

# Risk Factors Associated with Frozen Shoulder among Nepalese Population: A Hospital-based Comparative Study

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## ABSTRACT:

**Introduction:** Frozen shoulder is one of the common musculoskeletal disorders characterized by pain and restriction of motion of the shoulder joint. It is also considered a common self-limiting regional skeletal problem. This study aimed to evaluate related risk factors for frozen shoulder. **Methods:** This was a hospital-based comparative study involving 60 patients with a diagnosed frozen shoulder in the out-patient department as cases and 60 patients hospitalized during the same period with non-shoulder-related complaints as controls. A face-to-face interview was taken. Univariate and multivariate logistic regression analyses were performed. **Results:** A total of 120 consecutive subjects (60 patients with frozen shoulders and 60 controls) were taken. The mean age of cases was  $54.7 \pm 3.21$  years and that of controls was  $42.08 \pm 2.74$  years. Among the frozen shoulder patients, 33.3% had diabetes and 15% had a history of thyroid disorder. Multivariate logistic regression analysis showed age, diabetes mellitus, and thyroid dysfunction as independent risk factors for frozen shoulder ( $p < 0.05$ ). The frozen shoulder patients also had a higher prevalence of cardiac diseases and cervical spondylosis than the controls. No significant difference was found in body mass index, cholecystitis, history of surgical intervention, and uric acid level between the frozen shoulder group and the control group. **Conclusion:** The study findings indicated that diabetes, thyroid disease, and advanced age have been significantly associated with increased frozen shoulders.

**Keywords:** Frozen shoulder; Musculoskeletal; Risk factors.

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## INTRODUCTION:

Frozen shoulder is one of the common musculoskeletal disorders characterized by pain and restriction of motion of the shoulder joint. It is also considered the common self-limiting regional skeletal problem of unclear pathogenesis and is usually divided into primary and secondary causes. It usually

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has an insidious onset and follows a protracted course, especially primary causes than secondary causes.[1]

In a systematic review the point prevalence of shoulder pain among adults younger than 70 years was 7 to 27% and for adults older than 70 years was 13.2 to 26%.[2] The incidence of frozen shoulder in the general population is approximately 2 to 5% [3], but several conditions are associated with an increased incidence, including female gender, older age, diabetes mellitus (DM), cervical disc disease, prolonged immobilization, hyperthyroidism, stroke, or myocardial infarction, the presence of autoimmune diseases, and trauma. Individuals between the ages of 40 and 70 years are more commonly affected.[4,5]

Frozen shoulder can be categorized into three stages: the first stage is a stage of pain, the second, the stage of stiffness, and the third, the stage of thawing which is usually self-limiting and resolves in 12 to 18 months. [6]

Identifying the risk factors of a disease is important to gain an understanding of its etiology. The best treatment of frozen shoulder is prevention.[7] So the purpose of the present study was to examine the presumed risk factors and to warn about the disease progression and its early management.

Frozen shoulder presents with pain and stiffness in the shoulder which may lead to an inability to work and or to carry out household and leisure-time activities, Therefore, this study precisely assesses the potential influence of several factors on frozen shoulder development and evaluate the possible relationship between these factors in elevating the risk for frozen shoulder in individuals.

## **METHODS:**

This was a hospital-based comparative study in which cases and controls were taken from 2021 Jan to 2022 Jan. Informed consent was obtained from each study participant. The sample size was calculated using the power and sample size program[8]. We planned a study of independent cases and controls with one control per case. Prior data indicate that the probability of exposure among controls is 0.07.[2,3] If the true probability of exposure among cases is 0.27 [2,3], we needed to study 54 cases and 54 controls to be able to reject the null hypothesis that the exposure rates for cases and controls were equal with a probability (power) of 0.8. The Type I error probability associated with this test of the null hypothesis is 0.05. A total of 120 consecutive subjects (60 cases with frozen shoulder and 60 controls) were included. Ethical approval was obtained from the institutional review committee of the institute (IRC-LMC13-J/020). Participants were taken from those with newly diagnosed frozen shoulders who presented to the outpatient department of orthopedics in Lumbini medical college and Teaching Hospital (LMC-TH).

The inclusion criteria were: age more than 18 years; the presence of pain associated with active and passive restriction of glenohumeral motion with external rotation less than 50% of the normal side; normal radiograph and the shoulder ultrasound demonstrating no significant rotator cuff tear. The patients were excluded in case there was the presence of shoulder diseases like shoulder fracture, dislocations, impingement syndrome, supraspinatus calcific tendinitis, and rotator cuff injuries. For control, we included hospitalized patients without shoulder disease, frozen shoulder, and trauma history.

All the subjects were randomly interviewed using a common questionnaire set in proforma by two practicing doctors. They were trained to conduct the survey, with the written protocol. An in-person interview was conducted for all the participants and information on potential risk factors were collected. For Body Mass Index (BMI), we used the WHO category for obesity (< 25, 25 to 29.9, 30 to 39.9, and  $\geq$  40).[9] and age range were categories ( $\leq$  40 and > 40) years as median age group.

**Statistical analysis:** We used STATA version 16.1 for statistical analysis. The quantitative results were expressed as frequency, percentage, and mean $\pm$ standard deviation. We used the Chi-Square or Fisher's exact test where applicable to evaluate categorical variables. Univariate logistic regression analysis was performed to assess the effect of each risk factor for frozen shoulder. Furthermore, we performed a multivariate logistic regression analysis using those variables that were significant in the single-factor analysis. We used the forward direction to calculate the logistic model. Possible interactions between risk factors were calculated using multivariate logistic regression models. A p-value of  $\leq$ 0.005 was considered statistically significant.

## RESULTS:

There were a total of 120 patients, 60 each in cases and controls. For those presented with frozen shoulder, the durations of symptoms were one, two, three, and four months among 38.33%, 30%, 23.33%, and 8.33% respectively. The mean age of the cases was 54.7 $\pm$ 2.37 years and that of the controls was 42.08 $\pm$ 2.49 years. The distribution of demographic variables and the risk factors of frozen shoulder namely: age, gender, diabetes mellitus (DM), BMI, thyroid dysfunction, history of cardiac disease, cervical spondylosis, cholecystitis, past surgery, uric acid are outlined in Table 1.

Further, we divided the age range into two categories ( $\leq$  40 and > 40) years. We performed a single-factor logistic regression analysis including all the mentioned risk factors of which the result is shown in Table 2. No significant difference in gender (p=0.58), BMI (0.05), cervical spondylosis (p=0.69), cholecystitis (p=0.20), uric acid (hyperuricemia) (p=0.69), cardiac diseases like hypertension (p=0.08) among those with and without frozen shoulder. Whereas age, DM, thyroid dysfunction showed a statistical significance (p values <0.009, <0.002, 0.04 respectively). These were further analyzed using multivariate logistic regression analysis, which showed that age, DM, and thyroid dysfunction were independent risk factors for frozen shoulder (Table 3).

## DISCUSSION:

This comparative study found that age, DM, and thyroid dysfunction were the risk factors associated with frozen shoulder significantly. In addition, we found several other predictive factors for the risk of frozen shoulder, namely gender, BMI, cardiac disease, cervical spondylosis, and hyperuricemia. The result of this study can help for a better understanding of the underlying risk factor of frozen shoulder.

We found out that DM was an independent risk factor for the frozen shoulder with the risk nearly 12 times more than in the control group, which was consistent with the previous studies done by Dias R et al.[10], Miligrom C et al.[11], Cho c-h et al.[12] and Wei Li et al.[4] Above result and studies indicated that diabetes is by far the most common association with frozen shoulder. This may be due to high glucose causing collagen to be sticky resulting in movement restriction and stiffness which is also known as glycosylation[13].The study by Moren et al. reported that painful stiff shoulders among diabetics had 90% of painful shoulders with restricted mobility and difficulty in daily

Table 1: Distribution of selected demographic variables and risk factors in frozen shoulder cases and controls.

Factors		Cases (n=60) Frequency (%)	Controls (n=60) Frequency (%)	p value
Age	<40 years	2 (3.33)	31 (51.66)	<0.001
	≥40 years	58 (96.67)	29 (48.33)	
Gender	Male	33 (55)	36 (60)	0.58
	Female	27 (45)	24 (40)	
BMI	<25	16 (26.67)	22 (36.67)	0.09
	25-29.9	34 (56.67)	35 (58.33)	
	>30	10 (16.67)	3 (5)	
Diabetes mellitus	Yes	20 (33.33)	2 (9.33)	<0.001
	No	40 (66.67)	58 (96.67)	
Thyroid dysfunction	Yes	8 (13.33)	2 (3.33)	0.048
	No	52 (86.67)	58 (96.67)	
Cardiac disease	Yes	5 (8.33)	1 (1.67)	0.094
	No	55 (91.62)	59 (98.33)	
Cervical Spondylosis	Yes	4 (6.67)	3 (5)	0.69
	No	56 (93.33)	57 (95)	
Past Surgery (other than shoulder surgery)	Yes	0 (0)	14 (23.33)	
	No	60 (100)	46 (76.67)	
Cholecystitis	Yes	4 (6.67)	8 (13.33)	0.22
	No	56 (93.33)	52 (86.67)	
Uric acid	High	4 (6.67)	3 (5)	NA
	Normal	56 (93.33)	57 (95)	

*Table 2: Univariate logistic regression analysis of the potential risk factors associated with a frozen shoulder between case and control groups.*

<b>Factor</b>	<b>OR</b>	<b>95% CI</b>	<b>p value</b>
Gender	1.22	0.59 to 2.53	0.58
Age	30.99	6.93 to 138.62	<0.001
BMI	1.70	0.98 to 3.27	0.053
Thyroid dysfunction	4.46	0.90 to 21.97	0.041
Cardiac disease	5.36	0.61 to 47.3	0.08
Cervical spondylosis	1.36	0.29 to 6.34	0.69
Cholecystitis	2.15	0.61 to 7.57	0.20
hyperuricemia	1.36	0.29 to 6.34	0.69
DM	14.5	3.2 to 65.5	<0.001

OR: Odds Ratio; CI: Confidence Interval; DM: Diabetes Mellitus

*Table 3: Multivariate logistic regression analysis*

<b>Factors</b>	<b>OR</b>	<b>95% CI</b>	<b>p value</b>
Age	1.03	1.01 to 1.07	0.009
Diabetes mellitus	12.07	2.43 to 59.83	0.002
Thyroid dysfunction	5.45	1.03 to 28.67	0.045

activity in the acute phase[14]. This signifies the need for early detection and prevention of frozen shoulder among patients with DM.

Considering those with thyroid dysfunction, the result of our study indicated that the individuals with thyroid dysfunction have around five times more risk of developing frozen shoulder than the control group which was to the previous studies done by Miligron

C et al.[11] and Cakir M et al.[15]Milgrom et al. reported that among those with frozen shoulder, 13.5% were with thyroid dysfunction. While it was 10.9% in a study conducted in an endocrinology clinic among 137 patients by Cakir m et al.[15] Wohlgethan et al.[16] also found a possible link between frozen shoulder and altered thyroid function.

In this study, the patients with cervical spondylosis were 1.4 times high likely of having frozen shoulders than the control group although not statistically significant. This result is consistent with the result of the hospital-based case-control study conducted in China where the prevalence of frozen shoulder was 23.6 % and 15.3% among those with cervical spondylosis and the control group respectively.[4]

In this study regarding age, about 96% participated patients were above 40 years with a p-value less than 0.005 which is similar to other studies.[17,18]

We found a significant relationship between frozen shoulder with some comorbidities. We performed a hospital-based case-control study and analyzed the potential risk factors associated with a frozen shoulder in western Nepal. We found out overlapped as well as different patterns, comprising with other previous studies. This reflects the race-dependent effect on frozen shoulder. Yet, the result of the present study should be considered with certain limitations. We carried out this study in small groups of 60 participants in each case and control. We could not include some of the suspected risk factors as mentioned in various articles like Parkinson's disease, stroke, hyperlipidemia, and Dupuytren's contracture.

#### **CONCLUSION:**

This study showed that diabetes mellitus, thyroid disorder, and advanced age were associated with the frozen shoulder in Western, Nepal. However, more future prospective cohort studies will prove and simplify the association.

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