Research Article

Microbiological analysis of skin and soft tissue infections in children presenting to a paediatric tertiary care centre in Sri Lanka

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Abstract

Introduction: Skin and soft tissue infections (SSTIs) are a common cause of hospitalisation in children. They are diverse in spectrum, ranging from impetigo and abscesses to life threatening necrotising infections. The main pathogens associated with SSTIs are *Staphylococccus aureus* and *Streptococcus pyogenes*. Emergence of community acquired methicillin resistant *S. aureus* (CA-MRSA) is of major concern when antibiotics are required, and it is important to know the prevalence of these pathogens in different geographic locations. This study was done with the aim of identifying and characterising the common bacterial pathogens implicated in SSTIs in children presenting to Sirimavo Bandaranaike Children's Hospital (SBSCH), Peradeniya, Sri Lanka, which is one of the two paediatric referral hospitals in Sri Lanka.

Method: A retrospective, descriptive study analysed data gathered from request forms accompanying pus and tissue sent for culture from patients with SSTIs to the SBSCH microbiology laboratory during a period of 13 months from January 2021 to January 2022.

Results: Two hundred and ninety samples were received from suspected SSTIs of which 197 (67.9%) were positive for bacterial growth, with *S. aureus* present in 163 (83%). Methicillin resistant *S. aureus* (MRSA) was isolated from 113 (57%) and methicillin sensitive *S. aureus* (MSSA) from 50 (25%). The frequency of coliforms, *Pseudomonas* spp., and Group A streptococcus were 31 (16%), 3 (1.5%) and 4 (2%) respectively. Sensitivity of MRSA isolates to cotrimoxazole, clindamycin, ciprofloxacin and erythromycin were 97%, 86%,72% and 29% respectively. Among MSSA isolates, 94% were sensitive to cotrimoxazole, while sensitivity to clindamycin, ciprofloxacin and erythromycin were 74%, 67% and 40% respectively.

Conclusion: MRSA was the most frequent pathogen associated with purulent SSTIs in children, followed by MSSA. One fourth of MSSA were resistant to ciprofloxacin and clindamycin.

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Ciprofloxacin and clindamycin resistance in MRSA was 15% and 28% respectively.

Key words: Skin and soft tissue infections (SSTIs), MRSA, MSSA, Sri Lanka

Introduction

Skin and soft tissue infections (SSTI) are a major cause of hospitalisation in children.[1] The spectrum of disease has wide variation ranging from exclusive skin involvement to involvement of deeper tissues, and in severity from mild to life threatening infections. SSTIs are broadly categorised as purulent (abscess, carbuncles, furuncles) and non-purulent (cellulitis, necrotising infections). *S. aureus* and Group A streptococci are the traditional pathogens implicated in SSTIs and most empiric regimens are based on this assumption.[2] However, in more recent studies, Gram negatives and mixed pathogens are being increasingly reported in certain risk groups.[3]

Most importantly, the proportion of MRSA associated with SSTIs has significantly risen with the emergence of community acquired MRSA.[4] CA-MRSA is notorious for causing SSTIs and necrotising pneumonias and is seen in patients without any health care associated risk factors such as history of admission to a hospital or a nursing home during the previous year, history of dialysis, surgery, or presence of permanent indwelling catheters or medical devices that pass through the skin to the body.[5] Though CA-MRSA is a global community pathogen, its prevalence varies in different geographic locations.[6,7]

As studies have confirmed that poor outcomes are frequently associated with initial treatment failure, it is imperative to know the spectra and frequency of pathogens associated with SSTI and their antibiotic sensitivity pattern for successful management of SSTIs.[8]

Few local studies have assessed the aetiology of SSTIs in different subgroups. Dissanayaka et al. showed a high prevalence of Gram negatives in SSTIs in cancer patients at the National Cancer Hospital, Sri Lanka.[9] In a study characterising community acquired and health care acquired (HA) MRSA done in the largest tertiary care hospital in Sri Lanka, 88% of CA-MRSA and 82 % of HA-MRSA were from patients with SSTIs.[10] Microbiological analysis of SSTIs in the paediatric population has not been reported in Sri Lanka to the best of our knowledge. Sirimavo Bandaranaike Children's Hospital (SBSCH) is one of the two paediatric specialised care hospitals in Sri Lanka. This study was carried out to identify the characteristics of bacterial pathogens isolated from paediatric patients presenting to SBSCH with SSTIs.

Method

A descriptive study was carried out to analyse the characteristics of bacterial pathogens associated with SSTIs in children presenting to SBSCH. The study period was 13 months from January 2021 to January 2022. This is a retrospective study and data were gathered from request forms received at the laboratory within this study period. Samples received from both purulent and non-purulent infections were included. Epidemiological details included age and sex of the

patient. Site of infection, identity of the bacterial pathogen and the antibiotic sensitivity pattern were also gathered.

All samples received at the laboratory were processed according to the standard operating procedures in "Laboratory manual in Microbiology" (Sri Lanka College of Microbiologists, 2011). Only phenotypic identification methods were followed by the laboratory. Antibiotic sensitivity testing was done according to the Clinical Laboratory Standard Institute (CLSI) M–100 - 28th edition. For staphylococci, cefoxitin disk was used as the surrogate of beta lactam resistance. Cotrimoxazole, erythromycin, clindamycin and ciprofloxacin were the non-beta lactam antibiotics in the staphylococcal panel. Co-amoxiclav, cefuroxime, cefotaxime, ciprofloxacin, gentamicin, piperacillin-tazobactam and meropenem were the antibiotics in the coliform panel. Isolates could not be uniformly tested against all antibiotics due to irregular supply of antibiotic disks. The percentage of sensitive isolates for a particular antibiotic was calculated as number of the isolates sensitive to the tested antibiotic/total number of the same isolate tested for the particular antibiotic.

Results

The study analysed 290 samples received during the study period. The study population consisted of 162 males (55.8%) and 128 females (43.1%) with an age range from one day to 14 years (median: 7 years)**.** All patients were admitted to surgical units. Most samples were from purulent infections (97%). There were 228 pus aspirates and 56 swabs from purulent infections. Six tissue samples were received from patients with necrotising fasciitis. The commonest sites of infections were head and neck (27%), lower limb (16%) and the perineal region (9%).

Of the 290 samples, 197 were positive (67.9%) for bacterial growth. Of the 228 pus samples received, 160 (70%) were positive for bacterial growth and positivity rate of swabs was 58%. The positivity rate according to body sites were as follows: head and neck region 22%; lower limb 15%; chest and perineal area 11%; generalized rash 9%; upper limb 8%; purulent infections in the buttock region 7% **(Table 1)**. The site was not stated in the request forms accompanying 21 samples.

Table 1: Distribution of pathogens from different body sites

Site	MRSA	MSSA	Coliforms	*S. pyogenes*	CoNS	*Pseudomonas* spp.	*Acineto.* spp
Head and neck	26	13	05		01	01	
Chest	17	03	01				
Perineal region	10	04	06	01		01	
Buttocks	08	04	01				
Upper limb	11	04	02				01
Lower limb	16	08	05		01	01	
Generalized rash	10	08	00	01			
Site not mentioned	15	06	04	01	01		
Total	113	50	24	03	03	03	01

Of the pathogens isolated, 163 (82%) were *S. aureus*, of which 113 were MRSA (57%) and 50 were MSSA (25%). The frequency of coliforms and other pathogens were 15% and 6% respectively. Other pathogens included *Pseudomonas* spp. (3/197), Group A streptococci (3/197), coagulase negative *Staphylococcus* spp. (4/197) and *Acinetobacter* spp. (1/197).

Most cultures grew as a single isolate while 6 were mixed growths. The 6 mixed growths were from perineal sites.

S. aureus was the predominant pathogen from all sites. Most coliforms were isolated from abscesses in the perineal region. Two of the 5 coliform isolates from the head and neck region were from deep seated abscesses in the parapharyngeal and posterior pharyngeal wall. Group A Streptococcus was isolated from 3 samples and was associated with generalized pustular lesions and an inguinal abscess.

Coagulase negative staphylococci (CNS) were isolated from a skin swab sent from a patient with scalded skin syndrome and from a pus sample of a toe abscess. The only *Acinetobacter* spp. was isolated from a swab taken from an abscess on the thumb.

Four tissue samples from patients with suspected necrotising fasciitis were positive. Coliforms were isolated from two and *Pseudomonas* spp. from the other two. The only other *Pseudomonas* spp was isolated from a cervical abscess.

Figures 1-2 and Tables 2-3 show the characteristics of the MRSA and MSSA isolated from the study population.

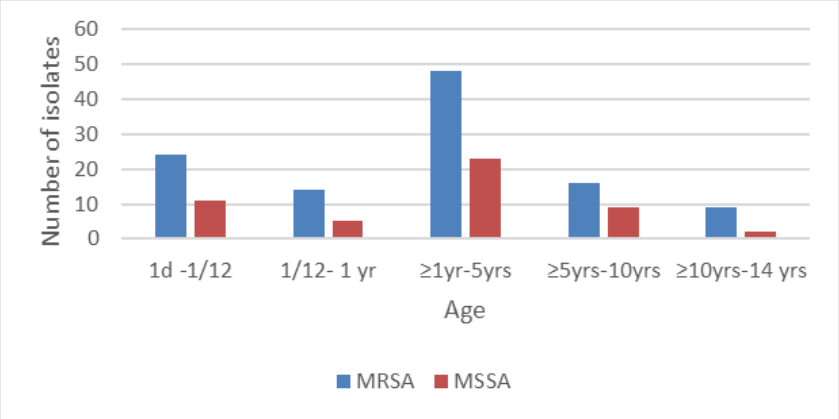

Figure 1: Distribution of MRSA and MSSA in different age

In the study population, the highest incidence of SSTIs were seen in the age group of 1 to 5 years. MRSA was the predominant pathogen in all age groups (**Figure 1**). The head and neck were the commonest site of infection and MRSA was the predominant pathogen from all sites (**Figure 2**). Both MRSA and MSSA isolates showed over 90% sensitivity to cotrimoxazole. One fourth of MSSA and MRSA isolates were resistant to clindamycin. One fourth of MSSA and 14% of MRSA were resistant to ciprofloxacin.

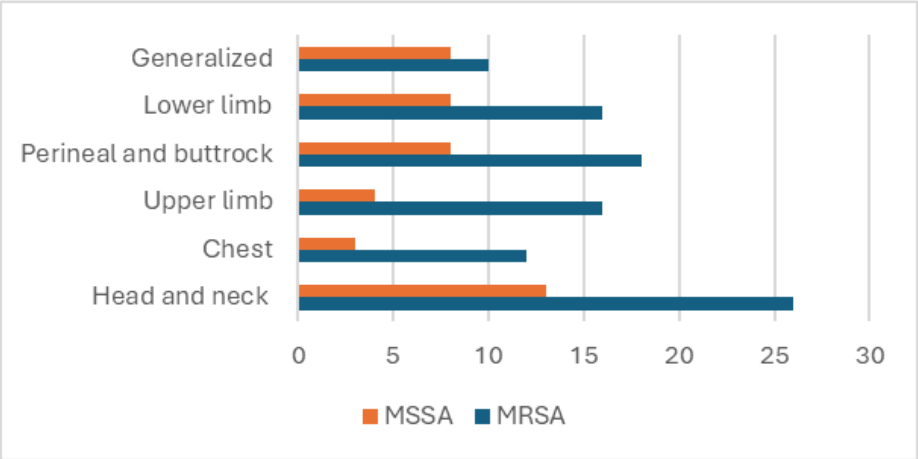

Figure 2: Prevalence of MRSA/MSSA at different body sites ↑buttock

Table 2: Antibiotic sensitivity pattern of MRSA and MSSA isolates

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Antibiotic	MRSA		MSSA	
	Number sensitive/Total number tested	% Sensitivity	Number sensitive/Total number tested	% sensitivity
Cotrimoxazole	68/70	97.1	30/32	93.7
Ciprofloxacin	96/111	86.5	37/49	74.0
Clindamycin	72/99	72.7	33/49	67.3
Erythromycin	26/82	28.5	20/43	40.0

Table 3: Antibiotic sensitivity pattern of coliforms

Antibiotic	Number tested	Number sensitive	% Sensitivity	No resistant	% Resistance
Co – amoxiclav	28	14	50	14	50
Cefuroxime	26	09	35	17	65
Cefotaxime	31	18	64	10	36
Ciprofloxacin	28	19	68	09	32
Gentamicin	30	21	70	09	30
Pip tazobactam	22	17	72	05	28
Meropenem	31	27	87	04	13

Antibiotic resistance in coliforms was substantial. Only 64% were sensitive to cefotaxime. There were 5 isolates resistant to piperacillin-tazobactam while 4 were resistant to meropenem (Table 4).

Discussion

Community acquired MRSA is emerging as the main pathogen in SSTIs in children worldwide.[11] According to a study done in the Asia-Pacific region from 2000-2016, CA-MRSA carriage in the community ranged from 0-23.5%. The highest prevalence of CA-MRSA was seen in India (16.5%–23.5%) followed by Vietnam (7.9%).[12] A similar trend was seen in our study too, where MRSA outnumbered MSSA.

There are several differences between CA-MRSA and HA-MRSA. CA-MRSA and HA-MRSA are often categorised based on where the infection was acquired. The other differences include site of infection, presence of different virulence factors and the differences in antibiotic profiles. CA-MRSA is often susceptible to non-beta lactam anti-staphylococcal antibiotics. We could not perform genotypic characterisations to categorise the MRSA isolates in the present study or gather information on where the infection was acquired. The only characteristic that favours the possibility that the MRSA isolates in the current study were community acquired rather than health care acquired is their increased susceptibility to non-beta lactam antibiotics. In our study population MRSA isolates showed high sensitivity to cotrimoxazole, ciprofloxacin and clindamycin which are good options for inpatient as well as outpatient management of patients.

Studies evaluating characteristics of MSSA isolated from SSTIs are sparce in the literature. A study from an outpatient dermatology clinic in the US[13] has evaluated antibiotic susceptibility profiles of *S. aureus* isolates over a 5-year period from 2005. They have noted that despite an increase in the proportion of MRSA, their susceptibility to ciprofloxacin has increased while MSSA has become more resistant to ciprofloxacin, clindamycin, gentamicin, and trimethoprim-sulfamethoxazole over the study period. In our study population, sensitivity of MSSA to most of the non-beta lactams tested was lower than that of MRSA isolates.

Though small in number, a range of pathogens other than *S. aureus* were isolated from samples, indicating the importance of identification and antibiotic sensitivity testing of isolates from patients presenting with SSTIs. These pathogens ranged from historically common culprits like Group A streptococcus to uncommon species like *Acinetobacter* spp. and CoNS. Aspirates are the preferred sample from purulent infections and swabs are discouraged due to the possibility of isolation of colonisers and contaminants. The possibility of contamination must be considered for the *Acinetobacter* spp. from the thumb abscess and CoNS from a patient with scalded skin syndrome in the current study as the samples received were swabs taken from the sites of infection. This demonstrates the importance of appropriate sample collection with adherence to proper collection methods for accurate end results. As this is a retrospective study, predisposing factors for infections with possible uncommon pathogens could not be gathered.

Conclusion

We gathered information from request forms which was a major drawback of the study as uniform data collection was not possible due to incompletely filled request forms. This highlights the importance of establishing properly designed laboratory information management systems in our hospitals for data management. The study also emphasises the need for prospective case

control studies to identify risk factors for CA-MRSA which is becoming the leading pathogen associated with SSTIs in children. Though we have many possible CA-MRSA isolates, we were unable to further characterise them for staphylococcal cassette chromosome mec (SCC mec) type and for the presence of PVL gene. We would like to emphasize the necessity of reference facilities for genotypic characterisation of pathogens circulating in the country.

Declarations

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Ethics statement: As this is a retrospective study analysing laboratory isolate characteristics ethical clearance was not sought.
Authors' contributions: G.A.P. Dilrukshi – Data gathering and writing the draft.
Madhumanee Abeywardena – Editing the manuscript.
Lakmini Yapa – Conceptualisation and Editing of the manuscript.

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