Results *There are 39 males and 21 females recruited into the study. Their average age was 63.90 ± 13.61 years old. Seventeen (28.34 %) had upper extremity complications; i.e. 12 (20 %) had shoulder subluxation, 3 (5 %) had frozen shoulder,1 (1.67 %) had swollen hand,1 (1.67 %) had reflex sympathetic dystrophy (RSD). Sex, age, education, marital status, occupation, type of pathology, side of weakness, underlying disease, onset of stroke, duration of rehabilitation treatment, cost of therapy had no significant difference between the patients with or without upper extremity complications. In addition, this study found that Brunnstrom stage and BAI on admission and discharge of the patients who had upper extremity complications were significantly lower than those who had not ($p < 0.001$ for Brunnstrom admission and discharge and BAI discharge, $p < 0.05$ for BAI admission).*

Conclusion : *The incidence of upper extremity complications in acute stroke are 28.34 %. (i.e. shoulder subluxation 20 %, frozen shoulder 5 %, swollen hand 1.67 % and RSD 1.67 %). Sex, age, education, marital status, occupation, type of stroke, side of weakness, underlying disease, onset of stroke, duration of rehabilitation treatment, cost of therapy are not the risk factors of upper extremity complications. Low Brunnstrom stage and admission BAI score were the risk factors of upper extremity complications in acute phase.*

Keywords : *Upper extremity complications, Rehabilitation, Stroke, Hemiplegia.*

Reprint request : Achareeyakul S. Department of Rehabilitation Medicine, King Chulalongkorn Memorial Hospital, The Thai Red Cross Society, Bangkok 10330, Thailand.

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วัตถุประสงค์ : *เพื่อศึกษาอุบัติการณ์ของภาวะแทรกซ้อนของแขนและมือในผู้ป่วยโรคหลอดเลือดสมอง ในระยะเฉียบพลัน และปัจจัยที่สัมพันธ์กับการเกิดภาวะแทรกซ้อนของแขนและมือ*

รูปแบบการวิจัย : *การศึกษาเชิงพรรณนา*

สถานที่ศึกษา : *ฝ่ายเวชศาสตร์ฟื้นฟู โรงพยาบาลจุฬาลงกรณ์*

วิธีการศึกษา : *ผู้ป่วยโรคหลอดเลือดสมอง 60 รายที่เข้ารับการรักษาในระยะเฉียบพลัน ได้รับการวินิจฉัยจากอาการทางคลินิกและการตรวจทางรังสีวินิจฉัย บันทึกข้อมูลภาวะแทรกซ้อนของแขนและมือ ประวัติการรักษาและการฟื้นฟูสมรรถภาพประเมินด้วย Brunnstrom motor recovery stage และ Barthel ADL Index (BAI) เมื่อแรกรับและก่อนจำหน่าย วิเคราะห์ปัจจัยเสี่ยงของภาวะแทรกซ้อนของแขนและมือด้วย Fisher's exact and Mann Whitney test, significant at $P < 0.05$.*

ผลการศึกษา : *ผู้ป่วยเพศชาย 39 ราย เพศหญิง 21 ราย อายุเฉลี่ย 63.90 ± 13.61 ปี พบภาวะแทรกซ้อนของแขนและมือ 17 ราย (ร้อยละ28.34) ได้แก่ ไหล่ตก 12 ราย (ร้อยละ 20) ไหล่ติด 3 ราย (ร้อยละ 5) มือบวม 1 ราย (ร้อยละ 1.67) Reflex Sympathetic Dystrophy (RSD) 1 ราย (ร้อยละ 1.67) ปัจจัยเรื่องอายุ เพศ การศึกษา สถานภาพ อาชีพ ชนิดของรอยโรค ข้างที่เป็นอัมพาต โรคประจำตัว ระยะเวลาตั้งแต่เป็นอัมพาตจนได้รับการฟื้นฟู ระยะเวลาที่ได้รับการฟื้นฟู ค่าใช้จ่ายในการรักษาทางกายภาพบำบัด ไม่แตกต่างอย่างมีนัยสำคัญระหว่างผู้ป่วยที่มีและไม่มีภาวะแทรกซ้อนของแขนและมือ Brunnstrom และ BAI แรกรับและก่อนจำหน่ายของผู้ป่วยที่มีภาวะแทรกซ้อนต่ำกว่าผู้ป่วยที่ไม่มีภาวะแทรกซ้อนอย่างมีนัยสำคัญทางสถิติ (Brunnstrom แรกรับก่อนจำหน่าย และ BAI ก่อนจำหน่าย มีค่า $p<0.001$, BAI แรกรับมีค่า $p < 0.05$).*

สรุป : *พบอุบัติการณ์ภาวะแทรกซ้อนของแขนและมือในผู้ป่วยโรคหลอดเลือดสมองระยะเฉียบพลัน ร้อยละ 28.34 ได้แก่ ไหล่ตกร้อยละ 20 ไหล่ติดร้อยละ 5 มือบวมร้อยละ 1.67 และ RSD ร้อยละ 1.67 อายุ เพศ การศึกษา สถานภาพ อาชีพ ชนิดของรอยโรค ข้างที่เป็นอัมพาต โรคประจำตัว ระยะเวลาตั้งแต่เป็นอัมพาตจนได้รับการฟื้นฟู ระยะเวลาที่ได้รับการฟื้นฟู ค่าใช้จ่ายในการฟื้นฟู สมรรถภาพไม่เป็นปัจจัยเสี่ยงของการเกิดภาวะแทรกซ้อน Brunnstom Stage เมื่อแรกฟื้นฟูและคะแนน BAI แรกรับต่ำเป็นปัจจัยเสี่ยงต่อการเกิดภาวะแทรกซ้อน ในระยะเฉียบพลัน*

คำสำคัญ : *ภาวะแทรกซ้อนของแขนและมือ, การฟื้นฟูสมรรถภาพ, โรคหลอดเลือดสมอง, อัมพาตครึ่งซีก*

Cerebrovascular diseases are major problems worldwide. In the US, the incidence of cerebrovascular diseases is about 750,000 cases per year, which is the third cause of death after coronary heart disease and cancer.[1] In 1983, Poungvarin N. *et al.* studied the population in the community of Wat Yai Srisupan, Thonburi, Bangkok and reported an incidence of cerebrovascular disease was 690 per 100,000. [2] Moreover, the incidence of cerebrovascular diseases was very high among people who were older than 55 years which was often a cause of morbidity.[3]

Cerebrovascular diseases [4,5] are neurological syndromes which cause sudden focal neurological deficit and lasts longer than 24 hours. The syndromes are originated from blood vessels which has one of the following pathology, namely: a) obstruction either from thrombosis or embolism of blood vessel in the brain which causes cerebral infarction; or b) rupture of blood vessel which causes intracerebral or subarachnoid hemorrhage.

After an episode of cerebrovascular diseases, most patients suffer from a weakness in an extremity (or extremities). The majority of the patients recover and are able to ambulate after receiving rehabilitation and gaining recovery of the neurological system. Although recovery might have taken place, the muscles involved are not completely function. During the recovery period, if the patient receives an inappropriate treatment, there is a risk for complications of the upper extremity especially on the side with weakness. These complications include shoulder pain, shoulder subluxation, etc.[6] Complications of the upper extremity interfere the recovery which commonly leads to permanent loss of function of the affected upper extremity and needs longer period of rehabilitation.[7,8] Complication prevention is therefore the heart and soul of the treatment; it should be started immediately after stroke or onset of cerebrovascular diseases.[9,10]

This study is aimed to explore the incidence and risk factors of upper extremity complications of the patients with cerebrovascular disease in the acute phase. Information from this study can lead to an improvement in the management of acute phase stroke rehabilitation in the future.

Research ethics

The study has been approved by the Institutional Review board (IRB) of the Faculty of Medicine, Chulalongkorn University. Every patients had do informed consent form, in order to be qualified for their recruitment. Every patients were informed all the details of the study before signing their consent forms , in order to qualify their recruitment.

Materials and Methods

Study population

The subjects were patients who were diagnosed with cerebrovascular diseases by neurologist according to the WHO clinical criteria plus neurologic imaging. They were received rehabilitation program at King Chulalongkorn Memorial Hospital from September 2004 to March 2005. Sixty first episode stroke patients were recruited into the study. All of them were in acute phase (not more than 3 months after onset).

Inclusion criteria

1. Patient who was diagnosed with the first episode of cerebrovascular disease and in an acute

phase, including both in- and outpatient. The diagnosis was done by clinical profile plus neuroimaging i.e. CT scan and MRI of the brain.

2. Patient who signed their informed consent form.

Exclusion criteria

1. Patient with paralysis of the extremity from other causes such as brain tumor, aneurysm, lower motor neuron diseases etc.

Methods

Each patient was informed about the details and benefits of the study. After signing their informed consent form, each patient was interviewed regarding their demographic data, upper extremity complications, medical history, and rehabilitation. Physical examination especially upper extremity region was performed by Physiatrists and physical therapist. Complications of upper extremity included shoulder subluxation (the shoulder subluxation was defined as the distance between the head of the humerus and the acromion process more than 1 finger breadth on physical examination)[11,12], frozen shoulder[13], painful shoulder, swollen hand and Reflex Sympathetic Dystrophy (RSD is defined as symptom presented with continuing pain, allodynia or hyperalgesia that is disproportionate to any inciting event in severity).[14] Recovery of the upper extremity was assessed using an upper extremity part of Brunnstrom motor recovery stage. Outcome of rehabilitation was assessed using Barthel ADL Index (BAI).

Statistical analysis

1. Quantitative analysis in term of percentage, expressed as mean ± standard deviation.

2. Risk factors of upper extremity complications were analysed with Fisher's exact and Mann Whitney test, significant at $P < 0.05$. All data was calculated by SPSS program version 12.0.

Result

There were 60 patients with cerebrovascular diseases recruited into the study. Thirty nine (65 %) were male. The average age was 63.9 ± 13.61 yrs (27-86 yr). Fifty five (91.7 %) were married. The education of most patients was lower or equal to primary school. Twenty three (40 %) were unemployed. Their demographic data are shown in Table 1.

Table 1. Demographical data of the subjects.

Characteristics	Cases (%)
Age (years)	
< 60 yr	23 (38.30)
> 60 yr	37 (61.70)
mean ± SD	63.9 ± 13.61
Sex	
male	39 (65)
female	21 (35)
Education	
< primary school	37 (61.70)
≥ secondary school	23 (38.30)
Social status	
single	5 (8.30)
married	55 (91.70)
Occupation	
no occupation	23 (38.30)
private employment	10 (16.70)
retired	7 (11.70)
trading	6 (10)
government officer	6 (10)
etc.	8 (13.30)

Most of them were ischemic stroke. The right hemiplegia was slightly more than the left hemiplegia. Hypertension was the most common underlying disease among the patients. The average period between stroke onset and upper extremity assessment was 3.65 ± 4.83 days. Medical history are shown in Table 2.

Data on complications of upper extremity

The study found complications of the upper extremity in 17 cases (28.34 %). There were as followed: shoulder subluxation 12 cases (20 %), frozen shoulder 3 cases (5 %), swollen hand 1 case (1.67 %) and RSD 1 cases (1.67 %). Forty three (71.66 %) had no complication of the upper extremity. Complications of upper extremity stratified by admission Brunnstrom stage and BAI score are shown in Table 3.

Table 2. Medical history of the patients.

Characteristics	Cases (%)
Pathology	
Infarction	57 (95)
Hemorrhage	3 (5)
Side of paralysis	
Right	32 (53.33)
Left	28 (46.67)
Underlying disease	
Hypertension	30 (50)
Hypertension with Diabetes	9 (15)
Diabetes	3 (5)
Hypertension with Thyroid	1 (1.67)
Diabetes with Hyperdipidaemia	1 (1.67)
Others	6 (10)
None	10 (16.67)
Duration of stroke	
< 1 day	24 (40)
> 1 day	36 (60)
mean ± SD	3.65 ± 4.83

Table 3. Complications of upper extremity stratified by admission Brunnstrom stage and BAI score.

Characteristics	No complication of	Complications of upper extremity; cases (%)				
Admission Brunnstrom stage	upper extremity; cases (%)	Total	shoulder subluxation	frozen shoulder	swollen hand	RSD
I	7 (22.58)	12 (38.70)	9 (29)	2 (6.45)	-	1 (3.22)
II	3 (60)	1 (20)	1 (20)	-		
III	6 (60)	2 (20)	2 (20)	-		
IV	5 (100)	-	-			
V	18 (82)	2 (9)	-	1 (4.50)	1 (4.50)	-
VI	4 (100)	-	-			
Admission BAI score						
< 12	24 (44.45)	15 (27.77)	11 (20.37)	3 (5.55)	-	1 (1.85)
> 12	19 (82.60)	2 (8.70)	1 (4.35)	-	1 (4.35)	-

Risk factors of upper extremity complications

Factors on age, sex, education, marital status, occupation, type of pathology, side of paralysis, underlying disease, duration from stroke onset to rehabilitation, duration of rehabilitation, cost of physiotherapy of those who were with and without complications of the upper extremity were found no statistical significant difference. However, it was found that admission Brunnstrom stage and admission and discharge BAI of patients with complication of upper extremity were lower than those who had no complication with statistical significance. ($p < 0.001$ for Brunnstrom admission and discharge and BAI discharge, $p < 0.05$ for BAI admission). Risk factors of upper extremity complications are shown in Table 4.

Table 4. Risk factors of upper extremity complications.

Characteristics		No complication of upper extremity cases (%)	With complications of upper extremity cases (%)	p value
Age	< 60 yr	16 (76.2)	5 (23.8)	0.765[a]
	> 60 yr	27 (69.2)	12 (30.8)	
Sex	Male	27 (69.2)	12 (30.8)	0.765[a]
	Female	16 (76.2)	5 (23.8)	
Marital status	Single	2 (40)	3 (60)	0.13[a]
	Married	41 (74.5)	14 (25.5)	
Education	< primary school	26 (70.3)	11 (29.7)	1.00[a]
	≥ secondary school	17 (73.9)	6 (26.1)	
Occupation				
	Unemployed	17 (70.8)	7 (29.2)	0.10[a]
	Employed	26 (72.2)	10 (27.8)	
Pathology				
	Infarction	42 (73.7)	15 (26.3)	0.19[a]
	Hemorrhage	1 (33.3)	2 (66.7)	
Side of weakness				
	Right	22 (68.8)	10 (31.2)	0.77[a]
	Left	21 (75)	7 (25)	
Underlying disease				
	Hypertension	22 (73.3)	8 (26.7)	
	DM and Hypertension	7 (77.8)	2 (22.2)	
	DM only	2 (66.7)	1 (33.3)	0.92[a]
	Others disease	6 (75)	2 (25)	
	None	6 (60)	4 (40)	
Duration of onset				
	< 1days	15 (62.5)	9 (37.5)	0.248[a]
	> 1 days	28 (77.8)	8 (22.2)	
Rehabilitation period				
	1 – 13 days	30 (81.1)	7 (18.9)	0.075[a]
	≥ 14 days	13 (56.5)	10 (43.5)	
Cost of physiotherapy				
	< 1,000 baht	30 (81.1)	7 (18.9)	0.075[a]
	> 1,000 baht	13 (56.5)	10 (43.5)	

Table 4. Continuous.

Characteristics		No complication of upper extremity cases (%)	With complications of upper extremity cases (%)	p value
Brunnstrom adm	median = 5	min = 1 max = 6	median = 1 min = 1 max = 5	$< 0.001_b$*
Brunnstrom disc	median = 5	min = 1 max = 6	median = 1 min = 1 max = 5	$< 0.001_b$*
BAI adm	median = 10	min = 0 max = 20	median = 4 min = 0 max = 19	0.02_b*
BAI disc	median = 18	min = 0 max = 20	median = 7 min = 0 max = 20	$< 0.001_b$*

BAI; Barthel ADL Index, a; Fisher's Exact test, b; Mann Whitney test, * ; $p < 0.05$, adm; admission, disc; discharge

Discussion

Demographic data

From the study, the average age of the patients was 63.9 years which was compatable with incidence in other studies. [2, 15] It was found that the duration between the onset of stroke and beginning of rehabilitation was averagely 3.65 ± 4.83 days. The short span of time is explainable by the fact that most patients and their family members lived in Bangkok; they were also concerned with the importance of the rehabilitation and thus resulted in fast recovery. The majority of the patients were male, and hypertension was the most common underlying disease which was found as high as 50 %. This is the main factor of cerebrovascular diseases. Regarding other factors such as age, sex, side of weakness and duration of treatment, they had no relation with level of recovery of the upper extremity. This also corresponds with an earlier report of Chanyut Lekhasiriroj.[16]

Complications of the upper extremity

Complications of the upper extremity were found in 17 cases (28.34 %); they were namely: shoulder subluxation 12 cases (20 %), frozen shoulder 3 cases (5 %), swollen hand 1 cases (1.67 %) and Reflex Sympathetic Dystrophy 1 cases (1.67 %). This finding is similar to a study of Zorowitz RD *et al.*[17] who reported the most common complication of the upper extremity in patients with cerebrovascular diseases was shoulder subluxation which was caused by weakness of the muscles around the shoulder. A preventive measure should be provided for muscles around the shoulder area which are pulled by the gravity by putting the position of the upper extremity with weakness in the correct posture. This is simply done by using a supporting pillow on the upper extremity while sitting, and the use of shoulder-support equipment while standing or walking. These equipments are such as shoulder support, Bobath Sling[18] etc. Zorowitz RD *et al.*[19] described several equipments for the treatment of shoulder subluxation and they are available in the market with reasonable price. The use of the equipment should be assessed from the function of the upper extremity of the weak side. From our study, one patient was found with RSD (1.67 %). This also corresponds to the study of

Petchkrua W *et al.*[20] who reported 1 cases (1.56 %) with cerebrovascular diseases in the acute phase with RSD. The actual cause of this is unclear. However, it is believed that it was from a defect in the physiology of the neurologic system in the section of the sympathetic nervous system.[21]

Risk factors of upper extremity complications

Sex, age, education, marital status, occupation, type of pathology, side of weakness, underlying disease, onset of stoke, duration of rehabilitation treatment, cost of therapy are not the risk factors of upper extremity complications during acute stroke. From our study, we found that the patients presented with lower admission level of Brunnstorm Stage and lower admission and discharge BAI score had higher opportunity for complications of upper extremity, which included shoulder subluxation, frozen shoulder, swollen hand and RSD. However, shoulder subluxation should be improved when there is a recovery of the neurologic system. Among patients whose recovery of neurologic system was high in stage 3 (basic extremity synergy or some components of it, voluntary performance and is sufficient development to show definite joint movement), had decreased incidence of shoulder subluxation.[22,23] Recovery of the upper extremity in patients with cerebrovascular diseases mostly took place in the first 3 months; the recovery was slightly lower after 6 months.[24] Gallez-Leman Mc *et al.*[25] and Kong KH *et al.*[26] found that higher admission BAI was associated with better rehabilitation outcome with low complications of the upper extremity. Jorgenson HS *et al.*[27] found that most patients had the highest recovery rate of the upper extremity assessed by BAI in the first 3 months of stroke. Therefore patients with cerebrovascular diseases in the acute phase should received rehabilitation from the beginning to ensure good results. If they do not receive an appropriate treatment, complication(s) of the upper extremity can hinder the recovery of the neurologic system which leads to the loss of function of the upper extremity of the weak side and daily activities of the patient. The patients should be trained to balance themselves, and to mobilize. Prevention is the heart and soul of the treatment. This could be arranged by avoiding all injuries of soft tissues which could occur from wrong treatment, mishandling, physical support and pulling of the upper extremity of weakness without caution.[28] Caregiver teams should be well trained and be aware of preventive measures by starting early preventive treatment, especially those with cerebrovascular diseases during the early phases who had low Brunnstorm and BAI on admission, as well as giving the information to the patients, their family members, and caregivers in order to enable the upper extremity with weakness to recover without any complications. This allowed the patients to use their upper extremity of the weak side in their daily activities in full capacity.

Conclusion

Complications of the upper extremity were found in 28.34 % of the patients diagnosed with the acute phase of cerebrovascular diseases. They were shoulder subluxation (20 %), frozen shoulder (5 %), swollen hand (1.67 %), and RSD (1.67 %). Sex, age, education, marital status, occupation, type of stroke, side of weakness, underlying disease, onset of stroke, duration of rehabilitation treatment, cost of

therapy are not the risk factors of upper extremity complications. The complications were of statistical significance and related to BAI and Brunnstom Stage on admission and before discharge.

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