

## A Morphometric Study to Assess the Validity of Sacral Rhomboid Diameter and Maternal Height (HT) to Predict Contracted Pelvis Antenatally

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Received: 19-12-2023 Revised: 11-01-2024 / Accepted: 25-01-2024

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Conflict of interest: Nil

### Abstract

**Aim:** The aim of the present study was to assess the validity of sacral rhomboid diameter and maternal height (Ht) to predict contracted pelvis antenatally and to compare its individual efficacy with the combination models in antenatal prediction of the contracted pelvis.

**Methods:** This was a hospital-based prospective study carried out in the Department of Obstetrics and Gynaecology and Department of Anatomy and included 200 Primigravidas at 37-40 weeks gestational age, aged 18-40 yrs with an uncomplicated pregnancy and singleton vertex presentation confirmed coming to the Antenatal clinic were randomly recruited in our study for the period of 6 months. Among 200 women, 140 of them delivered through spontaneous vaginal delivery, 12 women gave birth by caesarean section and 8 gave birth by assisted vaginal delivery (both formed the Contracted Pelvis group) while 40 women were excluded on follow-up.

**Results:** Mean Maternal height (1.443m) was significantly lower in group 2 ( $p=0.000$ ). Mean VD was less in group 2 and was statistically significant ( $p=0.000$ ). Mean TD was less in group 2 and was statistically significant ( $p=0.000$ ). Thus, the maternal anthropometric parameters i.e., Height, Weight, and Michaelis sacral rhomboid diameters (i.e., TD and VD) are valid in the independent prediction of Contracted pelvis antenatally ( $p<0.05$ ). When combination models were produced, HT+TD was the best predictor model at 10th percentile cut-off values with the highest PPV and Accuracy (76.74% and 92.32%) respectively.

**Conclusion:** Smaller dimensions of the sacral rhomboid along with the maternal height are independent predictors of contracted pelvis. Transverse diameter of Michaelis (TD) along with maternal height at cut-off values enhanced the predictability of contracted pelvis and can be used as a promising and easily measurable screening parameter to detect the women at risk of Contracted pelvis antenatally.

**Keywords:** Sacral Rhomboid diameters, Contracted pelvis, Antenatal Prediction, Maternal Height, Primigravida

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### Introduction

Pelvic disproportion complicates 2–15% of pregnancies [1-3] and is associated with significant maternal and fetal complications. [2,4] The antenatal prediction of this condition and timely management is essential for decreasing its contribution to obstetric mishaps. [4] As most women in developing countries are unable to avail high level of health care, it is essential to develop reliable screening parameters that can be used by all health personnel at primary level. Maternal height is presently the only parameter incorporated in antenatal charts for identification of women at risk of pelvic disproportion. Other anthropometric variables viz. maternal weight, shoe size and external pelvic measurements have also been evaluated with conflicting results. [5,6]

The posterior iliac spines bound it on either side, L5 vertebra superiorly and upper end of natal cleft inferiorly. Michaelis noticed that its shape and size differed in women with and without contracted pelvis. [7,8] However, it was abandoned without complete evaluation until the year 2000 when two African studies reported its use in identifying women with cephalopelvic disproportion. [1,9]

Knowledge of pelvic deformities, and obstruction of labour resulting there from, was held up well into the 16th century. Maternal death remains a major health problem in some developing region of world such as sub-Saharan Africa & South Asia and among these 20-30% are attributable to complications of cephalopelvic disproportion. [10] Pelvic

disproportion complicates 2-15% and the antenatal prediction of this condition and timely management is essential for decreasing its contribution to obstetric mishaps. [11] From centuries, the various methods to assess the pelvis antenatally has been in practice with variable outcome. These methods include manual pelvimetry, instrumental pelvimetry, radiological pelvimetry with sophisticated gadgets like x-ray, MRI & CT scan. Aranzio first suggested the use of whole hand. This method was elaborated by Johnson, a pupil of Smellie, and by Ramsbotham many years later. The only method which has stood the test of time and is still employed universally is that described by the pupil of Smellie. [12] The constant efforts are to devise a method which can predict the cephalopelvic disproportion with fair accuracy, which is easy to learn, easy to employ and universally accepted by the examiner and the subjects. The method should be less invasive and should not be harmful to the mother and fetus.

The aim of the present study was to assess the validity of sacral rhomboid diameter and maternal height (Ht) to predict contracted pelvis antenatally and to compare its individual efficacy with the combination models in antenatal prediction of the contracted pelvis.

### Materials and Methods

This was a hospital-based prospective study carried out in the Department of Obstetrics and Gynaecology and Department of Anatomy at Patna Medical College, Patna, Bihar, India and included 200 Primigravidas at 37-40 weeks gestational age, aged 18-40 yrs with an uncomplicated pregnancy and singleton vertex presentation confirmed coming to the Antenatal clinic were randomly recruited in our study for the period of 6 months. Among 200 women, 140 of them delivered through spontaneous vaginal delivery, 12 women gave birth by caesarean section and 8 gave birth by assisted vaginal delivery (both formed the Contracted Pelvis group) while 40 women were excluded on follow-up. This study has compared these measured parameters between the two groups formed depending on the mode of delivery.

Those with any pelvic deformity, past medical/surgical history, not willing to participate,

and Indications of caesarean section other than the contracted pelvis including elective section, fetal birth weight >3.5 kg, and not willing to fill consent form were excluded from the study.

Women were enrolled in the study after taking informed written consent. Detailed demographic history was taken followed by physical examination, anthropometric and pelvimetric measurements, all of these were recorded in the patient proforma. First-trimester weight was recorded using Ante Natal Care (ANC) record, Height was measured in meters using a portable stature meter (Easy-care).

For measuring sacral rhomboid dimensions, the following points were marked at the women back using a skin marking pen.

Point A was marked by palpating L5 (5<sup>th</sup> Lumbar Vertebra) spinous process and Point B was marked on the upper limit of the intergluteal cleft, the distance between A and B was measured as the Vertical Diameter of Michaelis (VD).

Then points C and D were marked on the posterior superior iliac spines which can be felt under the indent seen just above the buttocks, distance between C and D was measured as the Transverse diameter of Michaelis. The flexible measuring tape was used for measuring Michaelis sacral rhomboid diameters in centimetres (cm), (converted into m(meters)). All the measurements were taken in a standing position.

Women were then followed up to delivery. On follow-up, the main outcome variable was the Mode of Delivery. Depending on the Mode of delivery, subjects were divided into following two groups -

1. Normal delivery group (uncomplicated spontaneous vaginal delivery) and
2. Contracted pelvis group (assisted vaginal delivery due to CP and caesarean delivery due to CP).

The data was then entered and analyzed using Microsoft Excel and R studio (Open source analytical tool V 1.2.335). For inferential statistics, student t-test, Pearson chi-square test, and cross tabulation were used. A p-value less than 0.005 was considered significant. Cut-off values used were based on 10th percentile values.

### Results

**Table 1: Comparison of Mean Values and Standard Deviations of the different Variables between Final Outcome Groups**

Variable	Group	N	Mean	SD	P Value
Age	Contracted Pelvis	20	21.614	2.8	0.250
	Normal Delivery	140	22.222	2.68	
Gestational age	Contracted Pelvis	20	39.099	0.90	0.316
	Normal Delivery	140	38.905	0.950	
Weight (kg)	Contracted Pelvis	20	42.957	6.914	<0.001
	Normal Delivery	140	51.947	6.034	

Height (m)	Contracted Pelvis	20	1.443	0.07	<0.001
	Normal Delivery	140	1.561	0.063	
VD	Contracted Pelvis	20	10.13	0.394	<0.001
	Normal Delivery	140	10.954	0.674	
TD	Contracted Pelvis	20	9.504	0.201	<0.001
	Normal Delivery	140	10.477	0.512	
Birth weight (kg)	Contracted Pelvis	20	2.763	0.32	0.350
	Normal Delivery	140	2.679	0.45	

**Table 2: Sensitivity, specificity, Positive Predictive Value (PPV), Negative Predictive value (NPV), Positive likelihood Ratio (PLR) and Accuracy of Contracted Pelvis based on the cut off values of Individual Maternal parameters**

Parameters	Sensitivity	Specificity	PPV	NPV	Accuracy	PLR
HT	68.52%	92.58%	58.24%	94.85%	91.71%	10
TD	72.92%	93.47%	55.65%	95.35%	91.22%	8.72
VD	35.75%	87.88%	28.62%	92.04%	83.47%	3.16

Mean Maternal height (1.443m) was significantly lower in group 2 ( $p=0.000$ ). Mean VD was less in group 2 and was statistically significant ( $p=0.000$ ). Mean TD was less in group 2 and was statistically significant ( $p=0.000$ ). Thus, the maternal

anthropometric parameters i.e., Height, Weight, and Michaelis sacral rhomboid diameters (i.e., TD and VD) are valid in the independent prediction of Contracted pelvis antenatally ( $p < 0.05$ ).

**Table 3: Sensitivity, specificity, Positive Predictive Value (PPV), Negative Predictive value (NPV), Positive likelihood Ratio (PLR) and Accuracy of Contracted Pelvis based on the cut off values of Combined Models of Maternal parameters**

Parameters	Sensitivity	Specificity	PPV	NPV	Accuracy	PLR
HT+TD	61.88%	96.64%	76.74%	95.85%	92.32%	24
HT+VD	27.08%	97.23%	67.63%	91.82%	88.64%	17
TD+VD	31.44%	97.83%	78.72%	92.38%	92.36%	24

When combination models were produced, HT+TD was the best predictor model at 10th percentile cut-off values with the highest PPV and Accuracy (76.74% and 92.32%) respectively.

### Discussion

Pelvis constitutes the birth canal through which the fetus passes during childbirth. Narrowing of pelvic dimensions is one of the most important causes of obstructed labour responsible for 8% of maternal deaths in developing countries. [13,14] Contracted pelvis is associated with significant maternal and fetal complications if not diagnosed before the onset of labour especially in limited resource areas. [15] Most women in developing countries are unable to avail high level of healthcare during the antenatal period [16], thus it is essential to develop a reliable, cost-effective, and easily measurable screening parameter that can be used even by auxiliary personnel in primary health care settings.

On the contrary, Benjamin et al (2012) [12] considered assisted vaginal deliveries in the Normal Delivery group as they found the anthropometric characteristics of the assisted vaginal delivery group close to those of the Normal Delivery group, which was however not observed in our study. Mean Maternal height (1.443m) was significantly lower in

group 2 ( $p=0.000$ ). Mean VD was less in group 2 and was statistically significant ( $p=0.000$ ). Mean TD was less in group 2 and was statistically significant ( $p=0.000$ ). However, our findings were not in agreement with the study of Kara F et al., (2005) [17] and observed discrepancies in lack of significant association may be due to different cut-off points used for maternal heights. Several studies have used cut-off value  $< 150$ cm for height [18,19] which is not applicable in all sets of populations.

Thus, the maternal anthropometric parameters i.e., Height, Weight, and Michaelis sacral rhomboid diameters (i.e., TD and VD) are valid in the independent prediction of Contracted pelvis antenatally ( $p < 0.05$ ). When combination models were produced, HT+TD was the best predictor model at 10th percentile cut-off values with the highest PPV and Accuracy (76.74% and 92.32%) respectively. This was comparable to Deepika et al.(2019) [20] (sensitivity 28%), Shagun B et al.(2011) [13] (sensitivity 23%). However, it was insignificant in the study by Rahele et al.(2014). [21]

### Conclusion

Smaller dimensions of the sacral rhomboid along with the maternal height are independent predictors of contracted pelvis. Transverse diameter of

Michaelis (TD) along with maternal height at cut-off values enhanced the predictability of contracted pelvis and can be used as a promising and easily measurable screening parameter to detect the women at risk of Contracted pelvis antenatally.

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