

Fetal Head Circumference as a Predictor of Successful Spontaneous Vaginal Delivery

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ABSTRACT

Background: Intrapartum head circumference is an integral part of sonographic models and important for the purpose of fetal weight estimation as well as in cases which abnormal fetal head growth is suspected, it is considered the interface between maternal pelvis and fetus. **Aim:** This study aims to assess the accuracy of fetal head circumference compared to expected fetal weight as a predictor of spontaneous vaginal delivery **Methods:** A prospective observational study was conducted on 996 women in active stage of labor admitted to Labor ward of Ain Shams University Maternity Hospital and Labor ward in Manshiet El Bakry general hospital. **Results** large head circumference (odds ratio, 2.8; 95% CI, 1.37–5.73; p-value; .005 was independent predictors for cesarean delivery, and no significant difference on mode of delivery between different expected fetal weight,

Conclusion: A large head circumference is more strongly associated with unplanned caesarian section than high expected fetal weight.

Keywords: intrapartum head circumference, Spontaneous Vaginal Delivery, spontaneous vaginal delivery.

INTRODUCTION

The world health organization (WHO) defines normal birth as “spontaneous in onset, low risk at the start of labor and remaining so throughout labor and delivery. The infant is born spontaneously in the vertex position between 37 and 42 weeks of pregnancy. After birth, mother and infant are in good condition¹.

This is considered the preferred way of natural labor and delivery. It occurs when a pregnant woman goes into natural labor without drugs or other methods of inducing labor, and gives birth/delivers her baby normally, without a C-section, vacuum extraction, or forceps².

Obstetricians have divided labor into 3 stages that delineate milestones in a continuous process.

- First stage: from the onset of labor to full dilatation (commonly lasts for 8-12 hours in a first labor, 3-8 hours in subsequent labors).
- Second stage: from full dilatation of the cervix to delivery of the baby (commonly lasts 1-2 hours in a first labor, 0.5-1 hour in subsequent labors)
- Third stage: from delivery of the baby to the delivery of the placenta (commonly lasts up to 5-15 minutes if actively managed³.
- Active management often involves prophylactic administration of oxytocin or other uterotonic (prostaglandins or ergot alkaloids), cord clamping / cutting⁴.

- There are a lot of factors that can affect the success of normal vaginal delivery especially fetal biometry

The fetal head, from an obstetrical viewpoint, and in particular its size, is important because an essential feature of labor is the adaptation between the fetal head and the maternal bony pelvis⁵. And it is represent the point of interface between passenger and passageway⁶.

PATIENTS AND METHODS

A prospective observational study was conducted on 997 women in active stage of labor admitted to Labor ward of Ain Shams University Maternity Hospital and Labor ward in Manshiet El Bakry general hospital, in the period from January 2016 to June 2016.

Inclusion Criteria:

Singleton pregnancy, term pregnancy, vertex presentation and signed the informed consent to participate in the study

Exclusion criteria:

A. Multiple pregnancy, Labor before 37 weeks + 0 days or after 42 week gestation, Previous caesarian section (vaginal birth after caesarian section) and Other presentations than vertex.

All included women in this study were subjected to:

A- History taking.

b-Examination includes:

- Assessment of cervical dilatation
- Uterine contractions monitoring fetal heart rate assessment.

B- Ultrasonography immediately after admission to measure:

Head circumference, estimated fetal weight

- HC was measured on the same plane as BPD that is on an axial plane that traverses the thalami and cavum septum pellucidum⁷.
- The estimated fetal weight was calculated by the ultrasound device after measuring biparietal diameter, head circumference, femur length, abdominal circumference⁸.

C- Follow up of every woman until delivery was done by assessment of:

Cervical dilatation, head station, fetal heart rate and labor progress by partogram

D- Recording of any intervention during Labor including:

Instrumental delivery and caesarian section.

E- After labor the following was recorded:

1. Vaginal lacerations or perineal tares.
2. Fetal apgar score.

The study was done after approval of ethical board of Ain Shams university and an informed written consent was taken from each participant in the study.

RESULTS

This study was conducted on 997 women in active stage of labor admitted to Labor ward of Ain Shams University Maternity Hospital and Labor ward in Manshiet El Bakry general hospital.

Table (1): Descriptive statistics for the whole study cohort: Numerical variables

Variable	Mean	SD	Min.	Max.
Gestational age (weeks)	38.3	0.7	37.0	40.4
Head circumference (cm)	33.0	1.4	30.4	38.7
EFW (g)	3241	400	2399	4900

Table (1) showed the mean gestational age in the study was 38.3, head circumference 33 cm and expected fetal weight 3241gm.

Table (2): Descriptive statistics for the whole study cohort: Categorical variables

Variable		N	%
Parity	Multipara	781	78.3%
	Primipara	216	21.7%
Head circumference	HC <95 th percentile	938	94.1%
	HC ≥95 th percentile	59	5.9%
Estimated fetal weight	EFW <95 th percentile	943	94.6%
	EFW ≥95 th percentile	54	5.4%
HC/EFW strata	Normal HC/Normal EFW	906	90.9%
	Large HC/Normal EFW	37	3.7%
	Normal HC/High EFW	32	3.2%
	Large HC/High BW	22	2.2%

Table (2) showed distribution of different strata in the study 90.9% of the study group had normal head circumference and normal expected fetal weight, 3.7% had large head circumference and normal expected fetal weight, 3.2% had normal head circumference and high expected fetal weight and 2.2% had large head circumference and high expected fetal weight.

Table (3): Main outcome measures in the study cohort

<i>Variable</i>		<i>N</i>	<i>%</i>
Mode of delivery	<i>ND</i>	810	81.2%
	<i>Instrumental delivery</i>	70	7.0%
	<i>CS</i>	117	11.7%
Adverse outcomes	<i>Fetal distress</i>	31	3.1%
	<i>Perineal injury</i>	43	4.3%

Table (3) showed main outcomes of the study, 81.2% of the cases delivered by normal delivery, 7% by instrumental delivery and 11.7% by caesarean section, and showed secondary outcomes of the study as 4.3% of women in the study group get perineal injury during delivery and there is 3.1% fetal distress rate.

Table 4: Main outcome measures in 2 HC/EFW strata

Variable	Large HC/Normal EFW (n=37)		Normal HC/High EFW(n=32)		p-value
	N	%	N	%	
Mode of delivery					
NVD	23	62.2%	27	84.4%	.011 S
Instrumental delivery	5	13.5%	2	6.3%	.455 NS
CS	9	24.3%	3	9.4%	.031 S
Adverse outcomes					
Fetal distress	3	8.1%	3	9.4%	.031 S
Perineal injury	2	5.4%	2	6.3%	.098 NS

Table (4): showed the outcome measures in different strata of the study, we compared strata with large HC/normal EFW which showed 62.2% deliver normal vaginal delivery, 13.5% instrumental delivery, 24.3% caesarian section and strata with normal HC/ high EFW which showed 84.4% deliver with normal vaginal delivery, 6.3% instrumental delivery, 9.4% with caesarian section.

There is significant difference between the compared strata in the rate of normal vaginal delivery and percentage of caesarian section and rate of fetal distress but no significant difference between strata in rate of instrumental delivery and maternal complications.

Table (5): Relation between head circumference and main outcome measures

Variable	HC <95th percentile (n=938)		HC ≥95th percentile (n=59)		p-value
	N	%	N	%	
Mode of delivery					
Successful SVD	771	82.2%	39	66.1%	.005 S
CS	103	11.0%	14	23.7%	.006 S
Instrumental delivery	64	6.8%	6	10.2%	.296 NS
Adverse outcomes					
Fetal distress	28	3.0%	3	5.1%	.423 NS
Perineal injury	38	4.1%	5	8.5%	.104 NS

Table (5): showed relation between head circumference and different study outcomes in patient with fetal head circumference <95th percentile 82.2% of them delivered with normal vaginal delivery, 11% caesarian section, 6.8% instrumental delivery, 3% fetal distress and 4.1% perineal injury. In patients with fetal head circumference ≥95th percentile 66.1% delivered normal vaginal delivery, 23.7% caesarian section, 10.2% instrumental delivery, 5.1% fetal distress and 8.5% perineal injury.

There is statistical significant difference between the large and normal fetal head circumference group in rate of normal vaginal delivery and caesarian section. But no significant difference in rate of instrumental delivery, fetal distress and perineal injury.

Table (6): Relation between EFW and main outcome measures

Variable	EFW <95 th percentile (n=943)		EFW ≥95 th percentile (n=54)		p-value
	N	%	N	%	
Mode of delivery					
Successful SVD	767	81.3%	43	79.6%	0.722NS
CS	109	11.6%	8	14.8%	0.512NS
Instrumental delivery	67	7.1%	3	5.6%	1.000NS
Adverse outcomes					
Fetal distress	28	3.0%	3	5.6%	0.233NS
Perineal injury	38	4.0%	5	9.3%	0.077NS

Table (6): showed relation between expected fetal weight and different outcomes of the study, in group with expected fetal weight <95th percentile 81.3% delivered normal vaginal delivery, 11.6% caesarian section, 7.1% instrumental delivery, 3% fetal distress and 4% perineal injury. In the group with expected fetal weight ≥95% percintile 79.6% deliver normal vaginal delivery, 14.8% caesarian section, 5.6% instrumental delivery, 5.6% fetal distress, and 9.3% perineal injury.No significant difference between different expected fetal weight and different outcomes.

DISCUSSION

In the present study we used intrapartum fetal head circumference and fetal weight as a part of intrapartum ultrasound to predict labor outcome. The present study is a prospective study which was conducted on 996 women who attend the labor ward in Ain Shams Maternity Hospital and Manshiet El Bakry General Hospital.

There were 4 different stars in our study 90.9% of the study group had normal head circumference and normal expected fetal weight, 3.7% had large head circumference and normal expected fetal weight, 3.2% had normal head circumference and high expected fetal weight and 2.2% had large head circumference and high expected fetal weight.

The study showed significant difference between strata in the rate of normal vaginal delivery and percentage of caesarian section and rate of fetal distress but no significant difference between strata in rate of instrumental delivery and maternal complications.

The mean values of head circumference and expected fetal weight and gestational age were 33 cm, 3241 g, 38.3 weeks respectively, with caesarian delivery rate 11% with head circumference below 95th centile and 23.7% with large head circumference (above 95th centile) so

there were significant difference between both groups on rate of caesarian section.

Rate of normal vaginal delivery 82.2% with head circumference below 95th centile and 66.1% with large head circumference (above 95th centile) so there was significant difference between both groups on the rate of normal vaginal delivery.

Rate of instrumental delivery was 6.8% with head circumference below 95th centile and 10.2% with large head circumference (above 95th centile) so there was no significant difference between both groups on the rate of instrumental delivery.

Rate of fetal distress was 5.1% with head circumference above 95th centile and 3% with head circumference below 95th centile, so there was no significant difference between both groups on the rate of fetal distress.

Rate of perineal injury was 8.5% with head circumference above 95th centile and 4.1% with head circumference below 95th centile, so there was no significant difference between both groups on the rate of perineal injury.

So large head circumference can affect rate of normal vaginal delivery, caesarian section but doesn't have effect on rate of instrumental delivery, fetal distress and prineal injury. The study also showed relation between expected fetal

weight and different outcomes of the study, in group with expected fetal weight <95th percentile 81.3% delivered normal vaginal delivery, 11.6% caesarian section, 7.1% instrumental delivery, 3% fetal distress and 4% perineal injury. In the group with expected fetal weight \geq 95th centile 79.6% deliver normal vaginal delivery, 14.8% caesarian section, 5.6% instrumental delivery, 5.6% fetal distress, and 9.3% perineal injury.

So no significant difference between different expected fetal weight and different outcomes.

The study showed that, large head circumference (odds ratio, 2.8; 95% CI, 1.37 – 5.73; p-value; .005) and primiparity (odds ratio, 2.33; 95% CI, 1.52 – 3.55; p-value, <.001) were the only factors that have significant elevated rate of cesarean delivery.

This is in agreement with **Lipschuetz**, who conducted a retrospective study from electronic medical records in the Haddassah-Hebrwe university medical centers Jerusalem between 2010 to 2012 of 24780 full term singleton pregnant women⁶.

Our study results was also in agreement with **Andrew *et al.*** who concluded that no difference in risk of fetal distress (RR 1.06, 95% CI: 0.95, 1.18) according to fetal head circumference⁹.

Our study was in disagreement with **Elvander *et al.*** who concluded that large head circumference increase risk of instrumental delivery in study conducted on 265 singleton neonate born to nulliparous women at term between 1999 and 2008 in Sweden¹⁰.

This difference in instrumental delivery rate may be because some of our hospitals does not have the facility or the trained doctors to perform instrumental delivery.

CONCLUSION

A large head circumference is more strongly associated with unplanned caesarian section than high expected fetal weight.

Recommendations:

Further studies should be done for evaluation of the role of fetal head circumference as a predictor of successful vaginal delivery, and to detect cut of level of fetal head circumference above which we detect that normal vaginal delivery will fail. Those studies will decrease maternal and fetal morbidity and mortality.

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