Female pelvic dimensions relevant to labour process in a black Kenyan population

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Abstract

Introduction: Maternal pelvic dimensions are key to determining progress and outcome of labour. In addition, the size of the pelvis is a crucial reference point in attempting to predict cephalopelvic disproportion. There is paucity of data regarding pelvic dimensions amongst black Kenyan population despite the central significance of such data in local obstetrics practice.
Methods: A cross-sectional study of 50 female pelvic osteology specimens was performed at the National Museums of Kenya, Nairobi. Data were collected using a structured study instrument and were analyzed using Statistical Package for Social Sciences version 21.
Results: At the pelvic inlet, the true conjugate was 10.37 ± 1.02cm, the diagonal conjugate was 11.72 ± 1.07cm and the obstetric conjugate was 11.44 ± 0.78cm. The transverse diameter was 11.42 ± 0.96cm. In the mid-cavity, the anteroposterior diameter was 10.64 ± 1.00cm, while the interspinous diameter was 8.49 ± 0.92cm. At the outlet, the anteroposterior diameter was 9.66 ± 1.16cm, while the intertuberous diameter was 9.04 ± 0.92cm. The subpubic angle was 74.54 ± 9.72 degrees. The posterior depth was 9.95 ± 1.11cm, while the anterior depth was 3.24 ± 1.41 cm.
Conclusion: The average pelvic dimensions in this population are smaller than what has been observed in other populations. Of significance is that some morphometric dimensions were ominously smaller than what has been implicated in cephalopelvic disproportion. Imaging and clinical studies would help shed more light on correlation of the dimensions and obstetric outcomes in black Kenyan population.

Key words: Female pelvic dimensions, Black Kenyan population, Progress of labour, Obstetric outcomes, Cephalopelvic disproportion

Introduction

Maternal pelvic dimensions are key in the mechanism of labour. The ability of the fetus to successfully negotiate the potentially hazardous passage of labour is critically dependent on three variables: uterine activity, fetal size and the size of the maternal pelvis (1). The former two are modifiable via augmentation of uterine contractions (2), and fetal head moulding (3) respectively. However, the functional size of the maternal pelvis is a supply-limited constraint (4,5) dependent on the interaction of the bony pelvis and the variable resistance of the soft tissues (1). The presence of a relatively large fetus and/or a relatively small pelvis may lead to cephalopelvic disproportion (CPD) (2).

Since maternal pelvic anatomy impacts on the progress and outcomes of labour (1), multiple techniques have been employed in an attempt to predict caesarean section due to CPD, including the fetal pelvic index (6) and Magnetic Resonance Imaging pelvimetry (7). However, the majority of these studies have been conducted in Caucasian populations (8). There is scarcity of data on female pelvic dimensions in black populations. Such data are useful in providing baseline information on pelvic adequacy and in developing models to predict labour outcomes.

Materials and Methods

Study design: A cross-sectional study.
Study setting: The Osteology laboratory of the National Museums of Kenya, Nairobi.
Study population: Osteology specimens of deceased black Kenyan females. Out of 329 pelvic specimens on record, 141 were certified male, 82 were certified female and 106 could not be typed. Out of those certified females, 6 could not be traced, 3 were contracted, 7 were incomplete, 8 were paediatric and 8 were damaged. All of these were excluded, leaving only 50 complete pelvises for assessment and analysis.
Data collection and management: Data were collected using a structured study instrument by the authors and two trained research assistants using a Vernier callipers, string, ruler, and an orthopaedic protractor. The data were transcribed into a password-protected Excel spreadsheet that was only accessible to the authors and the research assistants.

Data analysis approach: Data were analysed using the Statistical Package for Social Sciences version 21 for determination of the arithmetic mean and standard deviation. These values were then compared to expected and previously reported means.
Ethics: Administrative approval was obtained from the National Museums of Kenya.

Results

Out of the 50 pelvis that were studied, the true conjugate was 10.37 ± 1.02cm, while the diagonal conjugate was 11.72 ± 1.07cm. The obstetric conjugate was 11.44 ± 0.78cm and the transverse diameter was 11.42 ± 0.96cm (Table 1).

Table 1: Dimensions of the pelvic inlet

Parameter (N=50)	Mean ± SD (cm)
True conjugate	10.37 ± 1.02
Diagonal conjugate	11.72 ± 1.07
Obstetric conjugate	10.76 ± 0.98
Oblique diameter	11.44 ± 0.78
Transverse diameter	11.42 ± 0.96

The other measures included that of the pelvic mid-cavity and outlet. The anteroposterior diameter of the mid-cavity was 10.64 ± 1.00cm, while the interspinous diameter was 8.49 ± 0.92cm. The subpubic angle was 74.54 ± 9.72 degrees. The anteroposterior diameter of the pelvic outlet (from the coccyx to the lower border of the pubic symphysis) was 9.66 ± 1.16cm, while the intertuberous diameter was 9.04 ± 0.92cm. The distance from the coccyx to the ischial tuberosity was 7.42 ± 1.17cm, whereas the distance from the ischial tuberosity to the lower border of the pubic symphysis was 7.80 ± 0.69cm (Table 2).

Table 2: Dimensions of the pelvic mid-cavity and outlet

Parameter (N=50)	Mean ± SD
Pelvic mid-cavity	
Anteroposterior diameter	10.64 ± 1.00
Interspinous diameter	8.49 ± 0.92
Pelvic outlet	
Subpubic angle	74.54 ± 9.72*
Anteroposterior diameter	9.66 ± 1.16
Intertuberous diameter	9.04 ± 0.92
Coccyx to Ischial tuberosity	7.42 ± 1.17
Ischial tuberosity to pubic symphysis	7.80 ± 0.69

* Degrees; all other dimensions are in cm

Table 3: Dimensions related to pelvic depth

Parameter (N=50)	Mean ± SD (cm)
Posterior depth	9.95 ± 1.11
Anterior depth	3.24 ± 1.41
Ischiopubic ramus length	10.84 ± 1.41

The distance from the sacral promontory to the tip of the coccyx (posterior depth) was 9.95 ± 1.11cm, while the length of the pubic symphysis (anterior depth) and the ischiopubic ramus were 3.24 ± 1.41 cm and 10.84 ± 1.41cm respectively (Table 3).

Discussion

The main finding of this study is that the pelvic dimensions were generally smaller than the average values stated in text books of obstetrics. The true conjugate and transverse diameters of the pelvic inlet in this population was smaller than the normal average values (12.5 and 13.0cm respectively), tending towards the critical limits for CPD (10.0 and 12.0cm respectively) (1). They were also less than the average dimensions of both African-American and Caucasian female pelvises with regard to both the true conjugate (12.1 and 12.3cm respectively) and the transverse diameter (11.8 and 12.6cm respectively) (8). Though it has been stated that pelvimetry has poor predictive value in predicting labour process, our findings of significantly smaller values could imply high rates of caesarean deliveries in this population.

Both the anteroposterior and interspinous diameters of the mid-pelvis were smaller than the average expected dimensions (11.5 and 10.5cm respectively), with the interspinous diameter being smaller than those in African-Americans and Caucasians (10.3 and 10.5cm respectively) (8), as well as the expected critical limit for CPD (9.5cm) (1). The mid pelvis plane allows the head to move and rotate with the backward curve of the sacrum. In some cases, for example in cases of congenital anomaly, sacrum do not curve backwards leading to reduced anteroposterior diameter. This may have adverse effect on labour process.

At the pelvic outlet, the average subpubic angle (74.54°) was less than the subpubic angle amongst African-Americans (82.8°) and Caucasians (83.7°) (8). Similar trends were noted in the anteroposterior outlet and the intertuberous diameters. The posterior pelvic depth in the present study (9.95cm) was less than that in the African-American and Caucasian populations (10.7 and 12.1cm respectively) (8).

There were no comparisons found in published literature for the oblique diameter, distance from coccyx to the ischial tuberosity, distance from the ischial tuberosity to the pubic symphysis, ischiopubic ramus length and the anterior depth. It was also not possible to compare the average height or body mass index of the black Kenyan to the African-American or Caucasian population in order to assess whether the differences observed were constitutional.

On average, the black Kenyan female pelvis seems smaller than the African-American and Caucasian pelvis, with some dimensions being lower than the critical values associated with CPD. When coupled with the inherently large waste space of Morris associated with the small subpubic angle (9), the probability of successful vaginal delivery is likely to be low unless the foetus is also either constitutionally or pathologically small at the time of delivery.

This study provides key local baseline data, which will be valuable for future assessment of female pelvic dimensions through radiological imaging and clinical outcome assessment. This study was, however, limited by the inability to account for the interference of soft tissues, most of the bony pelvis were old and by lack of access to data on the obstetric events of the females involved.

Conclusion

The average pelvic dimensions in this population are smaller than what has been observed in other populations. In deed some morphometric dimensions were significantly smaller than what have been implicated in cephalopelvic disproportion. Imaging and clinical studies would help shed more light on correlation of the dimensions and obstetric outcomes in black Kenyan population.

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