



PROSPECTIVE AND OBSERVATIONAL STUDY OF ADULT PATIENTS ADMITTED WITH LOWER LIMB CELLULITIS IN HOSPITALS ATTACHED TO TERTIARY HEALTH CARE CENTRE

General Surgery

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ABSTRACT

Introduction : Cellulitis is primarily a bacterial infection involving the dermal and subcutaneous layers of the skin, presenting as an acute inflammatory response, caused by bacteria such as Streptococcus pyogenes and Staphylococcus aureus. This study provides a detailed analysis of lower limb cellulitis in patients admitted to tertiary health care centre of the Hadoti region of Rajasthan, India. Early diagnosis and treatment are crucial to prevent rapid progression and severe complications. **Materials and Methods :** This prospective and observational study involved 100 adult patients diagnosed with lower limb cellulitis. Data collection included patient demographics, clinical presentations, microbial cultures, antibiotic sensitivity tests, and treatment outcomes. **Results:** The study found that males were affected more than females, the incidence increasing with the age. The lower limbs are the most commonly affected sites due to their susceptibility to injuries, ulcers, breaks in the skin barrier. Diabetic patients constituted a significant portion due to their predisposition to foot ulcers and compromised immunity. The predominant pathogens were Streptococcus pyogenes and Staphylococcus aureus. The sensitivity pattern indicated resistance against commonly used antibiotics. Early-stage cellulitis was managed with oral antibiotics and outpatient care. Higher-grade cellulitis required hospitalization, intravenous antibiotics, and surgical intervention. **Conclusion:** Lower limb cellulitis remains a significant health concern, in regions like Hadoti, Rajasthan, where socioeconomic factors and healthcare access play crucial roles. Early intervention and comprehensive management are essential to improve patient outcomes. This study underscores the need for ongoing research and the development of standardized treatment protocols to address the rising incidence and severity of cellulitis. Enhanced awareness, preventive measures, and tailored therapeutic approaches are necessary to mitigate the impact of this condition on the affected population.

KEYWORDS

Cellulitis, Diabetes mellitus, Amputation.

INTRODUCTION

Cellulitis is a condition which is characterized by inflammation of connective tissue of the skin with severe involvement of dermal and subcutaneous layers, whose incidence is rising, and consequently bear significant financial and medical costs. In actuality, severe cases of cellulitis constitute a frequent and steadily rising cause of hospital admissions in developing countries, especially the elderly and those with comorbidities or predisposing factors.

It is principally a bacterial infection caused by streptococcus pyogenes and staphylococcus aureus followed by non-group A beta hemolytic streptococci and gram negative bacilli (the organism can be either the normal skin flora or an exogenous one), although the proportional fraction may vary based on the patients unique characteristics and the type of cellulitis.

It mostly affects the skin, which is more vulnerable for breaks, cracks, blisters, ulcerations, cuts, bite wounds and injuries associated to hospitals, such as surgical wounds or the intravenous cannulae. The most frequently affected areas are the lower limbs since the skin over there is more prone to the aforementioned traumas.

Despite its frequency, there are few studies available in India, and the most of them are retrospective in nature, using data from computerised databases or medical charts. There is a dearth of information on the diseases in Rajasthan's Hadoti regions. Therefore, we have carried out a prospective and observational study of adult patients with cellulitis admitted to the Hospitals attached to Government Medical College, Kota.

MATERIALS AND METHODS

100 patients older than 18 years with cellulitis admitted to the Department of General Surgery at hospitals attached to Government Medical College, Kota, between November 1st 2022 and March 31st 2024 were included in the study.

This was a prospective and observational study, in which the patients received standard clinical care for cellulitis, with no modifications

made to its management or particular choices or practices. The study was approved by local ethical committee and a written informed consent was taken from each study object at the time of enrollment.

A number of parameters, including age and sex distribution, predisposing factors, microbiological, antibiotic sensitivity, treatment employed were recorded and analysed.

The diagnosis of cellulitis was primarily based on history and physical examination. In the OPD, cases were initially seen, history was obtained, and symptoms and signs were noted. Clinical evaluations of the cases were conducted, along with the normal and targeted investigations (Complete hemogram, Duplex scan, Culture sensitivity).

Inclusion Criteria

- All the adult patients above the age of 18 years with clinical diagnosis of lower limb cellulitis requiring hospital admission
- Patients giving written and informed consent.

Exclusion Criteria

- Patients younger than 18 years of age
- Patients who can be managed on the outpatient basis

RESULTS

In the present series of 100 cases:

1. Age distribution

S. No.	Age group (in years)	No. of cases
1.	<20	1
2.	21-30	1
3.	31-40	5
4.	41-50	21
5.	51-60	27
6.	>60	45

2. Sex distribution

Male	Female
85	15

3. Predisposing factors

S. No.	Predisposing causes	No. of patients
1.	Diabetes mellitus	44
2.	Trauma	14
3.	Chronic kidney diseases	11
4.	Bite	10
5.	Web space infection	6
6.	Edema in cardiac failure	5
7.	Lymphedema	3
8.	Unknown	3

4. Micro-organisms cultured

S. No.	Microorganism	No. of patients
1.	Staphylococcus aureus	37
2.	Streptococcus species	26
3.	Klebsiella species	21
4.	Proteus species	17
5.	E. Coli	7
6.	Pseudomonas	6
7.	No growth	31

Significant number (31) of the cases did not grow any microbe, probably because the patient had already been treated with oral antibiotics before hospitalisation/ or culture was taken, thus the bacteria causing the cellulitis may have been partially or completely eradicated, leading to a sterile culture.

5. Sensitive drugs

S. No.	Antibiotic	No. of patients
1.	Piperacillin-tazobactam	64
2.	Cephalosporin	39
3.	Imipenem	54
4.	Amikacin	18
5.	Ciprofloxacin	18
6.	Colistin	7
7.	Amoxycillin+clavulanic acid	6
8.	Gentamycin	12

6. Circulatory changes observed

S. No.	Changes observed	No. of patients
1.	Monophasic flow in popliteal artery	1
2.	Sluggish flow in DPA	5
3.	No flow in DPA & Monophasic flow in ATA	4
4.	Deep vein thrombosis (Popliteal vein)	2

7. Treatment

S. No.	Management	No. of cases
1.	Conservative	13
2.	Wound debridement	27
3.	Wound debridement with fasciotomy	48
4.	Amputation	12

8. Outcome

S. No.	Outcome	No. of cases
1.	Uneventful	27
2.	Post procedure wound	61
3.	Disability	11
4.	Death	1

9. Management of the resultant wound

S. No.	Management of the wound	No. of cases
1.	Split skin grafting	28
2.	Healing by secondary intention	72

10. Duration of hospital stay

S. No.	Duration	No. of cases
1.	1-7 days	22
2.	8-15 days	57
3.	16-30 days	18
4.	>30 days	3

DISCUSSION

1. Regarding the age distribution, it was evident that as the age increases, the incidence of cellulitis increases (the maximum incidence occurred above the age group of 60 years), and it has also been studied

that the severity of the disease increases with the age, both the inferences correlate, with the study conducted by Wong CH, Chang HC, Pasupathy S et al⁶. This is being explained by the comparatively poorer immune response and the associated comorbidities in the elderly population.

2. There were 85% males and 15% females, among the 100 patients and this slightly increased male preponderance is supported by the study conducted by RK Gupta & CS Agrawal¹³, being explained by the fact that men suffer more from chronic morbid conditions like diabetes mellitus, lymphedema or chronic venous insufficiency leading to impaired circulation, fluid buildup in the lower limb, creating an environment where bacteria can thrive, thus increasing the risk of cellulitis in them.

3. In our study, diabetes mellitus was found to be the most common precipitating factor for developing cellulitis in the study group, this can be explained by impaired immune function, poor circulation (particularly in the extremities), nerve damage/diabetic neuropathy leading to unnoticed injuries or infections that can progress to cellulitis, higher blood sugar levels providing an ideal environment for bacteria to grow, diabetic foot ulcers that can become infected leading to cellulitis.

In study conducted by May AK, Stafford RE et al⁹ and Wong CH, Chang HC⁶ it was also observed that people suffering from diabetes mellitus are more likely to develop cellulitis.

It is to be noted that cellulitis superimposing on the lower limb oedema occurring in chronic kidney disease, lymphedema and cardiac failure constitutes a considerable proportion as the aetiology for the cellulitis in our study group. In about 3 individuals the exact cause of cellulitis was not known.

4. Staphylococcus species and streptococcus species were the predominant organisms responsible for the cellulitis in the study group, which correlates with literature of May AK, Stafford et al⁹ & Baddour LM, Bisno AL². Additionally, it was noted that E. coli microbe was present in the diabetic cellulitis patients only.

Other organisms observed in the study group include Klebsiella species, Proteus species, pseudomonas species and E coli.

5. The sensitivity pattern studied for the organisms cultured showed that, piperacillin tazobactam and imipenem were the two groups of antibiotics which tend to have the maximum sensitivity for the common organisms causing the cellulitis, as supported by the study conducted by Miller LS, Cho JS⁵. Cephalosporin group of antibiotics, amikacin, ciprofloxacin and gentamycin are found to be effective in good proportion of individuals

6. We noticed 1% of the patients showed monophasic flow in popliteal artery and 4% had monophasic flow in anterior tibial artery with no flow in dorsal pedis artery, 5% had sluggish flow in DPA and venous insufficiency has been noticed in 2% of individuals. Of all these vascular abnormalities, the vast majority (91%) were discovered in patients suffering from diabetes mellitus. These changes in the form of peripheral arterial diseases and chronic venous insufficiency leading to severe infections including cellulitis and a higher incidence of lower extremity amputations in diabetic patients is well explained in the study conducted by Margolis DJ et al.(2005)⁸.

7. Regarding the treatment, we have observed that around 75 patients in the study group required surgical debridement, 48 of them required release of the muscular compartment by means of the fasciotomy. 13% of patients with less severe form of cellulitis were managed conservatively with parenteral antibiotics, anti-inflammatory agents and limb elevation so as to reduce the associated oedema. 12% of individuals in the study group required amputation, because of the loss of almost all viable soft tissues and the possibility of sepsis syndrome because of the badly infected limb.

8. Regarding the outcome of the management, 27% patients out of 100 had uneventful recovery, around 61% of the patients had the residual wound that needed further attention. 11% of the patients remained with disability (amputation being done), and around 1% of the patient died because of the comorbidities complicating the illness, especially diabetes mellitus.

9. In 28% of the patients, resultant wounds persisted as the raw area and they were managed with split skin grafting, and remaining 72% of the wounds were allowed to heal by secondary intention, these management of the resultant cellulitis wound correlates with the study of Lantis, J.C. Durville, F.M. Stern¹⁰, and study published by Rosenberg AE et al¹⁴ & Frykberg Rg¹⁴.

10. Based on the results, it was found that all the patients who received conservative care and the patients who had undergone wound debridement, a small proportion among them, spent no more than a week in the hospital. On the other hand, more than 50% of the patients required more than ten days of inpatient treatment. Individuals with comorbid conditions such as diabetes mellitus and chronic kidney diseases were among those who required hospitalization for longer than 15 days.

CONCLUSION

- As the age increases, the incidence of cellulitis increases.
- Males have higher incidence of cellulitis compared to females.
- In this study, diabetes mellitus emerged as the most common predisposing factor for the cellulitis. The link between diabetes mellitus and cellulitis is multifaceted, involving several physiological and clinical factors like immunocompromised state, hyperglycaemia, diabetic neuropathy, diabetic foot ulcer. By educating diabetic people to keep their blood sugar levels within a target range, regularly inspecting feet for cuts, blisters or other sign of injury and maintaining good foot hygiene, taking early treatment of infection at the first sign of development, regular and routine visits to healthcare providers can help detect cellulitis and its dreaded complications at an early stage and thus prevent themselves from limb loss
- Staphylococcus aureus and streptococcus species are the common organisms responsible for the cellulitis in the study group. Additionally, it was noted that E. Coli microbe was present only in the diabetic cellulitis patients.
- Piperacillin-tazobactam and imipenem are the most sensitive antibiotics in majority of cases, this shows the emerging resistance for the commonly used antibiotics (ampicillin, cloxacillin and cephalosporins).
- Altered arterial flow and venous insufficiency in lower extremity are also the notable factors predisposing the lower limb to develop cellulitis.
- The majority of patients with lower limb cellulitis requires surgical intervention and cannot be managed with conservative treatment alone.

Hospital admission for the severe forms of cellulitis, appropriate and emergency surgical intervention as and when needed, employing culture directed antibiotics, managing the comorbidities can salvage the limbs and lives.

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