

A PROSPECTIVE STUDY ON MANAGEMENT OF LOWER LIMB CELLULITIS AND ITS OUTCOME

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ABSTRACT

Background: Lower limb cellulitis is a common soft tissue infection associated with significant morbidity, particularly in elderly individuals and those with underlying comorbidities. Early diagnosis and appropriate management are essential to prevent complications and improve outcomes.

Methods: This prospective observational study was conducted over two years at a tertiary rural healthcare center and included 100 patients aged ≥ 15 years with lower limb cellulitis. Demographic characteristics, predisposing factors, disease severity (CREST grading), microbiological profile, management modalities, and clinical outcomes were evaluated.

Results: The majority of patients were aged >60 years (45%), with a slight male predominance (54%). Diabetes mellitus was the most common predisposing factor (46%), followed by infected traumatic wounds (14%) and chronic kidney disease (12%). Most patients presented with CREST Grade III cellulitis (67%). Culture positivity was observed in 69% of cases, with *Staphylococcus aureus* (37%) and *Streptococcus* spp. (26%) being the predominant pathogens. Conservative treatment was sufficient in 14% of patients, whereas 74% required surgical intervention, including debridement with or without fasciotomy. Amputation was performed in 12% of cases. Uneventful recovery occurred in 30% of patients, while 58% required further wound care, 11% developed disability, and mortality was 1%.

Conclusion: Lower limb cellulitis predominantly affects elderly patients with diabetes and frequently requires surgical management. Despite low mortality, substantial morbidity highlights the importance of early diagnosis, prompt treatment, and effective control of underlying risk factors.

Keywords: Lower limb cellulitis, Cellulitis, Diabetes mellitus, *Staphylococcus aureus*

How to cite this article: Dorkar A, Wakkar DN, Dorkar PS. A Prospective Study on Management of Lower Limb Cellulitis and Its Outcome. Int J Drug Deliv Technol. 2026;16(67s):1961-1965. DOI: 10.25258/ijddt.16.67s.176

INTRODUCTION

Cellulitis is an acute bacterial infection of the skin and subcutaneous tissues characterized by erythema, swelling, warmth, tenderness, and pain. It commonly affects the lower extremities and remains one of the leading causes of hospital admissions related to skin and soft tissue infections worldwide. The condition is predominantly caused by *Streptococcus pyogenes* and *Staphylococcus aureus*, although polymicrobial infections may occur in patients with diabetes mellitus, chronic ulcers, peripheral vascular disease, and immunocompromised states. Recent studies have reported an increasing burden of lower limb cellulitis owing to the growing prevalence of diabetes, obesity, chronic edema, and venous insufficiency [1,2].

Lower limb cellulitis is associated with significant morbidity, prolonged hospitalization, recurrent infections, and increased healthcare costs. Clinical manifestations range from mild localized inflammation to severe infection with systemic toxicity, sepsis, and limb-threatening complications. Early diagnosis and prompt initiation of appropriate treatment are essential to prevent progression and improve outcomes. However, distinguishing cellulitis from its mimics such as venous eczema, deep vein

thrombosis, contact dermatitis, and lymphedema remains challenging. A recent systematic review demonstrated substantial rates of cellulitis misdiagnosis, resulting in

unnecessary antibiotic exposure and avoidable hospital admissions [3].

The management of lower limb cellulitis primarily includes antimicrobial therapy, limb elevation, edema control, wound care, treatment of underlying risk factors, and surgical intervention when abscess formation or tissue necrosis is present. Despite advances in antimicrobial therapy, uncertainty remains regarding the optimal antibiotic regimen and duration of treatment. A systematic review evaluating antibiotic regimens for lower limb cellulitis found comparable clinical outcomes among several commonly used treatment strategies, emphasizing the need for individualized patient-centered management [4].

Recent research has focused on identifying prognostic markers that can predict disease severity, hospitalization, recurrence, and treatment outcomes. Inflammatory indices such as the neutrophil-to-lymphocyte ratio, platelet-to-lymphocyte ratio, and C-reactive protein/albumin ratio

have shown promise as predictors of disease progression and recurrence in lower [2]

Management of predisposing factors has become an important component of modern cellulitis care. Conditions such as chronic edema, obesity, diabetes mellitus, fungal infections, and venous insufficiency significantly increase the risk of recurrence. Recent evidence suggests that compression therapy and comprehensive edema management can reduce recurrent episodes and improve long-term outcomes in patients with lower limb cellulitis [5].

Furthermore, growing emphasis has been placed on multidisciplinary management and antimicrobial stewardship. Optimizing antibiotic use while ensuring effective treatment is crucial in reducing antimicrobial resistance and treatment-related complications. Recent meta-analyses have evaluated the efficacy and safety of various antibiotic regimens and adjunctive anti-inflammatory therapies, providing updated evidence for clinical decision-making [6,7].

Considering the increasing incidence, diverse clinical presentations, potential complications, and evolving treatment strategies associated with lower limb cellulitis, continuous evaluation of management approaches and outcomes is necessary. Therefore, the present prospective study was undertaken to assess the management practices employed in patients with lower limb cellulitis and to evaluate their clinical outcomes in a tertiary care setting.

Methodology

This prospective observational study was conducted over a period of two years at a tertiary rural healthcare centre. The study included all patients aged ≥ 15 years presenting to the Surgery Outpatient Department (OPD), admitted to hospital wards or ICU, or previously diagnosed with lower limb cellulitis. Patients with cellulitis secondary to deep venous thrombosis and those younger than 15 years were excluded.

A detailed clinical history and physical examination were performed for all participants. Demographic data, presenting symptoms, risk factors, comorbidities, recurrence history, and clinical severity were recorded. The severity of cellulitis was assessed according to the CREST classification (Classes I–IV).

Investigations included complete blood count, renal function tests, coagulation profile, serum electrolytes, HIV and HBsAg screening, wound/swab culture with antibiotic sensitivity testing, Doppler study of the arterial and venous systems of the affected limb, and plain radiography of the involved limb when indicated.

All patients received empirical broad-spectrum intravenous antibiotics covering gram-positive, gram-negative, and anaerobic organisms, which were subsequently modified based on culture and sensitivity results and clinical response. Surgical interventions, including aspiration of blisters, debridement, abscess drainage, fasciotomy, skin grafting, or amputation, were performed when clinically indicated.

Patients were followed throughout hospitalization, and outcomes were documented as uncomplicated recovery, residual tissue loss requiring further treatment, residual deformity, or mortality. Data regarding demographic characteristics, clinical presentation, microbiological profile, treatment modalities, and outcomes were analyzed.

Results

Table 1: Demographic Profile of Patients with Lower Limb Cellulitis (n=100)

Variable	Category	Frequency (%)
Age Group (years)	<20	1 (1.0)
	21–30	1 (1.0)
	31–40	5 (5.0)
	41–50	21 (21.0)
	51–60	27 (27.0)
	>60	45 (45.0)
Gender	Male	54 (54.0)
	Female	46 (46.0)

A total of 100 patients with lower limb cellulitis were included in the study. The majority of patients belonged to the older age groups, with 45% of cases occurring in individuals aged more than 60 years, followed by 27% in the 51–60 years age group and 21% in the 41–50 years age group. Only 7% of patients were younger than 40 years of age. These findings indicate that the incidence of lower limb cellulitis increases with advancing age. With respect to gender distribution, 54% of the patients were males and 46% were females, demonstrating a slight male predominance in the study population.

Table 2: Predisposing Factors Associated with Lower Limb Cellulitis (n=100)

Predisposing Factor	Frequency (%)
Diabetes Mellitus	46 (46.0)
Infected Traumatic Wound	14 (14.0)
Chronic Kidney Disease	12 (12.0)
Bite Injury	10 (10.0)
Web Space Infection	7 (7.0)
Edema due to Cardiac Failure	5 (5.0)

Lymphedema	3 (3.0)
Unknown Cause	3 (3.0)

Diabetes mellitus was identified as the most common predisposing factor, present in 46% of patients. This was followed by infected traumatic wounds (14%), chronic kidney disease (12%), and bite injuries (10%). Other contributing factors included web space infections (7%), edema secondary to cardiac failure (5%), and lymphedema (3%). In 3% of cases, no definite underlying cause could be identified. These findings suggest that metabolic disorders, particularly diabetes mellitus, play a major role in the development of lower limb cellulitis, while local trauma and systemic illnesses also contribute significantly to disease occurrence.

Table 3: Distribution of Cellulitis According to CREST Grading (n=100)

Grade	Frequency (%)
Grade II	24 (24.0)
Grade III	67 (67.0)
Grade IV	9 (9.0)
Total	100 (100.0)

The severity of cellulitis was assessed using the CREST grading system. Grade III cellulitis constituted the majority of cases, accounting for 67% of the study population. Grade II cellulitis was observed in 24% of patients, while Grade IV disease was present in 9% of patients. The predominance of Grade III cellulitis indicates that most patients presented with moderate-to-severe disease requiring inpatient management and close monitoring. The relatively smaller proportion of Grade IV cases suggests that severe systemic involvement was less common in the study cohort.

Table 4: Microbiological Profile of Lower Limb Cellulitis and Organisms Isolated (n=100)

Variable	Frequency (%)
Monomicrobial Growth	47 (47.0)
Polymicrobial Growth	22 (22.0)
No Growth	31 (31.0)
Organism	Frequency
Staphylococcus aureus	37
Streptococcus spp.	26
Klebsiella spp.	21

Proteus spp.	17
E. coli	7
Pseudomonas spp.	6

Microbiological analysis revealed that 47% of patients had monomicrobial infections, whereas 22% had polymicrobial infections. No bacterial growth was observed in 31% of culture samples. Among the isolated organisms, Staphylococcus aureus was the most common pathogen, identified in 37 cases, followed by Streptococcus species in 26 cases. Other organisms isolated included Klebsiella species (21 cases), Proteus species (17 cases), Escherichia coli (7 cases), and Pseudomonas species (6 cases). These findings highlight the predominance of gram-positive cocci, particularly Staphylococcus aureus and Streptococcus species, in the pathogenesis of lower limb cellulitis.

Table 5: Management Modalities for Lower Limb Cellulitis (n=100)

Management	Frequency (%)
Conservative Treatment	14 (14.0)
Wound Debridement	28 (28.0)
Wound Debridement + Fasciotomy	46 (46.0)
Amputation	12 (12.0)

The treatment approach varied according to the severity and extent of infection. Conservative management with antibiotics and supportive care was sufficient in 14% of patients. Surgical intervention was required in the majority of cases, with 28% undergoing wound debridement and 46% requiring wound debridement combined with fasciotomy. Amputation was necessary in 12% of patients due to extensive tissue destruction or failure of limb salvage. These findings indicate that a substantial proportion of patients presented with advanced disease requiring operative management.

Table 6: Clinical Outcome of Lower Limb Cellulitis (n=100)

Outcome	Frequency (%)
Uneventful Recovery	30 (30.0)
Post-procedure Wound Requiring Further Care	58 (58.0)
Disability	11 (11.0)

Death	1 (1.0)
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Regarding treatment outcomes, 30% of patients recovered uneventfully following management. However, 58% of patients had residual post-procedure wounds requiring further wound care and follow-up. Disability was observed in 11% of patients, reflecting the significant morbidity associated with severe cellulitis. Mortality occurred in 1% of cases. Overall, although most patients survived the disease, lower limb cellulitis was associated with considerable morbidity, often necessitating prolonged wound care and rehabilitation following treatment.

Discussion

This is a prospective study of 100 patients, which assessed the demographic profile, predisposing factors, microbiological pattern, management and outcomes of lower limb cellulitis. The results were correlated with the latest literature on the subject to evaluate the similarities and differences in the presentation and management of the disease.

Most of the patients in the current study were senior adults (45% >60 years old and 27% between 51 and 60 years old). The mean age of patients diagnosed with cellulitis (57.5 years) is similar to the results of Vilma Kantonen et al. [8] (2025) who found that the incidence of lower limb cellulitis rose significantly with age. In the other way round, Pınar Yürük Atasoy et al. [2] (2024) noted that older patients were more likely to be hospitalized for and have a recurrence of lower extremity cellulitis. This may be due to a greater prevalence in older individuals due to loss of immunity, secondary related diseases, and circulatory problems in the periphery. The current study also showed that the males predominated with 54%, which is similar to that of Kantonen et al [8] (2025) who found 56.8% male patients and Bhagat et al [1] (2023) who found a male predominance in hospitalized patients with lower limb cellulitis.

In the present study, the most common predisposing factor was diabetes mellitus (46%) patients. This is consistent with Bhagat et al. [1] (2023) who found diabetes to be the most common associated condition among patients with lower limb cellulitis. Likewise, Villamil Manrique et al. [9] (2023) in their systematic review and meta-analysis, found diabetes mellitus as one of the important risk factors for lower limb cellulitis. Cellulitis is associated with diabetes, because the impaired neutrophil function, peripheral neuropathy, vascular insufficiency and delayed wound healing results in an increased risk. Other risk factors found in the present work, such as chronic kidney disease, lymphedema, cardiac failure edema and traumatic wounds correspond with the recent evidence. Sierla et al. [10] (2025) pointed out that chronic edema and lymphatic dysfunction are prime factors in triggering recurrent cellulitis disease episodes, highlighting the importance of underlying systemic and local factors in the development of cellulitis.

Severity was assessed by the CREST grading system whereby 67% of cases were classified as Grade III and 9% as Grade IV. These results showed that most of the cases were presented with moderate to severe infection, which needed hospitalization. In a similar study, Bhagat et al. [1] (2023) report a significant number of patients presenting

with advanced disease who needed hospitalization. The higher prevalence of severe cellulitis reported in the present study may be due to delayed seeking of healthcare, the presence of diabetes and associated comorbidities.

The microbiological analysis revealed that 47% of patients had monomicrobial growth, 22% had polymicrobial growth and 31% did not grow any bacteria. The most common organism isolated was *Staphylococcus aureus*, followed by *Streptococcus* species. Bhagat et al. [1] (2023) found the same bacterium, *Staphylococcus aureus*, to be the most prevalent cause of lower limb cellulitis. In the present study, the isolation of gram-negative bacteria like *Klebsiella*, *Proteus*, *Escherichia coli* and *Pseudomonas* might be due to the high prevalence of diabetic patients and chronic wounds. In addition, there have been recent studies that have documented that there is an increased involvement of polymicrobial and gram-negative bacteria in those with diabetic lower extremity infections.

As far as management was concerned, only 14% responded to conservative treatment and most patients needed surgical treatment. Forty-six percent of patients had wound debridement by fasciotomy and 12% ended up having amputation performed. The results mirror the late presentation of the disease and are similar to the study done by Bhagat et al. [1] (2023) which found that severe cases of cellulitis had a high need for surgical procedures. Moreover, a recent study by Pradeep Kumar et al. [11] (2024) has shown the significant association between high tissue pressure in lower limb cellulitis and its response to surgical decompression. Early diagnosis and prompt treatment giving rise to the high rate of operative management in the present study is an important factor of preventing the disease from progressing to infection of the limb threatening nature.

With regards to outcomes, 30% of patients had a uneventful recovery, while 58% had prolonged wound care following treatment. Eleven per cent of patients had a disability and 1 per cent of patients died. These results indicate that mortality is still low, but lower limb cellulitis is still contributing to significant morbidity. Atasoy et al. [2] (2024) reached the same conclusion, noting that patients with severe lower extremity cellulitis were hospitalized for longer periods and experienced more recurrences. Residual wounds and disability were common in the present study, which might be attributed to the late presentation, with widespread involvement of tissues and the prevalence of diabetic mellitus.

The overall results of the present study were with the same trend as the modern literature, showing that low limb cellulitis frequently occurs in elderly people who have diabetes mellitus and other comorbidities. *Staphylococcus aureus* is still the predominant pathogen and surgery is often required for serious infection. While mortality rates are relatively low, there is still considerable morbidity, and early recognition, aggressive treatment, glycemic control, and control of predisposing factors are important for optimizing patient outcomes.

Conclusion

The lower limb cellulitis was mostly seen in older patients and diabetes mellitus was the most common risk factor. The majority of patients had moderate-to-severe infections (Grade III). *Staphylococcus aureus* and *Streptococcus* species were the most common organisms isolated. In

most cases, surgical intervention, especially wound debridement with fasciotomy, was necessary. While death rates were low, many of the patients had high morbidity rates and needed extensive treatment for the wound; some of the patients were disabled. Early diagnosis and timely surgical intervention along with effective infection control is important to enhance the prognosis and minimize the complications.

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