Section: General Surgery

Original Research Article

COMPARISON OF CLINICAL PRESENTATION AND LOCAL COMPLICATIONS OF LOWER LIMB CELLULITIS IN DIABETIC AND NON-DIABETIC PATIENTS

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ABSTRACT

Background: limb cellulitis is a common bacterial infection of the skin and subcutaneous tissues and a frequent cause of hospitalization. Delayed presentation and the presence of local and systemic risk factors contribute to disease severity, complications, and increased surgical burden. Data describing the clinical profile and outcomes of lower limb cellulitis in many regions of India remain limited. The objective is to describe the sociodemographic characteristics, risk factors, clinical presentation, treatment modalities, and outcomes of patients admitted with lower limb cellulitis.

Materials and Methods: This hospital-based retrospective study included patients admitted with a diagnosis of lower limb cellulitis. Data were collected from medical records using a structured proforma and included demographic details, underlying risk factors, clinical features, treatment, and outcomes. Results were expressed as frequencies and percentages. Associations between selected variables were assessed using the Pearson chi-square test, with a p-value <0.05 considered statistically significant.

Results: A total of 120 patients were included. The mean age was 46.6 ± 19.2 years, with a slight male predominance (51.7%). Toe-web intertrigo (77.5%) and disruption of the skin barrier (70.0%) were the most common local risk factors, while diabetes mellitus (39.2%) and hypertension (40.0%) were the most frequent systemic comorbidities. The leg was the most commonly affected site (55.8%). Complications developed in 56.7% of patients, with abscess formation being the most frequent. Surgical intervention was required in 56.7% of cases, most commonly debridement. The mean duration of hospital stay was 7.5 ± 5.0 days.

Conclusion: Lower limb cellulitis predominantly affects middle-aged adults and is strongly associated with local predisposing factors such as toe-web intertrigo and skin barrier disruption. Delayed presentation contributes to high complication and surgical intervention rates. Early recognition, prompt treatment, and preventive strategies targeting modifiable risk factors are essential to reduce morbidity and healthcare burden.

Keywords: Lower limb cellulitis; Risk factors; Toe-web intertrigo; Skin barrier disruption; Surgical management; Complications.

INTRODUCTION

Cellulitis is an acute, non-necrotizing bacterial infection of the skin and subcutaneous tissues that commonly involves the lower extremities. It is characterized clinically by erythema, warmth, edema with ill-defined margins, and tenderness, often accompanied by systemic features such as fever, lymphangitis, and regional lymphadenopathy.[1,2] The condition represents a significant cause of morbidity worldwide and frequently necessitates hospitalization, particularly in severe or complicated cases.

Several systemic and local risk factors predispose individuals to the development of cellulitis. Systemic factors include diabetes mellitus, obesity,

hypertension, vascular disease, immunocompromised states, and chronic alcoholism, while local factors such as disruption of the skin barrier, toe-web intertrigo, chronic dermatomycosis, prior surgery, radiotherapy, lymphedema, and leg ulcers play a crucial role by facilitating bacterial entry.[3-5] Among these, toe-web intertrigo and breaches in cutaneous integrity have been consistently identified as major contributors to lower limb cellulitis.[3]

The most frequently implicated causative organisms are Streptococcus pyogenes and Staphylococcus aureus, followed by other beta-hemolytic streptococci and gram-negative bacilli, particularly in patients with comorbidities or chronic skin conditions.[6] Despite being a common infection, reliable epidemiological data on cellulitis in India remain limited. In contrast, population-based studies from the United States estimate an annual incidence of approximately 2–3 cases per 100 persons.[7] Ellis Simonsen et al. demonstrated a slightly higher incidence in males compared to females, with working-age adults being most commonly affected.[7] Lower limb cellulitis is a frequent cause of hospital admission and is associated with substantial healthcare costs, loss of productivity, and economic burden.[8] Delayed presentation to healthcare facilities is common in low- and middle-income countries and is a key determinant of disease severity, complications, and the need for surgical intervention. The Lancet Commission on Global Surgery highlighted that more than five billion people worldwide lack access to timely and affordable surgical care, a burden that disproportionately affects low-resource settings.[9]

Given the scarcity of region-specific data and the clinical and economic implications of cellulitis, the present study was undertaken to evaluate the demographic profile, clinical presentation, risk factors, treatment modalities, and outcomes of patients admitted with lower limb cellulitis.

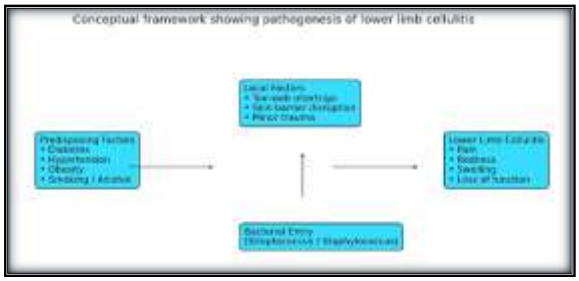

Figure 1: Conceptual framework showing the pathogenesis of lower limb cellulitis

Aim: To evaluate the demographic profile, clinical characteristics, treatment modalities, and outcomes of patients admitted with lower limb cellulitis.

Objectives

1. To describe the sociodemographic characteristics, underlying risk factors, and clinical presentation of patients with lower limb cellulitis.
2. To assess treatment outcomes, complications, and the need for surgical intervention among patients with lower limb cellulitis.

MATERIALS AND METHODS

This hospital-based retrospective study was conducted on patients admitted with a diagnosis of lower limb cellulitis at Sri Balaji Medical College and Hospital, Research Institute, Renigunta, between January 2025 and December 2025.

Patients with a discharge diagnosis of lower limb cellulitis were included in the study, while those with cellulitis involving other anatomical sites were excluded. Data were collected using a structured data abstraction form, which included patient demographics, risk factors, clinical presentation, treatment modalities, and outcomes. Information was obtained by reviewing medical records, including history, physical examination findings, and laboratory investigations.

The collected data were entered into Microsoft Excel and analyzed using descriptive statistics. Results were expressed as proportions using frequencies and percentages. Pearson's chi-square test was applied to assess the statistical significance of associations between selected variables. A p-value of less than 0.05 was considered statistically significant.

As the study utilized secondary data, there was no direct contact with patients and no intervention was performed.

RESULTS

A total of 120 patients admitted with a diagnosis of lower limb cellulitis were included in the analysis. The results are presented under the following headings: sociodemographic characteristics, underlying risk factors, clinical presentation, and treatment outcomes. Data are expressed as frequencies and percentages to describe the distribution of variables across the study population. Associations between selected variables were evaluated using appropriate statistical tests, and statistically significant findings were identified using a p-value threshold of less than 0.05.

Table 1: Sociodemographic details of patients with lower limb cellulitis (N = 120)

Sociodemographic characteristics	Frequency	%
Age (years)		
≤20	1	0.8
30–40	20	16.7
41–50	41	34.2
51–60	14	11.7
61–70	19	15.8

71–80	15	12.5
≥81	10	8.3
Sex		
Male	62	51.7
Female	58	48.3
Occupation		
Farmer	34	28.3
Labourer	29	24.2
Desk job	15	12.5
Student	3	2.5
Unemployed	8	6.7
Housewife	31	25.8
Education		
None	25	20.8
Basic	40	33.3
Secondary	35	29.2
Tertiary	20	16.7
Marital status		
Married	100	83.3
Unmarried / Single	20	16.7

The majority of patients were middle-aged adults (41–50 years), with a near-equal sex distribution. Occupations involving outdoor or manual work predominated. Most patients were married and had basic to secondary education, reflecting the rural–semiurban population served by the hospital.

Table 2: Underlying risk factors for lower limb cellulitis (N = 120)

Risk factors	Frequency	%
Obesity (BMI >30)	30	25.0
Diabetes mellitus	47	39.2
Hypertension	48	40.0
Previous cellulitis	15	12.5
Alcohol consumption	46	38.3
History of smoking	37	30.8
Current smoker	34	28.3
Disruption of skin barrier	84	70.0
History of lower-limb surgery	56	46.7
Toe-web intertrigo	93	77.5

Local factors were predominant, with toe-web intertrigo and disruption of the skin barrier being the most frequent risk factors. Systemic comorbidities such as diabetes and hypertension were also common, underscoring their contributory role in disease severity and recurrence.

Table 3: Clinical presentation of lower limb cellulitis (N = 120)

Clinical presentation	Frequency	%
Laterality		
Left	59	49.2
Right	54	45.0
Bilateral	7	5.8
Area involved		
Thigh	2	1.7
Leg	67	55.8
Foot	46	38.3
Whole limb	7	5.8
Pain present	113	94.2
Redness present	104	86.7
Swelling present	120	100
Loss of function	95	79.2

The leg was the most commonly affected site. Nearly all patients presented with pain, swelling, and erythema, with more than three-quarters experiencing functional limitation. Bilateral involvement was uncommon, indicating predominantly localized disease.

Table 4: Treatment outcomes and complications of lower limb cellulitis

A. Treatment outcome (N = 120)		
Outcome	**Frequency**	**%**
Recovered without complications	52	43.3
Recovered with complications	68	56.7
B. Mode of treatment (N = 120)		
Mode of treatment	Frequency	%
Conservative (antibiotics only)	52	43.3
Surgical intervention required	68	56.7
C. Complications among patients with complications (n = 68)		

Complication	Frequency	%
Abscess	50	73.5
Ulcer	35	51.5
Necrotizing soft tissue infection	20	29.4
Septic shock	6	8.8
Gangrene	3	4.4
D. Surgical procedures performed (n = 68)		
Procedure	Frequency	%
Debridement	63	92.6
Incision & drainage	37	54.4
Ray amputation	3	4.4

More than half of the patients developed complications necessitating surgical intervention. Abscess formation was the most frequent complication. Debridement was the most commonly performed surgical procedure, while gangrene and septic shock were rare but serious outcomes.

The mean duration of hospital stay was 7.5 ± 5.0 days, and cellulitis without an identifiable local risk factor was observed in 4 patients (3.3%).

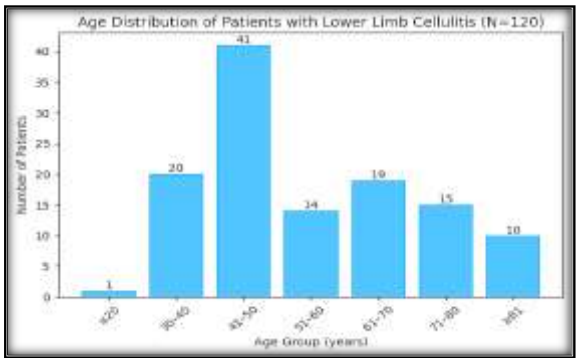

Figure 2: Age distribution of patients with lower limb cellulitis (N = 120).

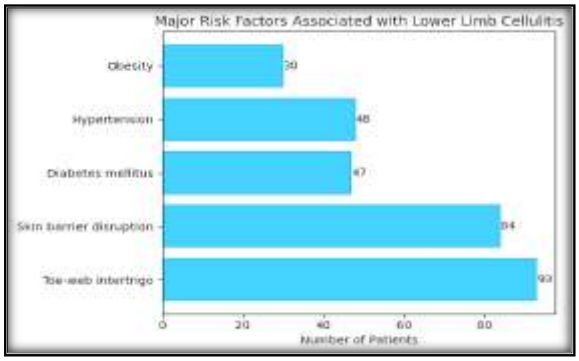

Figure 3: Distribution of major risk factors among patients with lower limb cellulitis.

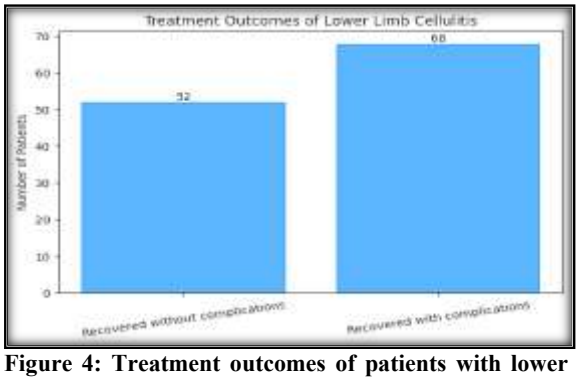

Figure 4: Treatment outcomes of patients with lower limb cellulitis.

DISCUSSION

Cellulitis is a common non-necrotizing bacterial infection involving the skin and subcutaneous tissues, predominantly affecting the lower limbs. The disease is more frequently observed in adults, with increasing incidence noted with advancing age.[6] In the present study, the mean age of affected patients was 46.6 ± 19.2 years, indicating a predominance in middle-aged and older adults. This finding contrasts with earlier Indian studies that reported a younger mean age of presentation, such as Bhagat et al., who observed a mean age of 36.4 years.[8] Similarly, Ellis Simonsen et al. reported the highest incidence among individuals aged 21–44 years in a population-based study.[9] The relatively higher mean age in our cohort may reflect delayed healthcare access and the cumulative effect of comorbidities in older populations.

A clear male predominance was observed in the present study (51.7% males), consistent with several previous reports.[9-11] Ellis Simonsen et al. documented a slightly higher incidence in males compared to females,[9] while Bhagat et al. reported a markedly higher male predominance.[8] In contrast, Njim et al. noted a higher frequency among females in a Cameroonian cohort.[10] In our study, males predominantly presented in the fifth decade of life, whereas females were more commonly affected in the fourth decade, suggesting possible occupational and lifestyle influences.

Educational status and occupation appeared to play a contributory role in disease presentation. A substantial proportion of patients had either no formal education or only basic education, and many were engaged in manual or outdoor occupations such as farming and labor work. Similar findings were reported by Deshpande et al., where farmers constituted the majority of cellulitis cases in a rural Indian setting.[11] Occupational exposure, minor unnoticed trauma, and delayed wound care likely increase susceptibility in these populations. These observations highlight the importance of preventive education and protective measures, particularly among rural workers.

The role of local risk factors in the pathogenesis of lower limb cellulitis was strongly evident in this study. Toe-web intertrigo (77.5%) and disruption of the skin barrier (70.0%) were the most frequently identified predisposing factors. These findings are in line with earlier studies that emphasized the importance of cutaneous breaches and fungal

infections as portals of entry for bacteria.[3,12] Systemic risk factors such as diabetes mellitus (39.2%), hypertension (40.0%), obesity (25.0%), smoking (30.8%), and alcohol consumption (38.3%) were also commonly observed, corroborating reports by Njim et al. and Tianyi et al., who identified similar associations.[10,15]

Clinically, the disease most often involved the leg (55.8%), followed by the foot (38.3%), with unilateral involvement being predominant. These findings are consistent with observations by Kenche et al. and Deshpande et al., who also reported the leg as the most commonly affected site.[11,13] Nearly all patients presented with pain, erythema, and swelling, and approximately 79.2% experienced functional limitation, underscoring the disabling nature of the disease at presentation.

The mean duration between onset of symptoms and hospital presentation was 13 ± 3.9 days, indicating delayed healthcare seeking behavior. Late presentation has been well recognized as a major determinant of disease severity and complications.[14] Although outpatient management of cellulitis is feasible and cost-effective in early stages, delayed presentation often necessitates hospitalization and surgical intervention.

The overall complication rate in the present study (56.7%) was higher than that reported in several previous studies, where complication rates ranged from 8.9% to 47.4%.[15,16] Abscess formation was the most common complication (73.5% among complicated cases), followed by ulceration and necrotizing soft tissue infection. Surgical intervention was required in more than half of the patients, with debridement being the most frequently performed procedure. Similar trends were reported by Deshpande et al. and Njim et al., although the rate of amputation in our study (4.4%) remained comparable to earlier reports.[10,11] The higher surgical burden in this study may be attributed to delayed presentation, self-medication, and inappropriate antibiotic use, which can contribute to poor response and progression of infection.

Table 5: Comparison of demographic and clinical characteristics with selected studies

Parameter	Present study (N=120)	Bhagat et al,[10]	Ellis Simonsen et al,[7]	Njim et al,[11]
Mean age (years)	46.6 ± 19.2	36.4 ± 1.23	21–44 (peak)	Younger adults
Male (%)	51.7	76.6	Higher than females	Female predominance
Common site	Leg (55.8%)	Leg	Lower limb	Lower limb
Unilateral involvement (%)	94.2	Predominant	Predominant	Predominant
Loss of function (%)	79.2	---	---	---

The present study demonstrates a higher mean age compared to earlier Indian studies, suggesting delayed healthcare access and accumulation of comorbidities. Male predominance was observed, consistent with population-based studies, though less pronounced than in some Indian cohorts.

Table 6: Comparison of risk factors, complications, and surgical outcomes

Parameter	Present study	Deshpande et al,[12]	Njim et al,[11]	Tianyi et al,[13]
Toe-web intertrigo (%)	77.5	Not specified	Major factor	Major factor
Skin barrier disruption (%)	70.0	Common	Common	Common
Diabetes mellitus (%)	39.2	52.0	33.0	41.0
Overall complications (%)	56.7	35.4	47.4	8.9–47.4
Abscess (%)	73.5*	Common	Common	Common
Surgical intervention (%)	56.7	35.4	Not specified	Variable
Amputation (%)	4.4	0.8	4.9	Rare

*Percentage calculated among patients with complications.

The complication and surgical intervention rates in the present study were higher than those reported in several earlier studies. This is likely attributable to delayed presentation, higher prevalence of local risk factors, and self-medication practices. Despite this, the amputation rate remained comparable to previous reports.

CONCLUSION

Lower limb cellulitis remains a significant cause of morbidity, particularly among middle-aged and older adults engaged in manual occupations. The disease shows a male predominance and is strongly associated with local risk factors such as toe-web intertrigo and disruption of the skin barrier, as well as systemic comorbidities including diabetes, hypertension, obesity, smoking, and alcohol consumption. Delayed presentation to healthcare facilities contributes substantially to higher complication rates, increased need for surgical intervention, and prolonged hospitalization.

Early recognition, prompt medical management, control of comorbid conditions, and preventive measures targeting local risk factors are essential to reduce disease burden. Public awareness regarding early symptoms and warning signs of severe infection may help prevent complications. Larger multicenter studies are recommended to better define the epidemiology and healthcare impact of cellulitis at a national level.

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