CHAPTER 5

DISCUSSION

This discussion focuses on explaining the results of the study outlined in Chapter 4 and relating them to other research findings. The discussion involves possible clinical applications and limitations of the study and the implications for further research.

5.1 ABILITY TO WALK INDEPENDENTLY

In this study 90% of the subjects regained independent walking function (Table 4.5) This is better than the 80% of subjects who were able to walk independently six months after the event reported by both Wade et al (1987) and Skillbeck et al (1983). However only two subjects in this study regained a walking speed faster than 1.0 m/s whereas one third of subjects the study by Wade et al (1987) regained normal walking speed. The walking function results are also markedly better than those of Olsen (1990). In his study, of the 54 patients with a BI≤60, only 17% were able to walk independently and a further 55% were able to walk with assistance. Of the 18 patients with a BI >60, 78% were able to walk independently. In the three studies referenced above, the patients received rehabilitation training. This demonstrates that the subjects in this study achieved relatively good independent walking function with little or no post stroke rehabilitation training. These results support the findings of Hale and Eales (1998) based on the results of a descriptive survey undertaken in the same Soweto community that recovery of walking after stroke appears to be good after minimal rehabilitation. However it raises the possibility that, considering the relatively low socioeconomic conditions in Soweto, those stroke survivors with low initial Barthel Index score do not survive to become the non ambulant or individuals requiring assistance for walking that are seen in other study results. It is also a possibility that, considering those same socioeconomic conditions, there is an element of "forced use" that actually drives the individual after stroke to achieve greater independence in this environment. Therefore further studies are needed to confirm these results.

5.2 WALKING SPEED

In this study the average walking speed was 0.5514 m/s (±0.2850) (Table 4.7). It is considerably lower than the normal walking speed which has been reported to range between 1.14 and 1.69 m/s (Murray et al 1970; Bradstater et al 1983). It is also much slower than the velocity of 1.32 m/s needed to cross an intersection in the period allowed by the pedestrian signal light (Sciurba and Slivka 1998).

However it compares with the results of 0.635 m/s (±0.2483) of Goldie et al (1996) and to a lesser extent with the 0.88 m/s (±0.43) of Dean et al (2001). In both of these studies self paced walking speed was calculated over a short distance without an acceleration or deceleration phase unlike this study where speed over ten metres was calculated from a standing start. This could have contributed to the slower times in this study. The walking speed for the studies by Dean et al (2001) and Goldie et al (1996) was measured after four to eight weeks gait rehabilitation training respectively whereas in this study post stroke gait training was negligible. However only two subjects walked at a speed greater than 1m/s which is considered normal.

5.3 FUNCTIONAL WALKING CAPACITY

Subjects after stroke walked a mean distance of 218.5 metres in six minutes (Table 4.7). This is even less than the 261.5 ±128.4m reported by Dean et al (2001) and 268 metres by Eng et al (2002). This result compares poorly with results of the study by Eales and Stewart (1996) on exercise capacity of elderly hypertensive patients in South Africa where the mean distance covered by a group of black subjects from an urban community was 354 metres and by subjects from a rural community, 346 metres. The actual distance walked in six minutes (Figure 4.3) was significantly less than that predicted by the reference equations for normal healthy individuals (Enright and Sherrill 1998). On average the distance walked by subjects after stroke was 39.58% of the predicted distance. Again this is less than the 49.8% reported by Dean et al (2001). It is also considerably less than the walking distance necessary to visit common community destinations (600 metres) reported by Sciurba and Slivka (1998).

These objective results though using a small sample are indicative of significant walking disability and are difficult to reconcile with the conclusion made by Hale and Eales (1998) from their study of a similar subject population that "these walkers ……were able to walk as far as they wished many times a day".
The study by Robinett and Vondran (1988) that investigated functional walking speed and distance in urban and rural communities may help explain the differences above. Their study results showed that the walking speeds and distances depended on the size of the community. It may be possible that the functional walking capacity needs of the subjects in the study by Hale and Eales (1998) were being met within the marked limitation of walking capacity found in the present study.

Recognising the high percentage of recovery of independent walking with minimal or no rehabilitation training, the relative forty percent deficit in the six minute walking distance of the distance calculated using normative equations, the self-paced walking speed at half of that estimated to be necessary to cross a road safely raises the question of the potential for improvement of the walking capacity of individuals following stroke in the Soweto community to a structured, training programme. This would be home based, bearing in mind the difficulty demonstrated by subjects to return for follow-up testing. It could focus on increasing walking speed and endurance (and any impairments that could be identified in a pilot study) using outcome measures that have been shown in this study to be simple to administer and well tolerated by the subjects.

In this study the distances calculated by using the self paced gait speed for two and six minutes underestimated the actual distance covered for the 2MWT and for the 6MWT by 10.3% and 7.4% (Table 4.7) respectively.

This differs from the results of Dean et al (2001) and Eng et al (2002) in that in both of the studies the distances calculated using the self paced gait speed overestimated the actual distance covered for the 6MWT. This can possibly also be explained by differences in calculating self paced gait speed. Dean et al (2001) concluded that the use of the ten metre walking speed test to estimate endurance is not appropriate since walking speed over a short distance overestimates the distance walked in six minutes. Using the protocol advocated by Watson (2002) for the 10 metre walking test appears to eliminate this danger and there is a strong correlation (Figure 4.1) of the distance calculated from the results of the ten-metre walk test multiplied by 360 and the 6MWT distance. Controversially, though speed and endurance are two different aspects of walking capacity they have a strong correlation as seen in Figure 4.1 and the ten-metre walk test results could possibly be used to estimate functional walk test performance. This recommendation would only be made if the ten-metre walking test protocol used in this study was followed. One of the limitations of the 6MWT is the minimum space required for the test, being approximately twenty eight metres. Most clinics have a passage with a minimum length of fourteen metres, which is required for the ten-metre walking test.

There was a high correlation between the results of the 2MWT and the 6MWT. Thus the 2MWT could be used to calculate functional walking distance. A subject in this study (who was unable to complete the 6MWT) had a normal walking speed of 0.13 m/s and was only able to walk 11.98 metres in two minutes which is evidence of significant walking disability. Therefore though she was able to walk independently using a walking aid she required a wheelchair for community mobility and she may have benefited from therapeutic intervention targeting functional walking ability i.e. walking to the toilet. This use of the functional walking tests to identify characteristics of people with diminished mobility capacity who will require appropriate support requires further investigation.

5.4 WALKING ENDURANCE

Endurance has been defined as the time limit of a persons ability to sustain a particular level of physical effort (McArdle et al 1996) and a reduction of distance traveled over time would have indicated that endurance was challenged during the test (Eng et al 2002). The very high correlation of results (Figure 4.2) for the 2MWT and 6MWT (R^2 = 0.9746) indicates this was not the case in this study and that these results better represent a measure of functional capacity of the subjects. This agrees with the results of the study by Eng et al (2002) where their subjects paced themselves at a speed that was maintained throughout the walk.

With regard to the physiological workload during the walk tests (Table 4.8), the intensity of exercise during the 6MWT can be classified as moderate according to the HR (mean of 60.83% of age predicted maximum). The range was 40%-86%. Nine (41%) of the subjects demonstrated a mean exercise intensity less than 60% of age-predicated maximum. This indicates possible capacity for endurance training. All but one subject in this study remained within the 85% of age predicted maximum heart rate that is recommended as the upper limit for submaximal exercise testing. This patient was one of the oldest in the group, walked with a tripod and had pain that limited walking. These results are very similar to those reported by Eng et al (2002) where the HR reflected an exercise intensity of 63% (±9) of age-predicted maximal HR. The functional walk test together with a measure of exertion (HR) may provide a level of an individual's ability to sustain submaximal activity e.g. activities of daily living and therefore to monitor change in response to therapeutic intervention.

5.5 THE IMPACT OF IMPAIRMENT (PAIN) ON WALKING

In this study impairment was represented by pain. Although almost two thirds of Study Group 2 reported pain sufficient to limit walking, no significant difference was found between means of the results (Table 4.8) for those subjects with and with no pain in the lower limb, hip, knee or ankle for either the ten-metre walk test or the 6MWT. There was little difference in the number of subjects reporting pain in the individual joints of the lower limb with slightly more complaining of ankle pain than either hip or knee pain. Though the sample size is relatively small the results indicate that though pain in the paretic lower limb is a common symptom it does not appear to negatively impact on self-paced walking speed or distance walked in six minutes. The results for the reported presence of knee pain in 50% of the sample is in fact greater than the 33% reported by Hale and Eales (1998), however the incidence of hip and ankle pain are not reported in their results. Though in this study the walking tests results did not significantly correlate with impairment represented by pain, the study by Eng et al (2002) showed that functional walk distances and self-paced speed correlated very well with impairments of balance function and the Chedoke-McMaster impairment score and to a lesser extent with both plantar-flexion strength on the paretic side and spasticity. Further investigation is required to clarify the relationship between specific impairments and the walking tests.

5.6 THE USE OF MOBILITY AIDS

Ten subjects from Study Group 2 (Table 4.5) required mobility aids to walk independently and a further subject who could not be tested used two elbow crutches. The 37% of subjects requiring a mobility aid in this study compares favourably with the results (49%) of Hale and Eales (1998) and is almost double the 18% dependent on a physical aid reported by Wade et al (1987). That access to mobility aids may be important in a South African context was reinforced to the researcher when she visited one of the subjects at home to remind her of her appointment for the walking tests. The subject was visiting a friend two houses away and she was observed making her way home using the walls and fences to assist her. When the same subject arrived at the hospital the following week for the walking tests it was realized that she could not walk independently. A borrowed tripod solved the problem and she completed the tests. Her own tripod would allow her to independently visit friends across the road (a requisition form was completed before she returned home). It is also an example of how the confined space, proximity to friends and limited access to personal means of transport may contribute to the relatively high levels of recovery of walking ability found in this cohort. Robinett and Vondran (1988) documented distances and velocities that individuals must walk to function independently in their communities and found that these parameters vary depending on the size of the community. They suggested that measurements should be taken locally to allow therapists to adequately prepare patients for their return to the community.

5.7 LEVEL OF ACTIVITY

Although the mortality rates for the Barthel Index group with a score less than 60 is 30.7% the prognosis of survivors does not appear to be uniformly poor (Table 4.10). In this study 38.4% of the group with BI≤ 60 had a second BI score of ≥ 85 indicative of mild or no disability. This is better than the results of the study by Wade and Hewer (1987) where 51.3% of patients with an initial BI of 0-9 (on the scale 0-20) died and only 25.5% recovered to a level of 15-19 on the same scale indicating moderate to mild disability. The results of this study are in line with those of the Copenhagen Stroke Study (Jorgensen et al 1995a) where almost one third of the patients that survived initially severe or very severe strokes were discharged with no or only mild disability in ADL function. However 30.7% of the group with BI≤ 60 had a second BI score of ≤ 75 indicating moderate disability. It is this group who need specific support e.g. supervised practice of transfers for carers; home evaluation for mobility and toileting aids; monitoring of carer needs and stress levels.

Studies by Kalra et al (2005) and Meijer et al (2005) found a low initial BI score predictive of poor discharge outcome. Nine patients (of the original 69) with an initial BI of less than forty did not return for their follow up appointment and could not be found to confirm the diagnosis and their subsequent ability level. It is possible that a number of these patients died. This may have strengthened the case of this study for using the initial BI to predict survival. The ability of the BI to predict survival and /or activities merits further study.

Using the BI as a measure of recovery, the mean score at three to six months was just over the 85 level which according to Granger (1979) was the cutoff for independence with minimal assistance. The BI was able to measure change from a mean of 49.39 to 85.78 or from "severely disabled to relative independence"

(Granger 1979). However the fact that the mean walking speed was only 0.55 m/s and the distance walked in six minutes only 218.5 metres are indicative of significant walking disability. This demonstrates the ceiling effect of the BI regarding walking function.

5.8 AGE OF SUBJECTS WITH STROKE

The mean age for the total sample of subjects with a diagnosis of first stroke (Table 4.11) was 60.12 years (11.57) and for the Study Group (Table 4.4) was 57.3 years (11.26). This is low, relative to the results of other stroke studies (Olsen 1990; Jorgensen et al 1995a; Goldie et al 1996) and may be a factor contributing to the relatively good results of the walking tests of these subjects as walking ability is known to decline with age. It is also indicative of the fact that stroke is a cause of significant disability in the economically active age sector of the South African population.

5.9 STUDY LIMITATIONS

During this study specific difficulties were encountered with the collection of data. The first was obtaining a confirmed diagnosis of stroke. Though the researcher had requested (and received) permission to conduct the study from the Chief Neurologist and the Professor of Medicine there had been no request for assistance regarding confirmation of the patient's diagnosis. It was the researcher's responsibility to confirm the diagnosis from the ward medical staff or senior nursing staff or the ward clerk who had access to the patient's discharge notes and was responsible for filling in the discharge summary in the ward patient register. The medical wards at Chris Hani Baragwanath hospital are very busy with a high turnover of patients due partly to the HIV/Aids pandemic. The number of patients admitted with a provisional diagnosis of stroke was a small percentage of the daily admissions. In practice it was often difficult to find a confirmed diagnosis in the patient's file within the first week of admission. The researcher found that the most reliable source of this information was the patient's discharge summary notes. The difficulty was that the patient usually left the hospital that same day. This resulted in patients being accepted into the study with a provisional diagnosis and then being excluded when a non stroke diagnosis was confirmed (Table 4.3). There are two copies of the discharge summary. A copy is sent with the patient's file to hospital records and the other is given to the patient in the patient's own personal file. This system of the patient being responsible for their own notes was found to work very well in practice. When the researcher visited the subjects at home to confirm both the diagnosis and the appointment for the second test the notes were always available carefully wrapped in plastic bags. The hospital is also in the process of changing to a computerized system of recording patient's information. This would facilitate the development of a register of patient's with a diagnosis of stroke which in turn could benefit this group in many ways including coordinated patient follow up and future research. To an extent the low subject numbers of this study are attributed to the difficulty confirming the diagnosis.

The second difficulty encountered in data collection was confirming patient appointments for the second test and the difficulties they experienced returning for the walking tests. Certain factors that appeared to facilitate a subject's returning for the second test were: if the researcher or her assistant had personal contact with the subject's family or caregiver; a stable home environment and support structure as well as telephone contact. Although 39 of the 69 subjects (Table 4.3) had telephone numbers listed on their patient information sheet (Appendix 3) these were not found to be a generally reliable means of contacting subjects. A factor that was associated with non return was a low initial BI score. It is known that four of these subjects died and a further nine subjects with a BI less than 40 did not return for their appointment and could not be found to confirm a diagnosis of stroke which would have allowed their information to be included in this study. It is possible that some of these subjects also died. This would have changed the subject characteristics in Table 4.4 and more particularly the Barthel Index information in Table 4.10 and could have strengthened the argument for using the BI to predict mortality and significant disability. In practical terms this could mean that community clinics are alerted to the return home of a patient with a BI less than 60 who could then be monitored in terms of progress and caregiver support.. Other factors impacting on low return for the walk test appointment were financial limitations, inability to access public transport (mini-bus taxis) and the lack of a caregiver to accompany the subject to hospital. Hale and Wallner (1996) and Hale et al (1999) corroborate these findings. Duncan et al (1998) provides evidence that this is a universal constraint in a study of a home-based exercise programme for individuals with mild and moderate stroke conducted in Kansas City. Only three of the 20 subjects could have participated in the study if the transportation for baseline and post-intervention assessments had not been provided. This is a factor that must be taken into account when planning patient intervention studies locally.