ISSN 2786-0183
Helwan International Journal for Nursing Research and Pratctice
Vol. 4, Issue 10, Month: June 2025, Available at: https://hijnrp.journals.ekb.eg/

# Risk Factors Associated with Occurrence of Cellulitis in Critically Ill Patients with Liver Cirrhosis

Shimaa Gamal Mohamed Hassan [1], Enas Ibraheem El-Sayed [2], Nora Salah Eldin Saad [3], Ahmed Shaaban Attia [4]

1. *Member of Development Team at the Nursing Administration, Beni-Suef Health Directorate, Egypt.*
2. *Assistant Professor of Medical- Surgical Nursing - Helwan University, Egypt.*
3. *Assistant Professor of Medical-Surgical Nursing-Faculty of Nursing - Helwan University, Egypt,*
4. *Lecturer of Adult Health Nursing, Faculty of Nursing / Helwan University, Egypt.*

## ABSTRACT

**Background**: Cellulitis is a common and potentially serious bacterial skin infection that can rapidly worsen in patients with compromised immunity, such as those with liver cirrhosis. Differentiating cellulitis from other skin conditions and identifying contributing risk factors is essential in critical care settings. **Aim**: This study aimed to assess the risk factors associated with the occurrence of cellulitis in critically ill patients with liver cirrhosis. **Design**: A descriptive exploratory design was used. **Setting**: The study was conducted in the intensive care units at Beni-Suef University Hospital. **Participants:** A purposive sample of 55 adult patients with liver cirrhosis were included herein. **Tool of data collection:** Data were collected using two tools: a structured interview questionnaire and a cellulitis assessment tool. Patients were followed for three consecutive days using the Dundee classification. **Results**: The findings revealed that the most significant risk factors associated with cellulitis were chronic venous insufficiency, previous cellulitis, sepsis, heart failure, diabetes mellitus, age over 65 years, clinically relevant bacteremia, and edema ($p \leq 0.05$). Regarding disease progression, 47.3% of patients were classified as Grade II on the first day, while 29.1% progressed to Grade IV by the third day. **Conclusion**: Cellulitis in critically ill cirrhotic patients is strongly associated with advanced age, chronic comorbidities, and prior episodes of cellulitis. Early risk identification and preventive nursing care are crucial to reduce complications and improve patient outcomes. **Recommendations**: Developing and implementing a structured educational program for ICU nurses to enhance early detection and prevention of cellulitis in cirrhotic patients.

**Keywords***: Cellulitis; Critical ill patients; Liver cirrhosis; Risk factors*

## Introduction

Cellulitis is an acute inflammatory bacterial infection affecting primarily the skin and subcutaneous tissue that spreads briskly with no treatment or with improper management. An acute onset of erythema, pain, heat and swelling are the unique character. Within severe cases, blistering may present buildup of edema, lymphangitis and lymphadenopathy. Also, flulike symptoms may appear prior or post visible manifestation in the skin ***(Mohamed Abdelhamed et al., 2022).*** Cellulitis is usually thought to be caused by β-hemolytic Streptococcus and Staphylococcus aureus ***(Burian et al., 2024).***

Risk factors that predispose individuals to the development of cellulitis include obesity and a history of previous cellulitis. Additionally, toe-web abnormalities, such as maceration and tinea pedis, can increase susceptibility. Any disruption of the skin barrier, including ulcers, trauma, fungal infections, eczema. Furthermore, chronic medical conditions such as diabetes, arterial insufficiency, chronic venous insufficiency, chronic kidney disease, neutropenia, cirrhosis, and hypogammaglobulinemia contribute to an increased likelihood of developing cellulitis ***(Erica et al., 2025).***

The typical presentation of cellulitis is an acute, unilateral, spreading skin infection with poorly demarcated erythema, and typical signs of inflammation including pain, erythema, heat, and swelling. Other signs include edematous lymphatics of the skin that can lead to the appearance of the orange peel

ISSN 2786-0183
Helwan International Journal for Nursing Research and Pratctice
Vol. 4, Issue 10, Month: June 2025, Available at: https://hijnrp.journals.ekb.eg/

sign, formation of bulla, and/or inflammation of proximal lymph vessels causing lymphangitis. Tender lymphadenopathy may also complicate severe cases of cellulitis. Most cases of cellulitis are on the lower limb. Fever can be present or absent depending on the case ***(Long & Gottlieb, 2022).***

Liver cirrhosis is a systemic, irreversible disease in which normal liver cells are replaced by fibrous septa and regenerating nodules. Any liver condition that has continued over time might lead to liver cirrhosis, which is its last stage. The course of cirrhosis is considerably worsened by infections. Problems with cirrhosis are another cause of illness. Numerous factors can lead to infections in cirrhotic patients, such as immunological failure, bacterial and fungal translocation brought on by small intestinal bacterial and fungal overgrowth with increased intestinal permeability, and genetic factors ***(Abd-ELlatief, et al., 2023).***

Serious bacterial infections are more likely to occur in cirrhotic patients. These infections cause cirrhosis to decompensate, which raises morbidity and death. The immune system, which includes humoral and cellular immunity, is compromised in cirrhotic individuals, which leads to an increase in infections. Cellulitis is a common bacterial illness associated with cirrhosis, along with respiratory tract infections, urinary tract infections, and spontaneous bacterial peritonitis (SBP). In cirrhosis, cellulitis is present in 10.5% to 12.5% of cases ***(Ong, Dotel & Ngian, 2022).***

Critical Care Nurses (CCNs) are essential in detecting and treating cellulitis since they are the first medical personnel to handle a patient's body. CCNs assess the presence of cellulitis using a range of techniques, such as complete blood counts, blood cultures, clinical exams, peripheral vascular state measurements, and sensitivity testing to guide treatment ***(Elsayed & Elbana, 2022).*** The present study aimed to identify the risk factors of cellulitis in critically ill patients with liver cirrhosis .

## Significance of the Study

One of the most prevalent dermatological conditions seen in the intensive care unit (ICU) is cellulitis, a skin and soft tissue infection that occurs frequently. Hospitalizations for infectious diseases are 10.1% caused by cellulitis ***(Boettler et al., 2022).*** Likewise, in patients with extremity lymphedema, the prevalence of cellulitis and its recurrence rate were 12.6% and 56.6%, respectively ***(Rodriguez et al., 2020).***

Some studies show an increase in the incidence of cellulitis, Cellulitis is thought to affect 200 out of every 100,000 people annually in European countries ***(Sapuła et al., 2020).*** Also, Patients with cirrhosis are more susceptible to potentially fatal bacterial infections. Cellulitis is a common infectious disease that develops in 10.5–12.5% of cases of cirrhosis ***(Wang, 2023).***

The mortality rate in cirrhotic with skin infections varies from 19% to 23.5%, depending on disease severity ***(Premkumar & Anand, 2022)).*** About 25% of cirrhotic patients reported infection, and the mortality rate was about four times higher than in the general population. Bloodstream infections (BSIs) are a serious problem for people with liver cirrhosis, leading to more hospitalizations and a higher risk of death. The infections caused by bacteria are most commonly cellulitis (2–11%) ***(Abd-ELlatief et al., 2023).***

A retrospective study conducted over a 20-year period at a tertiary eye care center in Egypt reported that 22.2% of patients with fungal orbital infections presented with orbital cellulitis ***(Eldesouky & Elbedewy, 2023).*** Another study examining trends in orbital cellulitis severity and management in Egypt between 2016 and 2022 — including the impact of the COVID-19 pandemic — also found that 22.2% of the cases were associated with orbital cellulitis ***(Gibbons et al., 2025).*** These findings reflect the broader impact of cellulitis and underscore the necessity of examining its risk factors among vulnerable patient groups, such as those with liver cirrhosis. Therefore, in this study, the investigator will examine the risk factors that increase the potentiality of cellulitis in critically ill patients with Liver cirrhosis.

ISSN 2786-0183
Helwan International Journal for Nursing Research and Pratctice
Vol. 4, Issue 10, Month: June 2025, Available at: https://hijnrp.journals.ekb.eg/

**Purpose of the study**:

The study aimed to assess risk factors associated with the occurrence of cellulitis in critically ill patients with liver cirrhosis.

**Research Question:**

What are the risk factors associated with the occurrence of cellulitis in critically ill patients with liver cirrhosis?

**Research Design**

A descriptive exploratory research design was utilized in this study.

**Setting:**

The current study was conducted in intensive care units of Beni suef university hospital which located on second floor and composed of 3 halls, 1 of them contain 10 beds and 2 of them contain 5 beds, and tropical care unit which located on 5th floor and composed of 8 beds.

**Sample Type:**

A purposive sample of 55 adult patients from both genders admitted to the intensive care unit (ICU) with Liver cirrhosis was involved in this study from the above-mentioned setting.

**Inclusion Criteria**

- Adults diagnosed with Liver cirrhosis.
- Aged above 21 years.
- Had no cellulitis symptoms or signs.

**Exclusion Criteria**

- Patients with deep vein thrombosis.
- Patients with skin infections.

**Sample Size:**

The sample size for this study will be calculated according to ***(Charan and Biswas (2013)*** used the following equation:

$$n = \frac{p(1-p)}{(SE \div t) + [p(1-p) \div N]}$$

$$n = \frac{0.05-(1-0.05)}{(0.09 \div 1.96)+[0.05(1-0,05) \div 100]} = 54.24 = \approx 55$$

n= (0.05- (1-0.05))/ ((0.09÷1.96) + [0.05(1-0,05) ÷100]) =54.24 = ≈55

N = Total sample size

P= Is probability = 0.05

SE= Standard error = 0.09

T = t tables probability at P< 0.05 = 1.96

N = number of population size in this study = (≈ 100)

**Tools of Data Collection:**

Data were collected using the following two tools:

**Tool I: Structured Interview Questionnaire**

It was adapted from ***(Elsayed & Elbana, 2022)***, the tool was divided in three parts as the following:

ISSN 2786-0183
Helwan International Journal for Nursing Research and Pratctice
Vol. 4, Issue 10, Month: June 2025, Available at: https://hijnrp.journals.ekb.eg/

**Part 1: Patients' Demographic characteristics:** which consist of (6) items to assess the patients' demographic characteristics which includes Age, Gender, Level of education, Marital Status, Occupation and Place of Residence.

**Part 2: Patients' Clinical Data:** which consist of (8) items to assess the patients' clinical data which includes Duration of liver cirrhosis, Duration of stay in intensive care unit, chief complain on admission, chronic health history, Diagnosis of admission, Etiology of cirrhosis, hemodynamic parameters and physical examination such as capillary refill and edema.

This part was modified to include removing certain question, rephrasing of certain questions and the addition of new questions focused on the patient's present health history of liver cirrhosis.

**Part 3: Patients' Laboratory Investigation:** which consist of (10) items to assess the patients' laboratory investigation which includes hemoglobin, leucocytes, serum creatinine and albumin, sodium in mmol/, Bilirubin, INR, platelet count in cmm, AST in U/L and ALT in U/L.

**Tool II: Cellulitis Assessment:**

It was adapted from ***(Elsayed & Elbana, 2022)*** and ***(Vignes, Poizeau & Dupuy, 2022),*** which used to assess the critically ill hepatic patients' risk factors associated with cellulitis, manifestation and degree of cellulitis severity, which consists of four parts as the following :

**Part 1: Risk Factors Associated with Cellulitis:** which consist of (18) items to assess the risk factors associated with cellulitis which includes chronic venous Insufficiency, Peripheral vascular disease, previous cellulitis, sepsis, heart failure, diabetes, Immune Suppression, on vasopressor medication, age>65, clinically relevant bacteremia, number of lines, edema, using elastic stoking, change position frequency, use of air mattress, BMI, level of activity and fluid balance.

**Part 2: Cellulitis Manifestation:** which consist of (4) items to assess the cellulitis manifestation which includes skin color, skin condition, skin temperature and location of cellulitis.

**Part 3: Complication Assessment**: which consist of (6) items to assess the complication which includes limited range of motion, abscess, gangrene, necrotizing, blood stream infection and a skin sore or rash.

**Scoring System:**

The scoring system regarding cellulitis assessment tool was as follows: one point was given for a "Yes" and zero for a "No".

This part was modified to include rephrasing of certain questions and the addition of new questions focused on the risk factors and manifestation of cellulitis.

**Part 4: Dundee Classification of Cellulitis Severity:** Which adopted from ***(Cutfield et al., 2019)***, which used to assess cellulitis severity. It classifies from one (least severity) to four (highest severity).

**Scoring System:**

The scoring system based on the Dundee classification was used to assess disease severity in all study patients. criteria to determine the presence of sepsis (two or more of: white blood count <4×109/L or >12×109/L; temperature <36 or >38°C; heart rate >90 beats/min; and respiratory rate >20 breaths/min). Although the Dundee severity classification uses a standardized early warning score (SEWS) of ≥4 as the threshold to distinguish between Class 3 and Class 4 severity, we instead used an early warning score (EWS) of ≥5, as at our institution an EWS of ≥5 is the threshold at which a medical emergency team response is mandated.

**Validity**

Content and face validity were conducted to determine whether the tools covered the aim and test their appropriateness, comprehensiveness, accuracy, clarity, relevance, understanding, and applicability through a jury of Five experts; three of them were assistant professors, and two of them

ISSN 2786-0183
Helwan International Journal for Nursing Research and Pratctice
Vol. 4, Issue 10, Month: June 2025, Available at: https://hijnrp.journals.ekb.eg/

were lecturers in the field of Medical-Surgical Nursing, Helwan University. Their opinions were elicited regarding tool consistency, rephrasing for some statements, and the scoring system. Finally, the final forms were developed.

**Reliability**

The reliability of the tools was assessed by measuring their internal consistency with the Cronbach Alpha Coefficient test. The results indicated a reliability score of 0.788 for the patients' clinical data. The second tool, which assessed patients' laboratory investigation, showed a reliability score of 0.876. The third tool, intended to assess cellulitis, had a reliability score of 0.847. This only proves that this tool is an instrument with good reliability.

**Pilot Study:**

The pilot study was carried out with 10% of the sample (6 patients) to test the applicability, clarity and efficiency of the tools. Subjects were included and chosen randomly from the previously mentioned setting then later included to the sample. According to the results of the pilot study, no modifications were done for the used tools. So, patients shared in the pilot study were involved in the sample.

**Field Work:**

- To conduct the study, approval was obtained from the hospital director and the nursing directors of the intensive care unit at Beni-Suef University Hospital.
- Sampling was started and completed within eight months from March 2024 to the end of October 2024, and official permissions were granted from director of hospital. A total of 55 patients who fulfilled the criteria for inclusion were recruited into the present study.
- All patients who admitted to the previously mentioned units who approved to participate in the study were enrolled in this study.
- The investigator collected data 3 days/week in the morning shift from 9 AM to 1 PM in the previously mentioned settings .
- Each patient was interviewed and assessed individually. The patients' oral acceptance to be included in the study was obtained after explaining the purpose and nature of the study, and the interview questionnaire was filled out. The investigator gathered data on approximately 1 patient per day.
- The interview questionnaire was filled out in a time range of 20-30 minutes according to the patients' tolerance, and every patient was allowed to ask any question to clear any misunderstanding and to fill out the interview questionnaire .
- A code number was used for every patient to ensure anonymity and to compare them.
- Patients' medical records were used to obtain the patients' clinical data, Duration of liver cirrhosis, Duration of stay in intensive care unit, chief complain on admission, chronic health history, Diagnosis of admission, Etiology of cirrhosis, hemodynamic parameters and physical examination such as capillary refill, edema and patients' laboratory investigation.
- The researcher starts with structured interviewing tool to take present and past medical history, assess hemodynamic parameters and laboratory investigation, then cellulitis assessment tool to assess risk factors associated with cellulitis, cellulitis manifestation, complication assessment, Dundee classification of cellulitis severity, and record every reading.

**Ethical Considerations:**

An official permission to conduct the proposed study was obtained from the Scientific Research Ethics Committee of the Faculty of Nursing Helwan University, specifically from Committee No. 39 on February 13, 2024. Participation in the study is voluntary and subjects were given complete full information about the study and their role before signing the informed consent. The ethical

ISSN 2786-0183
Helwan International Journal for Nursing Research and Pratctice
Vol. 4, Issue 10, Month: June 2025, Available at: https://hijnrp.journals.ekb.eg/

considerations included explaining the purpose and nature of the study, stating the possibility to withdraw at any time, confidentiality of the information was being guaranteed. Ethics, values, culture and beliefs were respected.

## IV-Statistical Item:

Numerical data were presented as mean and standard deviation (SD) values. Qualitative data were presented as frequencies (n) and percentages (%). Reliability of the questionnaire was assessed using Cronbach's alpha reliability coefficient. Cronbach's alpha reliability coefficient normally ranges between 0 and 1. Higher values of Cronbach's alpha (More than 0.7) denote acceptable reliability. Spearman's correlation coefficient was used to determine correlations between different variables.
The significance level was set at $P \leq 0.05$. Statistical analysis was performed with IBM SPSS Statistics Version 26 for Windows.

## Results

**Table (1):** Distribution of personal demographic characteristics for the studied patients (n=55):

| Items | Studied patients (n = 55) | |
|---|---|---|
| | N | % |
| **Age** Mean±SD | 54.55±6.48 | |
| **Gender:** | | |
| • Male | 32 | 58.2 |
| • Female | 23 | 41.8 |
| **Marital status:** | | |
| • Single. | 0 | 0 |
| • Married. | 29 | 52.7 |
| • Divorced | 8 | 14.5 |
| • Widow | 18 | 32.7 |
| **Educational Level** | | |
| • Can't read and write | 19 | 34.5 |
| • Primary education | 18 | 32.7 |
| • Secondary education | 11 | 20 |
| • University education | 7 | 12.7 |
| **Occupation** | | |
| • Working | 18 | 32.7 |
| • Not working | 37 | 67.3 |
| **Place of residence** | | |
| • Rural | 21 | 38.2 |
| • Urban | 34 | 61.8 |

**Table (1)** indicates that, mean and standard deviation of the age of the studied patient's was (54.55±6.48) years old and 69.1% were in age group from 51years - 65 years, while only 1.8% were 18 years - 30 years. Concerning gender, 58.2% are male and 52.7% are married. Regarding educational level, 34.5% can't read and write, while 12.7% have university education. 67.3 are not working and 61.8% are living in urban area.

ISSN 2786-0183
Helwan International Journal for Nursing Research and Pratctice
Vol. 4, Issue 10, Month: June 2025, Available at: https://hijnrp.journals.ekb.eg/

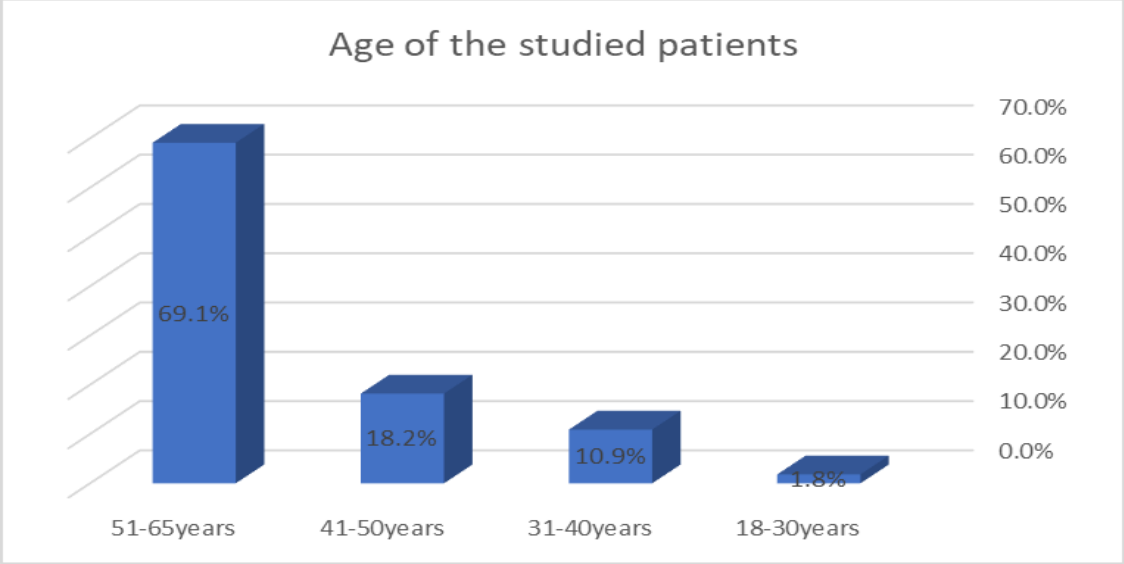


**Figure (1): Bar graph representing the age of the studied patients**

**Fig (1):** shows that, 69.1% were in age group from 51years - 65 years, while only 1.8% were 18 years - 30 years.

**Table (2):** Distribution of clinical data for the studied patients (n=55): -

| Items | Studied patients (n = 55) | |
|---|---|---|
| | N | % |
| **Duration of liver cirrhosis:** | | |
| • First presentation | 3 | 5.5 |
| • Less than one year | 4 | 7.3 |
| • More than one year | 48 | 87.3 |
| **Duration of stay in intensive care unit:** | | |
| • from (1-7) days | 48 | 87.3 |
| • from (8-14) days | 5 | 9.1 |
| • from (15-21) days | 0 | 0 |
| • from (22-28) days | 2 | 3.6 |
| • More than 4 weeks | 0 | 0 |
| **Chronic Health history:** | | |
| • Respiratory disorders | 26 | 47.3 |
| • Cardiovascular disorders | 33 | 60 |
| • Renal disorder | 27 | 49.1 |
| • GIT disorders | 45 | 81.8 |
| • Diabetes mellitus | 43 | 78.2 |
| • Hypertension | 40 | 72.7 |
| • Heart failure | 6 | 10.9 |
| • Immune suppression | 14 | 25.5 |
| • Previous cellulitis | 6 | 10.9 |
| • Chronic Venous insufficiency | 25 | 45.5 |
| • Peripheral vascular disease | 20 | 36.4 |
| **Diagnosis of admission**: | | |
| • Respiratory disorders | 15 | 27.3 |

ISSN 2786-0183
Helwan International Journal for Nursing Research and Pratctice
Vol. 4, Issue 10, Month: June 2025, Available at: https://hijnrp.journals.ekb.eg/

| | | |
|---|---|---|
| • Cardiovascular disorders | 4 | 7.3 |
| • Renal disorder | 8 | 14.3 |
| • GIT disorders | 27 | 49.1 |
| • Neurological disorder | 26 | 47.3 |
| **Etiology of cirrhosis:** | | |
| • HBV | 1 | 1.8 |
| • Alcohol intake | 4 | 7.3 |
| • HCV | 47 | 85.5 |
| • NASH | 3 | 5.5 |
| **Chief complain**: | | |
| • Neurological disorder | 16 | 29.1 |
| • Renal disorder | 7 | 12.7 |
| • Respiratory disorders | 7 | 12.7 |
| • Cardiovascular disorders | 3 | 5.5 |
| • GIT disorders | 22 | 40 |

**Table (2)** shows that, 87.3% of the studied patients has the liver disease more than one year, while only 5.5% are first presentation. Regarding duration of stay in intensive care unit, 87.3% are admitted to hospital from (1-7) days, while 3.6% were from (22-28) days. Concerning chronic health history, 81.8% are suffering from GIT disorders, while 10.9% suffered from heart failure. As regards to diagnosis of admission, 49.1% are diagnosed GIT disorders, while 7.1% are admitted with cardiovascular disorders.

**Table (3):** Distribution of patients' Hemodynamic Parameters (n=55): -

| Items | Studied patients (n = 55) | |
|---|---|---|
| | N | % |
| **Heart rate:** | | |
| • Normal | 21 | 38.2 |
| • Tachycardia | 33 | 60 |
| • Bradycardia | 1 | 1.8 |
| **Blood pressure:** | | |
| • Normal | 9 | 16.4 |
| • Hypertension | 21 | 38.2 |
| • Hypotension | 25 | 45.5 |
| **Respiratory rate:** | | |
| • Normal | 12 | 21.8 |
| • Tachypnea | 25 | 45.5 |
| • Dyspnea | 18 | 32.7 |
| **Temperature:** | | |
| • Normal | 7 | 12.7 |
| • Fever | 48 | 87.3 |

ISSN 2786-0183
Helwan International Journal for Nursing Research and Pratctice
Vol. 4, Issue 10, Month: June 2025, Available at: https://hijnrp.journals.ekb.eg/

**Table (4):** Distribution of patients' Risk Factors associated with cellulitis (n=55):

| Items | Studied patients (n = 55) | | | |
|---|---|---|---|---|
| | No | | Yes | |
| | N | % | N | % |
| Chronic venous insufficiency | 30 | 54.5 | 25 | 45.5 |
| Peripheral vascular disease | 33 | 60 | 22 | 40 |
| Previous cellulitis | 41 | 74.6 | 14 | 25.4 |
| Sepsis | 13 | 23.6 | 42 | 76.4 |
| Heart failure | 46 | 83.6 | 9 | 16.4 |
| Diabetes mellitus | 16 | 29.1 | 39 | 70.9 |
| Immune suppression | 27 | 49.1 | 28 | 50.9 |
| On vasopressors medication | 42 | 76.4 | 13 | 23.6 |
| Age > 65 years | 43 | 78.2 | 12 | 21.8 |
| Clinically relevant bacteremia | 29 | 52.7 | 26 | 47.3 |
| Number of linens | 6 | 10.9 | 49 | 89.1 |
| Edema | 4 | 7.3 | 51 | 92.7 |
| Using elastic stoking | 54 | 98.2 | 1 | 1.8 |
| Change position frequency | 44 | 80 | 11 | 20 |
| Use of air mattress | 42 | 76.4 | 13 | 23.6 |

**Table (4)** shows that, 45.5% of the studied patient suffer from chronic venous insufficiency, 76.4% of them has sepsis, and 78.2% are more than 65 years old. 92.7% of them has edema, while only 1.8% are using elastic stocking.

**Table (5): Distribution of the studied patients' according Dundee classification of cellulitis severity(n=55): -**

| Items | Dundee classification | | | | | |
|---|---|---|---|---|---|---|
| | Day1 | | Day2 | | Day3 | |
| | No | % | No | % | No | % |
| **Class** | | | | | | |
| • **Grade I** | **18** | **32.7** | **18** | **32.7** | **2** | **3.6** |
| • **Grade II** | **26** | **47.3** | **10** | **18.2** | **11** | **20** |
| • **Grade III** | **11** | **20** | **24** | **43.6** | **26** | **47.3** |
| • **Grade IV** | **0** | **0** | **3** | **5.5** | **16** | **29.1** |

**Table (5)** shows that, 47.3% of the studied patients have Grade II of Dundee classification in first day, only 5.5% have Grade IV of Dundee classification in second day, while 29.1% have Grade IV of Dundee classification in third day.

**Table (6):** Relation between total patients' Dundee classification and demographic characteristic: -

| Items | Dundee classification | | | | | | | | *x2* | *P*-value |
|---|---|---|---|---|---|---|---|---|---|---|
| | Grade I (n=2) | | Grade II (n=11) | | Grade III (n=26) | | Grade IV (n=16) | | | |
| | No | % | No | % | No | % | No | % | | |
| **Age group:** | | | | | | | | | | |
| • 18 - 30 years | 1 | 50 | 0 | 0 | 0 | 0 | 0 | 0 | 0.482 | 0.000* |
| • 31- 40 years | 0 | 0 | 0 | 0 | 3 | 11.5 | 3 | 18.8 | | |
| • 41- 50 years | 0 | 0 | 2 | 18.2 | 7 | 26.9 | 1 | 6.2 | | |
| • 51- 65 years | 1 | 50 | 9 | 81.8 | 16 | 61.5 | 12 | 75 | | |

ISSN 2786-0183
Helwan International Journal for Nursing Research and Pratctice
Vol. 4, Issue 10, Month: June 2025, Available at: https://hijnrp.journals.ekb.eg/

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Gender:** | | | | | | | | | | |
| • Male | 2 | 100 | 6 | 54.5 | 14 | 53.8 | 10 | 62.5 | 1.821 | 0.843 |
| • Female | 0 | 0 | 5 | 45.5 | 12 | 46.2 | 6 | 37.5 | | |
| **Marital status:** | | | | | | | | | | |
| • Married. | 2 | 100 | 3 | 27.3 | 12 | 46.2 | 12 | 75 | 19.90 | 0.102 |
| • Divorced | 0 | 0 | 0 | 0 | 8 | 30.8 | 0 | 0 | 5 | |
| • Widow | 0 | 0 | 8 | 72.7 | 6 | 23 | 4 | 25 | | |
| **Educational Level** | | | | | | | | | | |
| • Can't read and write | 1 | 50 | 9 | 81.8 | 4 | 15.4 | 5 | 31.2 | 24.19 | .<br>0.001* |
| • Primary education | 0 | 0 | 0 | 0 | 13 | 50 | 5 | 31.3 | | |
| • Secondary education | 0 | 0 | 2 | 18.2 | 7 | 26.9 | 2 | 12.5 | | |
| • University education | 1 | 50 | 0 | 0 | 2 | 7.7 | 4 | 25 | | |
| **Occupation** | | | | | | | | | | |
| • Working | 0 | 0 | 0 | 0 | 10 | 38.5 | 8 | 50 | 8.881 | 0.006* |
| • Not working | 2 | 100 | 11 | 100 | 16 | 61.5 | 8 | 50 | | |
| **Place of residence** | | | | | | | | | | |
| • Rural | 0 | 0 | 9 | 81.8 | 4 | 15.4 | 8 | 50 | 16.78 | 0.634 |
| • Urban | 2 | 100 | 2 | 18.2 | 22 | 84.6 | 8 | 50 | 1 | |

**: Significant at P ≤ 0.05*

**Table (6)** shows that, there was a highly statistically significant difference between patients' dundee classification, age group, educational level, and occupation with p-value = (0.000, 0.001, and 0.006 respectively), while there was no statistically significant difference between patients' dundee classification, gender, marital status, and place of residence with P-value = (0.843, 0.102, and 0.634 respectively).

**Table (7):** Relation between total patients' Dundee classification and risk factors: -

| Items | Dundee classification | | | | | | | | *x2* | *P*-value |
|---|---|---|---|---|---|---|---|---|---|---|
| | Grade I (n=2) | | Grade II (n=11) | | Grade III (n=26) | | Grade IV (n=16) | | | |
| | No | % | No | % | No | % | o | % | | |
| **Chronic venous insufficiency:** | | | | | | | | | | |
| • No | 2 | 100 | 8 | 72.7 | 12 | 46.2 | 8 | 50 | 4.005 | 0.126 |
| • Yes | 0 | 0 | 3 | 27.3 | 14 | 53.8 | 8 | 50 | | |
| **Peripheral vascular disease:** | | | | | | | | | | |
| • No | 2 | 100 | 6 | 54.5 | 13 | 50 | 14 | 75 | 4.053 | 0.02* |
| • Yes | 0 | 0 | 5 | 45.5 | 13 | 50 | 4 | 25 | | |
| **Previous cellulitis:** | | | | | | | | | | |
| • No | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4.053 | 0.001 |
| • Yes | 2 | 100 | 3 | 100 | 3 | 100 | 6 | 100 | | * |
| **Sepsis:** | | | | | | | | | | |
| • No | 2 | 100 | 7 | 63.6 | 4 | 15.4 | 0 | 0 | 22.146 | 0.000 |
| • Yes | 0 | 0 | 4 | 36.4 | 22 | 84.6 | 16 | 100 | | * |
| **Heart failure**: | | | | | | | | | | |
| • No | 2 | 100 | 11 | 100 | 23 | 88.5 | 10 | 62.5 | 6.209 | 0.008 |
| • Yes | 0 | 0 | 0 | 0 | 3 | 11.5 | 6 | 37.5 | | * |
| **Diabetes mellitus:** | | | | | | | | | | |
| • No | 0 | 0 | 7 | 63.6 | 9 | 34.6 | 0 | 0 | 14.133 | 0.000 |
| • Yes | 2 | 100 | 4 | 36.4 | 17 | 65.4 | 16 | 100 | | * |
| **Immune suppression** | | | | | | | | | | |
| • No | 2 | 100 | 6 | 54.5 | 10 | 38.5 | 9 | 56.2 | 3.709 | 0.617 |
| • Yes | 0 | 0 | 5 | 45.5 | 16 | 61.5 | 7 | 43.8 | | |

ISSN 2786-0183
Helwan International Journal for Nursing Research and Pratctice
Vol. 4, Issue 10, Month: June 2025, Available at: https://hijnrp.journals.ekb.eg/

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **On vasopressors medication:** | | | | | | | | | | |
| • No | 2 | 100 | 8 | 72.7 | 22 | 84.6 | 10 | 62.5 | 3.384 | 0.278 |
| • Yes | 0 | 0 | 3 | 27.3 | 4 | 15.4 | 6 | 37.5 | | |
| **Age > 65 years:** | | | | | | | | | | |
| • No | 0 | 0 | 0 | 0 | 8 | 30.8 | 4 | 25 | 14.133 | 0.007 |
| • Yes | 2 | 100 | 11 | 100 | 18 | 69.2 | 12 | 75 | | * |
| **Clinically relevant bacteremia:** | | | | | | | | | | |
| • **No** | 2 | 100 | 9 | 81.8 | 11 | 42.3 | 7 | 43.8 | | |
| • Yes | 0 | 0 | 2 | 18.2 | 15 | 57.7 | 9 | 56.2 | 7.178 | 0.02* |
| **Number of linens:** | | | | | | | | | | |
| • No | 0 | 0 | 2 | 18.2 | 4 | 15.4 | 0 | 0 | 3.339 | 0.257 |
| • Yes | 2 | 100 | 9 | 81.8 | 22 | 84.6 | 16 | 100 | | |
| **Edema:** | | | | | | | | | | |
| • No | 0 | 0 | 4 | 36.4 | 0 | 0 | 0 | 0 | 17.255 | 0.009 |
| • Yes | 2 | 100 | 7 | 63.6 | 26 | 100 | 16 | 100 | | * |
| **Using elastic stoking:** | | | | | | | | | | |
| • No | 1 | 50 | 11 | 100 | 26 | 100 | 16 | 100 | 26.991 | 0.01* |
| • Yes | 1 | 50 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| **Change position:** | | | | | | | | | | |
| • No | 2 | 100 | 7 | 63.6 | 23 | 88.5 | 12 | 75 | 3.754 | 0.933 |
| • Yes | 0 | 0 | 4 | 36.4 | 3 | 11.5 | 4 | 25 | | |
| **Use of air mattress:** | | | | | | | | | | |
| • No | 2 | 100 | 7 | 63.6 | 233 | 88.5 | 10 | 62.5 | 5.418 | 0.487 |
| • Yes | 0 | 0 | 4 | 36.4 | | 11.5 | 6 | 37.5 | | |

***: Significant at P ≤ 0.05***

**Table (7)** reveals that, there was a highly statistically significant difference between patients' dundee classification, Peripheral vascular disease, previous cellulitis, sepsis, heart failure, diabetes mellitus, age > 65years old, clinically relevant bacteremia, edema, and using elastic stocking with p-value = (0.02, 0.001, 0.000, 0.008, 0.000, 0.007, 0.02, 0.009,and 0.01 respectively), while there was no statistically significant difference between patients' dundee classification, chronic venous insufficiency, immune suppression, on vasopressor medication, number of linen, change position, and use of air mattress with P-value = (0.126, 0.617, 0.287, 0.257, 0.933, and 0.487 respectively).

## Discussion

Cellulitis is a skin and soft tissue infection (SSTI) of the deep dermis and subcutaneous tissue presenting with expanding erythema, edema, and warmth which may occur in adults or children. cellulitis is a prevalent infectious illness that affects 10.5–12.5% of people with cirrhosis. Cellulitis may be complicated by abscess formation, bacteremia, or sepsis. Hospitalization for cellulitis with additional complicating factors inflicts a significant burden on the health care system ***(Cucka et al., 2023).***

Cirrhosis of the liver predisposes patients to serious bacterial infections including cellulitis. These infections precipitate decompensation of liver disease and lead to increased morbidity and mortality. Multiple immune system defects such as complement deficiency, reduced chemo-attractant activity, decreased polymorphonuclear leukocyte activity, and reduced number of Kupffer cells predispose cirrhotic to these infections ***(Sanglodkar et al., 2019).***

As regard to age of the studied patients, the current study result showed that, mean and standard deviation of the age of the studied patient's was (54.55±6.48) years old and less than three quarters of

ISSN 2786-0183
Helwan International Journal for Nursing Research and Pratctice
Vol. 4, Issue 10, Month: June 2025, Available at: https://hijnrp.journals.ekb.eg/

them were in age group from 50 years < than 65 years. This age distribution is indicative of the prevalence of liver Cirrhosis patients in the middle to older age groups, which is consistent with patterns seen in many liver diseases. This result was contrasted with ***Lingiah and Pyrsopoulos, (2021)*** who applied study entitled "Bacterial Infections in Cirrhotic Patients in a Tertiary Care Hospital" and reported that the mean age among patients diagnosed with infection was 55.8 years and 57.3 years among patients without infection.

Concerning gender, the current study result showed that more than half of the studied patients were males. From the researcher point of view this could be attributed to variations in the prevalence of liver diseases among different genders or differences in healthcare-seeking behavior. This result was supported with ***Wang et al., (2023)*** who conducted a study entitled "Predictor of gram-negative bacteremia in cirrhotic patients with skin and soft-tissue infections" and found that highly percentage of the studied patients were males.

As regard to etiology of cirrhosis of the studied patients, the current study result showed that, most of the studied patients had liver cirrhosis from HCV infection, while only one percent had cirrhosis from HBV infection. This result was agreed with ***Lan et al., (2024)*** who conducted a study entitled "Characteristics and Related Factors of Bacterial Infection Among Patients with Cirrhosis" and reported that highly percentage of the studied patients had liver cirrhosis from HBV infection, while minority of them had liver cirrhosis from HCV infection. From the researcher point of view this finding underscores the long-term impact of past HCV outbreaks and burden it continues to pose despite recent advancements in antiviral therapies, particularly in countries like Egypt where HCV has historically been a leading cause of chronic liver disease.

As regard patients' hemodynamic parameters, the current study result revealed that, less than two thirds of the studied patients had a tachycardia and most of them had fever, while minority of them had bradycardia and less than half of them had hypotension. Concerning respiratory rate, and had tachypnea respectively, while less than one quarter of them had normal respiratory rate. These findings were supported with ***Lan et al., (2024)*** who conducted a study entitled "characteristics and related factors of bacterial infection among patients with cirrhosis" and reported that less than one fifth of them had tachycardia, and more than half of them had fever. From the researcher point of view the presence of the tachycardia, fever, and tachypnea among a large proportion of the studied patients suggests a systemic inflammatory response likely related to infection, which is a common complication in cirrhotic patients, especially those who are critically ill.

Concerning to patients' risk factors associated with cellulitis, the current study result showed that, less than half of the studied patient suffer from chronic venous insufficiency, more than three quarters of them had sepsis, and had more than 65 years old respectively. The majority of them had edema, while only one percent of them were using elastic stocking. From the researcher point of view this result may be due to distribution of the studied patients had different risk factors associated with cellulitis.

This result in the same line with ***Elsayed, & Elbana, (2022)*** who applied study to explore "Risk Factors Associated with Occurrence of Cellulitis in Critically Ill Patients with Fulminant Hepatic Failure" and reported that more than three quarters of the studied patients suffered from Chronic venous insufficiency, and had sepsis, less than three quarters of them were in age group from 50years < than 65 years, the majority of them had edema, less than one fifth of them were using elastic stocking.

According Dundee classification of cellulitis severity, the current study result showed that less than half of the studied patients had Grade II of Dundee classification in first day, only minority of them had Grade IV of Dundee classification in second day, while less than one third of them had Grade IV of Dundee classification in third day.

ISSN 2786-0183
Helwan International Journal for Nursing Research and Pratctice
Vol. 4, Issue 10, Month: June 2025, Available at: https://hijnrp.journals.ekb.eg/

This result was disagreed with ***Pandian, & Kumar, (2024)*** who revealed that less than one quarter of the studied patients had grade III. And contrasted with ***Cutfield et al., (2019)*** who applied study entitled "Association of the Dundee severity classification with mortality, length of stay and readmission in adult inpatients with cellulitis" and reported that more than half of the studied patients had Grade I of Dundee classification.

As regard to relation between total patients' Dundee classification and demographic characteristic, the current study result showed that, there was a highly statistically significant difference between patients' dundee classification, age group, educational level, and occupation, while there was no statistically significant difference between patients' dundee classification, gender, marital status, and place of residence.

This result was disagreed with ***Elsayed, & Elbana, (2022)*** who showed that there was statistically significant relation between grade of cellulitis and personal characteristics except age.

In relation between total patients' Dundee classification and risk factors, the current study result revealed that there was a highly statistically significant difference between patients' dundee classification, peripheral vascular disease, previous cellulitis, sepsis, heart failure, diabetes mellitus, age > 65years old, clinically relevant bacteremia, edema, and using elastic stocking, while there was no statistically significant difference between patients' dundee classification, chronic venous insufficiency, immune suppression, on vasopressor medication, number of linen, change position, and use of air mattress.

## Limitations:

The main limitation of the result is sample size was sample and generalized the results over population.

## Conclusion

The present study showed that the risk factors associated with cellulitis in critically sick patients with liver cirrhosis are age 65, male gender, cardiovascular history, peripheral vascular disease, previous cellulitis, sepsis, diabetes mellitus, clinically relevant bacteremia and edema are among the risk variables that cannot be changed and are thought to worsen the severity of cellulitis in older people, restricted range of motion, change in hemodynamic parameters like tachycardia, increase in mean arterial pressure and body temperature, increase in white blood count were among the modifiable risk factors. According to skin inspection, most patients exhibited unusually colored skin, dry skin, hot skin, and an increase in discomfort when touched.

## Recommendations

- Effect of a Nurse-Focused Educational Intervention on the Prevention of Cellulitis in Patients with Liver Cirrhosis
- Assess the impact of recurrent cellulitis episodes on the quality of life and psychological well-being of patients with liver cirrhosis.

## Acknowledgements

The researchers appreciate and thank the patients who participated in the present study.

## References:

**Abd-ELlatief, E. F., Hussein, H. I. M., Meawed, T. E., Mohammed, H. A., Awwaad, S. A. E., & Mohammed, A. S. (2023).** Assessment of Fungal Blood Stream Infection in Patients with Liver Cirrhosis Admitted to The Intensive Care Unit. The Egyptian Journal of Hospital Medicine, 91(1), 4679-4685.

ISSN 2786-0183
Helwan International Journal for Nursing Research and Pratctice
Vol. 4, Issue 10, Month: June 2025, Available at: https://hijnrp.journals.ekb.eg/

**Boettler, M. A., Kaffenberger, B. H., & Chung, C. G. (2022).** Cellulitis: a review of current practice guidelines and differentiation from pseudocellulitis. American Journal of Clinical Dermatology, 23(2), 153-165.

**Burian, E. A., Franks, P. J., Borman, P., Quéré, I., Karlsmark, T., Keeley, V., ... & Moffatt, C. J. (2024).** Factors associated with cellulitis in lymphoedema of the arm–an international cross-sectional study (LIMPRINT). BMC Infectious Diseases, 24(1), 102.

**Charan, J. and Biswas, T. (2013).** 'How to Calculate Sample Size for Different Study Designs in Medical Research?' Indian Journal of Psychological Medicine, 35(2): pp. 121–126.

**Cucka, B., Biglione, B., Xia, J., Tan, A. J., Chand, S., Rrapi, R., … & Kroshinsky, D. (2023)**. Complicated Cellulitis is an Independent Predictor for Increased Length of Stay in the Neonatal Intensive Care Unit. The Journal of Pediatrics, 113581.

**Cutfield, T., Walter, H., Hobbs, M., Chuang, A., Thomas, M. G., & Ritchie, S. R. (2019).** Association of the Dundee severity classification with mortality, length of stay and readmission in adult inpatients with cellulitis. Journal of Antimicrobial Chemotherapy, 74(1), 200-206.

**Eldesouky, M. A., & Elbedewy, H. A. (2023).** A Proposed Diagnostic Algorithm for Fungal Orbital Infections after 20 Years of Experience in a Tertiary Eye Care Center–Egypt. Ocular Immunology and Inflammation, 31(1), 105-111.

**Elsayed, S. M., & Elbana, H. A. (2022).** Risk Factors Associated with Occurrence of Cellulitis in Critically Ill Patients with Fulminant Hepatic Failure. Menoufia Nursing Journal, 7(2), 135-147.

**Erica S. Shenoy and David C. Hooper, Parsons, P. E., Wiener-Kronish, J. P., Berra, L., & Stapleton, R. D. (2025).** Critical Care Secrets, CHAPTER 43, 269-276 E-Book. Elsevier Health Sciences.

**Gibbons, A. B., Elsafy, R., Campbell, A., & Li, E. (2025).** Trends in orbital cellulitis severity and management: 2016 through 2022. Orbit, 44(2), 163-170.

**Lan, N. T. N., Lieu, D. Q., Anh, T. N., Tuong, T. T. K., & Bang, M. H. (2024).** Characteristics and Related Factors of Bacterial Infection Among Patients With Cirrhosis. Materia Socio-medica, 36(1), 90.

**Lingiah VA, Pyrsopoulos NT(2021).** Bacterial Infections in Cirrhotic Patients in a Tertiary Care Hospital. J Clin Transl Hepatol. 2021 Feb 28;9(1):32-39. doi: 10.14218/JCTH.2020.00076. Epub 2020 Dec 22. PMID: 33604253; PMCID: PMC7868695.

**Long, B., & Gottlieb, M. (2022).** Diagnosis and management of cellulitis and abscess in the emergency department setting: an evidence-based review. The Journal of Emergency Medicine, 62(1), 16-27.

**Mohamed Abdelhamed, H., El-Deeb, B. A. E. M., Hoda, X., Hassan Ali Awad, W., & Mahmoud Elrefaey, N. (2022).** Effect of using 5% potassium permanganate dressing solution on accelerating cellulitis healing process. Egyptian Journal of Health Care, 13(4), 1588-1600.

**Ong, B. S., Dotel, R., & Ngian, V. J. J. (2022).** Recurrent cellulitis: who is at risk and how effective is antibiotic prophylaxis?. International Journal of General Medicine, 15, 6561.

**Pandian, S. S., & Kumar, A. M. (2024).** Clinical study of risk factors, clinical presentation and management of cellulitis lower limb. Int J Acad Med Pharm, 6(2), 7-11.

**Premkumar, M., & Anand, A. C. (2022).** Overview of complications in cirrhosis. Journal of Clinical and Experimental Hepatology, 12(4), 1150-1174.

ISSN 2786-0183
Helwan International Journal for Nursing Research and Pratctice
Vol. 4, Issue 10, Month: June 2025, Available at: https://hijnrp.journals.ekb.eg/

**Rodriguez, J. R., Hsieh, F., Huang, C. T., Tsai, T. J., Chen, C., & Cheng, M. H. (2020).** Clinical features, microbiological epidemiology and recommendations for management of cellulitis in extremity lymphedema. Journal of surgical oncology, 121(1), 25-36.

**Sanglodkar U, Jain M, Jothimoni D, Parida S, G B, Venkataraman J(2019).** Cellulitis in liver cirrhosis - a series of 25 cases from southern India. Clin Exp Hepatol. 2019 Sep;4(3):201-204. doi: 10.5114/ceh.2018.78125. Epub 2019 Sep 10. PMID: 30324146; PMCID: PMC6185931.

**Sapuła, M., Krankowska, D., & Wiercińska-Drapało, A. (2020).** In search of risk factors for recurrent erysipelas and cellulitis of the lower limb: a cross-sectional study of epidemiological characteristics of patients hospitalized due to skin and soft-tissue infections. Interdisciplinary perspectives on infectious diseases,(1), 1307232.

**Wang, H. S., Hsiao, C. T., Fann, W. C., & Chang, C. P. (2023**). Predictor of gram-negative bacteremia in cirrhotic patients with skin and soft-tissue infections. Medicine, 102(28), e34075.