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RESEARCH ARTICLE

RELATIONSHIP BETWEEN LUMBOPELVIC ALIGNMENT AND SEVERITY OF PRIMARY DYSMENORRHEA

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ABSTRACT

Background: Primary dysmenorrhea is defined as menstrual pain that is not associated with macroscopic pathology .It is typically occurs in the first few years after menarche and affects as many as 50% of post pubertal females .Purpose: of this study was to investigate the relationship between lumbopelvic alignment and severity of primary dysmenorrhea. Methods: Fifty adolescent female suffering from primary dysmenorrhea; their ages ranged from 15 to 25 years old and their BMI ranged from 19.5 to 27.9 Kg/m^2 ,were selected from outpatient clinics of Gynecology in One Day Surgeries Hospital, Cairo, Egypt. They were assigned into 2groups equal in number according to severity of pain. Group (A);(n=25)suffered from mild primary dysmenorrhea and group (B);(n=25) suffered from severe primary dysmenorrhea. Evaluation of severity of primary dysmenorrhea was done for all participants in both groups (A&B) using Visual Analogue Scale (VAS) and Verbal multidimensional scoring system (VMSS). Radiography and Surgimap software program were used to assess and analyze lumbopelvic alignment in the form of three angles (pelvic tilt , sacral slope ,lumbar lordosis).Measurement was done for one shot for participants in both groups (A&B). Results; showed that there was a statistical significant increase in the mean values of sacral slope in group (B) than group (A),and a statistical significant decrease in the mean values of pelvic tilt in group (B)than group (A) (P=0.018), (P=0.047) respectively while there was no statistical significant difference in mean values of lumbar lordotic angle between the two groups(A&B)(P=0.547).Also, there was a statistical significant inverse correlation between sacral slope and pelvic tilt in both groups (A&B) (p=0.010) . There was a statistical significant direct correlation between sacral slope and lumbar lordotic angle in both groups (A&B) (p=0.001). Conclusion: It could be concluded that lumbopelvic misalignment could increase intensification ofdysmenorrhic pain and might be associated with severe degree of primary dysmenorrhea.

INTRODUCTION

Primary dysmenorrhea is defined as menstrual pain that is not associated with macroscopic pathology .It is typically occurs in the first few years after menarche and affects as many as 50% of post pubertal females (1) The pain is characteristically colicky and located in the midline of the lower abdomen, but may be dull and may extend to both lower quadrants. Pain can radiate to the back of the legs or the lower back. Associated nausea, vomiting, diarrhea, fatigue, mild fever and lightheadache are fairly common (De Sanctis *et al*., 2016). It is caused by myometrium activity resulting in uterine ischemia causing pain. This myometrial activity is modulated and augmented by prostaglandin synthesis (Guylaine *et al*., 2005) Also it was reported that the level of tension in the ligaments and nerves connecting the sacral vertebrae and the uterus is the cause of painGenders *et al*., 2003). Severity ofprimary dysmenorrhea is usually measured by Verbal Multidimensional Scoring System (VMSS) and the Visual Analogue Scale (VAS) (De Sanctis *et al*., 2016).

Based on verbal multidimensional scoring system (VMSS), pain levels are defined as mild Dysmenorrhea: Painful menses that do not limit or hinder normal daily activities, and results in little or no systemic symptoms and/or analgesic need. Moderate Dysmenorrhea: Painful menses that slightly limit or hinders normal daily activities, and result in moderate systemic symptoms and/or analgesic need. Severe Dysmenorrhea: Painful menses that severely limit or hinder normal daily activities result in noticeable symptoms (such as fainting, vomiting) and respond poorly to analgesics (De Sanctis *et al*., 2016). Measurement of lumbopelvic alignment includes measurement of 3 angles ,these angles are sacral slope(SS) which is defined as the angle between the line of the sacral plate and the horizontal line perpendicular to the direction of the force of gravity, pelvic tilt (PT) which is defined as the angle between the line connecting the midpoint of the sacral plate to the femoral head axis and the vertical line parallel to the direction of the force of gravity,and lumbar lordotic angle(LLA) which is the angle measured from the inferior end plate of T12 and the superior end plate of S1 (Suzuki *et al*., 2019).

Abnormal restriction of movement of lumbosacral vertebrae increases body fluid within pelvis as well as contraction of uterus this leads to intensification of menstrual pain(Proctor *et al*., 2006) Women who showed an imbalance of pelvis experienced greater pain, as the change in position of the uterus due to imbalance of pelvis, prompted an excessive amount of prostaglandin to be secreted(Kim MJ *et al*., 2016) The parasympathetic and sympathetic pelvic nerve pathways are closely associated with the spinal vertebrae ,in particular the second to fourth sacral segments and 10^{th} thoracic to the second lumbar segments(Proctor *et al*., 2006). Different studies have demonstrated that pelvic dysfunction and lumbar-sacral vertebrae mechanical restriction can compromise nervous functionality, blood supply, and fluid drainage. These conditions can generate local inflammation, which creates a nervous hypersensibility to painful stimuli. (Genders *et al*., 2003 & Proctor *et al*., 2010).

Misalignment of the pelvic girdle, including the sacrum and ilia, can cause dysmenorrhea. The uterus is supported within the pelvic cavity by the two broad ligaments, the two round ligaments, and the two utero-sacral ligaments, as well as other ligaments. Imbalance of the tension within the ligaments can predispose to dysmenorrhea. The uterus receives its innervation from spinal nerves T12-L4 and S2-S4. Misalignment in the vertebrae that encase the exiting spinal nerves at these levels causes interference, which can affect the function of the uterus and result in dysmenorrhea (Tolu Oyelowo, 2007). So this study was conducted toinvestigate the relationship between lumbopelvic alignment and severity of primary dysmenorrhea**.**

MATERIALS AND METHODS

Fifty participants diagnosed as primary dysmenorrhea were selected from outpatient clinics of One Day Surgeries Hospital, Cairo, Egypt. Duration of the study was eight months from February 2021 to September 2021. The study was approved by the research ethical committee of physical therapy, Cairo University in February 2021 (NO.P.T .REC/ 012/003146). All participants signed an informed consent form before initiating the study

Inclusioncriteria: Fifty adolescent female , All diagnosed as primary dysmenorrhea, their age ranged from 15to 25 years, their BMI was less than 30 kg/m2,

Exclusion criteria: Participant were excluded from this study if they had; Secondary dysmenorrhea, pelvic pathology, history of gynecological operations, fractures or previous operations related to the spine or pelvis.

Subjects: Fifty post-pubertal female diagnosed as primary dysmenorrhea were selected from outpatient clinics of One Day Surgeries Hospital, Cairo, Egypt. They were distributed into two groups equal in number according to severity of primary dysmenorrhea. Group A (n=25); diagnosed as mild primary dysmenorrheal Group B (n=25); diagnosed as severe primary dysmenorrhea. Lumbopelvic alignment was assessed by using digital radiograhy (plain X-ray) from lateral standing view then analyzed photos by using surgimap software program to measure lumbar lordotic angle ,pelvic tilt angle, sacral slope angle for participants in both groups (A&B)

Procedures

Assessment procedures: The physiotherapist conducted clinical assessment by recording personal data sheet, Weight and height measurements, BMI, menstrual history. One shot assessment was used in which all participant in the two studied groups(A&B)were assessed for one time. Severity of primary dysmenorrhea was assessed by using Visual analogue scale (VAS), Verbal multidimensional scoring system (VMSS). The VAS using a 10-cm line represented the continuum of the female opinion of the degree of pain. One extremity of the line represented 'unbearable pain', and the other extremity represented 'no pain at all' (Unsal A. *et al*., 2010). Each participant were asked to rate the degree of pain by making a mark on a line from zero to ten represented the VAS after explanation and understanding of VAS.

VMSS system was defined as mild, moderate, and severe based on pain and limited activities (Unsal *et al*., 2010). Each participant was asked to rate the degree of pain on VMSS after full explanation of VMSS. Lumbopelvic alignment was assessed by using digital radiograhy (plain X-ray) from lateral standing view then analyzed photos by using surgimap software program to measure lumbar lordotic angle ,pelvic tilt angle, sacral slope angle for participants in both groups (A&B).

Radiographic assessment of lumbopelvic alignment (Plain X-ray)

- Each participants in both groups (A&B) had standing lateral radiograph of the spine and pelvis by the same radio-technologist using the same radiographic equipment.
- Each participant was asked to remove anything metal in lumbopelvic region andto stand with knees fully extended and arms crossed over the chest.
- The radiographic equipment was centered on third lumbar vertebrae including all lumbar and sacral vertebrae with both heads of the femur.
- Each participant was asked to hold breath forfew seconds while taking X-ray imagethen exhale after taking view.

Analysis of radiograph views by surgimap software program

Radiographs was digitized and inserted to surgimap software which is validated according to (Wu *et al*., 2014).

Each lateral radiograph view was introduced to surgimap software program and the measurements followed the following steps;

- As for operating methods of the software, the introductions and specific measuring methods exist in the same window.
- First, the outlines of the femoral heads were identified with two adjustable circles.
- Second, the segments corresponding to key vertebral endplates (superiorS1, superior L1) once the landmarks were identified, spino pelvic parameters are automatically generated by the software based on the demarcated landmarks

- After identification of vertebral endplates and femoral heads and drawing the lines of the angles the software measures the angles automatically ,which may reduce sources of error, with the measuring results are displayed below the introductions

Statistical analysis; Data were expressed as mean± SD. Test of normality, Shapiro-Wilk and Kolmogorov-Smirnov test, was used to measure the distribution of data measured, accordingly, comparison between normally distributed variables in the two groups was performed using unpaired t test. Unpaired t-test was used to compare between measured variables of the two groups (A&B). Also, pearson correlation coefficient used to determine the relation between the severity of dysmenorrhea and lumbopelvic alignment. Statistical package for the social sciences computer program (version 20 for Windows; SPSS Inc., Chicago, Illinois, USA) was used for data analysis. *P* less than or equal to 0.05 was considered significant.

RESULTS

General characteristics of the participants in both groups (A & B): As shown in table (1),the mean values (± SD) of age in groups A and B were 20.8±4yrs and21.3±4.5 yrs , respectively. There was no statistical significant difference between the two groups (t= -0.297, p=0.768). The mean values (± SD) of weight in groups A and B were 61±9.6 and 61.5±12.6 kg., respectively. There was no statistical significant difference between the two groups (t= -0.127, p= 0.900) The mean values (± SD) of height in groups A and B were159.3±5.4and 160.5±5.8cm, respectively. There was no statistical significant difference between the two groups (t= -0.632, p= 0.532). The mean values (± SD) of BMI in groups A and B were23.9±3.1and 23.7±4.2kg/m2, respectively. There was no statistical significant difference between the two groups (t= 0.179, p= 0.860).

Sacral slope outcome measure: As shown in table (2). The mean value of sacral slope in group A was 32.5 ± 7.1degrees. While in group B, the mean value of sacral slope was 39.1 ± 7 degrees, where the paired t value was -2.52and P value 0.018,which revealed a statistically significant increase in group B than group A

Pelvic tilt outcome measure: As shown intable (2).The mean value of pelvic tilt in group A was 14 ± 6.8 degrees. While in group B, the mean value of pelvic tilt was 8.9 ± 6 degrees, where the paired t value was 2.7andP value 0.047, which revealed a statistically significant decrease in group B than group A .

Lumbar lordotic angle outcome measure: As shown intable (2). The mean value of lumbar lordotic angle in group A was 55.7 ± 15.6 degrees. While in group B, the mean value of lumbar lordotic angle was 58.7 ± 10.8 degrees, where the paired t value was -0.610 and P value 0.547, which revealed non-statistical significant differences in group B and group A .

Correlation between severity of primary dysmenorrhea and measured variables: As shown in table (3) ,both groups A&B recorded a statistically significant inverse correlation between sacral slope and pelvic tilt outcome measures were r value -0.465 with P value 0.010, both groups A&B revealed a statistically significant direct correlation between sacral slope and lumbar lordotic angle outcome measures were r value 0.738 with P value 0.001.

The results of this study revealed that: There was a statistical significant increase in the mean values of sacral slope in group (B) than group (A),and a statistical significant decrease in the mean values of pelvic tilt in group (B)than group (A) (P=0.018), (P=0.047) respectively while there was no statistical significant difference in mean values of lumbar lordotic angle between the two groups(A&B)(P=0.547). Also, there was a statistical significant inverse correlation between sacral slope and pelvic tilt in both groups (A&B) (p=0.010) . There was a statistical significant direct correlation between sacral slope and lumbar lordotic angle in both groups (A&B) (p=0.001)

DISCUSSION

Primary Dysmenorrhea is characterized by a crampy suprapubic pain that begins between several hours before and a few hours after the onset of the menstrual bleeding. Symptoms increase with maximum blood flow and usually last less than one day, but the pain may persist up to 2-3 days, it may impair the quality of personal and social life. In many women it is associated with mood disorders, sleep disturbance and limitations in performance of daily activities (school and work). (De Sanctis V *et al*., 2016). Sagittal alignment of the lumbopelvic region can be determined by pelvic and spinal parameters which have established the consistent correlations in normal population studies, to achieve sagittal balance, several parameters including pelvic tilt (PT) and sacral slope (SS) have been defined to evaluate the alignment of the spino‑pelvic complex(Chanplakorn P.,2011). Restriction in pelvis mobility affect the organs via pelvic floor , ligaments and fascia on the other hand. Moreover ,the close and relation to vessels and nerves play a significant role (Ramanah etal.,2012).Pelvic floor muscles and the connective tissue between the osseous structures build a link between the pubis symphysis ,pelvic,sacral and coccygeal bones .so, each change position causes a change in the tension of the pelvic floor (Wurn *et al*.,2004). Spinal manipulative procedures may be effective because of mechanical connection between sacrum and the uterus via ligamentous attachments and the neurologic connection between uterine function and sacral nerve roots. Spinal manipulation of lumbosacral joint restriction correct aberrant joint motion, and the resultant sympathetic response inhibits uterine contractions and increase blood flow to the pelvic region (Holtzman *et al*., 2008). There is a lack of research about whether lumbopelvic alignment causes intensification of pain during menstruation(Kim MJ *et al*., 2016). Therefore the purpose of this research was to investigate the relationship between lumbopelvic alignment and severity of primary dysmenorrhea.

The results of this study revealed that there was a statistical significant increase in the mean values of sacral slope in group (B) than group (A),and a statistical significant decrease in the mean values of pelvic tilt in group (B)than group (A) (P=0.018), (P=0.047) respectively while there was no statistical significant difference in mean values of lumbar lordotic angle between the two groups(A&B)(P=0.547). Also, there was a statistical significant inverse correlation between sacral slope and pelvic tilt in both groups (A&B) (p=0.010).

Table (1): General characteristics of participants in both groups (A&B)

Measurd variable	Group A Mean±SD	Group B Mean±SD	t-value	p-value
Age (years)	20.8±4	21.3±4.5	-0.297	0.768
Weight (kg)	61±9.6	61.5±12.6	-0.127	0.900
Height (cm)	159.3±5.4	160.5±5.8	-0.632	0.532
BMI (kg/m^2)	23.9±3.1	23.7±4.2	0.179	0.860

Data are expressed as mean ± SD. NS= p> 0.05= not significant

Table 2. Comparison of mean values of measured variables between both groups(A&B).

Measured variables	Group A Mean ±SD	Group B Mean ±SD	t- value	P value
Sacral slope (degree)	32.5 ± 7.1	39.1 ± 7	-2.52	0.018*
Pelvic tilt (degree)	14 ± 6.8	8.9 ± 6	2.07	0.047*
Lumbar lordotic angle (degree)	55.7 ± 15.6	58.7 ± 10.8	-0.610	0.547

SD: standard deviation p-value: probability value *: significant

Table 3. Correlation between severity of primary dysmenorrhea and measured variables for both groups(A&B)

Variables		PT	LLA
SS	r P-value	-0.465 0.010*	0.738 0.001*
PT	r P-value	1	-0.179 0.345
LLA	r P-value	-0.179 0.345	1

r: Pearson correlation coefficient P value: Probability value *: Significant

There was a statistical significant direct correlation between sacral slope and lumbar lordotic angle in both groups (A&B) (p=0.001). A possible explanation for these results is that the uterus is situated in the middle of the pelvis, between the symphysis pubis and the sacrum. Misalignment of the pelvic girdle, including the sacrum and ilia, can change in position of the uterus due to imbalance of pelvis, prompted an excessive amount of prostaglandin to be secreted and cause more pain during dysmenorrheal (Kim MJ *et al*., 2016). Another explanation for the result of the current study is that abnormal restriction of movement of lumbosacral vertebrae , increases body fluid within pelvis as well as contraction of uterus this leads to intensification of menstrual pain (Proctor *et al*., 2006). According to previous studies, the ligaments that connect the sacrum and the surrounding frame or the sacrum nerve roots passing around them have a close relationship with the uterus, Therefore, excessive uterine contraction during the menstrual period affects blood circulation by compressing the surrounding soft tissues and blood vessels, leading to the judgment that it is related to pain in the pelvis as well as pain in the sacrum (Park *et al*., 2020). The results of the current study agreed with that of Holtzman *et al*., 2008 who studied the effect of lumbosacral manipulation on primary dysmenorrhea and found that spinal manipulative procedures affect sacral position which decreases tension on broad ligaments of uterus and pelvic nerve roots thus alleviating menstrual pain. Also, the results of this study agreed with that of Lee JM *et al*., 2007 who reported that the more severe primary dysmenorrhea, the more the autonomic imbalance. Based on this fact, it is judged that the spine and primary dysmenorrhea are closely related. Moreover, Le Huec *et al*., 2011stated thatthere is a strong correlation between sacral slope and lumbar lordosis,and this fact corresponds with the current result. Also, the results of the current studyrevealed that there was a statistical significant inverse correlation between sacral slope and pelvic tiltin both groups (A&B) (r= -0.465) (p=0.010) and this result came in agreement with that of Shah A *et al*., 2019who reported that if lumbar lordosis becomes too small, an alternative is to increase pelvic tilt (since pelvic tilt and sacral slope are inversely proportional). On the other hand, the results of the present study was contradicted with that of Molins-Cubero *et al*. 2014who studied the changes in pain perception after pelvis manipulation in women with primary dysmenorrhea and found that there was no effect of pelvis manipulation on primary dysmenorrhea. Also, the results of the current study was contradicted with that of Kim MJ *et al*., 2016,who stated that there was statistical significant difference in thelordotic angle between primary dysmenorrhea group and normal group . From the obtained results it was concluded that misalignment of pelvis and sacral slope could increase intensification of pain and might be associated with severe degree of primary dysmenorrhea.

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