

Characterization of Pathogens Isolated from Cutaneous Abscesses in Patients Evaluated by the Dermatology Service at an Emergency Department

Nicole M. Rochet, MD MSc*; Reina M. González-Barreto, BS+; Rafael F. Martín, MD*

Objective: Emergency department (ED) visits for the treatment of skin abscesses have increased with the emergence of community-associated methicillin-resistant *Staphylococcus aureus* (CAMRSA). There is limited information about the bacteriology of cutaneous abscesses evaluated in ED in Puerto Rico. The purpose of our study was to characterize the pathogens cultured from abscesses of patients in the ED consulted to the Dermatology Service of University of Puerto Rico School of Medicine.

Methods: Patients with skin abscesses consulted to the Dermatology Service by the ED of P.R. Medical Center from 2012 to 2017 were included. Data retrieved included demographic information, past medical history, prior antibiotic use, distribution of lesions, and treatment provided. Bacteriology results and antimicrobial susceptibility patterns from cultured skin lesions were recorded.

Results: Ninety patients diagnosed with skin abscess were evaluated. All patients underwent incision and drainage; this was the sole treatment in two patients. The most frequently administered systemic therapy was oral clindamycin in 32 patients (36%). A total of 66 patients (73%) had *S. aureus* isolates, most of them (85%) MRSA. Among the isolates with MRSA, 14.3% were resistant to clindamycin. All MRSA strains were susceptible to tetracycline and vancomycin.

Conclusion: There is a high prevalence of MRSA causing abscesses in the Hispanic population evaluated in an ED in Puerto Rico. Systemic antibiotic use for the treatment of skin abscesses after incision and drainage remains high despite published guidelines arguing against their widespread use. Clindamycin resistance in our patient population appears to be more frequent than previously reported. [P R Health Sci J 2020;39:260-263]

Key words: Abscess, MRSA, Antimicrobial susceptibility, Emergency department

The incidence of emergency department (ED) visits for the treatment of skin abscesses has increased with the emergence of community-associated methicillin-resistant *Staphylococcus aureus* (CAMRSA) (1). The rise in multidrug-resistant strains and inadequate antibiotic treatment has significantly increased the morbidity rates and healthcare costs associated with these infections (2). It is estimated that in the United States alone, more than 4 million visits to the emergency department (ED) annually are for the treatment of skin infections (3).

The rates of skin infections caused by CAMRSA vary significantly among countries. A Latin American study reported an incidence of 46.9% methicillin-resistant *Staphylococcus aureus* isolates collected from 13 countries from 2004 to 2010. Their study sample included 23 patients from a single center in Puerto Rico and they found that 73.9% of isolates were caused by MRSA (4). However, this study was not limited to cutaneous abscesses and their sources included urine, blood,

skin, wounds, and other body fluids. Although this study reports a high prevalence of MRSA, little is known about the frequency of cutaneous abscesses, their bacteriological characteristics and their respective antibiotic sensitivities in the ED setting of Puerto Rico.

Incision and drainage (I&D) is the first-line treatment according to current guidelines for the management of skin abscesses (5). Systemic antibiotics should be given to patients with the following findings: severe or extensive disease

*Department of Dermatology, +School of Medicine, University of Puerto Rico, Medical Sciences Campus, San Juan, Puerto Rico

The authors have no conflict of interest to disclose.

Address correspondence to: Rafael F. Martín, MD, Department of Dermatology, Department of Dermatology, School of Medicine, University of Puerto Rico Medical Sciences Campus, PO Box 365067 San Juan, PR 00936-5067. Email: rafaelmartin@gmail.com

(single abscess ≥ 2 cm or multiple); extensive surrounding cellulitis (> 5 cm diameter); rapid disease progression; patients with signs and symptoms of systemic illness; patients with immunosuppression or other comorbidities; abscesses in areas that are difficult to drain; failure to improve with I&D alone; and the presence of indwelling medical devices (5). Although the primary treatment of skin abscesses continues to be I&D, the rising incidence of CAMRSA has complicated the choices of initial empiric antibiotic therapy. Therefore, clinicians must be aware of the resistance patterns in their community.

To our knowledge, there are no studies addressing the epidemiology, bacteriology and antibiotic sensitivities of cutaneous abscesses of patients evaluated in an ED setting in Puerto Rico. As the epidemiology of skin infections is continually evolving, the purpose of our study was to characterize the type and frequency of pathogens isolated from cutaneous abscesses and their corresponding antibiotic susceptibility profiles in patients evaluated by an academic dermatology service in a supra-tertiary ED in Puerto Rico.

Materials and Methods

After approval by the University of Puerto Rico Institutional Review Board, a retrospective chart review was conducted between July 2012 and May 2017. All patients with a diagnosis of skin abscess evaluated by Department of Dermatology of the University of Puerto Rico at the ED of the Puerto Rico Medical Center were included. We recorded the following data from the medical records: age, gender, past medical history, prior antibiotic use, prior history of skin infections, distribution and description of skin lesions, and treatment provided. All cases included in our cohort had microbiological culture from the skin lesion obtained using a sterile swab. Microbiology results and antimicrobial susceptibility information were recorded and evaluated.

Continuous variables were summarized with means, medians, and ranges. Categorical variables were reported using proportions and percentages. All the analyses were made using software JMP (version 13 for Macintosh).

Results

Ninety patients skin abscesses (total: 90 skin abscesses) were included. The mean age at diagnosis was 40 years (median 39 years; range 16 – 95 years) (Table 1). Fifty-eight patients (64%) were males and 32 (36%) were females (Table 1). Forty-four subjects (49%) had no prior history of a systemic disease at time of evaluation (Table 1). Diabetes mellitus type 2 was the most common pre-existing condition reported by 13 (14%) patients. Two patients (2%) had a diagnosis of human immunodeficiency virus, 1 patient (1%) had atopic dermatitis and another patient (1%) was an intravenous drug user (Table 1). Most patients (82; 91%) had lesions on head and neck area, followed by 3 (3%) on the upper extremities, 3 (3%) on the lower extremities

and 2 (2%) on the trunk (Table 1). The lesions at the time of initial evaluation at our institution were described as fluctuant nodule (67%), fluctuant plaque (21%), indurated nodule (7%), or indurated plaque (3%). Other less common lesions reported were multiple crusted draining nodules (1%) and pustules (1%) (Table 1).

Table 1. Characteristics and features of Emergency Department patients with cutaneous abscess

Characteristics	No. of patients (%)
Sex	
Female	32 (36%)
Male	58 (64%)
Age of onset, y	
Mean	40
Median	39
Range	16-95
Past medical history	
Diabetes mellitus II	13 (14%)
HIV	2 (2%)
Atopic dermatitis	1 (1%)
Intravenous drug abuse	1 (1%)
None	44 (49%)
Location of lesions	
Head & neck	82 (91%)
Upper extremities	3 (3%)
Lower extremities	3 (3%)
Trunk	2 (2%)
Description of lesions	
Fluctuant nodule	60 (67%)
Fluctuant plaque	19 (21%)
Indurated nodule	6 (7%)
Indurated plaque	3 (3%)
Multiple crusted draining nodules	1 (1%)
Pustules	1 (1%)

All patients in our cohort had I&D as part of their initial management. Only two patients (2%) had I&D without receiving adjuvant antibiotic therapy; all others had both I&D and adjuvant antibiotic treatment as part of their management. The most common initial recommended systemic therapy was clindamycin (63 patients, 70%). Other adjuvant systemic antibiotics recommended included minocycline (14%), vancomycin (7%), doxycycline (4%) and piperacillin/tazobactam (1%) (Table 2).

Table 2. Treatment of patients with cutaneous abscesses after incision and drainage

Treatment	No. (%)
Clindamycin (total)	63 (90%)
Clindamycin (oral)	32 (36%)
Clindamycin (intravenous)	31 (34%)
Minocycline	13 (14%)
Vancomycin	6 (7%)
Doxycycline	4 (4%)
Piperacillin/Tazobactam	1 (1%)
Mupirocin ointment	1 (1%)
No antibiotic	2 (2%)

S. aureus was isolated in 66 patients (73%) (Table 3). Of these, 56 (85%) grew MRSA. Among the cases with culture proven MRSA, 14.3% were resistant to clindamycin and 1.8% to trimethoprim/sulfamethoxazole. All MRSA strains were susceptible to tetracycline, vancomycin and gentamicin (Table 4).

A majority of patients (66%) received ambulatory treatment; one third (34%) of patients required hospitalization for intravenous antibiotic therapy. Significant leukocytosis was the most frequent criteria for hospitalization. The patients who required hospitalization were found to have history of other medical conditions, most commonly diabetes mellitus type 2, when compared with patients that received ambulatory treatment.

Table 3. Bacterial isolated from Emergency Department patients with cutaneous abscesses

Pathogens	No. (%)
Staphylococcus aureus	66 (73%)
MRSA	56 (85%)
MSSA	10 (15%)
Staphylococcus epidermidis	3 (3%)
Normal flora	2 (2%)
Streptococcus intermedius	1 (1%)
Staphylococcus lugdunensis	1 (1%)
Pseudomonas aeruginosa	1 (1%)
Proteus mirabilis	1 (1%)
Klebsiella pneumonia	1 (1%)
Bacteroides fragilis	1 (1%)
Bacillus species	1 (1%)
Actinomyces naeslundii	1 (1%)
Peptostreptococcus asacharolyticus	1 (1%)
No growth	10 (11%)

Table 4. Antimicrobial resistance rates for MRSA isolated from cutaneous abscesses in dermatology patients evaluated at the emergency department

Antibiotic	No. (%) (N = 56)
Tetracycline	0 (0%)
Gentamicin	0 (0%)
Vancomycin	0 (0%)
TMP-SMX	1 (1.8%)
Clindamycin	8 (14.3%)
Ciprofloxacin	44 (78.6%)
Erythromycin	47 (83.9%)
Piperacillin/tazobactam	56 (100%)
Benzylpenicillin	56 (100%)
Oxacillin	56 (100%)

Discussion

As the incidence of skin abscesses has increased, so has the frequency of CAMRSA infections. Previous studies evaluating the frequency of MRSA in skin abscesses of patients presenting to ED's across the US have reported rates varying from 51.3 to 63% (6-8). A study by Garza-Gonzalez et al (9) described a 73.9% frequency of MRSA in samples from Puerto Rico, the

highest among other Latin American countries studied. When compared to these studies, we found an even higher frequency (85%) of MRSA in skin abscesses from patients of a Hispanic origin. The observed variations in frequency rates of MRSA infections among studies may reflect different inclusion criteria and/or different populations evaluated.

Several risk factors are known to increase a patient's propensity to acquire skin infections (10). Such factors include: underlying chronic skin diseases, HIV, diabetes, immune deficiencies, lymphedema, obesity, poor renal function, and neutropenia (11). In our study, diabetes mellitus type 2 was the most common pre-existing condition reported (14%). Other conditions identified in our patient cohort that may have increased their risk of cutaneous skin abscesses included HIV, atopic dermatitis, and intravenous drug use. Low socioeconomic status, overcrowding, poor hygiene, limited water availability, hot and humid weather conditions, and sharing of personal items, which are more common in tropical countries, may also play a role in the increased risk of *S. aureus* infections (12).

Current treatment guidelines published by the Infection Diseases Society of America (IDSA) recommend I&D as first-line therapy for the treatment of skin abscesses (5). As per these established guidelines, adjuvant systemic antibiotics should be administered if the patient has one of the following: severe or extensive disease (single abscess ≥ 2 cm or multiple), extensive surrounding cellulitis (> 5 cm diameter), rapid disease progression, signs and symptoms of systemic illness, immunosuppression or other comorbidities, abscess in areas that are difficult to drain, failure to improve with I&D alone, and/or presence of indwelling medical devices (5). Multiple studies have demonstrated that I&D alone has a high cure rate of approximately 85% (6), therefore adjuvant systemic antibiotic treatment may not be needed if none of the factors mentioned above are present. In our study, all the patients had I&D as initial management and most of them (97%) received systemic antibiotic therapy. Due to the retrospective nature of the study and limited available data, we could not determine if those patients who received antibiotics satisfied the proposed IDSA criteria for the use of adjuvant systemic antibiotic therapy. The rate of systemic antibiotic treatment after I&D reported in our study is comparable to other published studies in the US, in which approximately 85% of cases of skin abscesses were also treated with adjuvant systemic antimicrobial therapy (12). Despite clear published guidelines, the use of systemic antibiotic therapy following I&D of cutaneous abscesses appears to be widespread (12).

The antibiotic susceptibility patterns of MRSA in our population resulted similar to Talan et al's study from 12 U.S. emergency departments (8). Both studies revealed a 100% susceptibility rate to tetracyclines and similarly high susceptibility rates (96 vs. 98%) to TMP-SMX. Additionally, our study revealed lower susceptibility rates to clindamycin (83.9%) when compared to another study from the US (83.9 vs. 94%). (8) In our study, clindamycin was the most commonly prescribed

antibiotic (70% of cases), while tetracyclines were used in 18% of the cases. Resistance to clindamycin in our study population may become problematic in the future, given its frequent use and a relatively high resistance rate of 14.3%. Nevertheless, studies have found other populations with higher clindamycin resistance rates (8,13,14).

Our study has several limitations. The retrospective nature of the study prevented us from evaluating treatment efficacy and compliance with currently established guidelines for the use of systemic antibiotics in the management of skin abscesses. The small sample size from a single referral center limits extrapolation of our results to other populations, including patients seen in outpatient dermatology clinics.

In summary, our study found an increased frequency of skin abscesses caused by MRSA among a Hispanic patient population evaluated at a tertiary academic center ED. Despite current guidelines recommendations, systemic antibiotic use in the treatment of skin abscesses after I&D remains high. Further prospective studies of patients with skin abscesses presenting to emergency departments from different regions of Puerto Rico should be undertaken in order to confirm our findings, evaluate the efficacy of management, and examine physician compliance with recommended guidelines for the treatment of cutaneous abscesses. The results from this study should serve to educate dermatologists and practitioners in general about the epidemiology, bacteriology and antibiotic susceptibility profiles of bacteria causing cutaneous abscesses in Puerto Rico, which should translate into more appropriate and effective patient management.

Resumen

Objetivos: La cantidad de visitas a salas de emergencia para tratamiento de abscesos cutáneos ha aumentado con el surgimiento de *Staphylococcus aureus* asociado a la comunidad. Información sobre la bacteriología de abscesos cutáneos evaluados en salas de emergencia en Puerto Rico es limitada. El propósito del estudio fue caracterizar patógenos cultivados de abscesos en piel de pacientes evaluados por el servicio de dermatología de la Escuela de Medicina de la Universidad de Puerto Rico en la sala de emergencia. **Métodos:** Todos los pacientes consultados al servicio de dermatología por abscesos cutáneos en la sala de emergencia del Centro Médico de P.R. desde julio 2012 hasta mayo 2017 fueron incluidos. La data obtenida incluyó información demográfica, historial médico, uso previo de antibióticos, distribución de lesiones cutáneas y tratamiento recibido. Los resultados bacteriológicos y patrones de susceptibilidad antibacteriana provenientes de los cultivos realizados fueron recopilados. **Resultados:** Se evaluaron noventa pacientes con abscesos cutáneos. Todos fueron manejados con incisión y drenaje y la gran mayoría (88/90)

recibió antibióticos sistémicos. El antibiótico sistémico más frecuentemente administrado fue clindamicina oral en 32 pacientes. Se aisló *S. aureus* en un total de 66 pacientes (73%). De éstos, 85% tenía cepas resistentes a meticilina con un 14.3% de ellas resistentes a clindamicina. **Conclusiones:** Se encontró una más alta prevalencia de *S. aureus* resistente a meticilina en abscesos cutáneos en una población primordialmente hispana. El número de pacientes tratados con antibióticos sistémicos luego de incisión y drenaje fue alto.

References

- Pallin DJ, Egan DJ, Pelletier AJ, Espinola JA, Hooper DC, Camargo CA, Jr. Increased US emergency department visits for skin and soft tissue infections, and changes in antibiotic choices, during the emergence of community-associated methicillin-resistant *Staphylococcus aureus*. *Ann Emerg Med* 2008;51:291-308.
- Olaniyi R, Pozzi C, Grimaldi L, Bagnoli F. *Staphylococcus aureus*-Associated Skin and Soft Tissue Infections: Anatomical Localization, Epidemiology, Therapy and Potential Prophylaxis. *Curr Top Microbiol Immunol* 2017;409:199-227.
- Nawar EW, Niska RW, Xu J. National Hospital Ambulatory Medical Care Survey: 2005 emergency department summary. *Adv Data* 2007;386:1-32.
- Moet GJ, Jones RN, Biedenbach DJ, Stilwell MG, Fritsche TR. Contemporary causes of skin and soft tissue infections in North America, Latin America, and Europe: report from the SENTRY Antimicrobial Surveillance Program (1998-2004). *Diagn Microbiol Infect Dis* 2007;57:7-13.
- Liu C, Bayer A, Cosgrove SE, et al. Clinical practice guidelines by the infectious diseases society of america for the treatment of methicillin-resistant *Staphylococcus aureus* infections in adults and children. *Clin Infect Dis* 2011;52:e18-55.
- Singer AJ, Talan DA. Management of skin abscesses in the era of methicillin-resistant *Staphylococcus aureus*. *N Engl J Med* 2014; 370:1039-1047.
- Jacobus CH, Lindsell CJ, Leach SD, Fermann GJ, Kressel AB, Rue LE. Prevalence and demographics of methicillin resistant *Staphylococcus aureus* in culturable skin and soft tissue infections in an urban emergency department. *BMC Emerg Med* 2007;7:19.
- Talan DA, Krishnadasan A, Gorwitz RJ, et al. Comparison of *Staphylococcus aureus* from skin and soft-tissue infections in US emergency department patients, 2004 and 2008. *Clin Infect Dis* 2011;53:144-149.
- Garza-Gonzalez E, Dowzicky MJ. Changes in *Staphylococcus aureus* susceptibility across Latin America between 2004 and 2010. *Braz J Infect Dis* 2013;17:13-19.
- Moran GJ, Krishnadasan A, Gorwitz RJ, et al. Methicillin-resistant *S. aureus* infections among patients in the emergency department. *N Engl J Med* 2006;355:666-674.
- Rajendran PM, Young D, Maurer T, et al. Randomized, double-blind, placebo-controlled trial of cephalexin for treatment of uncomplicated skin abscesses in a population at risk for community-acquired methicillin-resistant *Staphylococcus aureus* infection. *Antimicrob Agents Chemother* 2007;51:4044-4048.
- Prusakowski MK, Kuehl DR. Trends in emergency department management of skin abscesses. *Am J Infect Control* 2015;43:336-340.
- Szumowski JD, Cohen DE, Kanaya F, Mayer KH. Treatment and outcomes of infections by methicillin-resistant *Staphylococcus aureus* at an ambulatory clinic. *Antimicrob Agents Chemother* 2007;51:423-428.
- Han LL, McDougal LK, Gorwitz RJ, et al. High frequencies of clindamycin and tetracycline resistance in methicillin-resistant *Staphylococcus aureus* pulsed-field type USA300 isolates collected at a Boston ambulatory health center. *J Clin Microbiol* 2007;45:1350-1352.