International Journal of Geriatrics and Gerontology

Riad J, et al. Int J Geriatr Gerontol 8: 184.

www.doi.org/10.29011/2577-0748.100084

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Research Article

The Relation between Walking Capacity and Quality of Life after Stroke: A Study of Consecutive Patients in a Swedish County Hospital

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Citation: Riad J, Hattevig C, Nasic S, Romanus B (2024) The Relation between Walking Capacity and Quality of Life after Stroke: A Study of Consecutive Patients in a Swedish County Hospital. Int J Geriatr Gerontol 8:184. DOI: 10.29011/2577-0748.100084

Received Date: 18 February, 2024; **Accepted Date:** 23 February, 2024; **Published Date:** 26 February, 2024

Abstract

Background and Purpose: The incidence of stroke has decreased over the last 50 years but the seriousness of the disease has not. Stroke is the major cause of disability in the adult population. The exact degree of walking impairment and possible treatment of gait deviations is seldom sought. The purpose was to identify clinical and observational gait variables with effect on walking capacity and quality of life after stroke. **Methods:** Nottingham Health Profile self-reporting quality of life questionnaire, Barthel´s index of activities of daily living, Timed up and Go and Scandinavian Stroke Scale were used. Five meter walking velocity, positioning of the foot and knee during stance and swing phase and a clinical examination were assessed. **Results:** 141 patients with first time cerebral infarction or hemorrhage stroke without other diseases influencing gait were included. Sixty were females and 81 men, median age 74 years (range 29-103 years) were studied median 5,4 months (range 3,0-8,2 months) after admission. The stroke patients scored worse in quality of life compared to age and gender matched controls. Although the majority did well on the functional tests, 68 had deviations on the observational gait analysis and the clinical examination with one or several pathological findings. There was an association between walking speed and quality of life and gait variables. **Conclusion:** After stroke walking impairment is common and can be caused by clinically subtle neurological deficits. The gait impairment could influence quality of life and could if identified be treated.

Keywords: Stroke, Quality of Life, Gait, Walking Aid, Brace

Introduction

The incidence of stroke has decreased over the last 50 years, but the seriousness of the disease has not. Stroke is the major cause of disability in the adult population with a life time risk of 14.5% for men and 16.1%for women [1]. Eighty percent of the patients are older than 65 years. Stroke patients have a high frequency of recurrence and mortality, and generate yearly over one million hospital days in Sweden [2]. Early admission to a highly specialized stroke unit improves the end result. After confirming the diagnosis and providing adequate medical treatment, care is focused on functional training programs that concern daily activities and movement exercises. Early mobilization decreases risks of complications, contributes to recovery and increases possibility of early return to independent living [3, 4].

Apart from residual weakness foot deformity and stiff knee gait can be a cause of walking impairment after stroke. Even if the clinical findings with mild deformity are subtle, they can still cause major functional problems. The identification of patients with treatable walking impairment is rarely considered. Technological investigation of gait that can contribute to a more specified diagnosis and provide a guide for treatment is available, but seldom used [5-7].

Both caregivers at the stroke unit, at the rehabilitation unit and in the community are often unaware of possible specific treatment which results in few referrals to the orthopedic surgeon.

There are several different treatment modalities. Stretching, orthosis/braces, botulinum toxin injections or surgery with tendon lengthening and transfer can be indicated [5, 8-13].

Several authors have reported on quality of life and activity of daily life among stroke survivors. However, gait impairment is seldom well defined and often limited to whether the individual is able to walk or not. Therefore, correlation between quality of life and more detailed walking capacity has not been well investigated in stroke patients [14-16].

The aim of this study was to identify variables which could have major effects on walking capacity after stroke and to investigate the correlation to quality of life. Additionally, we wanted to make an inventory of the frequency of walking aid and foot and ankle orthosis/braces.

Patients

Approval from the ethic committee was obtained for the study. Skövde County Hospital is the only stroke referral hospital for the 172 000 inhabitants in the region. Between July and November 2002, 253 consecutive patients with stroke possible for inclusion were registered. The patients were examined and diagnosed by a stroke physician according to the WHO criteria [17]. Inclusion criteria were first stroke ever. Patients with subarachnoid and subdural hemorrhage, transitory ischemic disease or amaurosis fugax, as well as patients with other diseases or deformities that could influence walking were excluded.

Three months after admission to the stroke unit the patients were contacted by letter and asked for participation. Fifty-five (22%) were dead. Fifty-seven (23%) patients did not participate in the follow up for different reasons, where 23 did not want to or lacked the energy to participate, 13 patients suffered from senile dementia, and 6 suffered from other conditions (1 hip fracture, 1 dizziness, 1 psychiatric disease, 1 dysphasia and two patients were excluded for unspecified other disease). Six lived in other regions at a long distance. Six could not walk and 3 patients were missed for follow-up.

The remaining 141 (55%) were available for follow up after a median of 5,4 months (range 3,0-8,2 months) and gave their written consent to participate.

Methods

All questionnaires regarding quality of life were sent out prior to the clinical examination. One specially trained and instructed physiotherapist from the Orthopedic Department examined and interviewed all patients according to a standardized protocol. Some patients wanted to and were examined in their home and the remaining visited the hospital.

Quality of life questionnaires

The Nottingham Health Profile (NHP) is a self-reporting questionnaire of quality of life that measures the subjective emotional, functional and social impact of disease. NHP consists of two parts and is validated, reliable and translated to Swedish [18-20]. In this part of the study the patients were stratified in age groups and compared to the corresponding normal population.

Functional assessments

The Barthel´s index of activities of daily living (Barthel) that measures functional independence in personal care and mobility was used [21]. It consists of 10 variables from daily life activities.

The functional and validated test Timed up and Go (TUAG) was used and provides information on the time and quality of movement from a sitting position to standing up, walking 3 meters and returning to sitting [22]. For measurement of the neurological impairment the Scandinavian Stroke Scale (SSS) was used [23].

Observational Gait analysis and clinical assessment

The patients walked 5 meters with and without shoes and measurement of speed and cadence was obtained. The positioning of the foot and knee during stance and swing phase was assessed. In stance phase it was determined whether the heel, foot flat or the toes made initial contact with the floor. Additionally, it was registered if heel contact occurred at all and if there was knee hyperextension. In swing phase it was noted if the foot in relation to the tibia was dorsally flexed to or above neutral position or all the time in relative equinus/drop foot.

Muscle tone in the calf muscle on the affected side was registered [24]. Dorsiflexion strength of the foot at the ankle on the affected side was assessed by a “5 point scale” - normal strength=5, good=4, fair=3, poor=2, trace=1 and no trace of contraction=0 [25]. Active and passive range of motion from the hip, knee and ankle joints was measured.

Walking aid and braces

The type and design of walking aids and braces was noted as well as if the devices were used outdoor and/or indoors. How well the equipment fitted was evaluated.

Statistical Analysis

In order to evaluate the strength of associations between quality-of-life variables and variables for observational gait analysis and walking speed Spearman’s correlations coefficients was calculated. The correlations coefficients were based on bivariate correlation tests. All calculations were done using SPSS version 15.

Results

Of the 141 patients that met the inclusion criteria 60 were females and 81 men. The median age was 74 years, range 29-103 years. The Computed Tomography scan (CT) performed at admission in all patients but one, revealed cerebral infarction in 123 patients and cerebral hemorrhage in 17 patients. The mean hospital stay was 10 days. The majority, 112 patients returned directly to their previous independent private living, 22 were discharged to homes for elderly and 7 to other hospitals.

Quality of life questionnaires

In the quality-of-life questionnaire the stroke patients scored worse in all domains compared to age and gender matched controls. The higher score the worse reported quality of life. (Figure1).

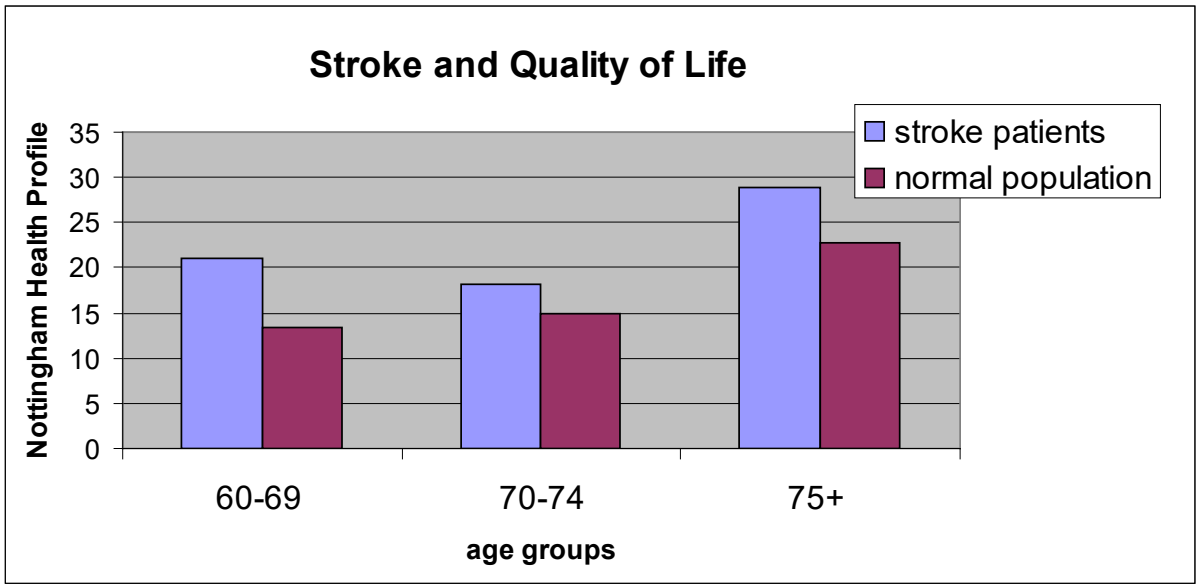

Figure 1: Quality of life and age groups after stroke

Functional assessments

The Barthel´s index of activities of daily life showed most patients on a high score meaning good ability. Of 141 patients, 106 scored above 90 points where 100 were considered normal. Similarly in the Timed Up and Go test 104 patients scored normal or nearly normal. Also, in the Scandinavian Stroke Scale the majority of patients scored high.

Observational gait analysis and clinical assessment

In 68 patients (48%) the observational gait analysis and the clinical assessment revealed one or more pathological findings with deviation from normal. Twenty-seven patients had drop foot in swing, 35 heel not down at initial contact, 14 hyperextension of the knee during stance and 51 decreased dorsiflexion strength (less than 3 on the "5 point scale"). Fourteen had decreased ankle dorsiflexion in passive motion (less than 5 degrees over neutral). Finally, 16 had an increased muscle tone in the calf muscle plantar flexors (triceps surae) on the affected side. (Table 1).

Variables		Responses N=68	Percent of Cases N
Observational gait analysis	Dropfoot	27	39,7%
	Heel not down at initial contact	35	51,5%
Clinical	Hyperextension of knee during stance	14	20,6%
	Decreased dorsiflexion strength*	51	75,0%
	Decreased passiv dorsiflexion**	14	20,6%
	Increased muscle tone in calf muscle	16	23,5%

Table 1: Variables from the observational gait analysis and clinical examination in the 68 patients (of 141) with one or more pathological findings.

The mean time for 5 meters walking with shoes was 7, 7 seconds and barefoot 8, 2 seconds.

The correlation between walking speed and the observational gait and clinical variables were statistically significant but the strength of associations was only fair. There was a moderate to good correlation between walking speed and quality of life, NHP 1. (Table 2). The other variables were not correlated.

Correlation	Observational gait analysis and strength			Quality of life	
Walking speed - 5 meter	Drop foot	Heel not down at initial contact	Decreased strength at dorsiflexion	Nottingham health profile 1	Nottingham health profile 2
with shoes	0,460*	0,444*	0,483*	0,554*	0,470*
barefoot	0,413*	0,409*	0,476*	0,523*	0,414*
* The pairwise correlation is statistically significant at 1%-level.					

Table 2: Correlation coefficients between walking speed 5 meters and variables from observational gait analysis and strength and quality of life.

Walking aid and orthosis/braces:

Walking aid was prior to stroke used by 23 patients (16%) and after stroke by 69 patients (49%). Before stroke no patients had walking aid indoor but after stroke 38 (27%) did. (Figure 2).

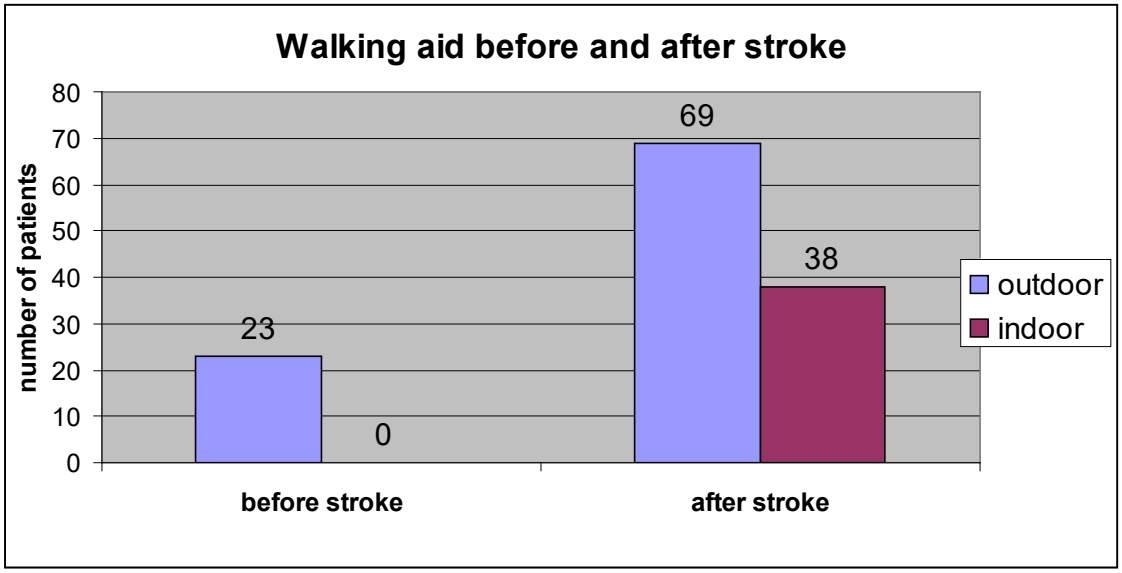

Figure 2: Walking aid before and after stroke.

In the group with pathological findings on the observational gait analysis and the clinical examination there was a marked increase in frequency of walking aid from 15 patients (22%) to 47 patients (70%). In the group without pathological findings 8 patients (11%) had walking aid before stroke and 22 patients (30%) after stroke.

Of 8 patients that had a brace 5 used it. Three were used outdoor, 1 always when walking and in one patient once in a while. These five braces were considered to fit well. In three patients the brace was not used and did not fit. Three braces were toe-off and five were premade pp-braces made of polypropylene.

Discussion

Most patients returned to their previous form of living after a shorter hospital stay even if some were in need of assistance which was provided by the primary care giver in the community.

Overall, the selected stroke patients in our study had relatively high scores in the activity of daily living test (Barthel) and the neurological assessment (SSS). The timed up and go test (TUAG) also showed high function. Nevertheless, they reported low quality of life (NHP) compared to an age matched normal population. Quality of life correlated relatively well to walking velocity and to some other gait variables corresponding to weak dorsiflexion of the foot. In addition, we found an increase in walking aid after stroke.

The functional tests consist of several different tasks but walking capacity is only a small part of the overall assessment. Therefore, these tests make it difficult to understand where effort for improvement should be directed when focusing on walking impairment. By using the observational gait analysis and the clinical examination, as in this study, we attempted to investigate if any particular part of gait could be predictive for lower scoring in the quality-of-life questionnaire or affect walking. Our focus was to find variables that could indicate a possibility of specific orthopaedic treatment.

Patrick J et al report on the use of three dimensional gait analysis and states that specific gait patterns and deviations from normal can be identified among stroke survivors [7]. Fuller also confirms the benefit of an objective quantitative assessment that three dimensional gait analysis provides [6]. With additional dynamic electromyography the assessment becomes even more conclusive [12]. However, these techniques are not easily accessible and have been used only sporadically in this patient group in Sweden. Our relatively easy and quick assessment with observational gait analysis in combination with a specific clinical examination can be used even in the patient's home.

The increase use of walking aids after stroke might have several causes. The availability and the degree of prescription in an early stage influence the number. The lack of follow-up after a few months with a reassessment may also be a cause of the continued high number of walking aids. The patients in this study often felt the walking aid provided safety and confidence when moving outdoors. We found a marked increase in walking aid in both groups but a greater increase in the group with pathological findings. One might speculate if many of those with drop foot, inability to heel strike and with weakness in ankle dorsiflexion managed with the walking aid and never reflected on the possibility of using a brace or receive other treatment. Other authors have reported on treatment of drop foot either with brace or by reducing spasticity [13], [26]. Even if 27 patients had drop-foot and 35 did not have heel contact initially in stance phase, very few used braces. It would be reasonable to assume that if the need of walking aid is high as reported the need of brace would also be high. We believe the low number of braces and the high number of walking aid is causes by a lack of knowledge and of proper assessment of the patient's walking impairment.

In Sweden the incidence of stroke among the elderly population is high and with an increasing elderly population is likely to become even higher. The Swedish national program named Riks-stroke started 1994 and produces yearly reports on several epidemiological and health related questions in the entire stroke population [2]. Among other things, Riks-stroke reports the ability of movement capacity outdoors and indoors, independently or with help, 3 months after stroke. Even if this number gives a rough idea of the functional status, it does not provide enough information about walking capacity. The stroke patients consist of a heterogeneous group, where some would possibly benefit from a more detailed assessment of more keen and could be more susceptible to improvement of their walking capacity, than others. The Riks-stroke questionnaire fails to identify those individuals.

This was a retrospective study and carries limitations. Of the total number of patients admitted with stroke many were excluded for different reasons that we only to some extent can report on. Additionally, the observational gait analysis that was used has limitations in relation to instrumented three- dimensional gait analysis. The three-dimensional gait analysis provides a much more objective and quantitative tool. Social factors of importance for well-being were not controlled for in this limited investigation.

Conclusion

After stroke gait impairment is common and can be caused by clinically subtle neurological deficits. Even relatively mild pathology in the lower extremity after stroke can have a great impact on gait. The different health care units providing care for stroke patients need to be aware of the relatively common gait impairment, which could influence quality of life and could possibly be treated. A specific screening program a few months after stroke could be motivated.

Acknowledgment: Eric Bertholds MD Skaraborg Hospital.

Funding: The study was supported by the Research fund at Skaraborg Hospital.

Conflicts of Interest Disclosures

There is no conflict of interest.

Kindly see collected Conflict of Interest information from all co-authors

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