Day Hospital Rehabilitation for the Elderly: A Retrospective Study

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Abstract

Alexandra Hospital has the first Day Hospital for rehabilitation of the elderly in Singapore. To determine if functional skills and mobility improved significantly with a Day Hospital rehabilitation programme, and the factors influencing the outcome, a pre-test/post-test study was conducted on 30 male and 34 female patients discharged from the programme between 1 October 1995 and 30 June 1996. The Barthel Index was used to assess functional status and the Elderly Mobility Scale was used to assess mobility. All patients were assessed by trained therapists and scored on admission to and at discharge from the programme. We found a significant difference in the mean Barthel Index scores of 59.7 (SD 18.7) on admission and 71.4 (SD 20.5) at discharge (P <0.001). The difference in the mean Elderly Mobility Scale of 7.1 (SD 4.3) on admission and 11.8 (SD 4.7) at discharge was also significant (P <0.001). Improvement in functional skills and mobility were both inversely correlated with age. Multiple linear regression analysis showed that age and Barthel Index on admission were significant independent determinants of the Barthel Index at discharge, while age, Barthel Index and Elderly Mobility Score on admission significantly determined the Elderly Mobility Scale at discharge. This study showed that functional skills and mobility improved with rehabilitation in the elderly population, but younger and less severely disabled individuals tended to fare better.

***Ann Acad Med Singapore* 1998; 27:468-73**

Key words: Disabled, Functional skills, Geriatric, Mobility

Introduction

Alexandra Hospital is the first hospital in Singapore with a Day Hospital[1] for the elderly. One of the main functions of the Day Hospital is to rehabilitate the disabled elderly. The patients usually present with deficits in mobility and self-care activities. Each patient is initially evaluated by a geriatrician, a gerontology-trained nurse, a physiotherapist and an occupational therapist at an Assessment Clinic. All medical, neurological and psychosocial problems are evaluated as a whole.[2] If the potential to improve is present, the patient will be enrolled into the Day Hospital programme. Goals are set for each individual. Multi-disciplinary case conferences are conducted at periodic intervals to monitor the progress of the patient, to evaluate new problems which have surfaced and to re-set the goals if necessary. When medical problems are identified, drug treatment would be instituted or optimised if indicated. Social problems are referred to the medical social worker. If necessary, the patient is referred to a psychiatrist, podiatrist, speech therapist or any other specialist in order to make the rehabilitation as comprehensive as possible. The duration and the weekly frequency of rehabilitation would differ according to the convenience and endurance of the patient. The ability to perform activities of daily living (ADL), mobility status and continence status are routinely rated on admission to and at discharge from the Day Hospital programme by the occupational therapist, the physiotherapist and the nurse.

With the changing demographic of our society, the next two decades will see a marked increase in the number of elderly patients with disabling conditions, increasing the need for rehabilitation services and the demand for proof of efficacy. So far, there have been no previous studies in Singapore to examine whether rehabilitation of the disabled elderly was effective. Studies elsewhere on stroke rehabilitation suggested that age,[3,4] functional status at the time of hospital admission[5] and social characteristics[4] predicted functional outcome. We therefore conducted a study to determine if functional skills and/or mobility improved significantly with a Day Hospital rehabilitation programme, and the factors influencing the outcome.

Materials and Methods

We used a pre-test/post-test study design. The study population comprised all patients who were discharged from the Day Hospital rehabilitation programme be-

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tween 1 October 1995 and 30 June 1996. The patients' particulars and demographic data such as age and sex were obtained from the medical records. Only discharged patients were analysed because they had both the admission and discharge scores. Discharged patients included all who were discharged after a completed course of rehabilitation. One patient who died and 6 who defaulted during treatment were excluded from the analysis. To minimise post-test bias, the physiotherapist, occupational therapist and nurse giving therapy and care to the patients were not informed that a study was being conducted.

Of the 3 most frequently used scales, viz. Kenny Self Care Evaluation,[6] Katz Index,[7] and Barthel Index (BI),[8] the BI was chosen to assess functional state as it had the advantages of being comprehensive, sensitive to change and easy to manipulate statistically. This ADL index has been previously validated in a variety of settings. It measures the severity of disability in self-care, sphincter control and mobility. Individuals are rated based on the following abilities: eating, drinking from a cup, upper and lower body dressing, grooming, bathing, bladder and bowel continence, chair and toilet transfers, getting in and out of a shower, walking 50 metres and walking up and down stairs. The maximum possible score is 100, representing independent self-care.

We used the Elderly Mobility Scale[9] (EMS) as a standardised validated scale for assessment of frail elderly people. The EMS tests the following functions: lying to sitting, sitting to lying, sitting to standing, standing, gait, walking speed and functional reach. It is an assessment of locomotion, balance and key position changes which are prerequisites to more complex activities of daily living. The maximum possible score, representing independent mobility, is 20 while the minimum score is zero.

For purposes of analysis, the primary indices used were the BI and EMS. The BI measured functional independence at one point in time, while the EMS measured mobility at one point in time. Other indices derived to measure function improvement were the change in BI and EMS from commencement of rehabilitation to discharge[10] (i.e., Change in BI = Discharge BI - Admission BI and Change in EMS = Discharge EMS - Admission EMS). Since the potential improvement for patients with high initial BI or EMS scores was lower than that for patients with low initial scores, another way to express function improvement was an index known as achievement of rehabilitation potential, a percentage reflecting the proportion of potential improvement actually achieved during rehabilitation.[11] The formulae used to derive achievement of potential were:

$$\text{Achievement of potential (ADL)} = \frac{\text{Change in BI}}{\text{100 - Admission BI}} \times 100\%$$

$$\text{Achievement of potential (mobility)} = \frac{\text{Change in EMS}}{\text{20 - Admission EMS}} \times 100\%$$

In the statistical analysis, each individual's BI on admission was compared with that at discharge by the paired *t*-test and the Wilcoxon matched-pairs signed-rank test. This was repeated for the EMS. The unpaired *t*-test and the Mann-Whitney U test were used to compare ADL and mobility outcomes after stratifying by age (into <75 years and 75 years and above). The results of the non-parametric tests were found to be consistent with those of the *t*-tests. A difference was considered to be statistically significant if it was likely to occur by chance no more often than one in twenty. To adjust for potentially confounding covariates, the data were next subjected to multivariate analyses using multiple linear regression modelling. In the mathematical modelling, the rehabilitation outcome indices (BI at discharge, EMS at discharge, and achievement of rehabilitation potential in ADL and mobility) were separately assigned as the dependent variable and simultaneously adjusted for age, BI on admission and EMS on admission as the independent variables.

Results

Sixty-four patients comprising 30 males and 34 females were included in this study. The demographic and outcome characteristics of the sample are shown in Table I. The majority (63%) of the patients were referred from hospitals, with 34% from non-geriatric departments and 29% from geriatric departments. Referrals from community hospitals amounted to 18% of the patients; primary health care providers, 11%; domiciliary health care service, 6%; and others, 2%. Stroke disease was identified in 36 (56%) of the patients; osteoarthritis, 14 (22%); osteoporotic fractures, 13 (20%) and movement disorders (predominantly Parkinson's Disease), 7 (11%). Depression was diagnosed in 17 (27%) while cognitive impairment was present in 10 (16%) of the patients. The duration and weekly frequency of therapy varied according to the convenience and endurance of the patients, and the total number of rehabilitation sessions ranged from 3 to 114 sessions. The median number of rehabilitation sessions was 18 (mean 29).

Figure 1 shows the proportion of subjects who were independent in each of the activities of the BI before and after rehabilitation. When we compared the mean BI on admission and at discharge, we found a significant improvement (P <0.001) (Table I). Independence in the activities of the EMS showed a similar but more apparent increase after rehabilitation (Fig. 2). We found a significant improvement when we compared the mean EMS on admission and at discharge (P <0.001) (Table I). Age was an important determinant in ADL and mobility outcomes, with those less than 75 years improving more

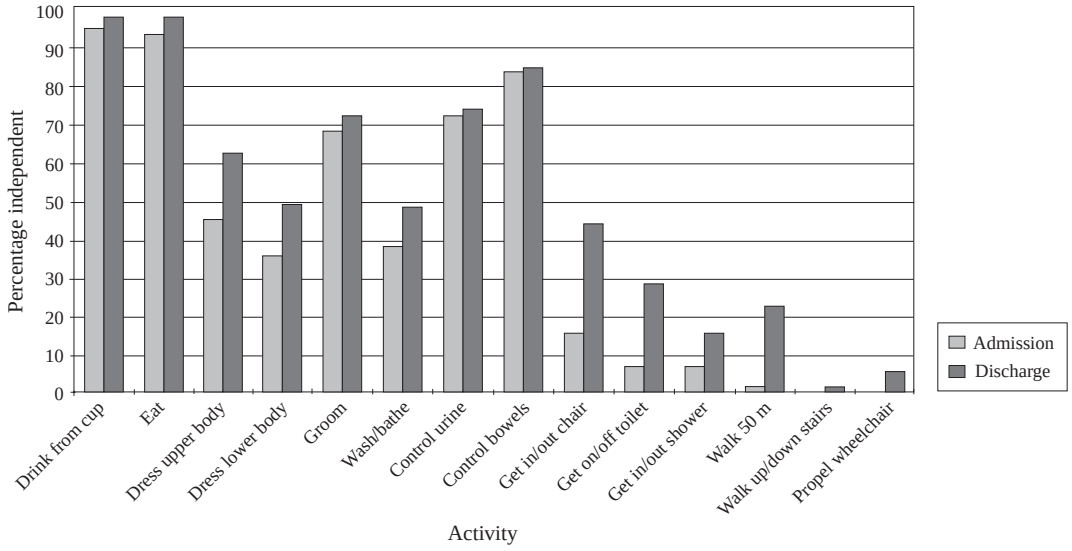

Fig. 1. Percentage of patients independent in Activities of Daily Living before and after rehabilitation.

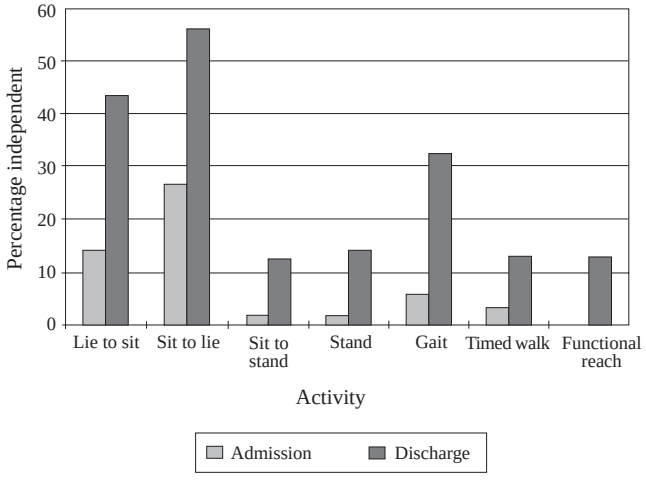

Fig. 2. Percentage of patients independent in mobility before and after rehabilitation.

with rehabilitation (P <0.001) compared with the older patients (Table II).

The results of the multivariate analyses are shown in Table III. The patients' age and BI on admission were found to be significant independent determinants of the BI at discharge. The coefficient of multiple determination, R^2, of this model indicated that 79% of the variability in the BI at discharge was accounted for by these two variables. The patients' age, BI on admission and EMS on admission were found to be significant determinants of the EMS at discharge. The three variables accounted for 67% of the variability in the EMS at discharge. The importance of the patients' age and BI on admission was again demonstrated when we performed multiple linear regression to look at the determinants of achievement of rehabilitation potential.

TABLE I: SAMPLE DEMOGRAPHIC AND OUTCOME CHARACTERISTICS

	Admission	Discharge
Age (y)		
Mean ± SD	75.4 ± 8.0	
Median	77.0	
Mode	80.0	
Range	59 to 88	
Gender (number)		
Male	30	
Female	34	
Barthel Index		
Mean ± SD	59.7 ± 18.7	71.4 ± 20.5*
Elderly Mobility Scale		
Mean ± SD	7.1 ± 4.3	11.8 ± 4.7*
Achievement of rehabilitation potential (ADL) (%)		
Mean ± SD	-	32.4 ± 28.6
Range	-	-15.9 to 100
Achievement of rehabilitation potential (mobility) (%)		
Mean ± SD	-	37.7 ± 27.2
Range	-	0 to 100

*P <0.001
ADL: activities of daily living

Discussion

Our study is a preliminary evaluation that should form the basis for a more comprehensive review in the future. It should be noted that the study population was a heterogeneous group. Strokes, fractures, arthritis and movement disorders formed the majority of conditions for which rehabilitation was provided. Cognitive deficits and depression were also identified in many. It is

TABLE II: COMPARISON OF REHABILITATION OUTCOME STRATIFIED BY AGE GROUP

	<75 years (n = 25)	≥75 years (n = 39)	Mean difference	95% Confidence interval
Change in Barthel Index	16.9	8.4	8.5*	3.4 - 13.7
Change in Elderly Mobility Score	6.1	3.8	2.3*	0.8 - 3.8
Achievement of rehabilitation potential (ADL) (%)	48.2	21.8	26.4*	13.4 - 39.4
Achievement of rehabilitation potential (mobility) (%)	51.2	28.7	22.5*	9.8 - 35.1

*P <0.001

ADL: activities of daily living

TABLE III: MULTIPLE LINEAR REGRESSION ANALYSES FOR DISCHARGE OUTCOME VARIABLES

	Dependent variables			
Significant independent variables	Discharge BI	Discharge EMS	Achievement of rehabilitation potential (ADL) (%)	Achievement of rehabilitation potential (mobility) (%)
Age	-0.66*	-0.17*	-1.87*	-1.38*
Admission BI	1.02*	0.07**	0.59**	0.54**
Admission EMS	ns	0.56*	ns	ns
Constant	64.59	16.03	148.15	116.45
R^2	0.79	0.67	0.34	0.24

*P <0.001; **P <0.05; ns: not significant

BI: Barthel Index; EMS: Elderly Mobility Scale; ADL: activities of daily living; R^2: coefficient of multiple determination

well known that even in patients with the same diagnosis, great variations exist in the degree of disability, and in their psychological reaction and adjustment to that disability. This was true also for our population. Similarly, social factors, known to significantly affect rehabilitation outcomes,[12] were diverse in nature in the study group. Hence, control groups are difficult to find in this context. The interventions in rehabilitation are also difficult to standardise. Therapists often make daily adjustments in treatment protocols even in patients with the same diagnosis due to factors such as cognition, endurance or medication effects. Finally, if the elderly, or their families, believe that they are entitled and expect to receive a particular service like rehabilitation, it becomes difficult to recruit subjects who are willing to be randomised into a control group receiving no rehabilitation. Alternatively, a control group could comprise those who, for whatever reasons, are unable or unwilling to participate in a rehabilitation programme after discharge from in-hospital stay. However, this could introduce bias into the study.

Based on our results, the most significant independent determinant of the various primary and derived indices of rehabilitation outcome was the patients' age. In this respect, increasing age is associated with a poor outcome. Although this could be the result of a Type II error if the number of "old-old" (aged 75 years and above)[13] patients is small, there are a number of possible alternate reasons for this. One is that as a person ages, function naturally deteriorates, a process that may mask any recovery, leading to an apparently static functional state. Often, it is difficult to separate the impact of age from the effects of disability itself. An alternative reason is that over-supportive caregivers may provide assistance more readily to an older person because it was more efficient or convenient to do so. The elderly person, having fewer social roles, has less opportunity to engage in activities that enable him to maintain self-care skills.[14] This can easily undermine rehabilitation efforts leading to "learned non-use". Thus, while the elderly person could perform or be taught to perform, he would not or need not, resulting in a falsely poorer recovery with rehabilitation. In addition, the concept of improvement versus maintenance of function with rehabilitation is poorly appreciated in the frail elderly. We assume that, after an initial disability, rehabilitation brings about an improvement of function. This does not always apply in the frail elderly. Instead, the sentinel event causing disability is usually the beginning of a continued, progressive loss of function. Rehabilitation may halt that decline so that he could maintain the new but lower functional state, but it would not be reflected as an improvement in function.[15] Therefore the value of rehabilitation would be unrecognised.

The impact of the patients' BI on admission on various rehabilitation outcome indices was not consistently demonstrated. This could be explained by the fact that the criteria for patient selection into the programme varied among the physicians doing initial assessments. No uniform criteria based on controlled studies exist that can reliably differentiate patients who are likely to benefit from intensive rehabilitation from those who are likely to do poorly or to recover spontaneously.[2] In rehabilitation settings, the BI correlates well with clini-

cal judgement and is predictive of various outcomes like mortality[16] and readiness for discharge to less restrictive settings.[17] While a general principle of triage, operating to select the "middle-band" of patients, was used in the initial assessment of the patients' need for rehabilitation, the inclusion of patients who were functionally poor with poorer rehabilitation potential on initial assessment could lead to a spurious appearance of poorer overall outcome with rehabilitation. On the other hand, the BI suffers from a "ceiling effect", i.e. improvement in scores for patients with a high initial score is limited because of the upper limit of the score. Therefore, patients who were "very good" improved beyond what this ceiling could measure. Non-medical and social factors, unmeasured and often unmeasurable, contribute to outcomes and reduce the ability of a regression equation to explain a large proportion of the variance in the dependent variable. However, the equations still serve to identify the independent variables that are significant in predicting BI at discharge and achievement of rehabilitation potential.

This study used statistical methods to discern the effect of therapy upon outcome. Studies elsewhere have shown that spontaneous recovery, which accounts for most of the noted improvements in functional ability, is greatest in the first month after stroke.[18] Within our study population, the interval between the onset of disability and the commencement of rehabilitation varied. Much of this information was lost in the referral process. Therefore, the actual impact of rehabilitation must be inferred with caution as spontaneous recovery could confound the effect of rehabilitation on functional gains, particularly the effect of early rehabilitation. Also, patients who began rehabilitation early were more likely to be in better health. It is also known that between 3% and 7% of stroke survivors do show late improvement. Any change seen after late rehabilitation can be attributed to that rehabilitation, but it must also be realised that late rehabilitation may be too late to have any influence. Although all the measures of functional improvement (BI at discharge, EMS at discharge, and achievement of rehabilitation potential in ADL and mobility) provided useful information to varying extent, the achievement of rehabilitation potential index performed less well in the multivariate analyses with R^2 values of 0.24 to 0.34. This could be reflective of the fact that other predictor variables (e.g. cognitive status, concomitant medical illnesses, mood status and social support) were not studied and pointed to the possibility of an underspecified regression model in the study.

In this study, no attempt was made at measuring neurological recovery for those with stroke or other neurological conditions. Generally, measures of functional ability are preferred to abnormalities on neurological examination because patients with similar neurological findings may function at different levels.[19] In addition, rehabilitation for the elderly emphasises small functional gains which may be so slight as to escape reliable measurement but may lead to great improvements in abilities. In some cases, this makes the difference between being institutionalised and being at home.[20] Therefore, carefully selected patients with "marginal functional impairment" may benefit from individualised and comprehensive rehabilitation in the Day Hospital to allow them to function independently at home for as long as possible.

We are aware of at least three limitations to our study. Firstly, the effect of age on outcome could be confounded by cognitive factors (e.g. whether older patients were more likely to be confused or have recurrent / multiple problems) and type of medical conditions (e.g. whether younger patients had more conditions that were amenable to rehabilitation), but our sample size was not large enough to analyse this in detail. Secondly, because the subjects were drawn from selected referrals rather than a defined population, the conclusions cannot be readily extrapolated to all elderly persons needing rehabilitation. Thirdly, patients showed considerable day-to-day variability in many functions, which made interpretation of change seen in the individual patient liable to error. Nonetheless, our study confirmed that a number of significant determinants could influence the outcome of Day Hospital rehabilitation for the elderly.

While the majority of discharged patients would be those who have improved functionally, significant improvement could still be demonstrated in most of our patients after an organised and comprehensive rehabilitation programme at the Day Hospital, with the younger elderly having an advantage. To look at maintenance of gains and evaluate the social and economic impact of rehabilitation, a long-term follow-up survey on a significant number of patients would be necessary. Another area of interest is the possible effect on reduction of caregiver stress. In addition, as the team approach to rehabilitation is both expensive and time-consuming, further research is needed to look into cost issues. In the meantime, this study has shown that if improved functional capacity at discharge is used as an end point, rehabilitation at a Day Hospital appeared effective even in the elderly.

REFERENCES

1. Chan K M. Day hospitals. In: Chan K M, Yap K B, Wong S F, editors. Geriatric Medicine for Singapore. Singapore: Gerontological Society, 1996:225-6.
2. Dombovy M L, Sandok B A, Basford J R. Rehabilitation for stroke: A review. Stroke 1986; 17:363-9.
3. Anderson T P, Bourestom N, Greenberg F R, Hildyard V G. Predictive factors in stroke rehabilitation. Arch Phys Med Rehabil 1974; 55:545-53.
4. Lehmann J F, DeLateur B J, Fowler R S, Warren C G, Arnhold R, Schertzer

G, et al. Stroke rehabilitation: Outcome and prediction. Arch Phys Med Rehabil 1979; 56:383-9.

5. Wade D T, Skilbeck C E, Hewer R L. Predicting Barthel ADL score at six months after an acute stroke. Arch Phys Med Rehabil 1983; 64:24-8.
6. Schoening H A, Iversen I A. Numerical scoring of self-care status: A study of the Kenny Self-Care Evaluation. Arch Phys Med Rehabil 1968: 49:221-9.
7. Katz S, Downs T D, Cash H R, Grotz R C. Progress in the development of the index of ADL. Gerontologist 1970; 10:20-30.
8. Mahoney F I, Barthel D W. Functional evaluation: The Barthel Index. Md Med J 1965; 14:61-5.
9. Smith R. Validation and reliability of the Elderly Mobility Scale. Physiotherapy 1994; 80:744-7.
10. Shah S, Vanclay F, Cooper B. Efficiency, effectiveness and duration of stroke rehabilitation. Stroke 1990; 21:241-6.
11. Heinemann A W, Roth E J, Cichowski K, Betts H B. Multivariate analysis of improvement and outcome following stroke rehabilitation. Arch Neurol 1987; 44:1167-72.
12. Silverstone B. Social aspects of rehabilitation. In: Williams T F, editor. Rehabilitation in Aging. New York: Raven Press, 1984:59-79.
13. Cheung P. The ageing population. In: Chan K M, Yap K B, Wong S F, editors. Geriatric Medicine for Singapore. Singapore: Gerontological Society, 1996:3-10.
14. Steger H G. Understanding the psychological factors in rehabilitation. Geriatrics 1976; 31:68-73.
15. Brummel-Smith K. Research in rehabilitation. In: Brummel-Smith, editor. Clinics in Geriatric Medicine: Geriatric Rehabilitation. Philadelphia: W B Saunders, 1993:900-1.
16. Wylie C M. Gauging the response of stroke patients to rehabilitation. J Am Geriatr Soc 1967; 15:797-805.
17. Granger C V, Greer D S. Functional status measurement and medical rehabilitation outcomes. Arch Phys Med Rehabil 1976; 57:103-9.
18. Twitchell T E. The restoration of motor function following hemiplegia in man. Brain 1951; 74:443-80.
19. Smith M E, Garraway W M, Akhtar A J. Therapy impact on functional outcome in a controlled trial of stroke rehabilitation. Arch Phys Med Rehabil 1982; 63:21-4.
20. Lind K. Synthesis of studies on stroke rehabilitation. J Chron Dis 1982; 351:133-49.