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Examining Disparities in Incidence of Cellulitis with Impact of Comorbidities on its Development: A Retrospective Observational Study

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ABSTRACT

Cellulitis is a fast-spreading bacterial infection that affects dermis and subcutaneous tissue. There is erythema, warmth, swelling & tenderness at the affected area. Cellulitis is diagnosed clinically based on the presence of spreading inflammation of deep dermis and subcutaneous tissue. Aim: The study aims at the incidence of cellulitis across different age groups, duration of symptoms that last in the patients with Diabetic patients and non-diabetic patients, the risk of cellulitis in individuals with comorbid conditions. A retrospective observational study was conducted over a period of 8 months from November 2023 to June 2024. The necessary data was collected from Medical Record Department. Total 179 patients from the Vascular Department were included in the study. The data was collected and analyzed by SPSS 29.0.1.0 version. Results: The study enrolled a total 179 subject out of them 123(68.7%) were Male and 56(31.3%) were Female. Among 179 patients 109(60.9%) were Diabetic 70(39.9%) out of 179 subjects the majority age group subjects were about 60-74 age group (38.0%), followed by 45-59 age group (35.2%). Based on the wound type, 161(89.9%) were non-purulent and 18(10.1%) were purulent. Patients with symptoms less than a week were 139(77.7%) and 40(22.3%) were more than a week. Patients with different comorbid conditions were 25.7% with Hypertension and Hypertension with CAD and CVA. The study concludes that older adults (60-80years) are at the higher risk of cellulitis. It was found that Hypertension played a key role as a risk factor for the development of cellulitis.

Keywords: Cellulites, Hypertension, Diabetes, purulent, non-purulent, erythema, tenderness.

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INTRODUCTION

According to the Global Burden of Disease research, there were approximately 43 million instances of cellulitis in 2019, with 555 cases per 100,000 people and 18,069 fatalities being the outcome.[1] Warm, red, poorly defined, palpably painful, and accompanied by swelling is the typical presentation of cellulitis. An acute bacterial infection triggers inflammation in the deeper dermal layers and subcutaneous tissues, leading to this disease. The two most prevalent types of beta-haemolytic streptococci that can cause cellulitis are methicillin-sensitive Staphylococcus aureus and Group A streptococcus, also known as Streptococcus pyogenes. Insect bites, burns, punctures, surgical incisions, and intravenous (IV) catheters are just a few of the many ways bacteria can enter the body. Infections generated by Staphylococcus aureus, which manifest as cellulitis, spread outward from a central site. Abscesses, folliculitis, or an infected foreign body like an IV catheter, prosthesis, splinter could be the cause of this ailment. People who already have other health problems, such as diabetes, an impaired immune system, a history of methicillin-resistant Staphylococcus aureus colonization, or an animal bite, are more likely to get secondary bacterial infections, risk factor were shown in figure 1 [2] Recurrent streptococcal cellulitis of the lower extremities, often caused by organisms of Group A, C, or G, is a common complication of prolonged venous stasis or saphenous vein harvest after coronary artery bypass surgery. Cellulitis can also occur in patients who have chronic lymphedema due to conditions like Milroy's disease, elephantiasis, or lymph node dissection, as might happen after a mastectomy.[3] The elderly and middle-aged are the most common age groups to have cellulitis. Cellulitis occurs at similar rates in both sexes, according to statistical analysis. For every 1000 patient-years, there are approximately 50 cases.[4] Cellulitis manifests itself when the immune system's cytokines and neutrophils react to bacteria that have entered the skin, causing redness, swelling, warmth, and sensitivity to probing. Cytokines and neutrophils are attracted to the affected area when germs have pierced the skin and triggered an epidermal reaction. The unique exam findings linked to cellulitis are thought to be caused by this response, which leads to the production of antimicrobial peptides and the proliferation of keratinocytes.[5] A Team Streptococci, the most common bacteria causing cellulitis, can also produce virulence factors such streptococcal superantigen and pyrogenic exotoxins (A, B, C, and F), which can worsen the condition and spread it to other parts of the body.[6] Obesity, skin lesions, lymphedema, venous insufficiency, tinea pedis, and a history of skin lesions are all risk factors for lower limb cellulitis, according to case-control studies.[7-9] Patients with sepsis may benefit from having their baseline renal and liver functions evaluated to better

understand the extent of end-organ damage and how to best administer antibiotics. In cases involving diving injuries or animal bites, patients with systemic signs of sepsis, immune compromised individuals, or those who should be examined for blood cultures, aspirates, or biopsies should have them considered. [10] Multiple studies have found that a significant number of people with cellulitis are incorrectly diagnosed. Eleven, twelve Lipodermatosclerosis, eczema, and lymphedema are common differential diagnoses. Misdiagnosed patients received antibiotics that were not necessary in 92% of cases and did not necessitate hospitalization in 85% of cases. An effective approach to managing cellulitis and abscesses requires drainage as well as the appropriate antibiotic treatment. [11] Drainage is required for all but the smallest abscesses, but drugs are usually helpful in treating them. An empirical course of treatment for non-draining cellulitis usually involves beta-lactam antibiotics; when there is purulent drainage or abscesses, MRSA coverage is considered. Although clindamycin resistance is a concern, macrolides and clindamycin are acceptable alternatives for those who are allergic to penicillin's. [12] In severe cases, particularly when systemic involvement is present, parenteral therapy is required. It is common practice to treat MRSA using vancomycin. Particular factors must be taken into account in order to provide empirical coverage that is particular to the most probable pathogens in cases of cellulitis resulting from bites, diabetic ulcers, or aquatic accidents, Impact of cellulitis was shown in figure 2.[13] Rare as they are, cellulitis complications can have devastating effects in those who do not receive treatment quickly or who already have preexisting health issues. Repercussion of infections, development of abscesses, painful enlargement of the lymphatic vessels, blood poisoning, tissue death, necrotizing fasciitis, and gangrene are all possible consequences. These disorders necessitate prompt medical intervention to avoid potentially fatal consequences.[14] Diabetes, chronic venous insufficiency, obesity, and immune system abnormalities are comorbidities that greatly increase the risk of cellulitis and worsen its prognosis. Severe and recurrent cases of cellulitis are associated with underlying medical problems that weaken the immune system. Abscesses, gangrene, and septicaemia are among the significant consequences that might result from their use, and they also hinder the healing process.[15] Longer and more extensive medical treatment is required, recovery times are longer, and the risk of bad consequences, including death, is higher for those with various medical diseases. The current research set out to answer several questions, including how common cellulitis is among various age groups, how long symptoms persist in diabetic and non-diabetic patients, and how many people with other health issues are at increased risk of developing cellulitis. [16]

Figure 1: Risk factors

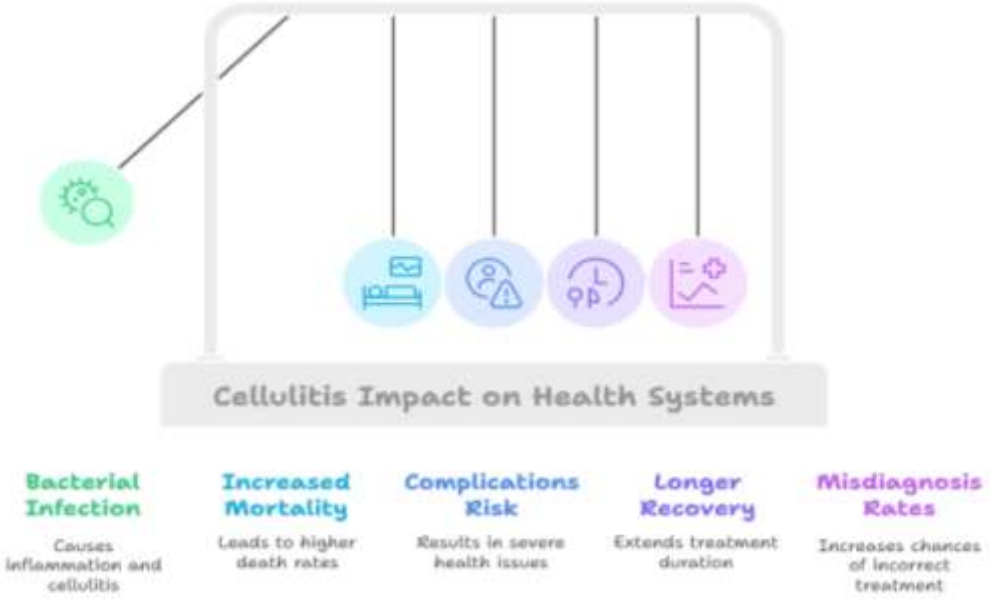

Figure 2: Cellulitis impact on health system

MATERIALS AND METHOD

Study design and subjects

This observational study was conducted at the vascular surgery departments at KIMS Hospitals in Secunderabad and Kondapur for eight months, from November 2023 to June 2024, situated in Hyderabad capital city of Telangana. Patients with aged 18 > years were selected for this study based on specific inclusion criteria, including those with a diagnosis of cellulitis, both male and female, diabetic and non-diabetic, and with comorbidities such as hypertension (HTN), HTN with cerebrovascular accident (CVA), and coronary artery disease (CAD). Exclusion criteria included pregnant and lactating women, patients with skin

conditions resembling cellulitis, and those without a clinical diagnosis of cellulitis. A total of 179 patients met the inclusion criteria and were enrolled in the study according COPE guidelines age criteria was selected. The primary outcomes measured included the incidence of cellulitis in diabetic and non-diabetic patients, the prevalence of various risk factors and comorbidities, the duration of hospitalization required for recovery, and the recurrence rate of cellulitis. The study found that while non-diabetic patients had a higher incidence of cellulitis, diabetic patients experienced more severe infections. Additionally, comorbidities such as hypertension, CAD, and CVA were identified as significant risk factors for developing cellulitis**.**

Statistical Analysis:

Statistical analysis was performed using Statistical Package for Social Sciences (SPSS) software for windows (version 29.0.1.0). The Paired T-test was used for the analysis. Descriptive statistics included means, standard deviations, medians, and inter quartile ranges for continuous data, while categorical data were summarized with frequencies and percentages, adjusted based on data distribution. P-value less than 0.05 was considered to be statistically significant.

Ethics statement and consent of the participants

The Scientific Review/Research committee granted ethical permission (SPCP/2023-24/IHEC/004). For this study, researchers drew on extensive clinical data collected from in-patient case notes and MRD records. Healthcare practitioners were also asked to fill out questionnaires that gathered more data about their patients. Important details were gleaned from these sources, including demographics (gender, age, and IP number), clinical presentation (wound look, discharge, infection grade, and length of symptoms), medical history (including past medications, comorbidities like diabetes, hypertension, cerebrovascular accident, and coronary artery disease), social history, prior cases of cellulitis, and any signs on the skin. This multi-pronged strategy made sure that all the data needed to evaluate cellulitis patients' clinical outcomes were collected. The institutional review board gave an imprimatur of approval to this research plan.

RESULTS AND DISCUSSION:

Patient Demographics:

There were 179 patients enrolled in the study represented in figure 1 and table 1, Patient Demographics where 56 (31.3%) were female patients and were 123 (68.7%) male patients. According to WHO criteria, the age distribution was as follows the most common age groups were 45–59 years (35.2%) and 60–74 years (38%). Less patients were in the younger age groups of 18–29 (3.4%) and 30-44 (5%), with 17.9% of patients being in the 75–89 age

range. The oldest patient was ninety-nine years old, Patient demographics and comorbidities in cellulitis study shown in figure 3, 4 and 6 based on age and gender.

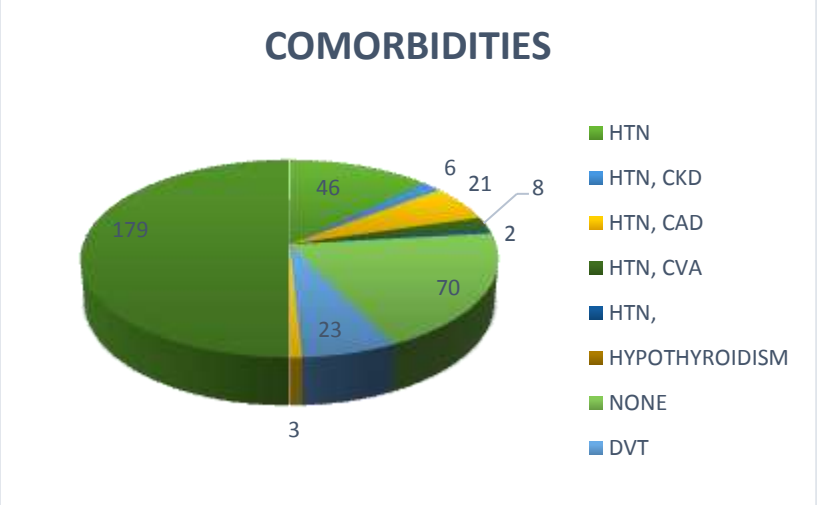

Figure 3: Distribution of patients based on comorbidities

Clinical Characteristics:

Wound Discharge and Metabolic Imbalance 109 (60.9%) of the individuals did not have diabetes, while 70 (39.1%) had the disease. There was a greater frequency of non-purulent instances in the wound discharge data, with 18 patients (10.1%) having purulent wounds and 161 patients (89.9%) having non-purulent wounds.

Table 2 Representing the duration of symptoms and location of cellulitis.

Duration of Symptoms and Location of Cellulitis:

Most patients (77.7%) reported symptoms lasting less than a week, while 22.3% experienced symptoms for more than a week. Cellulitis was most commonly located in the lower limbs: 43% in the left lower limb, 34.1% in the right lower limb, and 17.3% had bilateral lower limb involvement. A small percentage had cellulitis in the upper limbs or other locations.

Comorbidities and Statistical Findings:

Hypertension was the most prevalent comorbidity, found in 46 patients (25.7%). Comorbidities often co-occurred with chronic conditions such as CKD, CAD, CVA, or hypothyroidism. Statistical analysis using paired t-tests revealed significant correlations between variables, including wound type, age, and diabetic status, as well as between comorbidities and diabetic status ($p < 0.001$). Gender did not show a significant correlation with diabetic status ($p = 0.974$). Table 3 and figure 5 shows the distribution of patients based on comorbidities.

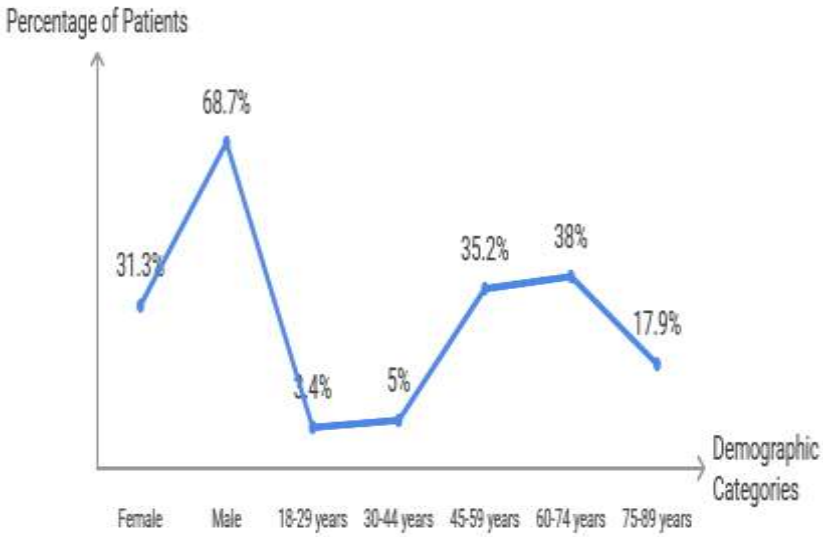

Figure 4: Patient demographics by age and gender

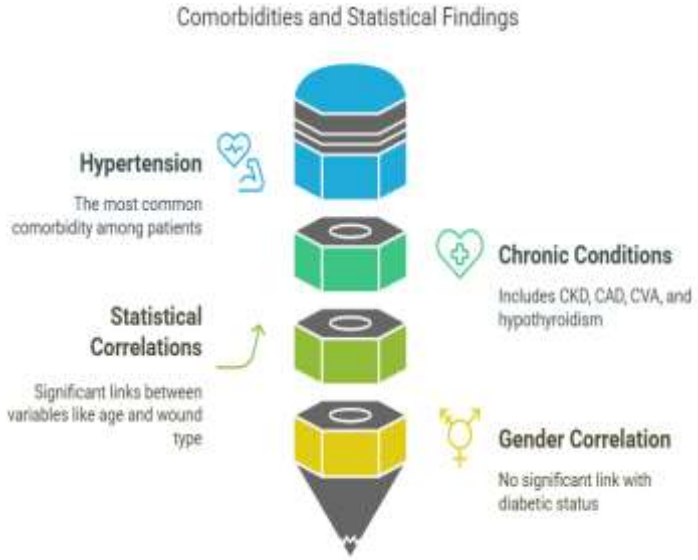

Figure 5: Statistical findings

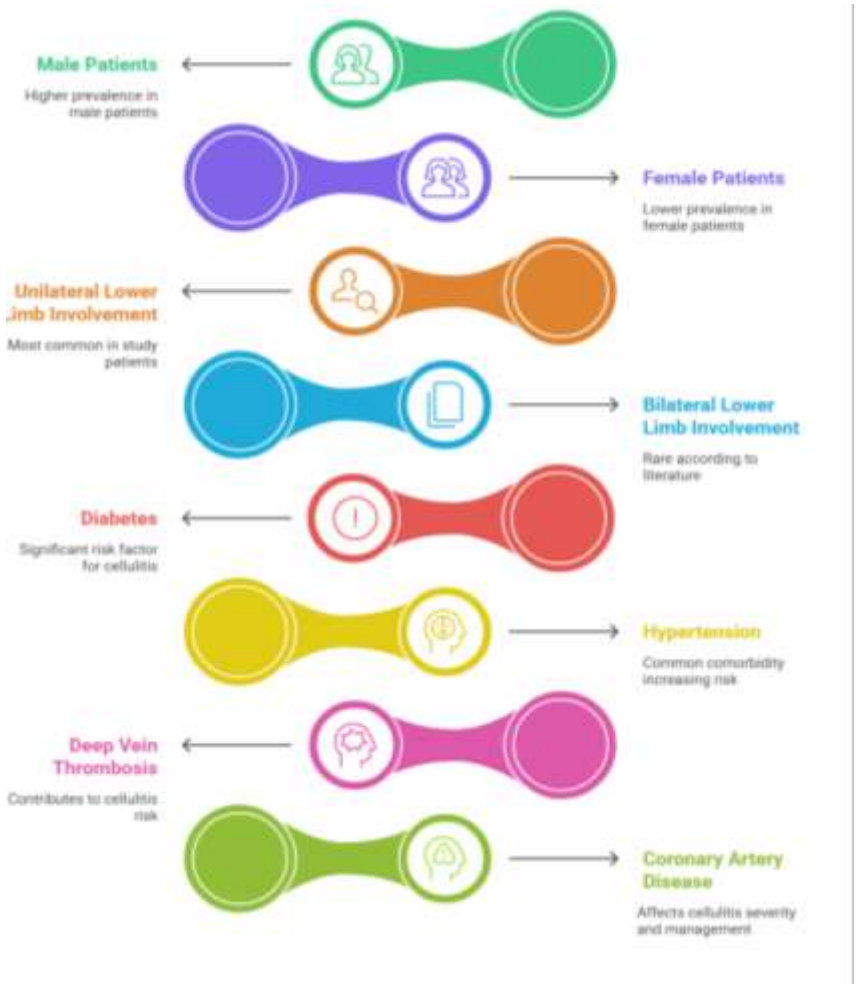

Figure 6: Patient demographics and comorbidities in cellulitis study

Table 1: Patient Demographics

	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Duration of Symptoms				
Less than a week	139	77.7%	77.7%	77.7%
More than a week	40	22.3%	22.3%	100%
Total	179	100%	100%	100%
Location				
Right lower limb	61	34.1%	34.1%	34.1%
Left lower limb	77	43.0%	43.0%	77.1%
Bilateral lower limb	31	17.3%	17.3%	94.4%
Right upper limb	5	2.8%	2.8%	97.2%
Left upper limb	3	1.7%	1.7%	98.9%
Others	2	1.1%	1.1%	100%
Total	179	100%	100%	100%

Table 2: Duration of symptoms and location of cellulitis.

Gender	Female	56	31.30%
	Male	123	68.70%
	Total	**179**	**100.00%**
Age Group	18-29	6	3.40%
	30-44	9	5.00%
	45-59	63	35.20%

	60-74	68	38.00%
	75-89	32	17.90%
	>90	1	0.60%
	Total	**179**	**100.00%**
Condition	Diabetic	70	39.10%
	Non-Diabetic	109	60.90%
	Total	**179**	**100.00%**
Wound Discharge	Purulent	18	10.10%
	Non-Purulent	161	89.90%
	Total	**179**	**100.00%**

Table 3: Statistical analysis.

Paired Samples Test										
Paired Differences							**t**	**df**	**Significance**	
Mean			**Std. Deviation**	**Std. Error Mean**	**95% Confidence Interval of the Difference**				**One-Sided p**	**Two-Sided p**
					Lower	**Upper**				
Pair	Wound type & Diabetic, non-diabetic	.291	.535	.040	.212	.369	7.269	178	<.001	<.001
Pair	Duration of symptoms & Diabetic, Non-Diabetic	.385	.672	.050	.286	.485	7.674	178	<.001	<.001
Pair	Comorbidities & Diabetic, Non-diabetic	2.737	2.189	.164	2.415	3.060	16.734	178	<.001	<.001

DISCUSSION

Through the use of Google Forms-based Data Collection from patient historical records from MRD, this retrospective observational study was carried out over the course of eight months in the vascular department at Krishna Institute of Medical Sciences (KIMS) in Secunderabad and Kondapur. Patients were systematically observed for this trial, with information including their age, gender, whether they were diabetic or not, length of stay in the hospital, wound discharge, and comorbidities. Patients with diabetes and the comorbidities associated with it are more likely to suffer from cellulitis. For the purpose of this investigation, we included a total of 179 individuals who were diagnosed with cellulitis. Of these patients, 123 (68.7%) were male patients, and 56 (31.3%) were female patients. Lower limb cellulitis was seen in a significant number of non-diabetic individuals, and their prognosis was significantly better than that of diabetes patients. The majority of the patients were in the elderly age group, which demonstrated that the prevalence of cellulitis rises with increasing age as compared to younger individuals. The results obtained by Sigridur et al. were higher than the data obtained by Rongey C et al., who had a mean age of 48.8 years in the cellulitis group. However, this result was lower than the results obtained by Sigridur et al., who had a mean

age of 66.7 years. According to the findings of the study, the severity of cellulitis increases with the patient's age, which is in line with the findings of Sigridur et al. (66.7 years). The findings of the current study are consistent with those of Cranendonk et al.15, who found that the majority of cases with cellulitis that required admission to the intensive care unit included older persons (with an average age of 57 years) who also had substantial comorbid illnesses, such as cardiovascular problems. The findings of the study also demonstrated that the severity of cellulitis tends to increase with increasing age. In our study, males were more likely to be affected than females (68.7%). During the course of the current investigation, we found that 77.1% of the patients had involvement in one lower limb, whereas 17.3% of the patients had involvement in both lower limbs. However, according to Smith et al., the prevalence of involvement in both lower limbs is highly uncommon. In our research, patients who did not have diabetes were found to be more than those who did have diabetes**.** We also noticed the length of time that patients were hospitalized. Seventy-seven percent of patients were hospitalized for less than a week, and their symptoms were less severe. Twenty-two-point three percent of patients were hospitalized for more than a week, and their symptoms were more severe, and they had comorbid diseases that made their symptoms worse. The presence of diabetes was found to be a substantial risk factor for cellulitis, with fifty-six percent of the individuals who were evaluated having diabetes [15]. Additionally, the importance of the lymphatic system was brought to light, as it was found that recurrent bouts of cellulitis could alter the function of the lymphatic system, which would result in increased rates of recurrence. There were also widespread comorbidities that enhanced the risk of cellulitis, such as coronary artery disease (11.7%), deep vein thrombosis (12.7%), and hypertension (25.7%). Additional research highlights the impact that obesity and numerous chronic illnesses have on the outcomes of cellulitis diagnosis and treatment. It was pointed out by Mzabi et al. that the interaction of many comorbidities might make illness management more difficult and can also make the prognosis poorer. (16–19)

CONCLUSION:

Several important discoveries have been uncovered as a result of the research that was carried out on the incidence of cellulitis and its link with comorbidities. People who are older, particularly those who are between the ages of 60 and 80, have a greater likelihood of acquiring cellulitis. Because of variables such as decreased skin integrity, poor immunological function, and the existence of comorbid illnesses, this age group is more susceptible to the adverse effects of the disease. Based on the findings of our research, hypertension has been recognized as a substantial risk factor for cellulitis. This is especially true when it is associated with other illnesses, such as coronary artery disease (CAD) and

cerebrovascular accident (CVA). Diabetes also has a significant influence, despite the fact that in this particular study, patients who did not have diabetes had a higher prevalence of cellulitis in comparison to diabetic patients. Almost of occurrences of cellulitis are non-purulent, and the majority of patients suffer symptoms for a period of time that is shorter than one week. How severe cellulitis is and how it should be treated are both substantially influenced by the type of wound and how long it has been there. It is possible to lessen the likelihood of developing cellulitis by addressing comorbidities such as high blood pressure and diabetes. When it comes to reducing complications and enhancing patient outcomes, it is crucial to have effective management of these illnesses, as well as fast treatment of cellulitis. Enhanced knowledge and proactive care for high-risk groups have the potential to contribute to improved health outcomes and a reduction in the occurrence of this difficult infection. It is necessary to do additional research and complete additional investigations in order to validate these conclusions. Consequently, this will make it possible to identify the risk variables that are connected with cellulitis in a more precise manner.

Declaration of Conflicting Interests:

The authors declared no potential conflicts of interest with respect to the research, authorship, and publication of this article.

Ethical approval

Ethical approval was acquired from SPCP/2023-24/IHEC/004 in Scientific Review/Research committee.

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