Original Research Article

Fetal head circumference versus fetal weight at term as a predictor of labour outcome

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ABSTRACT

Background: Several models have been proposed to predict the need for an LSCS. With reference to this, the impact of the size of the fetal head traversing the birth canal is an important determinant of delivery outcomes. We examined the association between the head circumference and mode of delivery and perinatal outcomes, when compared to birth weight predicted by scan.

Methods: This was a retrospective study, on 800 electronic delivery records between December 2019 and May 2021. Sociodemographic data, obstetrical parameter, term scan findings of head circumference and estimated fetal weight, and labour and perinatal outcomes were collected and analysed.

Results: HC >95th centile was found to be comparatively more predictive and statistically significant compared to EFW >95th centile in the prediction of LSCS, with the most common indication being cephalopelvic disproportion. Prolonged second stage of labour was statistically significant in both cohort A and B, undergoing vaginal delivery. It was also noted that a significant number of newborns in cohort A required NICU admissions, while NICU admissions after emergency LSCS was significantly higher in the cohort B (p=0.0032) though the overall 5 and 10 minute APGAR scores and duration of stay were comparable in the groups classified on basis of EFW and HC.

Conclusions: The above statistics observed on an Indian population may aid obstetricians in the planning of the mode of delivery, improve pre-labor counselling and efficient management of mothers of large babies.

Keywords: Indian population, Head circumference, Estimated- fetal weight, Term scan, Labour outcomes

INTRODUCTION

An uncomplicated vaginal delivery is the desire of every obstetrician and her parturient. LSCS is the surgical procedure indicated in situations where the vaginal delivery presents a higher likelihood of adverse maternal and/or fetal outcome. But when compared to vaginal delivery, Caesarean section has shown to increase the prevalence of maternal morbidity and mortality[1]. Hence many predictive models have been proposed to foresee a possible LSCS to facilitate early referral to a center where it can be performed, to considerably reduce maternal morbidity (perineal tears, postpartum hemorrhage, obstetric fistulae etc) and neonatal morbidity (birth asphyxia and birth trauma). Besides maternal BMI, maternal age, ethnicity, mode of previous delivery, presence of hypertensive disorders of pregnancy, diabetes, multiple gestations etc, several anthropometric measurements like height, bisacromial, intercristal, inter-trochanteric diameters, foot length, vertical and transverse diameters of the Michaelis rhomboid, symphysiofundal height and abdominal girth may help to predict mode of delivery.[2-5] While these factors predict the association of "passage" or the maternal factors that determine the labour outcome several studies have also evaluated the "passenger" or the fetal factors to predict

the association of mode of delivery namely the associations of sonographic estimation of fetal weight and head circumference with progress of labour or caesarean delivery.[6-9] The objective of this paper is to evaluate the accuracy of estimated fetal weight and head circumference noted on the ultrasound scan done at term to predict labour outcome.

METHODS

This a retrospective study carried out in the department of obstetrics and gynaecology at A.J institute of medical sciences among women who delivered between December 2019 and May 2021. A total of 800 electronic records were reviewed in the study.

Inclusion criteria

Inclusion criteria for given study were; women with singleton pregnancy between 18 to 40 years of age delivered between 37 to 42 weeks of gestation.

Exclusion criteria

Exclusion criteria for given study were; Age less that 18 years or more than 40 years, incomplete data and non availability of ultrasound scan at term gestation. Data collected was entered in Microsoft excel under the following headings: maternal demographic details, obstetric parameters - parity, type of delivery, 2nd stage duration, use of vaccum/forceps, indication for LSCS, Ultrasound scan findings- gestational age, head circumference, estimated fetal weight and neonatal parameters like 5 and 10 minute APGAR scores, NICU admission and duration of stay. The participants were then grouped into subgroups based on estimated fetal weight >95th centile –Cohort A and compared with those with estimated fetal weight < 95th centile, birth weight, mode of delivery, intraoperative findings and new born parameters. Similarly, the participants were grouped into cohort B, those with head circumference >95th centile and compared for the above stated parameters with those with head circumference <95th centile. The findings were analyzed using descriptive statistics like frequencies, percentages and measures of central tendencies. The predictive value of EFW>95th centile and HC >95th centile were given in the form of sensitivity, specificity, PPV, NPV and accuracy in anticipating mode of delivery.

RESULTS

The data of 800 study samples were collected. The results were analysed according to the following parameters.

Sociodemographic details of the mother

The age of the mothers ranged between 20 and 35 years (Table 1). The youngest patient in the study was 21 years. An elderly primigravida aged 39 years was included. While assessing the pre-pregnancy weights of the

mothers, it was noted that 49% had normal BMI, and no women in the study was morbidly obese. The proportion of the religions of the mothers surveyed and it almost corresponds to the distribution within the population is shown in (Table 1).

Table 1: Sociodemographic details of study participants.

Parameter	Percentage of participants
Age range (years)	
20-25	43
26-30	50
BMI	
Under weight	20
Normal	49
Overweight	25
Obese	6
Extremely obese	0
Educational status	
Informal education	18
Primary school	25
Middle school	12.5
High school	10
Intermediate/diploma	25
Graduate	9.5
Employment status	
Unemployed	95
Employed	5
Socioeconomic status	
Class 1	1.5
Class 2	6
Class 3	36
Class 4	46
Booking status	
Booked	97
Unbooked	3

While a small section of the mothers have received only informal education, almost 57% have been educated beyond middle school and 5% of the women were employed. The mothers were categorized according to modified BG Prasad classification as they belonged to both rural and urban backdrops. It was noticed that majority of the mothers belonged to class 4- upper middle class.97% of the mothers had their regular antenatal check-ups at our hospital. Parity: 38% of the mothers in the study were primiparas (Table 2).

Ultrasound parameters

Estimated fetal weight by term scan: total 12 percent of the fetuses were below the 5th centile for EFW for the corresponding weeks of gestation on term scan while 28%, that is 224 fetuses were above the 95th centile as per the Indian parameters as shown in (Table 3).

Table 2: Sociodemographic details of study participants.

Parity	Percentage
Primigravida	38
Multigravida	62

Table 3: Distribution of foetuses based on EFW by term scan according to Indian parameters corresponded to period of gestation.

EFW Percentile as per scan	Percentage
≤5th centile	12
Mean	60
>95th centile	28

Head circumference by term scan

It was noted that by the term scan 12 percent of the fetuses fell below the 5th centile for head circumference taken as per the Indian parameters for the corresponding period of gestation, in comparison to 32% ie 256 fetuses, who were above the 95th centile for the same (Table 4).

Table 4: Distribution of foetuses based on HC by term scan according to Indian parameters corresponded to period of gestation.

HC Percentile as per scan	Percentage
≤5th centile	12
Mean	56
>95th centile	32

Comparison between the intrapartum, labour and newborn outcome between the cohorts

It has been noted in Table 5 that 32 % of Cohort A (i.e. those with EFW >95th centile) underwent caesarean section, with the most common indication being cephalopelvic disproportion in 52%, followed by failed induction and fetal distress. 28% of the participants underwent caesarean section in the group with EFW >95th centile. The mode of delivery in the cohort A was statistically not significant when compared with the remaining participants and has a p value of 0.739. However among the participants in cohort A those who underwent vaginal delivery a statistically significant number had prolonged 2nd stage of labour (p=0.006).It was also noted that a significant number of newborns in cohort A required NICU admissions in comparison to the remainder, though the overall 5 and 10 minute APGAR scores and duration of stay were similar in the 2 groups classified on basis of EFW.

Total 59% of study participants in cohort B (those with HC >95th centile) underwent caesarean section, in comparison to20% in the group with HC <95th centile, and this finding had a statistically significant p value of <0.00001(Table 5).The most common indication for LSCS was cephalopelvic disproportion while 58% in cohort B who underwent vaginal delivery had prolonged 2nd stage of labour, both of which had a significant p value of <0.00001. NICU admissions post an emergency LSCS was significantly higher in the cohort B (p=0.0032) but the overall 5 and 10 minute APGAR scores and duration of stay were comparable in the groups classified on basis of HC.

Comparison of EFW >95th centile and HC >95th centile by term scan in the prediction mode of delivery

The sensitivity, specificity, PPV, NPV and accuracy of EFW >95th centile was 33%, 72%, 95.73%, 5.35% and 34.95% respectively. The sensitivity, specificity, PPV, NPV and accuracy of HC >95th centile was 59%, 80%, 98.25%, 9.31% and 60.05% respectively.

DISCUSSION

The study sample consisted of participants of similar socio-demographic data in a tertiary care centre in Mangaluru. 38 % of the subjects were primigravidas, and 97% of the cases were booked with our institution. The participant data was stratified into cohort A those with EFW >95th centile for respective period of gestation and compared with the remaining participants for labour and neonatal outcome. A similar comparison was made between cohort B those with HC >95th centile for corresponding weeks of gestation and the rest of the participants. According to a retrospective study by Dunja et al 2nd stage CS were significantly more likely when the EFW was below 2500g and was 42.9% vs. 24.2% in the normal group. However, a birth weight of 4000g or more did not have a significant influence on CS rate.[6] In the current study we have noted that 32% of those with EFW >95th centile in comparison to 28% in the group with EFW <95th centile underwent CS with the most common indication being CPD. It was noted that among those who underwent vaginal delivery, prolonged 2nd stage of labour ,more than 3 hours was statistically increased among the group with EFW >95th centile. It was also significant to note that among Cohort A that underwent emergency CS, the number of newborns requiring NICU admissions were also significantly higher compared to the other group. In another study cohort with 11687 singleton live births grouped into quartiles based on increasing neonatal head circumference, the rates of CS were also noted to increase 4.1%, 6.4%, 8.8% and 14.3%, showing a strong positive relationship between head circumference quartile and CS.[8] in our study we noted a statistical increase in number of CS in the group with HC > 95th centile p<0.00001, with the most common indication again being CPD. It is also observed that more number of neonates delivered out of emergency CS in this group required NICU admission though the duration of stay is comparable. Prolonged 2nd stage of labour was significantly more in Cohort B than the rest of the participants with HC <95th centile.

Table 5: Comparison between the intrapartum, labour and newborn outcome between the cohorts.

Parameter	EFW <95Th centile (576) %	Cohort A with EFW>95th centile (224) %	Chi square test- p value	HC <95th centile (544) %	Cohort B with HC > 95th centile (256) %	Chi square test p value
Mode of delivery						
Vaginal delivery	72	67		79	41	
Caesarean section	28	32	0.739	20	59	<0.00001
Instrumental delivery	0	1		1	0	
Length of 2nd stage in vaginally delivered subjects						
Normal	64	45		82	42	
Prolonged >3hrs	36	55	0.006	18	58	<0.00001
Indication for LSCS						
Cephalo-pelvic disproportion	28	52		12	71.2	
Fetal distress	45	21.5	0.000522	16	26	<0.00001
Failed induction	27	26.5		72	2.8	
Neonatal outcomes						
Good 5 and 10 minute APGAR Score	85	82	0.567	98	92	0.051
NICU admissions post vaginal delivery/ elective LSCS	6	10	0.297	5	6	0.756
NICU admissions post Emergency LSCS	14	26	0.03	10	26	0.0032
Mean NICU stay in days	2.65	5.23	-	2.5	3.28	-

Table 6: Comparison between the intrapartum, labour and new-born outcome between the cohorts.

Parameter	Value EFW >95th Centile at 95% CI	Value HC >95th Centile at 95% CI
Sensitivity	33% (23.92% to 43.12%)	59% (48.71% to 68.74%)
Specificity	72% (62.13% to 80.52%)	80% (70.82% to 87.33%)
Positive predictive value	95.73% (93.63% to 97.15%)	98.25% (97.34% to 98.85%)
Negative predictive value	5.35% (4.49% to 6.37%)	9.31% (7.37% to 11.70%)
Accuracy	34.95% (28.36% to 41.99%)	60.05% (52.90% to 66.89%)

In a similar study by Lipschuetz et al it was noted that infants with HC ≥95th centile were delivered vaginally in 62% of the cases, 16% had an unplanned LCSC and 11.2% had an instrumental delivery.[9] In contrast it was noted that infants with EFW ≥95th centile were delivered vaginally in 80.3% of the cases, 10.2% had an unplanned LCSC and 8.2% had an instrumental delivery. Multinomial regression analysis showed that large HC/normal EFW were more likely to undergo unplanned LSCS or instrumental delivery. It was found in our study that the statistical accuracy of HC >95th centile is comparatively more that of EFW >95th centile in the prediction of mode of delivery by the term scan. The sensitivity, specificity, PPV, NPV and accuracy of EFW >95th centile was 33%,72%, 95.73%, 5.35% and 34.95% respectively while it was 59%, 80%, 98.25%, 9.31% and 60.05% respectively for HC >95th centile.

CONCLUSION

A large head circumference is more strongly associated with Caesarean section, than a higher estimated fetal weight. Prenatal determination of head circumference in predicting vaginal or caesarean delivery may go a long way of advising, planning and managing women with a macrosomic fetus. Prospective studies to give cut-offs of head circumference applicable to the Indian subcontinent, beyond which vaginal delivery is more hazardous than beneficial are recommended.

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