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## Ultrasound in Emergency Medicine

### POINT-OF-CARE ULTRASOUND IS ASSOCIATED WITH DECREASED LENGTH OF STAY IN CHILDREN PRESENTING TO THE EMERGENCY DEPARTMENT WITH SOFT TISSUE INFECTION

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**Abstract—Background:** Point-of-care ultrasound (POCUS) is increasingly being used to differentiate cellulitis from abscess in the pediatric emergency department (ED). POCUS has also been shown to decrease length of stay (LOS) for other applications among adult patients. **Objective:** We sought to determine if ED LOS differed for children presenting with skin and soft tissue infections who received POCUS versus radiology-performed ultrasound. **Methods:** We performed a retrospective cohort study of children presenting to an urban pediatric ED between January 2011 and June 2013 with a diagnosis of cellulitis or abscess who underwent soft tissue ultrasound. Patients who received a surgical consult, had significant medical comorbidities, or had a lesion located on the face, hands, feet, or groin were excluded. We compared ED LOS among children who received radiology-performed ultrasound to children who received POCUS, adjusting for relevant clinical variables. **Results:** Among 3094 children with a diagnosis of cellulitis or abscess, we identified 202 who underwent a POCUS and 118 who underwent radiology-performed ultrasound. The POCUS group had a shorter median LOS than the radiology-performed ultrasound group (adjusted median difference  $-73$  min; 95% confidence interval  $-93.6$  to  $-52.4$  min). In the subset of patients discharged from the ED, this difference was more pronounced (adjusted median difference  $-89$  min; 95% confidence interval  $-109.9$  to  $-68.1$  min). **Conclusion:** Among children presenting to a pe-

diatric ED with superficial skin and soft tissue infections, children receiving POCUS experienced shorter LOS compared to children receiving radiology-performed ultrasound. © 2017 Elsevier Inc. All rights reserved.

**Keywords—**bedside ultrasound; length of stay; pediatrics; point-of-care ultrasound; soft tissue infection

#### INTRODUCTION

Superficial soft tissue infections (SSTIs) are commonly seen in the emergency department (ED) setting. The distinction between abscess and cellulitis is important, because the treatment and need for drainage differ for these two conditions. The decision to incise and drain may require sedation, especially in the pediatric population. Differentiating cellulitis from abscess may be difficult based on clinical findings alone, and sonography may aid clinicians (1–6). Recent studies have shown that point-of-care ultrasound (POCUS) performed on children by emergency physicians for soft tissue infection can improve the sensitivity for detecting abscess when used with physical examination (2,3,7,8).

POCUS is being used with increasing frequency in the pediatric ED and can improve ED throughput (9–12). In contrast, radiology-performed ultrasound is typically performed outside of the ED, which can lead to increased length of stay (LOS). Longer LOSs can contribute to ED crowding and may negatively impact various patient care metrics (10). In this study, we evaluated whether use of POCUS was associated with shorter LOSs compared to radiology-performed ultrasound in children presenting to the pediatric ED with superficial soft tissue infections.

## MATERIALS AND METHODS

### *Study Population*

A retrospective cohort study was performed of children who presented to an urban pediatric ED with an annual volume of 60,000 patients between January 2011 and June 2013 who had a diagnosis of cellulitis or abscess and underwent ultrasound to evaluate for a drainable fluid collection. Patients undergoing either radiology-performed ultrasound or POCUS performed by a pediatric emergency physician were included. Our facility has two mobile ultrasound systems available for clinical use in a 48-bed emergency department. The Department of Radiology performs ultrasound imaging 24 hours per day. Patients who received a surgical consult, had significant medical comorbidities (i.e., immunologic, developmental, surgical, and metabolic abnormalities), or had a lesion located on the face, hands, feet, or groin were excluded. Patients who underwent both POCUS and radiology-performed ultrasound were excluded.

All POCUS sonographers met our division-required criteria for soft tissue ultrasound credentialing, which includes: 1) attendance at a 1- to 2-day ultrasound course or ultrasound training during fellowship and 2) independent, successful performance of at least 25 POCUSs for the evaluation of abscess, all of which were determined to be adequate with respect to image quality and interpretation when reviewed by emergency ultrasound faculty.

This study was approved by the Boston Children's Hospital Institutional Review Board.

### *Data Collection*

Patients were identified by *International Classification of Diseases, 9th revision* codes corresponding to abscess or cellulitis (i.e., 682.2, 682.3, 682.5, 682.6, 682.8, 682.9, 685.0, 685.1, 686.8, 686.9, 709.8, and 709.9). Manual chart review was performed to identify which patients had radiology-performed ultrasound or POCUS. In addition to the *International Classification of Diseases* search, an internal Microsoft Access ultrasound database was reviewed to identify eligible patients with

soft tissue POCUS. Demographic (hour of arrival, age, race, and sex) and clinical information were abstracted from the electronic medical record. Clinical information included the presence of fever, use of procedural sedation, performance of incision and drainage, administration of antibiotics, provider level of training (i.e., trainee involved vs. attending alone), and disposition.

### *Data Analysis*

ED LOS among children who received radiology-performed ultrasound versus POCUS was compared. LOS was defined as time from placement into an examination room to time of discharge for discharged patients or to time of an admission order for hospitalized patients. An initial univariate screen of clinical and demographic variables was performed to test for an association with ultrasound type (radiology-performed vs. POCUS). These clinical variables were selected based on clinical relevance and precedence in the ultrasound literature. The chi-squared test was used for categorical variables, and the median test was used for continuous variables. All variables that were associated at the 0.10 level with ultrasound type as independent variables were included in a multivariable quantile (median) regression model with LOS as the dependent variable. Stata software (version 13.0; StataCorp LP, College Station, TX) was used for our analyses.

## RESULTS

A total of 3094 ED patients with a diagnosis of cellulitis or abscess presenting between January 2011 and June 2013 were identified. Of those, 320 patients met our inclusion criteria and received an ultrasound; 202 underwent POCUS, 118 underwent a radiology-performed ultrasound, and 2 underwent both. Demographic and clinical characteristics of the two groups are shown in [Table 1](#).

For our primary outcome, children undergoing POCUS had a significantly shorter LOS than the radiology-performed ultrasound group ([Table 2](#), [Figure 1](#)). When controlling for variables associated with LOS at the  $p < 0.10$  level with multivariable quantile regression, patients with POCUS had a shorter LOS by 73 min (95% confidence interval [CI] -93.6 to -52.4). Among discharged patients, this difference was even greater, at 89 minutes shorter LOS for patients receiving POCUS (95% CI -109.9 to -68.1 min). For admitted patients, while patients receiving POCUS had a shorter LOS, this difference was not statistically significant (median difference -39 min; 95% CI -87.9-9.42 min).

There were significant differences between the two groups in the proportion of patients that underwent abscess drainage, intranasal anxiolysis, and intravenous

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