# Things We Do For No Reason: Blood Cultures for Uncomplicated Skin and Soft Tissue Infections in Children

Eric Zwemer, MD*, John R. Stephens, MD[1]

*Division of General Pediatrics and Adolescent Medicine, University of North Carolina School of Medicine, Chapel Hill, North Carolina.*

Skin and soft tissue infections (SSTIs) are common pediatric diagnoses in both outpatient and inpatient settings. Blood cultures are frequently obtained for evaluation of SSTIs. Multiple studies have demonstrated that blood cultures rarely demonstrate true pathogenic bacterial growth, and even positive cultures do not change clinical management. Obtaining blood cultures has been associated with increased length of hospital stay. In addition, false-positive blood cultures may occur and result in repeat blood cultures and increased hospital charges. Clinicians should avoid obtaining blood cultures in pediatric patients with uncomplicated SSTIs but instead should focus on obtaining wound cultures when possible. *Journal of Hospital Medicine* 2018;13:496-499. © 2018 Society of Hospital Medicine

*The "Things We Do for No Reason" (TWDFNR) series reviews practices that have become common parts of hospital care but may provide little value to our patients. Practices reviewed in the TWDFNR series do not represent "black and white" conclusions or clinical practice standards but are meant as a starting place for research and active discussions among hospitalists and patients. We invite you to be part of that discussion.*

## CLINICAL SCENARIO

An 8-year-old previously healthy girl presented to the emergency department (ED) with 2 days of warmth, swelling, and pain over her right upper thigh. Three days prior before presentation, a "pimple" appeared on her leg and drained a small amount of pus. Over the next 24 hours, the lesion became swollen, red, and painful. Her pediatrician prescribed trimethoprim-sulfamethoxazole. The patient took 3 doses of this medication but still experienced worsening pain and swelling.

In the ED, she had normal vital signs for her age except for temperature of 100.8 °F. A 2 cm × 3 cm area of fluctuance, erythema, and warmth was noted, and bedside ultrasound demonstrated a simple fluid collection. Incision and drainage was performed with expression of several milliliters of pus. The patient was referred for admission due to worsening symptoms despite outpatient antibiotic therapy. The ED providers ordered a blood culture at the time of admission.

***Address for correspondence**: Eric Zwemer, MD, Assistant Professor of Pediatrics, Division of General Pediatrics and Adolescent Medicine, Macnider 231 Chapel Hill, NC 27599-7110; Telephone: (919) 923-0897; Fax: (919) 966-3766; E-mail: eric_zwemer@med.unc.edu

**Received**: October 29, 2017; **Revised**: March 9, 2018; **Accepted**: March 15, 2018



## BACKGROUND

Skin and soft tissue infections (SSTIs) are common pediatric diagnoses, which account for an estimated 390,000 ED visits annually[1] and represent the 7th most common reason for pediatric hospital admission in the United States.[2] The rates of SSTIs have increased over the past several decades partly due to the rise of methicillin-resistant *Staphylococcus aureus* (MRSA).[3]

## WHY YOU MIGHT THINK BLOOD CULTURES ARE HELPFUL IN CHILDREN WITH SSTIS?

Prior to the introduction of the *Haemophilus influenzae* vaccine, the rates of SSTI-associated bacteremia ranged from 8% to 20%.[4,5] Although the rate of bacteremia has declined significantly, blood cultures are still commonly performed as part of the evaluation of uncomplicated SSTIs in children; studies have shown that blood culture rates are 46% in the combined outpatient/inpatient setting,[6] 34% in the ED setting,[7] and 47%-94% in the inpatient setting.[7-11] Clinicians still feel that bacteremia detection is important to guide the selection of antibiotics and treatment duration. Providers may also underestimate the risk of obtaining a contaminant result and associated charges. Lastly, clinicians may perform blood cultures due to cultural norms at their institution.

## WHY BLOOD CULTURES ARE UNNECESSARY IN CHILDREN WITH UNCOMPLICATED SSTIS

Several decades into the post vaccine era, the current guidelines from the Infectious Diseases Society of America (IDSA) do not recommend blood cultures as part of the routine evaluation of uncomplicated SSTIs.[12] Multiple single-center studies have failed to demonstrate the benefits of obtaining blood cultures in pediatric patients with uncomplicated SSTIs in the post-*H. influenzae* vaccine era.[6–11]

Sadow et al[11] performed a retrospective case series of 381 children hospitalized with cellulitis to determine the rate and yield of blood cultures. Of the 266 (70%) patients who had a

blood culture performed, 5 (1.9%) were true positives and 13 (5.4%) were contaminants. Notably, the true positive results included 3 children with active varicella infection and 2 children with septic joints; the latter would qualify as a complicated SSTI or as a separate infectious process altogether. No significant change in management resulted the positive blood cultures.

Wathen et al[7] conducted a similar retrospective case series of 385 children with cellulitis who presented to the ED of a single tertiary-care children's hospital to determine the rate and yield of blood cultures. Of the 129 (33.5%) blood cultures performed, there were no true positives and 4 (3.1%) contaminants. Obtaining a blood culture was also associated with high rates of ordering complete blood count and hospitalization.

Malone et al[8] performed a retrospective case series of 580 children hospitalized with an SSTI at a single children's hospital to determine the yield of blood cultures for uncomplicated versus complicated SSTIs. Of the 482 patients with uncomplicated SSTIs, 455 (94.4%) had a blood culture, with no true positive cultures and 3 (0.7%) contaminants. Obtaining a blood culture in this study was associated with an almost 1 day increase in length of stay (LOS; mean LOS 3.24 vs 2.33 days, $P = .04$).

Parikh et al[6] conducted a retrospective cohort study of 304 children with SSTIs in both inpatient and outpatient settings to determine the yield and rate of blood cultures. Of this group, 140 (46.1%) patients had a blood culture performed, of which there were 3 (2.9%) true positives and 1 (0.7%) contaminant. True-positive bacteria included MRSA and *Streptococcus pyogenes*, neither of which was associated with a change in antibiotic regimen or increase in hospital LOS. The total charges associated with the original 140 blood cultures were estimated to be $42,450 annually in the authors' institution.

Lastly, Trenchs et al[9] performed a retrospective case series of 445 children hospitalized with SSTI in a Spanish children's hospital and found 353 (79.3%) blood cultures with 2 (0.6%) true positives and 10 (2.8%) contaminants. Methicillin-sensitive *Staphylococcus aureus* (MSSA) and *S. pyogenes* were the sole true-positive bacteria, and no change in management was reported. Obtaining blood cultures was associated with an increased hospital LOS (median LOS 4 vs. 3 days, $P < .001$).

Across these studies, the reported rates of true-positive blood cultures ranged from 0%-2.9%. Of the 1997 patients included in the studies, only 10 (0.5%) had true-positive blood cultures. This rate decreased to 0.4% if the 2 patients with septic arthritis from the study of Sadow et al were excluded. Isolated organisms included MRSA, MSSA, *S. pyogenes*, and *Streptococcus pneumoniae*. No unusual organisms were isolated in uncomplicated SSTIs, and the true-positive results were not associated with any reported change in antibiotic management.[6–9,11] False-positive blood culture results were found in 0%-5.4% of patients,[6–9,11] accounting for 30 patients or 1.5% of the total patients.

## HARMS ASSOCIATED WITH UNNECESSARY BLOOD CULTURES IN SSTIS

Blood cultures necessitate venipunctures, which are painful for children and families. The inevitable false-positive contaminants also lead to repeat venipunctures and, potentially, unnecessary antibiotic exposure. From a high-value care perspective, Parikh et al reported hospital charges of $300 per blood culture and $250 for identification and sensitivity of positives.[6] Assuming that these single-center charges are representative of national charges and using 0.5% true positivity and 1.5% false positivity rates, subjecting all children with uncomplicated SSTIs to blood culture would result in $60,250 charges to find one true positive blood culture, with no resultant changes in management. Additionally, among the 200 children cultured to find one true positive, there would be 3 false positives, necessitating another $1650 in charges for identification, sensitivity analysis, and repeat culture. These amounts do not factor in the significant expenditures associated with increased LOS. The potential savings associated with forgoing blood cultures in children with SSTIs should be an incentive for institutional change.

## WHEN BLOOD CULTURES MAY BE REASONABLE

The current IDSA guidelines recommend blood cultures for SSTIs in patients with immunodeficiency, animal bites, and immersion injuries (soft tissue injuries occurring in fresh or saltwater).[12] Previous studies also delineated criteria for "complicated" SSTIs, typically defined as surgical or traumatic wounds, infections requiring surgical intervention (not including simple incision and drainage), or infected ulcers or burns.[8,9] In the study of Malone et al, 10 (12.5%) positives were found among 80 patients with complicated SSTIs who had blood cultures performed.[8] Although this work had a single-center study design with a relatively small sample size, no unusual organisms were found; the grown cultures included MRSA, MSSA, and *S. pneumoniae*. In addition to patients with complicated SSTIs, immunocompromised children, such as those receiving chemotherapy or other immunosuppressive agents, were excluded from the studies of blood culture yield in SSTIs and may warrant blood cultures given the risk of overwhelming infection and susceptibility to rare or invasive organisms.[12] In a study of 57 pediatric patients with leukemia and no central catheters who experienced skin or soft tissue complications, Demircioglu et al[13] reported 6 positive blood cultures, including *Klebsiella oxytoca*, *Pseudomonas aeruginosa*, and *Escherichia coli*. These organisms would not be covered by typical SSTI antibiotic regimens, illustrating the value of blood cultures in this selected group of patients. Lastly, although the above studies included some infants, the data on utility of blood cultures in neonates are limited. Blood cultures may be reasonable in this group given the relative immunocompromised state of neonates compared with older children. Additionally, any infants aged <90 days with SSTI and fever should be evaluated separately under existing febrile infant protocols.

## WHAT YOU SHOULD DO INSTEAD OF BLOOD CULTURES FOR UNCOMPLICATED SSTIS

Gram stain and wound culture of any purulent material may assist with choice of empiric antibiotic therapy and appropriate narrowing of regimen for antibiotic stewardship. Wound cul-

TABLE 1. **Studies Reporting Blood Culture Yield in Children with Skin and Soft Tissue Infections**

| Lead Author | Year | Study Design | Population | Setting | Outcome Measures | Results |
|---|---|---|---|---|---|---|
| Sadow[11] | 1998 | Retrospective case series | Children aged 2 days to 22 years hospitalized with cellulitis. | Single urban university-affiliated hospital in Washington, D.C. | Rate and yield of blood culture | 266/381 (70%) had blood culture.<br>5 (1.9%) cultures were true positives.<br>13 (5.4%) were contaminants. |
| Wathen[7] | 2013 | Retrospective case series | Children aged 2 months to 18 years with ED diagnosis of cellulitis. | Single urban tertiary children's hospital ED in St. Louis | Rate and yield of blood culture | 129/385 (33.5%) had blood culture.<br>0 were positive.<br>4 (3.1%) were contaminants. |
| Malone[8] | 2013 | Retrospective case series | Children aged 0 to 18 years hospitalized with SSTI. | Single urban tertiary children's hospital in Oklahoma | Yield of blood culture in uncomplicated vs. complicated SSTI | 455/482 (94.4%) patients with uncomplicated SSTI had blood culture.<br>0 were positive.<br>3 (0.7%) were contaminants.<br>80/98 (81.6%) patients with complicated SSTI had blood culture.<br>10 (12.5%) were true positives.<br>1 (1.2%) was contaminant. |
| Parikh[6] | 2014 | Retrospective cohort | Children aged 6 months to 18 years with asthma, bronchiolitis, SSTI or pneumonia seen in clinic/ED or hospitalized. | Single urban, academic, quaternary children's hospital in Washington, D.C. | Rate and yield of blood culture | 140/304 (46.1%) children hospitalized with SSTI had blood culture.<br>3 (2.9%) were true positives.<br>1 (0.7%) was contaminant. |
| Trenchs[9] | 2015 | Retrospective case series | Children aged 0 to 18 years hospitalized with SSTI. | Single urban, tertiary children's hospital in Barcelona, Spain | Rate and yield of blood culture | 353/445 (79.3%) had blood culture.<br>2 (0.6%) were true positives.<br>10 (2.8%) were contaminants. |

Abbreviations: ED, emergency department; IV, intravenous; SSTI, skin and soft tissue infection.

tures of purulent material can identify the causative organism in 58%-66% of the cases.[9,14] The rate of wound culture varies widely from 29% to 81% in studies across different healthcare systems.[9,10,15] The use of visually appealing posters advising clinicians to "culture pus, not blood" has been shown to significantly decreased the number of blood cultures performed at a single pediatric hospital.[10]

## RECOMMENDATIONS

- Do not obtain blood cultures in pediatric patients with uncomplicated SSTIs.
- If purulent material is available spontaneously or after incision and drainage, then send it for Gram stain and bacterial culture.
- Blood cultures are reasonable in patients with complicated SSTIs and in immunocompromised patients with SSTIs.
- Despite limited data, blood cultures may be reasonable in neonates with SSTIs. Febrile infants with SSTIs aged less than 90 days should be managed under existing febrile infant guidelines.

## CONCLUSIONS

Blood cultures in pediatric patients with uncomplicated SSTIs have no proven benefit and are associated with increased LOS, non-negligible false-positive rate, and associated increase in financial charges to the patient and healthcare system. The patient described in the clinical scenario would have an extremely low likelihood of having any meaningful clinical information provided by blood culture as part of her evaluation.

*Do you think this is a low-value practice? Is this truly a "Thing We Do for No Reason?" Share what you do in your practice and join in the conversation online by retweeting it on Twitter (#TWDFNR) and liking it on Facebook. We invite you to propose ideas for other "Things We Do for No Reason" topics by emailing TWDFNR@hospitalmedicine.org.*

Disclosures: The authors have no conflicts of interest relevant to this article to disclose

## References

1. Mistry R, Shapiro D, Goyal M, et al. Clinical management of skin and soft tissue infections in the U.S. Emergency Departments. *West J Emerg Med.* 2014;15(4):491-498. doi:10.5811/westjem.2014.4.20583.
2. Witt WP, Weiss AJ, Elixhauser A. Overview of hospital stays for children in the United States, 2012; Statistical Brief #187. https://www.hcup-us.ahrq.gov/reports/statbriefs/sb187-Hospital-Stays-Children-2012.pdf.
3. Dukic VM, Lauderdale DS, Wilder J, Daum RS, David MZ. Epidemics of community-associated methicillin-resistant Staphylococcus aureus in the United States: a meta-analysis. Otto M, ed. *PLoS One.* 2013;8(1):e52722. doi: 10.1371/journal.pone.0052722.
4. Fleisher G, Ludwig S, Henretig F, Ruddy R, Henry W. Cellulitis: initial management. *Ann Emerg Med.* 1981;10(7):356-359.
5. Fleisher G, Ludwig S, Campos J. Cellulitis: bacterial etiology, clinical features, and laboratory findings. *J Pediatr.* 1980;97(4):591-593. doi: 10.1016/S0022-3476(80)80014-X http://www.ncbi.nlm.nih.gov/pubmed/6775063. Accessed July 26, 2017.

6. Parikh K, Davis AB, Pavuluri P. Do we need this blood culture? *Hosp Pediatr.* 2014;4(2):78-84. doi:10.1542/hpeds.2013-0053.
7. Wathen D, Halloran DR. Blood culture associations in children with a diagnosis of cellulitis in the era of methicillin-resistant Staphylococcus aureus. *Hosp Pediatr.* 2013;3(2):103-107. http://www.ncbi.nlm.nih.gov/pubmed/24340410. Accessed July 26, 2017.
8. Malone JR, Durica SR, Thompson DM, Bogie A, Naifeh M. Blood cultures in the evaluation of uncomplicated skin and soft tissue infections. *Pediatrics.* 2013;132(3):454-459. doi:10.1542/peds.2013-1384.
9. Trenchs V, Hernandez-Bou S, Bianchi C, Arnan M, Gene A, Luaces C. Blood cultures are not useful in the evaluation of children with uncomplicated superficial skin and soft tissue infections. *Pediatr Infect Dis J.* 2015;34(9):924-927. doi:10.1097/INF.0000000000000768.
10. Sloane AJ, Pressel DM. Culture pus, not blood: decreasing routine laboratory testing in patients with uncomplicated skin and soft tissue infections. *Hosp Pediatr.* 2016;6(7):394-398. doi:10.1542/hpeds.2015-0186.
11. Sadow KB, Chamberlain JM. Blood cultures in the evaluation of children with cellulitis. *Pediatrics.* 1998;101(3):E4. doi: 10.1542/peds.101.3.e4 http://www.ncbi.nlm.nih.gov/pubmed/9481023. Accessed July 26, 2017.
12. Stevens DL, Bisno AL, Chambers HF, et al. Executive Summary: practice guidelines for the diagnosis and management of skin and soft tissue infections: 2014 update by the infectious diseases society of America. *Clin Infect Dis.* 2014;59(2):147-159. doi:10.1093/cid/ciu444.
13. Demircioğlu F, Ylmaz S, Oren H, Ozgüven AA, Irken G. Skin and soft tissue complications in pediatric leukemia patients with and without central venous catheters. *J Pediatr Hematol Oncol.* 2008;30(1):32-35. doi:10.1097/MPH.0b013e31815cc429.
14. Ray GT, Suaya JA, Baxter R. Microbiology of skin and soft tissue infections in the age of community-acquired methicillin-resistant Staphylococcus aureus. *Diagn Microbiol Infect Dis.* 2013;76(1):24-30. doi:10.1016/j.diagmicrobio.2013.02.020.
15. Baumann BM, Russo CJ, Pavlik D, et al. Management of pediatric skin abscesses in pediatric, general academic and community emergency departments. *West J Emerg Med.* 2011;12(2):159-167. http://www.ncbi.nlm.nih.gov/pubmed/21691519. Accessed July 26, 2017.