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Prevalence of Hemiplegic Shoulder Pain in Chronic Stroke Patients

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ABSTRACT

Background: *Hemiplegic shoulder pain is a frequent and disabling complication of stroke that can persist into the chronic phase, adversely affecting upper-limb function, participation in daily activities, and overall quality of life. Despite its clinical importance, region-specific data integrating pain severity, functional disability, and objective shoulder mobility among chronic stroke survivors remain limited.* ***Objective****: To determine the prevalence and severity of hemiplegic shoulder pain in chronic stroke patients and to examine its association with shoulder-related disability and shoulder range of motion.* ***Methods****: A cross-sectional observational study was conducted among 160 adults with chronic stroke attending tertiary and secondary care hospitals in Faisalabad, Pakistan. Shoulder pain intensity was assessed using the Visual Analog Scale, functional disability using the Shoulder Pain and Disability Index, and active shoulder range of motion using goniometric measurement of flexion, extension, abduction, adduction, internal rotation, and external rotation on the hemiplegic side. Descriptive statistics summarized outcome distributions, and exploratory inferential analyses examined associations between pain severity and disability.* ***Results****: The mean Visual Analog Scale score was 3.85 ± 2.86, with 52.5% of participants reporting moderate-to-severe shoulder pain. The mean total Shoulder Pain and Disability Index score was 35.33% ± 25.85%, indicating moderate functional impairment, and 56.3% of patients had moderate-to-severe disability. Shoulder flexion and abduction were relatively preserved, whereas internal rotation (39.76°) and external rotation (37.55°) were most restricted. A significant linear trend was observed between increasing pain severity and higher disability levels.* ***Conclusion****: Hemiplegic shoulder pain remains highly prevalent in chronic stroke survivors and is associated with meaningful disability and disproportionate restriction of shoulder rotation. Routine standardized assessment and targeted rehabilitation strategies focusing on pain control and rotational mobility may improve long-term functional outcomes.*

Keywords
Hemiplegic shoulder pain; Stroke; Chronic stroke; SPADI; Visual Analog Scale; Shoulder range of motion

INTRODUCTION

Stroke is a major cause of long-term disability and remains a leading contributor to mortality and disability-adjusted life years worldwide, with an especially high and growing burden in low- and middle-income countries where vascular risk factors are prevalent and rehabilitation resources are variably accessible (1). Clinically, stroke is defined as a rapidly developing syndrome of focal or global cerebral dysfunction of vascular origin lasting more than 24 hours or leading to death, and survivors frequently experience persistent motor impairment and secondary musculoskeletal complications that compound activity limitation and participation restriction (2,3). Among these complications, hemiplegic shoulder pain (HSP) is one of the most frequent and disabling problems after stroke, often emerging during rehabilitation and persisting into the chronic stage, where it can undermine upper-limb recovery, prolong dependence in activities of daily living, and reduce quality of life (4,5). Prevalence estimates vary widely across settings and case definitions, but systematic reviews and observational studies consistently indicate that a substantial proportion of stroke survivors develop shoulder pain, with persistence reported beyond the acute and subacute phases (6,7). This variability reflects heterogeneity in patient characteristics, timing post-stroke, ascertainment methods, and the complex interplay of nociceptive, biomechanical, and neurogenic mechanisms (6–8).

The shoulder complex is particularly vulnerable after stroke because normal glenohumeral stability and scapulothoracic rhythm depend on coordinated neuromuscular control, which is disrupted by paresis, altered tone, impaired proprioception, and abnormal motor synergies (8,9). Post-stroke changes such as glenohumeral subluxation, soft-tissue shortening, rotator cuff dysfunction, spasticity-related malalignment, and immobility-related capsular restriction can collectively produce pain and progressive loss of range of motion (ROM), particularly in rotational movements that are essential for grooming, dressing, and reaching behind the body (6,8,9). Importantly, shoulder pain is not only a symptom but also a barrier to rehabilitation participation; patients with pain often demonstrate reduced tolerance to therapeutic handling and exercise, slower functional gains, and higher risk of chronic disability (4,7,10). Contemporary evidence further supports that post-stroke shoulder pain may include neuropathic features in some individuals, underscoring the need for standardized clinical assessment and context-specific profiling rather than assuming a single musculoskeletal etiology (11).

Despite extensive international literature, there remains limited, methodologically consistent evidence describing the burden of HSP among chronic stroke survivors in Pakistan using standardized, clinically interpretable instruments capturing pain intensity, shoulder-related disability, and objective ROM limitation in the same cohort (6,7). Many available studies emphasize acute or inpatient rehabilitation populations, while chronic survivors—who frequently continue to experience functional restrictions and healthcare access barriers—are underrepresented, and local estimates that integrate pain severity with disability indices and quantified ROM are scarce (4,6,10). In addition, inconsistent operationalization of "chronic stroke," non-uniform cut-points for clinically meaningful pain, and variable reporting of distributional patterns (e.g., proportion with moderate-to-severe pain) have limited direct comparability and clinical translation into routine screening pathways (6,7). Given that early identification and structured management of shoulder complications can mitigate long-term stiffness and disability, defining the magnitude and functional correlates of HSP in a representative chronic stroke cohort is essential to inform rehabilitation planning and resource prioritization in Pakistani clinical settings (6,8).

Accordingly, this study aimed to determine the prevalence and severity profile of hemiplegic shoulder pain among chronic stroke patients and to characterize its association with shoulder-related disability and shoulder ROM restriction using the Visual Analog Scale (VAS), the Shoulder Pain and Disability Index (SPADI), and goniometric ROM assessment on the hemiplegic side (6,8). The research question was: among adults with chronic stroke, what is the prevalence and severity distribution of hemiplegic shoulder pain, and how do pain intensity and shoulder disability relate to limitations in shoulder ROM across key planes of movement (6,9,10).

MATERIAL AND METHODS

This cross-sectional observational study was designed to quantify the prevalence and functional correlates of hemiplegic shoulder pain among adults with chronic stroke, using standardized clinical measures that capture pain intensity, shoulder-related disability, and objective shoulder range of motion. A cross-sectional design was selected because it is appropriate for estimating prevalence and describing distributional patterns of outcomes and their associations in a defined population at a single point in time, particularly for chronic conditions where exposure and outcome coexist and the primary aim is descriptive and exploratory rather than causal inference (11).

The study was conducted in tertiary-care and secondary-care hospital settings in Faisalabad, Pakistan, over a four-month period. These centers provide outpatient and inpatient rehabilitation services to individuals with neurological disorders, ensuring access to a stable population of chronic stroke survivors receiving routine follow-up care. Adults with a confirmed clinical diagnosis of stroke and residual hemiplegia were considered eligible if they were aged 30 years or older, medically stable at the time of assessment, and in the chronic phase of recovery, defined operationally as being beyond the early post-acute period with established neurological deficits. Individuals were excluded if they had a documented history of shoulder pathology predating the stroke, such as rotator cuff tears, fractures, or inflammatory joint disease, or if they had unmanaged medical comorbidities that could independently influence pain perception or limit participation in physical assessment. Participants who were unable to provide informed consent were also excluded to ensure ethical and data quality standards (6,12).

Eligible participants were identified through routine clinic lists and rehabilitation rosters and were approached consecutively during their scheduled hospital visits. The study purpose and procedures were explained in detail, and written informed consent was obtained prior to enrollment. Data collection was conducted by trained physical therapists following a standardized protocol to minimize inter-observer variability. All assessments were performed during a single session to reduce temporal variation in pain and movement status and to ensure consistency across participants.

Pain intensity in the hemiplegic shoulder was assessed using the Visual Analog Scale, a 10-cm horizontal line anchored by "no pain" and "worst imaginable pain," on which participants marked their average shoulder pain intensity. This tool has demonstrated reliability and validity in musculoskeletal and post-stroke populations and allows for both continuous analysis and clinically meaningful categorization of pain severity (13).

Shoulder-related pain and functional disability were evaluated using the Shoulder Pain and Disability Index, a self-reported questionnaire comprising pain and disability subscales that together provide a percentage score reflecting the impact of shoulder symptoms on daily activities. The SPADI has been widely used in neurological and orthopedic populations and exhibits good psychometric properties, including internal consistency and responsiveness (6,14).

Objective shoulder range of motion was measured on the hemiplegic side using a standard universal goniometer, with participants positioned according to accepted clinical guidelines. Active ROM was assessed for flexion, extension, abduction, adduction, internal rotation, and external rotation, with movements performed within pain-free limits to avoid symptom exacerbation. Each movement was measured once using standardized anatomical landmarks to ensure reproducibility, and values were recorded in degrees. ROM variables were treated as continuous outcomes and were also categorized into clinically interpretable levels of restriction based on commonly accepted normative ranges to facilitate descriptive interpretation (15).

The primary study variables included shoulder pain intensity (VAS score), shoulder pain and disability (SPADI pain, disability, and total scores), and shoulder ROM across six planes of movement. Demographic variables such as sex and side of hemiplegia were recorded as potential descriptive covariates. To reduce measurement bias, all assessors followed a predefined assessment sequence, used the same instruments, and adhered to uniform verbal instructions. Confounding was addressed analytically by limiting the sample to individuals without pre-existing shoulder pathology and by interpreting associations cautiously, recognizing the inherent limitations of cross-sectional data (11).

The target sample size was determined a priori based on previously reported prevalence estimates of hemiplegic shoulder pain in chronic stroke populations, allowing sufficient precision around prevalence estimates and stable estimation of descriptive statistics for secondary outcomes (6,7). Data were entered into a secure database with double-checking for accuracy and completeness to ensure data integrity and reproducibility.

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS), version 23. Continuous variables were summarized using means and standard deviations, while categorical variables were described using frequencies and percentages. The distribution of pain severity, disability levels, and ROM restriction categories was examined descriptively. Associations between categorical variables were explored using appropriate inferential techniques, with careful consideration of underlying assumptions and cell distributions, and results were interpreted conservatively when assumptions were not met. A two-sided significance threshold of $p < 0.05$ was applied for inferential analyses, and missing data were minimal due to single-visit assessments and were handled by complete-case analysis to maintain transparency (11).

Ethical approval for the study was obtained from the relevant institutional authority, and permissions were secured from participating hospitals prior to data collection. All procedures conformed to the principles of the Declaration of Helsinki, and participant confidentiality was maintained

through anonymized data coding and restricted access to study records. The standardized assessment protocol, use of validated instruments, and transparent analytic approach were intended to support reproducibility and allow other researchers to replicate the study in comparable clinical settings (11,12).

RESULTS

A total of 160 chronic stroke patients were included in the final analysis. The study population was evenly distributed by sex, with 80 males (50.0%) and 80 females (50.0%). Left-sided hemiplegia was slightly more frequent than right-sided involvement (51.9% vs. 48.1%). Detailed demographic characteristics are presented in Table 1. Pain intensity, shoulder-related disability, and shoulder range of motion outcomes are summarized in Table 2. The mean Visual Analog Scale score was 3.85 ± 2.86, reflecting a moderate level of shoulder pain. SPADI pain and disability subscale scores were 35.71% ± 26.49% and 33.37% ± 25.00%, respectively, yielding a total SPADI score of 35.33% ± 25.85%, consistent with moderate functional impairment. Among ROM measures, shoulder flexion (93.69° ± 53.22°) and abduction (90.22° ± 53.74°) showed comparatively better preservation, whereas internal rotation (39.76° ± 22.05°) and external rotation (37.55° ± 23.31°) were the most restricted movements. When pain severity was categorized clinically, 52.5% of participants reported moderate-to-severe shoulder pain (VAS ≥4), while 31.2% reported no pain and 16.3% reported mild pain. Functional disability assessed via SPADI revealed that 56.3% of patients experienced moderate-to-severe disability (SPADI >40%).

Table 1. Demographic Characteristics of the Study Population (N = 160)

Variable	Category	n (%)
Sex	Male	80 (50.0)
	Female	80 (50.0)
Side of Hemiplegia	Right	77 (48.1)
	Left	83 (51.9)

Table 2. Descriptive Statistics for Pain, Disability, and Shoulder Range of Motion (N = 160)

Outcome Variable	Mean ± SD	Minimum	Maximum
VAS Pain Score	3.85 ± 2.86	0	9
SPADI Pain (%)	35.71 ± 26.49	0	88
SPADI Disability (%)	33.37 ± 25.00	0	87.5
SPADI Total (%)	35.33 ± 25.85	0	87.75
Shoulder Flexion (°)	93.69 ± 53.22	0	180
Shoulder Extension (°)	27.24 ± 16.76	0	70
Shoulder Abduction (°)	90.22 ± 53.74	0	175
Shoulder Adduction (°)	25.42 ± 13.59	0	58
Internal Rotation (°)	39.76 ± 22.05	0	86
External Rotation (°)	37.55 ± 23.31	0	90

Table 3. Distribution of Pain Severity and Shoulder Disability Levels (N = 160)

Outcome	Category	n (%)
VAS Pain	No pain (0)	50 (31.2)
	Mild (1–3)	26 (16.3)
	Moderate (4–6)	57 (35.6)
	Severe (7–10)	27 (16.9)
SPADI Total	Mild (≤40%)	54 (33.8)
	Moderate (41–60%)	62 (38.8)
	Severe (>60%)	28 (17.5)

Table 4. Categorized Shoulder Range of Motion Restrictions (N = 160)

Movement	Normal n (%)	Mild n (%)	Moderate n (%)	Severe n (%)
Flexion	9 (5.6)	74 (46.3)	36 (22.5)	41 (25.6)
Extension	16 (10.0)	35 (21.9)	76 (47.5)	33 (20.6)
Abduction	9 (5.6)	79 (49.4)	34 (21.3)	38 (23.8)
Adduction	16 (10.0)	39 (24.4)	90 (56.3)	15 (9.4)
Internal Rotation	29 (18.1)	23 (14.4)	70 (43.8)	38 (23.8)
External Rotation	18 (11.3)	28 (17.5)	63 (39.4)	51 (31.9)

Table 5. Association Between Pain Severity and Shoulder Disability (N = 160)

Test	Statistic	df	p-value
Pearson Chi-square	189.31	220	0.934
Likelihood Ratio	185.68	220	0.955
Linear-by-Linear Association	8.96	1	0.003

Categorized distributions of pain and disability are shown in Table 3. Categorical analysis of shoulder ROM demonstrated widespread movement restriction (Table 4). More than 94% of patients exhibited some degree of limitation in shoulder flexion and abduction. Internal and external rotation were most affected, with 81.9% and 91.9% of participants demonstrating restricted motion, respectively. Severe restriction was most common in external rotation (31.9%).

Overall, the results demonstrate that hemiplegic shoulder pain is highly prevalent among chronic stroke survivors, with more than half experiencing clinically meaningful pain and disability. Rotational shoulder movements were disproportionately affected, underscoring their relevance to functional limitation and rehabilitation planning.

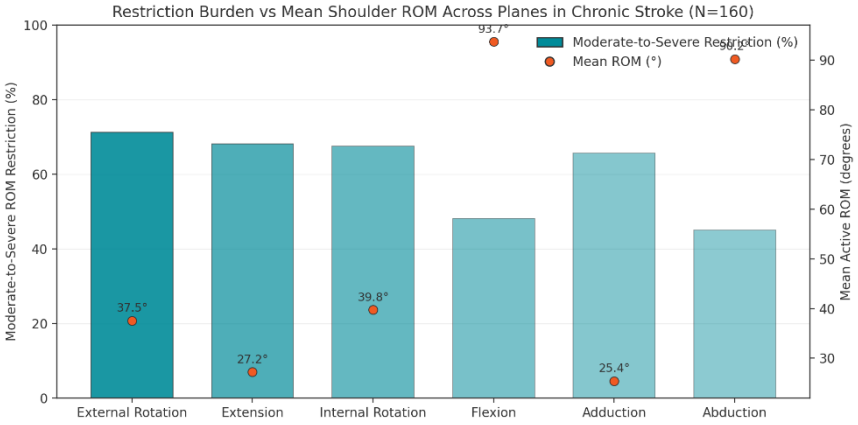

Figure 1 Restriction Burden Vs Mean Shoulder ROM Across Planes in Chronic Stroke (N = 160)

Figure 1 demonstrates a clinically interpretable dissociation between the distributional burden of restriction and absolute mean shoulder mobility across planes of movement in chronic stroke survivors (N = 160). Moderate-to-severe restriction was most concentrated in external rotation (71.3%), extension (68.1%), and internal rotation (67.5%), aligning with the lowest mean active ROM values for external rotation (37.6°), extension (27.2°), and internal rotation (39.8°). In contrast, flexion and abduction showed comparatively higher mean ROM (93.7° and 90.2°, respectively), yet still displayed clinically relevant restriction burdens (48.1% and 45.0% moderate-to-severe), indicating that preserved mean mobility can coexist with substantial subgroup-level limitation. Overall, the figure highlights a pronounced rotational impairment phenotype—particularly affecting external rotation—suggesting that rehabilitation plans prioritizing rotational mobility_toggle plus pain-informed functional retraining may address the highest-yield movement deficits in this chronic cohort.

DISCUSSION

The present study provides a comprehensive characterization of hemiplegic shoulder pain and its functional correlates among chronic stroke survivors, demonstrating that shoulder pain and movement restriction remain highly prevalent well beyond the acute and subacute phases of recovery. More than half of the participants experienced clinically meaningful shoulder pain, and a similar proportion exhibited moderate-to-severe shoulder-related disability, confirming that hemiplegic shoulder pain is not a transient complication but a persistent contributor to long-term functional limitation. These findings reinforce earlier population-based and rehabilitation-based studies reporting sustained shoulder pain prevalence ranging from approximately one-third to over two-thirds of stroke survivors in the chronic stage, depending on assessment methods and case definitions (6,7,16). The moderate mean VAS and SPADI scores observed in this cohort indicate a substantial symptom burden that is sufficient to interfere with daily activities while potentially remaining under-recognized in routine follow-up care.

The pattern of shoulder range of motion impairment observed in this study adds important nuance to the existing literature. While shoulder flexion and abduction were relatively better preserved in terms of mean ROM, a large proportion of patients still demonstrated moderate-to-severe restriction in these planes, highlighting marked heterogeneity within the chronic stroke population. In contrast, internal and external rotation emerged as the most consistently and severely affected movements, both in terms of restricted distribution and reduced mean ROM. This finding is concordant with previous studies showing that rotational movements are particularly vulnerable after stroke due to capsular tightening, altered scapulohumeral rhythm, and spasticity-related imbalance between internal and external rotator muscle groups (8,9,17). Clinically, these rotational deficits are especially consequential because they directly impair tasks such as dressing, grooming, and personal hygiene, thereby amplifying perceived disability despite seemingly acceptable gross shoulder elevation.

Comparative analysis with earlier work suggests both alignment and contextual distinctions. Studies conducted in inpatient or early rehabilitation settings have often reported higher pain intensity and more pronounced global ROM limitation, likely reflecting greater neurological impairment and less exposure to structured therapy early after stroke (4,10,18). In contrast, the slightly lower average pain scores in the present cohort may reflect access to ongoing physiotherapy services and adaptation over time; however, the persistence of moderate-to-severe disability underscores that symptom attenuation does not equate to functional normalization. Importantly, the observed linear trend between increasing pain severity and higher levels of shoulder disability supports prior evidence that pain and functional limitation progress in parallel, even when categorical associations fail to reach statistical significance due to sparse data or distributional constraints (6,16). This reinforces the conceptualization of hemiplegic shoulder pain as a multidimensional condition in which nociception, biomechanical restriction, and activity limitation interact dynamically.

From a mechanistic perspective, the findings are consistent with models that emphasize the combined influence of musculoskeletal and neurogenic factors in chronic hemiplegic shoulder pain. Prolonged immobility, abnormal tone, and altered motor control can promote capsular stiffness and soft-tissue shortening, particularly affecting rotational ROM, while persistent afferent input from dysfunctional shoulder structures may contribute to central sensitization and altered pain processing in some patients (8,11,19). The coexistence of relatively preserved mean flexion or abduction

with high restriction burden further suggests that compensatory movement strategies may mask underlying deficits at the group level, reinforcing the need for distribution-sensitive assessment rather than reliance on averages alone.

Several strengths of this study merit consideration. The use of validated and widely accepted instruments, including VAS, SPADI, and goniometric ROM assessment, enabled integrated evaluation of pain, disability, and objective movement limitation within the same cohort. The focus on chronic stroke survivors addresses an underrepresented population in regional research and provides clinically actionable insights relevant to long-term rehabilitation planning. Nonetheless, important limitations should be acknowledged. The cross-sectional design precludes causal inference regarding the temporal relationship between pain and ROM restriction. The use of non-probability sampling and recruitment from hospitals within a single city may limit generalizability to rural settings or populations with limited access to rehabilitation services. In addition, potentially influential factors such as spasticity severity, shoulder subluxation, psychological status, and detailed stroke characteristics were not quantified, which may partly explain inter-individual variability in outcomes.

Future research should build on these findings through longitudinal designs that track the evolution of shoulder pain and mobility from the subacute into the chronic phase, allowing identification of early predictors of persistent dysfunction. Incorporating objective assessments of muscle tone, imaging-based evaluation of shoulder structures, and standardized measures of psychological health would enable more precise phenotyping of hemiplegic shoulder pain and support stratified intervention approaches. Interventional studies evaluating targeted rotational mobility programs, pain-modulating strategies, and caregiver education in handling techniques are particularly warranted to translate descriptive evidence into optimized clinical care pathways.

Overall, the present study advances understanding of hemiplegic shoulder pain in chronic stroke by demonstrating that moderate pain, significant disability, and disproportionate rotational ROM restriction coexist in a large proportion of survivors. These findings emphasize the need for routine, multidimensional shoulder assessment and sustained, movement-specific rehabilitation strategies to mitigate long-term disability and improve functional independence in this growing patient population (6–9,16).

CONCLUSION

In conclusion, hemiplegic shoulder pain remains a common and clinically significant complication among individuals with chronic stroke, with more than half of patients experiencing moderate-to-severe pain and shoulder-related disability. Despite relatively preserved mean shoulder flexion and abduction, substantial restriction—particularly in internal and external rotation—was evident, underscoring the functional relevance of rotational deficits in daily activities. These findings align with the study objective and highlight hemiplegic shoulder pain as a persistent contributor to long-term disability rather than a transient post-stroke symptom. Routine use of standardized tools such as the Visual Analog Scale, Shoulder Pain and Disability Index, and goniometric range of motion assessment can facilitate early identification of high-risk patients, guide individualized rehabilitation planning, and support outcome monitoring. From a clinical perspective, targeted interventions emphasizing pain management and restoration of shoulder rotation should be integrated into chronic stroke care pathways, while future research should focus on longitudinal and interventional designs to refine evidence-based strategies for reducing shoulder-related disability and improving functional independence in stroke survivors.

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