

Original Article

Microbiology of pediatric soft tissue abscesses presenting to a Low-Middle Income Country

Saman Hamid,^{*1} Kashaf Khalid,² Areej Salim,² Muhammad Arshad²

1. Medical College, The Aga Khan University, Karachi, Pakistan
2. Department of Surgery, The Aga Khan University Hospital, Karachi, Pakistan

Cite as: Hamid S, Khalid K, Salim A, Arsad M. Microbiology of pediatric soft tissue abscesses presenting to a Low-Middle Income Country. J Pediatr Adolesc Surg. 2025; 3: 3-6.

This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited (<https://creativecommons.org/licenses/by/4.0/>).

ABSTRACT

Background: Skin and Soft Tissue Infections (SSTIs) are a prevalent and diverse group of clinical conditions, ranging from simple abscesses to severe cellulitis, often involving microbial invasion of skin and underlying soft tissues. Understanding the microbiology and antibiotic sensitivities of these infections is essential for effective management.

Methods: A retrospective cross-sectional study was conducted at The Aga Khan University Hospital in Pakistan. Data from 154 pediatric patients aged up to 17 years diagnosed with soft tissue abscesses were reviewed between January 2015 and June 2019. Exclusion criteria were applied to ensure the study's accuracy.

Results: Among the 121 included patients, the majority were male (57.9%), and children less than one year of age accounted for the highest percentage (43%). The most frequently affected anatomical sites were the legs and thighs (17.3%), followed by the buttocks (15.7%) and arms/forearms (13.2%). Staphylococcus Aureus was the most common pathogen (64.5%), with 89.7% being Methicillin-Sensitive Staphylococcus Aureus (MSSA) and 11.3% MRSA. Other pathogens included Streptococci, Escherichia coli, and anaerobic Bacteroides species.

Conclusion: MRSA remains a concern in pediatric SSTIs, necessitating targeted antibiotic therapy. However, MSSA was the primary pathogen and empirical antibiotic therapy remains crucial, guided by culture results. Improving injection safety practices is essential for reducing SSTI incidence. This study contributes valuable insights for optimizing SSTI management and underscores the need for evidence-based decisions in resource-constrained settings.

Keywords: Abscess, Organisms, Pediatric, Low middle-income country, Surgery

INTRODUCTION

Skin and Soft tissue infections (SSTIs) vary in presentation, etiology, and severity, involving microbial invasion of skin layers and soft tissues, ranging from simple furuncles to complex gangrene. A 2015 study reported 14.2 million SSTI-related hospital encounters in the U.S., with increasing trends. [1,2] SSTIs often necessitate surgical interventions and are prevalent in pediatric hospitalizations, ranking eighth as a cause. [3] Over the past decade, pediatric SSTI hospital visits have risen, doubling admission rates. [1]

These infections, typically caused by commensal skin bacteria, correlate with the depth of skin structure involvement. [4,5] SSTI incidence is rising, partly due to Methicillin-Resistant Staphylococcus Aureus (MRSA)

emergence. Staphylococcus Aureus is the most common cause, but other pathogens contribute. [3,6] Limited diagnostics and variable factors complicate choosing empirical antimicrobial therapy. [7,8]

The article emphasizes treating MRSA with broad-spectrum antibiotics, highlighting its characteristics, including tissue necrosis. MRSA infections can lead to septicemia and organ spread. [9] The study explores MRSA prevalence in pediatric abscesses in Pakistani hospitals. In Low-to-Middle Income Countries (LMICs) like Pakistan, cultures are underutilized due to healthcare costs. The study addresses the lack of literature on soft tissue abscess microbiology in LMIC pediatric populations, providing essential local data for evidence-based decision-making in a resource-constrained setting.

METHODS

This is a retrospective cross-sectional study conducted in the Pediatric surgery unit of The Aga Khan University Hospital with Ethics Review Committee approval. Data were collected from independent patient files and an online healthcare portal database.

Records of 154 pediatric patients (up to 17 years of age) diagnosed with soft tissue abscesses from 1st January 2015 to 30th June 2019, presenting to AKUH via emergency room &/or outpatient clinics &/or transfer of services from pediatric medicine team to pediatric surgery team were reviewed. Thirty-three (33) patients were excluded from the study based on the specified exclusion criteria which were the following: secondary site infections, patients leaving against medical advice, children with comorbid conditions, incomplete medical records, and absence of culture and sensitivity reports.

The primary outcome of this study was to evaluate the most common pathogens involved in pediatric skin and soft tissue abscesses and to evaluate their antibiotic sensitivities. The secondary outcomes included finding the most commonly involved sites for abscesses. We also evaluated the incidence of MRSA presenting to our hospital.

Statistical Analysis: Data analysis was done using IBM SPSS Statistics for Windows, version 23 (IBM Corp., Armonk, NY). We compared the patient characteristics and clinical outcomes.

RESULTS

There were 154 children, aged 0-17 years, diagnosed with soft tissue abscesses, out of which, 121 were included in this study after meeting the inclusion criteria.

The majority of the patients, 57.9% (n=70) were male patients and the remaining 42.1% (n=51) were female. The most common age group was less than 1 year of age 43% (n=52), followed by 1-5 years of age 39.7% (n=48). The mean age of patients was 2.9 years. All the patients presented with complaints of swelling and tenderness at the abscess site, and only 31.4% (n=38) of patients reported having systemic symptoms like fever.

The most common sites include the lower limb in 17.3% (n=21), the buttocks in 15.7% (n=19), and the upper limb in 13.2% (n=16) of the patients. Other commonly involved abscess sites included the face, perianal region, chest, scalp, and inguinal region.

All patients in this study underwent incision and drainage of the soft tissue abscess and drainage products were sent for culture and sensitivity reporting. Table 1 illustrates the results of the pus cultures and the growth of microorganisms. The most common organism yielded was *Staphylococcus Aureus*, which accounted for a total of 64.5% (n=78) of patients. Out of

this growth, further analysis revealed that out of all *Staphylococcus Aureus* species, an overwhelming majority of 89.7% (n=70/78) was Methicillin Sensitive *Staphylococcus Aureus* (MSSA) and only 11.3% (n=8/78) were MRSA species. The next most common species were *Streptococci*, followed by gram-negative *Escherichia coli* and anaerobic *Bacteroides* species, as shown in Table 1. In 25.6% (n=31) patients, culture results yielded no growth of organisms.

Table 1. Pus Cultures and growth of Organisms

No growth	31 (25.6%)
Methicillin Sensitive <i>Staphylococcus Aureus</i>	70 (57.9%)
Methicillin Resistant <i>Staphylococcus Aureus</i>	08 (6.6%)
<i>Streptococcus</i> Species	05 (4.1%)
<i>Escherichia Coli</i>	02 (1.7%)
<i>Bacteroides</i>	02 (1.7%)
Others	03 (2.5%)

Table 2 shows the antimicrobial susceptibility of MSSA vs MRSA for common antibiotics. MSSA was more sensitive to generally all antibiotics for MRSA. MRSA species showed great resistance to erythromycin, levofloxacin, fusidic acid, gentamicin, and tetracyclines. Both MRSA and MSSA have 100% sensitivity to Vancomycin, which was used in MRSA patients with greater resistance.

Table 2 Antimicrobial susceptibility for MSSA/MRSA

	CLI	ERY	LVX	FA	GEN	TET	VAN
MSSA	100 %	60%	62.5 %	77.1 %	75.7 %	61.4 %	100 %
MRSA	88.9 %	37.5 %	52.9 %	50%	62.5 %	62.5 %	100 %

Broad-spectrum antibiotic therapy was started for each patient, and the antibiotic was switched after culture and sensitivity results if there was a need for that. The most commonly prescribed antibiotic was for coverage of MSSA. Amoxicillin in combination with clavulanic acid was prescribed to 52.1% (n=63) of patients. This was followed by clindamycin in 28.9% (n=35) of patients. For more complicated abscesses and MRSA, linezolid (8.3%) and vancomycin (2.5%) were prescribed. The average length of the antibiotic treatment was 7 days for most patients and was only taken up to 10 days if the patient still had residual symptoms on their first follow-up to the clinic seven days post-surgery.

Out of all the patients, the majority 95.9% (n=116 patients) were treated completely without any

complications, and only in 4.1% (n=5 patients) did some complications arise. The main complication which resulted in incomplete treatment was a recurrence of the abscess, which was then further treated by a second incision and drainage procedure and also resulted in prolonged antibiotic course in these patients.

DISCUSSION

There is a dearth of data on pediatric skin and soft tissue abscesses, particularly in the context of a Low-to-Middle Income Country (LMIC) like Pakistan. To our knowledge, this is the first chart review study conducted in Southeast Asia to investigate the microbiology of soft tissue abscesses and assess the efficacy of current treatment guidelines. Given the paucity of overall management, this research aims to strengthen the implementation of guidelines.[10-12]

In this study, all hospitalized patients diagnosed with a soft tissue abscess requiring incision and drainage were included. The efficacy of incision and drainage alone or in combination with antibiotic treatment has been extensively studied. At our hospital, the standard inpatient incision and drainage procedure were performed under local or general anesthesia in an operating room, following strict precautions. Pus samples from all patients were sent for culture and sensitivity, and standard post-procedure care was administered, including wound washing with normal saline, packing of the abscess cavity, and sterile dressing. This uniform procedure was applied to all study participants, and antibiotics (including combinations of CLI=Clindamycin, ERY=Erythromycin, LVX=Levofloxacin, FA=Fusidic Acid, GEN=Gentamicin, TET=Tetracycline, VAN=Vancomycin), were initiated post-procedure.[13,14]

The primary study outcome was to identify the most common microorganisms and their antibiotic susceptibility in causing pediatric soft tissue abscesses. Our findings indicate *Staphylococcus aureus* as the predominant organism, consistent with its global prevalence in skin infections across age groups and geographical areas. [15-17] *Staphylococcus* species, predominantly methicillin-sensitive, were the most frequently isolated pathogens in our population.

The history of treating *Staphylococcus aureus* is marked by resistance development to various antimicrobial classes, complicating therapy. [18,19] While methicillin-sensitive *Staphylococcus aureus* (MSSA) infections were effectively treated with beta-lactam antibiotics, such as amoxicillin, a small proportion presented as methicillin-resistant *Staphylococcus aureus* (MRSA) cases,

constituting 6.6% of all abscess cases. MRSA infections were managed with linezolid or vancomycin. [20,21]

Our secondary objective was to identify major abscess sites, with thighs, legs, buttocks, and arms being the most commonly affected areas. Intramuscular injections, often administered at these sites, were linked to abscess development. The majority of affected children were under 5 years old, coinciding with the peak vaccination period, indicating a potential association between injections and abscess formation. Poor skin hygiene practices post-injection, prevalent in LMICs like Pakistan, contribute to this issue. Educating healthcare professionals on proper injection practices could significantly reduce the incidence of skin and soft tissue abscesses.

The study's strength lies in being the first of its kind in local setups, addressing a significant pediatric surgical concern with a rising trend. It also assesses the alignment of our management practices with global guidelines. However, a notable limitation is the single-center nature of the study, conducted in a private hospital, potentially reducing the sample size, as non-affording patients might seek care elsewhere.

CONCLUSION

Our data proves that incision and drainage of the abscess followed by a course of beta-lactam sensitive antibiotics lead to complete resolution of the abscess and should be the mainstay of treatment in a burdened LMIC where not all specimens drained could be sent for culture and analysis. This study also reports the prevalence of MRSA in pediatric soft tissue abscesses, which should be paired with stronger antibiotics like oxazolidinones or glycopeptides for complete disease resolution. We found the major sites involved with abscesses and concluded that one of the causes of these abscesses forming could be unsafe intramuscular vaccines and medications given, which allow entry of the pathogen leading to the formation of an abscess cavity. This could greatly be reduced by performing safer procedures and highlighting and educating the healthcare professionals involved in administration

Conflict of Interest: Nil

Source of Support: Nil

Consent to Publication: No clinical figure is being used in this manuscript.

Authors Contribution: Author(s) declared to fulfill authorship criteria as devised by ICMJE and approved the final version. Authorship declaration form, submitted by the author(s), is available with the editorial office.

Acknowledgements: None

REFERENCES

1. Hersh AL, Chambers HF, Maselli JH, et al. National trends in ambulatory visits and antibiotic prescribing for skin and soft-tissue infections. *Arch Intern Med*.

2008;168(14):1585-91.
10.1001/archinte.168.14.1585.

doi:

2. Moran GJ, Krishnadasan A, Mower WR, et al. Effect of cephalexin plus trimethoprim-sulfamethoxazole vs cephalexin alone on clinical cure of uncomplicated cellulitis: A randomized clinical trial. *JAMA*. 2017;317(20):2088-96. doi: 10.1001/jama.2017.5653.
3. Keren R, Luan X, Localio R, et al. Pediatric research in inpatient settings (PRIS) network. Prioritization of comparative effectiveness research topics in hospital pediatrics. *Arch Pediatr Adolesc Med*. 2012;166(12):1155-64.
4. Burnham JP, Kollef MH. Treatment of severe skin and soft tissue infections: a review. *Curr Opin Infect Dis*. 2018;31(2):113-9. doi: 10.1097/QCO.0000000000000431.
5. Talan DA, Mower WR, Krishnadasan A, et al. Trimethoprim-sulfamethoxazole versus placebo for uncomplicated skin abscess. *N Engl J Med*. 2016;374(9):823-32. doi: 10.1056/NEJMoa1507476.
6. Jenkins TC, Knepper BC, Sabel AL, et al. Decreased antibiotic utilization after implementation of a guideline for inpatient cellulitis and cutaneous abscess. *Arch Intern Med*. 2011;171(12):1072-9. doi: 10.1001/archinternmed.2011.29.
7. Crisp JG, Takhar SS, Moran GJ, et al. Inability of polymerase chain reaction, pyrosequencing, and culture of infected and uninfected site skin biopsy specimens to identify the cause of cellulitis. *Clin Infect Dis*. 2015;61:1679-87.
8. McMullan BJ, Andresen D, Blyth CC, et al. Antibiotic duration and timing of the switch from intravenous to oral route for bacterial infections in children: systematic review and guidelines. *Lancet Infect Dis*. 2016;16(8):e139-52. doi: 10.1016/S1473-3099(16)30024-X.
9. Russo A, Concia E, Cristini F, et al. Current and future trends in antibiotic therapy of acute bacterial skin and skin-structure infections. *Clin Microbiol Infect*. 2016;22 Suppl 2:S27-36. doi: 10.1016/S1198-743X(16)30095-7.
10. Vermandere M, Aertgeerts B, Agoritsas T, et al. Antibiotics after incision and drainage for uncomplicated skin abscesses: A clinical practice guideline. *BMJ*. 2018;360:k243. doi: 10.1136/bmj.k243.
11. Ramakrishnan K, Salinas RC, Agudelo Higuaita NI. Skin and soft tissue infections. *Am Fam Physician*. 2015;92(6):474-83.
12. Duong M, Markwell S, Peter J, et al. Randomized, controlled trial of antibiotics in the management of community-acquired skin abscesses in the pediatric patient. *Ann Emerg Med*. 2010;55(5):401-7. doi: 10.1016/j.annemergmed.2009.03.014.
13. Llera JL, Levy RC. Treatment of cutaneous abscess: a double-blind clinical study. *Ann Emerg Med*. 1985;14(1):15-9. doi: 10.1016/s0196-0644(85)80727-7.
14. Hogan PG, Rodriguez M, Spenner AM, et al. Impact of systemic antibiotics on staphylococcus aureus colonization and recurrent skin infection. *Clin Infect Dis*. 2018;66(2):191-7. doi:10.1093/cid/cix754.
15. Del Giudice P. Skin Infections caused by staphylococcus aureus. *Acta Derm Venereol*. 2020;100(9):adv00110. doi: 10.2340/00015555-3466.
16. Lawrence KR, Golik MV, Davidson L. The role of primary care prescribers in the diagnosis and management of community-associated methicillin-resistant Staphylococcus aureus skin and soft tissue infections. *Am J Ther*. 2009;16(4):333-8. doi: 10.1097/MJT.0b013e31817fdea8.
17. David MZ, Daum RS. Treatment of staphylococcus aureus infections. *Curr Top Microbiol Immunol*. 2017;409:325-83. doi: 10.1007/82_2017_42.
18. Natsis NE, Cohen PR. Coagulase-negative staphylococcus skin and soft tissue infections. *Am J Clin Dermatol*. 2018;19(5):671-7. doi: 10.1007/s40257-018-0362-9.
19. Alm RA, McLaughlin RE, Kos VN, et al. Analysis of staphylococcus aureus clinical isolates with reduced susceptibility to ceftaroline: an epidemiological and structural perspective. *J Antimicrob Chemother*. 2014;69(8):2065-75.
20. Berens P, Swaim L, Peterson B. Incidence of methicillin-resistant Staphylococcus aureus in postpartum breast abscesses. *Breastfeed Med*. 2010;5(3):113-5.
21. Alonzo F 3rd, Torres VJ. The bicomponent pore-forming leukocidins of Staphylococcus aureus. *Microbiol Mol Biol Rev*. 2014;78(2):199-230.