

## Shoulder Subluxation and its Associated Risk Factors in Post Stroke Hemiplegic Patients

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### Abstract

**Objectives:** Stroke is one of the leading causes of death or disability in India. One of the major sequelae of the stroke is glenohumeral subluxation (GHS). This study was conducted to find out the prevalence of shoulder subluxation and its associating risk factors in post stroke hemiplegic patients.

**Material and Method:** This descriptive study of post-stroke hemiplegic patients was conducted in the department of PMR, SMS Medical College, Jaipur, from December 2019 to September 2020. A plan radiograph (AP view) of the bilateral shoulder was taken in standing position with an unsupported dependent arm to diagnosed the shoulder joint subluxation. Muscle power and tone of the hemiplegic shoulder was rated by Medical Research Council scale and Modified Ashworth scale respectively.

**Results:** Thirty-seven hemiplegic participants with mean age of  $53.19 \pm 10.78$  were recruited in this study. Out of 37 participants, shoulder subluxation was reported in 21 participants (56.76%). Shoulder subluxation was found to be associated with muscle power and muscle tone of hemiplegic shoulders. Whereas there was no significant association was observed between hemiplegic shoulder subluxation and participant's age, gender, co-morbidity and with side of hemiplegia.

**Conclusion:** There is a high probability of shoulder subluxation in post stroke hemiplegic patients. There is a negative correlation between hemiplegic shoulder subluxation and muscle tone as well as power of muscles around the hemiplegic shoulders. This study suggest that hemiplegic shoulders with decreased muscle power and tone need more care with proper positioning of upper limbs to prevent shoulder subluxation in acute phase of hemiplegia.

**Keywords:** Shoulder Subluxation, Glenohumeral Subluxation (GHS), Post-stroke, Hemiplegia, Muscle Power, Muscle Tone

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## Introduction

Developing countries like India are facing burden of communicable and non-communicable diseases and stroke is one of the leading causes of death and disability in India. [1] Stroke survivors may experience impairments, such as memory loss, pain, spasticity, fatigue, urinary incontinence, cognitive impairment, communication disorders, disability and activity limitations, such as social isolation, emotional change, reduced physical functioning. [2]

One of the major sequela of the stroke is gleno-humeral subluxation (GHS) which is defined as a palpable gap more than one finger breadth between the inferior aspect of the acromion and the superior aspect of the humeral head. [3] The reported prevalence of gleno-humeral subluxation in hemiplegic stroke ranged from 17% to 64%. [4, 5, 6] This reported wide range of prevalence of gleno-humeral subluxation is thought to have resulted from variations in the methods of assessment for gleno-humeral subluxation. [7]

The development of gleno-humeral subluxation occurs most commonly during the first three weeks of hemiplegia. The incidence increases in patients with flaccid hemiplegia and patients with more significant motor deficits. Furthermore, the incidence is higher with left hemiplegia, which is postulated to be due to the more frequent association with hemi-neglect and subsequent increased risk for trauma, lack of attention to self-care, and poor positioning of the left upper extremity. [8]

Studies are having varied response for its associated risk factors. Some observational studies were done to find out burden of shoulder subluxation in hemiplegic shoulder, but results were inconsistent. There are very few studies which evaluate the effect of age, gender, side of hemiplegia, muscle tone and power on shoulder subluxation of hemiplegic shoulder in post stroke patients. [9]

## Objectives:

This study was conducted with the aim to find out prevalence of shoulder subluxation and its associating risk factors in post-stroke hemiplegic patients.

## Material and Method

### Study population

This study of post-stroke hemiplegic patients was conducted in the department of Physical Medicine and Rehabilitation, SMS Medical College, Jaipur, Rajasthan from December 2019 to September 2020.

After getting approval from institutional ethics committee, 37 post stroke hemiplegic patients who visited in OPD or admitted in the PMR department and fulfilled the study eligibility criteria, were recruited in the study.

### Inclusion Criteria:

1. Established first time post stroke hemiplegic patients
2. Age 18-65 Years
3. Patients with stroke within 1- 6 month duration
4. Those were willing to give an informed written consent
5. Involved shoulder having muscle tone flaccid to grade-2 by Modified Ashworth Scale (MAS)

### Exclusion Criteria:

1. History of the recurrent stroke
2. Past history of trauma or nerve injury of either limb
3. History of any other neurological disorder
4. Any musculoskeletal impairment affecting the shoulder

A detailed medical and neurological history was taken from each recruited participants. Detailed neurological and musculoskeletal examination was completed with special emphasis on inspection, palpation and range of motion, sensori-motor examination of the shoulder

for detection of any deformity, tenderness, restricted range of motion and shoulder subluxation.

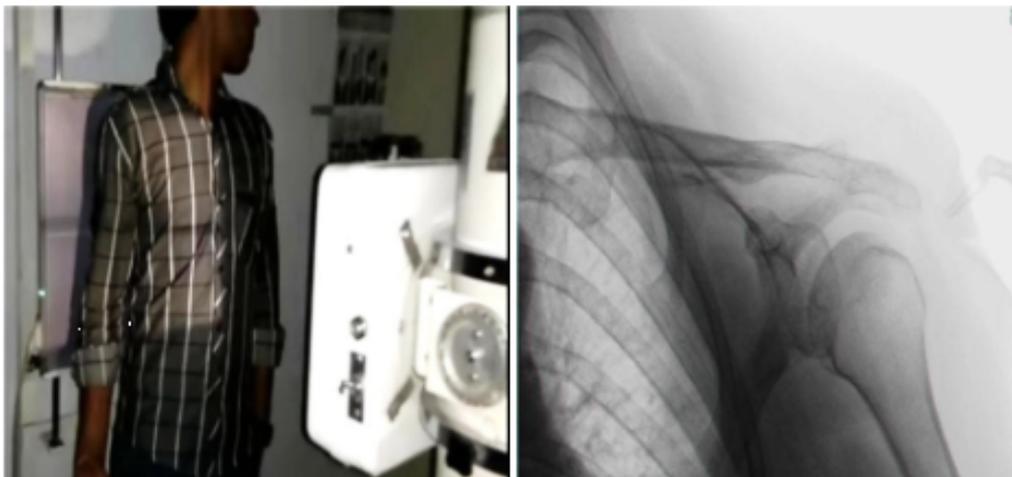
All eligible patients underwent a plain X - Rays of the both shoulder (Antero-posterior view) for detection of shoulder subluxation and blood glucose level, blood chemistry, coagulation and lipid profiles were done, to rule out any associated comorbidities. The radiograph (Antero-posterior view) of the bilateral shoulder was taken in standing position with an unsupported dependent arm. These radiograph's findings were rated according to the 5-point categorization as described by Van Langenberghe and Hogan [10]:

1. Category 0- Normal (no subluxation): The whole curvature of the glenoid fossa is opposed by and parallel to the humeral head.
2. Category 1- 'U' shaped widening (beginning of subluxation): The whole curvature of the glenoid fossa is

opposed by the humeral head with loss of parallelism.

3. Category 2- Moderate subluxation: There is inferior subluxation of the humeral head, but its most superior margin is above the line, perpendicularly bisecting the line connecting the most superior and the most inferior margin of the glenoid fossa.
4. Category 3- Severe subluxation: As category 2, but the superior margin of the humeral head is not above the bisecting line.
5. Category 4- Dislocation: The most superior margin of the humeral head is no above the most inferior margin of the glenoid fossa

In the present study category 0 & 1 were classified as non subluxated shoulder and category 2, 3 and 4 were classified as subluxated shoulder.



**Figure 1: Position of the patient during shoulder X-Ray and Shoulder X-Ray AP view**

Modified Ashworth Scale (MAS) was used to evaluate the muscle tone in study subjects [11] and Medical Research Council (MRC) scale was used to evaluate muscle strength of study subjects. [12]

**Statistical analysis:** Magnitude subluxated shoulder in post-stroke hemiplegic patients was expressed as proportion and to assess the risk factors,

chi-square test was used to infer the significance level. For significance  $p < 0.05$  was considered significant. All statistical analysis was done using Epi info version 7.2.1.0 statistical software.

#### **Results:**

The mean age of the post-stroke hemiplegic participants was  $53.19 \pm 10.78$  with range from 22 to 66 years and

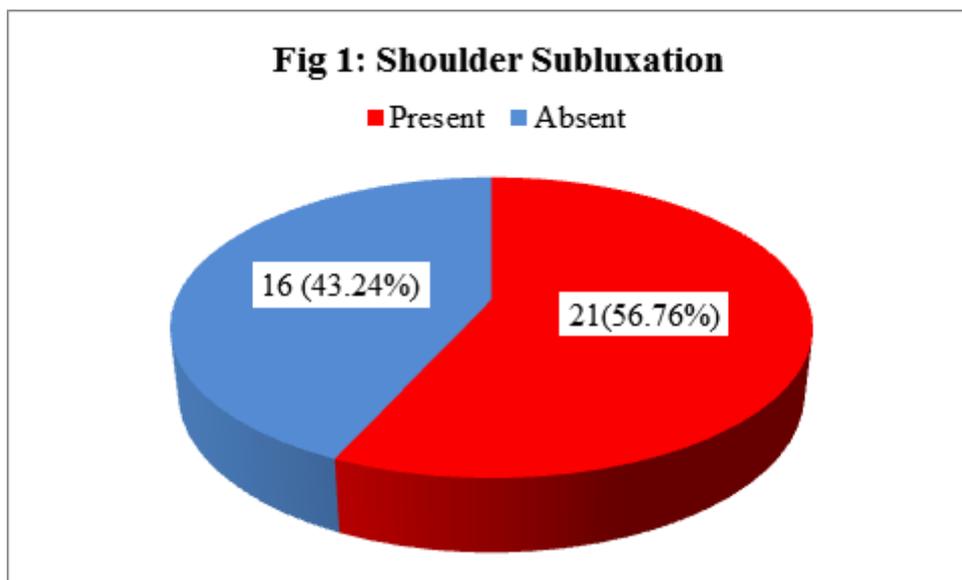
majorities were male (67.57%, n = 25). Fifty two percent (52%, n = 19) belonged to left sided hemiplegia i.e. right hemispherical lesion and the mean duration of stroke was 3.02 ± 0.5 months

with range from 1 - 6 months. The most common co-morbidities reported in current study were hypertension (48%) and diabetes mellitus (27.4%). (Table 1)

**Table 1: Characteristics of study participants (N=37)**

S. No.	Variables		Number of patients (%)
1	Sex	Male	25(67.57%)
		Female	12(32.43%)
2	Age (years) Mean ± SD		53.19 ±10.78
3	Hemiparesis Side	Right	18(48%)
		Left	19(52%)
4	Stroke duration (months) Mean ± SD		3.02 ± 0.5
5	Co-morbidity	Present	29(75.03%)
		Absent	8(24.97%)

**Magnitude of shoulder subluxation:** We observed that out of total 37 post stroke hemiplegic patients, 21 (56.76%) patients had shoulder subluxation. (Figure 2)



**Figure 2: Magnitude of shoulder subluxation in post stroke hemiplegic patients**

**Association of post stroke hemiplegia shoulder subluxation with other variables:** All the participants were distributed according to their age, sex, comorbidities; side of hemiplegia, muscle power and muscle tone and then association of these variables were

analyzed with shoulder subluxations.

When we analyzed the association of shoulder subluxation with age, sex, comorbidities and side of hemiplegia, we did not find any significant association between shoulder subluxation with these variables. (Table: 2)

**Table 2: Associations of general characteristics with shoulder subluxation**

Variables	Shoulder subluxation				P value (LS)	
	Absent		Present			
	No.	%	No.	%		
Age	<50 years	5	31.2%	8	38.1%	0.739 (NS)

	≥50 years	11	68.8%	13	61.9%	
Gender	Male	12	75%	14	66.7%	0.723 (NS)
	Female	4	25%	7	33.3%	
Comorbidity	Present	10	62.5%	12	57.1%	0.999 (NS)
	Absent	6	37.5%	9	42.9%	
Side of hemiplegia	Left	9	56.3%	10	47.6%	0.851 (NS)
	Right	7	43.7%	11	52.4%	

On analysis the association between shoulder subluxation and muscle power, we found significant association between shoulder subluxation with muscle power (p value = 0.047) (Table: 3)

**Table 3: Association of muscle power with subluxated hemiplegic shoulders**

Shoulder muscle power (MRC Scale)	Total cases		Subluxated hemiplegic shoulders	
	Number	%	Number	%
Grade 0	10	27.03%	8	38.1%
Grade 1	14	37.84%	9	42.9%
Grade 2	13	35.14%	4	19.0%
Total	37	100%	21	100%

Chi-square = 6.102 with 2 degrees of freedom; P = 0.047 (S)

When we analyzed the association of shoulder subluxation with muscle tone, we found significant association between shoulder subluxation with muscle tone (p value = 0.047) (Table: 4)

**Table 4: Association of muscle tone with subluxated hemiplegic shoulders**

Shoulder Muscle tone (MAS)	Total cases		Subluxated hemiplegic shoulders	
	Number	%	Number	%
Flaccid	10	27%	8	38.1%
Normal	6	16.2%	1	4.8%
Spasticity Grade I	12	32.4%	7	33.3%
Spasticity Grade II	9	24.4%	5	23.8%
Total	37	100%	21	100%

Chi-square = 6.132 with 2 degrees of freedom; P = 0.047 (S)

(Here for analysis, three classes were included i.e. Flaccid, Normal and Spastic)

Based on the study results we observed and inferred that shoulder subluxation was associated only with muscle power and muscle tone and has a negative correlation.

### Discussion

In stroke rehabilitation, it is aimed to bring the patient to their maximal functional capacity and to bring him as independent and productive as possible. The functional independence level after stroke is associated with the motor impairment. The predictor of the functional prognosis of the upper limb is related with the severity of

the initial motor involvement and subsequent complications like subluxation and pain of the involved shoulder. [13] Shoulder subluxation is one of the common complications of stroke that can cause disability and prolongation in the rehabilitation program.

In present study, shoulder subluxation was present in 56.76% of hemiplegic shoulders, which is well in accordance with previous studies. [6,7,13,14] In the present study all the hemiplegic shoulder were subluxated inferiorly which could be due to weakness in the shoulder girdle

muscles and gravitational pull of humeral head tend to result in this inferior subluxation of hemiplegic shoulders as reported in previous studies [15]

As far as factors affecting the subluxation of the hemiplegic shoulder concerned, no significant association between hemiplegic shoulder subluxation with age, gender, comorbidity and side of hemiplegia was found.

Daviet et al. [16] concluded that the increasing age could play an independent part to reduce the risk of shoulder subluxation due to loss of elasticity of the peri-articular tissues with ageing, which could have a protective role. In contrast to above study, we observed that out of 21 subluxated shoulder maximum number of the participants (n = 13, 61.9%) were  $\geq 50$  years of age group. This controversial finding of our study could be explained that we divided our study participants in only two age groups (<50 years and  $\geq 50$  years) and less number of study sample size as compare to Daviet et al.

In current study, maximum participants with shoulder subluxation (n = 8, 38%) had flaccid muscle tone. Culham EG et al. [17] also reported that shoulder subluxation is significantly more frequent in hemiplegic patients with low shoulder muscle tone.

In this study maximum participants with subluxated shoulder had muscle power of grade '1' (n = 9, 42.9%) followed by grade '0' (n = 8, 38%). We observed a statistically significant (P = 0.047) negative correlation between shoulder muscle power and shoulder subluxation. Culham EG et al. [17] and Chang JJ et al. [18] also observed that severity of paralysis was a significant risk factor for shoulder subluxation. Suethanapornkul S et al. [19] also reported that low muscle tone and low Brunnstrom's stage score increases the risk for shoulder subluxation. Chino N [20] and Chaco J et al. [21] observed that absence of supraspinatus muscle contraction was a significant risk

factor for shoulder subluxation. [22]

## Conclusion

The study concluded that there are high chances of shoulder subluxation in post stroke hemiplegics patients and shoulder subluxation increases with decrease in both muscle tone as well as muscle power of hemiplegic shoulder. We concluded that upper limb strength and muscle tone are the major factors associated with shoulder subluxation so, proper posture and positioning of the affected upper extremity is advisable to prevent hemiplegic shoulder subluxation. This knowledge will be useful to formulate effective strategies in prevention and management of shoulder subluxation in post-stroke hemiplegic patients. Stroke patients with persistent motor impairment should be encouraged to carry out an active exercise regime to increase voluntary motor control. This should include repetitive strength training and task-specific training which have shown some beneficial effect in improving muscle activity.

## Authors Contribution

All the authors contributed to the preparation of the final manuscript.

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