

# Post stroke recovery of balanced sitting and ambulation ability

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The primary aim of this retrospective audit was to determine whether sitting balance ability at initial physiotherapy assessment post stroke could predict ambulation ability at discharge. Also considered were the side affected by the stroke, sensory loss, dysphasia, whether they affected outcome and whether ambulation ability determined social destination at discharge. Forty stroke patients were treated during the 12-month study period. All patients received early physiotherapy treatment in the acute then rehabilitation wards. The average length of hospital stay was  $47.7 \pm 28.2$  [SD] days. All patients achieved independent sitting balance at discharge, with a significant improvement ( $p < 0.001$ ) from initial assessment. Twenty-seven achieved independent ambulation by discharge. This was shown to have a significant ( $p < 0.001$ ) relationship to early independent sitting balance but was not significantly related to side of stroke or sensory loss.

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An optimal level of functional ability and improved quality of life are the aims of stroke rehabilitation (Shah et al 1990). Sitting balance is a prerequisite for most functional activities including wheelchair use (Bohannon et al 1986, Sandin and Smith 1990). An improvement in sitting balance is vital in the stroke rehabilitation program to aid in, and increase, the patient's safety and independence. Bohannon et al (1986) noted that sitting balance was a significant predictor of recovery after stroke but did not specify recovery. Morgan (1994), on the other hand, investigated whether static sitting balance ability at the initial physiotherapy assessment post stroke could be used as a predictor of independent gait at six weeks post stroke and found a positive relationship.

The side affected by the stroke determines the combination of presenting signs and symptoms. Factors such as proprioceptive loss, spatial neglect and misperception of the vertical often present in the stroke patient with a left hemiplegia and have been implicated as the reasons for impaired sitting balance (Bohannon et al 1986, Rapport et al 1993). Dombovy (1990), Evans et al (1991), Granger et al (1989) and Wade et al (1985) list other problems associated with stroke which have been identified as influencing rehabilitation outcome. These problems include advanced age, prior stroke, incontinence, visuo-

spatial deficits and lack of satisfactory home care. Mayo et al (1991) mentioned the prognostic value of aphasia and swallowing difficulties which may, if not resolved, lead to inability to regain independence no matter how independent the patient is in ambulation and activities of daily living (ADL). Depression and lack of motivation have been identified as major factors which interfere with the effectiveness of physiotherapy treatment (Henley et al 1985, Mayo et al 1991).

Kent et al (1993) recognised that physiotherapists possess the skills to be able to understand the implications of the complex stroke picture and so are able to accurately predict functional task ability recovery. Despite this capability, many physiotherapists and others (Ada and Westwood 1992, Carr et al 1985, Dombovy 1990, Granger et al 1989, Kent et al 1993 and Morgan 1994) have identified the need to find a single assessment or group of assessments which can be used early post stroke to predict the patient's recovery of ambulation and independence in ADLs.

A number of authors agree that most recovery occurs within the first three to six months post stroke (Dombovy 1990, Loewen and Anderson 1990, Mayo et al 1991, Morgan 1994, Richards et al 1993 and Wade et al 1986). To enhance this outcome, Richards et al (1993) have demonstrated the need for early

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treatment intervention. In the study reported by Richards et al (1993), it was found that task specific treatment was very important during early physiotherapy intervention. This approach achieved gains superior to those achieved through early intervention with conventional physiotherapy which did not focus on specific tasks such as ambulation, but was based on a neurophysiological approach and techniques. A group of patients whose treatment was started later was also compared with the task specific treatment group. Their results were inferior to both early intervention groups. Mayo et al (1991) also identified the time delay between onset of stroke and the start of rehabilitation treatment as limiting the functional outcome.

The retrospective audit reported here was a quality assurance project undertaken in the Physiotherapy Department of Greenslopes Repatriation Hospital in Brisbane between July 1992 and July 1993. Its aims were to describe the stroke sample during this time period and to look specifically at recovery of sitting balance and ambulation ability; whether early independent sitting balance could predict independent ambulation at discharge; and whether side of stroke or sensory loss affected outcome. The occurrence of dysphasia and the relationship between this and ambulation ability as well as social destination at discharge were considered.

## Methods

Forty-six patients with stroke were seen by the physiotherapy rehabilitation team during the audit period. However, six were excluded from this group, four because they were still inpatients at the end of the study period, one because onset of stroke was more than six months prior to rehabilitation admission and one because of death. Seven patients were transferred for rehabilitation from other acute hospitals. The 40 patients included 14 females (mean age  $78.6 \pm$

$5.4$  [SD] years, range 68 to 86 years) and 26 males (mean age  $74 \pm 5.4$  [SD] years, range 65 to 89 years). The CT scan results were available for all patients. These showed 36 strokes were in the middle cerebral artery distribution, one in the posterior cerebral artery distribution, one in the anterior cerebral artery distribution, one in the brain stem and one in the cerebellum. Seventeen, or 42.5 per cent, of the patients had suffered previous strokes. Twenty-seven had left and 12 had right side strokes while one had a brain stem stroke with bilateral disability.

The physiotherapy intervention was initiated on admission to the acute medical wards within the hospital complex. It was undertaken by the physiotherapist working in the rehabilitation unit as early as possible after admission to hospital. The interval between stroke onset and this primary physiotherapy assessment was  $9 \pm 9.2$  [SD] days. At times this reflected the delayed transfer from other acute hospitals but did also reflect the medical status of patients in the early days post stroke.

Further data gathered from the patient's physiotherapy records included amount of sensory and proprioceptive loss, hemianopia, expressive or receptive dysphasia, sitting balance score at primary assessment and at discharge (see Appendix 1), ambulation ability at primary assessment and at discharge (see Appendix 2), and the date and social destination at discharge.

Since this study was undertaken retrospectively, to demonstrate the rehabilitation outcome of stroke patients, no inter or intra-rater reliability testing could be undertaken for the physiotherapists who provided records from which these data were drawn. However, all were conversant with the Motor Assessment Scale (MAS), having either undergraduate or postgraduate training in these techniques of assessment. Carr et al (1985) and Poole and Whitney (1988) have reported very good inter-rater reliability for the MAS scoring. Therefore, in this case, using the

balanced sitting component of the MAS to evaluate sitting balance when applied by a number of physiotherapists was not considered to unduly bias the results.

All physiotherapists working in the rehabilitation unit during the period of the audit participated. The treatment approach employed depended on the presenting problems found on patient assessment and utilised aspects of the motor re-learning approach to stroke rehabilitation (Carr and Shepherd 1982) as well as other facilitatory techniques deemed appropriate by the treating physiotherapists. Occupational therapy and speech therapy were undertaken as needed by the patients, with nursing staff reinforcing skills where possible.

Analysis of data was undertaken in the following manner: a Fisher Exact test was used to test the relationship between sensory loss and dependence or independence in ambulation at discharge, dependent or independent sitting balance at initial assessment and dependence or independence in ambulation at discharge, as well as the side of stroke to dependent or independent sitting balance at initial assessment. The Fisher Exact test was chosen because, on collation of the data, it was found there were fewer than five subjects in any one of the cells, thus precluding the use of a Chi Square test. A student *t* test was used to compare the score for sitting at the initial physiotherapy assessment with the score at discharge. An alpha level of 0.05 was adopted.

## Results

Information from the 40 patients admitted and discharged from physiotherapy treatment during the time period was analysed and revealed the following: 24 or 60 per cent of patients had mild, moderate or severe sensory and/or proprioceptive loss, 10 (25 per cent) had no loss, and information on six (15 per cent) patients was unavailable at primary physiotherapy assessment. A Fisher Exact test relating intact sensation and sensory loss with dependent and

**Table 1.**  
**Ambulation ability and social destination at hospital discharge.**

Walking aid	Home alone	Home with family	Hostel	Nursing home	Total patients
Nil	0	3	1	1	5
Independent single stick	5	12	2	0	19
Supervision single stick	0	1	0	0	1
Independent walking frame	1	1	0	1	3
Dependent walking frame	0	0	0	5	5
Wheelchair	0	1	0	6	7
<b>Total patients</b>	<b>6</b>	<b>18</b>	<b>3</b>	<b>13</b>	<b>40</b>

independent ambulation was applied to the data of these 34 subjects. A non significant result was found. However, nine of the 16 patients discharged to a nursing home or hostel showed some deficit. Receptive and or expressive dysphasia were found in eight patients on initial assessment. Of these patients, two were discharged to nursing homes and two to a hostel, while the rest went home.

A Fisher Exact test was applied to test the relationship between dependent or independent sitting balance at initial assessment and dependent and independent ambulation at discharge. A significant result was found ( $p < 0.001$ ). To test the improvement in sitting balance achieved during rehabilitation, a student *t* test for repeated measures was applied to initial and discharge sitting scores. A significant improvement was shown ( $t_{(40)} = 3.55, p < 0.001$ ).

When the Fisher Exact test was applied to test the relationship between side of stroke and dependent or independent sitting balance at initial assessment, no significant relationship was found. At discharge, all patients had at least Grade 2 sitting balance. If the five patients scoring a grade of 2 at

discharge were considered in more detail, there was one with a right sided stroke and left hemiplegia and four with a left sided stroke and right hemiplegia.

The number of days between onset of stroke and discharge from hospital was calculated and the average length of hospital stay was  $48 \pm 28.2$  [SD] days (range 10 to 111 days).

At discharge, six patients went home to live alone, 18 to live with their spouse or family, three went to a hostel and 13 to nursing home placement. Table 1 demonstrates the ambulation ability of all patients as well as their social status at discharge from rehabilitation. It should be noted that all patients discharged to a hostel or a nursing home had a history of prior stroke. Of those discharged to a nursing home, two were known to be previous nursing home residents.

### Discussion

The patients included in this retrospective audit were from an older age group of mid to late seventies when compared with other reported outcome studies. The predominance of male to female patients is most likely due to the fact that Greenslopes

Hospital is a veterans hospital with limited civilian inpatient admissions. The prevalence of left to right stroke (27 to 12) in the patient sample is similar to that reported by Kent et al (1993) where their incidence of left to right stroke was 25 to 10. Both studies had one patient with bilateral deficit. In other reported studies, the incidence of left to right stroke was around 50 per cent (Davidoff et al 1991, Loewen and Anderson 1990). The time span over which the studies were undertaken may have influenced this distribution.

Early instigation of a restorative rehabilitation program has been advocated by Dombovy (1990) and Richards et al (1993) who state that such a program should begin immediately on admission after stroke. In the present study, the delay to physiotherapy assessment and commencement of treatment was  $9 \pm 9.2$  [SD] days. This may be compared with the results of Shah et al (1990) reporting on the Brisbane stroke population, who cite  $17 \pm 14.2$  [SD] days delay. This delay is similar to that reported by Sandin and Smith (1990) of  $17 \pm 12.9$  [SD] days but much less than Davidoff et al (1991) who identified a delay of  $27 \pm 16.1$  [SD] days and Kent et al (1993) who had a delay of  $20 \pm 17$  [SD] days. The reduction in delay demonstrated in the present study was due to the early referral of each stroke patient by the acute medical ward physiotherapist to the rehabilitation physiotherapist. Referral by medical staff was not required.

Length of hospital stay is a most important factor considering the cost of inpatient management of stroke. The length of stay in the present study of  $48 \pm 28.2$  days (measured from date of stroke onset to discharge from hospital), compares favourably with those of other studies. These include Davidoff et al (1991), Israel,  $107 \pm 64.2$  days, Sandin and Smith (1990), USA,  $17 \pm 7.5$  days, Loewen and Anderson (1990), Canada,  $59 \pm 44$  days, Henley et al (1985), UK, 60 days, Shah et al (1990), Brisbane,  $61 \pm 45.1$

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days and Kent et al (1993), Melbourne, 64 ± 52 days.

The consensus is that most recovery from stroke occurs within the first three to six months (Dombovy 1990, Wade et al 1985). When sensory and proprioceptive impairments are present at initial assessment, Dombovy (1990) maintains that most stroke survivors recover this function within eight to 12 weeks. This statement remains controversial, as the effect on patient safety that sensory loss, neglect and other perceptual problems impose when present, or before resolution, remains a huge problem for the stroke patient (Mayo et al 1991). Henley et al (1985) noted in their study that 75 per cent of patients without sensory problems went home, but no statement on its effect on functional recovery was made. In the present study, when sensory and proprioceptive loss at initial assessment were related to dependence or independence in ambulation at discharge, no significant relationship was shown. However, there were only 24 out of 40 patients with sensory loss and this problem was taken into account during treatment and actively addressed. This may have accounted for the non significant result. Also, the high proportion of right to left hemiplegics in our study group may have affected this test of relationship as it is known that left hemiplegics tend to have greater sensory and perceptual deficits and neglect problems (Rappport et al 1993).

Can the achievement of early independent sitting balance predict ability to independently ambulate at discharge? The results presented here indicate that it can, as do those of Loewen and Anderson (1990), Mayo et al (1991), Morgan (1994) and Sandin and Smith (1990). Sandin and Smith (1990) identified that ongoing sitting balance evaluation can anticipate functional status at discharge of stroke patients receiving active therapy. This has been shown in the present study, where all patients achieved a Grade 2 sitting balance score or independent sitting by discharge. This was a very significant improvement from initial

assessment. Mayo et al (1991) noted that patients often require time to master a new skill before becoming proficient, and this often extends the rehabilitation stay.

It was found that there was no significant relationship between side of stroke and dependent or independent sitting balance at initial assessment. Bohannon et al (1986), on the other hand, demonstrated a weak correlation between side of weakness and ability to sit independently and that fewer left hemiplegics could balance than right hemiplegics. Perhaps the larger number of right hemiplegics in the present study affected the result for the reason that left hemiplegics have more sensory, neglect and perceptual problems (Rappport et al 1993).

In conclusion, this retrospective audit reported on a generally older age group of stroke patients. They received early rehabilitation therapy which was restorative in aim and led to all subjects attaining independent sitting balance by discharge from hospital. There was a highly significant relationship between independent early sitting balance and independent ambulation at discharge. Side of lesion and the presence of sensory loss showed no significant relationship to attaining independence in sitting or ambulation respectively, although this may have been due to the inequality in numbers of patients with right and left stroke included into the study.

Early restorative therapy may have some effect on reducing the length of hospital stay, as the results of the present study tend to indicate, although this may not be a consistent finding in future studies.

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**Appendix 1**  
**Motor Assessment Scale for Balanced Sitting**  
 (Carr et al 1985)

<b>SCORE</b>	<b>DESCRIPTION</b>
1	Sits only with support. (Therapist should assist patient into sitting).
2	Sits unsupported for 10 seconds. (Without holding on, knees and feet together, feet can be supported on floor).
3	Sits unsupported with weight well forward and evenly distributed. (Weight should be well forward of the hips, head and thoracic spine extended, weight evenly distributed on both sides).
4	Sits unsupported, turns head and trunk to look behind. (Feet supported and together on floor. Do not allow legs to abduct or feet to move. Have hands resting on thighs, do not allow hands to move onto plinth).
5	Sits unsupported, reaches forward to touch floor. do not allow patient to hold on. Do not allow legs or feet to move, support affected arm if necessary. Hand must touch floor at least 10cm in front of feet).
6	Sits on stool unsupported, reaches sideways to touch floor, returns to starting position. (Feet supported on floor. Do not allow legs to move, support affected arm if necessary. Patient must reach sideways not forward).

**Appendix 2**  
**Ambulation scale completed at discharge**  
 (compiled by the Physiotherapy Department of Greenslopes Repatriation Hospital)

<b>SCORE</b>	<b>AMBULATION ABILITY</b>
0	No walking aid
1	Single stick – independent
2	4 point stick – independent
3	Walking frame/ easy walker – independent
4	Single stick – dependent
5	4 point stick – dependent
6	Walking frame/ easy walker – dependent
7	4 point stick with physical assistance
8	wheelchair – dependent