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Acute Hematogenous Osteomyelitis in Children in The Era of Community Associated-Methicillin Resistant *Staphylococcus aureus* A Retrospective Review

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Abstract

Background: *Staphylococcus aureus (S. aureus)* is the predominant organism isolated from children with acute hematogenous osteomyelitis (AHOM). Increasingly, there have been reports of children with AHOM due to CA-MRSA. As the changing microbiologic pattern of AHOM impacts empiric therapy, long-term treatment and outcome, there is a need to identify those patients with AHOM who are at risk for infection with CA-MRSA.

Methods: Cases of pediatric (2 month to 18 years) AHOM treated at our institution from January of 2003 through December 2012 (A 10-year period) were retrospectively reviewed. Collected data included the demographics, symptoms and signs at presentation, laboratory values, and microbiology results. We compared the clinical and microbiology data for AHOM caused by MRSA to those caused by non-MRSA.

Results: AHOM (n=49; ages 3m-17y, median 6y; 23 female) was caused by MSSA (n=22; 44%), MRSA (n=7; 16%), or Group A streptococci (n=2). No pathogen was isolated in 13 patients (26%), all of whom were treated successfully with antimicrobial agents not active against MRSA. The incidence of MRSA has increased from 11% in the first half of the study duration (2003 through 2007) to 19% in the second half (2008 through 2012). The most common affected bones were femur (28%) and tibia (14%). In comparison to patients with non-MRSA, patients with MRSA infection had a higher rate of bacteremia (100% for MRSA vs. 28% for non-MRSA, P = 0.0001) and more inflammation at presentation evidenced by higher CRP, neutrophilia, and mean temperature (p = 0.01, 0.003, and 0.003; respectively). Personal or family history of skin/soft tissue infection, symptoms and signs at presentation, recent hospitalization or antibiotic use, and co-morbidities were not significantly different between MRSA- and non-MRSA infected patients. Clindamycin resistance occurred in none of the MRSA and 5 (23%) of MSSA isolates.

Conclusion: MSSA remains the most common organism causing AHOM in children at our institution, where an anti-staphylococcal b-lactam antibiotic remains appropriate empiric therapy. AHOM caused by MRSA is associated with a higher rate of bacteremia; higher fever and CRP value.

Introduction

- *Staphylococcus aureus*, principally MSSA, causes the vast majority of cases of Acute Hematogenous Osteomyelitis (AHOM) in children
- Recently, CA-MRSA has emerged as a significant pathogen causing AHOM in children
- CA-MRSA has been associated with more severe clinical presentation and worse outcome
- The changing microbiologic pattern of AHOM impacts empiric therapy, long-term treatment and outcome
- The aim of this study is to look at the microbiology of AHOM at our institution, and to identify those patients with AHOM who are at risk for infection with CA-MRSA

Methods

Retrospective Review

- All cases of AHOM between 2003-2012
- Ages 2 months-18 years
- ICD-9 codes
- Intra-departmental records of the Center for Pediatric Infectious Diseases

Exclusion Criteria

- Neonates less than 2 months of age
- Patients with chronic osteomyelitis
- Patients with previous surgery at the involved site of infection

Data Collected

- Demographics
- Signs and symptoms at presentation
- Laboratory values (CBC, ESR, CRP, Neutrophil percentages, liver function studies)
- Microbiology data

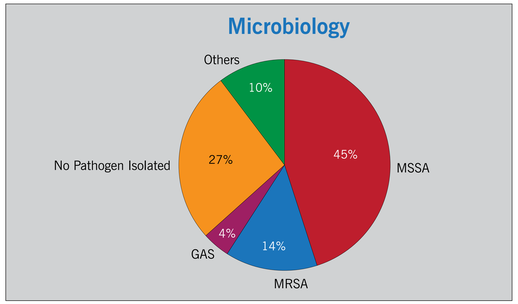
Statistics

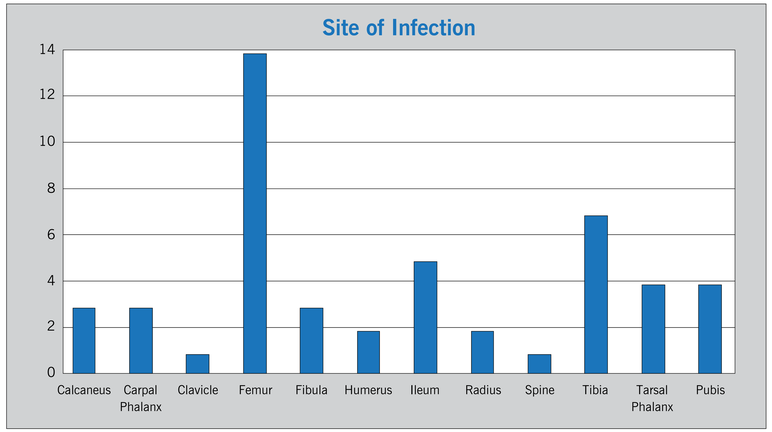
- Subjects' demographic and clinical characteristics, laboratory and microbiology results
  - Description via means and standard deviations, medians and ranges, or counts and percentages as appropriate
- Comparison of the clinical and microbiology data for AHOM caused by MRSA to those caused by MSSA and non-MRSA infections
  - Fisher's exact test
  - Wilcoxon rank sum test

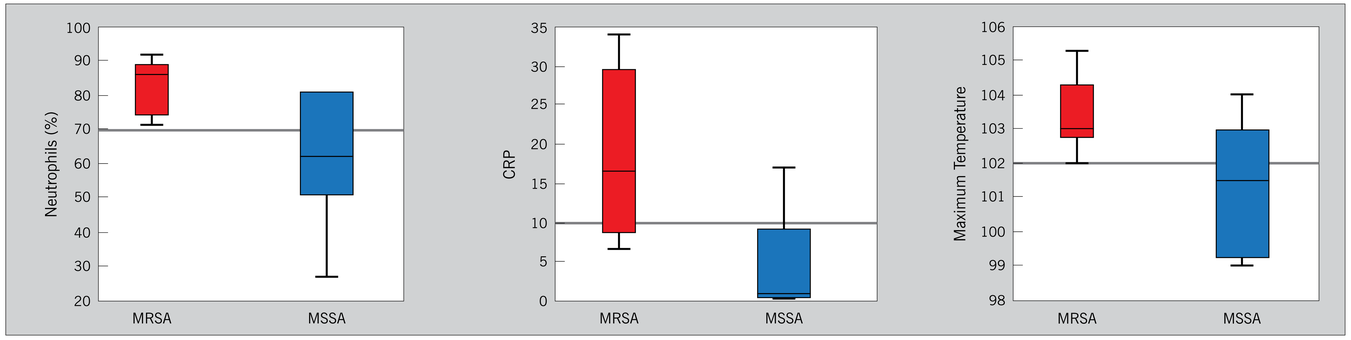
Results

- AHOM (n=49; ages 3m-17y, median 6y; 23 female)
  - MSSA (n=22; 45%)
  - MRSA (n=7; 14%)
  - Group A *streptococci* (n=2)
- No pathogen was isolated in 13 patients (27%), all of whom were treated successfully with antimicrobial agents not active against MRSA
- Comparable results were observed between MRSA- and MSSA-infected patients
- Personal history of skin/soft tissue infection or MRSA infection was detected more in patients with AHOM due to MRSA (29% vs. 2% for non-MRSA, *p=0.02*)
- Family history of skin/soft tissue infection, symptoms and signs at presentation, recent hospitalization or antibiotic use, and co-morbidities were not significantly different between MRSA- and Non-MRSA-infected patients
- Clindamycin resistance was observed in none of the MRSA and 17% of MSSA isolates

	Non-MRSA (N=42)	MRSA (N=7)	*P*-value
Bacteremia N (%)	11 (26%)	7 (100%)	<0.001
CRP median (range)	3.5 (0.1-30)	13 (2.3-34)	0.01
Neutrophil % median (range)	62% (17-96%)	86% (72-92%)	0.002
Max Temperature median (range)	101 (99-104)	103 (102-105)	0.003







Discussion

- Few studies have compared the clinical presentation and risk factors of MRSA vs MSSA acute haematogenous osteomyelitis
- In one retrospective review of 129 children presenting with culture-proven Staphylococcus aureus osteomyelitis, patients with MRSA osteomyelitis (n = 11) differed significantly from those with MSSA osteomyelitis (n = 118) with regard to non-weight bearing status, body temperature, hematocrit value, heart rate, white blood-cell count, platelet count, C-reactive protein level, and erythrocyte sedimentation rate[1]
- MRSA appears to be associated with more severe clinical presentation and long term complications; therefore, prompt start of appropriate antimicrobial therapy is crucial[2,3]
- Identifying patients who are at risk for having MRSA osteomyelitis is very important in order to initiate appropriate antimicrobial therapy
- In our study, there was no statistical significance when comparing MRSA and Non-MRSA in term of clinical presentation or radiological findings.
- Thus, it is difficult to differentiate between MRSA and Non-MRSA or MSSA osteomyelitis based on physical exam or radiological findings alone
- Patients with AHOM caused by MRSA were more likely to have higher temperatures and higher C-RP and neutrophil percentages at presentation
- Patients with MRSA were more likely to be bacteremic compared to Non-MRSA osteomyelitis
- 17% of MSSA isolates were resistant to clindamycin. This observation may limit the empiric use of clindamycin for AHOM at our institution

Conclusion

- MSSA is the most common cause of AHOM in children at our institution. MRSA was responsible for 14% of the cases.
- Beta lactams, directed mainly against MSSA, remain the most appropriate empiric therapy at our institution
- Higher C-RP, marked left shift, high grade fevers and bacteremia are factors to consider when choosing empiric antimicrobial coverage for MRSA in children with AHOM

References

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