Original Article

Prevalence and Factors Related to Post Stroke Shoulder Pain in Hemiplegic Patients Receiving Home-based Rehabilitation in Post-acute Phase

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ABSTRACT

Objectives: To study the prevalence of shoulder pain and related factors in stroke patients with home-based rehabilitation in the post-acute phase.
Study design: Cohort study.
Setting: Phatthalung Hospital, Thailand.
Subjects: Stroke patients who had a home-based rehabilitation program and monthly follow-up for 6 months at Rehabilitation outpatient clinic from February 2019 to January 2020.
Methods: Demographic and medical data including types of stroke, motor power, sensation, the Brunnstorm's arm recovery stage, shoulder subluxation, shoulder pain, self-care activities and home exercises, were recorded. Causes of shoulder pain was identified and treated until resolved. Factors such as using an overhead pulley for range of motion exercise and not using a shoulder sling while walking, were evaluated and analyzed.
Results: Of 110 patients, 58% reported shoulder pain, mean age was 64.14 (SD 13.91) years old, 80.9% had ischemic stroke, 58% had left side weakness, 52.7% had impaired sensation, 41.8% had the Brunnstorm's arm recovery stage 1, and 50% had shoulder subluxation. Of those with shoulder pain, 64.1% developed shoulder pain within a month after onset. The most common diagnosis of shoulder pain was impingement syndrome (57.8%). Impaired sensation (adjusted OR=17.52; 95% CI 4.74-64.78), using an overhead pulley for range of motion exercise (adjusted OR = 33.92; 95% CI 3.35-343.39), and walking without a shoulder sling (adjusted OR = 11.68; 95% CI 1.28-106.88), were significantly associated with post stroke shoulder pain ($p < 0.05$).
Conclusion: Post stroke shoulder pain was common among patients with home-based rehabilitation during post-acute phase. Factors significantly associated with shoulder pain were having an impaired sensation, using an overhead pulley for shoulder range of motion exercise, and not using a shoulder sling while walking. Patient education including using a shoulder sling and not using an overhead pulley for shoulder exercise at home exercise should be emphasized to prevent shoulder pain.

Keywords: shoulder pain, shoulder subluxation, stroke, exercise, home-based rehabilitation

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Introduction

Stroke, a common disease worldwide, usually causes brain damage or hypoxia resulting in an abnormal nervous system such as impaired motor control and tone change. Shoulder muscles weakness and decreased muscle tone in acute phase lead to shoulder subluxation and pain in which consequently leads to joint stiffness, limits movement and function of the hemiplegic arm, decreases activities of daily living (ADL) ability and increases the duration of treatment and rehabilitation.[1,2]

The incidence of shoulder pain has been reported to be 5%-84% depending on the duration of stroke and study populations.[3-6] In a previous study on stroke during post-acute inpatient rehabilitation in Thailand, 19% of the patients reported shoulder pain and more in those with shoulder subluxation.[3] A cohort study in the UK found that 40% of patients developed post stroke shoulder pain on the affected side and it was strongly associated with abnormal shoulder joint examination, ipsilateral sensory abnormalities and arm weakness.[6]

In Thailand, early but short hospital-based rehabilitation is provided to patients with stroke disabilities to reduce hospital cost.[3] After discharge, they have to continue with either a home-based rehabilitation or a community-based rehabilitation program. Most of disabled patients and their families tend to opt for home-based rehabilitation because of environmental familiarity, convenience and ease of continuity of care. However, there was no data on incidence of post stroke shoulder pain in stroke patients receiving home-based rehabilitation in Thailand.

Based on our observation, a large number of patients came back with shoulder pain in the first month after discharge. We observed that instead of passive ROM done by caregiver, some sort of equipment of range of motion exercise such as an overhead pulley was used. In addition, it has been observed that there is an overhead pulley installed at nearly all community rehabilitation centers and many health volunteers still advise patients to use it for shoulder exercise.

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Therefore, the purpose of this study was to determine the prevalence of shoulder pain and associated factors in the hemiplegic patients practicing home-based rehabilitation, and whether an overhead pulley for shoulder exercise related to shoulder pain. The results of this study would help improve a home-based as well as a community-based rehabilitation program to prevent post stroke shoulder pain that interferes with ADL and thus reduces quality of life.

Methods

Participants

Stroke patients who were discharged from the stroke unit and had been appointed to follow-up within 1 month of stroke onset at Rehabilitation Outpatient Clinic, Phatthalung Hospital, Thailand.

Inclusion criteria

- Older than 18 years of age
- Less than a month from stroke onset
- Motor power of the hemiplegic arm less than grade 5

Exclusion criteria

- Could not communicate.
- Lost to follow up

Study protocol

1. After receiving the hospital Ethical Review Board's approval, those who met the inclusion criteria were asked to participate in the study.

2. After the patients signed the informed consent, they were registered and the following baseline variables: age, gender, main type of stroke, comorbid disease, and stroke onset date were collected. Physical and neurological examinations were performed to assess shoulder pain, shoulder subluxation, motor power, sensation and the Brunnstorm's arm recovery stage.

3. The patients were interviewed by predetermined structured questionnaires consisting of history of shoulder pain and injury before stroke onset. In addition, they were asked how often they did range of motion (ROM) exercise, whether or not they used an overhead pulley and wore a shoulder sling while walking.

4. If shoulder pain presented, treatments for shoulder pain such as physical modalities and medications were prescribed. Physical modalities included heat therapy and transcutaneous electrical nerve stimulation (TENS). Medications such as analgesics, anti-inflammatory drugs, antispastics, anti-neuropathic pain medications, were prescribed. Oral corticosteroid was only for complex regional pain syndrome. Shoulder pain was re-assessed every month until resolved or 6 months after onset. The following information: diagnoses of pain, treatments, treatment outcomes, numerical rating scale (NRS) and duration of pain, were recorded.[7,8] If the patients did not have shoulder pain, they were followed up monthly for 6 months.

Statistical analysis

Descriptive statistics was used to demonstrate the characteristics of the subject demographics. All variables were examined with a univariate analysis and all variables with a $p < 0.05$ were included in a multivariate logistic regression analysis. Multivariate analysis was performed by binary logistic regression using forward analysis (variables were included and excluded from the model using a cut-off p of 0.05). All analyses were performed with SPSS version 17 for Windows.

Results

There were 142 patients who underwent an initial interview. During the 6-month follow up period, 31 failed to follow up and 1 died, resulting in the remaining 110 patients recruited in the study. The demographic baseline of 110 patients is shown in Table 2: 59 patients (53%) were males, age ranged from 33 to 98 years with the mean of 64.14 (SD 13.91) years, 80.9% had ischemic stroke, 74.5% had underlying hypertension, 29.1% had diabetes, 68.2% had dyslipidemia, 8.2% had heart disease and 4.5% had previous stroke; 58% had left side weakness, 52.7% had impaired pinprick sensation, 41.8% had the Brunnstorm's arm recovery stage 1, and 40% had motor power grade 0; 50% had shoulder subluxation and 58% experienced post stroke shoulder pain.

Factors related to shoulder pain are shown in Table 3. There was no statistically significant relation to age, type of stroke, gender, comorbid disease, or weak side. Upon a simple regression analysis, statistically significant association was observed between post stroke shoulder pain and shoulder subluxation (crude OR = 4.08;95%CI 1.01-1.85), motor power

Table 1. Terms, definition and available references

Terms	Definitions	References
Post stroke shoulder pain	Shoulder pain on the same side of hemiparesis	
Shoulder subluxation	Having a palpable gap between the acromion and humeral head caused by a change in the mechanics of the glenohumeral joint.	Suethanapornkul et al[3]
Impaired sensation	When using a pinprick on the face, arms, trunk and legs and comparing the sensation sharpness side by side, the difference is mild to moderate or severe to total loss is observed.	Lyden[9]
Walking without a shoulder sling	Not wear a sling during walking.	Jeong et al[10]
Not exercising everyday as instructed	Not exercise to maintain range of motions of the shoulder regularly every day.	Winstein et al[11]

Table 2. Demographic and neurological examination data of all 110 participants at baseline

Demographic variables	Number (%)
Sex: male	59 (53.6)
Age (years)	
≤ 60 years	47 (42.7)
> 60 years	63 (57.3)
Type of stroke	
Infarction	89 (80.9)
Hemorrhage	21 (19.1)
Comorbid diseases	
Hypertension	82 (74.5)
Diabetes	32 (29.1)
Dyslipidemia	75 (68.2)
Heart disease	9 (8.2)
Previous stroke	5 (4.5)
Side of weakness	
Right	46 (41.8)
Left	64 (58.2)
Brunnstorm's arm recovery stages	
1 Flaccidity	46 (41.8)
2 Synergies, some spasticity	18 (16.4)
3 Marked spasticity	16 (14.5)
4 Out of synergies, less spasticity	9 (8.2)
5 Selective control movement	15 (13.6)
6 Isolated movement	6 (5.5)
Motor power (elbow flexors of the affected side)	
0 Total paralysis	44 (40.0)
1 Palpable or visible contraction	8 (7.3)
2 Active movement, gravity eliminated	27 (24.5)
3 Active movement, against sum resistance	11 (10.0)
4 Active movement, against full resistance	20 (18.2)
Sensation	
Normal	52 (47.3)
Impaired	58 (52.7)
Shoulder subluxation, yes	55 (50.0)

grade 0 (crude OR = 3.25; 95%CI 1.07-9.82) and grade 2 (crude OR = 4.41; 95%CI 1.28-15.17), the Brunstorm's arm recovery stage 1-2 (crude OR = 3.33; 95%CI 1.20-9.26), impaired sensation (crude OR = 13.43; 95%CI 5.30-34.04), using an overhead pulley for shoulder exercise (crude OR = 23.57 ;95%CI 3.04-182.67), and walking without wearing a shoulder sling (crude OR = 9.17; 95%CI 1.52-55.34) ($p < 0.05$).

The multivariate logistic regression analysis identified impaired sensation (adjusted OR = 17.52; 95% CI 4.74-64.78), ROM exercise with an overhead pulley (adjusted OR = 33.92; 95% CI 3.35-343.39) and walking without a shoulder sling (adjusted OR = 11.68; 95% CI 1.28-106.88) to be associated with post stroke shoulder pain (Table 4). The following factors: age, gender, type of stroke, underlying diseases, side of weakness, motor power, shoulder subluxation and the Brunnstorm 's arm recovery stage, were not significantly associated with post stroke shoulder pain.

Of the 64 patients with shoulder pain, 64.1% developed shoulder pain within a month, 17.2% within 2 months and 8 (12.5%) within 3 months after the stroke onset. The stroke duration of patients with shoulder pain was 1.63 (SD 0.98) months on average. The diagnoses of post stroke shoulder pain were obtained from history taking and physical and neurological examinations as shown in Table 5. All patients were treated with treatments such as ranges of motion exercise, modality, non-sterioidal anti-inflammatory drugs (NSAIDs), oral steroid for complex regional pain syndrome (CRPS), neuropathic pain drugs. Most patients had good outcomes: 54.7% had completely resolved of shoulder pain, and 21.9% had some improvement (pain scores 1 to 3) but 23.4% still had shoulder pain (pain scores 4 to10) at 6 months after the onset of the stroke. The duration of shoulder pain was 3.22 (SD 1.45) months on average.

Discussion

This study revealed that the occurrence hemiplegic shoulder pain was 58%. In the literature, prevalence of shoulder pain varied and ranged from 5 to 84%.[3-6] In a study of post-acute stroke rehabilitation in Thailand,19% of admitted patients had hemiplegic shoulder pain[3] which was much less than this study. The difference in the prevalence of shoulder pain might be due to different settings as well as activities and exercises at home. The results of this present study revealed that those walking without a shoulder sling developed shoulder pain significantly. Ambulatory patients with a flaccid shoulder muscles need a support, such as a shoulder sling, to decrease the severity of shoulder subluxation by narrowing the gap between acromion and the head of humerus and realigning scapular symmetry.[10,12] Shoulder slings would protect the hemiplegic arm and hand from trauma and prevent traction of brachial plexus and shoulder capsule, but not recommended when muscle tone increased.[10] One possible reason that the patients did not use a shoulder sling was that they could not put on the sling by themselves and need a caregiver to assist them.

This present study also demonstrated that patients with impaired pinprick sensation had a high risk of shoulder pain. Impaired pain perception makes shoulder of hemiplegic patients more prone to injury.[13] The brain lesion itself or reduction in mobility and sensory input might lead to an imbalance in central neural control of the sympathetic system.[4] In addition, inappropriate handling, positioning and transferring could exert great stress on the vulnerable shoulder.[14] The problem may be exacerbated by sensory and perceptual deficits. However, this study did not evaluate improper handling and transferring techniques used in the patients.

Moreover, there was no relation between shoulder pain and age, sex, type of stroke, underlying disease, side of weakness that agree with other studies.[3-6] During the study, the patients were instructed to do shoulder ROMs exercises one session per day to maintain ROMs and prevent joint problem. However, the daily ROM exercises was not related to hemiplegic shoulder pain. It is suspected that shoulder

Table 3. Factors related to post stroke shoulder pain: univariate analysis (n=110)

Factor		Shoulder pain		Crude OR	*p*-value	95% CI
		Yes	No			
Gender						
Female		29 (56.9)	22 (43.1)			
Male		35 (59.3)	24 (40.7)	1.11	0.794	0.52-2.37
Age						
≤ 60 years		26 (55.3)	21 (44.7)			
> 60 years		38 (60.3)	25 (39.7)	1.23	0.599	0.57-2.64
Type of stroke						
Infarction		48 (53.9)	41 (46.1)			
Hemorrhage		16 (76.2)	5 (23.8)	2.73	0.070	0.92-8.11
Comorbid disease						
Hypertension	No	17 (60.7)	11 (39.3)			
	Yes	47 (57.3)	35 (42.7)	1.15	0.753	0.48-2.76
Diabetes	No	50 (64.1)	28 (35.9)			
	Yes	14 (43.8)	18 (56.3)	0.44	0.052	0.19-1.00
Dyslipidemia	No	23 (65.7)	12 (34.3)			
	Yes	41 (54.7)	34 (45.3)	0.63	0.276	0.27-1.45
Heart disease	No	58 (57.4)	43 (42.6)			
	Yes	6 (66.7)	3 (33.3)	1.48	0.592	0.35-6.26
Previous stroke	No	61 (58.1)	44 (41.9)			
	Yes	3 (60.0)	2 (40.0)	1.08	0.933	0.17-6.75
Side of weakness						
Right		24 (52.2)	22 (47.8)			
Left		40 (62.5)	24 (37.5)	1.59	0.280	0.71-3.30
Brunnstorm's arm recovery stages						
1-2		43 (67.2)	21 (32.8)	3.33	0.021*	1.20-9.26
3-4		13 (52.0)	12 (48.0)	1.76	0.347	0.54-5.73
5-6		8 (38.1)	13 (61.9)			
Motor power						
0		28 (63.6)	16 (36.4)	3.25	0.037*	1.076-9.82
1		5 (62.5)	3 (37.5)	3.10	0.193	0.57-16.96
2		19 (70.4)	8 (29.6)	4.41	0.019*	1.28-15.17
3		5 (45.5)	6 (54.5)	1.55	0.568	0.35-6.94
4		7 (35.0)	13 (65.0)			
Sensation						
Normal		15 (26.8)	37 (71.2)			
Impaired		49 (84.5)	9 (15.5)	13.43	<0.001*	5.30-34.04
Subluxation						
No		23 (41.8)	32 (58.2)			
Yes		41 (74.5)	14 (25.5)	4.08	0.001*	1.81-9.15
Shoulder pain or injury before stroke onset						
No		57 (55.9)	45 (44.1)			
Yes		7 (87.5)	1 (12.5)	5.53	0.116	0.67-46.57
Overhead pulley used						
No		42 (48.3)	45 (51.7)			
Yes		22 (95.7)	1 (4.3)	23.57	0.002*	3.04-182.67
Walking without shoulder sling						
No		9 (64.3)	5 (35.7)			
Yes		33 (94.3)	2 (5.7)	9.17	0.016*	1.52-55.34
Not exercising every day as instruction						
No		37 (41.6)	52 (58.4)			
Yes		9 (42.9)	12 (57.1)	1.05	0.915	0.40-2.76

Number (%), * statistically significant at $p < 0.05$

Table 4. Multivariate logistic regression result of risk factors for development of shoulder pain

Factor	Yes	No	Crude OR	Adjusted OR	*p*-value	95% CI
Sensation						
Normal	15 (26.8)	37 (71.2)				
Impaired	49 (84.5)	9 (15.5)	13.43	17.52	< 0.001*	4.74-64.78
Exercise with an overhead pulley						
No	42 (48.3)	45 (51.7)				
Yes	22 (95.7)	1 (4.3)	23.57	33.92	0.003*	3.35-343.39
Walking without shoulder sling						
No	9 (64.3)	5 (35.7)				
Yes	33 (94.3)	2 (5.7)	9.17	11.68	0.030*	1.28-106.88

Number (%), *statistically significant at $p < 0.05$

Table 5. Diagnoses, treatments and outcome of post stroke shoulder pain (n=64)

	Number (%)
Diagnoses	
Adhesive capsulitis	17 (26.6)
Shoulder impingement	37 (57.8)
Complex regional pain syndrome	15 (23.4)
Central pain	16 (25.0)
Others (bicipital tendinitis, acute arthritis, severe spasticity)	5 (7.8)
Treatments	
ROM exercise	60 (93.8)
Modality	17 (26.6)
Oral steroid	15 (23.4)
Neuropathic pain drug	23 (35.9)
Non-steroidal anti-inflammatory drugs	6 (9.4)
Outcome	
Resolved	35 (54.7)
Improved	14 (21.9)
Ongoing pain at the end of the study	15 (23.4)

ROM, range of motion

pain might be due to incorrect shoulder exercises.[11,15] Some studies previously reported that an overhead pulley increased risk of shoulder pain because a traction force to the weak arm injures the soft tissue around the shoulder as the joint moves excessively in ROM.[3,16] This study confirmed that using an overhead pulley exercise was associated with shoulder pain significantly, and shoulder exercise with an overhead pulley should not be recommended in the post stroke patients.

This study showed 64.1% developed shoulder pain within a month, 17.2% within 2 months and 8 (12.5%) within 3 months after the onset of the stroke which was corresponding to the previous studies showing that most patients developed shoulder pain in the first month,[17,18] with an estimated prevalence of 17% in the first week and elevated throughout the recovery period with 20% to 24% the patients experienced shoulder pain from 1 to 16 months after stroke.[17] One large scale study revealed that self-reported shoulder pain increases from 256/1474 (17%) at one week and 284/1201 (23%) at six months.[18]

The major diagnoses of post stroke shoulder pain in this present study were impingement injury, adhesive capsulitis, central pain, complex regional pain syndrome, respectively. Most experts agreed that shoulder pain after stroke was not limited to a single pathology and affected by more than one pathologic condition.[5,18] Most patients would develop shoulder pain when they had muscle weakness and developed glenohumeral subluxation and scapular dyskinesis.[19] In the flaccid stage, the weight of the weak arm pulls down coracoacromial arch.[12] When patients raised the arm, soft tissue around the shoulder would squeeze the arch leading to impingement injury especially with an incorrect passive ROM exercise in forward flexion and abduction, like when using an overhead pulley. Another diagnosis of post stroke shoulder pain in this study was adhesive capsulitis which might be a result of immobilization and muscle wasting due to disuse. Adhesive capsulitis usually presents with pain and limitation in external rotation and abduction.[20] Painful stiffness of the shoulder adversely affects activities of daily living and consequently impairs quality of life.

For treatments of shoulder pain, physical modalities and medications were prescribed like in other studies.[6,11,21-23] The literature review also identified various treatment options to treat hemiplegic shoulder pain, such as electroacupuncture, therapeutic elastic taping, suprascapular nerve block and subacromial corticosteroid injection.[24-29] Although the patients in this study were treated with conventional treatments, the outcomes at the end of study was satisfactory with 76.6% resolved and improved, and only 13.4% still had ongoing shoulder pain that was similar to those admitted for inpatient rehabilitation in Thailand.[3] Early diagnosis and treatment may positively affect treatment outcomes.

This study had some limitations. It did not assess handling and transferring techniques which were reported to be associated with post stroke shoulder pain.[15] For further study, these factors should be assessed, collected and analyzed to confirm association with shoulder pain during home-based rehabilitation in post-acute phase.

In conclusion, post stroke shoulder pain was common during the first six months of post-acute home-based rehabilitation period. Early diagnosis and treatment could improve

or resolve shoulder pain. It was associated with impaired pinprick sensation, using an overhead pulley for shoulder exercise, and walking without a shoulder sling. An overhead pulley shoulder exercise should be abandoned in patients with stroke.

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Disclosure

The author has no conflict of interest to declare.

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