Original Article

A Study on Surgical Site Infections Caused by Staphylococcus Aureus with a Special Search for Methicillin-Resistant Isolates

Microbiology Section

GAYATHREE NAIK, SRINIVAS R. DESHPANDE

ABSTRACT

Objective: To study the prevalence of Staphylococcus aureus and Methicillin-Resistant Staphylococcus Aureus (MRSA) in surgical site infections (SSIs) in referral hospitals at the coastal city of Mangalore, India.

Materials and Methods: This study was conducted on 300 patients who underwent surgery in the obstetrics and gynaecology, orthopaedic and surgical departments which were attached to the referral hospitals which were attached to Kasturba Medical College, Mangalore. Pus samples were collected with two sterile swabs and processed in the Microbiology department.

Results: Of the 300 pus samples, 216(72%) showed growth. 258 aerobic bacteria were isolated. The most common organism which was isolated was Staphylococcus aureus, with 83(32.2%) isolates. Of these, 8 (9.6%) were Methicillin Resistant Staphylococcus Aureus (MRSA).

Conclusions: Indian clinicians and infectious disease specialists in the coastal areas are facing formidable challenges from Methicillin Resistant Staphylococcus aureus. Despite the best surgical practices, nearly a tenth of all the SSIs cases could be caused by MRSA. Routine screening for these multidrug resistant organisms in the hospital staff, especially in the surgical departments and pre-surgical screening of the patients could help in reducing the incidence of MRSA.

Key Words: Surgical Site Infections, Staphylococcus aureus, Methicillin resistant Staphylococcus aureus (MRSA)

INTRODUCTION

Surgical infections which are acquired in the hospital, are recognized to be associated with an extended length of hospital stay, pain, discomfort and sometimes prolonged or permanent disability [1]. Surgical site infections (SSIs) are common complications that follow all types of operative procedures [1]. These infections are usually caused by the exogenous and endogenous microorganisms that enter the operative wound during the course of the surgery [1]. The incidence of the infected surgical wounds may be influenced by factors such as pre-operative care, the theatre environment, post operative care and the type of surgery. The aim of these guidelines [2] has been to reduce surgical site infections by ensuring that the hospital personnel practice optimal preoperative, intraoperative and postoperative care.

The common pathogenic bacteria in SSIs include Staphylococci, Pseudomonas, Streptococci, Enterococci, E.coli, Klebsiella, Enterobacter, Citrobacter, Acinetobacter, Proteus, etc. S.aureus forms a part of the normal flora and can be isolated from the noses of up to 60% of the healthy individuals. It is readily transmitted from person to person onto the hands and clothes of the health care staff, onto objects and into the air [1], [2]. S.aureus is the commonest cause of SSI and other nosocomial infections. S.aureus was once susceptible to Penicillin but widely resistant organisms soon emerged. The introduction of Methicillin initially solved the problem, but later, strains which were resistant to Methicillin developed. Thus, an increased number of resistant strains have been seen worldwide. [2], [3]

The clinical significance of Methicillin-resistant Staphylococcus Aureus (MRSA) is heightened by the fact that these isolates are usually resistant to other anti-staphylococcal agents (Clindamycin, Erythromycin, Tetracycline, sometimes Gentamicin and Trimethoprim/ Sulphomethoxazole), with the exception of Vancomycin. Sometimes, Methicillin-resistant-Staphylococcus aureus appears to be susceptible in vitro to other β-lactam agents such as Cephalosporins; however, they are clinically ineffective [3]. Since MRSAs are resistant to all the β-lactam antibiotics, the therapeutic options are significantly limited. The incidence of MRSA in India ranges from 30-70% [4], [5]. The incidence of nosocomial infections which are caused by MRSA continues to increase; therefore, the importance of their detection, especially for treatment and epidemiological purposes, arises [6], [7], [8]. The present study was done in various hospitals in Mangalore to determine the incidence of S. aureus and MRSA in surgical site infections, with the characterization of S.aureus by phage typing.

MATERIAL AND METHODS

Study Population

This study was conducted in the Department of Microbiology at four teaching hospitals which were attached to Kasturba Medical College, Mangalore, from October 2003 to September 2004. The study population included three hundred patients suffering from surgical site infections in the surgical and orthopaedic departments of Government Wenlock Hospital, the Obstetrics and Gynaecology department of Lady Goschen Hospital, K.M.C Hospital, Attavar and K.M.C Hospital, Ambedkar Circle, Mangalore. These patients were selected randomly and they belonged to the age group of three to seventy five years. The first two hospitals which have been mentioned are government run hospitals, while the latter two private hospitals belong to the private management of Kasturba Medical College.

INCLUSION CRITERIA

A surgical wound with pus discharge, wounds with serous or seropurulent discharge and negative cultures, but with signs of sepsis present concurrently (warmth, erythema, induration and pain) and the physician diagnosis was considered as surgical site infection [7].

EXCLUSION CRITERIA

Wounds with cellulitis and no drainage and suture abscesses were not included in the study.

RELEVANT HISTORY

A short clinical history regarding the age, sex, type of illness, diagnosis, the type of operation performed, antibiotics given and the presence of associated diseases like diabetes and peripheral vascular disease was obtained.

SPECIMEN COLLECTION

Pus samples were collected from each patient with the help of two sterile swabs under aseptic precautions, of which one was used for smear preparation and the other was used for culture.

Specimen Transport: The swabs were brought to the Department of Microbiology, K.M.C. Mangalore, immediately and processed within thirty minutes of collection.

METHODS

Sample Processing: The pus samples were inoculated onto the media immediately and were incubated at 37°C for 24 hours in 7-10% CO2 concentration. After 24 hours of incubation, the isolated organisms were identified by standard methods. [6], [7]. Colonies which were suggestive of S.aureus were identified by gram's staining, catalase test, tube coagulase test and mannitol fermentation tests.

ANTIMICROBIAL SUSCEPTIBILITY TESTING [8], [9]

Antibiotic susceptibility testing was done by the disc diffusion test which was described by the modified Kirby Bauer method. The antimicrobial containing discs were placed on the agar plate within 15 minutes of inoculation by using sterile forceps and these were pressed firmly against the plate. The plates were inverted and incubated for 18-24 hours at 35°C, at a CO2 concentration of 7-10%. [9] The drugs were chosen, based on their action on a particular organism and also on the antibiotic policy of the hospitals.

Six discs were used on a 9 cm diameter plate. The antimicrobial discs for Staphylococcus aureus were: Penicillin (10 units), Erythromycin (15mcg), Ciprofloxacin (5mcg), Cefoperazone (30mcg), Oxacillin (l mcg), and Co-trimoxazole (25mcg) .These were tested as first line antibiotics. Those which were resistant to the first line antibiotics were tested with second line drugs like Vancomycin (30mcg), Teicoplanin (30mcg), Rifampicin (30mcg). Cephotaxime (30mcg) and Amoxyclav(30mcg). The antibiotic discs were obtained from HiMedia Laboratories, Pvt. Ltd. Mumbai.

After 18-24 hours of incubation, the diameter of the inhibitory zone was measured by using a millimeter scale. The zone size around each antimicrobial disc was interpreted as sensitive, intermediate or resistant, according to The National Committee for Clinical Laboratory Standards (NCCLS), which is now called the Clinical and Laboratory Standards Institute (CLSI) criteria. The test of diffusion in the agar was applied according to the CLSI recommendations (CLSI, 2006), by using Mueller-Hinton Agar and antibiotic discs. The NCCLS/CLSI recommends the Cefoxitin disk screen test, the latex agglutination test for PBP2a, or a plate containing 6 µg/ml of Oxacillin in Mueller-Hinton agar which is supplemented with NaCl (4% w/v; 0.68 mol/323wL) as the alternative methods of testing for MRSA. [9], [10], [11]Detection of Methicillin-Resistant Staphylococcus aureus:

Methicillin-resistant Staphylococcus aureus were detected by the agar screen, and the agar dilution method. The strains of Staphylococcus aureus which were resistant to Oxacillin were referred to as Methicillin-Resistant Staphylococcus aureus (MRSA). Oxacillin was used because it is a stable β-lactamase resistant Penicillin.

The agar screen method for the detection of Oxacillin resistance in Staphylococcus aureus: Mueller-Hinton agar (HiMedia Laboratories, Mumbai) which was supplemented with 4% NaCl and 6µg of Oxacillin per ml was used. Inoculum suspensions were prepared by selecting colonies from overnight growth on a blood agar plate. The colonies were transferred to nutrient broth to produce a suspension that matched the 0.5 McFarland's turbidity standards. This suspension was used to inoculate the Oxacillin agar screen plate by streaking across a small section of the agar surface. The test plates were incubated for 24 hours at 35°C and were then examined for any evidence of growth which indicated resistance.

Quality Control: Staphylococcus aureus ATCC 25923 (Oxacillin susceptible) and Staphylococcus aureus ATCC 43300 (Oxacillin resistant) were used as the control strains.

The agar dilution method for the detection of Oxacillin resistance in Staphylococcus aureus: Mueller-Hinton agar (pH:7.2) which was supplemented with 2% NaCl was dispensed into screw capped containers in volumes of 19ml and these were sterilized in an autoclave at 121°C for 15 min at 15 lb/in2 pressure. After sterilization, the containers were kept in a water bath at 55°C. One ml of antibiotic solution was added to the 19ml medium, mixed by gentle rotation, poured into a sterile glass petridish and allowed to solidify. Once prepared, the plates were used immediately or stored at 4-8°C for not more than 5 days.

The inoculation procedure: Four to five colonies were picked from the overnight growth on blood agar and these were inoculated into 5ml of nutrient broth. The tubes were incubated at 37°C for 2 to 6 hours and the turbidity was matched with 0.5 McFarland's Std.(Bacterial concentration of 1.5 x 108 colony forming unit/ml). A one in 100 dilutions was done by using normal saline once the inoculum was prepared and these were used within 30 minutes. By using a calibrated loop, 0.01 ml of the inoculum was delivered to the agar surface, resulting in a final inoculum of approximately 104 cfus/spot. Growth controls were used with each test.

Incubation: The plates were incubated at 35°C for 24 hours.

Interpretation of the results: While reading and interpreting the results, the growth control and the results with the quality control strains were checked [6, 10]. The end point was determined for the test by placing the plates on a dark background and by then examining the plates for the lowest concentration of Oxacillin that inhibited the visible growth, which was recorded as the Minimum Inhibitory Concentration (MIC). Staphylococcus aureus strains which had an MIC of Oxacillin as < 2mcg/ml were considered as Methicillin-sensitive Staphylococcus aureus and those having an MIC of >4mcg/ml were considered as Methicillin-Resistant Staphylococcus aureus (MRSA) [10].

Phage Typing: All the Staphylococcus aureus isolates were sent to Maulana Azad Medical College, New Delhi, for phage typing.

Statistical Analysis: P-values were derived from the standard statistical tables. Chi square test was applied to find the statistical significance of various organisms.

RESULTS

Out of the 258 aerobic bacteria which were isolated (Table/Fig-1), 133 were gram positive cocci (51.6%) and 125 were gram negative bacilli (48.5%). The most common organism was Staphylococcus aureus, with 83 isolates (32.2%). Other predominant organisms which were isolated were Pseudomonas, Escherichia, Citrobacter, Klebsiella, Proteus, and Enterococcus. Of the 83 Staphylococcus aureus isolates, Penicillin (P) sensitivity was seen in 7 (12.3%), Erythromycin (E) sensitivity was seen in 36 (43.4%), Ciprofloxacin (Cf) sensitivity was seen in 38 (45.8%), Co-trimoxazole (Co) sensitivity was seen in 58 (69.9%), Cefaperazone (Cs) sensitivity was seen in 53 (66.3%), Netillin (Nt) sensitivity was seen in 63 (75.9%) and Oxacillin (Ox) sensitivity was seen in 75 (90.4%) respectively. All the 83 (100%) isolates were sensitive to Vancomycin (Va).

Among the 83 isolates, 8 (9.6%) showed growth, which indicated Methicillin- resistant Staphylococcus aureus and 75 (90.4%) showed no growth, which indicated Methicillin-sensitive Staphylococcus aureus.

Aerobic Organisms	No. of isolates	Percentage
Gram Positive Cocci:		
Staphylococcus aureus	83	32.2
Staphylococcus epidermidis	38	14.8
Group A beta hemolytic Streptococcus	5	1.9
Enterococcus faecalis	5	1.9
Enterococcus faecium	2	0.8
Total	133	51.6
Gram Negative Bacilli:		
Pseudomonas aeruginosa	33	12.8
Ps e u do m on as fluorescens	13	5.0
Pseudomonas putida	8	3.1
Escherichia coli	23	8.9
Acinetobacter species	15	5.8
Klebsiella pneumoniae	12	4.7
Klebsiella oxytoca	1	0.4
Proteus vulgaris	7	2.7
Proteus mirabilis	4	1.6
Citrobacter freundii	6	2.3
Enterobacter aerogenes	3	1.2
Total	125	48.4

[Table/Fig-1]: Aerobic bacteria isolated from infected postoperative wounds

Chi-square test: X2= 182.30; P value=.000 (P-value >0.05 non significant, Value <.05 statistically significant, Value < 0.01 highly significant)

MINIMUM INHIBITORY CONCENTRATION (MIC)

The minimum inhibitory concentration of Methicillin for all the 8 isolates(9.6%) which were resistant to Methicillin by the agar screen method, was tested by the agar dilution method. All the 8 isolates showed an MIC of >4mcg/ml. Among the 83 Staphylococcus aureus isolates, 49 were typable and 34 were non-typable. A majority of the typable strains belonged to the phage group III. Among the 8(10%) MRSA isolates, 5 were non-typable. 2 isolates belonged to Group IV respectively. This is depicted in [Table/Fig-3].

DISCUSSION

The prevalence rate of surgical site wound infections, though preventable, is high [13], [14]. Several studies all over the world [13-18, 20-24, 28, 30] have well established that the early detection of Methicillin resistance is very essential in the prognosis of infections which are caused by S.aureus. Studies by Agarwal (1972), Rao and Harsha (1975), Kowli et al. (1995) and Anvikar (1999) have shown the surgical site infection rates in India to be between 4 to 30% [16-18, 22-35].

It has been regularly noted that S. aureus continues to be the single most important bacterial species in the primary aetiology of surgical site infections since the past thirty years or so [15]. In our study, we attempted to estimate the prevalence of S.aureus and MRSA in surgical site infections (SSI) in Mangalore, a health conscious, south Indian, coastal city of nearly 1 million population, as there are was a paucity of recent data which was available in this city with four medical colleges and numerous well maintained hospitals. We realize that we have to interpret our findings with caution and are aware that the values may not be representative of the whole of India, but that they may be comparable to those from Kerala, a similarly urbanized state of India. The nutritional status, literacy, nursing facilities and the access to the good health care facilities of Mangalore are comparable to those in the cities of Kerala.

In our study, we could see that, of the 300 pus samples which were collected from the patients with surgical site infections (SSI), the highest incidence of SSIs was seen in orthopaedic cases (52.3%), followed by surgical (30.1%) and obstetrics and gynaecology cases (17.6%) respectively. The orthopaedic case group (n=149) showed statistically significant values (x^2=21.02; p value P=.000). Further, we noted that a majority of the orthopaedics patients (98) who were included in the study were operated for the open reduction of fractures. Contamination from the external environment may be a possible reason for the higher rate of surgical site infections (SSI) in orthopaedic surgeries. Among them, the number of male patients (63%) was higher than the female patients (37%). This could be due to increased mobility in the male population. In both the sexes, a maximum number of patients belonged to the age group of 21-30 years; males (25.9%) and females (22.2%) respectively.

The P value (P=0.000) was highly significant with respect to government hospital surgeries when compared to private

	P		E*		Cf		Co**		Cs***		Ox		Nt		Va		Ri		Tc		Lz	
	S	R	S	R	s	R	s	R	s	R	S	R	S	R	S	K	S	R	S	R	S	1
N	7	76	36	49	55	28	58	25	53	30	75	8	63	20	83	0	83	0	83	0	83	1
%	12.3	87.7	43.4	56.6	66.3	33.7	69.9	30.1	66.3	33.7	904	9.6	75.9	24.1	100	0	100	0	100	0	100	1

[Table/Fig-2]: Antibiogram of Staph.aureus

*22(26.5%) isolates intermediate, **4 (4.8%) isolates intermediate, ***2 (2.4%) isolates intermediate

Phage group	No. of strains	Percentage
I	–	–
II	–	–
III	33	67.3
IV	–	–
Mixed	16	32.7
Typable	49	59
Non-Typable	34	41
Total	83	100

[Table/Fig-3]: Phage Pattern of Staphylococcus aureus from Postoperative Wound Infection.

hospital surgeries. This high statistical significance of surgical site infections in the government hospitals of Mangalore which were attached to the same medical college, as compared to the two private hospitals of Kasturba Medical College, Mangalore, may be due to the relatively poor hygienic measures in the government hospitals, and this needs further confirmatory studies. The common denominator in our study and in Udgaonkar's study [16-20] was that a majority of the samples were derived from government hospital patients. The changing pattern could be due to the reported indiscriminate use of new/many broad spectrum antibiotics, the increasing use of instrumentation, the long preoperative stay and coexisting infections at a remote body site [20], [21]. Also, another limitation of our study was the use of the oxacillin disc. The cefoxitin disc diffusion method and the polymerase chain reaction method for the detection of the mecA gene, which have been currently recommended by the CLSI criteria, would have been more sensitive in the detection of the MRSA isolates. [13], [14].

Again, out of the 300 pus samples, 216 (72%) showed growth. Our results are similar to a study on SSIs by Soleto et al (2003, Bolivia) [21]-[22], who reported 75.6% growth. A total of 258 aerobic bacteria were isolated from the 300 samples. Staphylococcus aureus was the most common pathogen and it grew in 83 samples (32.2%), which was found to be statistically highly significant (p value: 0.000).This was comparable to the study which was conducted by Edwards et al [15], who reported a high incidence of S. aureus (30.3%). Also, previous studies in India by Surange et al [17] and Subramanian et al [12] have reported the incidence of S. aureus to be 34.2% and 30.9% respectively. Again, recent studies on SSIs in India by Kownhar et al in 2008, have shown an incidence of 37% [23-31] and those done in USA by Eagye et al [32] have shown an incidence of 39% of S.aureus. A higher predominance of S.aureus (51.6%) was observed by Keith et al [29] in older operative patients. It is our postulation that there may be more S.aureus carriers, as the hospital staff could be silent carriers and this finding may be relevant to the city hospitals of Mangalore also. Four isolates of S. aureus were seen with Pseudomonas species and Escherichia coli respectively. Two isolates each were seen along with Proteus species, Acinetobacter species and Group A beta haemolytic Streptococcus.

The distribution of the bacteria which were isolated from our study on SSIs and from various previous studies as compared to our study is given in [Table/Fig-4]. While studying the antibiotic sensitivity patterns, we observed that Vancomycin, Rifampicin, Linezolid and Teicoplanin were the most sensitive (100%) antibiotics for S.aureus. Among the first line antibiotics, the highest sensitivity was recorded with Oxacillin (90.4%) and the least sensitivity (12.3%) [was seen with Penicillin. Other effective antibiotics were Erythromycin (43.4%), Ciprofloxacin (45.8%), Cefoperazone (66.3%) and Netillin (75.9%).

S.aureus has been known to acquire resistance to most antibiotics including the penicillinase resistant ones like Methicillin. A study by Weigelt et al in USA, found an incidence of 20.6% MRSA [33] in SSIs. Still higher incidences of 45% and 58.2% MRSA have been documented by Eagye et al [32] and Keith et al [29]. The incidence of Methicillin–resistant S.aureus in our study was 8 (9.6%).This finding is in agreement with the reported incidence of (10%) MRSA in a study which was conducted by Agarwal and Khanna [35]. But, observations by Kownhar et al [23] have showed a higher incidence of 21.7%. We found that all the MRSA strains (100%) were sensitive to Vancomycin, Rifampicin, Teicoplanin and Linezolid .This finding could have relevant clinical use in the antibiotic policy guidelines for hospitals.

Of the 83 isolates of Staphylococcus aureus which were sent to the Maulana Azad Medical College, New Delhi, for phage typing, only 49 were typable (59%) while the rest of the 41% were non typable. These phage typing values are similar to those which were found in the study by Agarwal et al [16], who reported 58.5 percent typable and 41.5% untypable strains. The predominant phage group in

S.No	Organism	Authors (Previous studies)					Present study	Kownhar et al (2008)
		Agarwal et al (1972)	Edwards et al (1976)	Udgaonkar et al (1986)	NNIS 1986–89	NNIS [2] 1990–96		
1	Staphylococcus aureus	38%	30.3%	28.13%	17%	20%	32.2%	37%
2	Staphylococcus epidermidis	07%	21.5%	22.16%	12%	14%	1.4.8%	–
3	Enterococcus spp.	–	22.6%	0.6%	03%	03%	1.9%	1.6%
4	Group A Beta Hemolytic streptococcus	06%	–	1.01%	13%	12%	1.9%	–
5	Pseudomonas aeruginosa	13%	13.8%	13.36%	08%	08%	12.8%	37%
6	Escherichia coli	17%	27.8%	21.25%	10%	08%	8.9%	4.8%
7	Klebsiella pneumonia	–	11.75%	14.17%	03%	03%	4.7%	8.0%
8	Proteus vulgaris	15%	–	16.59%	–	–	2.7%	4.8%
9	Proteus mirabilis	–	9.2%	–	04%	03%	1.6%	–
10	Citrobacter freundii	–	–	1.16%	–	–	2.3%	1.6%
11	Enterobacter aerogenes	–	4.9%	–	08%	07%	1.2%	–
12	Acinetobacter spp.	–	–	–	–	–	5.8%	3.2%

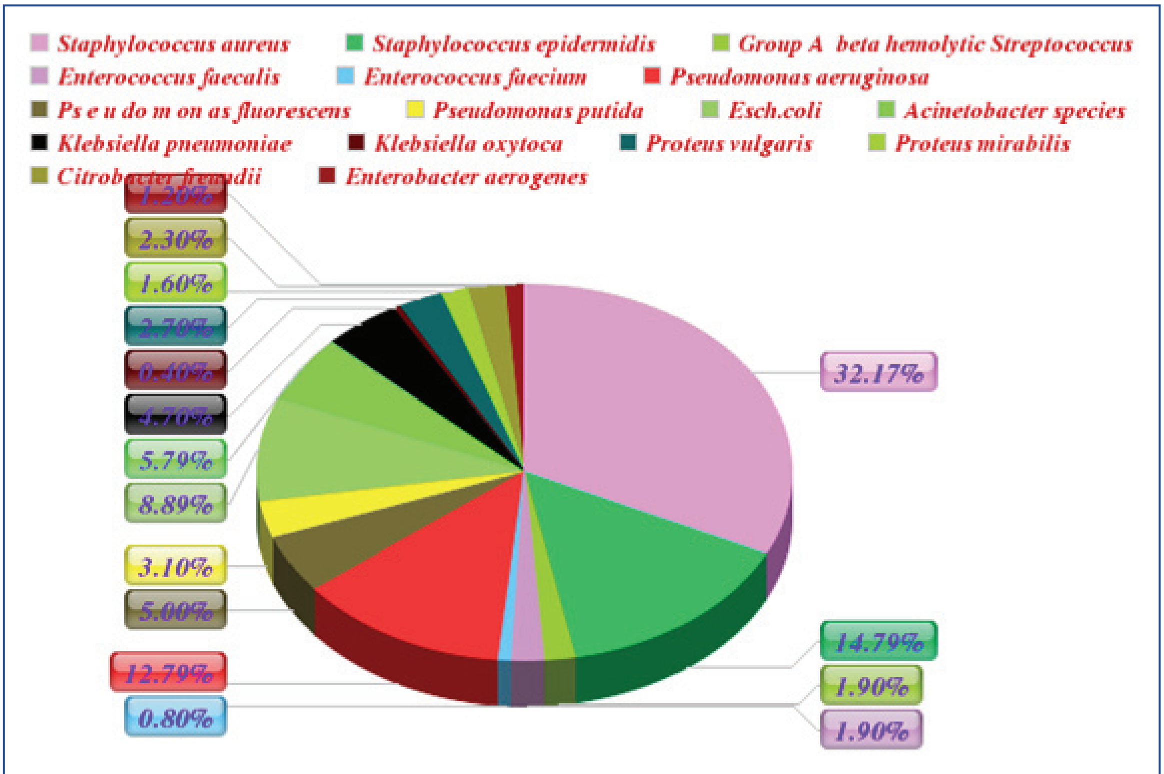
[Table/Fig-4]: Distribution of bacteria isolated from study on SSI in various studies as compared to our study our study was group 3 (57%), as in Agarwals's study. Among the 8 (10%) MRSA isolates, five were non typable, while two isolates belonged to group III and one isolate to group IV respectively.

It is an undisputed fact that the infection may originate from the patient's normal flora or that it may be derived from the hospital environment. Multidrug resistant S.aureus is commonly associated with the hospital environment. In the present study, 32.2% of the postoperative wound infections were due to this organism and this indicates that the possible source of infection in these cases may be from the hospital environment. This fact needs to be kept in mind by the surgeons. Also, is well known that surgical site infections are also associated with significant increases in the length of hospital stay, additional costs, morbidity and mortality [23-25]. The widespread availability and the use of antimicrobial agents for prophylaxis seem to have altered the surgical practice in the past twenty years.

Since MRSA strains are highly resistant to many groups of antibiotics, there is an increased rate of morbidity and mortality in the ICU facilities, as well as in immuno-compromised individuals [18]. Staphylococcal resistance to oxacillin/methicillin occurs when an isolate carries an altered Penicillin-binding protein, PBP2a, which is encoded for by the mecA gene [22], [28]. This penicillin-binding protein binds beta-lactams with lower avidity, which results in resistance to this class of antimicrobial agents [21], [22], [23]. Recently, Harbarth et al. (2008) have observed that methicillin-resistant S. aureus (MRSA) alone constituted 5.1% of the surgical site infections [24].

Further, it has been established by Classen et al (1992) that prophylactic antimicrobials are often not administered at the optimal times, to ensure their best presence in effective concentrations peri-operatively [25].This point influences most surgical outcomes [27], [28], [29]. It is highly desirablethat prophylactic antibiotics should be administered within one hour before the operation and that they should be continued for only 24-72 hours post operatively, as a policy to avoid multidrug resistance. Inappropriate dosage and the duration of antibiotic use not only fail to reduce the infection, but also lead to an increase in multidrug resistant mutants due to selection pressures. [28, 29] Hence, the prevention of SSIs is essential and this poses a major challenge in any healthcare system. [28] Infection control measures such as the active surveillance of SSIs, the implementation of a checklist, compliance observations and instruction/training of healthcare workers, as well as Staphylococcus aureus /MRSA screening, clipping instead of shaving, adherence to perioperative antibiotic prophylaxis, maintaining intraoperative normothermia and blood glucose control are essential in order to prevent SSIs. [29-31] The prevention of nosocomial infections is not only highly desirable for patients, but it is now seen as a major political priority in all the hospitals, irrespective of whether they are private or public .Guidelines and protocols for basic infection control practices such as hand washing and written protocols for the safe insertion and maintenance of devices such as intravascular catheters, should be widely available and adhered to. [31], [32], [33], [34]

Further, we feel that the high incidence of MRSA could be reduced by screening for these organisms routinely in all the hospital staff and that the nation's celebrated health care facilities should lead to the change here. Relevant policy and protocol changes could usher in a culture of cleanliness and abundant caution in the operation theatres. The Municipal Corporation of the Indian cities can pitch in implementing and monitoring operation theatre protocols [31]. A pre-surgical screening of the patients and treating those who carry these bugs would definitely help in reducing infections, the duration of hospital stay and the economic burdens which are associated with these. [33, 36]It is high time for the Indian hospital managements to ensure a regular, close clinical liaison between the surgical team, the microbiologist, and the infection control team to provide proper quality surgical services. [33-38] Regular periodic studies could be established by the Indian medical colleges to control and conquer the resistant organisms in surgical site infections. The national governments should formulate national standard operating procedures and



[Table/Fig-5]: [Table/Fig-5] : Aerobic Bacteria Isolated from infected postoperative wounds infection control standards to face the challenges which are posed by antibiotic resistant organisms [36],[37].

As Dr. Vincent Cheng explains, the anti-MRSA success of Hong Kong [37] is a consequence of several factors – an aggressive approach, single room isolation, and contact screening. For various reasons, almost every cluster of cases was reported in the press. Nonetheless, in the UK at least, stories of "dirty hospitals" are evocative, with public acceptance, leading to a cycle of reinforcement that eventually transforms the history of MRSA control in the country. [37] Since 2003, Hong Kong has leaped a big step forward and there is no reason why we can't emulate Hong Kong. Indian governments should act more proactive and emulate anti-community acquired MRSA measures as aggressively as United Kingdom and Hong Kong and make it notifiable.The judicious use of antibiotic prophylaxis and the use of an organized system of wound surveillance and reporting can help in reducing the wound infection rate to an attainable minimum [37].

It is clear that the two papers in Lancet (August 2010 and April 2011) have at last shaken the Indian government [38], which has initially been in denial, out of its slumber and inaction. The Indian Council of Medical Research has invited research proposals from scientists to generate scientific evidence on antimicrobial resistance. This move indicates that the apex medical research body has finally realised there is no place for jingoism in matters of science, and that the latest findings on antibiotic resistance must be taken seriously and verified scientifically. [38] This exercise will prove to be useful only if the researchers are truly free to report the presence of the superbugs and the extent of their spread. The second important development has been the drafting of the much-needed national policy for the containment of antimicrobial resistance. The policy admits that the use of antibiotics is inappropriate in 20 per cent to 50 per cent of the cases. It targets the indiscriminate use of antibiotics in food animals and intends to curb the practice, since it ultimately causes drug resistance in humans. Most importantly, the access to third generation antibiotics like carbapenems is to be restricted to Indian tertiary hospitals [38]. But even in these hospitals, efforts must be directed towards restricting their use to patients with severe infections. The Indian government should waste no time in creating a national surveillance system for measuring antibiotic resistance if it is serious about getting on top of the problem. [38] By all parameters, our war against antibiotic-resistant bacteria is far from winning. The question is – are we serious? Will the Indian government do its role and save the hospitals and its public?

CONCLUSIONS

Our most common surgical site infection isolate was Staphylococcus aureus (32.2%). Methicillin resistant Staphylococcus aureus (MRSA) constituted 9.6% of the total SSI isolates. Due to the increased morbidity and mortality which are associated with these drug resistant organisms, an early detection and intervention is a prerequisite in surgical patients. Although surgical wound infections cannot be completely eliminated, a reduction in the infection rate to a minimal level could have significant benefits, by reducing postoperative morbidity and mortality, and the wastage of health care resources. Antimicrobial therapy should be designed to deliver an adequate drug concentration to the site of infection. The governments should take proactive steps in setting up national hospital antibiotic policy guidelines and in instituting a culture of simple anti-MRSA measures like hand washing among the health care personnel. Hospitals should screen for MRSA among their staff and treat the hospital staff who are affected by the bacteria.

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AUTHOR(S):
1. Dr. Gayathree Naik
2. Dr. Srinivas R Deshpande

NAME OF DEPARTMENT(S)/INSTITUTION(S) TO WHICH THE WORK IS ATTRIBUTED:
Department of Biochemistry,
Malabar Medical College, Modakallur, Atholi,
Calicut Dist, Kerala - 670001, India.

NAME, ADDRESS, TELEPHONE, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Srinivas R Deshpande
Professor and HOD Biochemistry,
Malabar Medical College, Modakallur, Atholi,
Calicut Dist, Kerala- 670001
E mail:sriradesh1971@yahoo.com.
Ph:+91-9480158750

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