Research Article

Surveillance of Antibiotic Sensitivity and Resistance Pattern of Bacteria Isolated from Orthopaedic Wound Discharge

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ABSTRACT

Infections are inevitable in different orthopaedic procedures. In spite of all aseptic precautions, significant postoperative morbidity, mortality, prolonged hospital stay and increased hospital costs are observed. These infections are usually caused by the exogenous or endogenous microorganisms that enter the wound site. Here, we found out the common organisms in orthopaedic wound infections and also performed the antibiotic sensitivity study. This was a prospective study carried out on 2510 patients who were admitted to the orthopedics wards during the last 4 years. The wound swab and pus discharge from orthopaedic patients were sent to Microbiology department and with standard procedure the organisms were identified. Then the antibiotic sensitivity patterns were carried out and basing upon the sensitivity pattern, antibiotics were prescribed. *Staphylococcus aureus* (675) was the most commonly isolated organism in this study. Apart from this, *Pseudomonas aeruginosa* (285), *Klebsiella* Sp. (270), *Acinetobacter* Sp. (220), *Citrobacter* (125), *Proteus* Sp. (85), *E. coli* (45) and budding yeast cells (35) were isolated. In antibiotic sensitivity pattern, it was found that *S. aeureus* is more sensitive to Tigecycline. Antibiotics should be properly selected and its timing of administration is also crucial. So keeping in mind all these parameters, possible chances of development of surgical site infections and subsequent antibiotic resistance can be reduced to great extent, if not completely eliminated.

Keywords: Infection, orthopaedic surgery, surgical site infection.

INTRODUCTION

Surgical site infections (SSI) are one of the most disastrous and commonest complications of surgery and causes significant postoperative morbidity, mortality, prolongs hospital stay, and increase hospital costs also. These infections concern 2 million cases annually worldwide.[1] WHO described Hospital acquired infections as one of the major infectious diseases having huge economic impact.[2] Nosocomial infections are significant problem throughout the world and range from 1% in Europe and America to more than 40% in parts of Asia, Latin America and sub Saharan Africa.[3]

A wide variety of aerobic and anaerobic species of bacteria may be present, either singly or in combination. The lowest infection rate (less than 2%) followed clean operations, such as elective orthopedic procedures, in which the possible sources of contamination were solely airborne or exogenous.

The scenario of SSI is different in orthopaedic surgeries as compared to other surgeries in terms of use of implants, duration of surgery etc. which are important risk factors that accounts to higher infection rate in these surgeries.

This study was undertaken to estimate the common microorganisms found in orthopaedic wards and sensitivity pattern of those organisms.

The microbiology of wound infections in all surgical services has changed very little over the years.[4-13] *Staphylococcus aureus* is the single most commonly encountered organism. Others include aerobic gram negative organisms such as *Escherichia Coli, Pseudomonas* species, *Proteus* species and *Enterococcus*. The relative rates of each vary from one hospital study to another.[4-7,9,14,15]

In Nigeria, Mbamali observed that 60% of his patients who had implant infection were infected by *Staphylococcus aureus.* Other organisms in that study were *Pseudomonas pyocyanea* and *Klebsiella* species. Onche[4] in Lagos cultured *Staphylococcus aureus* in 72% of cases of wound infections in implants while *Escherichia coli* and *Klebsiella* species accounted for 14% each. In Jos, North Central Nigeria, the picture was slightly different where Oguachuba[16] found that in 41.9% of his wounds, *Proteus* species were cultured while *Staphylococcus aureus* was 25.6%. Coliforms (13.9%), *Streptococcus* Sp., *Pseudomonas* sp. and *Klebsiella* were the other isolates.[16] In this particular study all wound infections were considered and not specifically in implant infections. Classen[7] at Salt Lake City in USA reported that of the 43 bacterial isolates from clean surgical wounds including Orthopaedics, *Staphylococcus aureus* was isolated in seven cases (16.3%); gram negative rods in six(14%); *Enterobactercloaca* in five(11.6%); *Enterococcus* in

five(11.6%) and *Klebsiella pneumonia* in two (4.6%). They also found that the anaerobe, *Bacteroides fragilis* accounted for 14% of the infections. Sanderson in Middlesex, England, found *Staphylococcus aureus* being responsible for 35% of post-operative wound infections in hip implants, *staphylococcus epidermidis* 15%, Coliforms 25% while anaerobes and unnamed others accounted for 25%.

The purpose of this report was therefore to elucidate the pattern of bacteriological isolates, which are responsible for post-operative wound infections to identify their antimicrobial sensitivity pattern in our environment.

MATERIALS AND METHODS

In this prospective study of 4 years, all the patients admitted to the orthopaedic wards of the hospital were recruited. Patients with diabetes mellitus, obesity, carcinoma and patients on drugs such as steroids or cytotoxics were excluded. Wound swab was taken from the compound fractures and post operative pus discharge. Wounds were examined for infection on the day of admission to the orthopaedic wards, at discharge and subsequent follow-up visits at the outpatient clinic. Any patient who developed wound infection had his/her culture and sensitivity done.

The documentation of isolated organisms was based on the results of culture and sensitivity. Aerobic culture was carried out using Nutrient, blood and chocolate agar on each infected wound specimen. The antibiotic sensitivity patterns were carried out with Mueller-Hinton agar. This was done at Department of microbiology, IMS & SUM Hospital. All the isolated bacteria and antibiotic sensitivity pattern were document in both register and computer. These data were statistically analysed with SPSS 20 software.

RESULT

Table 1: Number of bacteria isolated from Orthopaedic wound discharge.

S.No.	Name of Bacteria	Number	Percentage
1	S. aureus	675	26.89
2	P. aeruginosa	285	11.35
3	Klebsiella Sp.	270	10.76
4	Acinetobacter Sp.	220	8.76
5	Citrobacter Sp.	125	4.98
6	Enterococci Sp.	100	3.98
7	Proteus Sp.	85	3.39
8	E. Coli	45	1.79
9	BYC	35	1.39
10	No growth	645	25.70
11	Contamination	25	1.00
	Total	2510	100.00

In this prospective study, a total of 2510 orthopaedic wound samples were collected for culture and antibiotic sensitivity study. Among them, 645 samples did not show any growth in culture medium. Apart from this 25 samples were found to be contaminated. These samples were excluded from this study. This study revealed 1805 bacteria from the 2510 wound discharge samples. *Staphylococcus aureus* (26.89%) was the most commonly isolated organism in this study followed by *Pseudomonas aeruginosa* (11.35%), *Klebsiella* Sp. (10.76%), *Acinetobacter* Sp. (8.76%), *Citrobacter* Sp. (4.98%), *Proteus* Sp. (3.39%) and *E. coli* (1.79%). Apart from this, budding yeast cells (1.39%) were isolated (Table 1).

Based upon the standard guidelines it was observed that antibiotics are being prescribed empirically without knowing their resistance pattern. Such prescriptions can lead to an increase in the antibiotic resistance. Hence, commonly administered antibiotics were screened for their efficacy. In case of *S.aureus*, it was highly resistant to ceftriaxone (68.75%), where as it was least resistant to amoxyclav (3.93%). Though Piperacillin/tazobactam was preferred as the first line drug of choice for *P. aeruginosa,* but it was revealed in this study that the resistance pattern of this drug has increased to 41.46% because of indiscriminant use (Table 2).

After studying the resistance pattern of the commonly prescribed antibiotics it was deduced that many antibiotics were being administered even though their resistance pattern had increased. So antibiotics having good sensitivity pattern (selected 5 antibiotics) should be selected for initial use. The most sensitive antibiotics were Amikacin, Tigecycline, Amoxyclav, netilmycin and vancomycin (Fig 1).

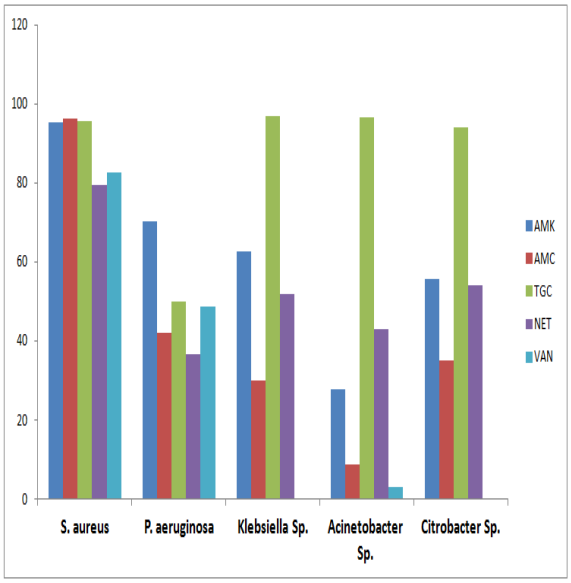

Figure 1: Sensitivity of antibiotics towards common organism isolated from the wound infections of orthopaedic department.

Table 2: Antibiotic resistance pattern of isolated bacteria from Orthopaedic wound discharge.

Bacteria	AMK	AMC	CEF	NOR	PIT	LNZ	OFL	CTR	CFM	VAN	NET	IC	CFS	TGC	CXM	IMP	CIP	MRP	CFP
Acinetobacter Sp.	72.41	91.42	85	83.33	75.75	97	63.04	68	88	97	57	78.94	86.66	3.57	97	62.5	66.66	63.63	96
E. Coli	11.62	71.42	87.09	90.9	32.6	NA	44.04	28.88	82.35	97	16.66	88.09	96	2	91	20	92	NA	NA
Citrobacter Sp.	44.44	65.21	71.42	61.53	52.63	NA	54.76	36	70	NA	46.15	71.28	87.4	5.88	89	16.66	66.66	79.23	NA
S. aureus	4.78	3.93	68.75	NA	35.44	13.26	12.16	24.59	27.77	17.5	20.51	98	20	4.32	34.09	6.33	47.72	59.26	50
Enterococci Sp.	25	52.38	49.22	41.22	49.22	NA	35.71	66.66	66.66	42.85	5	66.66	98	2.56	NA	7.22	20.16	NA	NA
Klebsiella Sp.	**37.5**	70.21	63.33	63.33	53.33	NA	51.8	64.21	85.71	NA	48.22	65	92	3.18	97	17.07	75.22	94.32	NA
Pseudomonas aeruginosa	29.78	58.06	97	97	41.46	97	49.35	56.33	87.5	51.36	63.34	33.33	65	50	93	23.33	51.60	66.66	91.33
Proteus Sp.	46.15	71.42	62.5	66.66	9.09	NA	58.82	49.18	97	NA	83.33	28.57	19	12.5	NA	30	81.33	96.33	NA

DISCUSSION

Wound infections not only pose a problem to the surgeon but to all those who have a stake in the care of orthopaedic and trauma patients. It is associated with increased morbidity, cost of health care and at times can be catastrophic.[2] The microbiology of post-operative wound infection in implants has changed very little over time except[2-13] for the emergence of resistant organisms. *Staphylococcus aureus* was the most commonly isolated micro-organism in this study accounting for 26.89%. It was similarly most common in various other reports worldwide. The relative rates however vary from centre to centre. At the National Orthopaedic Hospital Lagos, Onche[4] found it accounted for 71.4% of his isolates while in Zaria, North Central Nigeria, Mbamali[6] isolated *staphylococcus aureus* in 60% of patients while Classenl[7] in USA noted that it occurred in 16.3% of their cases. The picture was however different at Jos where Oguachuba[16] found *Proteus sp* to be the most common isolate with a rate of 41.9% followed by *Staphylococcus aureus* with 25.6%. What is pertinent here is that at the Jos centre, the wound was unclassified. Other important isolates in this study were *E. coli* and *Proteus species*.

Amikacin followed by tigecycline were found to be most effective against *Staphylococcus aureus*. Traditionally potent cephalosporins were highly resisted by it. This is because of the emergence of highly resistant strains of *Staphylococcus aureus* in hospital settings. Antibiotics are still sold across the counter in pharmaceutical stores and by patent medicine vendors.

The gram-negative aerobic rods like *E.Coli, Pseudomonas, Proteus* and *Klebsiella* were found to be sensitive to Amikacin while essentially resistant to the cephalosporins tested.

This study has highlighted three issues in the microbiology of orthopaedic wound infections. Firstly, *Staphylococcus aureus* remains the most important microorganism responsible for post-operative wound infection in implants and prostheses.

Secondly, resistant strains of organisms have emerged and previously reserved drugs have become first line in treatment of these infections. Thirdly, anaerobic organisms remain important isolates where such cultures are feasible. Finally, remote site infections should be eradicated before undertaking implant or prosthetic operations.

CONCLUSION

The results obtained from this study have far reaching consequence with respect to health care delivery and socioeconomic status of individual. No doubt, antibiotics have been used empirically at the out set of the management of a patient having a wound either following trauma or coming with infection, without any culture and sensitivity. This study, moreover throws light on nearly sensitive antibiotic administration at the beginning of such management.

This would be most appropriate in reducing morbidity, mortality, prolonged hospital stay and increased health care costs.

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