The influence factor affected on the pelvic morphology for nulliparous women and men: A retrospective cohort study on 213 cases.

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【Abstract 】

Background:

Our previous research has suggested that aging and vaginal delivery after adulthood favor occurrence of pelvic torsion (PT). Therefore, etiological investigation must take gender and history of vaginal delivery into account. In addition, no previous studies have evaluated the effects of age-related changes, degree of pelvic opening and pelvic torsion in men and nulliparous women.

Purpose:

The purpose of our study was to examine the secular trend, factors influencing the degree of pelvic opening (PO), and the degree of PT in men and nulliparous women.

Methods:

The study participants were divided into two groups: group M consisted of 122 healthy men with a mean age of: 26.2±15.2 years, whereas group N consisted of 91 nulliparous women with a mean age of 25.5±12.7 years. Group M and N were further divided into three age groups. Category 1 comprised of individuals 0-19 years old, category 2 was comprised of individuals 20-39 years old and category 3 consisted of individuals over 40 years old.

Pelvic measurements in groups M and N were compared using the Student's t test. The relationship between PO and/or PT and each pelvic measurement was assessed using Pearson product-moment correlation coefficients. Next, a one-way analysis of variance (ANOVA) was conducted to compare pelvic measurement values, among each category. This study was conducted in accordance with the DECLARATION OF HELSINKI.

Results:

Student's t-test found no significant difference in the mean values of pelvic measurements between group M and N. In groups M and N, PO was strongly positively correlated with the posterior superior iliac spines (PD) and weakly negatively correlated with the interspinous diameter (ID).

The results of the one-way ANOVA indicated significant differences in group M and N between categories 1 and 2 and between categories 1 and 3 in ID. There was a significant difference between categories 1 and 3 and between categories 2 and 3 in Group N in PO.

Conclusion:

There is no difference in pelvic measurements between group M and N, and individual variation affect pelvic morphology. Factors affecting the degree of pelvic opening in both groups were anterior widening and posterior narrowing of the pelvis, with the latter having a stronger effect. Regarding secular change in pelvic morphology over time, the only age-related change was the relatively wider anterior part of the pelvis in nulliparous women over 40 years of age. This phenomenon is unique to nulliparous women. Pelvic torsion is affected by individual differences.

【Introduction】

Pelvic girdle pain is the most prevalent symptom after delivery, and is one of the major problems during the perinatal period[1]. In particular, it hinders childcare and return to work. Postpartum pelvic alignment changes compared to early pregnancy[2], and abnormal pelvic alignment is one of the causes of pelvic pain[3]. Higher levels of women hormones produced during pregnancy results in increased laxity of the ligaments around the pelvis[4] and the pelvic girdle joint[5]. The effects of changes to the pelvic girdle that occur during the perinatal period result in a preauricular groove[6] on the facies auricularis. In addition, sclerosing osteitis, which is more common in women during childbirth, is associated with the repair of minor trauma to the subchondral bone at birth[7].

Therefore, the perinatal period is a time of abnormal stress on the pelvic girdle. The perinatal period is a time of significant changes to pelvic alignment due to the mechanical stress and the effects of women hormones on the pelvic girdle during pregnancy and delivery. Prevention of pelvic alignment abnormalities prior to delivery is important because abnormalities in pelvic alignment can interfere with normal childbirth, cause sacroiliac pain[2], and result in urinary incontinence[8]. However, there is a lack of basic data on trends in changes to pelvic alignment over time and actual measurements for different age groups.

Therefore, the purpose of this study was to determine the normal pelvic morphology and age-related changes in nulliparous women and men aged 3-77 years.

【Method】

The study participants were divided into two groups: group M consisted of 122 healthy men with a mean age of: 26.2±15.2 years, whereas group N consisted of 91 nulliparous women with a mean age of 25.5±12.7 years. The frequency distribution of age for each group is shown in Table 1.

Group M and N were further divided into three age groups. Category 1 comprised of individuals 0-19 years old (group M: n=40, mean age=12.6±3.0 years, group N: n=29, mean age=12.7 ± 3.4 years); category 2 was comprised of individuals 20-39 years old (group M: n=64, mean age=26.6±5.9 years, group N: n=49,mean age=26.9±5.3 years); and category 3 consisted of individuals over 40 years old (group M: n=18, mean age=55.3±13.0

years, group N: n=13, mean age=49.2±8.1 years).

Measurement of the pelvic morphology was performed by external pelvimetry using the Martin pelvimeter. The interspinous diameter (ID), the distance between the posterior superior iliac spines (PD), the first oblique diameter (FOD), the second oblique diameter (SOD), and the lateral conjugates were measured. The mean of FOD and SOD was the oblique distance (OD). The degree of pelvic opening (PO) was calculated by dividing PD by ID. Pelvic torsion (PT) was calculated by dividing the absolute value, which was calculated by dividing FOD by SOD by the height. We excluded women who individuals with a ≥0.5 cm difference between the lateral conjugates.

Pelvic measurements in groups M and N were compared using the Student's t test. The relationship between PO and/or PT and each pelvic measurement was assessed using Pearson product-moment correlation coefficients. Next, a one-way analysis of variance (ANOVA) was conducted to compare pelvic measurement values, between each category. The Tukey-Kramer method was used for post-hoc comparisons. SPSS version 23 was used for statistical analysis, and the significance level was set to < 5%.

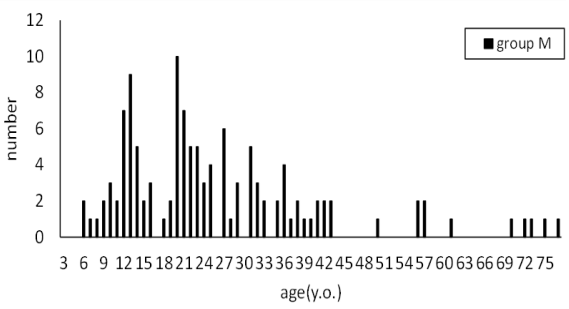
This study was conducted in accordance with the DECLARATION OF HELSINKI.

【Results】

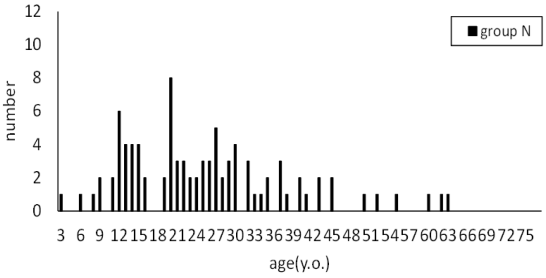
Student's t-test found no significant difference in the mean values of pelvic measurements between group M and N (Table 1).

In group M, the PO was significantly correlated with PD (r=0.86, p<0.01) and ID (r=-0.27, p=0.01) (Table 2a). In group N, the PO was significantly correlated with PD (r=0.89, p<0.01), ID (r=-0.25, p=0.02) and OD (r=0.23, p=0.01) (Table 2a). PT was not significantly correlated in both groups (Table 2b).

The results of the one-way ANOVA indicated significant differences in group M and N between categories 1 and 2 and between categories 1 and 3 in ID (Fig.2). There were differences in OD between all categories in



a: Group M



b: Group N

Fig.1 Frequency distribution

Table 1 Measurement value of Group M and N

	Group M	Group N	p value
Age(y.o.)	26.2±15.2	25.5±12.7	-
Height(cm)	165.0±1.4	155.8±12.3	-
Weight(kg)	59.1±14.8	49.5±12.3	-
BMI(kg/m2)	21.3±3.3	20.0±4.1	-
ID(cm)	23.1±2.7	23.2±2.2	p=0.60
OD(cm)	22.4±2.3	22.3±2.2	p=0.58
PD(cm)	8.3±2.0	8.1±1.9	p=0.69
PO	0.36±0.08	0.35±0.08	p=0.95
PT	0.27±0.26	0.34±0.31	p=0.17

ID : Interspinous diameter distance
OD : Mean of first obligate distance and second obligate distance
PD : Posterior superior iliac distance
PO : Pelvic opening dgree
PT : Pelvic torsion dgree

Table 2. Pearson product-moment correlation coefficient of PO and PT

	ID		OD		PD	
Group M	−0.27	p=0.01	−0.03	n.s.	0.86	p<0.01
Group N	−0.25	p=0.02	0.23	p=0.01	0.89	p<0.01

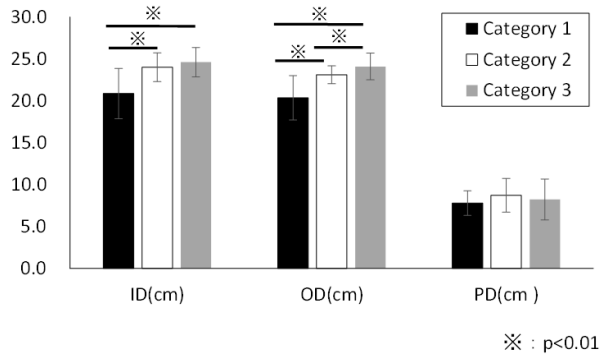
a: P O

	ID		OD		PD	
Group M	0.15	n.s.	0.13	n.s.	0.13	n.s.
Group N	0.08	n.s.	0.17	n.s.	0.09	n.s.

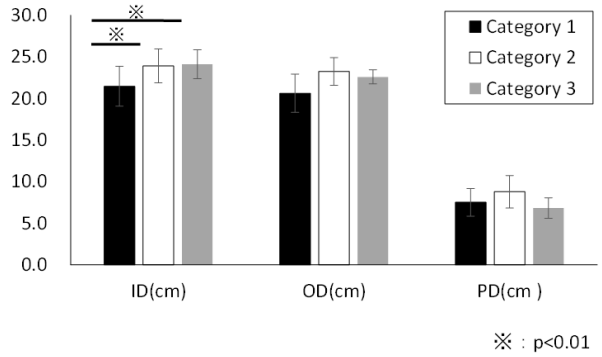
n.s. : not significant

b: P T

ID : Interspinous diameter distance
OD : Average of first obligate distance and second obligate distance
PD : Posterior superior iliac distance



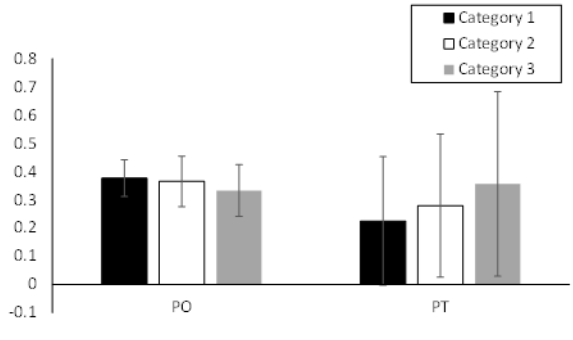
a: Group M



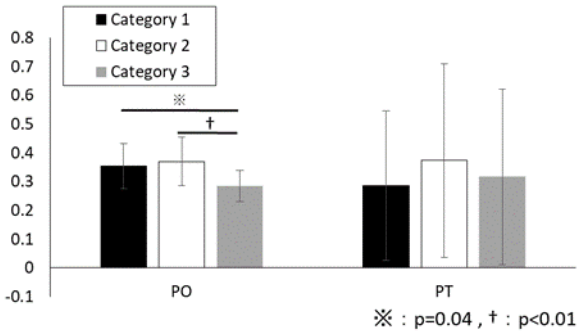
b: Group N

Fig. 2 ANOVA results for External pelvimetry value among each category

group M (Fig. 2a). The PD was not significantly different among the categories in both groups. There was no significant relationship between the PO categories in group



a: Group M



PO : Pelvic opening dgree
PT : Pelvic torsion dgree

b: Group N

Fig. 3 One-way ANOVA results for PO and PT among each category

M (Fig. 3a), but there was a significant difference among categories 1 and 3 (p=0.04) and between categories 2 and 3 (p<0.01) in Group N (Fig. 3b). In addition, there was no significant relationship between each category in both groups in PT.

【Discussion】

The external pelvimetry measurements reflect the linear distance in the pelvic cavity. As a result, the external pelvic measurements indicate the distance between each index of the iliac bone. The results of external pelvimetry values, PO and PT, indicated no gender differences (Table 1). Therefore, differences in pelvic morphology were due to individual differences and not

gender.

The influencing factors for PO were ID (group M: r=-0.27, group N: r=-0.25) and PD (group M: r=0.86, group N: r=0.89) in both groups (Table 2). Thus, the PO was strongly dependent on the ratio of the distance between posterior superior interosseous spines. The PD is derived from the posterior superior iliac distance and indicates the transverse diameter of the sacrum. There was substantial variation in the size of the sacrum among participants, which was the cause of the influence on the PO. The aging in pelvic morphology, the N group had significantly different PO in categories 1 and 3 and categories 2 and 3 (Fig.3b). This is a change in PO over time that was only observed in women participants over 40 years of age. This event may be related to gender differences in the iliac auricular surface and the influence of women hormones. Because, the measured parameter values for the size of the iliac auricular surface are significantly greater in men than in womens[9]. Therefore, the distance between the superior anterior iliac spines in women may be more variable than in men. Furthermore, joint laxity is higher in women than in men [10]. In addition, the hormonal changes during the menstrual cycle increases the amount of estrogen exposure over time. As estrogen exposure increases joint laxity[10,11], the distance between the superior anterior iliac spines in women may increase with age.

There was no significant difference in values of PT among the different age categories in groups M and N. In our previous study, we found that previous vaginal delivery and aging were factors associated with PT. However, the women in this study had never delivered, suggesting that aging alone may not cause PT. Moreover, in the presence of osteoarthritis, there is a progressive deformity of the sacroiliac joint surface[12], which is a factor affecting PT. However, in this study, there was no correlation between PT and age in either group. We found that PT depends on individual differences rather than on gender or age-related effects.

【Limitations】

The study is a retrospective study, and therefore, has certain limitations in assessing the relationship between pelvic morphology and each category. In addition, the relationship between the pelvic morphology and the sacroiliac joint surface morphology is unclear because the image of the sacroiliac joint surface has not been evaluated.

【Conclusion】

There was no difference in pelvic measurements between men and women, and there was substantial individual variation. Factors affecting the degree of pelvic opening in both study groups were anterior widening and posterior narrowing of the pelvis, with the latter having a stronger effect. Regarding secular changes in pelvic morphology over time, the relative anterior part of the pelvis tended to be wider in nulliparous women over 40 years of age. This phenomenon is unique to nulliparous women. Pelvic torsion is affected by individual characteristics.

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