

Correlation of pelvic tilt with balance in geriatrics with low back pain.

¹Riddhi Hitendra Patel, ²Dr. Shruti Mulaokar

¹Intern, ²Assistant Professor

²Department of Musculoskeletal Physiotherapy,
LSFPEF's college of Physiotherapy, Nigdi, Pune, India

Abstract: Background - Individuals with the age group of 60 and above are considered as geriatrics. Low back pain is most commonly found in geriatrics which leads to functional impairments and disability in them. People with back pain may show reduced proprioception in the pelvic region affecting their awareness of movement and thus can lead to potentially reduced postural control. With ageing there are changes seen in muscle strength, endurance, power, flexibility, range of motion and postural alignment which may affect the person's ability to respond to balance perturbation. There is change in lumbar spine and pelvis position with ageing because of changes in surrounding structures. Position of pelvis not only influences abdominal and back muscles but also muscles of lower limb attached to pelvis are affected, mostly gluteus maximus or muscle group of posterior thighs which help in maintaining erect posture.

METHODOLOGY-

Ethical approval had been obtained. 100 subjects above 60 years of age were included in this study. Pelvic tilt was measured using pelvic inclinometer. Berg balance was used to assess the balance of geriatrics. A statistical analysis was performed and results were obtained.

RESULT-

On statistical analysis there is no correlation of anterior pelvic tilt and sitting to standing balance ($p=0.281$); standing unsupported balance ($p=0.790$); reaching forward with outstretched hand ($p=0.734$); retrieving object from floor ($p=0.346$); turning to look behind ($p=0.251$). There was a negative correlation between anterior pelvic tilt and standing to sitting balance ($p=0.007$); transfer balance ($p=0.007$); standing with eyes closed ($p=0.010$); standing with feet together ($p=0.004$); turning 360 degrees ($p<0.001$); placing alternate foot on stool balance ($p=0.044$); standing with one foot in front ($p<0.001$); standing on one foot ($p<0.001$); total berg balance score ($p<0.001$). Correlation of posterior pelvic tilt with balance could not be concluded because of less subjects.

CONCLUSION-

The study concludes that, there is a negative correlation between anterior pelvic tilt and balance in geriatrics with low back pain ($r=-0.394$).

Keywords: geriatrics, low back pain, pelvic tilt, balance, correlation

I. INTRODUCTION

Individuals with the age group of 60 and above are considered geriatric. With aging the normal homeostasis of the body is disturbed which maintains a stable internal environment of the body.[1] Along with advancing age various changes are seen in musculoskeletal and all other different systems of the body.[1]

With ageing muscles and ligament experience decline in water, elastin and proteoglycan content along with changes in amount, diameter, fibril size.[1] There is also an increase in number of collagen crosslinks with increasing age which will manifest as decreased range of motion and an increase in stiffness.[1] Because of stiffness there is greater muscular effort required for less output. Lack of perfusion to skeletal muscles results in additional loss of fibres [1]

Low back pain is one of the common condition affecting geriatrics, contributing to their functional limitations. Low back pain is defined as any pain between lower ribs and lower gluteal folds and may or may not have pain in lower limbs. [2] People with back pain may show reduced proprioception in the pelvic region affecting their awareness of movement and thus can lead to potentially reduced postural control.[3] With aging there is change in lumbar spine and pelvis position.[4] The pelvis gradually tilts forward and lumbar lordosis deepens, depending on activities of surrounding muscles and ligaments.[4] With an excessive anterior tilt of pelvis there is compression forces on posterior aspect of vertebral bodies along with increased in interdiscal pressure. There is stretching of abdominal muscles and shortening of iliopsoas and lumbar extensors. [5]

Pelvic tilt is a position-dependent parameter defined as the angle created by a line running from the sacral endplate midpoint to the centre of the bifemoral heads and the vertical axis.[6] In case of asymmetrical alignment of pelvis, there is consequent changes in stability of pelvis with lower limb and the trunk.[7] Position of pelvis not only influences abdominal and back muscles but also muscles of lower limb attached to pelvis are affected, mostly gluteus maximus or muscle group of posterior thighs.[7]

Loss of postural control is one known fact that increases risk of falling, because of this there is decrease in ability to maintain static posture.[1] Changes in muscle strength, endurance, power, flexibility, range of motion and postural alignment affects the ability of person to respond to balance perturbation also decreasing postural control in static positions.[1] For maintaining adequate postural control, we need to keep centre of gravity over the base of support during static and dynamic balance. To maintain the balance our sensory system works to acquire information about body positions and trajectory in space, then to determine an effective response in advance, central processing plays role, body carries out this response via the effector system.[8] When there is deficit in any one

component it typically does not cause postural instability, as compensatory components come into action. In case of deficits across multiple components there is instability eventually resulting in falls. [1]

Because of the degenerative changes occurring in the body, it leads to muscle imbalance in postural muscles. With change in position of pelvis the line of gravity also displaces which leads to increases in gravitational force acting on body and thus cause further muscle imbalance. If pelvis is unstable, it will therefore increase the risk of fall in an old individual. On extensive review of literature, no studies have shown related to the relation of pelvic tilt with balance.

AIM-

To study the correlation between pelvic tilt and balance in geriatrics with low back pain.

OBJECTIVE-

To evaluate correlation between pelvic tilt and balance in geriatrics with low back pain using berg balance scale.

HYPOTHESIS-

Null Hypothesis- There is no correlation of pelvic tilt with balance in geriatrics with low back pain.

Alternative Hypothesis- There is correlation of pelvic tilt with balance in geriatrics with low back pain.

RESEARCH QUESTION-

Is there a correlation between pelvic tilt and balance in geriatrics with low back pain.

MATERIAL & METHODOLOGY-

METHODOLOGY -

Study design- Cross- sectional study

Study set-up- PCMC

Sampling technique- purposive sampling

Sample size- 100

Study duration- 6 months

Materials Required-

Pelvic inclinometer, pen, paper, mat, scale, stopwatch

INCLUSION AND EXCLUSION CRITERIA

Inclusion criteria	Exclusion criteria
Age > 60 years	Neurological conditions
Low back pain	Severely impaired vision
	Recent lower limb fracture
	Spinal deformity
	Vestibular conditions
	Limb length discrepancy
	Recent spine surgery

OUTCOME MEASURES-

Berg balance scale- Berg balance scale is used to assess postural control and is used in many fields of rehabilitation.[9] There are 14 items in the scale which are used to assess static and dynamic balance during activities commonly performed in daily living. scoring is done on a 5-point scale, that considers whether the patient can perform task safely and independently.[9] Scores of individual items are summarised with a maximum of 56 points.[9] The interclass correlation coefficients measuring the inter and intra rater reliability for the test as a whole were 0.98 and 0.99 respectively. Correlation coefficient for individual item ranged from 0.71 to 0.99 and a Cronbach's alpha of 0.96.[9]

Pelvic inclinometer- Pelvic inclinometer is clinically used to measure pelvic inclination angles in a non-invasive, quick and user friendly and harmless method. Hand held inclinometer ICC value of 0.9 and Cronbach's alpha value of 0.88of rt. And lt. innominate respectively throughout, showing strong intertester reliability. Intra- tester reliability also demonstrated strong congruity with an ICC value ranging from 0.921-0.88 for rt. And lt. innominate respectively, showing strong intratester reliability.[10]

PROCEDURE-

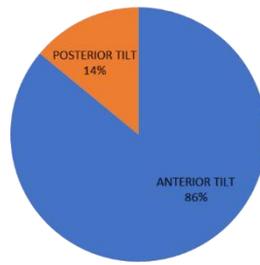
Ethical committee clearance was taken. Consent was taken from the subjects who fulfil the inclusion criteria. Pelvic tilt was measured with pelvic inclinometer, one tip of calliper was applied to anterior superior iliac spine and other tip of calliper to posterior superior iliac spine of the same ilium, degree of pelvic tilt was noted on protractor scale. Berg balance scale was used to interpret the balance.

STATISTICAL ANALYSIS-

Data was collected and analysed by appropriate statistical tests. Parametric test Pearson's correlation coefficient test was performed for data. Each component of berg balance was correlated with pelvic tilt along with total berg balance score. Level of significance was considered to be 0.05.

INTERPRETATION-

PERCENTAGE OF PEOPLE HAVING ANTERIOR AND POSTERIOR TILT

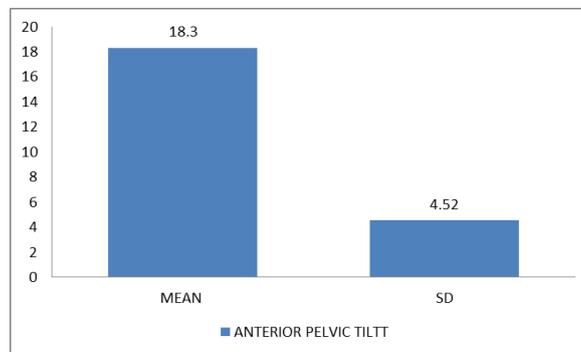


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Interpretation- Figure 1: depicts that out of 100, 86 % population had anterior pelvic tilt and 14% population had posterior pelvic tilt

Interpretation -Table 1: shows that mean for anterior pelvic tilt in both male and female is 18.3 ± 4.52

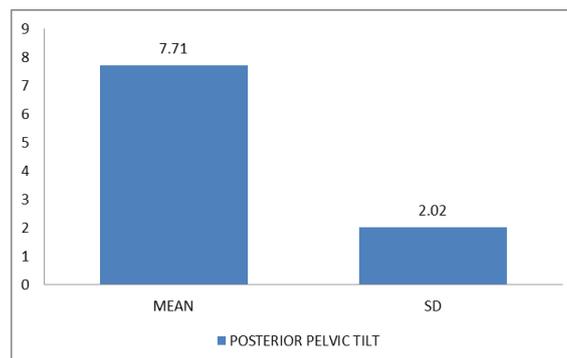
ANTERIOR PELVIC TILT	
MEAN	18.3
SD	4.52



Interpretation -Figure 2: Graphical representation of mean of anterior pelvic tilt in both male and female.

Interpretation- Table 2: shows that mean for posterior pelvic tilt in male is 7.71 ± 2.02

POSTERIOR PELVIC TILT (PT)	
MEAN	7.71
SD	2.02



Interpretation- Figure 3: Graphical representation of mean of posterior pelvic tilt in male.

Interpretation – Table 3: The results show that there is no significant correlation between anterior pelvic tilt and sitting to standing balance.

SITTING TO STANDING	
PEARSON'S r	-0.118
P- VALUE	0.281

Interpretation – Table 4: The results show that there is no significant correlation between anterior pelvic tilt and standing unsupported with eyes open balance.

	STANDING UNSUPPORTED
PEARSON'S r	0.029
P- VALUE	0.790

Interpretation – Table 5: The results correlation of pelvic tilt and sitting unsupported couldn't be concluded

	SITTING UNSUPPORTED
PEARSON'S r	NOT CONCLUDED
P-VALUE	NOT CONCLUDED

Interpretation – Table 6: The results show that there is negative correlation between anterior pelvic tilt and standing to sitting balance.

	STANDING TO SITTING
PEARSON'S r	-0.289
P-VALUE	0.007

Interpretation – Table 7: The results show that there is negative correlation between anterior pelvic tilt and transfers.

	TRANSFERS
PEARSON'S r	-0.287
P-VALUE	0.007

Interpretation – Table 8: The results show that there is negative correlation between anterior pelvic tilt and standing with eyes closed.

	STANDING WITH EYES CLOSED
PEARSONS'S r	-0.276
P-VALUE	0.010

Interpretation – Table 9: The results show that there is negative correlation between anterior pelvic tilt and standing with feet together.

	STANDING WITH FEET TOGETHER
PEARSON'S r	-0.309
P-VALUE	0.004

Interpretation – Table 10: The results show that there is no correlation between anterior pelvic tilt and reaching forward with outstretched hand.

	REACHING FORWARD WITH OUTSTRETCHED HAND
PEARSON'S r	0.037
P- VALUE	0.734

Interpretation – Table 11: The results show that there is no correlation between anterior pelvic tilt and retrieving object from floor.

	RETRIEVING OBJECT FROM FLOOR
PEARSON'S r	0.103
P-VALUE	0.346

Interpretation – Table 12: The results show that there is no correlation between anterior pelvic tilt and turning to look behind

	TURNING TO LOOK BEHIND
PEARSON'S r	-0.125
P-VALUE	0.251

Interpretation – Table 13: The results show that there is negative correlation between anterior pelvic tilt and turning 360 degrees

	TURNING 360 DEGREES
PEARSON'S r	-0.360
P-VALUE	< 0.01

Interpretation – Table 14: The results show that there is negative correlation between anterior pelvic tilt and placing alternate foot on stool

	PLACING ALTERNATE FOOT ON STOOL
PEARSON'S r	-0.218
P-VALUE	0.044

Interpretation- Table 15: The results show that there is negative correlation between anterior pelvic tilt and standing with one foot in front

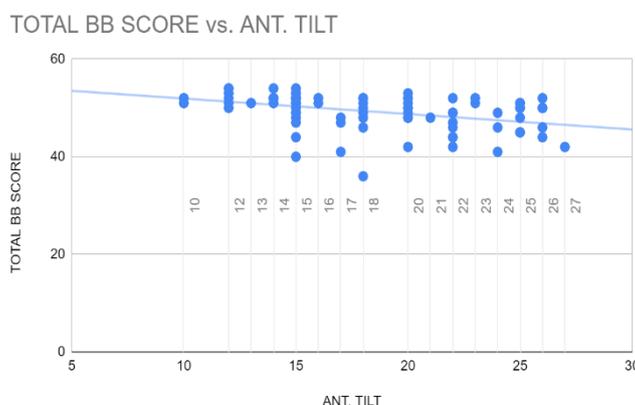
	STANDING WITH ONE FOOT IN FRONT
PEARSON'S r	-0.390
P- VALUE	<0.001

Interpretation- Table 16: The results show that there is negative correlation between anterior pelvic tilt and standing on one foot.

	STANDING ON ONE FOOT
PEARSON'S r	-0.366
P-VALUE	<0.001

Interpretation- Table 17: The results show that there is negative correlation between anterior pelvic tilt and total berg balance score.

	TOTAL BERG BALANCE SCORE
PEARSON'S r	-0.394
P-VALUE	<0.001



Interpretation- Figure 3: scatter plot graph showing negative correlation of anterior pelvic tilt with total berg balance score.

RESULT-

In this study 100 sample size was taken out of which most of them were females (54 females,46 males).

On statistical analysis there is no correlation of pelvic tilt and sitting to standing balance(p=0.281); standing unsupported balance(p=0.790)

On statistical analysis there is slight negative correlation between standing to sitting balance(p=0.007); transfer balance(p=0.007); standing with eyes closed(p=0.010); standing with feet together(p=0.004).

On statistical analysis there is no correlation of pelvic tilt with reaching forward with outstretched hand(p=0.734); retrieving object from floor(p=0.346); turning to look behind(p=0.251)

On statistical analysis there is negative correlation of pelvic tilt with turning 360 degrees(p<0.001); placing alternate foot on stool balance(p=0.044); standing with one foot in front(p<0.001); standing on one foot (p<0.001); total berg balance score(p<0.001).

Correlation of posterior pelvic tilt with balance could not be concluded because of less subjects having posterior pelvic tilt.

DISCUSSION-

There is a rapid growth in aging population with that there is an increased prevalence of diseases such as musculoskeletal pain. There is 36-70% prevalence of low back pain in elderly population, resulting in pain and disability. There is impaired motor control in patients having low back pain which further affects the balance performance and motor behaviour.[11]

Pain in back leads to reduced spinal mobility, loss of lumbar proprioception, sensory feedback weakening of lower extremities along with weakness and atrophy of trunk muscles. [11]

In this study a total of 100 people above 60 years of age were taken out of which 14 had posterior pelvic tilt, pelvic tilt was measured using pelvic inclinometer and berg balance scale was used to assess the static and dynamic balance. Each component of berg balance scale was correlated with the pelvic tilt. According to the results obtained from our study there is a negative correlation of anterior pelvic tilt and balance using berg balance scale ($r=-0.394$, $p<0.001$)

Because of anterior pelvic tilt the position of pelvis changes, which leads to lengthening of some muscle group and shortening of muscle group. This will cause impairment in length of core muscles which play important role in balance. As there is anterior tilt the line of gravity also shifts which results in the greater amount of muscle force to maintain balance, however because of weak core muscle the force generated may not be adequate.

Lee et al study which assessed the reactive balance control showed that there is poor postural response along with greater centre of pressure sway area compared to older healthy control. [12]

According to Malarvizhi et al there was increase in pelvic tilt for both male and female population having low back pain. For female normal value of tilt was 15 degree and for male it was 13 degrees.[13] In anterior pelvic tilt there is downward tipping of pelvis so pubic symphysis moves inferiorly. [13]

With an increase in pelvic tilt there is also increase in force necessary required to stabilize pelvis against undue rotation. When the pelvis is normally aligned, the axis of trunk weight force is near the axis of ground reaction force, hence the moment arm is short and the torque remains low. [14]

As there is an increase in pelvic tilt, moment arm also increases which in turn leads to increase in torque generated in the muscle causing muscle fatigue and pain from muscle strain. [14]

Prior study done by Chuang in 2018 showed that there was significant correlation between pelvic tilt and functional activities in both degenerative lumbar spondylolisthesis and non-degenerative spondylolisthesis.

Garbossa et al concluded that values of pelvic tilt higher than 20 degrees have been related to poor spinal function and HRQoL.[14] Kurzeja in 2022 analysed the ability to tolerate body balance disturbance in relation to selected changes in the sagittal plane of the spine in early school- age children conclude that with an increase in lumbar lordosis, increase in the body weight, there is deterioration of body balance disturbance tolerance skills. [15]

Mitsuru et al conducted a study on standing balance and compensatory mechanisms in adult spinal deformity in age group above 50 years and cobb angle >20 degree and C7 sagittal vertical axis at distance of more than 5 cm concluded that there was significant body sway and uneven weight bearing in adult spinal deformity. The postural parameters, head deviation and pelvic shift correlated most strongly with outcomes. [16]

CONCLUSION-

The study concludes that, there is a negative correlation between anterior pelvic tilt and balance in geriatrics with low back pain($r=-0.394$).

LIMITATIONS-

- Sample size was less
- Ratio of people having posterior pelvic tilt were less compared to people having anterior pelvic tilt.
- Ratio of male population was less than female population.
- Correlation of posterior pelvic with balance couldn't be determined because of less population size
- No specification for chronic and acute low back pain was taken

CLINICAL IMPLICATION-

According to various changes which body goes through during ageing balance is already a problem in geriatric population, however, this problem is increased because of low back pain. Geriatric having low back pain along with anterior pelvic tilt are at further risk of fall because of muscle imbalance caused. Thus, it is important to add postural correction training along with balance training for geriatrics with low back pain.

FUTURE SCOPE OF STUDY-

- To find if there is any relation between pain and balance.
- To find out if there is any comparison between male and female population.
- To find correlation of posterior pelvic tilt with balance.

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