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.[1] 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.[2]

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.[3] 60% of cellulitis cases involve the lower leg, with 35% of cases affecting the upper limb 2 occurring most frequently in intravenous drug users.[4] 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.[5]

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 induced 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.[6] 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.[7]

Severity of Cellulitis

Cellulitis severity classifications[2]

	ERON/CREST classification	Modified 'Dundee' classification
Class I	No or well-controlled comorbidities, systemically well	No sepsis, no comorbidities and SEWS <4
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	Documentation of one or more significant comorbidities (e.g., obesity, peripheral vascular disease or venous insufficiency), no sepsis, SEWS <4
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	Sepsis but SEWS <4
Class IV	Septic shock or life-threatening presentations such as necrotizing fasciitis requiring urgent critical care and surgical input	Sepsis and SEWS ≥4

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, Umarda, 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.

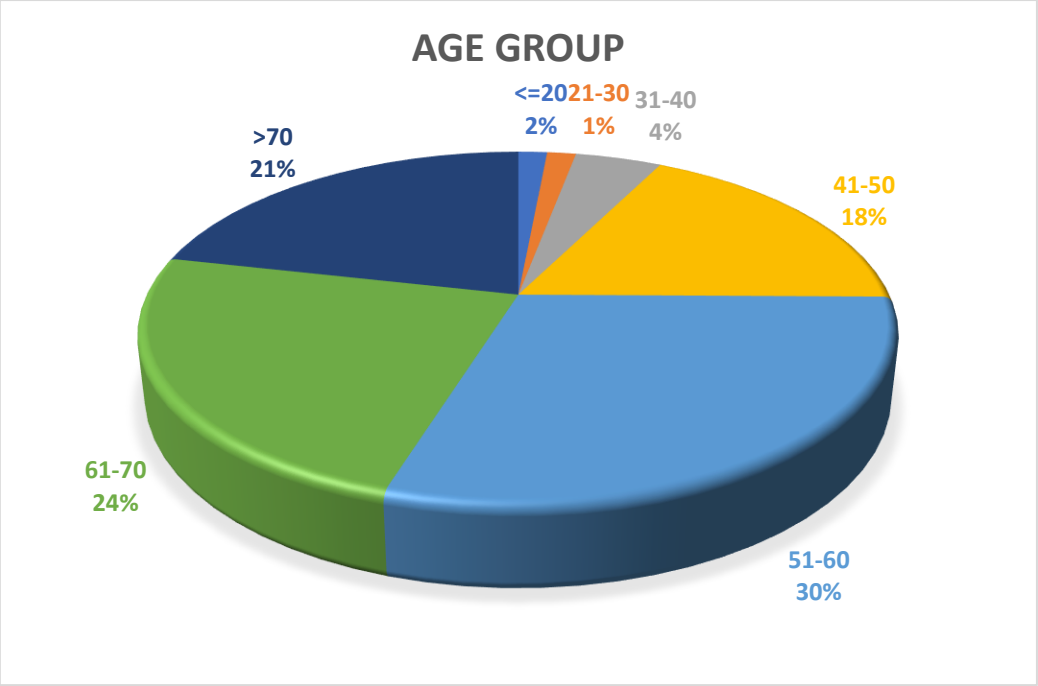
Detailed history of the patients was taken such as any history of skin erythema localized on extremity with well demarcated border other skin diseases, recent history of acute onset of fever or chills, traumatic wounds and previous operations, history of any comorbidities. All routine biochemical investigations, 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.

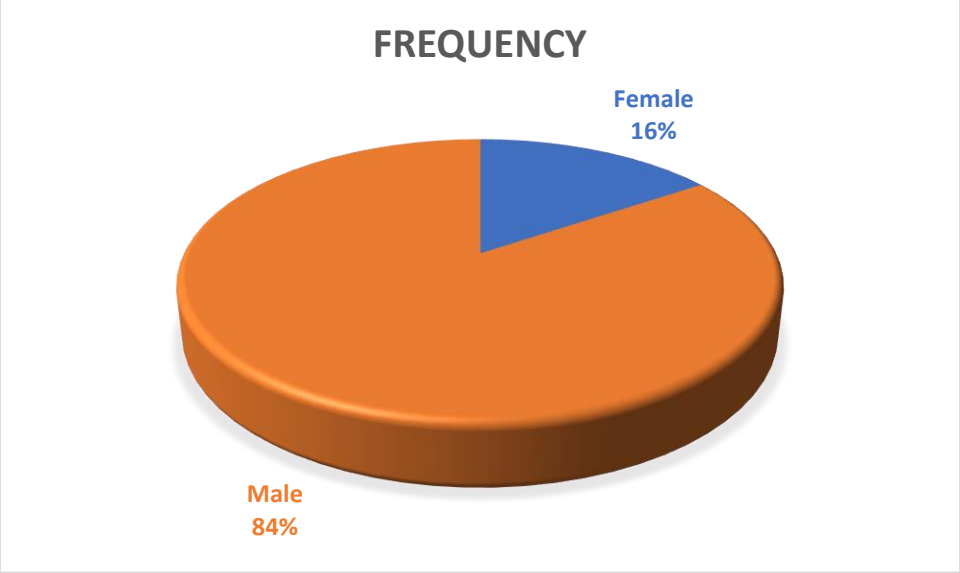
RESULTS

Figure 1: Distribution of patients according to the age



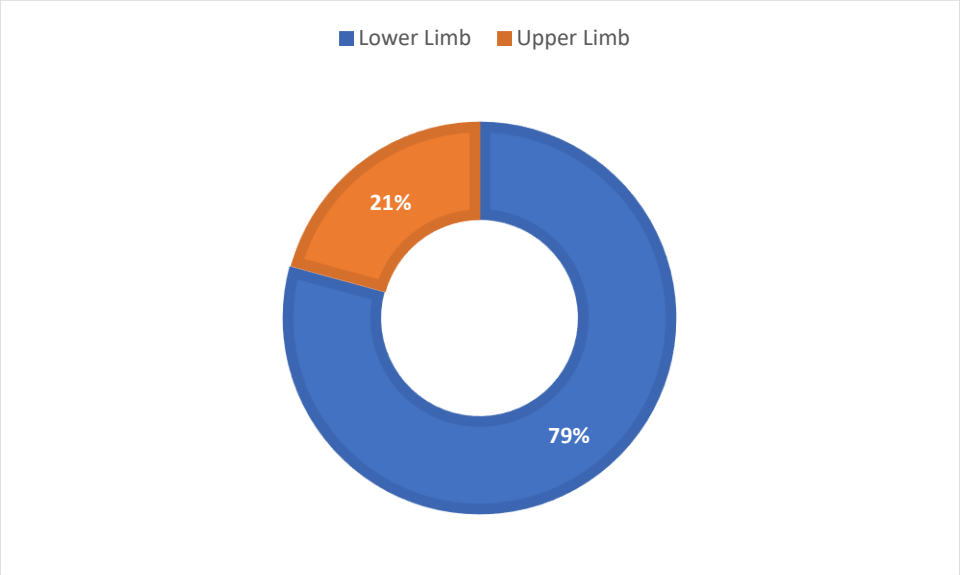
Maximum patients were present in age group 51-70 years of age (72/135; 63.30%). The mean age of the patients was 59.04±13.65 years.

Figure 2: Distribution of patients according to the gender



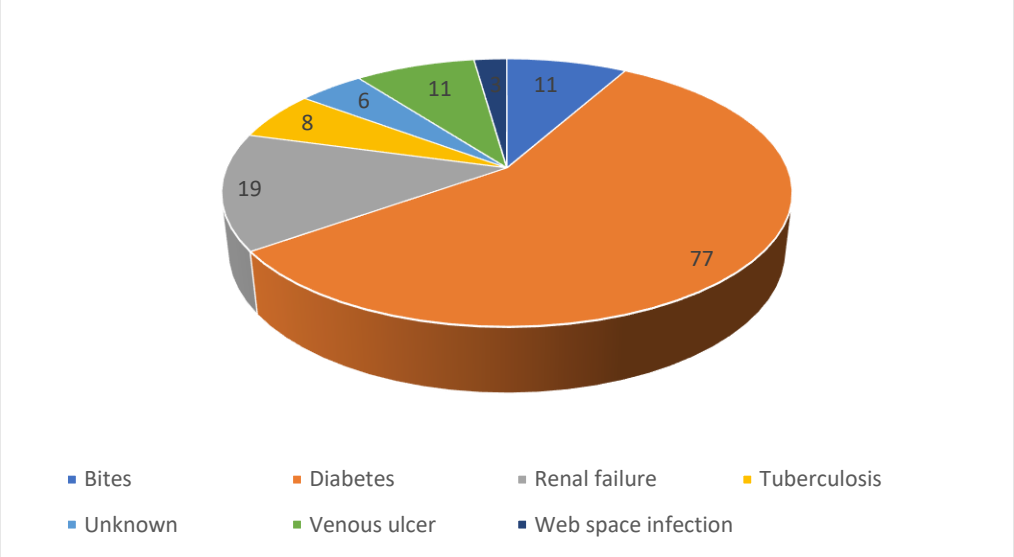
Study consisted of more males than females. 21(15.60%) of the patients were females while 114(84.40%) of patients were male.

Figure 3: Distribution of patients according to limb involved



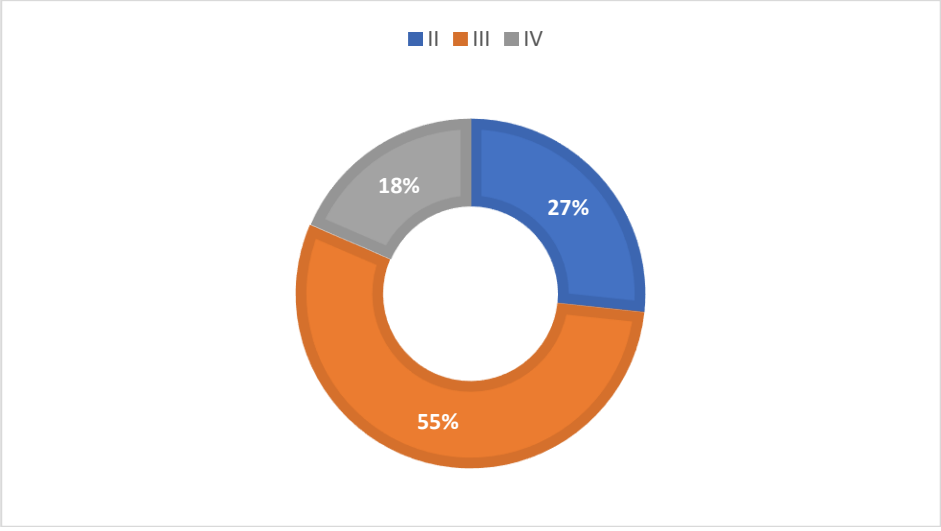
In most of the patients (107; 79.30%) lower limb was involved while in 28(20.70%) upper limb was involved.

Figure 4: Distribution of patients according to the comorbidities



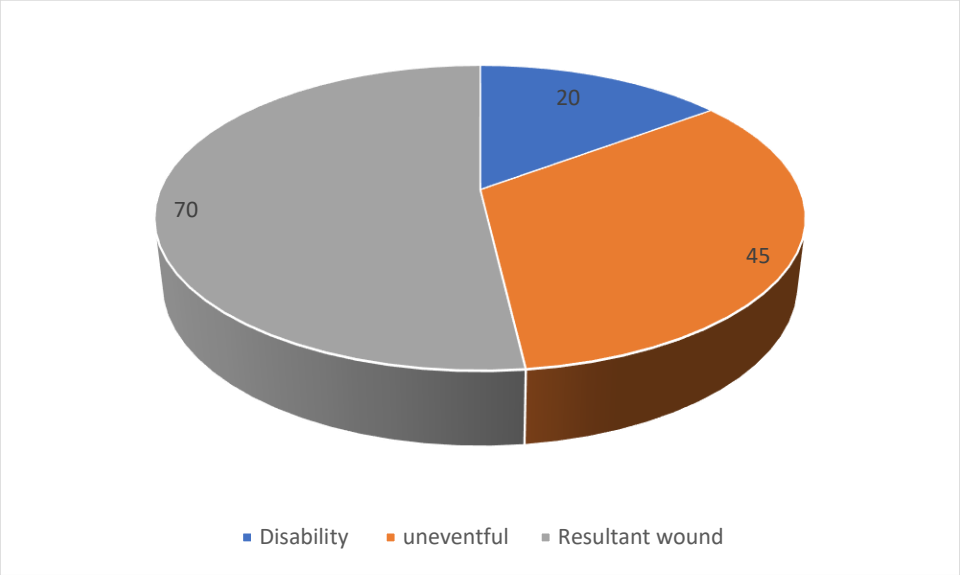
In majority of cases cellulitis were seen in diabetes (57%) followed by renal failure (19;14.10%), bites and venous ulcer (11;8.10% each) , Tuberculosis (8,5.9%) web space infection in 3(2.20%). In 6(4.4%) the cause was unknown.

Figure 5: Distribution of patients according to grade of cellulitis



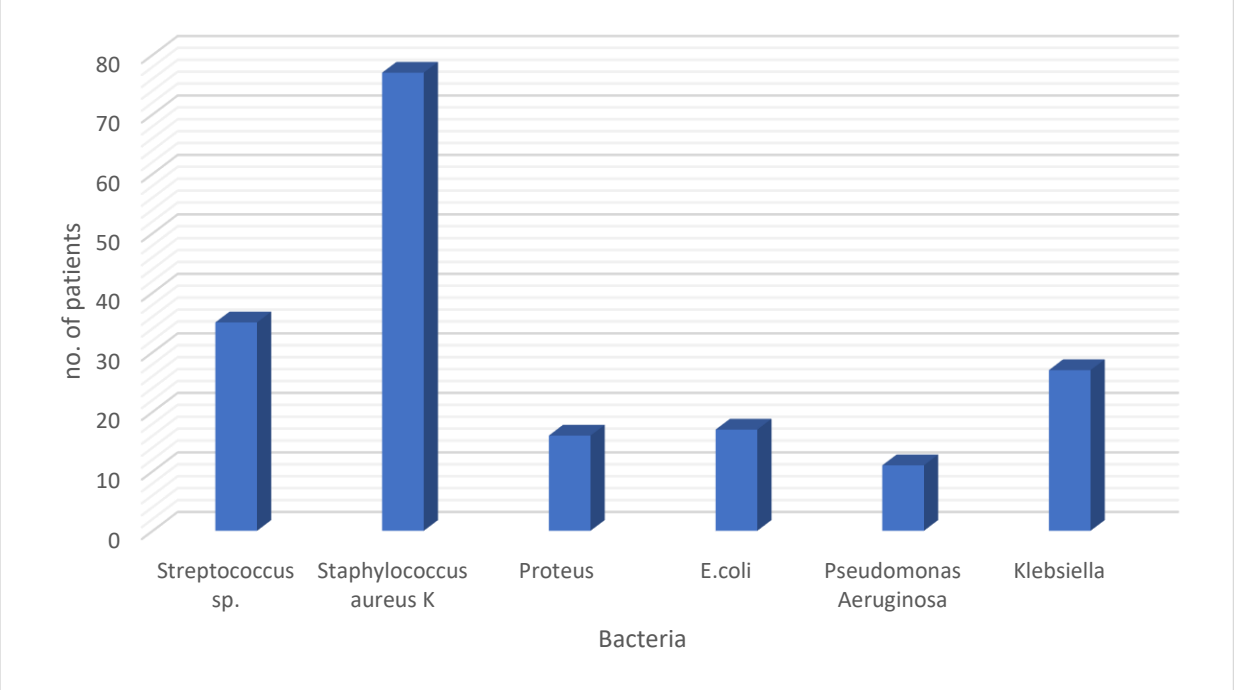
74(54.80%) patients have grade III cellulitis , 26.70% have grade II cellulitis while 18.50% patients have grade IV cellulitis.

Figure 6: Distribution of cases according to outcome



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 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 Aeruginosa11(8.14%)**

Table 1: Distribution of patients according to Procedure performed

Procedure	**Frequency**	**Percentage**
Amputation	20	14.80%
Conservative treatment	21	15.60%
Fasciotomy	34	25.20%
wound debridement	60	44.40%
Total	135	100.00%

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.[8] 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.[9] Although some research have suggested that the incidence may be higher among males, others have demonstrated that there is no difference between the sexes[10] The most prevalent cause of cellulitis is an infection with group A beta-hemolytic streptococcus (i.e., Streptococcus pyogenes). [11]

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.[12] 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.[13]

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

REFRENCES

1. Eron LJ, Lipsky BA, Low DE, Nathwani D, Tice AD, Volturo GA; Expert panel on managing skin and soft tissue infections. Managing skin and soft tissue infections: expert panel recommendations on key decision points. J Antimicrob Chemother. 2003 Nov;52 Suppl 1:i3-17.
2. Sullivan T, de Barra E. Diagnosis and management of cellulitis. Clin Med (Lond). 2018 Mar;18(2):160-163.
3. Cox NH. Management of lower leg cellulitis. Clin Med. 2002; 2(1):23-7.
4. Ginsberg MB. Cellulitis: analysis of 101 cases and review of the literature. South Med J. 1981 May;74(5):530-3. PMID: 6972617.
5. Semel JD, Goldin H. Association of athlete's foot with cellulitis of the lower extremities: diagnostic value of bacterial cultures of ipsilateral interdigital space samples. Clin Infect Dis. 1996 Nov;23(5):1162-4. doi: 10.1093/clinids/23.5.1162. PMID: 8922818.
6. Richmond JM, Harris JE. Immunology and skin in health and disease. Cold Spring Harb Perspect Med. 2014 Dec 01;4(12):a015339.
7. Cunningham MW. Pathogenesis of group A streptococcal infections. Clin Microbiol Rev. 2000 Jul;13(3):470-511.
8. 8. Marcelin JR, Challener DW, Tan EM, Lahr BD, Baddour LM. Incidence and Effects of Seasonality on Nonpurulent Lower Extremity Cellulitis After the Emergence of Community-Acquired Methicillin-Resistant Staphylococcus aureus. Mayo Clin Proc. 2017 Aug;92(8):1227-1233.
9. 9. Kaye KS, Petty LA, Shorr AF, Zilberberg MD. Current Epidemiology, Etiology, and Burden of Acute Skin Infections in the United States. Clin Infect Dis. 2019 Apr 08;68(Suppl 3):S193-199.
10. McNamara DR, Tleyjeh IM, Berbari EF, et al. Incidence of lower-extremity cellulitis: a population-based study in Olmsted County, Minnesota. Mayo Clin Proc 2007;82(7):817-21.
11. Liu C, Bayer A, Cosgrove SE, Daum RS, Fridkin SK, Gorwitz RJ, et al. Infectious Diseases Society of America. Clinical practice guidelines by the infectious diseases society of america for the treatment of methicillin-resistant Staphylococcus aureus infections in adults and children. Clin Infect Dis. 2011 Feb 01;52(3):e18-55.

12. Stevens DL, Bisno AL, Chambers HF, Dellinger EP, Goldstein EJ, Gorbach SL, Hirschmann JV, Kaplan SL, Montoya JG, Wade JC. Practice guidelines for the diagnosis and management of skin and soft tissue infections: 2014 update by the infectious diseases society of America. Clin Infect Dis. 2014 Jul 15;59(2):147-59
13. Brown BD, Hood Watson KL. Cellulitis. [Updated 2021 Dec 10]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK549770/