

Measurement of Subpubic Angle in Radiograph

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ABSTRACT

Introduction: Subpubic angle, an important parameter used for sex determination in the pelvis, is the angle between two inferior pubic rami below the symphysis pubis. This study was carried out to determine the subpubic angle among the individuals referred for pelvic and KUB radiographs in the department of Radiology and Imaging, Tribhuvan University, Teaching Hospital.

Methods: Prospective cross-sectional study was done on 120 individuals. The subpubic angle was measured by drawing two tangent lines on the inferior border of the pubic rami. The subpubic angle of both sexes was measured. An independent sample t-test for equality of means was used to determine the difference between the two sexes regarding the subpubic angle. The correlation between the subpubic angle and the age of subjects was obtained using Pearson Correlation Coefficients in males and females.

Results: The range of the subpubic angle in male was 82° to 122° and the mean was 104.72°±10.47°. In females, the range was 96° to 159° and the mean was 137.15°±11.92° with a significant statistical difference from the angle in male (p<0.05). The subpubic angle was not significantly correlated with age in males (r=0.029, p=0.824) whereas, in females, the correlation of subpubic angle with age was significant (r=-0.303, p=0.019).

Conclusion: The mean subpubic angle was significantly wider in females than in males in this study. We found a weak negative correlation between subpubic angle and age in females whereas in the male there was no correlation between age and subpubic angle.

Keywords: Age; Pelvis; Pubic Bone; Sex Determination; Symphysis Pubis

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INTRODUCTION

Many areas have been investigated for the morphological differences in males and females, the bony pelvis is one of the most evaluated body parts. Apart from their medical



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and anatomical values, these morphological differences for sex determination have been used in forensic and anthropological studies.^{1,2} Within the bony pelvis one of the important parameters used for sex determination is the subpubic angle. Subpubic angle (SPA), referred to as pubic arch, is the angle that exists between the inferior rami and below the pubic symphysis in an articulated bony pelvis.³ Subpubic angle of the female is significantly larger than that of the male. It is V-shaped in males and U-shaped in the female.⁴ Although many studies evaluating subpubic angles are available worldwide, no such study is available in Nepal. Thus, this study was aimed to measure the subpubic angle and correlate it between male and female.

METHODS

This prospective cross-sectional study was carried out in 120 individuals (60 male and 60 female) sent to the Department of radiology and imaging of Tribhuvan University Teaching Hospital for radiographs of pelvis or KUB radiographs from the period of July 2019 to October 2019. As sex determination doesn't occur until puberty, children were not included in the study. Those radiographs with underlying pathology within the bony pelvis were also excluded from the study.

The measurements were carried out with the measuring tools available on the software of the system. All the measurements were carried out with appropriate magnification. For measuring subpubic angle, two tangent lines were drawn along the inferior border of the pubic rami. The angle made through the intersection of these two lines represents the subpubic angle.

Statistical analysis was carried out with the help of SPSS version 25 and Microsoft Excel. The mean, standard deviation, and range of subpubic angles were obtained. Comparison of subpubic angle in male and female and correlation of subpubic with age was done with independent sample t-test and Pearson's correlation coefficient, $p < 0.05$

was considered to be statistically significant.

RESULTS

Among 120 subjects, 60 were male and 60 were female. The mean age of the subjects was 43.3 ± 17.4 years with a range of 18-93 years. The mean SPA of the total sample was found to be $120.90^\circ \pm 19.95^\circ$ with a range of 82° to 159° . Mean SPA in male was $104.72^\circ \pm 10.47^\circ$ with a range of 82° to 122° and mean SPA in female was $137.15^\circ \pm 11.92^\circ$ with a range of 96° to 159° (Table 1). SPA in females was significantly wider than that in males ($p=0.001$).

There was no significant correlation between age and subpubic angle in males ($p=0.824$) whereas in female there was a weak negative correlation between subpubic angle and age ($p=0.019$) which means that in female, subpubic angle decreases with an increase in age (Table 2, Figure 1 and 2).

Table 1: Subpubic angles in male and females. (n=120)

Sex	Widest (°)	Narrowest (°)	Mean (°)	S.D.
Male	122	82	104.72	10.47
Female	159	96	137.15	11.92
Total			120.93	19.75

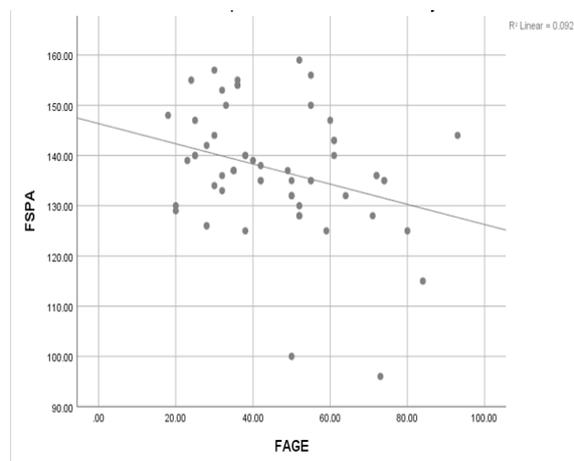


Figure 1: Correlation between SPA and Age in Female

Table 2: Correlation of subpubic angle with gender and age. (n=120)

Sex	Karl Pearson's Correlation Coefficient (r-value)	p-value
Male	0.029	0.824
Female	-0.303	0.019

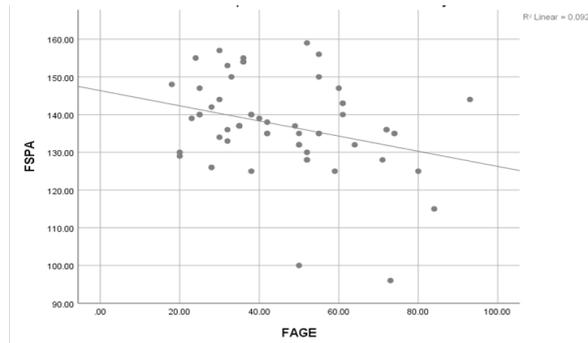


Figure 2: Correlation between SPA and Age in Male

DISCUSSION

Responsiveness of the pelvis to sex hormone increases the growth of the pelvis during the adolescent growth phase in the region of the pubis and ischium, which results in a longer pubis, a larger pelvic outlet, and a more obtuse subpubic angle. These differences in growth are also related to the sexual dimorphism between males and females associated with parturition. The subpubic angle in the female is morphologically different from the subpubic angle in males with a widely accepted cut-off value of 90° for the discrimination.⁴ However, our study showed a mean SPA in male (104.72° ± 10.47°) more than 90°. Though our study findings cannot be generalized for our population due to the smaller sample size, this widely accepted simple rule of 90° SPA for sex determination may not still be applicable in our population as mean SPA in the male in our study is way more than the cut-off value. Khodeary M et al. also found higher SPA (102.31° ± 12.50°) than the widely accepted cut-off value in male, whereas Mohd Ali et al. found smaller SPA (68.6° ± 7.6°) in male.^{4,5}

Mohd Ali et al. found smaller SPA than the widely accepted cut-off value in females (87.4° ± 6.5°) as well. Demarcating point to discriminate between females and males in their study was 78.6°.⁴

Our study showed significantly higher SPA in females as compared to male (137.15° ± 11.92° and 104.72° ± 10.47° respectively), which is concordant with findings of many other similar studies done by Mohd Ali et al., Khodeary M et al., Torimitsu et al., Franklin et al., Akhlaghi et al. and Oladipo et al.^{4,5,6,7,8,9} SPA in our study is comparable to the SPA in the study done by Akhlaghi et al. (140.0° ± 14.3° in male and 101.0° ± 13.3° in female), but wider than the SPA in above mentioned other similar studies.⁸ The differences may be due to the different ethnic groups studied. However, SPA in male and female were also lower in the study done by Kanika Sachdeva et al. in the Indian population (59.05° ± 7.11° and 75.60° ± 9.81° respectively) as compared to our study finding.³ Thus, another reason for this variation could be due to different modalities used to measure the angle – plain radiographs, CT, projection images and even bony pelvis. We used plain radiographs of the pelvis or KUB radiograph for the measurement of SPA in our study.

There was no significant correlation of SPA with age in the male in our study. The weak negative correlation of SPA with age in female was seen in our study. The reason behind this could be the responsive of the pelvis to sex hormones.

CONCLUSION

The mean subpubic angle for male and female was found to be 104.72° and 137.15° respectively. There was a statistically different SPA between males and females (p < 0.05) and therefore SPA have dimorphic potential. There was no significant correlation of SPA with age in males whereas in female there was a weak negative correlation between subpubic angle and age, probably due to responsiveness of the pelvis with sex hormones.

CONFLICT OF INTEREST

None

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None

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