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Balance scores of hospitalized middle-aged medical patients on the day of discharge: indication for balance re-training

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Summary

Falls due to inadequate balance may occur among newly discharged hospitalized patients of any age but most studies focused on recuperating older adults with neurological or orthopaedic disorders. This study assessed on-the-spot discharge day balance of middle-aged medical patients and investigated whether this related to duration of hospitalization. Eighty-seven newly discharged middle-aged patients managed for hypertension, diabetes mellitus, lung and heart diseases and cancer patients receiving only chemotherapy and 87 age and sex matched apparently healthy controls were assessed for static and dynamic balance using the One Leg Stance (OLS) and 5-meter Timed Up and Go (5mTUG) tests respectively. Mean duration of hospitalization was 15.72 ± 9.51 days. The OLS was shorter (4.79 ± 2.34 secs) in the patients than controls (11.64 ± 2.59 secs); while the 5mTUG was longer (22.26 ± 11.67 secs) in the patients. Significant differences ($P<0.05$) were obtained when both tests were compared for both groups. Using Pearson's correlation, duration of hospitalization significantly ($P<0.05$) related with both tests. Middle-aged medical patients had low balance at discharge. The balance reduced as the hospitalization period advanced. Hospitalized medical patients should be assessed for balance and treated accordingly before final discharge in order to minimize dangerous outcomes from falls.

Keywords: *Falls, admission, balance scores, discharge*

Résumé

La plupart des études sont focalisées sur la récupération des adultes plus âgés avec des désordres neurologiques et orthopédiques que sur le déséquilibre des nouveaux hospitalisées. Cette étude évaluait ces patient d'âge moyen a leur point de décharge des déséquilibre vis-à-vis de la durée d'hospitalisation. Quatre vingt sept a la décharge ayant obtenu les soins d'hypertension le diabète mellite, les infections pulmonaires et les désordres cardiaques et une chimiothérapie du cancer. Compare a 87 contrôle sain de même sexe de l'équilibre statique et dynamique utilisant les tests d'équilibre (OLS) et 5mTUG. La durée moyenne d'hospitalisation était de 15.72 ± 9.51jours. Le test d'OLS était court de 4.79 ± 2.34 jours aux patients compare a 11.64 ± 2.59 aux contrôles sain tandis que le test de 5mTUG était plus long de 22.26 ± 11.67 aux patients. Ils avaient des différences significatives lorsque les groupes étaient compares utilisant la corrélation de Pearson, la durée d'hospitalisation liaient significativement les groupes ($P<0.005$). Les patients en leur moitié d'âge avaient une équilibre faible a la décharge. Cet équilibre réduisait avec la durée longue d'hospitalisation. L'équilibre des patients doit être évalué et les soins nécessaires, attribués avant la décharge finale dans le but de minimiser les résultats dangereux d'insuffisance ou chute.

Introduction

Postural balance is a delicate function that depends on the integration of different systems. The vestibular apparatus registers the position of the head and its dynamic changes; the visual system integrates its signals with those from the vestibular system while the proprioceptive or somatosensory system registers small changes in tension within muscles and tendons [1]. Lack of postural balance may result in fall in both young and adult populations. The most commonly identified risk factors for falls are impairments of gait and balance (postural instability), environmental hazards, drugs, and cardiovascular diagnoses [2]. In the elderly, falls are a common reason for attending the accident and emergency departments of hospitals and the result of a research found that a quarter of older patients presenting to the accident and emergency department after a fall had cognitive impairment [3]. Cognitive impairment and dementia in adults may contribute to falls [2].

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The rate of falls in the elderly in the first 2 weeks after discharge was 8 falls per 1000 person-days. The rate of falls decreased rapidly to 2.5 falls per 1000 person-days by 8 weeks after discharge and is an important cause of injury and morbidity [4].

In a group of elderly patients discharged after hospitalization, 11% of falls in the first month after discharge resulted in serious injury requiring hospitalization [4]. The serious injuries included fractures of the ankle, pelvis, spine, and arm; dislocated hip, severe bruising, and head laceration. Falls can result in restricted activity, loss of independence, social isolation, psychological distress and increased use of health and social services [5]. Post-hospital factors associated with increased risk include using a tertiary amine, having probable delirium, and having poorer balance [4].

Prevention of falls in the elderly may include different strategies as required in those with cognitively normal older people [2]. For example, physiotherapy may need to be undertaken for longer period, and intervention to modify cardiovascular risk factors may be important [2]. By undertaking strength and balance training exercises through regular physical activities that increase muscle strength in the legs and improve balance, older people can reduce their risk of falling [5]. Post-hospital risk factors for falls may be potentially modifiable and efforts to assess and modify risk factors should be integral to the hospital and post-hospital care of older adults aged ≥ 65 years [4]. For instance, use of a cane at discharge decreases risk compared with no assistive device [4].

Not much is known about the risk of falls in newly discharged middle-aged medical patients who are just about to go home. Most studies carried out on loss of balance and risks of falls have discussed the older population [2, 5-6]. A study by Mahoney *et al* [4] on the risk of falls in hospitalized patients who are already discharged and recuperating at home found that post hospitalization period may be a high risk period for falls in older adults. We also observed that in addition to studying older adult patients, most of these researches were on risk of fall in those with neurological and orthopaedic disorders. We further noticed that there is want of information on the risk of falls in hospitalized medical patients just at the point of hospital discharge (before they get home). This represents an important stage of the management because it marks the transition between a medically supervised hospital setting and an unsupervised home environment. This survey is thus designed to assess the balance scores of medical patients on the day of their discharge before leaving the hospital premises and to investigate whether this was related to the duration of hospitalization.

Materials and methods

This research was a cross-sectional survey of middle-aged medical patients admitted in the medical wards of Aminu Kano Teaching Hospital (AKTH) Kano and apparently healthy controls from the Bayero University, Kano community. All the medical patients who met the eligibility criteria during the study period of six months were included in the study. The eligibility criteria for the patients included being free of cerebral concussions and lower extremity orthopaedic injuries. In addition to these, the apparently healthy participants were not on admission for the past one year and not on any form of medication. Patients who met the inclusion criteria were recruited consecutively as soon as they were being discharged from the medical wards of the AKTH. In both groups, being of middle-age, consent to measurements and willingness to give informed consent were also set as eligibility criteria. None of the participants must have taken any alcohol as at the time of assessment. The participants met the eligibility criteria, and volunteered to participate in the study.

We were able to identify 87 patients during the study period hence we recruited 87 age and sex matched apparently healthy controls making a total of 174 participants. The patients studied were those managed for hypertension, diabetes mellitus, lung and heart diseases and cancer patients managed medically using only chemotherapy. Healthy controls were introduced in order to reveal if there were actually any differences between the balance scores of patients discharged after a period of hospitalization and that of apparently healthy individuals who were not hospitalized in the previous one year. In both groups, participants were in their middle age, which was taken as the period of life beyond young adulthood but before the onset of old age. It varies in different settings but is usually between 35 and 55 years. The healthy controls were made up of students and both academic and non-academic staff of the Bayero University, Kano community. Ethical approval was obtained for this study from the Ethical Committee on Research of the AKTH, Kano.

Morris *et al* [7] listed a number of simple balance tests that may be used in clinical settings to predict falls in deconditioned or older people. Some of these include the 'One leg Stance', 'Chair Stand', the 'Timed Up and Go', the 'Tandem Walk' and the 'Functional Reach' tests. For this study, we used the One Leg Stance Test (OLS) and the 5-meter version

of Timed Up and Go (5mTUG) tests to assess the risk of falls in the discharged patients. These tests were able to assess the static and dynamic balance of the participants. In this present study, one of the authors assessed only the 5mTUG of all the participants while another qualified physiotherapist was financially rewarded to assess only the OLS of all the participants. The results of both tests were later correlated.

Data collection:

One Leg Stance test

Participants in both groups performed three trials of quiet standing in single-leg stance on the dominant limb without any shoes. Dominant limb was determined by asking the patient what leg would he or she rather prefer to kick a football with [8]. An earlier study demonstrated no significant differences in postural control measures between the dominant and non-dominant limbs of healthy subjects standing in single-leg stance [9]. We chose to use the dominant leg for the purpose of uniformity and to ensure we arrive at the best display of balance from each participant. Subjects stood with arms folded across their chest and eyes open while focusing on a stationary poster demonstrating one-leg stance attached on a wall 3 feet from the participant. The poster served as a biofeedback to guide the patients. We instructed participants to stand as motionless as possible. Trials were stopped and time recorded if the arms moved from their start position, legs touched each other, the feet moved on the floor or the non-stance foot touched the ground during the test. One-leg stance score was the length of time the individual was able to maintain his/her balance while standing on one leg. This was measured in seconds (s).

Five meter Timed Up and Go (5mTUG)

The 5mTUG measurements were obtained using an ordinary armchair of 45 cm high and a stopwatch. Subjects were seated with their back against the chair. They were instructed to stand up, walk five metres to a cylindrical can placed on the ground, turn around it, walk back to the chair and sit down. The task was done at their fastest but comfortable speed. The stopwatch was started on the word "go" and stopped as the subject sat down. The 5mTUG time was measured in seconds (s). The "Timed Up and Go" test measures speed during several functional manoeuvres, which include standing up, walking, turning and sitting down. Limited training and equipment are required, and the test is therefore convenient in clinical settings. Good test-retest reliability (ICC = 0.97–0.99 and Spearman's = 0.93) and inter-rater reliability (ICC = 0.99) have been demonstrated [10]. The results of study by Morris *et al* [7] suggests that, out of the various performance-based balance tests investigated, the 5 m-TUG test performed the best in predicting falls in older women with vertebral fractures. The 5 metre distance is long enough to identify a patient with balance problems.

Analysis of data:

Mean and standard deviations were used to summarize the data of the participants. The various conditions and the duration of hospitalization were also analyzed using descriptive statistics. Independent t-test was used to compare the 5mTUG and OLS scores between the patient and apparently healthy control groups. Pearson's Moment Correlation Coefficient (r) was calculated to reveal the relationships between the 5mTUG and OLS and each of age, BMI and duration of hospitalization. Significance level was set at 5%. Data analyses were done using the SPSS 15.

Results

One hundred and seventy four participants made up of patients and apparently healthy controls (87 each) participated in the study within a period of six months. Table 1 contains information describing the various characteristics of the patients and the apparently healthy controls. The mean age of the participants was 46.10 ± 4.84 years and 46.21±6.21 years for the patients and the healthy controls respectively. Hypertension (26.44%) was the most prevalent

Table 1: Description of participants

	Patients	Healthy controls
Age (years)	46.10±4.84	46.21±6.21
BMI (Kg/m^2)	21.91±2.70	27.52±3.59
Duration of Hospitalization (days)	15.72±9.51	0.00
Balance test results		
One Leg Stance (s)	4.79±2.34	11.64±2.59
5m Timed Up and Go (s)	22.26±11.67	10.12±3.29
Medical Conditions studied n (%)		
Hypertension	23 (26.44)	
Diabetes mellitus	17 (19.54)	
Lung diseases	21 (24.14)	
Heart diseases	11 (12.64)	
Cancer	15 (17.24)	
Total	87 (100.00)	

Table 2: Independent t-test comparing the balance scores of discharged patients with that of healthy controls

Variable	Patients (Mean ± SD)	Healthy controls (Mean ± SD)	t	P-Value
One Leg Stance (s)	4.79 ± 2.34	11.64 ± 2.59	-18.28	0.0001
5m Timed Up and Go (s)	22.26 ± 11.67	10.12 ± 3.29	9.33	0.0001

condition among hospitalized medical patients who met our criteria within the study period. The patients were admitted for a mean duration of about two weeks. The mean duration of the One Leg Stance (OLS) was shorter in the patients (4.79 ± 2.34 s) than their age matched healthy controls (11.64 ± 2.59 s); while the reverse was the case for the 5m Timed Up and Go (5mTUG). Independent t-test was significant ($P<0.05$) when the OLS and 5mTUG of the patients and their apparently healthy controls were compared (Table 2). Significant inverse relationships were obtained between the duration of hospitalization and OLS ($r = -0.81$, $P<0.05$) while direct relationships were obtained for duration of hospitalization and 5mTUG ($r = 0.84$, $P<0.05$) (Table 3). There was significant ($P<0.05$) but inverse relationship between OLS and 5mTUG. We did not find any significant relationship between age and each of OLS and 5mTUG in this study.

Table 3: Correlations matrix for the variables studied

	5mTUG	OLS	DurHosp	BMI	Age
5mTUG					
OLS	-0.71*				
DurHosp	0.84*	-0.81*			
BMI	-0.33*	0.51*	-0.47*		
Age	-0.05	-0.01	-0.07	-0.01	

** = Significant correlation*
DurHosp = Duration of admission
OLS = One leg stance
5mTUG = 5 metre Timed up and go

Discussion

The principal finding of this study was that newly discharged middle-aged medical patients at the point of discharge had lower balance scores than their apparently healthy counterparts and the duration of their hospitalization had significant relationship with their balance scores. However, age of the participants was not significantly related with the balance scores. The fact that our data was unable to demonstrate any relationship between age and balance scores might be because we studied only the middle-aged population, when the effects of aging on balance is yet to be profound. It could also be due to the narrow age range of the participants. The significant difference in balance scores between the discharged patients and the apparently healthy controls may be because of the various factors associated with the period of hospitalization. Within the period, the patient might have lost some muscle strength, fed minimally and ingested a lot of drugs that could have affected their balance. The higher BMI in the controls could also explain their higher balance scores. Though we could not infer causality, the relationship between the duration of hospitalization and the balance scores signifies the possibility of hospitalization period affecting balance.

Most studies that were conducted focused on older adults and those with core neurological and orthopaedic problems such as Parkinson's disease, dementia, osteoarthritis and lower limb fractures [2, 5, 7, 10-11]. Our study however supports the findings of a study on older populations by Mahoney *et al* [4] where they reported that older patients at high risk for post-hospital falls could actually be identified at the point of hospital discharge. Even though unlike our study of middle-aged patients, their study was in the older population and they reported that in addition to pre-hospital risk factors for falls, patients with poorer balance scores at discharge were at increased risk for falls after hospitalization. Our study established that middle-aged medical patients who were newly discharged and ready to proceed home had deficiencies in their balance scores. This implies that middle-aged patients like the older patients also have increased risk of falls following a period of hospitalization. The reason for this may be multifaceted. The deconditioning effects of bed rest, iatrogenic complications of diagnostic and therapeutic interventions, and the effects of acute illness could all have contributed to the risk of post-hospital falls and fall-related injuries [12]. Another study on older women with vertebral fractures claimed that combining previous history of recurrent falls and the inability to perform the 5m-TUG test within 30 s predicted falls with a high degree of specificity, allowing the identification of a group of patients suitable for fall and fracture prevention measures [7].

This study considered only patients within the middle-age group thereby mitigating the effect of old age on balance scores. We ensured that the medical patients were matched as closely as possible with the apparently healthy controls for age, sex and height. A major problem however was that we were unable to match them for weight. This was because most of the patients had actually lost a lot of weight during hospitalization and sourcing for healthy controls with similar weight and stature was a problem. Another limitation was that we did not match on the basis of likely confounders such as muscle strength and proprioception. This study could not establish the exact cause of the decrease in balance of the hospitalized medical patients hence we do not imply that the period of hospitalization was solely responsible. The various medications, period of bed rest and diets of the medical patients could be confounding factors but we did not see these as major problems. This was because the study was set to identify whether or not the discharged middle-aged medical patients had balance deficiencies as at the day of their discharge regardless of the main or remote causes. A major improvement in our study over that of Mahoney *et al* [4] who assessed few days after discharge, was that we assessed the balance scores of the patients right on the wards as soon as they were discharged. This gave the balance profile of the patients just before leaving for their respective homes.

Conclusions and recommendations

This study provides evidence that the middle-aged medical patients at the point of discharge presented with balance problems and this was related to the duration of their hospitalization. Consequently, fall prevention strategies should be utilized for medical patients who are being considered for discharge from hospitalization. This prevention should be regardless of age or drug history. A patient whose balance deficiency is overlooked by the health personnel will be discharged as fit for independent ambulation with lesser attention paid to their balance and risk of falls. However if patients with poor balance scores are identified right in the hospital, it will be rewarding to delay them in order to treat their balance deficiencies rather than discharging them only to return with injuries from falls. If they must leave, walking aids such as cane, wheeled or standard walker, or wheelchair should be prescribed at the point of discharge for those at risk to minimize falls. This should however be discontinued as soon as the patient has gained appreciable balance. We recommend that large studies be done to determine whether the decreased balance scores noticed in middle-aged hospitalized medical patients is due to the actual effect of bed rest, diet or medication. Since falls can occur at any age, research should be directed at looking more precisely into the occurrence of falls and the determinants of decreased balance scores in adolescent and middle-aged medical and non-medical patients.

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