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Wheelchair Compliance in Stroke Patients: A Single Center Experience

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Abstract

Introductions: To define wheelchair suitability in patients with stroke due to a cerebrovascular event (CVE).

Materials and Methods: The study included 40 patients with a diagnosis of stroke. Demographic and clinical characteristics of the patients were noted. All wheelchair parts were evaluated by the same rehabilitation physician. In general, a wheelchair was considered inappropriate if at least three parts were inappropriate. The dependence and satisfaction of the patients in wheelchair use were evaluated.

Results:: The mean age of the patients was 68.07±7.24 years. Seat height (n=24, 60%), seat depth (n=16, 40%), footrest (n=24, 60%), cushion (n=26, 65%) and belt (n=30, 75%) were the most common inappropriate factors. It was determined that 85% of the patients were using an inappropriate wheelchair, 60% of the wheelchairs were purchased on prescription, 90% of the patients were completely wheelchair dependent, and only 2.5% were using a powered-wheelchair. Wheelchair-related falls were reported by 13 (32.5%) patients.

Conclusion: The results of this study showed that 85% of patients with stroke due to CVE were using inappropriate wheelchairs. These patients require the use of a wheelchair designed specifically for the patient.

Key words: Wheelchair; stroke; appropriateness; ergonomics.

Introduction

Stroke is the third leading cause of death in developed countries after heart disease and cancer, and the second leading cause of death worldwide (1). Although the incidence of stroke varies according to countries, it is reported to be 258 per 100,000 worldwide and 177 per 100,000 in Turkey (1,2). Early and effective treatment methods for risk factors that increase the incidence of stroke and the development of post-stroke medical care facilities have resulted in a decrease in stroke mortality and an increase in life expectancy. Although there is a decrease in mortality, physical and social losses are still observed in a significant proportion of patients (3). Patients who have lost the ability to ambulate or who need to expend a lot of energy to ambulate require the use of a wheelchair. Wheelchair use aims to prevent deformity and contracture formation, increase functionality, protect balance, and prevent pressure sores (4,5). The wheelchair should be designed according to the needs of the patient. The area and purpose of the patient's chair should be taken into account, and wheel placement, width, rim diameter, footrest and armrest height should be planned accordingly (6). The most sought- after features are that the wheelchair can be used independently, has low resistance in the wheels, and it is ergonomic and inexpensive. However, studies have shown that many wheelchair users do not have a suitable wheelchair (4,7). There are studies in the literature on ideal wheelchair biomechanics, in which it has been shown that wheelchair suitability and satisfaction are important for better mobilization (3,7-9). Although there are studies in the literature evaluating the suitability and satisfaction of wheelchair users due to spinal cord injury and cerebral palsy, to the best of our knowledge, there are no studies of patients who are immobile following a stroke (3,7). Therefore, the aim of this study was to evaluate wheelchair suitability and patient satisfaction in patients who use wheelchairs after a stroke. It was aimed to identify the points that should be focussed on by documenting the most common causes of wheelchair incompatibility in stroke patients.

Materials and Methods

This cross-sectional, descriptive study included patients with stroke who presented at the Physical

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Medicine and Rehabilitation Clinic of Local City Training and Research Hospital between November 2022 and January 2023. The study inclusion criteria were defined as wheelchair use, age ≥18 years, and a sufficient level of literacy to complete the study. Patients were excluded from the study if they had a cognitive dysfunction, were illiterate, had aphasia, or any disease other than stroke that required wheelchair use (such as spinal cord injury, cerebral palsy, multiple sclerosis, polyneuropathy, amputation).The demographic and clinical characteristics of the patients (age, gender, height, weight, education level, disease duration, disease etiology) were noted. Functional outcome was assessed using the Functional Independence Scale-Motor Score (FIM-MS). The FIM includes eighteen items measured in 2 areas: motor (13 items) and cognitive (5 items). The maximum scores that can be obtained in the functional independence scale- motor (FIM-M) and the functional independence scale-cognitive (FIM-F) are 91 and 35, respectively. The total FIM score can vary between 18-126. Higher scores indicate increased independence. Reliability and validity studies of the FIM in Turkish for stroke patients were conducted by Küçükdeveci et al. (10). Functional outcome assessments were cross-sectional for the motor area, using the Functional Ambulation Scale (FAS) and Brunnstrom staging.
The FAS is a scale that evaluates the ambulation ability of patients. It is divided into six categories rated from 0 to 5. FAS 0: non-functional ambulation, FAS 5: independent ambulation (11). Brunnstrom staging is used to evaluate improvement in motor function. The lowest stage (the flaccid stage and no voluntary movement) is stage 1, and the highest stage (the period with isolated joint movements) is stage 6. Hand, upper extremity and lower extremity motor function can be evaluated with this staging. The validity and reliability of this scale have been previously proven (12). Evaluations were made in respect of whether the wheelchair was battery powered or manual, whether it was obtained with or without a prescription, by which department it was prescribed, any history of falling while using the wheelchair, usage area of the wheelchair (indoor/outdoor), duration of daily use (hours), dependency on wheelchair use (independent, assisted, fully dependent use was determined by asking the patient) and satisfaction with wheelchair use (Patients were asked to rate their satisfaction on a scale of 1-5. 1: not at all satisfied, 2: slightly satisfied, 3: moderate, 4: very satisfied, 5: excellent). All the wheelchairs were evaluated by the same physical therapy and rehabilitation physician, taking into account each component (seat width, seat depth, seat height, arm height, back height, wheels, cushion, head support, foot support, seat belt) (Figure 1).

Figure 1. Picture designates the wheelchair parts. AR, armrest; BH, back height; FR, footrest; SD, seat depth, SH, seat height; SL, seat length.

Wheelchairs were evaluated according to the standard dimensions determined by Brown et al. (13). In general, the wheelchair was considered inappropriate if at least three parts of the wheelchair were unsuitable (3,7,13). Only cases where 3 regions are inappropriate are considered significant.

Ethical approval: The study was conducted in accordance with the principles of the Declaration of Helsinki and ethics committee approval was obtained from local Ethics Committee (Number: 2230 Date: 03.11.2022). Each patient provided written informed consent before the evaluation.

Statistical analysis: First, all data were classified as continuous and categorical variables. Continuous variables were expressed as mean ± standard deviation (SD) and/or median (min-max) values, and categorical data as number (n) and percentage (%). Analyses of the data obtained were performed using IBM SPSS version 26.0 software (IBM Corporation, Armonk, NY, USA).

Results

Evaluations were made of 40 patients (mean age 68.07±7.24 years) diagnosed with stroke due to CVE. The clinical and demographic characteristics

Table 1: Distribution of demographic and clinical parameters of the groups

	Patient group (n=40)
Mean age (years) (mean ± SD)	68.07±7.24
BMI (kg/m²)	28.20±3.16
Disease duration (months) [median (min-max)]	6 (1-72)
FIM score	26 (13-65)
Gender (n,%)	
Female	20 (%50.0)
Male	20 (%50.0)
Hemiplegic side (n,%)	
Right	22 (%55.0)
Left	18 (%45.0)
Etiology (n,%)	
Thromboembolic	36 (%90.0)
Hemorrhagic	4 (%10.0)

BMI: body mass index; **FIM:** Functional Independence Measures

Table 2: Clinical features of the patients

BRS upper extremity [median (min-max)]	1.5 (1-4)
BRS hand [median (min-max)]	1.5 (1-4)
BRS lower extremity [median (min-max)]	2 (1-4)
FAS score [median (min-max)]	1 (0-3)

BRS: Brunnstrom stage; **FAS:** Functional Ambulation Scale

of the patients are given in Table 1. The Brunnstrom median values were determined to be 1.5 (1-4) for the arm, 1.5 (1-4) for the hand, and 2 (1-4) for the lower extremity. The median FAS score was 1 (0-3) (Table 2). The wheelchair features are presented in Table 3. It was determined that 97.5% of the wheelchairs were non-motorized-manual, 60.0% were obtained on prescription, of which 95.8% were FTR prescription, 65% were used only outside the home, 90% of the patients were completely dependent on the wheelchair, and 65% used the chair for 1-3 hours a day. In respect of patient satisfaction with the wheelchair, 55% were less or not satisfied with the wheelchair, and 60% were not satisfied with the wheelchair. It was determined that the wheelchair was not suitable for the environment in which they lived, and 32.5% of the patients had a history of falling out of the wheelchair (Table 3). Evaluations regarding the suitability of the wheelchair are presented in Table 4. Accordingly, the suitability was determined for 87.5% of seat width, 60% of seat depth, 40% of seat height, 60% of back height, 75% of arm height, 90% of wheels, and 40% of footrest. It was determined that only 2.5% of the wheelchairs had head support, 35% had cushions, and 25% had belts. all these features, it was determined that 15% of the wheelchairs were suitable (Table 4).

Discussion

The aim of this study was to evaluate wheelchair suitability in patients with stroke due to CVE. The results showed that 85% of the patients were using an inappropriate wheelchair. Seat height, seat depth, footrest, cushion and belt were the most common inappropriate areas. It was seen that 26 (65%) patients did not have a seat cushion or had an inappropriate seat cushion. Although 30 (75%) patients did not have sitting balance, they did not have a seat belt. Ekiz et al. (3) examined wheelchair suitability in patients with spinal cord injury, and found that wheelchairs were inappropriate in 55% of the patients, with seat height and seat cushion the most commonly inappropriate elements. in another study conducted of patients with cerebral palsy Ekiz et al. (7) reported that 80% of wheelchairs were inappropriate. Seat depth, seat cushion, seat height were found to be the most inappropriate parts. Cherubini et al. (9) evaluated the suitability of wheelchairs and reported that the chair was inappropriate in 68% of the patients and the most common inappropriate part was the seat cushion. In the current study, 85% of the evaluated wheelchairs were found to be inappropriate, and

Table 3: Some features of a wheelchair

	Patient group (n=40)
Wheelchair feature (n,%)	
without motor-manual	39 (%97.5)
motor-battery	1 (%2.5)
How many hours does spend in wheelchair?	
<1 hour	13 (%32.5)
1-3 hour	26 (%65.0)
5-8 hour	1 (%2.5)
Prescription status (n,%)	
By prescription	24 (%60.0)
Not by prescription	16 (%40.0)
Who prescribed it? (n,%)	
PMR	23 (%95.8)
Neurology	1 (%4.2)
Environment where wheelchair is used ?(n,%)	
Outdoor	26 (%65.0)
indoor-outdoor	14 (%35.0)
Wheelchair usage (n,%)	
Assisted	4 (%10.0)
Fully dependent	36 (%90.0)
Does wheelchair meet expectations? (n,%)	
Yes	29 (%72.5)
No	11 (%27.5)
What is the wheelchair satisfaction level? (n,%)	
Not satisfied at all	6 (%15.0)
Less satisfied	16 (%40.0)
Moderately satisfied	17 (%42.5)
Very pleased	1 (%2.5)
Is the wheelchair suitable for its environment? (n,%)	
Appropriate	16 (%40.0)
Inappropriate	24 (%60.0)
Is there a history of falling from wheelchair? (n,%)	
Yes	13 (%32.5)
No	27 (%67.5)

similar to other studies, the seat cushion and belt were found to be the most inappropriate parts. Wheelchair prescription is associated with prevention of musculoskeletal pathologies, facilitating the patient's independence and social life (9). Although patient and equipment profiles have been defined for the sitting position in a wheelchair, there is no standard and accurate information about sitting (14). The sitting position ensures that the body is in a balanced, symmetrical, stable posture, and the posture that works best is the best sitting position for the person. In this context, the rehabilitation team often uses adaptive devices to improve stability and mobility (15). It is difficult to sit still for a long time if trunk control is not good and sitting tolerance is poor, which are factors associated with post-stroke tone abnormalities (16,17). Seat width, depth and height are the three main parts of a wheelchair for sitting position. In addition, these parts are associated with the development of contractures and posture disorders such as scoliosis (17,18). Cushions are very important to stabilize the pelvis and provide postural support (3). If patients do not have sitting balance or head control, seat belts and head restraints are required. Seat belts are very important to provide trunk control in patients. Various factors may play a role in wheelchair incompatibility. In the current study population, 60% of the wheelchairs were prescribed by a physician. A significant proportion of the wheelchairs were not recommended by a healthcare professional. There may also be the effect that healthcare professionals do not fully understand the details of wheelchair prescribing. Another reason may be the failure to assess the suitability of prescribed wheelchairs. However, after purchasing a wheelchair with a prescription, there is no application requirement for an eligibility check. While 60% of the patients bought their wheelchair with a doctor's prescription, 40%

Tablo 4: Appropriateness regarding the each part of the wheelchair (n, %)

	Patient group (n=40)
Seat length	
Appropriate	35 (%87.5)
Inappropriate	5 (%12.5)
Seat depth	
Appropriate	24 (%60.0)
Inappropriate	16 (%40.0)
Seat height	
Appropriate	16 (%40.0)
Inappropriate	24 (%60.0)
Back height	
Appropriate	24 (%60.0)
Inappropriate	16 (%40.0)
Armrest	
Appropriate	30 (%75.0)
Inappropriate	10 (%25.0)
Wheels	
Appropriate	36 (%90.0)
Inappropriate	4 (%10.0)
Cushion	
Appropriate	14 (%35.0)
Inappropriate	26 (%65.0)
Headrest	
Appropriate	1 (%2.5)
Inappropriate	39 (%97.5)
Footrest	
Appropriate	16 (%40.0)
Inappropriate	24 (%60.0)
Belt	
Appropriate	10 (%25.0)
Inappropriate	30 (%75.0)
Wheelchair availability	
Appropriate	6 (%15.0)
Inappropriate	34 (%85.0)

bought it without a doctor's prescription. In the studies conducted by Ekiz et al., it was determined that 93.3% of children with cerebral palsy and 44.4% of patients with spinal cord injury were provided with over-the-counter wheelchairs (3,7). There can be several reasons for using a wheelchair without a prescription. Due to the conditions in the health insurance system in Turkey, it is difficult for patients to purchase a wheelchair on prescription. The criteria set are strict, so patients may turn to alternative means of obtaining wheelchairs outside the healthcare system. Moreover, many wheelchairs are donated by charities in Turkey and especially when the patient and their family are in a low economic situation, they can obtain wheelchairs without a prescription. Patients with a sufficient economic level can buy wheelchairs with their own means. Of the patients in this study, 55% were not at all or only slightly satisfied with their wheelchair, 60% of the patients stated that a wheelchair was not suitable for their living environment, and 32.5% of the patients reported wheelchair-related falls. There may be several reasons for the low satisfaction rate and the relatively high falling frequency. First of all, it is an expected result that unsuitable wheelchairs will decrease the satisfaction rate. Wheelchairs recommended without evaluating the physical characteristics of the living spaces of the patients and making modifications in this context may decrease the satisfaction rate and increase the frequency of falls. Therefore, a wheelchair recommendation should be made by a healthcare professional. Prescriptions containing all the details should be prepared by considering the clinical condition of the patient and the environment in which he lives. Individualized recommendations including all modifications would be more beneficial than standard prescriptions. Motorized wheelchairs can be recommended for fully dependent patients after stroke. There is also a need for motorized

wheelchairs with reduced mobility and increased maintenance. In this study, although the upper extremity functionality of the patients was found to be lower than the Brunstrom staging, only 1 (2.5%) patient used a motorized wheelchair, while 39 (97.5%) patients used a manual wheelchair. In order for the motorized wheelchair to be covered by the insurance in Turkey, the patient must have weakness in both upper and lower extremities. Since these patients are hemiplegic, reports cannot be prepared in accordance with the conditions of the insurance system, and due to the high cost of purchasing without a report, patients have difficulties in obtaining motorized wheelchairs. This situation increases the dependence of the patient on the presence of another person for mobilization. Wheelchair parts, dimensions, durability and all other factors can vary on an individual basis, which can affect patient satisfaction with the wheelchair in general. Wheelchair selection (manual / battery powered) should be based on the patient's individual medical needs, physical abilities, preferences, home and community physical environment, and accessible transportation availability (19).

Study limitations: This study has some important limitations. First, the sample size was relatively small. All the patients were wheelchair users who presented at our outpatient clinic or used a wheelchair during the 3-month follow-up period, and the study was conducted in a single centre. Second, although it was attempted to define some standards for wheelchairs, there is no definitive standardization. Third, these results cannot be generalized to other countries or centres. The results may have been affected by many important points such as socio-economic status, the insurance system, and educational status. Finally, evaluation of the wheelchairs by more than one person would have been more objective.

Conclusion

The results of this study demonstrated that 85% of patients with stroke due to CVE use an inappropriate wheelchair. By making wheelchairs more "user friendly", the harmony between user ability and wheelchair features can increase patient independence, facilitate social integration, and improve the patient's quality of life. For fully dependent patients after stroke, the use of a wheelchair specially designed for the patient is required. Wheelchair recommendation should be made by healthcare professionals. While preparing prescriptions, the clinical condition of the patient and the physical conditions of the living environment should be considered, and individualized recommendations should be made. Checks should be made in the short term after prescribing, and wheelchair compatibility with the prescription should be evaluated. In long-term follow-up examinations, patient satisfaction should be questioned and additional recommendations should be made if necessary.

Ethical approval: The study was conducted in accordance with the principles of the Declaration of Helsinki and ethics committee approval was obtained from local Ethics Committee (Number: 2230 Date: 03.11.2022). Each patient provided written informed consent before the evaluation.

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