Post Stroke Shoulder Subluxation and Shoulder Pain: A Cohort Multicenter Study

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Objective: *To study the occurrence of shoulder subluxation, shoulder pain in stroke patients and identify factors associated to these conditions during rehabilitation period.*
Material and Method: *Stroke patients from 9 rehabilitation centers from March to December 2006 were enrolled in the present study. All subjects were registered for demographic data including risk factors and type of stroke. They were assessed for motor recovery, cognitive ability, functional ability, psychological reaction and quality of life by using Brunnstrom stage, Thai Mental State Examination (TMSE), Barthel ADL Index (BI), Hospital Anxiety and Depression Scale (HADS) and WHOQOL-BREF questionnaires respectively at the beginning and the end of the present study. The occurence of shoulder subluxation and shoulder pain were recorded and then were analyzed for the associated factors. All subjects received the conventional rehabilitation program until they reached their rehabilitation goals or discharge criteria.*
Results: *Of 376 stroke patients, 327 met the inclusion criteria, 62 patients (19%) were found to have shoulder pain and 122 (37%) patients had shoulder subluxation. Shoulder pain was significantly more frequent in subjects with shoulder subluxation (odds ratio (OR) 2.48, 95% confidence interval (CI) 1.38-4.46) and at 2-6 months after stroke onset (OR 4.0, 95%CI 2.06-7.79). Shoulder subluxation was significantly associated with hemorrhagic type of stroke (OR 2.06, 95%CI 1.08-3.93), loss of proprioceptive sensation (OR 3.03, 95%CI 1.26-7.29) and negatively associated with Brunnstrom's stage of arm recovery (OR 0.44, 95%CI 0.34-0.56). No significant functional and quality of life impact was found from these conditions.*
Conclusion: *Post stroke shoulder pain and subluxation were common during the rehabilitation period. Shoulder pain significantly occurred within 6 months after stroke onset and increased risk in patients with shoulder subluxation. Shoulder subluxation was correlated with Brunnstrom's stage, proprioceptive loss and hemorrhagic type of stroke.*

Keywords: *Shoulder pain, Subluxation, Stroke, Rehabilitation*

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Hemiplegic shoulder pain (HSP) and subluxation are common complications after stroke. Shoulder pain can result in significant disability that can limit the patients' ability to reach their maximum functional potential and impede rehabilitation[1]. Shoulder pain can negatively affect rehabilitation outcomes as good shoulder function is a prerequisite for successful transfers, maintaining balance, performing activities of daily living and for effective hand function[2].

Shoulder subluxation is defined as changes in the mechanical integrity of the glenohumeral joint causing a palpable gap between the acromion and humeral head. The incidence of shoulder subluxation

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has been reported from 17-81% depending on the duration of the stroke and the diagnostic measurement[3] and is probably the most cited problem causing shoulder complication after a stroke[4].

The consequences that might follow would be shoulder pain[5-9], limitation of movement, injury to the neurovascular tissues around the shoulder joints and delayed neurological recovery after a stroke[10]. There are no such data on incidences of HSP and subluxation in Thailand. The purposes of the present study were to determine the occurrence of shoulder pain and subluxation after stroke and identify associated factors including impact on functional and quality of life outcome.

Material and Method

The present study was part of the Thai Stroke Rehabilitation Registry (TSRR) which was the first multi-centre and tertiary hospital-based registry conducted prospectively during a 10-month period in 2006[11]. Inclusion criteria were stroke patients who were aged more than 18 years, had stable vital signs within 48 hours, could follow at least one-step command, co-operate the program and tolerate sitting position without vertigo or dizziness for at least 30 minutes. Patients who had severe medical conditions, could not communicate, were known to have dementia or any psychiatric problem and had coexisting physical disability such as amputation, blindness, spinal cord injury were excluded from the present study.

From 376 patients, 327 were enrolled in the present study. After giving written informed consent, patients were registered for the following baseline variables: age, gender, main type of stroke, underlying diseases, smoking history, stroke onset date. Physical and neurological examinations were performed. There were several assessments on admission including the Modified Ashworth Scale (MAS)[12] for assessing spasticity, the Brunnstrom's stage of recovery[13] for assessing neurological recovery, the Barthel Index (BI)[14] for assessing functional ability, and the Thai Mental State Examination (TMSE)[15] for assessing the cognitive function. 295 patients were interviewed for assessing the quality of life using the WHOQOL-BREF questionnaire[16] and 251 patients were assessed for anxiety and depression using the Hospital Anxiety and Depression Scale (HADS)[17] on admission.

During the rehabilitation program, patients were assessed with BI and for the musculoskeletal complications including shoulder pain and subluxation. The assessment was recorded every week along with the treatment given and the result at the end of the present study.

The present study was considered as complete if the patients achieved the discharge criteria: fulfilled rehabilitation goals or a stable BI score for 2 consecutive weeks. If patients had medical complications that required transfer to intensive medical care and withholding the rehabilitation program for 2 weeks, those would be terminated from the present study. At the end of the present study, BI, WHOQOL-BREF and HADS were reassessed.

Statistical Analysis

Descriptive statistic was used to demonstrate character of the studied population. Univariate statistics (Chi-square and *t* tests) were used to determine the relationships between each of the demographic and stroke characteristics, neurological impairment data, pre-existing medical diseases, and the occurrence of shoulder pain and shoulder subluxation. These factors were then included in the multiple logistic regression analyses. The level of significance for independent factors on multivariate was set at 0.05. All analyses were performed with SPSS version 13 for Windows (SPSS Inc., Chicago, USA).

Results

Demographic baseline of the 327 from 376 enrolled stroke patients is shown in Table 1 and 193 (59%) patients were male. The mean age was 62.2 $\pm$ 12.12 years and age range 21-93 years. The mean onset-to-admission interval was 84.3 $\pm$ 174.6 days, median 24 days and range 1-1456 days. Mean range of hospital stay was 27.3 $\pm$ 17.9 days, range 2-74 days. The main type of stroke was cerebral infarction (71.6%). Most of the patients (74.9%) had underlying hypertension, 178 (54.4%) had dyslipidemia, 87 (26.6%) had diabetes, 59 (18%) had heart disease and 64 (19.6%) had a history of smoking.

From physical finding, 176 (54.2%) had left side weakness, 142 (43.7%) had right side weakness and 7 (2.1%) had bilateral weakness. Regarding perceptual dysfunction, 26 (8%) had hemianopia, 23 (7%) had visual neglect and 67(20.5%) had hemineglect. Proprioceptive loss was found in 37 (11.3%), and 101 (30.9%) had proprioceptive impairment.

Most of the patients enrolled had Brunnstrom's arm recovery stage 2 (31.5%). The mean TMSE score was 20.3 $\pm$ 7.3 and BI score on admission was 7.5 $\pm$ 3.4

The occurrence of shoulder subluxation was 122/327 (37.3%) and 62 (19%) developed shoulder pain.

Table 1. Baseline demographics (n = 327)

Baseline variables	Number (%)	Mean ± SD
Sex: male	193 (59.0)	
Age (yrs)		62.2±12.12
Type of stroke		
Infarction	235 (71.9)	
Hemorrhage	92 (28.1)	
Comorbid disease		
HT	245 (74.9)	
DM	87 (26.6)	
Dyslipidemia	178 (54.4)	
Heart disease	59 (18.0)	
Previous stroke	48 (14.7)	
Smoking: yes	64 (19.6)	
Weakness side		
Left	176 (54.2)	
Right	142 (43.7)	
Bilateral	7 (2.1)	
Perceptual dysfunction		
Hemianopia	26 (8.0)	
Visual neglect	23 (7.0)	
Tactile double simultaneous extinction	67 (20.5)	
Loss proprioceptive sensation	37 (11.3)	
Brunnstrom stage (arm)		
1	76 (23.2)	
2	103 (31.5)	
3	59 (18.0)	
4	29 (9.0)	
5	22 (6.7)	
6	38 (11.6)	
BI score on admissiom		7.5±3.4
TMSE score (n = 294)		20.3±7.3
1-23	168 (51.4)	
≥ 24	126 (38.5)	

Factors related to shoulder pain and shoulder subluxation

Comparison of variables among groups of patients with and without either shoulder pain or shoulder subluxation is shown in Table 2. There was no statistically significant difference between patients with and without shoulder pain in relation to age, sex, type of stroke, underlying disease, weakness side, perceptual dysfunction, Brunnstrom's stage of arm recovery, elbow spasticity and TMSE score. Table 3 illustrates patients who have shoulder subluxation and time interval since stroke onset and who were found to be significantly related to shoulder pain (OR 2.48, 95% CI 1.38-4.46).

Multivariate logistic regression analysis in Table 4 revealed risk factors of shoulder subluxation as hemorrhagic type of stroke (OR 2.06, 95% CI 1.08-3.93), loss of proprioceptive sense (OR 3.03, 95% CI 1.26-7.29) and Brunnstrom's stage of arm recovery. This was negatively associated with shoulder subluxation (OR 0.44, 95% CI 0.34-0.56).

Outcomes of treatment are shown in Table 5. For shoulder pain, 25/62 (40.3%) were resolved, 23/62 (37.1%) improved after treatment and only 13/62 (21%) still had shoulder pain on discharge. For shoulder subluxation, 31/122 (25.4%) were resolved, 38/122 (31.1%) got improvement and 44/122 (36.1%) remained the same at discharge.

Comparison of BI, WHOQOL score, anxiety and depression score both on admission and at discharge between the group of patients with and without shoulder pain are shown in Table 6. No statistic

Table 2. Factors related to shoulder pain and shoulder subluxation

	Shoulder pain (%) (n = 62)	Shoulder subluxation (%) (n = 122)
Age (yrs)		
18-40	1 (7.7)	8 (61.5)*
41-60	23 (17.6)	56 (42.1)
> 60	38 (21.1)	58 (32.0)
Sex: male	31 (16.1)	73 (37.8)
Duration after stroke onset (days)		
1-60	33 (14.2)	81 (34.8)
61-180	23 (38.3)*	25 (41.7)
> 180	6 (17.6)	16 (47.1)
Type of stroke		
Infarction	38 (16.4)	76 (32.5)
Hemorrhage	24 (26.1)	46 (50.0)*
Co-morbid disease		
HT	48 (19.8)	92 (37.6)
DM	18 (20.9)	31 (35.6)
Dyslipidemia	30 (17.1)	55 (30.9)*
Heart disease	14 (24.1)	23 (39.0)
Smoking: yes	11 (17.5)	26 (40.6)
Weakness side		
Left	38 (21.7)	71 (40.3)
Right	24 (17.1)	48 (33.8)
Perceptual dysfunction		
Hemianopia	7 (28.0)	9 (34.6)
Visual neglect	5 (21.7)	7 (30.4)
Tactile double simultaneous extinction	17 (25.4)	28 (41.8)
Loss proprioceptive	10 (27.0)	24 (64.9)*
Shoulder subluxation	35 (28.7)*	
Brunnstrom stage (arm)		
1	18 (23.7)	44 (57.9)*
2	22 (21.4)	56 (54.4)
3	11 (19.3)	18 (30.5)
4	5 (17.9)	1 (3.4)
5	3 (13.6)	3 (13.6)
6	3 (7.9)	0 (0.0)
Spasticity (elbow) MAS $\geq$ 3	26 (22.0)	53 (44.9)*
TMSE		
1-23	29 (17.3)	64 (38.1)
24-30	29 (23.0)	49 (38.9)

* $p < 0.05$

Table 3. Univariate and multivariate analysis of risk factors associated with shoulder pain

Characteristics	Crude OR (95% CI)	Adjusted OR (95% CI)
Shoulder subluxation	2.652 (1.51-4.66)*	2.480 (1.38-4.46)*
Duration after stroke onset (days)		
> 180	3.780 (1.2-7.1)*	4.000 (2.06-7.79)*

* p-value < 0.05

Table 4. Univariate and multivariate analysis of risk factors associated with shoulder subluxation

Characteristics	Crude OR (95% CI)	Adjusted OR (95% CI)
Age 18-40	0.30 (0.09-0.94)	
Hemorrhage type of stroke	2.08 (1.27-3.40)*	2.06 (1.08-3.93)*
Dyslipidemia	0.55 (0.35-0.86)	
Loss proprioceptive Sense	4.71 (2.19-10.14)*	3.03 (1.26-7.29)*
Spasticity (elbow)	1.65 (1.04-2.63)	
Brunnstrom stage (arm)	0.45 (0.36-0.56)*	0.44 (0.34-0.56)*

* p-value < 0.05

Table 5. Treatment outcomes of shoulder pain and shoulder subluxation

Outcomes	Shoulder pain (%) (n = 62)	Shoulder subluxation (%) (n = 122)
Resolved	25 (40.3)	31 (25.4)
Improved	23 (37.1)	38 (31.1)
Ongoing at the end of program	13 (21.0)	44 (36.1)
Worst	0 (0)	2 (1.6)
No record	1 (1.6)	7 (5.7)

Table 6. BI, WHOQOL score, anxiety and depression score on admission and at discharge periods between patients with and without shoulder pain

Outcome	Admission		Discharge	
	Shoulder pain (n = 54)	No shoulder pain (n = 236)	Shoulder pain (n = 50)	No shoulder pain (n = 232)
Barthel index	6.98 ± 3.77	7.59 ± 3.99	13.19 ± 4.88	13.28 ± 4.86
WHOQOL	77.16 ± 12.02	74.64 ± 12.81	84.76 ± 10.95	84.23 ± 11.73
Physical	18.53 ± 3.92	18.03 ± 3.85	21.92 ± 3.84	21.29 ± 3.62
Psychological	18.33 ± 3.71	18.08 ± 3.98	20.24 ± 3.23	20.33 ± 3.48
Social	9.37 ± 2.08	8.93 ± 2.35	10.04 ± 1.91	9.58 ± 2.02
Environment	25.16 ± 4.44	24.25 ± 4.21	25.96 ± 3.90	26.30 ± 4.08
Q1	2.55 ± 1.02	2.45 ± 1.02	3.26 ± 0.88	3.20 ± 0.82
Q26	3.01 ± 0.90	2.87 ± 0.88	3.41 ± 0.77	3.38 ± 0.73
Anxiety score	7.76 ± 3.60	7.66 ± 4.01	5.66 ± 2.69	5.90 ± 3.38
Depression score	8.82 ± 4.12	8.93 ± 4.21	6.83 ± 3.66	7.19 ± 3.95

difference was found between both groups for each score. The similar results were obtained in patients with and without shoulder subluxation as presented in Table 7.

Discussion

The present study revealed the occurrence of HSP was 19% of stroke patients who were admitted for rehabilitation. It did not include neuropathic pain as the causes of shoulder pain and stroke patients with communication difficulty. Reports of prevalence of shoulder pain in the literature were varying between 5 and 84%[10]. There are a number of reasons for this variation such as different populations selected, type of the studies (many of which are retrospective). Most of the epidemiological data has been gathered from patients attending rehabilitation programs. HSP incidence was significantly related to time since onset

Table7. BI, WHOQOL score, anxiety and depression score on admission and at discharge periods between patients with and without shoulder subluxation

Outcome	Admission		Discharge	
	Shoulder subluxation (n = 101)	No shoulder subluxation (n = 189)	Shoulder subluxation (n = 97)	No shoulder subluxation (n = 185)
Barthel Index	7.92 ± 4.10	7.20 ± 3.85	13.82 ± 4.73	12.93 ± 4.91
WHOQOL	74.55 ± 13.94	75.41 ± 11.98	85.18 ± 12.03	83.87 ± 11.34
Physical	18.24 ± 3.89	18.06 ± 3.85	21.96 ± 3.44	21.11 ± 3.75
Psychological	17.90 ± 4.46	18.25 ± 3.61	20.47 ± 3.71	20.24 ± 3.27
Social	9.10 ± 2.30	8.96 ± 2.31	9.93 ± 2.09	9.51 ± 1.95
Environment	23.90 ± 4.86	24.69 ± 3.88	26.02 ± 4.49	26.35 ± 3.79
Q1	2.57 ± 1.04	2.41 ± 1.00	3.28 ± 0.87	3.18 ± 0.81
Q26	2.83 ± 0.90	2.94 ± 0.84	3.41 ± 0.72	3.37 ± 0.74
Anxiety score	7.73 ± 3.70	7.59 ± 4.07	6.12 ± 3.18	5.69 ± 3.31
Depression score	9.00 ± 4.03	8.85 ± 4.28	7.52 ± 3.69	6.88 ± 4.00

of stroke. The authors found 33/233 (14.2%) developed shoulder pain by 2 months after stroke, additional 23/60 (38.3%) by 6 months and only 6/34 (17.6%) developed pain after 6 months. The natural progression of hemiplegia over time is characterized by changes in muscle tone, weakness and limitation of normal range of movement. All these have an effect on normal shoulder posture and render the shoulder vulnerable to contractures and soft tissue damage from inappropriate handling. Prospective studies reported hemiplegic shoulder pain starting almost immediately after a stroke in a few patients, with the majority developing pain some weeks or months later[8,18,19]. In a recent prospective study in an unselected stroke population reported that 52/123 (40%) developed shoulder pain within the first 6 months after the stroke[20]. One large population-based study has described self-reported shoulder pain among survivors increased from 256/1474 (17%) at one week, to 261/1336 (20%) at one month and 284/1201 (23%) at six months[21].

Contributing factor of shoulder pain in the present study was shoulder subluxation which was the most frequently associating factor reported in other previous studies[5,7,22,23]. During the initial period following a stroke the hemiplegic arm is flaccid or hypotonic. Therefore, the shoulder musculature, in particular the rotator cuff muscle, cannot maintain the humeral head in the glenoid fossa and there is a high risk of shoulder subluxation. Improper positioning in bed, lack of support while the patient is in the upright position or pulling on the hemiplegic arm when transferring the patient all contribute to glenohumeral subluxation. The resulting mechanical effect is overstretching of the glenohumeral capsule and flaccid supraspinatus and deltoid muscles which increase the risk of soft tissue injury and pain[24,25].

There is no relationship of shoulder pain with age, sex, type of stroke, hemiplegic side, risk factors, perceptual dysfunction and Brunnstrom's stage of arm recovery that agreed with other studies[23,26,27]. Some reports demonstrated that arm weakness using NIH stroke scale[20,28] and self-reported severe upper limb motor deficit[21] were associated with shoulder pain in unselected stroke population including those who were at home.

Other pain syndromes have been shown to be associated with depression[29] and some report hemiplegic shoulder pain was significantly associated with depression[6,20,25]. The authors found no relationship of shoulder pain with anxiety and depression scores, both at time of admission and at discharge period. This might indicate mood disorder was not a risk factor for HSP and proper intervention could ease this problem during the rehabilitation period.

No association between HSP and arm spasticity (MAS $\geq$ 3) was found which corresponds with other studies[19,30]. Nevertheless, there are evidences for spasticity in particular hypertonic muscle imbalance, as a cause of hemiplegic shoulder pain[9,31]. The problem of HSP appeared to be a combination of spastic muscle imbalance that might develop secondary myofascial pain and a frozen, contracted shoulder which needs proper positioning and an exercise program.

The outcome of the shoulder pain at the end of rehabilitation was good, with 25/62 (40.3%) resolved and 23/62 (37.1%) improved, only 13/62 (21%) still had ongoing shoulder pain at discharge. Standard treatments comprised simple analgesic, NSAIDs, physical therapy and steroid injection as appropriate. HSP has been associated with negative impact such as prolonged hospital stay in the acute admission period and poorer performance on ADL and arm function[8,32]. The authors' study was done during the rehabilitation period that had particular discharge criteria in terms of functional ability or any complications taken place that needed to transfer to intensive medical care.

The occurrence of shoulder subluxation was 37%. Shoulder subluxation was found to be negatively associated with Brunnstrom's stage of arm recovery which was corresponding to previous reports[27,28]. Hemorrhagic type of stroke and proprioceptive loss were correlated with shoulder subluxation but no correlation was found between shoulder subluxation and arm spasticity which might not be corresponding to the muscle tone around the shoulder.

Shoulder pain and subluxation did not have any correlation with cognitive impairment, self-care activity or BI score and the authors found no significant difference of WHOQOL outcome between patients with and without either shoulder pain or subluxation. This could be due to good outcome after treatment. One report demonstrated that significantly more patients with BI scores less than 15 reported HSP compared to those with a score between 15-20 at discharge (59% vs. 25%)[18]. A recent study of chronic stroke survivals reported post stroke shoulder pain was associated with reduced QOL assessed with the Brief Pain Inventory question 23 (BPI 23), but not with motor impairment or activity limitation[35]. This may be the long-term impact of chronic post stroke shoulder pain, after discharge, on the quality of life and probably specific tool assessment is more sensitive to change.

Conclusion

Shoulder pain and subluxation are common musculoskeletal complications after a stroke and they have significant correlation with each other. Shoulder pain significantly occurs within 6 months after stroke onset. Shoulder subluxation is correlated with Brunnstrom's stage, proprioceptive loss and hemorrhagic type of stroke. To identify associated factors of these conditions would be beneficial in preventive strategy and proper intervention may reduce the impact on the quality of life and functional ability of stroke patients.

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ภาวะข้อไหล่เลื่อนและปวดข้อไหล่ในผู้ป่วยหลอดเลือดสมอง การศึกษาแบบไปข้างหน้าในสหสถาบัน

สุมาลี ซื่อธนาพรกุล, วิไล คุปต์นิรัติศัยกุล, ปิยะภัทร เดชพระธรรม, พัชรวิมล คุปต์นิรัติศัยกุล, พิมพ์วิภา อุเทนสุต, จงกลภรณ์ วงศ์วิเศษกาจณ์

วัตถุประสงค์: *เพื่อศึกษาอุบัติการณ์ของการเกิดภาวะข้อไหล่เลื่อนและอาการปวดข้อไหล่ในผู้ป่วยหลอดเลือดสมองในระหว่างการฟื้นฟูสภาพ และหาปัจจัยที่เกี่ยวข้องกับการเกิดภาวะเหล่านี้*

วัสดุและวิธีการ: *ทำการศึกษาในกลุ่มผู้ป่วยโรคหลอดเลือดสมองที่เข้ารับการฟื้นฟูสภาพใน 9 สถาบัน ตั้งแต่เดือนมีนาคม ถึง เดือนธันวาคม พ.ศ. 2549 โดยบันทึกข้อมูลพื้นฐาน โรคประจำตัว ชนิดของโรคหลอดเลือดสมอง การตรวจร่างกาย ทางระบบประสาท และประเมินการฟื้นตัวทางระบบประสาทตามเกณฑ์ของ Brunnstrom ประเมินสภาพความรับรู้ โดยแบบประเมิน Thai Mental State Examination ผู้ป่วยจำนวนหนึ่งจะได้รับการประเมินด้านคุณภาพชีวิต โดยใช้แบบประเมินขององค์การอนามัยโลก รวมทั้งการประเมินสภาพจิตใจ สอบวัดภาวะกังวลและซึมเศร้า โดยแบบสอบถาม Hospital Anxiety and Depression Scale ผู้ป่วยทุกรายได้รับการประเมินระดับความสามารถในการทำกิจวัตรประจำวันตามแบบ Barthel Index (BI) และประเมินซ้ำทุกสัปดาห์ ร่วมกับบันทึกกรณีที่เกิดภาวะข้อไหล่เลื่อนหรือปวดข้อไหล่ขึ้น และหาปัจจัยที่สัมพันธ์กับการเกิดภาวะนี้ ผู้ป่วยทุกรายได้รับการฟื้นฟูสภาพจนถึงเป้าหมายที่ตั้งไว้ หรือมีคะแนน BI คงที่ 2 สัปดาห์*

ผลการศึกษา: *จากผู้ป่วยจำนวน 376 ราย เข้าสู่การศึกษาตามเกณฑ์ 327 ราย 62 ราย (19%) มีอาการปวดข้อไหล่ 122 ราย (37%) มีภาวะข้อไหล่เลื่อน อาการปวดไหล่พบได้มากในผู้ป่วยที่มีภาวะข้อไหล่เลื่อน (OR 2.48, 95% CI 1.38-4.46) และเกิดในช่วง 2-6 เดือนหลังจากเกิดโรคหลอดเลือดสมอง (OR 4.0, 95% CI 2.06-7.79) ภาวะข้อไหล่เลื่อนสัมพันธ์กับโรคหลอดเลือดสมองชนิดแตก (OR 2.06, 95% CI 1.08-3.93) การสูญเสียการรับรู้ proprioception (OR 3.03, 95% CI 1.26-7.29) และการฟื้นตัวทางระบบประสาทตามเกณฑ์ Brunnstrom (OR 0.44, 95% CI 0.34-0.56) ไม่พบความแตกต่างในด้านระดับความสามารถในการทำกิจวัตรประจำวันและคุณภาพชีวิต รวมทั้งสภาพจิตใจระหว่างผู้ป่วยที่มีและไม่มีภาวะเหล่านี้ ทั้งในขณะเริ่มเข้ารับการรักษาและเมื่อออกจากโรงพยาบาล*

สรุป: *ภาวะข้อไหล่เลื่อนและอาการปวดข้อไหล่พบได้บ่อยในผู้ป่วยโรคหลอดเลือดสมอง โดยอาการปวดข้อไหล่มักเกิดขึ้นในช่วง 6 เดือนแรกหลังจากเกิดโรคและจะพบมากในกลุ่มผู้ป่วยที่มีภาวะข้อไหล่เลื่อน ส่วนภาวะข้อไหล่เลื่อนมีความสัมพันธ์กับการฟื้นตัวทางระบบประสาทตามเกณฑ์ของ Brunnstrom การสูญเสียการรับรู้ proprioception และโรคหลอดเลือดสมองชนิดแตก*