Skin and soft tissue infections (SSTIs) are a common entity in the emergency department (ED). This issue of the “Resident Journal Review” focuses on selected updates and review of key articles in the management of these infections. We specifically review articles on outpatient treatment regimens and antibiotic stewardship, predictors of outpatient treatment failure, clinical signs that a more serious infection may be underlying, and trends in pediatric treatment of soft tissue infections. For a detailed discussion of the individual articles please see the full review published on the AAEM/RSA website (www.aatemrs.org/publications/aaemrsa-in-common-sense) and Medscape. Presented here is a listing of the articles reviewed and a brief synopsis of each.

Antibiotic Regimens and Stewardship

Routine treatment of skin and soft tissue infections in the ED is focused upon identification and drainage of fluid collections, followed by oral antibiotics and outpatient follow-up. The emergence of community acquired MRSA (CA-MRSA) and other resistant organisms have raised new concerns, though, about effective antibiotic regimens and responsible antibiotic stewardship. Here we review several articles on antibiotic choice and duration to guide outpatient therapy.


This retrospective cohort study at a single center, with a high incidence of CA-MRSA, looked at the rates of treatment success of cellulitis in outpatients treated with antibiotic monotherapy. A total of 405 patients met inclusion criteria; they were most commonly treated with cephalexin (44%), trimethoprim-sulfamethoxazole (TMP-SMX) (38%), and clindamycin (10%). Combined therapy with antibiotics and incision and drainage (I/D) was done in 28% of patients. Treatment success was significantly higher in the TMP-SMX group when compared with cephalexin (91% vs. 74%, OR 3.38; 95% CI, 1.79-6.39; p<0.001). Success rates were not significantly different in comparisons between clindamycin and cephalexin, or between clindamycin and TMP-SMX. Empiric therapy with antibiotics that cover CA-MRSA resulted in higher treatment success in this retrospective study.


These investigators hypothesized that adding an antibiotic that covers MRSA would improve treatment outcomes in cellulitis when added to standard streptococcal therapy. They conducted a multicenter, prospective, randomized, double blind, placebo-controlled trial that enrolled patients with cellulitis who had less than one week of symptoms and no evidence of abscess. Patients were randomized to receive cephalexin plus TMP-SMX (intervention) or cephalexin plus placebo (control). The primary outcome was the risk difference for cure in the intention-to-treat (ITT) group, and cure was defined as resolution of symptoms other than slight residual erythema or rash at 12 days.

One hundred forty-six participants were included in the ITT analysis. Clinical cure was achieved in 85% of intervention patients and 82% of controls (risk difference 2.7%, 95% CI, -9.5% to 15%; p=0.66). These authors found no benefit to addition of TMP/SMX when treating cellulitis. The results of this are in contrast to the retrospective study by Khawcharoenporn presented earlier. The Pallin, et al., prospective randomized design adds additional weight to their conclusions; however, Pallin, et al., studied only uncomplicated cellulitis, excluding patients with abscesses, whereas 44% of patients included in the Khawcharoenporn study had abscesses. Prior evidence has suggested that though streptococcal species are frequently responsible for simple cellulitis, MRSA is often the source of suppurative skin infections. This may explain some of the discrepancy in benefit of CA-MRSA coverage between the two studies. Ultimately, the choice of antibiotic coverage remains dependent on local antibiotic resistance patterns, and clinical discretion.


The authors attempted to test the extent to which duration of antibiotic treatment affects outcome. Specifically, they compared a five-day and ten-day course of levofloxacin. The authors enrolled 121 patients from various sources including primary care clinics and urgent care facilities. All patients received five days therapy with levofloxacin, after five days patients were randomized to either receive placebo for five days (total 5 days antibiotic duration), or continue receiving levofloxacin for five further days (total 10 days duration). Exclusion criteria for randomization included worsening infection despite therapy, unimproved infection despite therapy, intolerance of levofloxacin, and missed follow up appointments. Both arms of the study had a 98% treatment success rate, suggesting the possibility that a shorter duration than the typical 7-10 day course prescribed for cellulitis could be equally successful.

While the study suggests a five-day course may be reasonable for uncomplicated cellulitis, the need for close follow up must be emphasized, particularly if a shorter course of antibiotics is used.

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Predictors of Treatment Failure

Most soft tissue infections can be safely managed in an outpatient setting with drainage of fluid collections, oral antibiotics and close follow-up. Occasionally, though, an abscess re-forms or infection persists despite these measures and inpatient management is necessary. Two studies set out to determine the factors associated with a higher risk of outpatient treatment failure.


The authors of this study set out to quantify the failure rate for emergency department (ED) treatment of pediatric SSTIs, as well as to identify risk factors associated with these failures, including presence of CA-MRSA as the causative organism. Toward this goal, they performed a retrospective review of patients 18 years of age and younger with culture-positive SSTIs.

They examined several factors including demographics, initiation of antibiotics, causative organism, size of lesion, presence of surrounding cellulitis, and whether or not the initial ED treatment included drainage, but were unable to find any statistically significant associations with treatment failure (defined as any of these after initial evaluation: change in antibiotics, performance of I/D, or hospital admission). Out of 148 eligible patients, S. aureus was responsible for 87.1% of infections (66.2% MRSA, 20.9% MSSA). Eleven treatment failures (7.6%) were identified, all with S. aureus as the causative organism.

This study confirmed that most pediatric culture-positive skin infections are abscesses, and these are primarily caused by S. aureus infection. Initial ED treatment is effective 92% of the time, with most treatment failures requiring subsequent I/D and occurring regardless of whether or not initial antibiotic therapy is active against the causative agent, and whether or not that causative agent is CA-MRSA.


Using data previously collected on a cohort of 212 adult patients receiving I/D of abscess at four EDs, the authors attempted to determine if an association exists between abscess treatment failure within seven days of I/D and any of the following three variables: abscess >5cm, surrounding cellulitis >5cm, and MRSA positive cultures.

The authors found no significant difference in seven-day failure rates between abscesses >5cm and those <5cm (26% vs. 22%, respectively, p=0.66). Similarly, the amount of surrounding cellulitis (<5cm vs. >5cm) was not significantly associated with treatment failure (27% vs. 16%, respectively, p=0.1). Thirty-one percent of patients with MRSA-positive cultures failed treatment compared to 10% of patients without MRSA. Therefore, MRSA-positive cultures were a significant predictor of treatment failure (OR 4.7, 95% CI 1.9-11.7, p=0.001). However, the authors also found that neither abscess size nor size of surrounding cellulitis was significantly associated with MRSA-positive cultures.

In conclusion, SSTIs caused by MRSA have a higher rate of treatment failure; however neither the size of the abscess nor surrounding cellulitis was associated with outcomes.

Predictors of Deeper Infection

Although most presentations of cellulitis are limited anatomically to a single area and do not penetrate beyond the subcutaneous tissues, vigilance must be maintained for infections that have expanded to include deeper tissues (necrotizing fasciitis, tenosynovitis, osteomyelitis, septic arthritis), or spread systemically into the bloodstream. Two recent articles explore signs and symptoms suggestive of a more serious infection.


This retrospective study reviews risk factors associated with bacteremia in patients presenting to the ED with limb cellulitis. The authors reviewed 2,678 patients presenting to a single ED with limb cellulitis, of whom 308 (about 11%) had blood cultures drawn, and 57 (18.5%) of these were found to be bacteremic. Factors most strongly associated with bacteremia were absence of previous antibiotic treatment (odds ratio 4.3, 95% CI 1.6-11.7), a length of illness less than two days (odds ratio 2.44, 95% CI 1.07-5.56), presence of two or more comorbid factors such as COPD, diabetes, renal failure or obesity (odds ratio 4.3, 95% CI 1.6-11.7), and proximal limb involvement (odds ratio 6.0, 95% CI 3.03-12.04). Although these results appear to highlight sub-segments of the population that may benefit from further diagnostic studies, this paper is limited in that no guidelines dictated which cellulitis patients received blood cultures, thereby making them eligible for inclusion. One could assume that patients with more severe cellulitis, abnormal vital signs, or who were toxic appearing were more likely to have had cultures drawn, thus biasing the study population toward sicker patients.

Based in part on this data, the Infectious Disease Society of America recommends against routine blood cultures for most patients presenting to the ED with isolated cellulitis as there is significant cost and limited benefit. Specific patient populations, those who are immunocompromised, have multiple comorbid medical conditions, have a head or neck cellulitis, or possess the risk factors outlined in this paper may be more likely to be bacteremic. ED physicians should evaluate these patients on a case-by-case basis when deciding on the value of blood cultures.


Bacterial infection can cause significant, irreversible joint damage, but discerning a septic joint from a sterile inflamed joint or simply a superficial skin infection overlying a sterile joint poses a challenge. To address this, the authors of this paper performed a meta-analysis of studies that evaluated sensitivity and specificity of various presenting factors for...
infectious arthritis, including risk factors, laboratory studies and physical exam findings.

Their results were most notable for identified risk factors. Importantly, of the risk factors studied, a skin infection overlying a prosthetic knee or hip carried the strongest positive likelihood ratio for septic arthritis (15.0, 95% CI 8.1-28.0). Similarly, a skin infection overlying a native joint carried a positive LR of 2.8 (95% CI 1.7-4.5). Other predictive risk factors included age >80 (3.5, 95% CI 1.8-7.0), history of diabetes mellitus (2.7, 95% CI 1.0-6.9), rheumatoid arthritis (2.5, 95% CI 2.0-3.1), recent joint surgery (6.9, 95% CI 3.8-12.0), hip or knee prosthesis (3.1, 95% CI 2.0-4.9), and infection with HIV-1 (1.7, 95% CI 1.0-2.8). For all of the risk factors listed, the negative likelihood ratio was less than one, suggesting that the absence of any of these does not make the diagnosis less likely.

In light of the elevated likelihood ratio for septic arthritis in the setting of overlying soft tissue infection, emergency physicians must maintain a strong clinical suspicion when evaluating cellulitis. No single element of the history, finding on physical exam or laboratory study reviewed in this paper definitively diagnoses or rules out joint sepsis.

**Updates in Management of Pediatric SSTIs**

Skin and soft tissue infections continue to be a common pediatric ailment just as in adults. Also similar to adults, the spread of CA-MRSA has muddied the waters of antibiotic choices in pediatric emergency departments (PEDs). We review two recent papers investigating treatment strategies for SSTIs in pediatrics.


To better characterize patterns in the management of pediatric skin and soft tissue infection, the authors performed a retrospective cohort study examining neonates ages 0-28 days old seen for SSTI in two large PEDs over a six year period. Included subjects were reviewed as to the type of SSTI present, the types of cultures taken and their outcome, whether antibiotics were given, and whether the patient was admitted. Patients were followed up within one month of the initial visit to identify any potential treatment failures.

One hundred and four neonates were included in the study. Blood cultures were obtained in 13% of pustulosis cases, 96% of cellulitis cases, and 69% of abscesses. Urine cultures were obtained in 0% of pustulosis cases, 62% of cellulitis cases, and 35% of abscesses. CSF cultures were obtained in 0% of pustulosis cases, 53% of cellulitis cases, and 25% of abscesses. Methicillin-resistant S. aureus was found in 25 of 49 cultures obtained by drainage or skin swabs. Of note, none of the study subjects had a positive blood, urine, or CSF culture.

Patients with cellulitis were more likely to have blood cultures drawn (OR 13.7; CI 3.03-62.3), to receive IV antibiotics (OR 5.87, CI 2.16-15.0), and to be admitted to the hospital (OR 5.62, CI 2.16-14.6) as compared to other SSTIs studied. Pustulosis cases were the least likely to receive blood cultures, IV antibiotics or to be admitted. Only four of the 36 discharged neonates returned to the ED within 72 hours after discharge. No neonate returned with a fever. Reviews of all return visits showed no neonate returned for fever or skin and soft tissue infection related complaints within 28 days.

Of the neonates included in this study, none were found to have bacteremia, a urinary tract infection, or meningitis. This suggests that for afebrile neonates with SSTI obtaining cultures may be unnecessary. As always, though, clinical discretion should dictate management.


The authors investigated whether a course of antibiotics post-drainage of skin abscess improved cure rates relative to drainage alone. They conducted a randomized controlled trial, in which afebrile pediatric patients presenting to a single, large urban emergency department with skin abscess were randomized to receive either TMP-SMX or placebo for 10 days following drainage of their abscess. Patients were followed at 10 and 90 days. The primary endpoint was treatment failure at 10 days; the secondary endpoint was formation of a new lesion at either the 10 or 90-day follow up points.

Of 1,305 patients presenting with abscess during the study period, 161 were enrolled in the trial and randomized, 76 (52%) to the placebo group and 73 (48%) to the antibiotic group. Both groups had similar rates of treatment failure: 5.3% in the placebo group and 4.1% in the antibiotic group. The difference of 1.2% established non-inferiority with a one-sided 95% confidence interval of -6.8% to 6.8%, suggesting that antibiotics following drainage of skin abscess do not definitively improve outcomes.

**Conclusions**

The management of skin and soft tissue infections in the ED continues to be challenging, especially in the face of increasing incidence of drug-resistant bacteria. Good antibiotic stewardship through knowledge of local antibiograms and appropriate duration of treatment will help improve outcomes now and for years to come. Similarly, recognition of signs that outpatient treatment of an SSTI may fail, or that there may be a deeper infection will help avoid return trips to the ED, and reduce morbidity associated with missed infections.

**Additional Resources**