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 ilic 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

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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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Each patient had prenatal, intrapartum, and postpartum monitoring, and mother and fetal outcomes were examined.

Inclusion criteria

All pregnant women with > 36 weeks of gestation in labor admitted in C.R Gardi Hospital, Ujjain, Madhya Pradesh.

Exclusion criteria

- 1. Pregnant women with pelvic or leg deformity
- 2. Gestational age below 36 weeks
- 3. Previous LSCS
- 4. Patients who are at high risk and are already in labor at the time of arrival
- 5. Twin pregnancy.

Measurement

After obtaining written informed consent, the following points were marked on the woman's back.

- The two posterior iliac spines (A1, A2) are protuberances on the dimples overlying the gluteal region.
- The spine of the lumbar 5 vertebra corresponds to the upper border of the sacrum (B).
- Uppermost point of natal cleft which represented lower border of sacrum (C).

The sacral rhomboid's vertical diagonal (VD) was measured between points B and C.

Transverse diagonal (TD) was measured from point A1 and A2.

In order to determine the vertical diagonal (VD) of the sacral rhomboid, the distance between points B and C was measured.

Height Measurement

Mothers were measured for height while standing next to a wall with their feet and knees together, knees straight, heels, legs, hips, and shoulders parallel to the wall, hands hanging by their sides, and faces front. The mother's height was measured with the standiometer above her head (Figure 1).



Figure 1: Height measurement

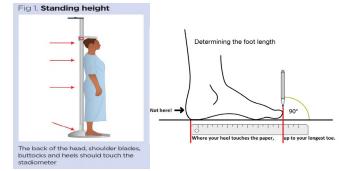


Figure 2: Foot length measurement

Foot length measurement

The length of the foot is measured on a wooden scale in centimeters from the heel to the end of the longest toe (Figure 2).

Observation and Result

Mode of delivery

The vast majority of the individuals, 190 (86.4%), were born by a normal birth, whereas just 30 (13.7%), were born with LSCS (Table 1).

Comparison of mean values of maternal anthropometric measurements according to mode of delivery

These women were divided into two groups based on their birth type: normal vaginal delivery and cesarean section group. Various maternal anthropometric parameters were then compared between the two groups. The table demonstrates that there was no discernible difference in mean mother age between the normal and LSCS groups. The transverse diagonal was significantly lower in LSCS cases with mean 9.53 ± 0.69 cm as compared to normal with mean of 10.59 ± 0.55 cm (p = 0.000). Vertical diagonal was significantly lower in LSCS cases with a mean 10.73 ± 0.87 cm compared to normal with a mean of 11.54 ± 0.73 cm. The transverse diagonal was significantly lower in LSCS cases with a mean 9.53 ± 0.69 cm as compared to normal with a mean 10.59 ± 0.55 cm. When compared to normal, where the vertical diagonal was 11.94 ± 0.73 cm, the mean was 10.73 ± 0.87 cm in LSCS patients. The mean foot length in LSCS patients was substantially shorter than the mean for controls $(24.48 \pm 1.05 \text{ cm})$, with a mean of 23.12 ± 1.28 cm. Height was substantially shorter in LSCS individuals than in the general population (mean 148.23 ± 5.56 vs. mean 153.94 ± 3.31 cm) (Table 2).

 TD+VD is predictor of LSCS with sensitivity 77%, specificity 92%, PPV 61%, NPV 96%, FPR 8%, FNR

Table 1: Mode of delivery				
Mode of delivery	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 sensitivity87%, 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%, NPV96%, FPR 22%, FNR 20% and accuracy 78% and Odds ratio=23.37,95% 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 Archna *et al.* With a sensitivity of 64.29%, specificity of 54.48%, and positive predictive value of 21.4 3%, 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

Mode of delivery		Ν	Mean	Std. Deviation	t	Р
Age (years)	Normal	190	24.01	3.42	1.40	0.154
	LSCS	30	23.07	2.92	1.43	0.154
Transverse diagonal	Normal	190	10.59	0.55	0.422	0.000
	LSCS	30	9.53	0.69	9.422	0.000
Vertical diagonal	Normal	190	11.54	0.73	8.217	0.000
	LSCS	30	10.73	0.87		0.000
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 2. Comparison of	f mean values of materna	al anthropometric measur	ements according	to mode of delivery
Table 2: Companson o	n mean values of materna	a anunopometric measur	emenus according	to mode of derivery

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

	r ·				
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 8.86fold 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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