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FEATURED ARTICLE

Revision of a Treatment Algorithm for Community-Associated Methicillin-Resistant *Staphylococcus Aureus* Skin Infections

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Abstract

Purpose: Describe the need for a revision to a treatment algorithm for community-associated methicillin-resistant *Staphylococcus aureus* (CA-MRSA) skin infections 3 years after implementation.

Methods: Medical records for patients seen in the emergency department (ED) for CA-MRSA skin infections from October 2005 through August 2007 were compared with records for patients seen from September 2002 through September 2004.

Results: Most patients with CA-MRSA initially were seen in the ED; however, by mid-2007 an increasing number of patients were coming to primary care clinics, particularly with recurrent episodes, and treatment for CA-MRSA was suboptimal in this setting. In addition, approximately 14% of CA-MRSA cases were not considered high risk based on the algorithm risk assessment. When the algorithm was implemented, the risk assessment classified less than 5% of CA-MRSA cases as low risk. Furthermore, newly published data suggested that incision and drainage (I&D) was sufficient for small abscesses. Therefore, a revised algorithm that provided for treatment in all ambulatory settings, encouraged I&D for small abscesses, and facilitated empiric treatment for CA-MRSA in all cases of suspected staphylococcal infection was developed. Initial feedback from providers has been positive, and a post implementation review has been planned.

Conclusion: A treatment algorithm that initially facilitated the care of patients with CA-MRSA skin infections in the ED only required revision because changes in the epidemiology of this disease had been observed. The new algorithm provides for empiric treatment for CA-MRSA in all cases of suspected staphylococcal skin infection, regardless of perceived risk or setting.

Key Words—community associated, MRSA, skin infections, treatment algorithm

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The national incidence of community-associated methicillin-resistant *Staphylococcus aureus* (CA-MRSA) is continually increasing.[1-3] A previous article described the development and initial assessment of a treatment algorithm for CA-MRSA skin infections in the emergency department (ED) of a 120-bed veterans affairs medical center with over 400,000 outpatient visits per year.[4] This algorithm (see Figure 1), implemented in November 2004 for use in the ED, worked well for almost 3 years. Although primary care (PC) providers were briefly educated on CA-MRSA infections and treatment, the main focus at the time of the educational campaign was the ED staff. The aim of this article is to describe the trends for CA-MRSA at the previously described facility and the subsequent revision of the treatment algorithm for CA-MRSA skin infections in the ambulatory setting.

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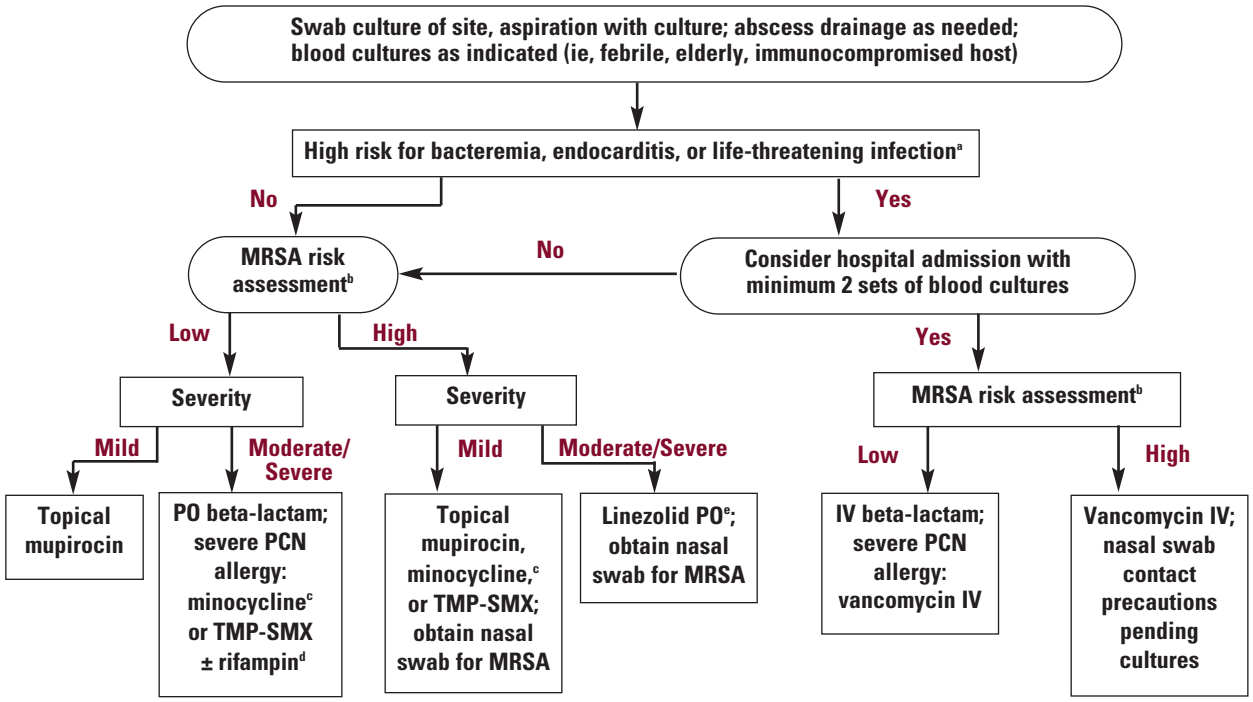


[a]High risk for bacteremic *Staphylococcus aureus:* patients with poorly controlled diabetes, patients receiving dialysis, patients with intravascular devices (eg, port, pacemaker, prosthetic valve), patients who are immunosuppressed (eg, taking more than 40 mg/day of prednisone, have undergone transplant, have acquired immunodeficiency syndrome or cancer), or those with multiple areas of skin breakdown.
[b]MRSA risk assessment. High risk: homeless, recent incarceration, recent courses of beta-lactam or quinolone antibiotics, history of spider bite, or history of MRSA infection/colonization.
[c]May cause dizziness; caution for women and for patients who are elderly or visually impaired. Minocycline dose: 100 mg PO twice daily for 10 days.
[d]Caution for contact lens wearers and potential drug interactions. Rifampin dose: 600 mg PO daily for 10 days.
[e]May cause thrombocytopenia after 14 days of therapy. Linezolid dose: 600 mg PO twice daily for 10 days.

Figure 1. Original algorithm for staphylococcal pyoderma treatment. IV = intravenous; MRSA = methicillin-resistant *Staphylococcus aureus;* PCN = penicillin; PO = oral; TMP-SMX = trimethoprim/sulfamethoxazole. (From Segarra-Newnham M. Development of a treatment algorithm for staphylococcal pyoderma in the emergency department. *Hosp Pharm.* 2007;42[3]:226-229.)

METHODS

As part of the infectious diseases (ID) surveillance at this facility, cases of CA-MRSA skin infections have been monitored on a monthly basis since September 2002. The medical records of patients identified as being infected with methicillin-resistant *S. aureus* (MRSA) have MRSA noted on their problem lists, and per facility policy, a medical record alert is generated by infection control when the organism is isolated.[5] As assessment has continued through the years, the prevalence of CA-MRSA has increased and the number of patients returning for treatment of skin infection recurrences has also increased. To further analyze trends, data from the electronic medical record and microbiology laboratory reports of patients with CA-MRSA skin infection seen in the ED from October 2005 through August 2007 were evaluated, and trends were compared with the previously published data from September 2002 through September 2004. The medical records of patients who had recurrences over the full 5-year period (September 2002 through August 2007), regardless of setting (eg, ED or PC), were also reviewed. Parameters collected included age, cultures

obtained, treatment received, and outcomes, including repeat visits and treatment for recurrences. A t-test was used to compare the average age of patients in the original and the follow-up evaluations. Use of the algorithm was evaluated and compared among ED and PC clinics to determine whether any changes were needed in the antimicrobial formulary policy.

One of the main sections of the initial algorithm included a risk assessment for possible MRSA infection. This assessment was based on the information known at the time about CA-MRSA and observations of the patient population.[6-8] The initial published evaluation showed that most patients with CA-MRSA skin infections seen in the ED had at least 1 of the identified risks associated with CA-MRSA, particularly a history of an insect or spider bite, homelessness, or recent use of beta-lactam or quinolone antimicrobial.[4] However, by early-to-mid 2007 it appeared that there was an increasing number of cases in which these usual risk factors were absent. This issue was being reported by other investigators as well.[9] Furthermore, case reports and studies were demonstrating that incision and drainage (I&D) was sufficient treatment for small abscesses and that systemic antimicrobial therapy could be avoided.[1,10]

RESULTS

From October 2005 through August 2007, a total of 87 patients with CA-MRSA skin infections were seen in the ED. The average patient age was 52.5 years (age range, 22 to 71 years), statistically significantly older than the average age of 46 years for the 27 patients included in the 2002 through 2004 review ($P < 0.01$). Thirty-seven patients were seen from October 2005 through December 2006 (15 months), and 50 patients were seen in the first 8 months of 2007. This change in the number of cases suggested an increasing incidence. Of the 87 patients seen in the ED, 12 (14%) did not meet risk criteria for CA-MRSA based on the algorithm risk assessment; all but 1 of these patients were seen in 2007. When the algorithm was implemented, the risk assessment classified less than 5% of CA-MRSA cases as low risk.

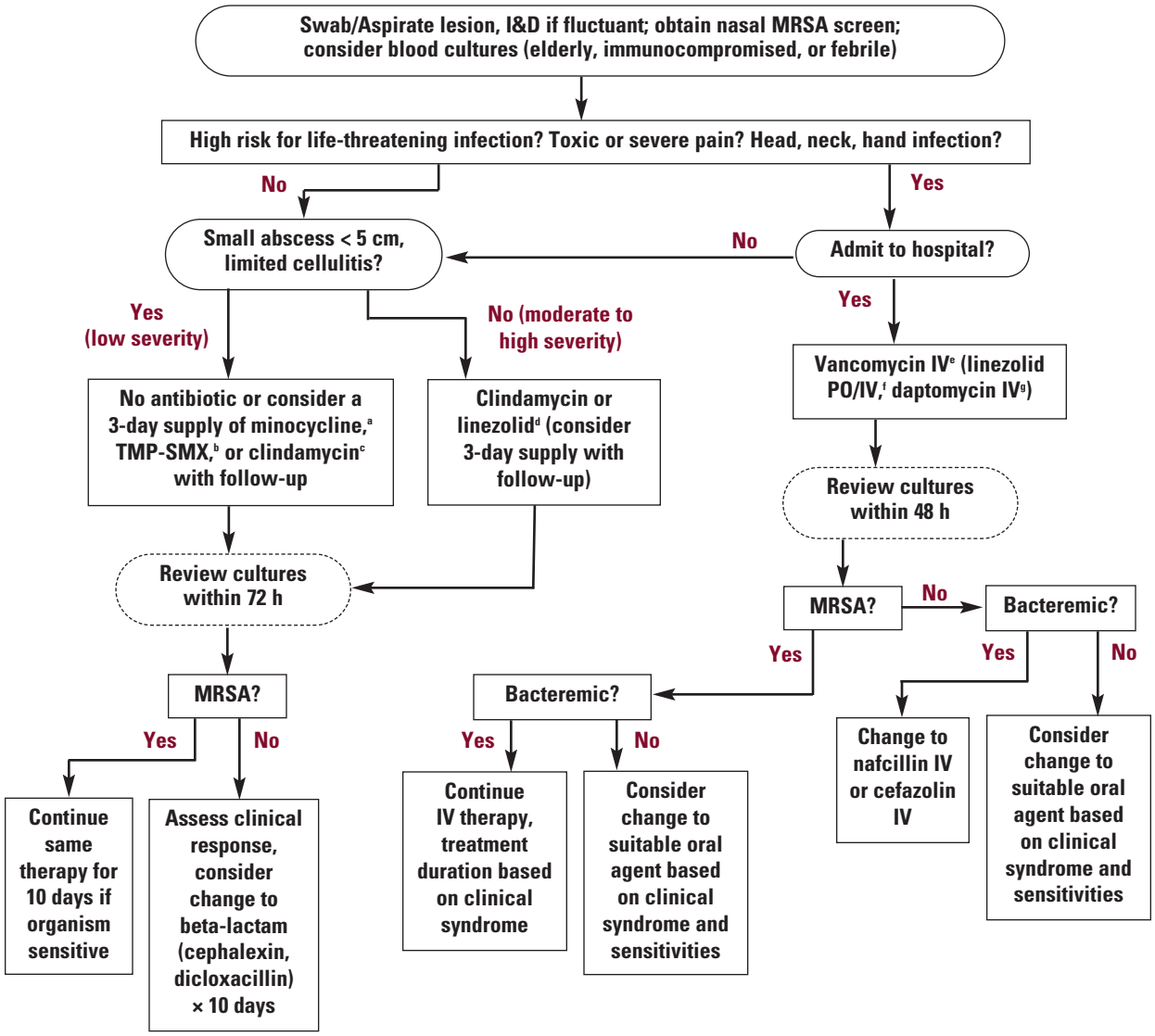
A total of 44 patients had at least 1 recurrence in the 5 years that the trends in CA-MRSA were monitored (September 2002 through August 2007). In the initial 2-year review (September 2002 through September 2004), approximately 39% of patients had at least 1 recurrence of CA-MRSA infection, and it appeared that the incidence was stable until 2006. Most of the patients seen in the ED returned to the ED for the recurrences and were treated appropriately for CA-MRSA. However, in 2007 the recurrence rate increased to 43% and almost half of the patients with recurrences were seen in PC clinics instead of returning to the ED. Most of the patients seen in PC clinics were not treated appropriately for CA-MRSA, even though medical records listed this organism in the patients' problem lists and the records had the alert previously described. It appeared that few PC providers were using the available algorithm or were familiar with CA-MRSA skin infections.

Based on the information about these developing trends, a revised algorithm and an educational campaign for PC providers regarding covering for MRSA in most cases of skin infection, regardless of perceived risk and particularly for patients with recurrences, was needed. The revised algorithm focused on providing appropriate treatment in all ambulatory settings instead of limiting treatment to the ED; encouraged I&D only for small abscesses; and facilitated empiric treatment for CA-MRSA in all cases of suspected staphylococcal infection, regardless of perceived risk for MRSA (see Figure 2). An educational campaign targeting PC providers was completed by the ID team (composed of an ID physician, an ID pharmacist, and an infection control nurse), which included noon conferences, pocket guides, and posters with the new algorithm distributed in PC clinic areas. Furthermore, 2 formulary policy changes were implemented. PC providers were allowed to prescribe hexachlorophene soap and oral minocycline, prescribing of which had been previously restricted to the ED or ID only. Use of linezolid remained restricted to the ED or to approval by ID physician or the ID pharmacist, given cost and resistance considerations.[11]

The new algorithm was implemented in October 2007 after approval by the Medication-Use Committee (equivalent to a Pharmacy and Therapeutics Committee) and the Infection-Control Committee. Preliminary feedback from PC providers has been positive. A 24-month evaluation of the new algorithm has been planned. CA-MRSA infection surveillance is ongoing.

DISCUSSION

After implementation of an initial treatment algorithm in the ED only, patients who had new or recurrent CA-MRSA skin infections were being seen in PC clinics more frequently than in the ED. Treatment for CA-MRSA was usually suboptimal in the PC setting. The initial risk factors illustrated in



[a]May cause dizziness; caution for women or for patients who are elderly or visually impaired. Dose: 100 mg PO twice daily.
[b]One double-strength tablet twice daily. Significant drug interaction with warfarin; avoid concomitant use.
[c]Caution in elderly patients because of the possible complication of *Clostridium difficile* infection. Dose: 300 mg PO every 8 hours.
[d]Risk of thrombocytopenia after 14 days of therapy. Dose: 600 mg PO twice daily. ID only, except in ED.
[e]ID approval required, except as listed in criteria for use. Dose varies according to renal function.
[f]ID approval required, except in ED where PO linezolid may be started; IV only for patients who cannot take PO medications.
[g]ID approval required in all cases; use in cases of severe allergies to vancomycin.

Figure 2. Revised algorithm for staphylococcal pyoderma. ED = emergency department; ID = infectious diseases; I&D = incision and drainage; IV = intravenous; MRSA = methicillin-resistant *Staphylococcus aureus;* PO = oral; TMP-SMX = trimethoprim/sulfamethoxazole.

the algorithm helped increase the suspicion for CA-MRSA in the first years following increasing reports of CA-MRSA nationwide. However, after almost 3 years these risk factors were less predictive of CA-MRSA because the incidence of CA-MRSA was continually increasing; thus, a revision of the treatment algorithm was needed.

CONCLUSION

Treatment for CA-MRSA infections is becoming more common in ambulatory settings beyond the ED. A treatment algorithm that initially facilitated the care of these patients in the ED only required revision because of changes in the epidemiology of this disease and suboptimal treatment in PC areas. The new algorithm provides for empiric treatment of MRSA in all cases of suspected staphylococcal skin infection, regardless of perceived MRSA risk or setting, thereby ensuring appropriate therapy for most patients. Evaluation of treatment algorithms after implementation is paramount to assessing the need for changes in policy or guidelines.

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REFERENCES

1. Mollering RC Jr. The growing menace of community-acquired methicillin-resistant *Staphylococcus aureus*. *Ann Intern Med*. 2006;144(5):368-370.

2. Moran GJ, Krishnadasan A, Gorwitz RJ, et al. Methicillin-resistant *S. aureus* infections among patients in the emergency room. *N Engl J Med*. 2006; 355(7):666-674.

3. Frazee BW, Lynn J, Charlebois ED, Lambert L, Lowery D, Perdreau-Remington F. High prevalence of methicillin-resistant *Staphylococcus aureus* in emergency department skin and soft tissue infections. *Ann Emerg Med*. 2005;45(3): 311-320.

4. Segarra-Newnham M. Development of a treatment algorithm for staphylococcal pyoderma in the emergency department. *Hosp Pharm*. 2007;42(3): 226-229.

5. Segarra-Newnham M, Volpp BD, Lang C, Carman KI. Evaluation of an electronic mail system for communication of resistant organisms in a medical center. *J Infect Dis Pharmacother*. 2001;4:1-7.

6. Dominguez TJ. It's not a spider bite, it's community-acquired methicillin-resistant *Staphylococcus aureus*. *J Am Board Fam Pract*. 2004;17:220-226.

7. Salgado CD, Farr BM, Calfee DP. Community-acquired methicillin-resistant *Staphylococcus aureus:* a meta-analysis of prevalence and risk factors. *Clin Infect Dis*. 2003;36(2):131-139.

8. Centers for Disease Control and Prevention. Community-associated MRSA information for clinicians. http://www.cdc.gov/ncidod/dhqp/ar_mrsa_ca_clinicians.html#3. Modified February 3, 2005. Accessed May 12, 2008.

9. Miller LG, Perdreau-Remington F, Bayer AS, et al. Clinical and epidemiological characteristics cannot distinguish community-associated methicillin-resistant *Staphylococcus aureus* infection from methicillin-susceptible *S. aureus* infection: a prospective investigation. *Clin Infect Dis*. 2007;44(4):471-482.

10. Hankin A, Everett WW. Are antibiotics necessary after incision and drainage of a cutaneous abscess? *Ann Emerg Med*. 2007;50(1):49-51.

11. Gales AC, Sader HS, Andrade SS, Lutz L, Machado A, Barth AL. Emergence of linezolid-resistant *Staphylococcus aureus* during the treatment of pulmonary infection in a patient with cystic fibrosis. *Int J Antimicrob Agents*. 2006;27(4):300-302.