STROKE REHABILITATION OF ELDERLY PATIENTS IN SINGAPORE

C H Ee, P E Kwan, E S Tan

ABSTRACT

A retrospective study of 100 elderly stroke patients admitted to a rehabilitation centre in Singapore was done to study the characteristics of the patients and the factors associated with the outcome.

The mean age of the patients was 72.7 ± 5.4 years with an equal sex ratio. There was a predominance of Chinese. Two or more concomitant diseases were present in 43% of the patients with a markedly high prevalence of hypertension. Majority had unilateral motor deficit, and cerebral infarcts were seen in 66% of the scans done. Altogether 79% of the patients improved on their level of self-care in activities of daily living (ADL) while 60% showed improvement in their level of mobility.

Patients with good prognosis were those who were assessed to be at least partially independent in ADL prior to rehabilitation and those who showed improvement in the motor power of their affected limbs during rehabilitation. Those with dense hemiplegia at the outset were likely to remain dependent. Age, sex, delay in rehabilitation, duration of rehabilitation, presence of dysphasia and sides of deficit had no bearing on the outcome.

Keywords: stroke, rehabilitation, elderly,

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INTRODUCTION

Stroke is a major disabling disease. Physical rehabilitation of stroke patients is an important part of treatment. One of the aims of rehabilitation is to help the afflicted individual achieve maximal potential to recover and regain as much independence as possible. The more suitable place for rehabilitation is in a specialised centre like a rehabilitation centre or stroke unit[1,2]. The reasons are obvious as such centres are adequately equipped with therapeutic equipment, movable and non-movable, and is well staffed with a team of medical and ancillary staff who can provide daily intensive therapy to all the patients, thus enabling them to recover quicker. Unfortunately, not all stroke patients can be admitted to these centres due to physical constraints.

In order to be more objective in selecting patients who would benefit most from rehabilitation, many studies have been done to identify factors which influence the outcome of rehabilitation[3-5]. Certain prognostic scores have been devised and suggested for use, not only for the purpose of assessment and selection of patients, but also for predicting outcome[6-8].

The Department of Rehabilitation Medicine at Tan Tock Seng Hospital (DRM) is the main centre in Singapore for the rehabilitation of patients disabled by stroke, head injury, spinal trauma and various neurological diseases. This paper, besides studying some of the characteristics of elderly patients admitted to the department for stroke rehabilitation, aims to analyse certain factors which may influence the outcome of rehabilitation.

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MATERIALS AND METHODS

This study is a retrospective analysis of the data available in the case-notes and rehabilitation cards of the first 100 consecutive elderly patients (aged 65 years or more) admitted to the DRM for stroke rehabilitation in 1987. The patients were referred from the various medical departments and were preselected by the rehabilitation physician prior to admission to the DRM.

The outcome of rehabilitation mentioned in the study refers to the functional status of the patient on discharge. The functional status of each and every patient was assessed according to two aspects, that of ADL and mobility, which were done by the occupational therapist and physiotherapist respectively. The grading of ADL and mobility were based on the Rehabilitation Profile System (RPS) adapted for use by the DRM since 27 April 1989[9]. The grading for ADL ranges from 0 to 5 while that of mobility from 0 to 8. For the purpose of this study, we graded the patients into either independent (I), partially dependent (P) or totally dependent (T) according to the following:

Activities of Daily Living (ADL):

I (RPS grade 0-1): normal or complete independence without aids/appliances; supervision only.

P (RPS grade 2-3): complete independence with the use of aids/appliances or requiring occasional help of another person with minimal assistance in one or two activities of daily living or moderate assistance in the performance of more than two activities of daily living.

T (RPS grade 4-5): maximal assistance in the performance of all activities of daily living or complete dependence.

Mobility:

I (RPS grade 0-1): normal or with the use of aids/appliances, can ambulate and manage steps without handrail; able to take public transport.

P (RPS grade 2-5): can ambulate and manage steps with handrail but unable to take public transport; ambulant on 1 level but requires minimal to maximal personal assistance.

T (RPS grade 6-8): independent or complete dependence in wheel-chair mobility only, or bedridden.

The assessment of the motor function was graded according to the Disability Profile System (DPS)[10] but for this study, we corresponded it with the Medical Research Council's (MRC) scale of grading of motor power as follows:

MRC grade 0 (DPS grade 4): complete motor paralysis/ sensory loss/gross incoordination/major joint range of motion 0 - 25% (passive) or grade 0 Oswestry Scale for spasticity.

MRC grade 1-2 (DPS grade 3): major joint range of motion 25 - 50% (active)/average motor power grade (MRC scale) 1-2/ reduced coordination or sensation clearly evident on inspection/ grade 1-2 Oswestry scale.

MRC grade 3 (DPS grade 2): major joint range of motion 50-75% (active)/average motor power grade 3/reduce dcoordination or sensation evident only on specific clinical tests/grade 3 Oswestry scale.

MRC grade 4 (DPS grade 2): major joint range of motion not less than 75% (active)/average motor power not less than grade 4/mildly reduced coordination or sensation/grade 4 Oswestry scale.

MRC grade 5 (DPS grade 0): normal or no gross abnormality considering the age of the individual.

Patients with independent or partially dependent functional status were considered to have good function or good outcome and those who were totally dependent were considered to have poor function or poor outcome.

Comparisons were done between the outcome and the various factors and in some instances, the improvement in the functional status (which can be determined by comparing the RPS at admission and on discharge) was used in the comparison.

Whenever appropriate, the results were expressed as means ± SD, and Chi-square tests (with Yates' correction) were used to calculate for statistical significance which was taken as $p < 0.05$.

RESULTS AND COMMENTS

A. Characteristics of elderly stroke patients

The results of the various characteristics studie dare summarised in Table I. Details are as follows:

(1) Age, sex and race distribution

The mean age of the study population was 72.7 ± 5.4 years with a range between 65 to 88 years. The sex ratio was equal (1:1), almost conforming to that of the general population of 1.037 male to 1 female[11]. There were more female "old elderly" (more than 75 years old) patients which was consistent with the longer life expectancy of the female[12]. See Table II.

Chinese patients constituted 91% of the study population, while there were 3% of Malays, 4% of Indians and 2% of the other ethnic groups. In contrast, the population of Singapore in 1987 comprised 76.1% Chinese, 15.1% Malays, 6.5% Indians and 2.3% of the other ethnic groups[11]. The Chinese thus appear to have a higher admission rate for stroke rehabilitation ($p < 0.01$), but this could have been partly contributed by the relatively low hospitalisation rate amongst local Malays. More studies are needed to determine whether Chinese have indeed a higher risk of suffering a stroke because one previous local study done in 1984 showed a higher rate of Indians being admitted for stroke[13].

(2) Associated diseases

Forty-three patients had two or more concomitant diseases in addition to the stroke, and only 6 patients were not diagnosed to have any other medical problems. The three most common associated diseases were hypertension, diabetes mellitus and ischaemic heart disease. This was consistent with the findings of

Table I
Characteristics of the 100 geriatric patients admitted for stroke rehabilitation

Characteristics		No.
Age (years):		
64 - 69		34
70 - 74		25
75 - 79		34
> 80		7
Sex:	Male	50
	Female	50
Race:	Chinese	91
	Malays	3
	Indians	4
	Others	2
Associated diseases:		
Hypertension		69
Diabetes mellitus		27
Ischaemic heart disease		13
Others		37
Previous stroke		16
Sides of deficit:		
Left		43
Right		46
Bilateral		11
Dysphasia		25
Severity of deficit (MRC scale):		
Upper limb:	0	66
	1 - 2	12
	3 - 4	21
	5	1
Lower limb:	0	62
	1 - 2	22
	3 - 4	15
	5	1
CTscan brain done		59
Infarct		31
Multiple infarcts		8
Haemorrhage		17
Normal		3
Functional status at admission:		
ADL –	Independent	1
	Partially dependent	53
	Totally dependent	46
Mobility –	Independent	2
	Partially dependent	22
	Totally dependent	76
Functional status on discharge:		
ADL –	Independent	5
	Partially dependent	79
	Totally dependent	16
Mobility –	Independent	4
	Partially dependent	61
	Totally dependent	35

another local study which revealed that 46% of the old elderly and 39% of the young elderly had at least three medical problems, and again the top three prevalent diseases were hypertension, ischaemic heart disease and diabetes mellitus in that order[14].

Table II
Age, sex and race distribution

Age (years)	Chinese M	Chinese F	Malay M	Malay F	Indian M	Indian F	Others M	Others F	Total
65 – 69	15	13	1	1	3	0	1	0	34
70 – 74	10	12	0	1	1	0	1	0	25
75 – 79	16	18	0	0	0	0	0	0	34
> 80	2	5	0	0	0	0	0	0	7
Total	43	48	1	2	4	0	2	0	100

(3) Previous stroke

Sixteen patients had past history of stroke and all except one had some degree of residual motor deficit. Eight of them had significant deficit to result in bilateral stroke on presentation. The remaining 7 had the current stroke on the same side as the previous, and therefore the history of residual deficit could not be confirmed. It must be noted that none of these 15 patients with residual deficit was recorded to have poor function previously.

(4) Types of severity of deficit

The majority suffered only unilateral motor deficits with 43 affecting the left, 46 the right and 11 had bilateral motor deficits, of which 8 of them were the result of the residual deficits due to previous stroke. The majority of the motor deficits was severe with 66% and 62% having grade 0 power of the upper limb and the lower limb respectively. Only 2 patients had monoplegia of the upper and lower limb respectively while the remaining had various grades of hemiparesis.

Dysphasia was present in 25 patients but the details were not available. The majority (68%) were in patients with right sided deficit ($p < 0.05$). See Table III.

Table III
No. of patients with dysphasia according to the affected side of neurological deficit

Dysphasia	Right	Left	Bilateral
Present	17	6	2
Absent	29	37	9

$p < 0.05$ (excluding bilateral stroke)

(5) Types of stroke

Computerised-tomogram scanning (CT Scan) of the brain was done in 59 patients. Thirty-one patients (52.5%) had single cerebral infarct, 8 (13.6%) had multiple infarcts (infarct in more than one area of the brain), 17 (28.8%) had cerebral haemorrhage, while the remaining 3 patients showed no abnormality in the scan.

(6) Functional status

The functional status of the patients at admission is related strongly to the severity of the motor deficit as shown in Table IV (ADL:$p < 0.001$; Mob:$p < 0.01$). Majority were totally dependent (46 in ADL: 76 in mobility).

Table IV
Functional status at admission according to the severity of neurological deficit

Motor power (MRC scale)	Activities of Daily Living (ADL) I	P	T	Mobility I	P	T
Upper limb:						
0	0	22	44	1	9	56
1 – 5	1	31	2	1	13	20
	$p < 0.001$			$p < 0.01$		
Lower limb:						
0	0	19	43	0	5	57
1 – 5	1	34	3	2	17	19
	$p < 0.001$			$p < 0.01$		

I – Independent; P – Partially dependent; T – Totally dependent

Table V shows the functional status at admission and on discharge. There were 79 patients who showed improvement in ADL and 60 who showed improvement in mobility, but note that not all improved sufficiently to achieve a higher level of independence.

Table V
Functional status at admission (adm) and on discharge (dis) and number improved (n*)

Functional level	ADL Adm	ADL n*	ADL Dis	Mobility Adm	Mobility n*	Mobility Dis
Independent	1	1	5	2	1	4
Partially dependent	53	46	79	22	18	61
Totally dependent	46	32	16	76	41	35
p	< 0.001			< 0.001		

*not all who improved were able to attain a higher functional level

B. Factors affecting the outcome of rehabilitation

The results of the various factors on the outcome of rehabilitation are summarised in Table VI. Details are as follows:

(1) Age and Sex

All other factors being equal, older patients have poorer prognosis compared to younger stroke patients[6, 15-18]. But in the geriatric population, was there any difference between the young elderly and the old elderly? Eighty-one percent of the young elderly were at least partially independent in ADL on discharge compared to 88% of the old elderly while 66% of the young elderly as compared to 63% of the old elderly were at least partially independent in mobility. These differences were not significant. Therefore, age should not be an important criterion in selecting patients for rehabilitation.

There was no significant difference in outcome between the male and female.

(2) Delay in admission to rehabilitation centre

Delay in admission to the rehabilitation centre may indicate a delay in the rehabilitation of the stroke patients. Early physiotherapy is important because functional potentialities of the affected side can be developed earlier and "spastic" patterns

can be ameliorated and thus result in better coordination and posture following recovery[19].

The average delay of the patients in the study from the time of stroke to admission to the DRM was 5.01±5.28 weeks. Sixty-nine patients were admitted within 4 weeks but the outcome was not significantly different from those who were admitted after 4 weeks. While noting that the duration of delay did not influence the outcome, one should not forget that while awaiting transfer to DRM, most of the patients would have been referred to and "treated" by the physiotherapists as is the practice, thus negating the significance of delay on the outcome. One should also realise that the quality of the outcome was not considered in the study.

Table VI
Percentage of patients with good outcome according to the various factors

Factors	Good outcome in ADL (n = 84) n	%	p	Mobilty (n = 65) %	p
Age					
65 – 74	59	81.4		66.1	
> 75	41	87.8	ns	63.4	ns
Sex					
Male	50	82.0		72.0	
Female	50	86.0	ns	58.0	ns
Delay in admission					
< 4 weeks	69	84.1		68.1	
> 4 weeks	31	83.9	ns	58.1	ns
Duration of rehabilitation					
< 4 weeks	46	82.6		67.4	
> 4 weeks	54	85.2	ns	63.0	ns
Dysphasia					
Present	25	80.0		56.0	
Absent	75	85.3	ns	68.0	ns
ADL at admission					
Good	54	96.3		87.0	
Poor	46	69.6	< 0.001	39.1	< 0.001
Mobility at admission					
Good	24	95.8		100	
Poor	76	80.3	ns	54.0	< 0.001
Power of upper limb at admission					
Grade 0	66	75.8		53.0	
Grade 1 – 5	34	100	< 0.01	88.2	< 0.01
Power of lower limb at admission					
Grade 0	62	74.2		43.6	
Grade 1 – 5	38	100	< 0.01	100	< 0.001
Improvement of power					
Upper limb: yes	34	100		91.2	
Upper limb: no	66	75.8	< 0.01	51.5	< 0.001
Lower limb: yes	45	100		97.8	
Lower limb: no	55	70.9	< 0.001	38.2	< 0.001
Types of stroke:					
Infarct	31	90.3		67.7	
Haemorrhage	17	58.8	< 0.05	52.9	ns
Sides of deficit:					
Right	46	87.0		69.6	
Left	43	86.1	ns	62.8	ns

(3) Duration of rehabilitation

The average duration of stay in the DRM was 5.91 ± 5.41 weeks. Fifty-four patients stayed longer than 4 weeks but the outcome was not significantly different from those who stayed less than 4 weeks. While spontaneous recovery from stroke can still occur gradually up to 6 months, the improvement is usually maximal within the first 4 weeks. Prolonged stay therefore does not mean better outcome. Furthermore, patients with little or no improvement would tend to stay longer for various reasons, like the reluctance of the patient himself to go home and the request from the family to keep the patient longer till the latter improved.

(4) Functional status at admission

Does assessment of the level of ADL and mobility at admission help to predict the outcome?

ADL: While only 69.6% of the 46 patients who had poor ADL on admission attained good ADL on discharge, 96.3% of the 54 patients with good ADL on admission remained so on discharge ($p < 0.001$). The outcome in terms of mobility was similarly better in those with good initial ADL (87%) compared to those with poor initial ADL (39.1%) ($p < 0.001$).

Mobility: While 100% of the patients with good mobility at admission remained so, only 54% of those with poor mobility at admission achieved good outcome in mobility ($p < 0.001$). But a good level of mobility at admission did not appear to be associated with good outcome in terms of ADL.

It seems from the above that patient with poor functional ability at admission had poor outcome, but was it due to lack of improvement in their function despite rehabilitation?

The answer appeared to be true as shown in Table VII except that the difference between patients with good initial ADL showing more improvement in ADL compared to those with poor initial ADL was not statistically significant.

Table VII
Percentage of patients with improvement in function according to the functional status at admission

Functional status	Improvement in ADL (n = 79) n	%	p	Mobility (n = 60) %	p
ADL:					
Good	54	87.0		77.8	
Poor	46	69.6	ns	39.1	< 0.001
Mobility:					
Good	24	95.8		79.2	
Poor	76	73.7	< 0.05	54.0	< 0.05

(5) Severity of motor deficit

Sixty-six patients had motor power of the upper limb of grade 0 at admission while only one had grade 5 power. The rest had power ranging from grade 1 to 4. Table VIII shows that patients with at least a grade 1 motor power of the upper limb at admission had a less likely chance of becoming totally dependent in both ADL and mobility on discharge ($p < 0.01$).

Similarly, as shown in Table IX, for patients with at least grade 1 motor power of the lower limb at admission, the chance of becoming totally dependent was less. There were 16 of the 62 patients with grade 0 power at admission who were totally dependent in ADL on discharge, while none of the 38 patients with at least grade 1 power was ($p < 0.01$). The difference in the outcome in mobility was also very significant ($p < 0.001$), favouring those with some residual motor power.

Table VIII
Outcome of rehabilitation according to the motor power of the affected upper limb

Motor power (MRC scale)	n	Outcome in ADL Good (n = 84)	ADL Poor (n = 16)	Mobility Good (n = 65)	Mobility Poor (n = 35)
Grade 0	66	50	16	35	31
Grade 1 – 5	34	34	0	30	4
p		< 0.001		< 0.01	

Table IX
Outcome of rehabilitation according to the motor power of the affected lower limb

Motor power (MRC scale)	n	Outcome in ADL Good (n = 84)	ADL Poor (n = 16)	Mobility Good (n = 65)	Mobility Poor (n = 35)
Grade 0	62	46	16	27	35
Grade 1 – 5	38	38	0	38	0
p		< 0.01		< 0.001	

These results were not unexpected because it was shown earlier that functional status is related to the degree of motor deficit (see Table IV).

Table X further confirms that an improvement in the motor power was associated with improvement in the functional status.

(6) Dysphasia

Communication is important for effective rehabilitation and patients with dysphasia may have difficulty in participating. Twenty-five patients had dysphasia and the majority (68%) were in patients with right sided stroke. This difference is significant ($p < 0.05$) and is not unexpected since the speech centre is in the left cerebrum in most people. The centre has a part-time speech therapist who provides one morning service per week.

Of the 17 right-sided stroke cases, 11 had mixed sensory/motor dysphasia, 5 had pure motor dysphasia and one, pure sensory dysphasia. Five of the 6 left-sided stroke cases had motor dysphasia and one mixed sensory/motor dysphasia. The 2 bilateral stroke cases had motor dysphasia. Nine of the 12 cases with mixed sensory/motor dysphasia and the one with pure sensory dysphasia did not improve after rehabilitation and had to be discharged in wheelchairs. This proves that speech disturbance (especially the sensory component) affects adversely the outcome of rehabilitation in stroke patients.

(7) Types and sides of stroke

Whether the patients with multiple infarcts were included or not in the calculation, patients with cerebral haemorrhage appeared to have poorer outcome in terms of ADL when compared to those with infarct ($p < 0.05$). The outcome in mobility was not significantly different. This finding was similar to one study which showed that patients with intracerebral haemorrhage had poorer outcome[7].

There was also no significant correlation between the outcome and the sides of deficit.

(8) Skin Sensation

It is an established fact that progress in rehabilitation is hampered in patients with sensory deficits (touch, pain, temperature, proprioceptive and position sensation). Unfortunately, in this cohort of patients skin sensation was excluded because it was not properly documented in the physical findings. However, most of the patients complained of "numbness" of the affected side though pin-prick and temperature senses were intact.

Table X
Association of improvement in motor power with improvement in function

Improvement in power of:	n	Improvement in ADL (n = 79) %	ADL p	Mobility (n = 60) %	Mobility p
Upper limb					
yes	34	94.1		79.4	
no	66	71.2	<0.02	50.0	<0.01
Lower limb					
yes	45	93.3		93.3	
no	55	67.3	<0.01	32.7	<0.001

CONCLUSION

Factors which are known barriers to recovery in stroke such as memory disturbances, lack of motivation, depression, higher cerebral dysfunction (parietal deficit as defined by sensory or visual inattention, visuospatial neglect or joint position sense loss) were not discussed in this study because all patients admitted to DRM were decided by the rehabilitation physician and very few with these "barriers" were selected. Furthermore, the absence or presence of these "barriers" was not well documented in every case-note.

Nevertheless, our results on the factors affecting the outcome of stroke rehabilitation in elderly patients were consistent with that of other studies (which were not confined to elderly patients), but direct comparisons were not made because the methodology and the measurement of outcome in the different studies vary[2-8].

In our study, factors like age, sex, delay in rehabilitation, duration of rehabilitation, presence of dysphasia and sides of stroke had no bearing on the outcome. Factors which have prognostic significance include the level of functional ability and the severity of motor deficit, and both of these were inter-related. Improvement of motor power of the affected limbs during rehabilitation was a good prognostic sign. While a better level of the ADL function at admission would indicate better outcome in both ADL and mobility, a better level of mobility at admission would imply a better outcome in mobility only.

In terms of achieving improvement in the functional level, it was found that patients with good initial function had more of them showing improvement, which probably explains their better prognosis.

Finally, it must be emphasized that mental rehabilitation and social readjustment which are not discussed in this paper are just as important in the total rehabilitation of stroke patients.

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