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The Growing Concern of Community-acquired Skin and Soft-Tissue Infections

1. Dr. Balaji Puri
Assistant Professor Dept. of Microbiology, Vilasrao Deshmukh Government Medical College, Latur Maharashtra state. India. 415312.
Email-ID: drbalajis.puri@gmail.com
2. Dr. Varsha Kalshetti
Assistant Professor Dept. of Microbiology, Vilasrao Deshmukh Government Medical College, Latur Maharashtra state. India. 415312.
Email-ID: vskanthikar@gmail.com
3. Dr. Namdeo Suryawanshi
Associate Professor Dept. of Microbiology, Vilasrao Deshmukh Government Medical College, Latur Maharashtra state. India. 415312.
Email-ID: drsnamdev@gmail.com
Corresponding author:
Dr. Namdeo Suryawanshi
Associate Professor Dept. of Microbiology, Vilasrao Deshmukh Government Medical College, Latur Maharashtra state. India. 415312.
Email-ID: drsnamdev@gmail.com

ABSTRACT

Background: Skin and soft tissue infections (SSTIs) are frequent forms of disease. In order to define or improve empirical antibiotic therapy, it is necessary to generate data on the current spectrum and susceptibility profile of bacteria associated with community-acquired SSTIs.

Material and Methods: The clinicalsamples were obtained from 600 out-patients and the in-patientswith community acquired skin and soft tissue infections.All clinical samples were inoculated on the routine laboratorymedia. Antibiotic sensitivity testing was performed as per standard guidelines.

Results: Out of 600 patients with community acquired skinand soft tissue infections, 258 (43%) were diagnosedwith abscess followed by cellulitis 145 (24.2%).Gram positive cocci accounted for 92.27% of total isolates. *Staph. aureus* was the predominant pathogen accounting for 78.75% of total isolates. Amongst the Gram negative isolates, *P. aeruginosa* was predominant pathogen 7.72%.71 (19.34%)strains of MRSA were detected in the present series.Sensitivity to other antimicrobials varied from 6.3% (penicillin G) to 97% (clindamycin).All the strains of *P. aeruginosa* were found to be sensitive to the antipseudomonal agent ceftazidime and to amikacin. The sensitivity of Pseudomonas strains to other antimicrobials ranged from 52.8% to 97.22%.

Conclusion: Staphylococcal and streptococcal species are the common organisms of SSTIs. Therefore, for all mild to moderate infections empirical therapy should always be directed against these species. It is important to generate periodic data to monitor trends in spectrum and resistance.

Keywords: Community-acquiredSSIs, abscess, Staphylococcus aureus, MRSA

INTRODUCTION

Skin and soft tissue infections (SSTIs) such as primary pyodermas, complicated/secondary pyodermas and necrotizing infections are frequent forms of disease [1]. Predisposing factors for SSTIs include reduced tissue vascularity and oxygenation, increased peripheral fluid stasis and decreased ability to combat infections. Co-morbidities and mechanisms of injury can determine the bacteriology of SSTIs [2].Patients with neutropenia more often develop infections caused by gram-negative bacteria, anaerobes, and fungi.

In most of the SSTIs cases, bacteriological culture practices are not observed hence, the common causes of SSTIs in general remain uncertain. Among culture-confirmed SSTIs, *Staphylococcus aureus* and beta-hemolytic Streptococci are often suggested as being the most important, although *Pseudomonas aeruginosa*, *Enterococcus* spp., *Escherichia coli*have also been identified as important causes of some types of SSTIs [3-8].

In order to define or improve empirical antibiotic therapy, it is necessary to generate data on the current spectrum and susceptibility profile of bacteria associated with community-acquired SSTIs. This can help to prevent administration of ineffective antibiotics and its associated complications in any given setting.The present study was conducted to determine and compare the bacterial spectrumincluding their antimicrobial susceptibility profile of community-acquired skin and soft tissue infections.

MATERIAL AND METHODS

The present study was carried out in the Department ofMicrobiology, in a tertiary care hospital for aperiod of one year. The clinicalsamples were obtained from 600 out-patients and the in-patientstreated in various clinical departments.

Inclusion criteria

- Patients with community acquired skin and soft tissue infections.
- An SSTIs occurring among the in-patients or among out-patients with an isolate earlier than 48 hours ofhospitalization is considered ascommunity acquired SSTIs.

Exclusion criteria

- History of surgery, hospitalization, residence in a long-term care facility, catheterization or any other invasive procedure in the previous year.
- Any isolate from a specimen collected after 48 hours of admission.
- Previous isolation of MRSA in the patient.

Methodology

All clinical samples were properly collected under strictaseptic precautions and appropriately delivered to the Microbiology laboratory.After an initial direct gram staining technique, allsamples were inoculated on the routine laboratorymedia like blood agar, MacConkey agarand chocolate agar and isolate identification was done following the standardmicrobiological techniques [9].

Antibiotic sensitivity testing was performed on MuellerHinton agar media using the Kirby-Bauer disc diffusiontechnique according to Clinical Laboratory StandardsInstitute (CLSI) guidelines 2021 [10].Culture plates with no growth obtained after 48 hoursincubation were labeled as sterile.

RESULTS

A total of 600 patients were included in the present study. Of these 466, demonstrated a positive growth from the specimen collected. 17 specimens showed polymicrobial growth. Thus, a total of 483 isolates were obtained.

Table 1: Types of lesions

Lesion	No. of Cases	Culture growth	% Culture growth
Abscess	258	199	77.13
Boils	18	9	50.00
Bullous pemphigoid	3	1	33.33
Carbuncle	14	11	78.57
Cellulitis	145	127	87.59
Erosion	3	2	66.67
Erysipelas	3	2	66.67
Erythema multiforme	1	1	100.00
Furunculosis	5	4	80.00
Impetigo	15	12	80.00
Infected keloid	1	1	100.00
Mycetoma	2	1	50.00
NecrotizingFasciitis	3	3	100.00
Otitis externa	15	9	60.00
Pustules	30	22	73.33
Scrofuloderma	1	1	100.00
Sebborhoea	4	2	50.00
Ulcer	59	48	81.36
Vestibulitis	20	11	55.00
Total	**600**	**466**	**77.67**

Out of 600 patients with community acquired skinand soft tissue infections, 258 (43%) were diagnosedwith abscess followed by cellulitis 145 (24.2%) and ulcer 59 (9.8%) (Table 1). Gram positive cocci accounted for 92.27% (430/466) of total isolates. *Staph. aureus* was the predominant pathogen accounting for 78.75% of total isolates, followed by the genus Streptococcus (12.23%).Amongst the Gram negative isolates, *P. aeruginosa* was predominant pathogen (7.72%, 36/466).

Table 2: Lesion Wise Distribution of Pathogens in SSTIs

Lesion	Culture growth	S. aureus	S. pyogens	Strepto. spp.	Other GPCs	Pseudo.	E. coli	Kleb.
Abscess	199	170	5	6	5	10	4	3
Boils	9	9	0	0	0	0	0	0

Bullous pemphigoid	1	1	0	0	0	0	0	0
Carbuncle	11	11	0	0	0	0	0	0
Cellulitis	127	83	18	15	0	11	2	2
Erosion	2	2	1	0	0	0	0	0
Erysipelas	2	0	0	2	0	0	0	0
Erythema multiforme	1	1	0	0	0	0	0	0
Furunculosis	4	4	0	0	0	0	0	0
Impetigo	12	12	0	0	0	0	0	0
Infected keloid	1	1	0	0	0	0	0	0
Mycetoma	1	1	0	0	0	0	0	0
Necrotizing Fasciitis	3	1	2	0	1	0	0	0
Otitis externa	9	3	0	1	0	4	1	0
Pustules	22	21	1	1	0	0	0	1
Scrofuloderma	1	1	0	0	0	0	0	0
Sebborhoea	2	2	0	0	0	0	0	0
Ulcer	48	34	1	3	0	11	2	1
Vestibulitis	11	10	0	1	0	0	0	1
Total	**466**	**367**	**28**	**29**	**6**	**36**	**9**	**8**

Staph. aureus was the predominant pathogen in almost all types of SSTIs. *S aureus* was the sole etiological agent in boils and carbuncles. Streptococci were associated with lesions such as cellulitis, erysipelas, impetigo, abscesses and necrotizing fasciitis. *S pyogenes* was associated with abscess, cellulitis, ulcer and erosion.*Pseudomonas spp* were associated with lesions such as abscess, cellulitis and ulcer.

Table 3: Antibiotic susceptibility pattern

Antibiotics	*Staph. aureus*(n=367)	Strepto. spp. (n=57)	*P.aeruginosa*(n=36)	*E.coli* (n=9)	Klebsiella spp. (n=8)
Penicillin G	23 (6.3%)	19 (33.3%)	--	--	--
Co-trimoxazole	100 (27.2%)	28 (49.1%)	--	--	--
Ciprofloxacin	142 (38.7%)	34 (59.7%)	--	7 (77.8%)	7 (87.5%)
Cefazolin	243 (66.2%)	--	--	--	--
Cefoxitin	296 (80.6%)	--	--	--	--
Erythromycin	307 (83.7%)	41	--	--	--

		(71.9%)			
Clindamycin	356 (97%)	--	--	--	--
Fusidic acid	351 (95.5%)	--	--	--	--
Gentamicin	344 (93.7%)	23 (40.3%)	35 (97.2%)	9 (100%)	6 (75%)
Amikacin	353 (96.2%)	27 (47.4%)	36 (100%)	9 (100%)	6 (75%)
Ampicillin	--	--	--	3 (33.3%)	2 (25%)
Co-amoxyclav	--	--	--	5 (55.5%)	4 (50%)
Cefotaxime	--	--	19 (52.8%)	7 (77.8%)	6 (75%)
Ceftriaxone	--	--	22 (61.1%)	7 (77.8%)	7 (87.5%)
Ceftazidime	--	--	36 (100%)	7 (77.8%)	7 (87.5%)
Cefuroxime	--	--	22 (61.1%)	6 (66.7%)	5 (62.5%)
Piperacillin-tazobactam	--	--	34 (94.4%)	--	--
Netilmicin	--	--	35 (97.2%)	--	--
Imipenem	--	--	36 (100%)	9 (100%)	8 (100%)
Linezolide	367 (100%)	--	--	--	--

All the strains of *Staph. aureus* were sensitive to linezolide.71 (19.34%)strains of MRSA were detected in the present series.Sensitivity to other antimicrobials varied from 6.3% (penicillin G) to 97% (clindamycin). 100 (27.2%) strains were sensitive to co-trimoxazole.Sensitivity to fusidic acid was 95.5%.Of the 60 isolates of *Staph. aureus* resistant to erythromycin, 48 were found to be sensitive to clindamycin. These strains were subjected to D-test to detect inducible clindamycin resistance. 11 strains were D-test positive (22.91%).

Streptococcus spp. sensitivity to the different antimicrobials tested varied from 33.3% to 71.9%. The strains were maximally sensitive to erythromycin (71.9%).Only 33.3% of the strains were sensitive to penicillin G.

All the strains of *P. aeruginosa* were found to be sensitive to the antipseudomonal agent ceftazidime and to amikacin. The sensitivity of Pseudomonas strains to other antimicrobials ranged from 52.8% to 97.22%. They showed maximal resistance to the other third generation cephalosporins.

All *E.coli*strains were sensitive to amionoglycosides.77.8% of the strains were sensitive to ciprofloxacin.Only 33.3% of the strains were sensitive to ampicillin and 55.5% to Co-amoxyclav. Majority of the Klebsiella spp. strains (75%) were sensitive to amionoglycosides.87.5% of the strains were sensitive to ciprofloxacin.

DISCUSSION

Patients with skin and soft tissue infections form a major part of the subjects attending outpatient department. Skin and soft tissue infections (SSTIs) are also responsible for increasing the length of stay and cost of therapy in hospitalized patients.The therapy for majority of patients with SSTIs attending OPD usually remains empirical. In order to define or improve empirical antibiotic therapy, it is necessary to generate data on current spectrum and susceptibility profile of bacteria causing SSTIs.

The patients included in the study were those reporting to different specialties with community-acquired SSTIs (both primary and secondary pyodermas). In case of hospitalized patients with community-acquired SSTIs, samples were collected within 48 hours of admission.Among the lesions with which the patients presented, abscess was the most common presentation (43%), followed by cellulitis (24.17%), ulcer (9.83%), pustules (5%), impetigo (2.5%), carbuncle (2.33%) and other lesions.

In the present study, a further analysis was carried out to determine any association between a specific pathogen and the type of SSTI. *Staph. aureus* was the predominant pathogen in almost all the types of SSTIs. *Staph. aureus* was the sole etiological agent in boils and carbuncles. Anti-staphylococcal cover would therefore suffice in such lesions. The Streptococci were associated with lesions such as abscess, cellulitis, erysipelas, otitis, and necrotising fasciitis. Gram negative organisms, especially *P. aeruginosa* were found to be associated with lesions such as abscess, cellulitis and ulcers. This analysis reveals that cellulitis and ulcer would need an additional Gram negative cover if culture sensitivity is not routinely performed.

In a study on primary pyodermas by Matthew et al, children with typical primary pyoderma lesions were included. In this study, impetigo contagiosa was found to be the most common lesion (45%), followed by folliculitis of the scalp (44.2%).[11] A study from Lady Hardinge Medical College, New Delhi, which included 100 cases of primary pyodermas, impetigo was the commonest primary pyoderma.[12] In the present study, impetigo accounted for only 2.5% of the total cases. This difference may be due to the patient population selected, which included both primary and secondary pyodermas in all age groups who presented with CA-SSTIs (samples collected on an outpatient basis or within 48 hours of admission in case of hospitalized patients).

Staph. aureus has been the dominating pathogen of skin and soft tissue infections globally, since many decades. A SENTRY antimicrobial surveillance program carried out from 1998 to 2004, which included medical centers from 3 continents (Europe, Latin America and North America) to find out the contemporary causes of skin and soft tissue infections documented that, *Staph. aureus* was the predominant pathogen with an incidence of 44.6% in North America, 37.5% in Europe and 33.5% in Latin America.[13]

In the same study *P. aeruginosa* accounted for more than 10% of pathogens for all regions followed by *E coli*. Enterococcus spp occurred more frequently in North America (9.3%). Enterobacteriaceae (Enterobacter spp, Klebsiella spp and *Proteus mirabilis*) ranked 4-9. β hemolytic streptococcus was ranked 10th in Latin America. Acinetobacter spp. ranked 10th in Europe.[13]

In a large study published in 2004, (AIIMS, New Delhi) of the 2783 isolates, 54.04% were Gram negative bacilli and 45.96% were Gram positive cocci. In this study, *Staph. aureus*, *E. coli* and Pseudomonas spp were the top 3 pathogens.[14] A community-based study carried out by Nagaraju U et al, also showed *Staph. aureus* to be the predominant pathogen (80.8%).[15] A retrospective study of 331 patients carried out in a tertiary dermatological center in Singapore revealed dominance of Gram-positive organisms with *Staph. aureus* accounting for 60.4% of all isolates, followed by Streptococci (15.2%). *P. aeruginosa* was the commonest Gram-negative isolate (8.5%), followed by Klebsiella spp (4.2%), Proteus (3.9%) and*E. coli* (2.5%).[16]The findings of the present study are similar to those reported in literature.

CONCLUSION

One should always consider staphylococcal and streptococcal species as the instigating organisms of SSTIs. Therefore, for all mild to moderate infections empirical therapy should always be directed against these species.Penicillinase resistant penicillins, clindamycin and erythromycin in that order can be used as suitable antimicrobials for empiric therapy of CA-SSTIs, in addition to surgical debridement when required.It is important to generate periodic data to monitor trends in spectrum and resistance.

Conflict of Interest: None to declare

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