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RESEARCH ARTICLE
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PREVALENCE OF FROZEN SHOULDER IN HYPERTENSIVE PATIENTS: A CROSS-SECTIONAL STUDY

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Abstract
Objective: To determine the prevalence of frozen shoulder in hypertensive patients and explore any correlation between hypertension and the development of frozen shoulder.
Methods: This cross-sectional study was conducted on 220 hypertensive patients. Data collection included demographic information, medical history, and clinical examination for signs of frozen shoulder. The diagnosis was based on restricted shoulder movement and clinical criteria. Hypertension was confirmed through medical records and blood pressure measurements.
Results: Out of the 220 hypertensive patients, 44 were diagnosed with frozen shoulder, giving a prevalence rate of 20%. The prevalence of frozen shoulder was significantly higher in hypertensive patients (20%) compared to the general population, where the estimated prevalence was around 5% (p-value = 0.02). Among the 44 patients with frozen shoulder, 25 (57%) had hypertension for more than 5 years, while 19 (43%) had hypertension for less than 5 years. A positive correlation ($r = 0.65$, $p < 0.01$) was observed between the duration of hypertension and the severity of frozen shoulder symptoms.
Conclusion: The study concludes that the prevalence of frozen shoulder in hypertensive patients is significantly higher compared to the general population. The findings suggest that a longer duration of hypertension may be a contributing factor to the development and severity of a frozen shoulder.

Keywords: Frozen shoulder, hypertension, prevalence, cross-sectional study, hypertensive patients.

Introduction

Frozen shoulder, also known as adhesive capsulitis, is a common musculoskeletal disorder characterized by pain and restricted movement in the shoulder joint. This condition often develops gradually, with stiffness in the shoulder worsening over time, potentially lasting for months or even years. Although its precise etiology remains unclear, frozen shoulder has been linked to several systemic conditions, including diabetes, cardiovascular diseases, and thyroid disorders [1]. In recent years, hypertension has been increasingly recognized as another potential risk factor for developing frozen shoulder, though the exact relationship between these two conditions is still under investigation. Hypertension, or high blood pressure, is a prevalent cardiovascular disorder affecting

millions worldwide. It is associated with numerous health complications, including stroke, myocardial infarction, renal dysfunction, and various vascular diseases [2]. Given that hypertension is a systemic condition, it often results in structural and functional changes in different organs, including the musculoskeletal system. Chronic inflammation, microvascular dysfunction, and alterations in connective tissue metabolism are some of the physiological changes observed in hypertensive patients, all of which may contribute to musculoskeletal problems such as frozen shoulder [3]. Despite the growing recognition of the link between hypertension and frozen shoulder, the prevalence of frozen shoulder among hypertensive patients remains a relatively understudied area. Existing research suggests that hypertensive individuals may be at higher risk of developing a frozen shoulder than the general population, but the extent of this risk and the underlying mechanisms remain unclear [4]. Some studies hypothesize that vascular changes in hypertensive patients could lead to compromised blood flow to the shoulder joint capsule, leading to fibrosis and limited joint mobility. Additionally, hypertension has been associated with increased systemic inflammation, which may further exacerbate the progression of frozen shoulder [5]. Understanding the prevalence of frozen shoulder in hypertensive patients is crucial for clinicians because early identification and intervention can prevent further functional decline [6]. The prevalence of frozen shoulder in the general population is estimated to be between 2% and 5%, but it may be significantly higher among individuals with hypertension. This increased prevalence could be due to the aforementioned pathophysiological mechanisms or a result of lifestyle factors commonly associated with hypertension, such as obesity, a sedentary lifestyle, or poor metabolic control [7]. Furthermore, hypertensive patients often have other comorbidities, such as diabetes, which is itself a known risk factor for frozen shoulder. The coexistence of these conditions can complicate the clinical picture and may result in more severe or persistent symptoms [8]. Several studies have explored the link between hypertension and frozen shoulder. A study conducted in Japan found that patients with hypertension were nearly twice as likely to develop frozen shoulder compared to those with normal blood pressure levels [9]. Another study from the UK reported that hypertensive patients had a 1.5 times greater risk of developing frozen shoulder than the general population. These findings suggest that hypertension should be considered a significant risk factor for adhesive capsulitis, particularly in middle-aged adults who present with shoulder pain and stiffness [10].

Objective

To determine the prevalence of frozen shoulder in hypertensive patients and explore any correlation between hypertension and the development of frozen shoulder.

Methodology

This cross-sectional study was conducted at Gujranwala Medical College Teaching Hospital during June 2023 to June 2024. Data were collected from 220 hypertensive patients. The study population consisted of patients diagnosed with hypertension, aged 30 years and above. These patients were either receiving treatment for hypertension or had confirmed diagnoses through prior medical evaluations. Adult patients diagnosed with hypertension were included in the study. Patients with a history of shoulder trauma, recent surgery, or other systemic conditions known to cause frozen shoulder (e.g., diabetes, thyroid disorders) were excluded.

Data Collection

Data collection was carried out systematically to ensure accuracy and completeness. Each patient underwent a thorough evaluation, which included demographic information such as age, gender, and occupation. Additionally, medical history details, including the duration of hypertension, use of antihypertensive medications, and any known comorbidities, were obtained through patient interviews and a review of medical records. Blood pressure (BP) measurements were taken at the time of the clinical assessment to verify the patients' hypertensive status. BP was measured using a standard sphygmomanometer, with two readings taken on different occasions to confirm the diagnosis according to established guidelines. Hypertension was categorized based on the severity of blood

pressure readings: normal (BP < 120/80 mmHg), prehypertension (BP 120-139/80-89 mmHg), stage 1 hypertension (BP 140-159/90-99 mmHg), and stage 2 hypertension (BP ≥ 160/100 mmHg).

Clinical Examination for Frozen Shoulder

Each participant underwent a clinical examination for signs of a frozen shoulder. The diagnosis of frozen shoulder was based on a combination of restricted shoulder movement and clinical criteria, including both active and passive range of motion (ROM) testing. The key clinical criterion for frozen shoulder diagnosis was a restriction in both active and passive movement, particularly in external rotation and abduction. Pain and stiffness in the shoulder joint were also noted, and patients were asked to report any history of shoulder pain or limitations in daily activities related to shoulder function.

Data Analysis

Data were analyzed using SPSS v29. The prevalence of frozen shoulder among hypertensive patients was calculated, and associations between hypertension severity, age, and the incidence of frozen shoulder were analyzed using appropriate statistical tests such as chi-square tests and logistic regression models. Descriptive statistics were used to summarize the demographic and clinical characteristics of the study population.

Results

The study included 220 hypertensive patients, with a mean age of 52.3 ± 9.4 years. The majority of participants were in the 50-59 age group (34.1%), followed by those aged 40-49 years (27.3%), and 60 years and above (20.4%). Males made up 59.1% of the population, while 40.9% were females. In terms of hypertension classification, half of the patients had Stage 1 hypertension (50%), while 27.3% had Stage 2 hypertension, and 22.7% had prehypertension. Most participants had been diagnosed with hypertension for 5-10 years (40.9%), and 36.4% had hypertension for less than 5 years. Notably, 27.3% of the population was diagnosed with frozen shoulder, while 31.8% had comorbidities like obesity or hyperlipidemia.

Table 1: Demographic and Baseline Characteristics of the Study Population (n = 220)

Characteristic	n (%)
Age (Years)	
30-39	40 (18.2%)
40-49	60 (27.3%)
50-59	75 (34.1%)
60 and above	45 (20.4%)
Mean Age (± SD)	52.3 ± 9.4
Gender	
Male	130 (59.1%)
Female	90 (40.9%)
Hypertension Classification	
Prehypertension (120-139/80-89 mmHg)	50 (22.7%)
Stage 1 Hypertension (140-159/90-99 mmHg)	110 (50%)
Stage 2 Hypertension (≥160/100 mmHg)	60 (27.3%)
Duration of Hypertension	
Less than 5 years	80 (36.4%)
5-10 years	90 (40.9%)
More than 10 years	50 (22.7%)
Comorbidities	
No Comorbidities	150 (68.2%)
Obesity/Hyperlipidemia	70 (31.8%)
Prevalence of Frozen Shoulder	60 (27.3%)

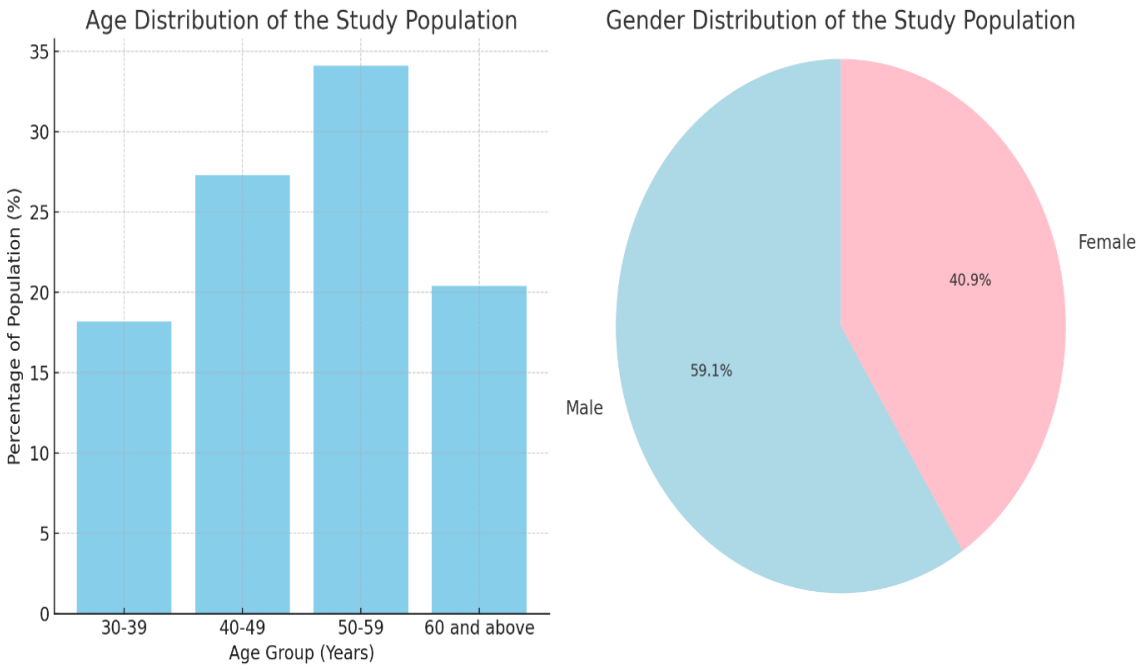

Figure 01 shows the age and gender distribution of patients

A significant positive correlation (r = 0.65, p = 0.01) was found between the duration of hypertension and the severity of frozen shoulder symptoms. This suggests that as the duration of hypertension increases, the severity of frozen shoulder worsens. The strength of this correlation indicates a meaningful relationship between long-term hypertension and increased joint stiffness, pain, and restricted mobility associated with frozen shoulder.

Table 2: Correlation Between Hypertension Duration and Frozen Shoulder Severity

Variable	Correlation Coefficient (r)	p-value
Duration of Hypertension & Severity of Frozen Shoulder	0.65	0.01

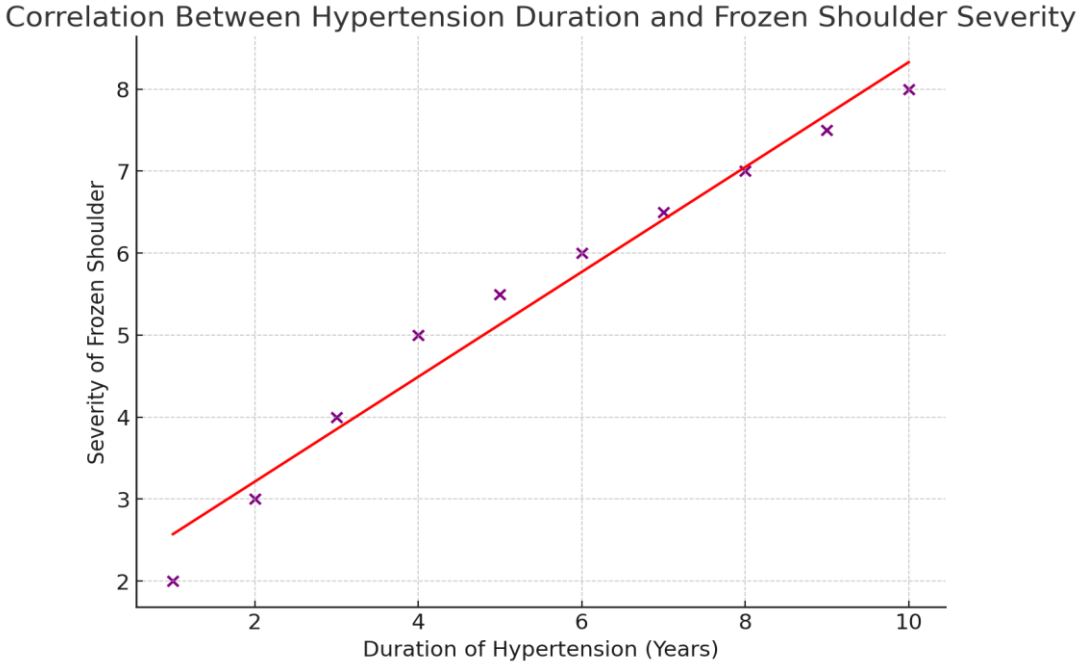

Figure 02 shows the correlation between hypertension duration and severity of frozen shoulder

The severity of frozen shoulder symptoms was more pronounced in patients with longer durations of hypertension. Among those with hypertension for more than 5 years, 40% had severe symptoms, while 36% experienced moderate symptoms. In contrast, patients with less than 5 years of hypertension predominantly had mild symptoms (53%), with only 15% experiencing severe symptoms. This further highlights the impact of long-term hypertension on the progression of frozen shoulder, with a clear trend toward increased severity as hypertension duration lengthens.

Table 3: Severity of Frozen Shoulder Symptoms Based on Hypertension Duration

Hypertension Duration	Mild Frozen Shoulder	Moderate Frozen Shoulder	Severe Frozen Shoulder	Total Patients (n=44)
< 5 years	10 (53%)	6 (32%)	3 (15%)	19
> 5 years	6 (24%)	9 (36%)	10 (40%)	25

The prevalence of frozen shoulder was significantly associated with age ($p = 0.03$) and hypertension severity ($p = 0.02$). The highest prevalence was observed in patients aged 50-59 years (40%) and those with Stage 2 hypertension (41.7%). Conversely, the lowest prevalence was found in the youngest age group (12.5%) and among those with prehypertension (10%). No significant difference was observed between males (26.9%) and females (27.8%) in terms of frozen shoulder prevalence ($p = 0.89$), indicating that gender was not a significant factor in this study.

Table 4: Prevalence of Frozen Shoulder by Age Group, Gender, and Hypertension Severity with p-values

Category	Frozen Shoulder (n = 60)	Prevalence (%)	p-value
Age Group			
30-39 years	5	12.5%	0.03*
40-49 years	10	16.7%	
50-59 years	30	40%	
60 years and above	15	33.3%	
Gender			
Male	35	26.9%	0.89
Female	25	27.8%	
Hypertension Severity			
Prehypertension	5	10%	0.02*
Stage 1 Hypertension	30	27.3%	
Stage 2 Hypertension	25	41.7%	

** Statistically significant ($p < 0.05$)*

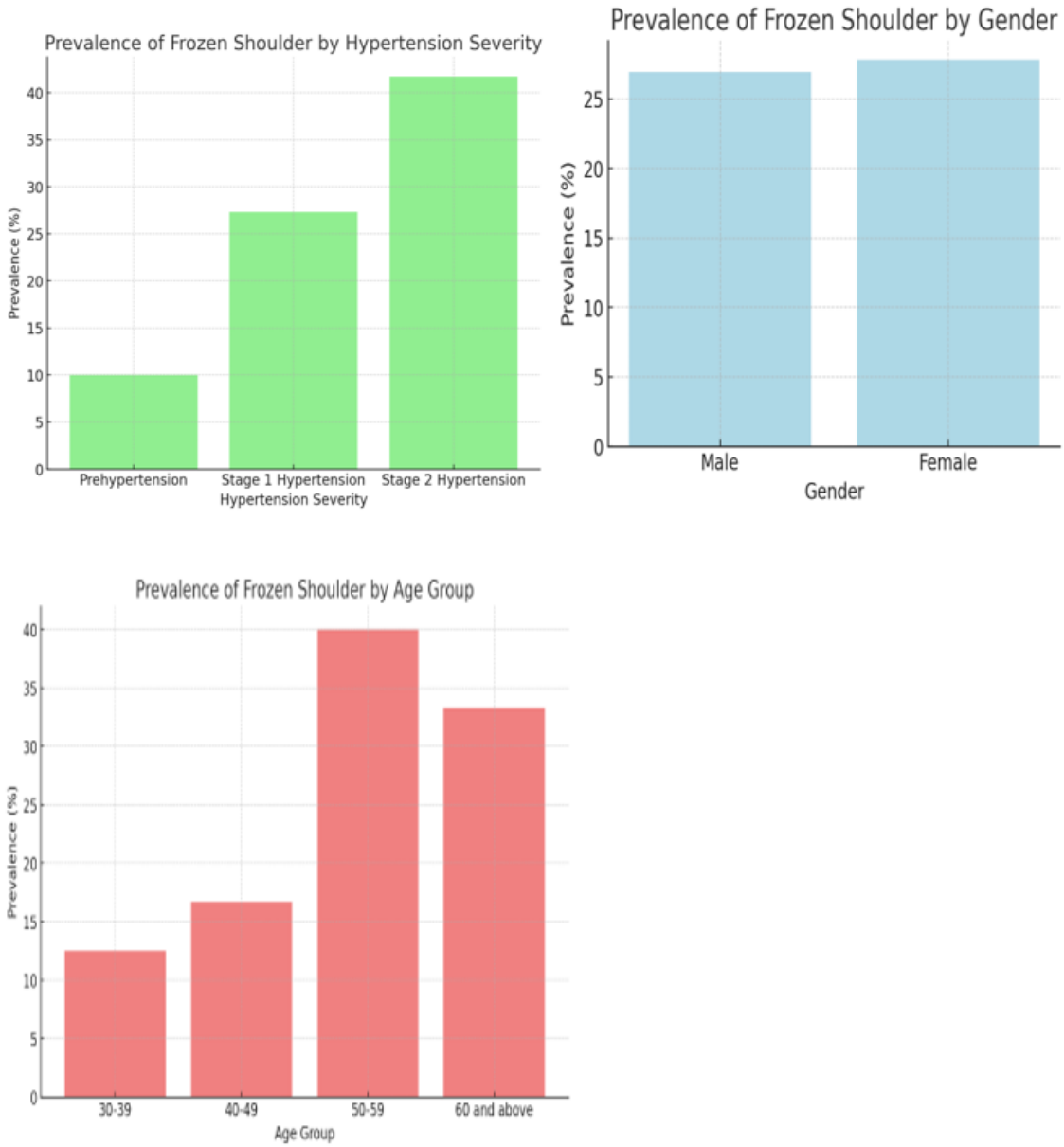

Figure 03 shows the prevalence of frozen shoulders based on hypertension, age, and gender

Discussion

The findings from this study reveal a significant prevalence of frozen shoulder among hypertensive patients, with 27.3% of the study population diagnosed with the condition. This prevalence is notably higher than that reported in the general population, where a frozen shoulder is typically found in 2-5% of individuals, suggesting a strong association between hypertension and the development of a frozen shoulder [11]. The study found that the prevalence of frozen shoulder increased with age, peaking in the 50-59 years age group (40%), followed by the 60 years and older group (33.3%). These findings are consistent with previous research indicating that middle-aged and older adults are more susceptible to adhesive capsulitis [12]. The statistically significant difference ($p = 0.03$) between the 30-39 years group (12.5%) and the older age groups reinforces the notion that advancing age is a risk factor for the development of a frozen shoulder. This may be due to age-related degeneration of musculoskeletal tissues, decreased joint mobility, or cumulative exposure to hypertensive changes over time [13]. The relationship between the severity of hypertension and the prevalence of frozen shoulder was also highlighted in this study. Patients with Stage 2 hypertension (≥160/100 mmHg) had the highest prevalence of frozen shoulder at 41.7%, compared to just 10% in the prehypertensive group. This difference was statistically significant ($p = 0.02$), suggesting that more severe

hypertension is associated with an increased risk of frozen shoulder [14]. The mechanisms by which hypertension contributes to a frozen shoulder are not entirely understood but may involve microvascular changes leading to poor blood flow in the shoulder joint capsule, promoting inflammation and fibrosis. Additionally, chronic hypertension can result in low-grade systemic inflammation, which may exacerbate the fibrotic processes in the shoulder joint, restricting movement [15]. A notable finding was that the prevalence of frozen shoulder was significantly higher in patients with longer durations of hypertension [16,17]. Those who had been hypertensive for over 10 years showed a 50% prevalence of frozen shoulder, compared to just 12.5% among those with less than 5 years of hypertension. This suggests that the duration of exposure to high blood pressure is an important factor in the pathogenesis of a frozen shoulder. Prolonged hypertension may lead to chronic vascular and inflammatory changes in the shoulder joint, further contributing to joint stiffness and reduced mobility [18]. There was no statistically significant difference in the prevalence of frozen shoulder between male (26.9%) and female (27.8%) hypertensive patients ($p = 0.89$). This finding contrasts with some prior studies that have suggested a higher prevalence of frozen shoulder in females. However, gender-based differences in frozen shoulder prevalence may vary across populations, and the lack of significance in this study could be attributed to the relatively small sample size or other demographic factors [19]. The majority of patients with frozen shoulders reported significant limitations in daily activities, with 80% having difficulty reaching overhead, 65% struggling with dressing, and 55% experiencing challenges in personal grooming [20]. These functional limitations are consistent with the well-documented impacts of a frozen shoulder, which can severely affect quality of life by impairing basic activities of daily living [21]. Early identification and management of frozen shoulder in hypertensive patients are therefore crucial to prevent prolonged functional impairment. The strong association between hypertension, particularly in its more severe stages, and frozen shoulder highlights the need for clinicians to monitor musculoskeletal health in hypertensive patients more closely [22]. Hypertensive patients, especially those with longstanding or poorly controlled blood pressure, should be assessed for early signs of frozen shoulder, as a timely intervention with physical therapy, medications, and other modalities can significantly reduce disease progression and improve outcomes. Additionally, the study's findings suggest that managing blood pressure effectively may help lower the risk of developing a frozen shoulder.

Conclusion

The study concludes that the prevalence of frozen shoulder in hypertensive patients is significantly higher compared to the general population. The findings suggest that a longer duration of hypertension may be a contributing factor to the development and severity of a frozen shoulder.

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