

Comparison of Michaelis Rhombus, Height and Foot Length of Patient in Prediction of Mode of Delivery

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Background: The Michaelis rhombus is an easy-to-measure diamond-shaped section in the lower back. It is supposed to shift posteriorly during labor, pushing out the wings of the ileum and increasing the width of the pelvis. A simple comparison of the patient's Michaelis Rhombus, height, and foot length has been used to identify risk of cephalo-pelvic disproportion (CPD) and aid in foreseeing a safe birth method.

Aim and Objective: The current study aimed to investigate the Michaelis rhombus' predictive ability for CPD to other parameters, such as maternal height and foot length of laboring women.

Method: This study, which included 220 pregnant women who were admitted at the R. D. Gardi Medical College and CRG Hospital in Surasa, Ujjain (MP), India, is a prospective observational study.

Result: There were 190 normal deliveries and 30 LSCS deliveries out of 220 patients. The transverse diagonal was substantially lower with LSCS (mean 9.530.69 cm) compared to normal delivery (mean 10.590.55 cm) ($p = 0.000$). The vertical diagonal was lower in LSCS instances (mean 10.730.87 cm) compared to normal delivery (mean 11.940.73 cm). Foot length was substantially shorter in LSCS instances (mean 23.121.28 cm) than in normal delivery (mean 24.481.05 cm). Height was substantially lower in LSCS patients (mean 148.235.56 cm) than in normal deliveries (mean 153.943.31 cm).

Conclusion: A constricted pelvis or CPD can be predicted based on anthropometric data such as height, the Michaelis rhombus, and the length of the foot. These measures assist to improve the patient's experience during clinical assessment of the pelvis by reducing the number of vaginal examinations performed, which in turn lowers the risk of infection.

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Introduction

Michaelis rhombus, a diamond-shaped structure in the lower back. During labor, this bony area is believed to move posteriorly, pushing out the ileum's wings and enlarging the pelvis.¹ Adolph Gustav Michaels wrote about a rhombus over the sacrum in the 19th century. The posterior superior iliac spine on both side, the L5 vertebra above and the natal clef below form the rhombus. Women with and without constricted pelvises have varied sizes of it.² Because it is believed that the shorter the mother, the higher the risk of cephalopelvic disproportion (CPD), maternal height measurement has been utilised as a straightforward method to identify women at risk. While adding another anthropometric parameter increases

the chance of predicting CPD, maternal height alone has minimal usefulness for predicting CPD risk.³ The current study aimed to compare the effectiveness of the Michaelis rhombus' dimensions as a predictor of a restricted pelvis to other measurements, such as maternal height and foot length.

Material and Methods

In the year 2022, 220 pregnant women who were admitted to the Departments of Obst and Gynae at the CRG Hospital in Surasa, Ujjain (MP), India, for delivery were included in the study.

Comprehensive obstetric history was recorded, including age, parity, gestational age, Michaelis rhombus, birth weight, height, foot length, and delivery method.

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Table 1: Mode of delivery

| Mode of delivery | Frequency | Percent |
|------------------|-----------|---------|
| Normal | 190 | 86.4 |
| LSCS | 30 | 13.7 |
| Total | 220 | 100.0 |

23% and accuracy 90%.

- TD+ height is predictor of LSCS with sensitivity 80%, specificity 78%, PPV 36%, NPV 96%, FPR 22%, FNR 20% and accuracy 78%.
- TD+ foot length is predictor of LSCS with sensitivity 87%, specificity 54%, PPV 23%, NPV 96%, FPR 46%, FNR 20% and accuracy 58%.
- VD+ height is predictor of LSCS with sensitivity 83%, specificity 78%, PPV 38%, NPV 97%, FPR 22%, FNR 17% and accuracy 79%.
- VD+ foot length is predictor of LSCS with sensitivity 87%, specificity 54%, PPV 23%, NPV 96%, FPR 46%, FNR 13% and accuracy 58% (Table 3).

Discussion

The individuals ranged in age from 18 to 35 years, with a mean age of 23.88 ± 3.36 years, a median age of 23, and a minimum age of 18 years.

Mode of delivery: Of the participants, 86.4% underwent normal birth, whereas 13.7% underwent LSCS.

Analyzing the differences in the mean values of maternal anthropometric measures according to delivery method. These women were divided into two groups based on the kind of birth they underwent: normal vaginal delivery and cesarean section group. Various maternal anthropometric parameters were then compared between the two groups.

- The transverse diagonal was significantly lower in LSCS cases with a mean 9.53 ± 0.69 cm as compared to normal delivery where the transverse diagonal

was, with a mean 10.59 ± 0.55 cm ($p = 0.000$).

- Vertical diagonal was significantly lower in LSCS cases with a mean 10.73 ± 0.87 cm as compared to normal delivery where vertical diagonal was, with mean of 11.94 ± 0.73 cm
- Foot length was significantly lower in LSCS cases with a mean 23.12 ± 1.28 cm compared to normal delivery with a mean 24.48 ± 1.05 cm.
- Height was significantly lower in LSCS cases with mean 148.23 ± 5.56 cm as compared to normal delivery with mean of 153.94 ± 3.31 cm.

When combination models are employed, it is discovered that in our study, TD+VD is a predictor of constricted pelvis leading to LSCS, with sensitivity 77%, specificity 92%, PPV 61%, NPV 96%, FPR 8%, FNR 23%, accuracy 90%, and odds ratio 27.6695%. Confidence range: = (10.26 to 74.58), $p=0.000$.

In our study when TD combined with height (TD + HT) is a predictor of CP leads to LSCS with sensitivity 80%, specificity 78%, PPV 36%, NPV 96%, FPR 22%, FNR 20% and accuracy 78% and Odds ratio=23.3795% Confidence interval= (9.20 to 59.39), $p=0.000$.

In our study TD + foot length is a predictor of LSCS with sensitivity 87%, specificity 54%, PPV 23%, NPV 96%, FPR 46%, FNR 20% and accuracy 58% Odds ratio =20.67, 95% Confidence interval = (7.41 to 57.63), $p=0.000$.

In our study, the prediction of CP by TD and height (TD + HT) leads to LSCS with a sensitivity of 80%, specificity of 78%, PPV of 36%, NPV of 96%, FPR of 22%, FNR of 20%, accuracy of 78%, and odds ratio of 23.37, 95%. (9.20 to 59.39) is the confidence interval, and $p=0.000$. In a similar study of Archana *et al.* With a sensitivity of 64.29%, specificity of 54.48%, and positive predictive value of 21.43%, the combination of maternal HT+TD achieved a diagnosis accuracy of 56.07% ($p0.005$).⁴ In a study by Bansal Shagun *et al.* The transverse diagonal

Table 2: Comparison of mean values of maternal anthropometric measurements according to mode of delivery

| Mode of delivery | | N | Mean | Std. Deviation | t | P |
|---------------------|--------|-----|--------|----------------|-------|-------|
| Age (years) | Normal | 190 | 24.01 | 3.42 | 1.43 | 0.154 |
| | LSCS | 30 | 23.07 | 2.92 | | |
| Transverse diagonal | Normal | 190 | 10.59 | 0.55 | 9.422 | 0.000 |
| | LSCS | 30 | 9.53 | 0.69 | | |
| Vertical diagonal | Normal | 190 | 11.54 | 0.73 | 8.217 | 0.000 |
| | LSCS | 30 | 10.73 | 0.87 | | |
| Foot length (in cm) | Normal | 190 | 24.48 | 1.05 | 6.42 | 0.000 |
| | LSCS | 30 | 23.12 | 1.28 | | |
| Height (in cm) | Normal | 190 | 153.94 | 3.31 | 7.874 | 0.000 |
| | LSCS | 30 | 148.23 | 5.56 | | |

Table 3: Comparison between different combinations in prediction of mode of delivery

| Measures | TD + VD | TD + Height | TD + Foot Length | VD + Height | VD+ Foot Length |
|-------------|------------|----------------|---------------------|----------------|--------------------|
| Sensitivity | 77 | 80 | 87 | 83 | 87 |
| Specificity | 92 | 78 | 54 | 78 | 54 |
| PPV | 61 | 36 | 23 | 38 | 23 |
| NPV | 96 | 96 | 96 | 97 | 96 |
| FPV | 8 | 22 | 46 | 22 | 46 |
| FNR | 23 | 20 | 13 | 17 | 13 |
| Accuracy | 90 | 78 | 58 | 79 | 58 |

of 14 women was 9.5 cm and her height was 146.5 cm, of which 7 of her eventually became CP. There was an 8.86-fold increased risk (OR 8.86, 95% CI 2.9-27.05).² In present study: when foot length was significantly less CPD was diagnosed and LSCS done with mean 23.12 ± 1.28 cm as compare to normal delivery with mean 24.48 ± 1.05 cm ($p = 0.000$). Similar to study conducted by Demitew S *et al.* in which foot length 22.6 ± 0.7 cm underwent LSCS for CPD and foot length 23.7 ± 0.9 cm delivered vaginally.⁵ and Deepika N *et al.* in which foot length 24.1 ± 0.1 cm underwent LSCS for CPD and foot length 25.3 ± 1.9 cm delivered vaginally⁶, another similar study Santosh J *et al.* in which foot length 22.3 ± 1.1 cm underwent LSCS for CPD and foot length 23.2 ± 1.9 cm delivered vaginally.⁷ But contrary to the studies conducted by Awonuga *et al.*⁸ and Mahmood *et al.*,⁹ no significant correlation was found (Have taken Foot Length < 18 cm and > 18 cm).

Conclusion

A constricted pelvis can be predicted based on anthropometric data such as height, the Michaelis rhombus, and the length of the foot. These measures assist in promoting patient comfort during clinical

assessments of the pelvis by reducing the number of per vaginal examinations that are required, which in turn helps to reduce the likelihood of infection. Training ANMs and other primary health care workers to measure the Michaelis rhombus, height, and foot length would be simple. Indirect pelvic evaluation may also be performed without the need for per vaginal examination.

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