An Observational Study of Etiology and Risk Factors of Cellulitis at A Medical College in Rajasthan

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ABSTRACT: Cellulitis is one of the commonest disorder dealt by surgeons worldwide. It is primarily a bacterial infection, with the organism being either the usual flora of the skin or a foreign pathogen. It can cause considerable morbidity to the patient and in very severe cases mortality too. Early recognition and prompt management with a multidisciplinary team approach is usually needed for optimum outcome. In this observational study we tried to find out the common etiological and risk factors of cellulitis.

KEYWORDS: Cellulitis, etiological factors, abscess, necrotizing fasciitis, bacterial infection, risk factors,

INTRODUCTION
Cellulitis is a suppurative infection of the dermal and subdermal tissues that spreads and results in an inflammatory response from the host. It is a bacterial infection that spreads via the dermis and subcutaneous tissues. It causes local signs of inflammation, such as heat, erythema, discomfort, and lymphangitis, as well as systemic symptoms, such as fever and an elevated white blood cell count. It predominantly affects the skin, which is more susceptible to fractures, cracks, blisters, ulcerations, cuts, bite wounds, and hospital-related injuries such as surgical wounds and intravenous cannulae.

Cellulitis typically affects the legs, arms, and face. Most frequently, cellulitis affects the leg, which has distinct risk factors for bacterial invasion, growth, and infection dissemination. 60% of cellulitis cases involve the lower leg, with 35% of cases affecting the upper limb occurring most frequently in intravenous drug users. The one that affects the face is more prevalent in newborns and the elderly. Periorbital variation occurs around the eye, and if left untreated, it is quite mutilating. Whereas in adults, the lower limbs are the most prevalent sites of infection due to the prevalence of cracks, wounds, breaks, and ulcers, especially in those accustomed to walking barefoot.

Pathophysiology
Due to the cytokine and neutrophil response to bacteria entering the epidermis, cellulitis is characterized on examination by erythema, heat, edema, and pain. After pathogens penetrate the skin and induce an epidermal response, cytokines and neutrophils are drawn to the affected area. Antimicrobial peptide production and keratinocyte proliferation are believed to contribute to the appearance of cellulitis on physical examination. Group A Streptococci, the most common bacterial cause of cellulitis, can produce virulence factors such as pyrogenic exotoxins (A, B, C, and F) and streptococcal superantigen, which can induce a more severe and invasive disease.

Severity of Cellulitis
Cellulitis severity classifications

<table>
<thead>
<tr>
<th>ERON/CREST classification</th>
<th>Modified ‘Dundee’ classification</th>
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<tbody>
<tr>
<td>Class I No or well-controlled comorbidities, systemically well</td>
<td>No sepsis, no comorbidities and SEWS &lt;4</td>
</tr>
<tr>
<td>Class II Systemically unwell with no uncontrolled comorbidities (e.g., obesity, peripheral vascular disease or venous insufficiency) or systemically well with poorly controlled comorbidities, which may delay their recovery</td>
<td>Documentation of one or more significant comorbidities (e.g., obesity, peripheral vascular disease or venous insufficiency), no sepsis, SEWS &lt;4</td>
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<tr>
<td>Class III Marked systemic inflammatory response (altered mental status, tachypnoea, tachycardia, hypotension etc.) or may have very poorly controlled comorbidities which may affect their response to treatment or have a limb-threatening infection due to vascular compromise</td>
<td>Sepsis but SEWS &lt;4</td>
</tr>
<tr>
<td>Class IV Septic shock or life-threatening presentations such as necrotizing fasciitis requiring urgent critical care and surgical input</td>
<td>Sepsis and SEWS ≥4</td>
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SEWS : Sepsis early warning score

MATERIALS AND METHOD
This is an observational study of cases of cellulitis in the out patient department and admitted patients in the department of General Surgery, Pacific Institute of Medical Sciences, Umarada, Rajasthan. Period of Research study was 1st March 2021 to 30th September 2022 on 135 patients. Patients more than 18 years of age with presence of limb cellulitis, sudden onset (over <72 h) that was associated with fever, chills or leukocytosis (leukocyte count, >10.5 × 10^9 cells/L), abscess formation or necrotizing fasciitis were included in the study while patients with cellulitis associated with surgical wounds, surgical instrumentation, and patients unwilling to give consent were excluded.

Detailed history of the patients was taken such as any history of skin erythema localized on extremity with well demarcated border other skin diseases, recent history of acute onset of fever or chills, traumatic wounds and previous operations, history of any comorbidities. All routine biochemical investigations, radiological investigations including Doppler evaluation to assess the vascular status and X-rays were carried out to rule out osteomyelitis, subcutaneous gases. Management options included debridement, wound dressings, fasciotomy and amputation was done.

AIMS & OBJECTIVES
- To find out the clinical risk factors for cellulitis
- To find out the bacterial etiology of cellulitis.

RESULTS

Figure 1: Distribution of patients according to the age

Maximum patients were present in age group 51-70 years of age (72/135; 63.30%). The mean age of the patients was 59.04±13.65 years.

Figure 2: Distribution of patients according to the gender

Study consisted of more males than females. 21(15.60%) of the patients were females while 114(84.40%) of patients were male.
In most of the patients (107; 79.30%) lower limb was involved while in 28(20.70%) upper limb was involved.

Figure 4: Distribution of patients according to the comorbidities

In majority of cases cellulitis were seen in diabetes (57%) followed by renal failure (19;14.10%), bites and venous ulcer (11;8.10% each) , Tuberculosis (8,5.9%)  web space infection in 3(2.20%). In 6(4.4%) the cause was unknown.

Figure 5: Distribution of patients according to grade of cellulitis

74( 54.80%) patients have grade III cellulitis , 26.70% have grade II cellulitis while 18.50% patients have grade IV cellulitis.
In 20(14.8%) patients disability occurred while in 45(33.3%) the healing was uneventful. Resultant wound was seen in 70(51.9%) patients.

**Figure 6: Distribution of cases according to outcome**

Staphylococcus aureus was the most common organism that was isolated 77(57.03%) followed by streptococcus 35(25.9%), klebsiella 27(20%), E.coli 17(12.5%), proteus 16(11.8%) and *Pseudomonas Aeruginosa*11(8.14%) 

**Figure 7: Distribution of patients according to the organism isolated from the culture**

Staphylococcus aureus was the most common organism that was isolated 77(57.03%) followed by streptococcus 35(25.9%), klebsiella 27(20%), E.coli 17(12.5%), proteus 16(11.8%) and *Pseudomonas Aeruginosa*11(8.14%)

**Table 1: Distribution of patients according to Procedure performed**

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Frequency</th>
<th>Percentage</th>
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<tr>
<td>Amputation</td>
<td>20</td>
<td>14.80%</td>
</tr>
<tr>
<td>Conservative treatment</td>
<td>21</td>
<td>15.60%</td>
</tr>
<tr>
<td>Fasciotomy</td>
<td>34</td>
<td>25.20%</td>
</tr>
<tr>
<td>Wound debridement</td>
<td>60</td>
<td>44.40%</td>
</tr>
<tr>
<td>Total</td>
<td>135</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

In 20%(14.80%) amputation was performed while in 21(15.60%) conservative treatment was given, in 34(25.20%) wound debridement was conducted while in 60(44.40%) wound debridement with fasciotomy was conducted.

**DISCUSSION**

Cellulitis can affect people of any age, but it is most prevalent in middle-aged and elderly adults. Cellulitis can affect any part of the body, but the lower extremities are most commonly affected. Rarely it is bilateral. Comorbidities such as diabetes mellitus,
venous insufficiency, peripheral artery disease, and lymphedema increase the incidence of cellulitis in patients. Although some research has suggested that the incidence may be higher among males, others have demonstrated that there is no difference between the sexes. The most prevalent cause of cellulitis is an infection with group A beta-hemolytic streptococcus (i.e., Streptococcus pyogenes).

The skin functions as a barrier that prevents normal skin flora and other microbial infections from penetrating the subcutaneous tissue and lymphatic system. When the skin is broken, normal skin flora and other microorganisms are able to infiltrate the dermis and subcutaneous tissue.

In the case of cellulitis of the lower extremities, the spaces between the toes should be thoroughly examined. In addition, if any extremities are damaged, ensure proper feeling and pulses are present to properly monitor for compartment syndrome. Additionally, the presence of vesicles, bullae, peau d'orange, and lymphadenopathy should be noted.

Present observational study was conducted at Department of General Surgery, Pacific Institute of Medical Sciences, Rajasthan with the aim to find the clinical risk factors and bacterial profile of patients with cellulitis. The result of the study is summarized below:

- The male predominated the study with 84.4% and the mean age of the patients was 59.04±13.65 years.
- In 79.30% patient’s lower limb was involved while in 20.70% upper limb was involved.
- In majority of cases cellulitis was seen in diabetes (57%) followed by renal failure (19;14.10%), bites and venous ulcer (11;8.10% each), Tuberculosis (8.5%9) web space infection in 3(2.20%). In 6(4.4%) the predisposing factor was unknown.
- 74(54.80%) patients have grade III cellulitis, 26.70% have grade II cellulitis while 18.50% patients have grade IV cellulitis.
- Staphylococcus aureus was the most common organism that was isolated 77(57.03%) followed by streptococcus 35(25.9%), klebsiella 27(20%), E-coli 17 (12.5%), proteus 16(11.8%) and Pseudomonas Aeruginosa11(8.14%).
- In 20(14.80%) amputation was performed while in 21(15.60%) conservative treatment was given, in 34(25.20%) wound debridement was conducted while in 60(44.40%) wound debridement with fasciotomy was conducted.
- In 20(14.8%) patients disability occurred while in 45(33.3%) the healing was uneventful. Resultant wound was seen in 70(51.9%) patients.

In our study, the most common etiology of cellulitis was bacterial infection with Group A streptococci and most important risk factor found out to be Diabetes Mellitus.

**CONCLUSION**

In the current research, it is possible to infer that cellulitis is a subcutaneous bacterial infection that is more prevalent in men and that its prevalence is greatest among the elderly. Diseases such as diabetes, bites, tuberculosis, and infections of the web space are predisposing factors for cellulitis since the leg is the most often afflicted location of the lower extremity. Patients must be made aware of the indicators of severe infection, such as bullae, cutaneous bleeding, skin anesthesia, sloughing, and loss of peripheral pulses, since these predispose patients to surgical intervention, lengthen hospitalization, and increase morbidity. The patient must see a medical institution prior to the onset of these symptoms since individuals with severe infection symptoms are likely to need surgical intervention for treatment. Proper awareness of the risk factors and variables related to the consequences of limb cellulitis (particularly lower limb) would aid healthcare providers in adopting preventative methods, reducing the disease’s cost and health impact.

Conflict of interests : none
Ethical approval : taken

**REFERENCES**