

Orthopaedic Infections: Organisms and Antibiotic Sensitivity

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Summary

Staphylococcus aureus infection remains the commonest organism causing musculoskeletal infection and antibiotic is the mainstay of treatment apart from adequate and appropriate surgical intervention. The exact figure of antibiotic resistance in orthopaedic practice is not known but it is expected to be higher than previously reported, as the use of antibiotics is rampant. Its sensitivity to various antibiotics differs from one center to another making local surveillance necessary. From 66 patients with musculoskeletal infections studied in our centre, *Staphylococcus aureus* was cultured in 50-65% of patients, depending on the sample taken. Fifteen percent of this were methicillin resistant *Staphylococcus aureus* (MRSA). *Staphylococcus aureus* was found to be sensitive to cloxacillin in 95% of patients' sample. MRSA remained highly sensitive to vancomycin, clindamycin and fucidic acid.

Key Words: Orthopaedic infection, *Staphylococcus aureus*, Antibiotic sensitivity

Introduction

Orthopaedic infection is common in our hospitals and many of them are complicated infections. Antibiotics play a crucial role in the treatment of these orthopaedic infections, apart from adequate and appropriate surgical intervention. Infection caused by *Staphylococcus aureus* is commonly encountered and methicillin resistance *Staphylococcus aureus* (MRSA) causes a substantial portion of the prevalence¹.

The pattern of antibiotic resistance differs from one hospital to another. The use of new generation antibiotics in one hospital based on studies done elsewhere is not recommended as drug sensitivity and resistance vary. Improper antibiotic use may lead to emergence of multi drug-resistant organisms.

The objective of this study is to identify organisms that are responsible for common musculoskeletal infection and their antibiotic sensitivity in Hospital Universiti Sains Malaysia (HUSM).

Materials and Methods

All the patients who were admitted in the orthopaedic wards in HUSM from January 2001 to December 2002 (2-year duration) were reviewed. They were admitted for various orthopaedic infections including chronic osteomyelitis, pin tract infection, infected implants, traumatic and surgical wound infection.

Specimens were taken from the infected sites using a standard technique. For chronic osteomyelitic patients and those who required a surgical procedures, like surgical debridement or abscess drainage (I&D), deep specimens were taken from the infected sites, during the surgical procedures in the operation theatre. The sampling were done by the doctors who performed the procedures. Those who did not require surgical procedures, specimens were taken in the ward from the infected wound before wound dressing. The sampling were performed by the doctors or the nursing staffs under the doctor's supervision.

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Organisms causing the infection and their sensitivity pattern were identified based on their culture and sensitivity results obtained from their microbiology reports. Specimens taken were either pus, soft tissue or bone, depending on the nature of infection.

Results

A total of 66 patients were studied. There were 38 cases of chronic osteomyelitis, 8 cases of infected implant, 12 cases of pin tract infection, 8 infected surgical or traumatic wounds.

i. Gram positive organism

From the pus specimen, *Staphylococcus aureus* was the commonest gram positive organism cultured (50% of all organisms cultured from the specimens). Of these, 35% were methicillin sensitive *Staphylococcus aureus* and 15% were methicillin resistant *Staphylococcus aureus* (MRSA), followed by *Enterococcus sp* (11%) and β -Hemolytic *Streptococcus* (7%).

From the bone and sequestrum specimens, the commonest organism cultured was *Staphylococcus aureus* (65% of all organisms cultured from the specimens). Of these 50% were methicillin sensitive

Staphylococcus aureus and 15% were MRSA, followed by β -Hemolytic *Streptococcus* (5%).

ii. Gram negative organism

From the pus specimen, *Pseudomonas aeruginosa* was the commonest gram negative organism cultured (11% of all organisms cultured from the specimens). From bone and sequestrum specimens, the commonest organism cultured was *Enterobacter sp.* (10%). *Pseudomonas aeruginosa* was isolated in 5% of the specimens.

iii. Mixed organism growth

The specimens with more than one organism cultured formed about 10% of isolates from pus, bone and sequestrum.

iv. Sensitivity pattern

Most of the commonly used antibiotics were effective against *Staphylococcus aureus*, except penicillin G. *Staphylococcus aureus* was 95% sensitive to cloxacillin and 100% sensitive to clindamycin, rifampicin and vancomycin. MRSA was resistant to most of the antibiotics tested. Vancomycin, clindamycin and chloramphenicol are 100% sensitive against MRSA. *Pseudomonas aeruginosa* was resistant to cefotaxime (100%) and some were resistant to ceftazidime (11%).

Table I: The percentage of organisms cultured from the different specimens

Organisms cultured	Percentage of organisms cultured	
	Specimens	
	Pus (%)	Bone/sequestrum (%)
MRSA	15	15
<i>S. aureus</i>	35	50
<i>B-Streptococcus</i>	7	5
<i>Enterococcus sp</i>	11	10
<i>Proteus sp</i>	2	0
<i>P.aeruginosa</i>	11	5
<i>Acinobacter sp</i>	2	5
<i>E.coli</i>	4	0
<i>Klebsiella sp</i>	2	0
Mixed growth	11	10
Total	100	100

Table II: The prevalence of resistance againsts *S. aureus* and MRSA

Antibiotics	Prevalence of Resistance	
	<i>S.aureus</i>	MRSA
	Resistance (%)	Resistance (%)
Amikacin	0	100
Bactrim	8	92
Cefuroxime	4	100
Chloramphenicol	0	0
Clindamycin	0	0
Cloxacillin	4	100
Erythromycin	4	100
Fucidic acid	4	8
Gentamicin	8	100
Penicillin G	78	100
Rifampicin	0	50
Vancomycin	0	0

Discussion

Staphylococcus aureus remains the leading cause of infection in our community. Musculoskeletal infection caused by this organism is also predominant. Methicillin resistant *Staphylococcus aureus* (MRSA) infection is of concern to both the orthopaedic surgeons and the microbiologists.

The present study shows that methicillin sensitive *Staphylococcus aureus* (35-50%) and MRSA (15%) formed 50-65% of orthopaedic infection. *Staphylococcus aureus* was isolated 15% more from the deep tissue (bone and sequestrum). This may suggest that culture from pus does not reveal the true pathogen as it can be contaminated by other skin commensals. About 25% of chronic osteomyelitis is possibly caused by organisms other than *Staphylococcus aureus*, namely *Enterobacter sp.*, *Pseudomonas aeruginosa* and *Acinobacter sp.* based on bone and sequestrum culture. *Staphylococcus aureus* was also found to be the commonest bacterial isolates from surgical wounds¹.

Most of the commonly used antibiotics are still effective against *Staphylococcus aureus*, except penicillin. *Staphylococcus aureus* is still sensitive to cloxacillin (95%) and 100% sensitive to amikacin, chloramphenicol, ciprofloxacin, clindamycin, rifampicin and vancomycin. Therefore cloxacillin is still the drug of choice for *Staphylococcus aureus* infection, especially for soft tissue infections.

Compared to another local study in 1986,² *Staphylococcus aureus* had developed rapid resistance to methicillin and other antibiotics. Resistance to cephalixin (64%), tetracyclin (46%), erythromycin (18%) with small number of resistance to methicillin (about 5%) were reported. Penicillin was no longer antibiotic of choice because of its high level of resistance to penicillin (72%). Based on the present study, the prevalence of methicillin resistant *Staphylococcus aureus* has tripled (15%) with an increased resistance rate of approximately 0.5 -1% per year.

It was observed that the sensitivity pattern of *Staphylococcus aureus* changes dramatically when it became resistant to methicillin. MRSA became 100% resistant to many other antibiotics tested including gentamycin, erythromycin and cefuroxime and some resistance to rifampicin and fucidic acid. vancomycin and clindamycin are the only 2 antibiotics that maintain 100% efficacy against MRSA. Cheong et. al. reported that 35.4% isolates of *Staphylococcus aureus* were found to be methicillin-resistant with high prevalence of MRSA in orthopaedic wards. There was no resistance towards vancomycin with most isolates were resistant to aminoglycosides³. Therefore these 2 studies suggested that vancomycin is still drug of choice for MRSA. Based on this observation, ceftazidime is currently the best antibiotic for *Pseudomonas aeruginosa* as sensitivity to ceftazidime is in nearly 90% of patients.

Resistance to the commonly used antibiotics like ampicillin, cloxacillin, cephalosporins, gentamicin, cotrimoxazole and tetracycline was high with differences in resistance rate in different hospitals⁴. MRSA isolated from different wards or hospital could also be of different PFGE types. As reported, strains with the same antibiotype could be of different PFGE types and antibiograms alone may not be useful in determining the spread of MRSA in a hospital⁵.

Both modern surgical technique and proper antibiotic usage have been shown to be effective in controlling difficult orthopaedic infections⁶. Failure of treatment is multifactorial. Drug resistance, inadequate treatment dose or duration, inadequate surgical debridement are important factors of treatment failure. However, the recognition of organisms causing the infection is crucial. The recognition can be difficult as isolates from the sample may not be the causative organism. Approximately, 50-70% of our population are possible *Staphylococcus aureus* carriers². Faisham et. al had reported that none of their patients with open fractures developed infection with similar organisms sampled before surgical debridement⁷. Therefore, proper sampling is another important factor for successful treatment.

Conclusion

Staphylococcus aureus is still the most common organism causing musculoskeletal infections. Prevalence of MRSA has been increased from the past, even though less than half of these were methicillin-resistant. Increased prevalence of MRSA in musculoskeletal infection is associated with increased antibiotic resistance. *Pseudomonas aeruginosa* and other Gram negative organisms are other important pathogens causing orthopaedic morbidity.

Antibiotic preference should be individualized depending on local sensitivity and resistance pattern. Effective treatment and control of emergence of new antimicrobial resistance require continuous surveillance of antimicrobial sensitivity and resistance pattern.

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