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Measurement of Ischiopubic Index in Pelvic Radiographs

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Methodology: Data were collected over the period of 4 months from June to September 2018 with the total of 120 patients who underwent pelvic and KUB radiographs. The pubic length, ischial length and the ischiopubic index were measued.Pubic length is a straight line drawn on the radiograph from centre of the triradiate cartilage to the medial end of pubic symphysis. Ischial length is a straight line drawn on the radiograph from triradiate cartilage perpendicular to the line joining the bilateral lower ischial tuberosities.Ischiopubic index is determined from the pubic length divided by ischial length, and then multiplied by 100.

Results: The mean pubic length in male was 8.3±0.82 cms and 9.21±0.8 cms in female. Mean ischial length were 9.05±0.73 cms and 8.32±0.72 cms in male and female respectively. The ischial and pubic lengths exhibited statistically significant differences between males and females ($p<0.05$).

Keywords: *ischial length, ischiopubic index, pelvic radiograph, pubic length.*

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Measurement of Ischiopubic Index in Pelvic Radiographs

B R Joshi [α] & Sahana Kayastha [σ]

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Results: The mean pubic length in male was 8.3±0.82 cms and 9.21±0.8 cms in female. Mean ischial length were 9.05±0.73 cms and 8.32±0.72 cms in male and female respectively. The ischial and pubic lengths exhibited statistically significant differences between males and females ($p<0.05$). In males and females, the mean ischiopubic index were 91.73±5 and 110.9±7 respectively. The ischiopubic index were found to be higher in females than in males.

Conclusion: This study concluded that the pubic length and ischial length are higher in females than in males and therefore have dimorphic potential.

Keywords: ischial length, ischiopubic index, pelvic radiograph, pubic length.

I. Introduction

The pelvis, the most sexually dimorphic area of the body, is essential for biological sex determination of the adult skeleton.[1] This is because one of the major biological differences between men and women, that of having babies, largely determines the shape of that part of the body. Various studies have shown extensively that the hip bone is an ideal bone for sex determination because it reflects not only the general differences between the sexes but also the special adaptation of the female hip bone for child bearing.[2] The innominate bone has long been recognized as one of the best skeletal indicators of sex in an adult individual. The ischiopubic index is useful in sex differentiation.[3] The sexual differences in the pelvis are of interest to anatomist, gynecologist, and even anthropologist. The extent of sex determination is so important to females with narrow cavity which find it more difficult to deliver babies naturally than those with wide pelvic cavity. The growth of the pelvis is in the width resulting to wide pelvic inlets as such, study will determine the sex difference using the ischiopubic measurement (index) of patients radiograph with no pathological abnormalities and fractures. The ischiopubic index is the measurement of the distance between the triradiate cartilage (acetabulum) and the pubic tubercle of the pelvic bone divided by the distance between the triradiate cartilage (acetabulum) and the ischial tuberosity of the pelvic bone, multiplied by hundred.[4]

This study reflects not only the general differences between the sexes but also the special adaptation of female hip bone for child bearing. It has been observed that the size of the ischiopubic index determines the size of the birth canal, which is an important criterion in vaginal delivery. This may be of value in physical anthropology, anatomy, gynecology to estimate the extent of labor, archeological analyses and in solving medicolegal cases. The objective of this study is to measure pubic length and ischial length and to define ischiopubic index.

II. Methodology

This study was conducted in a tertiary hospital in Nepal during the period from June 2018 to September 2018. Data were collected over the period of 4 months from June to September 2018 with the total of 120 patients. Inclusion criteria were normal AP radiographs aged between 18 to 70 years of male and female patients. Exclusion citeria were trauma of pelvis and underlying bone disease which could affect the intact pelvic bone.

All the AP pelvic and KUB radiographs fulfilling the selection criteria for during the study period were enrolled numbering 120 total patients. These radiographs were performed in anterior-posterior view by using Hitachi x-ray machine with capacity 150 kV and 500 mA. The x-rays were performed in Kv ranges from 65-70 and mAs ranges 35-40 using Computed Radiography image receptor (AGFA Company) of standard speed. The size of image receptor was 14"x17" with use of table bucky. These x-rays were processed in AGFA CR 30 readers.

The measurement were carried out with the measuring tools available on the software of the system. All the measurements were carried out with appropriate

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magnification. The parameters measured were pubic length and ischial length.Pubic length is a straight line drawn on the radiograph from centre of the triradiate cartilage to the medial end of pubic symphysis.Ischial length is a straight line drawn on the radiograph from triradiate cartilage perpendicular to the line joining the bilateral lower ischial tuberosities (Figure 1). All the measurement were taken twice and the average recorded as the actual distance to ensure accuracy. Ischiopubic index is determined from pubic length divided by ischial length and then multiplied by 100.



Figure 1: Measurement of pubic length (AB) and ischial length (AC) in male radiograph

Statistical analysis was carried out with the help of SPSS version 16 and Microsoft Excel. The mean,standard deviation of pubic length, ischial length and ischiopubic index and corelation between pubic length,ischial length and ischiopubic index with the gender were expressed in tables and figures.

III. Results

The data was collected from 120 normal subjects, 60 males and 60 females with the age from 18 years old up to 70 years old. Patient's age, gender, pubic length, ischial length and ischiopubic index were recorded. Data were presented as mean and standard deviation for all variables. Data obtained were analyzed using the descriptive statistics to summarize the information, and inferential statistics (independent samples t-test) to verify if there were significant sex differences. $P<0.05$ was considered to be statistically significant. Detailed results are shown in the tables and figures below:

Table 1: Distribution of sample size according to gender

Gender	Frequency	Percent
Male	60	50%
Female	60	50%
Total	120	100%

Table 2: Mean, S.D and Range of pubic length of male and female pelvis

Sex	Mean	S.D	Max.	Min.	Range
Male	8.3	0.82	10.48	6.80	3.66
Female	9.21	0.8	11.04	7.70	3.34

S.D: Standard Deviation; N: Sample Size.

Table 3: Test of significance difference between males and females pubic length

Parameter	Mean difference	T	df	P
Pubic length	-0.910	-6.16	118	0.000

The mean values of pubic length for males in pelvic radiograph were found to be 8.3cm±0.82 with maximum 10.48cm and minimum 6.80 cm and that of female were found to be 9.21cm±0.8 with maximum 11.04cm and minimum 7.70cm [Table2]. The pubic length in females was observed to be higher than in males. These differences were observed to be statistically significant ($p<0.05$) [Table 3].

Table 4: Mean, S.D and Range of ischial length of male and female pelvis

Sex	Mean	S.D	Max.	Min.	Range
Male	9.05	0.73	11.36	7.75	3.61
Female	8.32	0.72	10.04	7.07	2.97

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Table 5: Test of significance difference between males and females ischial length

Parameter	Mean difference	T	df	P
Ischial length	0.73	5.474	118	0.000

The mean values of ischial length for males in pelvic radiograph were found to be 9.05cm±0.73 with maximum 11.36cm and minimum 7.75cm and that of female were found to be 8.32cm±0.72 with maximum 10.04cm and minimum 7.07cm [Table 4]. The ischial length in males measured more than that of females. These differences were observed to be statistically significant ($p<0.05$) [Table 5].

Table 6: Mean, S.D and Range of ischiopubic index of male and female pelvis

Sex	Mean	S.D	Max.	Min.	Range
Male	91.73	5	103.16	81.78	21.38
Female	110.9	7	134.23	100.43	33.80

Table 7: Test of significance difference between males and females ischiopubic index

Parameter	Mean difference	T	df	P
Ischiopubic Index	-19.14	-17.264	118	0.000

The mean values of ischiopubic index for males in pelvic radiograph were found to be 91.73±5 with maximum 103.16cm and minimum 81.78cm and that of female were found to be 110.9±7 with maximum 134.23cm and minimum 100.43cm [Table 6]. The ischiopubic index of the females was higher than that of males. These differences were observed to be statistically significant ($p<0.05$) [Table 7].

Table 8: Male and Female Ischiopubic Index

Subject	N	Mean±S.D	Median	Range	95% Confidence Interval	
					Lower	Upper
Male	60	91.72±5.0	92.1124	81.78-103.16	90.4357	93.0195
Female	60	110.8±7	110.54	100.43-134.23	109.07	112.67

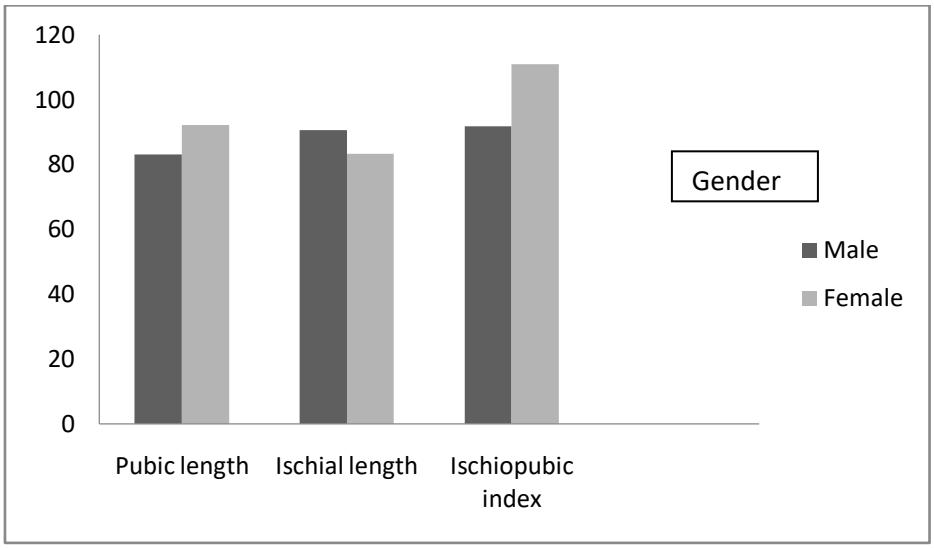


Figure 2: Bar-chart of different parameters according to gender

IV. Discussion

The objective of this study were to measure pubic length, ischial length and ischiopubic index. The sample consisted of 120 subjects with different genders, 60 males (50%) and 60 females (50%) [Table 1]. The mean values of pubic length for males were found to be 8.3±0.82cms with range 6.80 to 10.48cms and that for females were found to be 9.21±0.8cms with the range 7.70 to 11.04cms. The mean values for ischial length for males were found to be 9.05±0.73cms with range 7.75 to 11.36cms and for females were found to be 8.32±0.72cms with 7.07 to 10.04cms range. The mean values of ischiopubic index for males were found to be 91.72±5 with 81.78 to 103.16 range and that of female were found to be 110.9±7 with range 100.43 to 134.23.

It was observed that the males had higher ischial length than females while the females had longer

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pubic length and higher ischiopubic index in the present study. (Figure 2) The study done by Attah et al. in 120 radiographs(60 male and 60 females) resulted that the mean values of pubic length, ischial length and ischiopubic index of males in Maiduguri North Eastern Nigerian population were 81.0mm, 91.7 mm and 88.5 respectively while those of their female counterparts were 92.7mm, 87.1mm and 106.8 respectively. The mean ischial length was significantly higher in males than in females ($p<0.05$). The mean pubic length and the ischiopubic index of the females were significantly higher than that of the males ($p<0.05$) and the outcome from my study supports the same.[5]

The observation in this present study is similar with earlier reports from previous authors such as Igbigbi and Msamati (2000). Our observation was found with slight higher mean than on ischiopubic index of black Malawains with a mean index of 85.0 for males and 104.6 for females.[6] This dispersion might be due to the different techniques of measurement and also might be related to genetic and environmental factor.

Ekanem T. B, Udongwu A. and Singh S, (2009) who reported that the mean pubic length was significantly longer in females than males whereas the mean ischial length was significantly higher in males than females in Cross river people of Nigeria. The values for male ischiopubic index 94.2 and female ischiopubic index 118.8 are higher than ours. Nonetheless, the sex difference of pubic length, ischial length and ischiopubic index were found to be statistically significant when male and female x-ray films were compared ($p<0.001$). This study supports our study even when the sex differences of pubic length, ischial length and ischiopubic index were found to be statistically significant at $p<0.05$.[7]

My study supported the study done by Oladipo G.S, Okoh P.D and Suleiman Y.A on pubic length, ischial length and ischiopubic index of eastern Nigerians with a mean of 71.00mm, 84.4 mm and 84.0 for males respectively while in females was 85.00mm, 83.0mm and 102.6 respectively resulting in higher pubic length and ischiopubic index in females.[8] But this is of lower values than our study. The mean ischiopubic index of different parts of Nigerian population was also different. This may be a result of regional variation of the ischiopubic index.

A study among Portuguese subjects conducted by Phenice T W, 1969showed a reversal of this pattern which reported that the mean ischiopubic index in males with mean ischiopubic index 78.2±6.2 which was greater than in females whose mean ischiopubic index was 71.3±3.1. This dispersion might be related to genetic and environmental factors, which are known denominators for intra and inter-population variability .[9]

Despite the adequate sample size, it was still small for generalization of the study. We measured patient's parameter manually and the value may not be consistent. In addition, the measured parameters may not be considered true as the patients were referred having certain clinical condition which warrants the need of the pelvic radiograph. We measured the parameters of different patients so the level of the site of measurement might not be the same in all cases. The sample size was not adequate to generalize the result and required the measurement with large sample size.

Measurement of ischiopubic index should be taken at reproducible anatomic landmarks if measurements are taken by radiograph and CT pelvis that may provide high accuracy. CT pelvis may provide better anatomic landmarks for the measurement of pubic length, ischial length and ischiopubic index providing better results.

V. Conclusion

The mean pubic length for male was found to be 8.3±0.82cms and 9.21±0.8cms for female. Mean ischial length was 9.05±0.73cms for male and 8.32±0.72cms for female. The ischial and pubic lengths showed statistically significant differences between males and females ($p<0.05$) and therefore have dimorphic potential. In males and females, the mean ischiopubic index were 91.73±5 and 110.9±7 respectively. This may explain the significant higher sexual differences in ischiopubic index observed in the females when compared with that of male counterparts.

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