

PAIN, RANGE OF MOTION AND ACTIVITY LEVEL AS CORRELATES OF DYNAMIC BALANCE AMONG ELDERLY PEOPLE WITH MUSCULOSKELETAL DISORDER

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SUMMARY

Background: Assessment of impairment and disability measures on dynamic balance status of elderly patients is well documented in the rehabilitation of neuromuscular disorders. Few studies however considered similar evaluation in musculoskeletal disorders.

Objective: To determine the influence of pain, hip range of motion and level of activity on dynamic balance among elderly people with hip osteoarthritis (OA).

Methods: Elderly patients with hip OA participated in the cross-sectional survey. The impairment measures were assessed using the visual analogue scale and double-arm universal goniometer whilst their levels of activity were assessed with the Barthel Index. Participants performed Turn-180 on two trials by taking steps clockwise and anti-clockwise round a sturdy arm chair. The total number of steps taken to complete each Turn-180 was determined. Descriptive statistics were used to summarize data whilst Pearson moment correlation coefficient determined the correlations of the variables at 95% confidence interval.

Results: The study involved 87 participants comprising 40(46%) males and 47(54%) females. The age of the participants ranged from 60 to 74 years with a mean of 65.8±4.5 years. There was a positive and significant correlation ($r=0.596$; $p<0.001$) between the participants' pain and steps taken to complete Turn-180. The participants' hip flexibility and the level of activity were also significantly and inversely correlated with the performance of Turn-180.

Conclusion: The dynamic balance of the sampled elderly patients was considerably influenced by pain, hip flexibility and level of activity, thereby putting premium on the assessment of the variables during musculoskeletal rehabilitation of elderly patients.

Keywords: Pain, Hip flexibility, Activity level, Turn-180, Dynamic balance

INTRODUCTION

Turning difficulties with increasing age have been reported in elderly population due to conglomeration of changes in structures and function.¹ Although, trips and slips have been reported to be responsible for falls in both young and elderly individuals, most incidence of falls occur during turning events among the latter.^{2,3} Falling while turning is reported to be 7.9 times more likely to cause hip fracture than falling while walking straight.³

A considerable number of activities of daily living involves turning from one point to another in order to interact with the environment. Turns embedded in locomotion are essential for functional mobility and have a common occurrence in everyday life activities.⁴ It thus demands of the rehabilitation practitioners to assess the common impairments associated with dynamic balance in order to return the individual to the highest functional level and prevent falls and their consequences.

Osteoarthritis is a debilitating condition characterized by pain, joint inflammation and joint stiffness, and can result in a substantial degree of physical disability among young adults and elderly patients.⁵ It is a common form of arthritis and the World Health Organization estimates that 25% of adults aged over 65 years suffer from pain and disability from this disease globally.⁶ In spite of the giant stride recorded in the management of this condition, dynamic balance is not often included in the assessment of the affected elderly patients.

Many activities of daily living involve turning while standing such as turning around to respond to call and turning to pick items from one shelf to the others.

Impaired dynamic balance therefore is an important clinical deficit in elderly individuals with musculoskeletal disorders among whom age-related changes in visual function, lower-extremity weakness, poor balance, poor grip strength and poly-pharmacy, are the potential risk factors of falls.⁷

Dynamic balance in the form of turning requires asymmetric direction of the step length and ground reaction forces under the two feet to redirect the cyclical movement of the lower limbs.^{8,9} Impairment of motor control components due to disease, may give rise to poor coordination during turning and subsequent falls particularly in elderly patients.

Turn-180 is a clinical measure of dynamic stability designed to identify elderly person at risk of falls and is assessed by turning clockwise and anticlockwise thereby noting the time taken or the number of steps taken during the process.¹ Most people rarely turn through full cycle (360°) during any daily life activities whereas turning half cycle (180°) is an essential manoeuvre when preparing to sit.¹⁰

It has been reported that elderly people who took more than four steps to complete 180° turning have an increased risk of falling compared to those who took four steps or less. A study had shown that community-dwelling elderly people with previous fall history, who took 5 or more steps to complete Turn-180, had an unadjusted relative risk of 1.9 for sustaining 2 or more falls during one year follow-up period.¹¹

Performance of dynamic balance activities in elderly people could be potentially influenced by several factors that need to be evaluated in clinical settings. Clinical parameters such as pain, muscular strength, cognition and visual problems have been identified as determinants of stability in elderly people with neuromuscular conditions,^{12,13} while consideration for similar study on musculoskeletal condition has received disproportionate attention.

Whereas, prolonged exposure to nociceptive stimulation from the skin or sore muscles has been reported to affect the perception of a produced torque in lower limbs, thus undermining balance.¹⁴ Mecagni *et al.*, also reported that decreased ankle range of motion may lead to altered movement patterns which may compromise balance, thus limiting functional activities.¹⁵ Balance disability has been described as the strongest predictor of function with regard to activities of daily living and mobility in elderly people.¹⁶

The present study thus sought to determine the influence of pain, hip range of motion and activity level on Turn-180 among the elderly people with musculoskeletal dysfunctions with a view to broaden musculoskeletal assessment in clinical practice.

MATERIALS AND METHOD

Study design

Cross sectional survey design was adopted for this study in which selected clinical variables were recorded to make inferences about their possible relationships with hip Osteoarthritis among the sampled elderly patients.

Study place

The study was carried out at the Out-Patient Units of Physiotherapy Departments of Korle-Bu Teaching Hospital and Ridge Hospital in the Greater Accra Metropolitan.

Participants

Eight-Seven (87) elderly patients with hip osteoarthritis were enrolled into the study. The patients were included if they met the following criteria: independent walking, not less than 60 years of age and presence of hip OA accompanied with pain. Elderly patient with neurological conditions and severe cognitive problems were excluded from the study.

Sampling Method

Participants were sampled using convenience sampling technique in which the elderly patients who reported to these units were selected based on the set inclusion criteria but without any underlying probability-based method.

Ethical clearance

Ethical clearance was obtained from the Ethical Review Committee of the School of Allied Health Sciences, College of Health Sciences, University of Ghana. (Identification Number: SAHS-Et/022007003/AA/26A/2010-2011)

Data collection period

Data were collected from May to July, 2010 at both referral health facilities.

Instruments for data collection

Visual analogue scale (VAS) was used to rate the participants' pain as perceived following any activities. The scale has been shown to be reliable in measuring pain perception.¹⁷ The level of activity of the participants was determined with Barthel Index which includes self-care, mobility and other activities of daily living.

The index was adopted to determine what the participant does and not what the participant could do. The activity level is scored on Likert scale. For instance "Transfer item" is rated as follow: 0 = unable, no sitting balance; 1 = major help (one or two people, physical), can sit; 2 = minor help (verbal or physical); 3 = Independent. The maximum score is 20 and minimum score is 0.¹⁸ A sturdy chair with arm rest was used to provide support for the participants to allay fear of fall during the turning procedure. Universal doubled-armed goniometer was used to measure hip range of motion.

Procedure for data collection

Participants' range of motion for hip flexion was measured in supine lying position. The stationary arm of the goniometer was placed along the trunk whilst the moveable arm was placed at the lateral aspect of the thigh and the axis of the goniometer was positioned on the greater trochanter. From full hip extension position, participants were required to flex the hip slowly without any compensatory movements at the spine and pelvis.¹⁹

The score was read for the involved lower limb. The hip ROM for internal rotation was also measured with the patients in high sitting on a couch such that the hip and the knee were positioned at 90°. The axis of the goniometer was placed anteriorly on the mid-patella with the moving arm placed parallel to the long axis of the tibia whilst the stationary arm pointing perpendicular to the floor. Participants moved the leg into internal rotation (shank away from the body) whilst the assessor moves the movable arm of the goniometer alongside without compensatory movement at the trunk. The scores were read for the involved lower limb. The level of disability was thereafter determined by administering the Modified Bathex Index to the participants.

Turn-180 protocol

Participants held a sturdy armchair as a point of support whilst performing Turn-180. During the initial trial, they were instructed to rise from sitting to standing position in a stable state. Thereafter, they were asked to turn steadily to the direction of their choice whilst the number of steps taken to complete Turn-180 was counted. The second trial was performed following an appreciable rest in sitting and the procedure was repeated in the opposite direction. The number of steps taken was similarly counted and recorded.

Data analysis and Results presentation

Data analysis was performed using SPSS version 19.0. Description statistics of mean and standard deviation were used to present the participants' pain, hip flexion,

hip internal rotation and activity level. The correlations of pain, hip flexion, hip internal rotation and activities level with Turn-180 were determined through Pearson's Product Moment Correlation Coefficient. Correlation of variables at Alpha level of 0.05 was considered significant.

RESULTS

Eighty-seven (87) elderly patients took part in this study consisting of 47 females (54%) and 40 males (46%). The mean age of the participants was 65.8±4.5 years with age range 60 to 74 years. Majority of the participants 35(40.2%) were found in the age group 60-64 years (Table 1).

Table1 Sex and age distribution of the participants

Age (years)	Male		Female		Total	
	N	%	N	%	N	%
60-64	10	11.5	25	28.7	35	40.2
65-69	18	20.7	12	13.8	30	34.5
70-74	12	12.8	10	11.5	22	25.3
Total	40	46	47	54	87	100

The mean scores of the participants on pain, range of motion and disability level were presented in Table 2. The mean scores on VAS and the number of steps for Turn-180 were 7.38±1.03 and 4.51±0.70 respectively in which male participants had higher mean scores.

Table 2 Summary of the participants' scores on the variable measures

Variables	Male (n=40)	Female (n=47)	Total (n=87)
Visual Analogue Scale	7.6±1.1	7.2±0.9	7.4±1.0
Hip Internal rotation ^(o)	23.4±5.9	25.3±5.4	24.3±5.7
Hip Flexion ^(o)	74.0±9.5	75.7±11.2	74.8±10.3
Activity level	13.9±2.2	14.51±2.1	14.2±2.1
Turn-180 (steps)	4.7±0.6	4.3±0.7	4.5±0.7

Table 3 Correlations between variable measures and Trun-180 among the participants

Variable	N	Rho-value	P-value
Visual Analogue Scale	87	0.596	<0.001*
Hip Internal rotation ^(o)	87	-0.428	<0.001*
Hip Flexion ^(o)	87	-0.385	<0.001*
Turn-180 (steps)	87	-0.586	<0.001*

Legend:*=Significant

The Pearson product moment correlation coefficient analysis results were presented in Table 3. Participants' pain was positively and significantly correlated ($r=0.596$, $p<0.001$) with the steps taken in performing Turn-180. On the other hand, inverse but significant correlations were found between the performance of Turn-180 and the participants' hip flexion, internal rotation and their level of activity.

DISCUSSION

The study attempts to determine the influence of pain, hip range of motion and the activity level on the dynamic balance of the sampled elderly patients with osteoarthritis of the hip joint. Our findings showed that pain, hip flexibility and activity level of the patients were significantly correlated with the performance of Turn-180. The mean step of the participants to complete Turn-180 was 4.5 ± 0.7 steps which indicate moderate dynamic balance of the participants.

Previous findings had reported that community-dwelling elderly people with previous fall history, who took 5 or more steps to complete Turn-180, had an unadjusted relative risk of 1.9 for sustaining 2 or more falls during one-year follow-up period.¹¹ Since the number of steps recorded in this study is less than five, it seems reasonable to assume that the sampled elderly patients have moderate dynamic balance.

Participants' mean age, pain and activity levels conform to the World Health Organization estimation that 25% of adults aged over 65 years suffer from pain and disability from OA globally.⁶ Pain perceived by the patients was found to directly and significantly correlate with their mean step in performing Turn-180.⁰ This implies that as pain increases the number of steps taken to complete Turn-180 increases thus indicating less balance.

This finding upholds the previous reports in which moderate to severe musculoskeletal pain has been identified to have direct correlation with balance impairment among elderly people.²⁰⁻²² An experimental report also stipulates that prolonged exposure to nociceptive stimulations from the skin or sore muscles could lead to over estimation of the level of torque generated in the painful limb of an individual thereby compromising the balance.¹⁴ This submission tends to lend its support to our findings.

Although the activity level of the participants indicates moderately active individuals (Barthel index of 14.2 ± 2.1) in this study, it showed an inverse and significant correlation with their mean step. This is indicative of the greater number of steps taken during Turn-180⁰ by the less active and more dependent elderly patients thereby increasing their risk of falls. Active involvement in the performance of daily activity has been shown to improve balance and reduce the risk of falls.²³ On the contrary, other authors did not find significant link between physical activity and balance.^{24,25} Whilst conclusion about this topic is still being trailed by varying views, our study recruited relatively active elderly individuals thus lending credence to the present results.

Similarly, there was a marked reduction in the participants' hip flexibility. Significant and inverse correlation was found between the mean step and the hip flexibility in flexion and internal rotation. This goes to show that as the hip flexibility decreases the number of steps required to accomplish Turn-180 increases thereby predisposing the elderly patients to increased risk of falls.

Similar causal relationship has been previously reported in which a significant relationship was found between the range of motion at the hip and the number of falls in women aged 40 to 80 years.²⁶ Chiacchiero also found significant reduction in the hip extension, hip abduction, hip internal rotation and ankle dorsiflexion among elderly fallers compared to their non-faller counterparts.²⁷ Relationships have been reported between the range of joint motion in general and disability. For instance, Steultjens, *et al*, concluded that there is a clear relationship between joint ROM and disability in patients with OA of the knee or hip.⁵ Limitation in internal rotators of the hip could inevitably lead to compensatory movement patterns thereby placing strain on the surrounding soft tissue and joint structure and eventually impairing balance.

CONCLUSION

Pain, flexibility and activity level of elderly patients with musculoskeletal dysfunctions could form a substantial platform for the assessment of their dynamic balance in physiotherapy practice.

RECOMMENDATION

These findings have profound implication in the management of elderly patients with musculoskeletal dysfunctions. Although, previous studies have established the impacts of various impairment and disability measures on dynamic balance of elderly patients, they largely focussed on neurological conditions. Based on the outcome of these findings it seems logical therefore to appraise impairment measures in relation to the dynamic balance of patients with hip musculoskeletal dysfunctions.

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