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Etiology of Leg Edema: A Tertiary Care Hospital Experience

Dr. Sobroto Kumar Roy[1*], Dr. Anisur Rahman Bhuiyan[2], Dr. Rajee Mahmud Talukder[3], Dr. Mahabubur Rahman[4], Dr. Shahriar Kabir Khan[5]

[1]Junior Consultant (Medicine), OSD, DGHS, On Deputation (Dept. of Hepatology), Dhaka Medical College Hospital, Dhaka, Bangladesh
[2]Associate Professor, Department of Medicine, Sheikh Sayera Khatun Medical College Hospital, Gopalgonj, Bangladesh
[3]Associate Professor, Department of Medicine, Medical College for Women & Hospital, Dhaka, Bangladesh
[4]Assistant Professor, Department of Neurology, Sheikh Sayera Khatun Medical College Hospital, Gopalgonj, Bangladesh
[5]Associate Professor, Department of Radiology, Sheikh Sayera Khatun Medical College Hospital, Gopalgonj, Bangladesh.

Abstract: ***Background:*** Leg edema can be a benign inconvenience or a symptom of severe health issues involving the cardiac, vascular, respiratory, renal, hepatic, or hematologic systems. Types of leg edema include venous edema, lymphedema, lipedema, inflammatory edema, pulmonary hypertension-induced edema, hormonal imbalance-related edema, drug-induced edema, idiopathic edema, and dependent edema. ***Aim of the study:*** This study aims to investigate the various causes and underlying factors contributing to leg edema and explore the different etiologies of leg edema. ***Methods:*** This observational study was conducted at Department of Medicine, Sheikh Sayera Khatun Medical College Hospital, Gopalgonj, Bangladesh, from January 2024 to June 2024, using purposive sampling to select 270 patients with leg edema. Inclusion criteria encompassed individuals aged 18 and older with unilateral or bilateral leg edema, while exclusion criteria included incomplete medical records and specific conditions. Data were gathered through structured forms, clinical assessments, and patient interviews, covering demographics, medical history, and edema characteristics. Ethical approval was obtained, and informed consent was provided. Data analysis was conducted using SPSS. ***Result:*** The majority (35.19%) are over 70 years old, with a mean age of 55.4 years. Females represent 61.85% of the population. Most participants are overweight (mean BMI = 28.5 kg/m²). A significant number (71.85%) have hypertension, and 64.07% report mobility issues, with 60% being wheelchair-bound. Leg edema is common, with 30.37% experiencing it for over 6 years. Venous insufficiency is the leading cause (71.11%), followed by congestive heart failure (18.15%) and nephrotic syndrome (12.96%). Other factors include NSAIDs, obesity, and hypoalbuminemia. ***Conclusion:*** Leg edema is primarily caused by venous insufficiency, congestive heart failure, and nephrotic syndrome. Our study found venous insufficiency as the most common etiology, with hypertension, diabetes, obesity, and immobility contributing to its development. Accurate diagnosis and management are crucial for improving patient outcomes.

Keywords: Etiology and Leg Edema.

Research Paper

***Corresponding Author:**
Dr. Sobroto Kumar Roy
Junior Consultant (Medicine), OSD, DGHS, On Deputation (Dept. of Hepatology), Dhaka Medical College Hospital, Dhaka, Bangladesh

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INTRODUCTION

Leg edema, defined as a palpable swelling due to an increase in interstitial fluid volume, can manifest as visible or palpable swelling when fluid buildup in tissues reaches significant levels [1]. This common condition, involving either unilateral or bilateral swelling, can be a benign inconvenience or an indicator of severe underlying health issues affecting the cardiac, vascular, respiratory, renal, hepatic, or hematologic systems [2]. Given its diverse etiologies, accurate assessment, history-taking, and physical examination are essential for diagnosis and management [3]. Leg edema can be classified into different types based on the underlying mechanisms. Venous edema, correctly defined as a swelling caused by an increase in protein-poor interstitial fluid, which is a consequence of increased capillary filtration, is the most frequent type of leg edema [4,5]. Lymphedema, a protein-rich fluid within skin and subcutaneous tissue as a sign of lymphatic dysfunction,

is rarely seen on both legs [6]. Lipedema, as a form of fat-maldistribution (around the hips, sublingual, supra malleolar), is not an increase in interstitial fluid (not really edema). It can be distinguished solely by its clinical appearance from venous edema or lymphedema [7]. Inflammatory edema results from increased vascular permeability due to infections, trauma, or immunological factors. Pulmonary hypertension, often secondary to heart failure or chronic lung disease, causes edema through elevated right ventricular diastolic pressure. Hormonal imbalances, such as thyroid dysfunction, Cushing's syndrome, and premenstrual or pregnancy-related changes, can also contribute to edema. Drug-induced edema is another significant category caused by medications such as calcium channel blockers, NSAIDs, and certain hormones. Idiopathic edema, primarily affecting women, presents as periodic swelling without an identifiable cause [8]. Dependent edema, often seen in immobile or elderly patients, is prevalent among individuals with severe motion disabilities, particularly those over 60 [9]. Immobility-related venous stasis, known as dependent or gravitational edema, is frequently mismanaged due to a lack of recognition among physicians [10]. Similarly, symmetric leg edema is common in elderly populations, yet its causes are often overlooked, leading to inappropriate treatments [11]. Chronic venous insufficiency is the most probable cause of bilateral edema in elderly individuals, impacting up to 60% of those over the age of 80 [12]. Effective management of leg edema requires a systematic approach that includes differentiating between systemic and local causes, understanding the patient's history, and performing targeted physical examinations. For instance, distinguishing between dependent edema and more serious conditions like DVT or heart failure is crucial. Diagnostic measures, such as ultrasound for DVT or blood tests for organ dysfunction, help in accurate diagnosis. Treatment strategies vary based on the underlying cause. Compression stockings are commonly prescribed for venous insufficiency, while manual lymphatic drainage is essential for managing lymphedema. Preventive measures, patient education, and lifestyle modifications, such as ankle elevation and regular physical activity, play significant roles in reducing the recurrence of dependent edema [13]. This study aims to investigate the various causes and underlying factors contributing to leg edema and explore the different etiologies of leg edema.

METHODOLOGY & MATERIALS

This observational study was meticulously designed and conducted at the Department of Medicine, Sheikh Sayera Khatun Medical College Hospital, Gopalgonj, Bangladesh from January 2024 June 2024. Employing a purposive sampling method, a carefully selected cohort of 270 patients was assembled to investigate the underlying etiological factors contributing to leg edema. Patient selection adhered to rigorous inclusion and exclusion criteria to ensure the reliability, relevance, and clinical significance of the findings.

- **Inclusion Criteria:** The study included individuals aged 18 years and older who presented with either unilateral or bilateral leg edema.

- **Exclusion Criteria:** Patients were excluded if they had incomplete medical records or a diagnosis of intra-abdominal malignancy, hypothyroidism, or idiopathic cyclic edema.

Data were systematically collected through structured forms, direct clinical assessments, and patient interviews. The collected variables encompassed demographic details (age, gender, marital status, and BMI), medical history (including comorbidities such as diabetes and hypertension), mobility status, duration of edema, and history of medication use. The etiological categorization of leg edema was determined based on a comprehensive review of clinical, laboratory, and imaging findings. Prior to inclusion, each participant was provided with a thorough explanation of the study's objectives, aims, and procedures. Written informed consent was obtained to ensure ethical compliance. All baseline demographic and clinical information was collected under strict confidentiality, with ethical approval secured from the institutional ethics review board.

Data Analysis

The data were meticulously organized into structured tables, accompanied by detailed narratives to facilitate a clear and comprehensive understanding of the findings. Statistical analyses were performed using SPSS software (version 26). Continuous variables were summarized as mean ± standard deviation (SD), while categorical variables were expressed as frequencies and percentages.

RESULT

Table 1 provides an overview of the demographic characteristics of the sample population. The age distribution shows that a majority of participants are over 50 years old, with 35.19% being older than 70 years and 30.00% aged between 51 and 70 years, respectively. The mean age is 55.4 (SD±12.3) years, indicating a relatively older sample. The mean Body Mass Index (BMI) of the participants is 28.5 (SD±12.3) kg/m². Gender distribution reveals a higher proportion of females (61.85%) compared to males (38.15%). Table 2 presents data on the medical history and mobility status of study participants. Among the participants, 65.19% did not have a history of diabetes, while 34.81% did. For hypertension, a higher prevalence was observed, with 71.85% reporting a history of the condition, compared to 28.15% who did not. Regarding mobility status, 35.93% had no problems walking, whereas 64.07% experienced walking difficulties or were confined to bed. The impact

of gait disturbances showed that 60.00% were wheelchair-bound, and 40.00% depended on crutches or a walking frame for mobility. Table 3 presents the clinical presentation of leg edema, outlining the frequency and percentage of various variables. The duration of edema shows that the majority (30.37%) experienced edema for over 6 years, while smaller groups had it for less than 3 months (21.85%), respectively. In terms of presentation type, 60% had bilateral edema, and 40% had unilateral edema. A majority (55.19%) experienced pitting edema, while 25.19% had non-pitting edema. Regarding associated symptoms, 85.19% reported edema without pain, whereas 15.19% had edema accompanied by pain. The most common etiology is venous insufficiency, accounting for 71.11%. Congestive heart failure follows with 18.15%, while nephrotic syndrome is seen in 12.96%. Other less frequent causes include pulmonary hypertension (2.22%), cor pulmonale (1.48%), and lymphedema (1.85%). Additionally, factors such as hypoalbuminemia, the use of nonsteroidal anti-inflammatory drugs (NSAIDs), corticosteroids, obesity, and sleep apnea contribute to a smaller percentage, ranging from 1.11% to 2.59%. A small portion of cases (3.33%) remain uncertain regarding their etiology (Table 4).

Table 1: Demographic Characteristics of the Study Population (N=270)

Variables	Frequency (N)	Percentage (%)
Age (in years)		
<30	26	9.63
30-50	68	25.19
51-70	81	30.00
>70	95	35.19
Mean ± SD	55.4 ± 12.3	
BMI (kg/m2)		
Mean ± SD	28.5 ± 4.3	
Gender		
Male	103	38.15
Female	167	61.85
Marital status		
Married	137	50.74
Single	42	15.56
Divorced/separated	44	16.30
Widowed	47	17.41

Table 2: Medical History and Mobility Status Among Participants

Variables	Frequency (N)	Percentage (%)
History of diabetes		
No	176	65.19
Yes	94	34.81
History of hypertension		
No	76	28.15
Yes	194	71.85
Mobility status		
No problems walking	97	35.93
Problems walking/confined to bed	173	64.07
Effect of gait disturbance		
Wheelchair-bound	162	60.00
Crutch or walking-frame dependent	108	40.00

Table 3: Clinical Presentation of Leg Edema

Variables	Frequency (N)	Percentage (%)
Duration of edema		
Less than 3 months	59	21.85
3-6 months	30	11.11
6-12 months	35	12.96
1-2 years	35	12.96
2-6 years	29	10.74
>6 years	82	30.37

Variables	Frequency (N)	Percentage (%)
Presentation Type		
Bilateral edema	162	60.00
Unilateral edema	108	40.00
Pitting edema	149	55.19
Non-pitting edema	68	25.19
Edema with pain	41	15.19
Edema without pain	230	85.19

Table 4: Etiology of Leg Edema in Study Population

Etiology	Frequency (N)	Percentage (%)
Congestive heart failure	49	18.15
Venous insufficiency	192	71.11
Nephrotic syndrome	35	12.96
Lymphedema	5	1.85
Pulmonary hypertension	6	2.22
Cor pulmonale	4	1.48
Hypoalbuminemia	5	1.85
Use of nonsteroidal anti-inflammatory drug	5	1.85
Use of corticosteroids	6	2.22
Sleep apnea	3	1.11
Obesity	7	2.59
Uncertain	9	3.33

DISCUSSION

Leg edema, the accumulation of fluid in the legs, poses a significant health burden. It can result from various conditions, such as heart failure, kidney disease, or venous insufficiency. Among 270 patients, we found that most patients were aged more than 70 years in our study, with a mean age of 55.4 (SD±12.3) years. This finding is similar to a study done by Robert P. *et al.*, where they found the average age was 56.6 (SD±15) years [14]. Obesity significantly increases the risk of leg edema due to the excessive accumulation of adipose tissue, which exerts extra pressure on the venous and lymphatic systems. Our study suggests the same aligns with previous studies [14,15]. According to our study, females are more affected than males. The medical history of participants revealed a significant prevalence of hypertension (71.85%) and a notable proportion with diabetes (34.81%) (Table 2). These findings align with existing literature that highlights hypertension and diabetes as common comorbidities in patients with leg edema [16]. Mobility issues were prevalent, with 64.07% of participants experiencing problems walking or being confined to bed. This high percentage underscores the impact of leg edema on mobility and quality of life. Furthermore, a substantial number of participants (60%) used wheelchairs, indicating severe mobility impairment [17]. The clinical presentation of leg edema among participants varied significantly in duration and type (Table 3). Chronicity was a common feature, with 30.37% experiencing edema for over six years. The persistence of edema is indicative of underlying chronic conditions, likely contributing to the mobility limitations observed. Bilateral edema was more common (60%) compared to unilateral edema (40%), and the majority of the cases were pitting edema (55.19%). These characteristics are typical of venous insufficiency, the most frequent etiology in this study (71.11%). Notably, most participants (85.19%) reported edema without pain, which can help differentiate between various underlying causes [16]. A study found that one-third had edema for less than 6 months, and 30% reported edema lasting more than 6 years [14]. The etiological analysis (Table 4) identified venous insufficiency as the predominant cause (71.11%), followed by congestive heart failure (18.15%) and nephrotic syndrome (12.96%). The high prevalence of venous insufficiency aligns with the demographic and clinical characteristics observed, such as the high incidence of pitting and bilateral edema. Congestive heart failure as a significant contributor further highlights the cardiovascular comorbidities prevalent in this population. Other less common etiologies included conditions such as pulmonary hypertension, cor pulmonale, hypoalbuminemia, and the use of specific medications like corticosteroids and NSAIDs, each contributing to a small fraction of cases. The presence of uncertain etiologies in 3.33% of the cases suggests that further diagnostic workups are necessary to identify the underlying causes in some patients. The study's limitations include its observational design, which does not allow for establishing causal relationships between the identified etiologies and leg edema. The exclusion of patients with incomplete medical records or certain conditions (e.g., hypothyroidism, idiopathic cyclic edema) may have excluded relevant cases, potentially affecting the study's comprehensiveness. The reliance on clinical assessments, which may vary between practitioners, could also introduce measurement biases.

CONCLUSION

In conclusion, leg edema is a multifactorial condition with a wide range of underlying causes, primarily venous insufficiency, congestive heart failure, and nephrotic syndrome. Our study, conducted in a tertiary care hospital in Bangladesh, found that venous insufficiency was the most common etiology, affecting the majority of patients, followed by cardiovascular and renal conditions. The findings also highlight the significant impact of comorbidities like hypertension and diabetes, as well as the effects of obesity and immobility on edema development.

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