suffered from post-operative wound infection. The overall infection rate is being 1.7%.

Our finding is similar to a study by Shah *et al.*, (2015) from Mumbai, who reported an overall incidence of 1.6%. Bangal *et al.*, (2014), Golia *et al.*, (2014), Korol *et al.*, (2013), have reported SSI incidence of <5%. In contrary, studies by Mundhada *et al.*, (2015) and Mawalla *et al.*, (2011) have reported a higher incidence of SSI.

The incidence of post-operative wound infection was 4.01% in obstetrics and gynaecological surgeries in this study. Incidence of 2.8%, 6.12% and 7.47% has been reported by Bangal *et al.*, (2014) from Loni, Bhadauria *et al.*, (2013) from Wardha and Rahman *et al.*, (2011) from Dhaka respectively. Devjani *et al.*, (2013) from New Delhi reported a higher incidence of SSI (24.2%).

The incidence of SSI was 1.74% among patients undergoing orthopaedic surgeries in this study. Jain *et al.*, (2013) have reported 22.58% of SSI in their study in Bhopal. In the present study, rate of post-operative wound infection was least (0.42%) in operations conducted in department of general surgery. Incidence of 5%, 11.7% and 39% has been reported by Sahu *et al.*, (2009), Maheshwari *et al.*, (2013) from Meerut and Apanga *et al.*, (2014) from Ghana.

There may be inappropriate recording of incidence of post-operative wound infection because all patients who developed post-operative wound infection may not have approached our hospital.

Gender distribution (Table 2)

There were a total of 35 males and 47 females in our study, the ratio of male to female being 1:1.34. Male to female ratio was 4:1in orthopaedic patients and 1:1.33 in patients admitted under general surgery.

Age distribution (Figure 1)

Amongst the patients with post-operative wound infection, the incidence was higher in the age group of >48 years (35.37%) followed by 38-47 years (30.44%), 28-37 years (24.39%) and 18-27 years (12.9%). In this study age >48 years was found to be a risk factor for developing SSI. Ahmed M *et al.*, (2007), Bandaru *et al.*, (2012), Saxena *et al.*, (2013) have also stated that age >50 years is a risk factor for developing SSI. We also noticed that number of post-operative wound infection increased as the age increased. Mahesh CB *et al.*, (2010) have observed a similar finding in their study. Higher incidence of post-operative wound infection in the elderly age group may be attributed to malabsorption, malnutrition, low healing rate, low immunity, underlying chronic disorders.

Risk factors (Table 3)

We found Diabetes Mellitus and advancing age as risk factors among patients who developed post-operative wound infection. Razavi *et al.*, (2005), Ahmed *et al.*, (2007) and Apanga *et al.*, (2014) have also noted a similar finding in their study. Hyperglycaemia has deleterious effects on host immune function especially on function of neutrophils. Poor control of glucose during surgery and in the peri operative period increases the risk of infection and worsens outcome from sepsis.

We also observed multiparty as the risk factor in 28 of 35 (80%) obstetrics and gynaecology patients. Bhadauria *et al.*, (2013) and Rahman *et al.*, (2011) have also stated a similar finding. This may be attributed to malnutrition and anaemia due to repeated child birth.

Type of surgeries conducted (Table 4)

Fracture repair was associated with highest number of post-operative wound infections (38 out of 82) followed by abdominal hysterectomy (29.27%), emergency Caesarean section (10.98%). Modified radical mastectomy and inguinal hernia repair constituted 2.44% each. Rest of the operative procedures constituted for 1.22% of post-operative wound infections (Total hip replacement, Total knee replacement, Elective LSCS, Postpartum sterilization, Laparoscopic appendicectomy, Open appendicectomy, Laparoscopic adhesiolysis and appendicectomy).

Post-operative wound infections among elective and emergency surgeries (Table 5)

In the present study elective surgeries were associated with higher number of post-operative wound infections (56.1%) when compared to emergency surgeries (43.9%). In our study risk factors were more in patients who underwent Obstetrics and Gynaecological surgeries. This may have contributed to increased incidence of post-operative wound infections in elective surgeries than in emergency surgeries.

However the rate of infection was found to be more in emergency surgeries than elective surgeries among patients who underwent surgery in the department of Orthopaedics and General surgery. Patel *et al.,* (2012) reported higher infection rate in patients who underwent emergency surgeries than elective surgeries because emergency surgeries are more often involved with complications and more number of dirty cases. Shahane *et al.,* (2012) reported a higher SSI rate in elective surgeries (7.9%) when compared to emergency surgeries (2.7%).

Time of presentation of SSI (Table 6)

More than half of the patients presented with post-operative wound infection in the post-operative period of 3-10 days (53.66%) followed by 11-30days (21.95%), 31-60 days (12.12%), >3 months-6months (4.88%), >6 months-1year (3.66%), 61-90 days (2.44%). Only one patient presented on post-operative day 2 with SSI. When considering the new guidelines of surgical site infections by CDC (2015), 7 cases that presented after 90 days will have to be excluded.

Since CDC 1999 guidelines were available during the study period, the data of patients who presented with SSI after 90 days has been included and analysed.

Majority of the Obstetrics and gynaecological patients (28 out of 35) had SSI in the post-operative period of 3-10 days, the data was further divided and analysed. It was observed that 9 among them (32.14%) presented with SSI on post-operative day (POD) 8 followed by 17.86% on POD 9; 14.29% on POD 5, 7 and 10; 7.14% on POD 6. Rahman *et al.,* (2011) also noticed that majority of their patients (52%) presented with SSI during the post-operative period of 6-10 days. Bhadauria *et al.,* (2013) reported that majority of the patients presented with SSI after 4 days of operation. Our finding indicates that the source of infection was mainly from the patients, wards, surroundings, attendants etc.

Table.1 Incidence

	Total number of surgeries performed	Total number of cases infected
ORTHO	2290	40 (1.74%)
OBG	873	35 (4.01%)
SURGERY	1666	07 (0.42%)
Total	**4829**	**82 (1.70%)**

Table.2 Gender distribution

	MALE	FEMALE	TOTAL
ORTHO	32	08	40
OBG	-	35	35
SURGERY	03	04	07
TOTAL	35	47	82

Table.3 Risk factors

Risk factors / Department	ORTHO (n=40)	OBG (n=35)	SURGERY (n=07)	TOTAL (n=82)	Percentage
Diabetes Mellitus	09	05	01	15	18.29%
Hypertension	03	01	01	05	6.10%
Advanced age	16	09	04	29	35.37%

Table.4 Type of surgeries conducted

Department	**Type of surgery**	**Number (%)**
Orthopaedics (n=40)	Fracture repair	**38 (73.08%)**
	Total hip replacement	01 (1.22%)
	Total knee replacement	01 (1.22%)
Obstetrics and Gynaecology (n=35)	Elective LSCS	01 (1.22%)
	Emergency LSCS	09 (10.98%)
	Abdominal hysterectomy	24 (29.27%)
	Post-partum sterilization	01 (1.22%)
Surgery (n=07)	Laparoscopic appendicectomy	01 (1.22%)
	Open appendectomy	01 (1.22%)
	Modified radical mastectomy	02 (2.44%)
	Inguinal hernia repair	02 (2.44%)
	Laparoscopic adhesiolysis and appendicectomy	01 (1.22%)
	TOTAL	**82**

Table.5 Post-operative wound infections in emergency and elective surgeries

	Emergency	Elective	Total
ORTHO	23	17	40
OBG	09	26	35
SURGERY	04	03	07
TOTAL (n, %)	**36 (43.90%)**	**46 (56.10%)**	82 (100%)

Table.6 Time of presentation

Time of presentation	Number of cases					
	ORTHO		OBG	SURGERY	**TOTAL (n, %)**	
	According to 1999 CDC guidelines	According to 2015 CDC guidelines			According to 1999 CDC guidelines	According to 2015 CDC guidelines
<3 days	01	01	-	-	01 (1.22%)	01
3-10 days	12	12	28	04	**44 (53.66%)**	**44**
11-30 days	08	08	07	03	18 (21.95%)	18
31-60 days	10	10	-	-	10 (12.12%)	10
61-90 days	02	02	-	-	02 (2.44%)	02
>3 months-6months	04	-	-	-	04 (4.88%)	-
>6 months-1year	03	-	-	-	03 (3.66%)	-
TOTAL	40	33	35	07	82 (100%)	75

Table.7 Presenting symptoms

Symptoms	ORTHO (n=40)		OBG (n=35)		SURGERY (n=7)		TOTAL (n=82)
	Number	%	Number	%	Number	%	n,%
Fever	10	25%	7	20%	02	28.57%	19 (23.17%)
Purulent Discharge	35	87.5%	24	68.57%	03	42.86%	**62 (75.61%)**
Wound gaping	05	12.5%	08	22.86%	01	14.29%	14 (17.07%)
Pain and tenderness	21	52.5%	09	25.71%	04	57.14%	34 (41.46%)

Table.8 Aerobic bacterial profile of post-operative wound infection

Organisms isolated	ORTHO	OBG	SUREGRY	TOTAL (n, %)
Staphylococcus aureus	17	17	02	36 (73.47%)
Escherichia coli	-	03	03	06 (12.24%)
Klebsiella pneumoniae	03	-	-	03 (6.12%)
Pseudomonas aeruginosa	01	01	-	02 (4.08%)
Proteus mirabilis	-	01	-	01 (2.04%)
Klebsiella pneumoniae + *Escherichia coli*	01	-	-	01 (2.04%)
TOTAL	22	22	05	49 (100%)

Table.9 Antibiotic susceptibility pattern of *Staphylococcus aureus*

Antibiotics	ORTHO n=17	OBG n=17	SURGERY n=02	TOTAL n=36
P	5.88%	5.88%	0	5.55%
GEN	76.47%	70.59%	50%	72.22%
E	52.94%	58.82%	0	52.78%
CD	76.47%	76.47%	0	72.22%
TE	64.71%	88.24%	100%	77.78%
CIP	29.41%	41.18%	0	33.33%
COT	76.47%	70.59%	50%	72.22%
C	88.24%	94.12%	100%	91.67%
LZ	100%	100%	100%	**100%**
VA	100%	100%	100%	**100%**

P-Penicillin, GEN-Gentamicin, E-Erythromycin, CD-Clindamycin, TE-Tetracycline, CIP-Ciprofloxacin, COT-Cotrimoxazole, C-Chloramphenicol, LZ-Linezolid, VA-Vancomycin

Table.10 Antibiotic susceptibility pattern of Enterobacteriaceae

Antibiotics	*Escherichia coli* n=07	*K. pneumoniae* n=04	*P. mirabilis* n=01
Amikacin	71.42%	50%	100%
Gentamicin	28.57%	25%	100%
Ceftazidime	14.29%	25%	100%
Ceftriaxone	14.29%	25%	100%
Cefotaxime	14.29%	25%	100%
Cefipime	14.29%	25%	100%
Imipenem	**100%**	**100%**	-
Meropenem	**100%**	**100%**	100%
Piperacillin-tazobactam	**100%**	**100%**	100%
Ciprofloxacin	14.29%	25%	100%
Levofloxacin	28.57%	25%	100%
Cotrimoxazole	14.29%	**100%**	100%
Chloramphenicol	57.14%	**100%**	100%

Table.11 ESBL producers

Organisms	Total number of isolates	ESBL producers	Percentage
Escherichia coli	07	06	85.71%
Klebsiella pneumoniae	04	03	75%
TOTAL	12	09	75%

Total: 09 out of 12 Enterobacteriaceae (75%); *Escherichia coli*: 06 (66.67%); *Klebsiella* pneumoniae: 03 (33.33%)

Table.12 Antibiotic susceptibility pattern of *Pseudomonas aeruginosa*

Antibiotics	*Pseudomonas* aeruginosa (n=02)
Amikacin	100%
Gentamicin	100%
Tobramycin	100%
Ceftazidime	100%
Cefipime	100%
Imipenem	100%
Meropenem	100%
Piperacillin-tazobactam	100%
Ciprofloxacin	100%
Levofloxacin	100%

Fig.1 Age Distribution

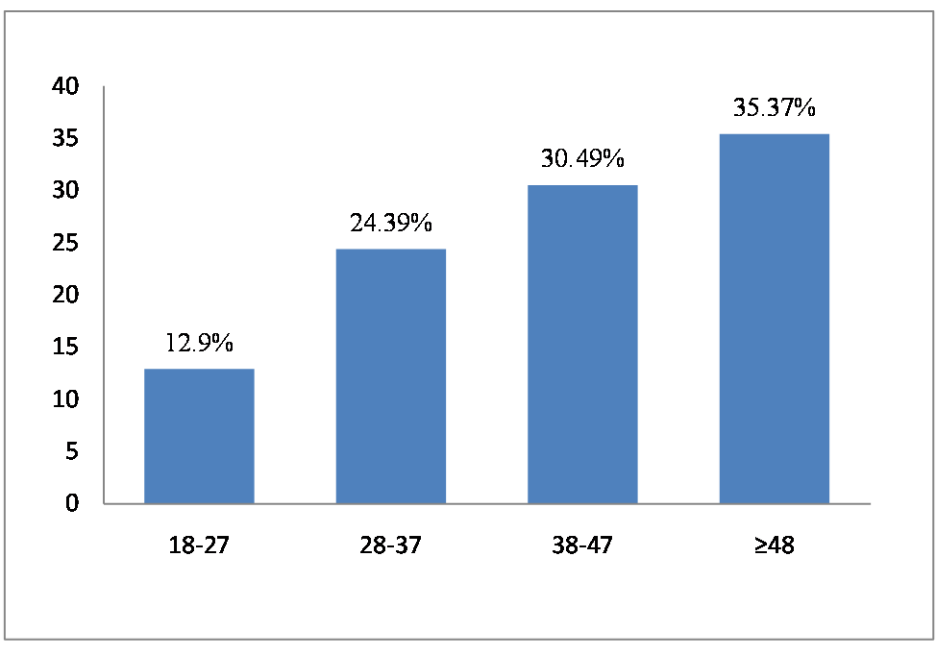


Fig.2 Presenting symptoms

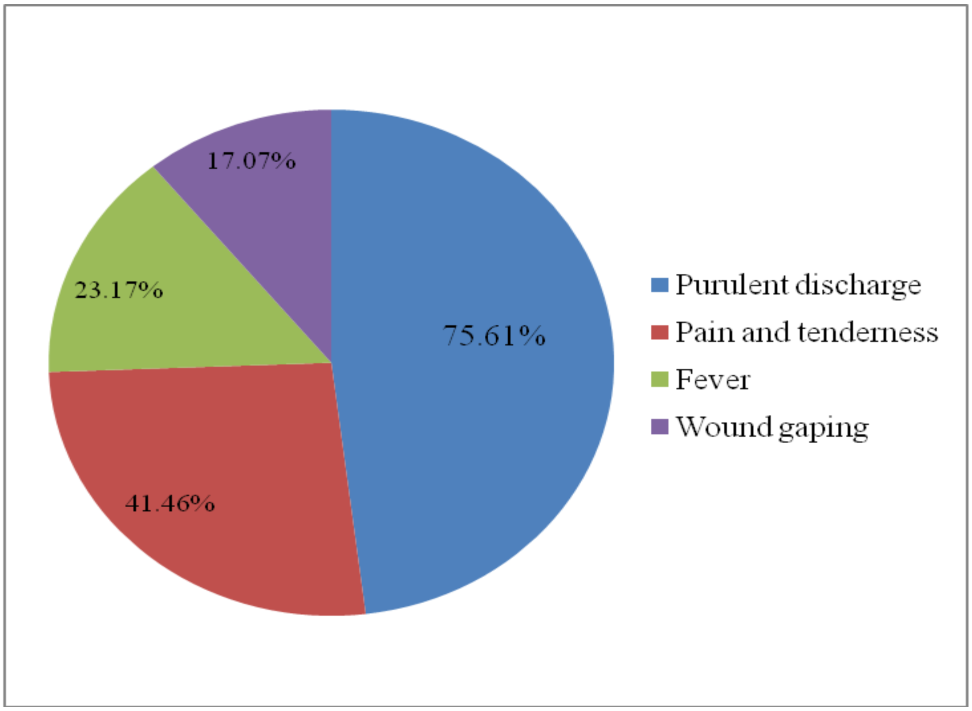


Fig.3 Correlation of Gram stain and culture

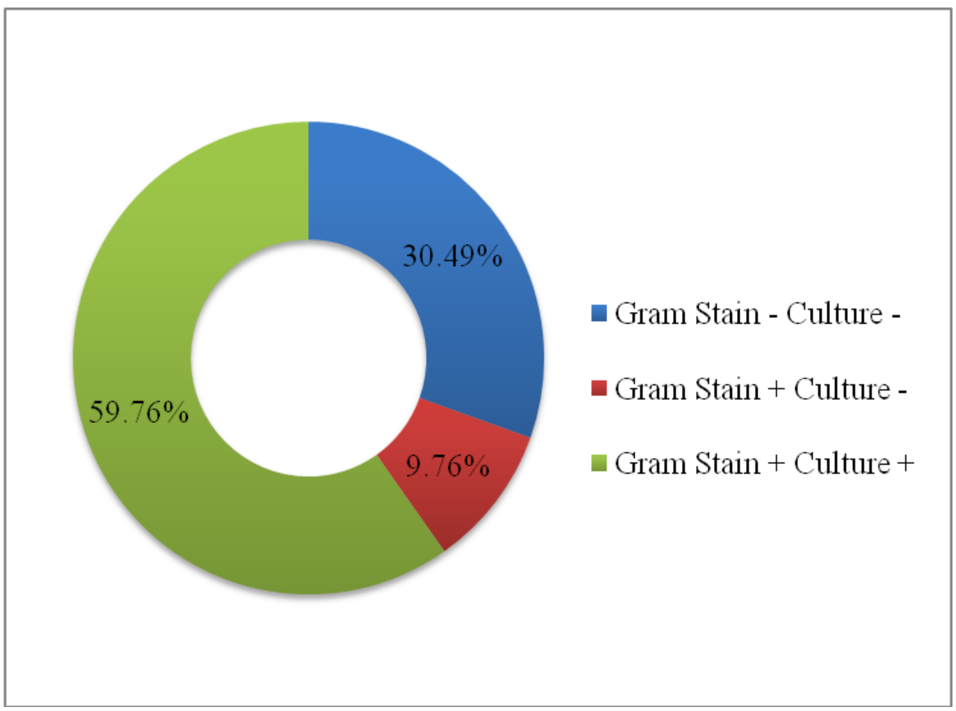


Fig.4 Aerobic bacterial profile of post-operative wound infection

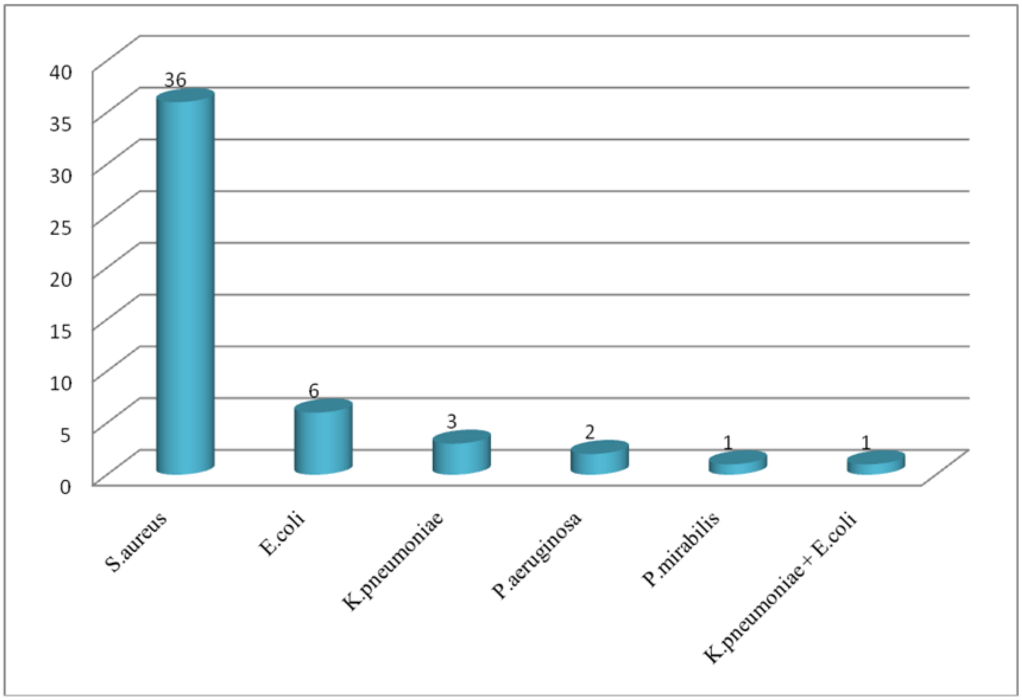


Fig.5 Comparison of antibiotic sensitivity pattern of MSSA and MRSA

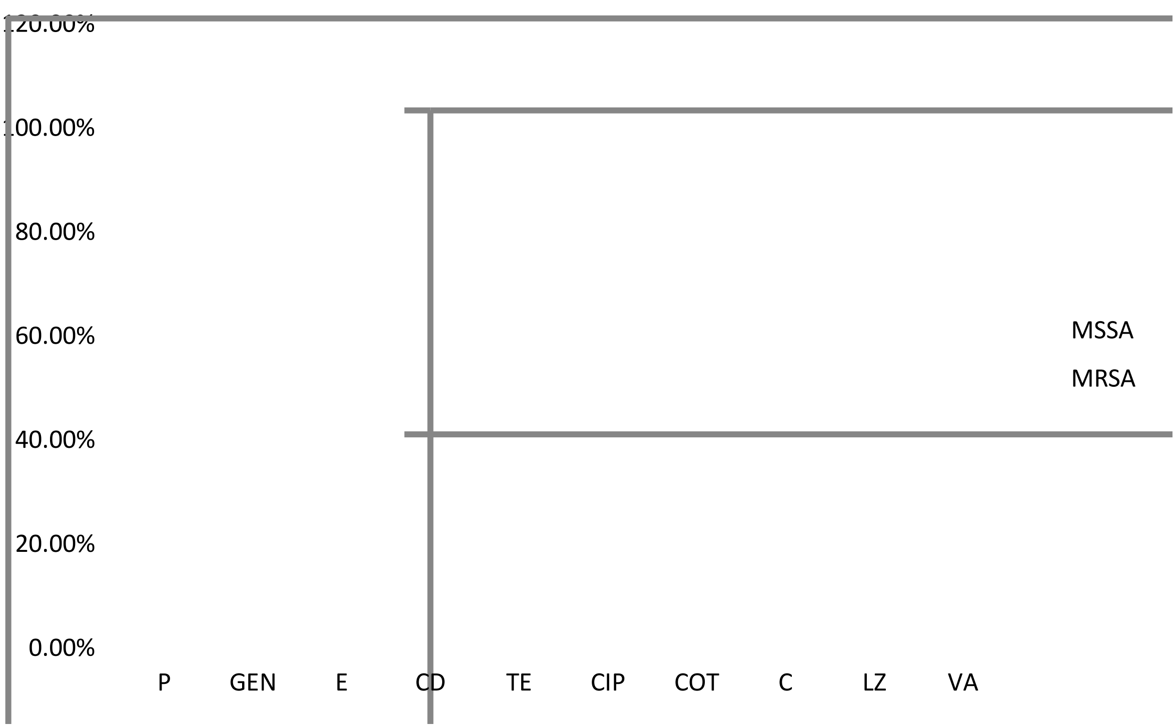
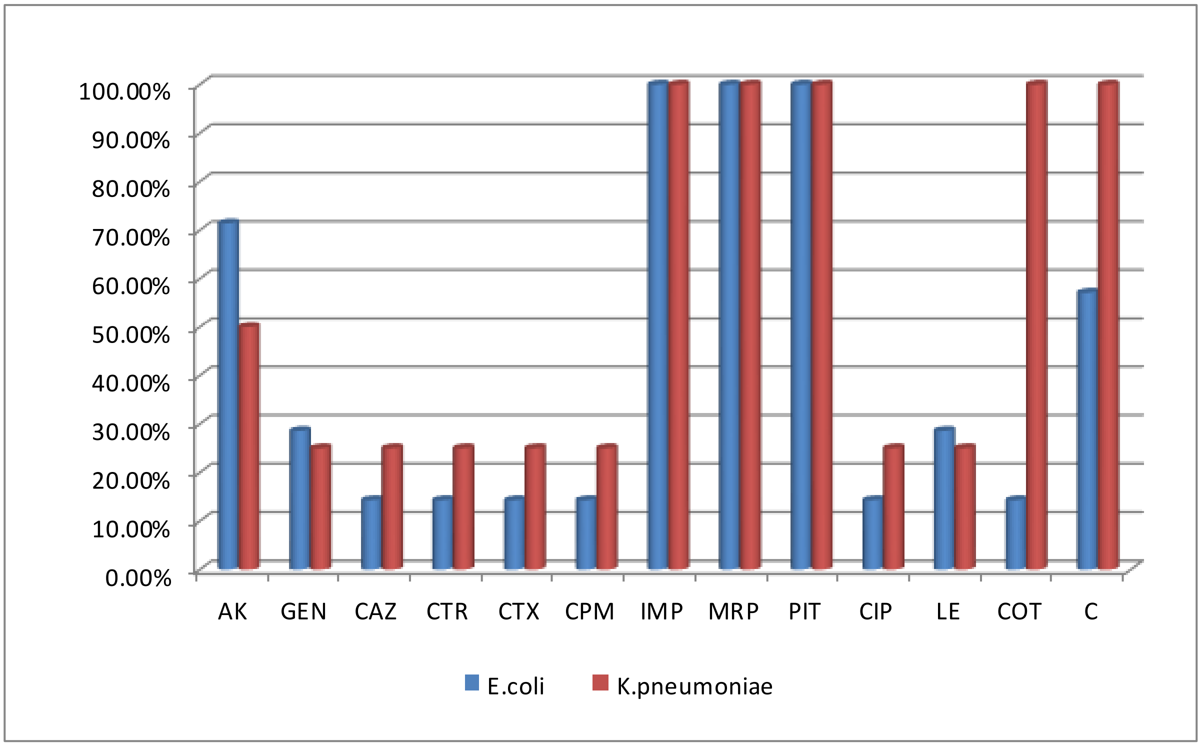


Fig.6 Antibiotic susceptibility pattern of *E. coli* and *K. pneumoniae*



Presenting symptoms (Table 7, Figure 2)

The most common presenting symptom in this study was purulent discharge (75.61%) followed by pain and tenderness (41.46%), fever (23.17%) and wound gaping (17.07%).

Correlation of Gram stain and culture (Figure 3)

More than half of the samples (59.76%) showed organisms in Gram Stain and in culture as well. 30.49% samples had no organisms in Gram stain and had no growth on aerobic culture. Our finding on culture positivity is similar to studies by Rahman *et al.*, (2011) and Ramesh *et al.*, (2012) who reported 65% and 66% culture positivity respectively. In the present study it was noticed that some patients were already receiving antibiotic therapy even before the sample was sent for culture. This might have led to the absence of organisms in Gram Stain and culture. A small percentage (9.76%) of the samples showed organisms in the smear which did not grow. The reason for this may be the presence of anaerobes which could not have grown on aerobic culture.

Aerobic bacterial profile and antibiotic sensitivity pattern (Table 8, Figure 4)

A total of 49 samples showed growth on aerobic culture. Among these *Staphylococcus aureus* was the predominant isolate (36 out of 49) accounting for 73.47%. This finding of Staphylococcal predominance is similar to other studies by Gupta (2012), Ramesh *et al.*, (2012), and Khosravi *et al.*, (2009). Proportion of MRSA in the present study was 77.78%. Over 75% of *S. aureus* were Methicillin resistant in studies by Gupta (2012), Mahesh *et al.*, (2010) and Golia *et al.*, (2014). Majority of *S. aureus* were isolated from orthopaedic and gynaecological surgeries in our study. All the *Staphylococcus aureus* isolates showed 100% susceptibility to Linezolid and Vancomycin (Table 9). This finding is supported by Rao *et al.,* (2013), Shahane *et al.,* (2012) and Ranjan *et al.,* (2013). Over 70% of the isolates were sensitive to Gentamicin, clindamycin, tetracycline and cotrimoxazole. Out of 10 Clindamycin resistant isolates, 3 showed inducible resistance (D test positive). All the three isolates were Methicillin sensitive.

When we compared the sensitivity patterns of MSSA and MRSA (Figure 5), we noticed that both showed maximum susceptibility to Linezolid and Vancomycin (100%) followed by Chloramphenicol (92.86% for MSSA and 87.5% for MRSA). Majority of MSSA were sensitive to erythromycin and clindamycin (64.29% and 89.29% respectively) whereas only 12.5% of MRSA were sensitive to these drugs. This finding of MRSA isolates being more drug resistant than MSSA is supported by Ranjan *et al.,* (2013). Wassef *et al.,* (2012) have also reported co-resistance of MRSA to tetracycline, clindamycin and Gentamicin in their study.

Escherichia coli was the second most common organism isolated in this study. Rahman *et al.,* (2011), Sonawane *et al.,* (2010) and Mawalla *et al.,* (2011) also reported a similar finding. Maximum (100%) susceptibility was seen against Piperacillin-tazobactam, Imipenem and Meropenem followed by Amikacin (71.42%) and Chloramphenicol (57.14%). Least susceptibility was observed against Gentamicin and Levofloxacin (28.57% each); cephalosporins, ciprofloxacin and Cotrimoxazole (14.29% each) (Table 10). Similar antibiotic sensitivity pattern has been reported by Sonawane *et al.,* (2010), Shah *et al.,* (2015) and Golia *et al.,* (2014).

Klebsiella pneumoniae was the third most common organism isolated accounting for 6.12%.. This organism showed 100% susceptibility to Cotrimoxazole, Chloramphenicol, Piperacillin-tazobactam, Imipenem and Meropenem (Table 10, Figure 6). Only about a half of the isolates were sensitive to Amikacin. Like *E. coli, K. pneumoniae* also showed least susceptibility against cephalosporins, Gentamicin, ciprofloxacin and Levofloxacin (25% each). 75% of all isolates showed ESBL production. Sonawane *et al.,* (2010) have reported a similar finding of antibiotic susceptibility pattern. However Verma *et al.,* (2012) reported maximum susceptibility towards ceftriaxone (66.67%) in their study.

ESBL producers (Table 11)

ESBL production was seen in 9 of the 12 Enterobacteriaceae isolated accounting for 75%. Among these, 6 were *E. coli* and 3 were *K. pneumoniae* (66.67% and 33.33% respectively). Over 60 % of ESBL production has been noted by Shanthi *et al.,* (2012), Wassef *et al.,* (2012) and Mawalla *et al.,* (2011).

There were 2 isolates of *P. aeruginosa* in the present studies which were 100% susceptible to all the antibiotics tested (Table 12). Over 83% susceptibility against Piperacillin-tazobactam, Ceftazidime and Imipenem has been reported by Shahane *et al.,* (2012). Sonawane *et al.,* (2010) also reported 80-90% sensitivity of *P. aeruginosa* against Piperacillin-tazobactam and Imipenem and higher percentage of resistance to all the other antibiotics tested.

Overall incidence of post-operative wound infections in the present study was 1.7%. The risk factors associated were Diabetes mellitus, hypertension, advanced age and multiparty. *S. aureus* was the predominant isolate followed by *E. coli, K. pneumoniae, P. aeruginosa* and *P. mirabilis*. 22.22% of *S. aureus* were Methicillin resistant and also showed co-resistance to many of the commonly used antibiotics. Among the Enterobacteriaceae isolated, more than half of them were ESBL producers.

Reduction in the rate of post-operative wound infection is necessary to bring down the morbidity and mortality associated with it as well as to lower the wastage of healthcare resources, treatment cost and economical burden on the patient. Adequate glycaemic control in diabetic patients, proper antimicrobial prophylaxis, infection control measures, suitable antibiotic policy development, and surveillance are the most effective measures to reduce post-operative wound infections as well as emergence of multidrug resistant strains.

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