

# Skin and soft tissue infections: Clinico-microbiological and drug resistance profile

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## Abstract

**Background:** Early diagnosis, appropriate antibiotic therapy and timely surgical intervention are the need of the hour in managing skin and soft tissue infection. Improperly managed skin and soft tissue infections pose a great challenge and add on to morbidity and mortality in the patients. **Objectives:** This study aims to study the clinical infections, type of Skin and soft tissue infections and risk factors. It also aims at determining the bacteriological profile and the antibiogram of the isolates obtained. **Materials and methods:** The study was conducted in a teaching hospital with a total of 34 SSTI cases during August 2018 to September 2018. Samples were inoculated in blood agar, and MacConkey agar and further biochemical tests were performed according to the standard protocol. Antibiotic Susceptibility testing was done for the isolates as per the CLSI guidelines. **Results:** Among the 34 cases, 55 bacterial isolates were obtained. Of the 34 cases, 11 (32.35%) had cellulitis, 3 (8.82%) had abscess, 14(41.17%) had necrotizing fasciitis, 4 (11.76%) had carbuncle and 2(5.88%) had diabetic foot ulcers. The commonest bacteria isolated was Acinetobacter spp (n=11), E. coli (n=10), Pseudomonas spp (n=8), Methicillin sensitive Staphylococcus aureus (n=8), and Methicillin resistant Staphylococcus aureus (n=6). **Conclusions:** In this study, Acinetobacter spp, E. coli followed by MSSA was the most common organism isolated. With the varied pathogens and their antimicrobial susceptibility patterns, it is essential to start definitive treatment after microbiological culture and sensitivity results are obtained.

**Key Word:** Antibiotic resistance, Necrotizing fasciitis, Skin and soft tissue infections.

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## INTRODUCTION

Skin and soft tissue (SSTI) infections are common in outpatient clinic and emergency department visits and include a variety of infections.<sup>1</sup> SSTIs usually result from traumatic, surgical or health-care-related skin breakdown with secondary bacterial invasions. <sup>2</sup> The severity of SSTI ranges from mild superficial to deeper or potentially fatal necrotizing infections requiring

hospitalization or intensive care.<sup>1</sup> The practice guidelines of the Infectious Disease Society of America for the diagnosis and management of SSTIs classifies it into: Superficial, uncomplicated infection (includes erysipelas, impetigo and cellulitis); necrotising infections, surgical site infections and infections associated with bites; infections in the immunocompromised host. The predominant pathogens in all these include Staphylococcus aureus, Pseudomonas aeruginosa, Escherichia coli, and Enterococcus spp.<sup>3</sup> SSTI are now more challenging to manage, as the spectrum of causative pathogens is more complex and the prevalence of antibiotic resistant microorganisms is increasing.<sup>2</sup> Antimicrobial resistance is considered to be a major public health threat. SSTI have several factors that may be associated with a high risk of multidrug resistant micro-organisms carriage, such as inappropriate antibiotic treatment, chronic course of the wound, and frequent hospital admissions. In recent years, there has been an increase in resistant organisms and this increases the

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hospital stay, cost of management and may cause additional morbidity and mortality. Although it is varied microorganisms responsible for the infection, there has been a significant increase in multi drug resistant isolates. Early diagnosis is aimed to institute the appropriate antibacterial therapy to avoid complications. Therefore this study was aimed to determine the bacterial profile and antimicrobial resistance pattern of the isolates obtained from SSTIs. The purpose of this prospective study was to investigate the bacterial agents responsible for SSTIs in a tertiary care hospital setting and to study their antibiogram so as to guide empirical therapy.

### MATERIALS AND METHODS

**Source Of Data:** This was a descriptive study in which samples collected from both out and in patients of a tertiary care hospital was conducted in the Department of Microbiology from August 2018 to Sep 2018 were taken for the study.

**Inclusion Criteria:** All patients with signs of local skin and soft tissue infection- swelling, exudates, surrounding cellulitis and crepitation and also systemic signs like fever and leucocytosis.

**Exclusion Criteria:** Patients who were on antibiotics for more than 48 hours.

**Procedure:** After obtaining written informed consent, A detailed proforma involving the patient epidemiological and clinical characteristics was recorded. Clinical samples were collected as appropriate for the clinical condition.

Samples collected were pus, soft tissue, aspirates from closed wounds, wound swab; after cleaning the surface of the wound by vigorously washing with saline and debridement of superficial exudates. Specimens were transported to the laboratory immediately for processing and further processed for culture and antimicrobial sensitivity testing. For isolation of aerobic organisms, the samples were inoculated on 5% sheep agar and Mac Conkey agar. The isolated colonies were picked for Gram stain performed and identified by biochemical reactions as per the standard protocol for identification. The antimicrobial susceptibility testing was performed using Mueller Hinton Agar (BD) as per the Clinical Standards Laboratory Institute guidelines.

**Statistical Analysis:** All statistical analyses were performed by using a statistical Software program (SPSS version 22). Frequency tables and graphs were produced for the data obtained.

### RESULTS

A total of 34 cases of SSTI were included in the study. From these 34 cases there were 55 bacterial isolates obtained. Of which 13 (38.23%) had monomicrobial growth and 21 (61.76%) had polymicrobial growth. The risk factors involved in the study were diabetes mellitus in 19 (56.25%), trauma 6 (17.4%) and of unknown etiology in 9 (26.47%) of the cases. Of the 34 cases in the study, pus was obtained in 23 (67.65%), tissue in 2 (5.88%) and swab in 9 (26.47%) of cases.

**Table 1:** Distribution of different types of SSTI

Type of SSTI	Number of cases (%)
Cellulitis	11 (32.35%)
Abscess	3 (8.82%)
Necrotizing fasciitis	14(41.17%)
Carbuncle	4 (11.76%)
Diabetic foot ulcers	2(5.88%)

Of the 34 cases, 11 (32.35%) had cellulitis, 3 (8.82%) had abscess, 14(41.17%) had necrotizing fasciitis, 4 (11.76%) had carbuncle and 2(5.88%) had diabetic foot ulcers (Table 1).

**Table 2:** Bacteriological profile in SSTI

Diagnosis	Total number of isolates	Isolates	Number of isolates obtained	Percentage of isolates (%)
Cellulitis (n=11)	19	<i>E.coli</i>	6	31.5
		<i>Klebsiella spp</i>	4	21.0
		MRSA	4	21.0
		<i>Proteus mirabilis</i>	1	5.3
		MSSA	1	5.3
		<i>Enterobacter</i>	1	5.3
		<i>Acinetobacter</i>	2	10.5
Necrotizing fasciitis (n=14)	23	<i>Acinetobacter</i>	8	34.8
		<i>Pseudomonas</i>	7	30.4
		MSSA	4	17.4
		<i>E.coli</i>	2	8.7

		MRSA	1	4.3
		<i>Enterobacter</i>	1	4.3
Abscess (n=3)	5	MRSA	2	40
		<i>E.coli</i>	2	40
		<i>Enterobacter</i>	1	20
Carbuncle (n=4)	4	MSSA	3	75
		MRSA	1	25
		<i>Proteus mirabilis</i>	1	25
		<i>Acinetobacter</i>	1	25
Diabetic foot ulcer (n=2)	4	<i>Pseudomonas</i>	1	25
		MRSA	1	25

Table 3: Antibiotic resistance profile of Gram negative bacilli

Antibiotics (µg/disc)	<i>E.coli</i> (n=10)	<i>Klebsiella</i> (n=4)	<i>Pseudomonas</i> (n=8)	<i>Acinetobacter</i> (n=11)
Amikacin (30)	40%	25%	12.5	18.18%
Cotrimoxazole(1.25/23.75)	30%	0	-	-
Cefotaxime (30)	60%	25%	50%	100%
Ceftriaxone (30)	60%	25%	50%	100%
Cefepime (30)	20%	0	37.5%	100%
Genatmicin (10)	0	0	0	18.18%
Imipenem (10)	0	0	0	27.27%

There was high resistance seen to Cefotaxime and Ceftriaxone. Imipenem showed to have good activity against most of the isolates. There was high resistance seen among *Acinetobacter* spp (Table 3) Among the Gram positive cocci (n=17), methicillin resistance was seen in 9(52.9%) of the isolates.

## DISCUSSION

During the study period from August 2018 to September 2018 a total of 34 cases of skin and soft tissue infections were recruited for the study. Of the 34 cases, 55 bacterial isolates were obtained of which 38(69.09%) were Gram negative bacilli and 17(30.9%) were Gram positive cocci. The mean age group of the population was 46.23 years. The skin and soft tissue infections were seen in majority of males who were outdoor workers involved in agricultural farming and outdoor activities and thus prone for trauma. The risk factors involved in our study in developing SSTI are diabetes mellitus in 19 (55.88%), trauma in 6(17.64%) and unknown etiology in 9(26.47%). In a study done by Lispky *et al* it was seen that diabetes mellitus ranked first in the list of risk factors.<sup>9</sup> In our study, the growth was predominantly polymicrobial with more than one aerobic organism isolated. The polymicrobial growth was seen in 21 (61.76%) of the patients and monomicrobial in 13 (38.23%) patients. The samples obtained in our study were, pus in 23 (67.65%), tissue in 2 (5.88%) and swab in 9 (26.47%) of cases. Of the 11 cellulitis cases, 19 isolates were obtained of which 6 (31.5%) were *E. coli*, 4(21%) were *Klebsiella* spp, 4(21%) were Methicillin resistant *Staphylococcus aureus*, 1(5.3%) was *Enterobacter* spp, and 2(10.5%) were *Acinetobacter* spp. From the 14 necrotising fasciitis cases, 23 isolates were obtained. Of the 23 isolates, 7(30.45%) were *Pseudomonas* spp, 8(34.8%) were *Acinetobacter*, 4(17.4%) were Methicillin sensitive *Staphylococcus*

*aureus*, 2(8.7%) were *E.coli*, 1(20%) was Methicillin resistant *Staphylococcus aureus* and 1(4.3%) was *Enterobacter* spp. of the 5 isolates from 3 abscess cases, 2(40%) were Methicillin resistant *Staphylococcus aureus*, 2(40%) were *E.coli*, and 1(20%) was *Enterobacter* spp. Of the 2 diabetic foot infections, 4 isolates were obtained. There was 1(25%) isolate each of *Proteus mirabilis*, *Acinetobacter*, *Pseudomonas* spp and Methicillin resistant *Staphylococcus aureus*. Of the 4 cases of carbuncle, 4 isolates were obtained. Carbuncle has shown monomicrobial growth in a study by Anandi *et al*. In a study by Sah P *et al* it was seen amongst the various superficial SSTIs like folliculitis, furuncles, cellulitis and abscesses, *S. aureus* was the most common organism isolated. In the patients with diabetic foot infection, there was a predominance of *E.coli*. Other common pathogens isolated were *Pseudomonas aeruginosa*. and *P. vulgaris*. Anandi *et al* (13)stated that the *Pseudomonas* spp. and *Proteus* spp. carry a special role and are responsible for continuing and extensive tissue destruction in diabetic foot. *E.coli*, *P. aeruginosa* and *K. pneumoniae* were the organisms more commonly isolated from patients of necrotising fasciitis. The bacteriology of these infections has undergone a major change since they were first described.<sup>14</sup> They were originally attributed to beta-hemolytic streptococci but lately these infections have become polymicrobial and increasingly Gram negative bacilli are being implicated as causative agents as has been seen in the study by Singh *et al*<sup>14</sup>also. However, no

isolate of *Streptococcus* spp. was found. Gram positive cocci- *S.aureus* was the most common isolate and methicillin resistance was detected in 52.29 %, with cross- resistance to other beta-lactams but 100% sensitivity to vancomycin, Methicillin resistant *S.aureus* (MRSA) strains were also more resistant to other antibiotics compared to methicillin sensitive *S.aureus* strains (MSSA). In a study by Najotra *et al*<sup>17</sup> more than 65% of MRSA were resistant to other antibiotics like erythromycin, clindamycin, and cotrimoxazole whereas almost 50% resistance was seen to ciprofloxacin and gentamicin which is a worrisome scenario since options to treat these infections are drastically reduced. Thus, at present vancomycin and linezolid seem to be the drug of choice for treating MRSA infections. Studies from India show amongst the gram-negative bacilli, highest resistance was seen to ciprofloxacin (68.42%), gentamicin (60.41%) and tobramycin (66.67%). Also in the beta-lactam group of antibiotics, resistance was around 50%. Resistance to third generation cephalosporins ceftazidime (48.23%), cefotaxime (53.84%), ceftriaxone (54.16%) and cefuroxime (53.84%). This could be due to increasing extended spectrum beta lactamase (ESBL) expression in Gram negative bacteria. However, these gram-negative bacilli were sensitive to imipenem (100%) and the combination of beta- lactam / beta -lactamase inhibitor are the drugs of choice for treatment of infection due to such multidrug resistant organisms.<sup>11,17</sup>

## CONCLUSION

The high resistance rate to various antimicrobials observed in the present study could be attributed to the fact that it is a tertiary care hospital with widespread usage of broad-spectrum antibiotics. In conclusion, this study suggests that the most common organism likely to be encountered in skin and soft tissue infections is *S. aureus* followed by multi drug resistant *Acinetobacter* spp. Thus, any first line antibiotic treatment should give effective coverage against MRSA and therefore either of the drugs like vancomycin, linezolid can be used for empirical therapy. For coverage of Gram negative bacteria, imipenem is an effective drug. But in view of the varied bacteriology and antibiogram of SSTIs antimicrobial susceptibility testing should be done and definitive therapy started as soon as possible. There is also a need to strengthen our understanding of the dynamics of use and resistance underpinned by robust and meaningful surveillance, to reduce the selection pressure on bacteria in hospitals.

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