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Assessment of Risk Factors and Treatment Outcomes in Patients with Cellulitis Over a Defined Period

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Abstract:

- ***Background:***
  Cellulitis, a common bacterial skin condition, requires prompt treatment. This study analyzed risk factors and treatment outcomes of patients over six months.

- ***Methods:***
  A prospective observational study was conducted at Government Cuddalore Medical College and Hospital for a period of six months (November 2024-April 2025). Fifty adult patients with diagnosed cellulitis were included. Data on demographics, comorbidities, use of antibiotics, complications, and hospital stay was reviewed.

- ***Results:***
  Most patients were male and in the 41–50 age group. Diabetes mellitus was the most common comorbid condition. No significant link was found between the type of antibiotic and treatment outcomes, but a strong association ($p < 0.001$) was found between the number of comorbid conditions and recurrence, complications, and duration of hospital stay.

- ***Conclusion:***
  Comorbid conditions significantly affect treatment outcomes in cellulitis. Effective management should include treatment with antibiotics, as well as addressing underlying health issues.

Keywords: *Cellulitis, Risk Factors, Treatment Outcomes, Complications.*

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I. INTRODUCTION

Cellulitis is a common and serious bacterial infection that affects the skin and the tissues just under the skin. It usually comes suddenly and needs quick diagnosis and treatment to stop serious problems like abscesses, severe skin infections, or blood infections (Stevens et al., 2014; CDC, 2022). Cellulitis is an acute infection that spreads in the deeper layers of the skin and under the skin, most often caused by bacteria called *Streptococcus pyogenes* and *Staphylococcus aureus* (Mandell et al., 2020; NICE, 2019). While it can happen anywhere on the body, it most commonly appears on the legs (Baddour et al., 2023). The signs of cellulitis include redness, swelling, warmth, and tenderness in the affected area. In more serious cases, people may also feel feverish, tired, or shivery. The skin might blister, feel tight, or show streaks that look like lines (Mayo Clinic, 2023; Baddour et al., 2023). The infection starts when bacteria enter through a break in the skin, causing inflammation and an immune response. This leads to increased fluid in the tissues and the movement of white blood cells, which cause the symptoms (Mandell et al., 2020). Factors that increase the risk of getting cellulitis include skin damage (like cuts or insect bites), existing skin conditions, diabetes, poor blood flow, a weak immune system, being overweight, not keeping skin clean, and a history of past cellulitis (Stevens et al., 2014; NICE, 2019). Doctors usually diagnose cellulitis based on the patient's symptoms and a physical exam. In some cases, tests like blood work or blood cultures may be done to help confirm the diagnosis, especially if the infection is severe or

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spreading (Baddour et al., 2023). Treatment generally starts with antibiotics that target the most common bacteria, and these may be changed based on how the patient responds or test results. Along with antibiotics, it's important to rest the affected area, keep it elevated, and manage pain. In severe cases or for people with weak immune systems, hospital care may be needed (Stevens et al., 2014; NICE, 2019).

This article looks at the risk factors and outcomes of cellulitis within a specific time frame, aiming to better understand the condition and help with better treatment approaches.

II. MATERIALS AND METHODS

➢ *Study Site*

This study was done at one center. It took place in the inpatient ward of the Surgery Department at Government Cuddalore Medical College and Hospital (GCMCH), located in Annamalai Nagar, Chidambaram, Tamil Nadu, with the postal code 608002.

➢ *Study Design*

Prospective Observational study.

➢ *Study Period*

The study was conducted for a period of 6 months (November 2024-April 2025).

➢ *Sample Size*

As it was Preliminary Research, there was no sample size calculation. The number of participants was decided based on how many patients were available and met the inclusion and exclusion criteria.

➢ *Study Recruitment:*

- *Target Population:*

Patients clinically diagnosed with Cellulitis, at Government Cuddalore Medical College and Hospital, Chidambaram.

- *Study Population:*

The patients enrolled for the study were selected based on inclusion and exclusion criteria.

➢ *Inclusion Criteria*

- Patients who were 18 years or older and had been diagnosed with cellulitis.
- Patients treated within the defined study period.
- Availability of complete clinical records including demographics, risk factors and treatment details.
- Patients who provided informed consent.

➢ *Exclusion Criteria*

- Patients who had other skin infections that were mistaken for Cellulitis, such as necrotizing fasciitis or an abscess without Cellulitis.
- Post-surgical or trauma-related cellulitis not of spontaneous origin.
- Patients who left against medical advice (LAMA) or had incomplete treatment data.

➢ *Data Collection*

The data was collected in a predesigned data collection form through direct interview with patients and from patient medical records. Details like patient demographics, clinical history, symptoms, treatment details, and outcomes. Key variables were age, comorbidities, antibiotics used, complications, and length of stay.

➢ *Data Analysis*

The data gathered were recorded using Microsoft Excel and statistical analysis was done using JASP (Jeffreys's Amazing Statistics Program) software.

III. RESULTS AND DISCUSSION

A. Descriptive Statistics

➢ *Gender-Wise Distribution*

Among the 50 patients with cellulitis who took part in the study, 60% (n = 30) were male, while 40% (n = 20) were female, as shown in Table 1. This suggests that male patients had a higher rate of cellulitis in this group. The difference in gender may be connected to higher exposure to work-related risks, injuries, or other lifestyle factors that are more common in males. Similar results showing a higher rate of cellulitis in males and an increase with age were found by Simonsen et al. in 2005.

Table 1 Gender-Wise Distribution of Cellulitis Patients

Gender	Number of patients	Percentage (%)
Male	30	60%
Female	20	40%
Total	50	100%

➢ *Age Group Distribution*

The spread of cellulitis across different age groups is shown in Table 2.

Table 2 Age Group Distribution of Cellulitis Patients

Age group (years)	Number of patients	Percentage (%)
18–30	8	16%
31–40	10	20%

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41–50	12	24%
51–60	10	20%
61–70	6	12%
71 and above	4	8%
Total	50	100%

Patients were divided into six separate age groups. The highest number of cellulitis cases was in the 41–50 years group (24%), followed by the 31–40 years and 51–60 years groups, each making up 20%. The highest occurrence of cellulitis was seen in middle-aged people, likely due to the growing number of health conditions like diabetes, high blood pressure, and vascular diseases in these groups. Also, the natural decline in immune function and skin health with age could make people more vulnerable.

➢ *Comorbidities*

Each patient diagnosed with cellulitis was evaluated for the presence or absence of risk factors, and the results were presented in Table 3. The high prevalence of diabetes mellitus supports the known pathophysiological association between hyperglycemia and impaired wound healing, reduced immunity, and increased susceptibility to infection. Patients with prior episodes of cellulitis or underlying vascular disease were also at increased risk, suggesting recurrence and poor circulation as key factors.

Table 3 Comorbidities in Cellulitis Patients

Comorbidities	No. of Patients	Percentage (%)
Prev h/o of cellulitis	16	32%
Diabetes mellitus	33	66%
Hypertension	20	40%
Peripheral vascular disease	12	24%
No comorbidities	10	20%

➢ *Complications*

Among the 50 patients diagnosed with cellulitis, local complications were observed in 24 patients (48%), systemic complications were observed in 2 patients (4%) and no complications were reported in 24 patients (48%), as illustrated in Table 4.

Table 4 Complications in Cellulitis Patients

Complications	No. of Patients	Percentage (%)
Local Complication	24	48%
Systemic Complication	2	4%
No Complication	24	48%

➢ *Local Complication*

As shown in Table 5, amputation was the most common local complication, seen in 14% (n = 7) of patients. Surgical intervention or drainage was required in 12% (n = 6), reflecting severe infections. Abscess or fluid collections were reported in 10% (n = 5), indicating localized infection. Ulceration, skin necrosis, and hemorrhagic blistering were observed in 8% (n = 4), suggesting significant tissue damage. Deep tissue infections were less frequent, occurring in 4% (n = 2).

Table 5 Local Complication in cellulitis patients

Type of complication	No. of patients	Percentage (%)
Surgery/Drainage	6	12%
Abscess/Collection	5	10%
Ulceration/Skin necrosis/Haemorrhagic blistering	4	8%
Deep tissue infection	2	4%
Amputation	7	14%

➢ *Systemic Complications*

As illustrated in Table 6, systemic complications were infrequent yet clinically important. Multiorgan failure occurred in 2% (n = 1) of the patients, suggesting a serious systemic reaction to infection. Likewise, new-onset arrhythmias were documented in 2% (n = 1), indicating possible cardiac involvement. Although these events were rare, their occurrence underscores the importance of close monitoring for systemic deterioration in high-risk patients.

Table 6 Systemic Complication in Cellulitis Patients

Type of Complication	No. of Patients	Percentage (%)
Multiorgan Failure	1	2%
New-onset Arrhythmia	1	2%

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B. Inferential Statistics

➢ *Association Between Treatment and Recurrence*

Table 7 shows the association between the type of antibiotic treatment and recurrence.

As indicated in Table 8, the chi-square test ($\chi^2 = 4.433$, df = 4, p = 0.351) reveals that there is no statistically significant link between the type of antibiotic treatment given and the recurrence rate. This suggests that, within this sample of 50 patients, the selection of treatment among the five groups does not have a significant effect on the likelihood of recurrence.

Table 7 Association Between Treatment and Recurrence

Treatment	Recurrence		Total
	No	Yes	
Amoxicillin + Clavulanic acid	2	8	10
Cefotaxime	5	5	10
Clarithromycin + Metronidazole	6	4	10
Piptaz + Gentamicin	3	7	10
Piptaz + Metronidazole	5	5	10
Total	21	29	50

Table 8 Chi-Square Test for Association Between Treatment and Recurrence

Chi-square	Value	df	P
X^2	4.433	4	0.351
N	50		

- Note. X^2 - Chi-Square, df - degrees of freedom, p value - Probability value

➢ *Association Between Treatment and Hospital Stay*

Table 9 shows the association between the type of antibiotic treatment and hospital stay.

Table 9 Association Between Treatment and Hospital Stay

Treatment	Hospital Stay		Total
	< 1 week	> 1 week	
Amoxicillin + Clavulanic acid	5	5	10
Cefotaxime	4	6	10
Clarithromycin + Metronidazole	6	4	10
Piptaz + Gentamicin	3	7	10
Piptaz + Metronidazole	6	4	10
Total	24	26	50

In the chi-square test results ($\chi^2 = 2.724$, df = 4, p = 0.605), as shown in Table 10, there is no significant statistical connection between the type of treatment and the length of hospital stay. This suggests that whether the length of stay was less than or more than one week was not significantly affected by the type of antibiotic treatment in this study.

Table 10 Chi-Square Test for Association Between Treatment and Hospital Stay

Chi-square	Value	df	P
X^2	2.724	4	0.605
N	50		

➢ *Association Between Treatment and Complications*

Table 11 shows the association between the type of antibiotic treatment and the occurrence of complications.

Table 11 Association Between Treatment and Complications

Treatment	Complications		Total
	No	Yes	
Amoxicillin + Clavulanic acid	4	6	10
Cefotaxime	5	5	10
Clarithromycin + Metronidazole	5	5	10
Piptaz + Gentamicin	4	6	10
Piptaz + Metronidazole	6	4	10
Total	24	26	50

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The chi-square test ($\chi^2 = 1.122$, df = 4, p = 0.891), as shown in Table 12, shows that there is no significant association between the type of treatment and the occurrence of complications. This indicates that the choice of antibiotic treatment did not significantly affect the likelihood of complications among patients in this study.

Table 12 Chi-Square Test for Association Between Treatment and Complications

Chi - Square	Value	df	P
X^2	1.122	4	0.891
N	50		

➢ *Association Between Risk Factors and Recurrence*

Table 13 shows the association between risk factors and recurrence.

Table 13 Association Between Risk Factors and Recurrence

Risk factors	Recurrence		Total
	No	Yes	
No Comorbidities	8	2	10
One Comorbidity	13	9	22
More than One Comorbidities	0	18	18
Total	21	29	50

Table 14 Chi-Square Test for Association Between Risk Factors and Recurrence

Chi - Square	Value	df	P
X^2	21.60	2	< 0.001
N	50		

There is a clear and statistically significant connection between the number of comorbidities (risk factors) and the chance of recurrence, as shown by the p-value being less than 0.001 in Table 14. Individuals who have more comorbidities face a much higher risk of experiencing a recurrence. Additionally, Ong et al., 2022 found that a prior episode of cellulitis is a known risk factor for future recurrences.

➢ *Association Between Risk Factors and Hospital Stay*

Table 15 shows the association between risk factors and hospital stay.

Table 15 Association Between Risk Factors and Hospital Stay

Risk factors	Hospital Stay		Total
	< 1 week	> 1 week	
No Comorbidities	10	0	10
One Comorbidity	14	8	22
More than One Comorbidities	0	18	18
Total	24	26	50

There is a strong and statistically significant link between the presence of comorbidities and the duration of hospitalization, as indicated by the p-value being less than 0.001 in Table 16. Patients with more comorbidities are more likely to require a longer hospital stay, exceeding one week. Cranendonk et al., 2017 also reported that diabetic patients had higher rates of hospitalization and more complications.

Table 16 Chi-Square Test for Association Between Risk Factors and Hospital Stay

Chi - Square	Value	df	P
X^2	29.60	2	< 0.001
N	50		

➢ *Association Between Risk Factors and Complications*

Table 17 shows the association between risk factors and the occurrence of complications.

Table 17 Association Between Risk Factors and Complications

Risk factors	Complications		Total
	No	Yes	
No Comorbidities	10	0	10
One Comorbidity	14	8	22
More than One Comorbidities	0	18	18
Total	24	26	50

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There is a statistically significant association between the number of comorbidities and the development of complications, as demonstrated by the p-value being less than 0.001 in Table 18.

Table 18 Chi-Square Test for Association Between Risk Factors and Complications

Chi - Square	Value	df	P
X^2	29.60	2	< 0.001
N	50		

Patients with multiple comorbidities are at a significantly increased risk of suffering complications. In a study by Collazos et al., 2018, it was concluded that previous episodes of cellulitis, non-surgical trauma, venous insufficiency, sepsis, and immunosuppression were independently linked to treatment outcomes for cellulitis. However, factors such as the causative microorganism, the number of antimicrobials used, and the duration of treatment did not significantly affect the treatment response.

IV. CONCLUSION

The study showed that there was no significant connection between the type of antibiotic used and outcomes like treatment success, recurrence, length of hospital stay, or complications in patients with cellulitis. However, it was found that the number of existing health conditions, or comorbidities, was strongly linked to negative health outcomes. Patients with more comorbidities were more likely to experience a return of symptoms, needed to stay in the hospital longer, and faced more complications. These results emphasize the need to take into account individual patient factors, especially the presence of other health conditions, when treating cellulitis and predicting patient outcomes, rather than focusing only on the antibiotic prescribed.

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