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Comparison of fetal weight estimation at term : ultrasound versus clinical assessment using leopold’s maneuvers

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Introduction

Accurate estimation of fetal weight (EFW) during labor is essential for identifying high-risk pregnancies, particularly in cases of macrosomia or intrauterine growth restriction, and for guiding decisions on the mode of delivery. Clinical methods such as Leopold's maneuver are less reliable, while ultrasound generally provides better accuracy, though still limited to within about 10%. The accuracy of EFW is influenced by factors such as maternal BMI, and even small deviations may significantly impact delivery decisions.

Objective

The objective of this study was to compare the accuracy of fetal weight estimation during labor, performed using ultrasound, Leopold's maneuvers by midwives and fetal weight estimation by the mother.

Methods

Our study employed a prospective, blinded, observational design. It involved 150 patients presenting to our gynecology and obstetrics department for delivery during a three-month period from January 1, 2021, to March 31, 2021. Inclusion criteria were as follows: a viable fetus with a gestational age greater than 37 weeks and less than 41 weeks, singleton pregnancy not complicated by fetal death in utero or congenital malformations of the fetus, admission for labor without maternal or fetal emergency and delivery within 24 hours, regardless of the mode of delivery. The estimation of fetal weight was performed using three methods: the first, which involved the patient herself providing an approximate estimate of her fetus's weight; the second, which utilized Leopold's maneuver performed by the midwife; and the third, which employed ultrasound estimation by residents utilizing two Hadlock formulas. The first formula, hardlock 1, was developed based on AC and FL : hardlock 1 : Log 10 'weight) = 1.304 + 0.05281*AC + 0.1938*FL – 0.004*AC*FL The second Hardlock formula, Hardlock 3 uses the Head Circumference (HC), Abdominal Perimeter (AP) and Femoral Length (FL) : Hadlock 3 : Log 10 (weight) = 1.326 – 0.00326*AC*FL + 0.0107*HC = 0.0438*AC + 0.158*FL At birth, the actual weight and head circumference of the neonate were recorded. The quality of the ultrasound images was also evaluated.

Results

The clinical estimation by the midwife demonstrated significantly greater accuracy (–0.9%±4.5%–0.9%±4.5%) compared to the ultrasound approach using two formula (formula 1: –4.65%±6.22%–4.65%±6.22%) and (formula 2: –4.36%±9.47%–4.36%±9.47%) (P < 0.01).

Analysis of ultrasound images for abdomen and femur revealed satisfactory measurements in 68% of cases for both, whereas only 52% of images showed satisfactory head circumference measurements.

Conclusion

- Our results are consistent with the data in the literature, despite the small number of cases.
- The data obtained in our prospective, blinded observational study demonstrate that ultrasound has significantly less accuracy in fetal weight estimation in pregnant women during labor compared to Leopold's manoeuvres.
- The clinical estimation must continue to hold a place of choice in the estimation of fetal weight in the delivery room, particularly in countries with poor infrastructure and limited access to ultrasound devices.Furthermore, obstetricians must consider multiple methods for estimating fetal weight.
- The clinical estimate allows them to adjust the sonographic estimate, thereby providing the most precise estimate and minimizing the risk of maternal and neonatal complications.

Table 1: Criteria for score-based objective evaluation of quality of biometric images

Cephalic	Abdominal	Femoral
1. Symmetrical plane	1. Symmetrical plane	1. Both ends of bone clearly visible
2. Plane showing thalami	2. Plane showing stomach bubble	2. < 45° angle to horizontal
3. Plane showing cavum septi pellucidi	3. Plane showing portal sinus	3. Femur occupying more than half of total image
4. Cerebellum not visible	4. Kidneys not visible	4. Calipers placed correctly
5. Head occupying more than half to total image	5. Abdomen occupying more than half of total image	
6. Calipers and dotted ellipse placed correctly	6. Calipers and dotted ellipse placed correctly	

Table 2 : Patient characteristics

	N = 150	%
Maternal age (years)	29,18 [19 – 37]	
Gravity (mean ± SD)	2,7 ± 1,4 [1 – 6]	
Parity (mean ± SD)	1,3 ± 1, 02 [0 – 4]	
Primiparous	33	22
Multiparous	9	6
Mean gestational age at examination (weeks ± SD Days)	38 ± 5 days [37 – 41]	
Mode of delivery		
• Spontaneous vaginal delivery	102	68
• Operative vaginal delivery	0	0
• Cesarean section	48	48
Mean maternal BMI (kg/m²)		
• BMI < 25	18	12
• BMI 25-30	63	42
• BMI > 30	69	46
Gestational diabetes	21	14
Pre-eclampsia	0	0

Table 3 : Mean weight estimates of each method of estimation fetal weight

	Mean ± SD	Range
Birth weight (g)	3293,76g	2200 – 4400 g
Moternal self-estimation	3050 g	2000 – 4000 g
Midwife estimation	3260 g	2500 – 4500 g
Hardlock 1’s formula	3150 g	1839 – 4288 g
Hardlock 3’s formula	3140 g	2069 – 4114 g
HC ultrasound	318,7 mm	286 – 364 mm
HC in birth	341,4 mm	310 – 360 mm

Table 4 : Mean weight difference (estimated fetal weight (EFW) – birth weight (BW)) and mean percentage error ((EFW – BW) × 100/BW) for each of the fetal weight estimates

EFW method	Weight difference (g, mean ± SD (range))	Percentage error (mean ± SD (range))
Leopold’s manoeuvres	-29 ± 351,975	-0,9% [-32% – 23%]
Maternal-self estimation	-99 ± 489,453	-2, 09% [-21.4% - 26.8%]
Hardlock 1	-128.260 +/- 266.502	-4,36% [-16,4% - -2,54%]
Hardlock 2	-164.440 +/- 340.561	-4,65% [-6,5% -5,95%]

Table 5 : Differences between Clinical and Ultrasonic Estimated Fetal Weight

EFW method	P
Maternal-self estimation VS Leopold’s manoeuvres	0,023
Maternal-self estimation VS Hardlock 2	0,355
Maternal-self estimation VS Hardlock 1	0,675
Hardlock 1 VS Hardlock 2	0,353
Leopold’s manoeuvres VS Hardlock 2	0,01
Leopold’s manoeuvres VS Hardlock 1	0,01