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Measurement of The Fetal Occiput-Spine Angle during The First Stage of Labor as A Predictor of The Progress and Outcome of Labor

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ABSTRACT

Background: Spontaneous vaginal delivery without intervention is the ideal route for most pregnancies. Failure of progression in some women may need interventions including Caesarian section or instrumental delivery.

Objective: To assess the accuracy of the fetal occiput-spine angle measured through transabdominal ultrasound during the first stage of labor on the prediction of progress and outcome of labor.

Patients and Methods: The study included (65) cases recruited from the prelabour unit in Ain Shams University hospital who was in labor. The fetal OSA is measured by abdominal ultrasound during the first stage of labor to assess its effect on the progress of labor, mode of delivery, and postnatal events.

Results: It was found that there is a significant relationship between occiput-spinal angle with both mode of delivery and duration of the first and second stage of labor, Cut off was more than (118) degrees. Which had a high negative predictive value in predicting caesarian section at the present age of 97.7% while less than or equal to (118) degrees had a positive predictive value for caesarian section and instrumental delivery of 52.6% only, at the same time it was found that there was a positive correlation between the fetal occiput-spinal angle with advanced gestational age, the angle increased with advanced gestational age we did not have any obvious explanation for it.

Conclusion: OSA equal to or less than (118) degrees correlates with a significant increase in the rate of cesarean delivery and prolongation of the active and second stage of labor. There is no correlation between the angle and maternal or fetal complications.

Keywords: Occiput-spinal angle, Primigravida, First stage of labor, Obstetric ultrasound.

INTRODUCTION

Fetal malpositions and cephalic malpresentation are found in about 10%of all pregnancies and continue to present a challenge for obstetricians. They are well-recognized causes of failure to progress in labor and usually result in protracted or arrested descent, an increasingly important dilemma of contemporary obstetrics [(1)]. They frequently require operative delivery and are associated with an increased probability of fetal and maternal complications [(2)].

Thus far, the diagnosis relied entirely on digital examination, which is notoriously subjective and imprecise [(3)].

Difficulties in the prospective identification contribute to creating uncertainties in the management of these conditions. Intrapartum sonography was recently reported to be an objective and accurate diagnostic tool. However, except for persistent posterior occiput, the subject of many studies, the most available experience with other abnormalities of cephalic position and presentation is based on case reports and small series. The sonographic technique and findings are also demonstrated in a video accompanying the article. Furthermore, the approach to diagnosis is variable, as transabdominal, transperineal, and transvaginal sonography, or a combination of methods, were used [(3)].

The objective of this review is to summarize the current body of literature and provide recommendations to identify malpositions and cephalic malpresentation with ultrasound. The review was performed according to the Meta-analysis of Observational Studies in Epidemiology guidelines. We systematically searched PubMed for the following terms: malpositions, malpresentation, occiput posterior, deep transverse arrest, deflexed presentation, face, brow, sinciput, and asynclitism as related to intrapartum sonography. The initial yield included 172 articles; 23 of these provided details on the methodology and findings of intrapartum sonography [(3)].

We combined information from these articles with our own experience collected over a decade of intensive use of ultrasound in labor. The following discussion focuses on the second stage of labor, as this is the most optimal time for the diagnosis of malpositions and cephalic malpresentation [(4)].

Traditionally, the assessment and management of a woman in labor are based upon clinical findings. The diagnosis of the arrest of labor and decisions regarding the timing or type of intervention rely mostly on digital evaluation of cervical dilatation and fetal head station and position. However, clinical examination of the head station and position is inaccurate and subjective, especially when caput succedaneum impairs palpation of the sutures and fontanelles. The use of ultrasound has been proposed to aid in the management of labor. Several studies have demonstrated that ultrasound examination is more accurate and reproducible than clinical examination in the diagnosis of fetal head position and station and the prediction of the arrest of labor. Ultrasound examination can, to some extent, distinguish those women destined for

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spontaneous vaginal delivery and those destined for operative delivery. Furthermore, there is growing evidence that ultrasound in labor may predict the outcome of instrumental vaginal delivery [5].

Ultrasound in labor can be performed using a transabdominal approach, mainly to determine head and spine position, or a transperineal approach, for assessment of head station and position at low stations. Several quantitative sonographic parameters have been proposed to assess head stations currently, there is no consensus regarding when in labor ultrasound should be performed, which parameter(s) should be obtained, and how the sonographic findings should be integrated into clinical practice to improve management of the patient [6].

This study aimed to assess the accuracy of the fetal occiput-spine angle measured through transabdominal ultrasound during the first stage of labor on the prediction of progress and outcome of labor.

PATIENTS AND METHODS

In this study sonographic assessment of fetal OSA was investigated to assess its accuracy in the prediction of successful labor.

The study was a cross-sectional prospective study done at the prelabor unit in Ain Shams University Maternity Hospital from January to June 2019. All cases (n=65) were healthy pregnant women who attended the emergency room in the active phase of labor fulfilling the inclusion criteria & exclusion criteria.

Sampling and randomization:

Sample Size: The study had been conducted on sixty-five healthy women fulfilling the inclusion criteria.

Sample Size Justification: A sample size of 65 cases (with an expected number of normal deliveries = 50 cases) is satisfactory to get an area under the ROC curve of 70% and confidence interval of 55%: 85% to predict normal delivery in the cases studied. The required sample size has been calculated using the Power Analysis and Sample Size software version 08.0.15 (PASS© 2008, NCSS, LLC, Keysville, Utah, USA).

Based on a previous study done in Cairo University Maternity Hospital in November 2017, which was conducted on 400 women with term uncomplicated singleton pregnancy with occipitoanterior position during active labor. The result was a significantly longer duration of both first and second stage of labor among women with OSA <126° when compared to those with OSA ≥126°. Reported that OSA at a cutoff value of 126° had a sensitivity, specificity, and accuracy and 78.4% and 93.79 and 92% in prediction of the mode of delivery and overall complications, respectively [7].

Allocation and confidentiality:

The sonographer was not involved in the patient's care and the managing obstetrician was blinded to the ultrasound findings and the occiput-spine angle to avoid bias.

All patients were reassured that all information gathered through the survey including personal history would be kept undisclosed.

Ethical Consideration:

Before the beginning of the study and following the local regulation followed, the protocol and all corresponding documents had been declared for Ethical Research approval by the Council of OB/GYN Department, Ain Shams University. All patients were assured that the information gathered through the survey would be kept confidential, be collected anonymously. The nature of the study was explained and signed written consent was obtained. Exclusion and inclusion criteria were applied before data collection.

Study Procedures: all included cases had been recruited according to the following criteria

Inclusion criteria: Age 20-35 years. BMI 20-30 kg/m^2.Primigravida (PG). Singleton pregnancy. Gestational age between 37 and 40 weeks. Cephalic presentation (vertex, LOA).Intact membranes. Admitted before the active phase of labor (dilation of cervix <6cm + sufficient uterine contractions), and hemoglobin (Hb) level above 10gm/dl.

Exclusion criteria: Occipitoposterior position, fetal malpresentations, or congenital malformations. Women with contraindicated vaginal delivery (e.g. placenta previa, previous myomectomy).Women with medical disorders associated with pregnancy (eg., DM, bleeding disorders).Obese women with BMI> 30 kg/m^2. The expected fetal weight is more than 4kg and less than 2.5 kg. Liquor abnormalities (oligohydramnios/polyhydramnios).Uterine .abnormalities (uterine myomas, uterine septum), and intrauterine growth restriction (IUGR) / intrauterine fetal death (IUFD).

Patient information and medical consent: Before being admitted to the clinical study, the patient signed consent to participate after the nature, scope, and possible consequences of the clinical study have been explained in a form understandable to her, in the Arabic language.

Study Interventions:

All women underwent: History taking to fulfill selection criteria: Personal history. Menstrual history: using Naegele's role for sure and reliable estimation of gestational age. Present history: Any warning symptoms such as headache, visual symptoms, edema of lower limbs, epigastric pain, vaginal bleeding, and reduced fetal movement. First, second, and third-trimester antenatal visits, complaints, and complications. Obstetric history: Marital history,

history of abortion, history of present pregnancy. General examination: Body mass index (BMI). Vital data measurement; blood pressure, pulse, temperature, and respiratory rate. Chest and heart examination for any abnormalities. Lower limb examination for bilateral extensive edema and varicose veins. Abdominal examination: Assessment of fundal level and presentation. Presence of scars of previous abdominal or pelvic surgeries.

Initial pervaginal examination done with the recording of the cervical condition represented by Bishop score (dilatation, effacement, consistency, head station, and position), membrane state, and pelvic capacity.

Investigation CBC, blood group + Rh + viral markers (HBsAg, HCVAb).Initial Obstetric ultrasound evaluation in the supine slightly left tilted position to evaluate the fetus (gestational age + weight), placenta, and liquor. A sagittal plane showing both the fetal head and spine was obtained. Three images were taken by the same sonographer then the image was frozen. The angle between two tangential lines to the occipital bone and the body of the first cervical spine vertebral was measured three times and the right most upper angle mean was taken and documented.

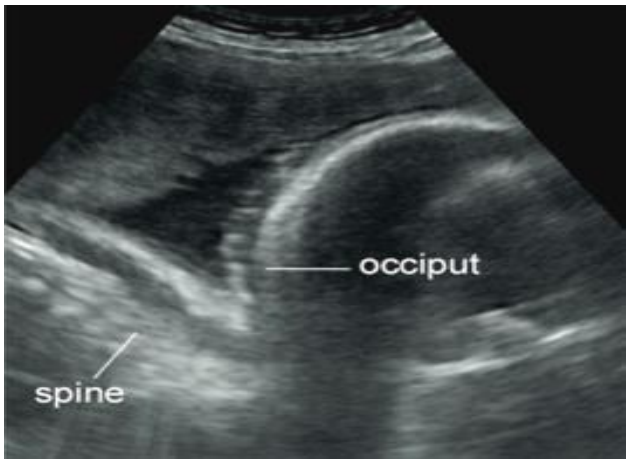

Figure (1): Occiput spine angle

The ultrasound which had been used in the study is Madison Sonoace RS (SN B25310300001050), in the labor ward at Ain Shams University Maternity Hospital. Artificial rupture of membranes (AROMs) was performed when cervical dilatation reaches (6cm) with the administration of antibiotics in the form of(3 gm of Unasyn IV/ repeated every 8 hours) with the presence of sufficient uterine contractions (not less than 3-5 times/10mins, each lasting 30-50 seconds), but if contractions are insufficient oxytocin intravenous infusion administered as follows (the starting dose is 5 units in 500ml of ringer solution at a rate of 12 drops/min) to augment labor. Partogram was plotted based on examination every 1 hour by the same examiner. Then the patients followed regarding the mode of delivery (spontaneous vaginal delivery, assisted delivery whether forceps or vacuum) or patients delivered by caesarian section if there is a failure of progress of active phase of labor which is defined as women at or beyond 6 cm of dilation with rupture of membranes who does not progress despite 4 hours of adequate uterine contractions or at least 6 hours of oxytocin administration if there are inadequate uterine contractions this is also called arrest first stage of labor. The arrest of 2nd stage of labor is prolonged pushing for > 4 hours in primigravidae with epidural anesthesia, or more than 3 hours in primigravidae without epidural anesthesia. Fetal distress may happen at any stage of labor and end in a caesarian section. The time of delivery was measured in minutes from the start of admission (active phase of labor Cervix > 6 cm dilated) till the end of 2nd stage of labor (fetal delivery). The mode of delivery for each patient was recorded. All patients delivering vaginally underwent examination after delivery of the fetus and the placenta to exclude the occurrence of genital tract injuries or a ruptured uterus. All patients following delivery were observed for elevation in body temperature, offensive vaginal discharge, and uterine tenderness to exclude puerperal sepsis.

All patients were observed for symptoms and signs of primary postpartum hemorrhage in the first 24 hours after delivery: Vital data (pulse, BP). Postpartum uterine contraction. The amount of bleeding was calculated in sanitary pads using a pectoral bleeding assessment chart. Postpartum hemoglobin level by repeated CBC: APGAR score for all neonates was recorded by an attending neonatologist. The need for NICU admission or occurrence of any neonatal complication was observed and recorded.

Measured outcomes

Primary outcome: successful spontaneous vaginal delivery within 24 hrs.

Secondary outcomes: Duration of the active phase of labor (cervical dilation 6 cm starting from dilated till full cervical dilation).Duration of 2nd stage of labor (from full cervical dilation till delivery of the fetus).The need for assisted vaginal delivery (forceps, ventouse).Complications (maternal, fetal).

Maternal complications: Vaginal, cervical tears, and genital tract hematomas. Rupture uterus, and primary postpartum hemorrhage.

Neonatal complications: APGAR score at 1 min and 5 mins. Need for NICU admission, and neonatal trauma.

Statistical analysis

Statistical analysis had been performed using SPSS for Windows version 20.0 and Microsoft Excel version 2017. Data presented in terms of range, mean and standard deviation (for numeric parametric variables); range, median and interquartile range (for numeric non-parametric variables); and number and percentage (for

categorical variables). The difference between the two groups is to be analyzed using the independent student's t-test (for numeric parametric variables); Mann-Whitney's U-test (for numeric non-parametric variables); and chi-squared test (for categorical variables). Association between the outcomes and measured variables was estimated using logistic regression analysis and expressed in terms of odds ratios and their 95% confidence intervals. The significance level is set at 0.05.

RESULTS

Table (1) shows demographic characteristics and occiput-spinal angle of the studied cases. Twenty cases with OSA less than (120) degrees represented (30%) of the cases, 18 cases with OSA between (120 and 129) were (27%) of the patients and the remaining 27 cases had OSA more or equal to 130 degrees (41%).

Table (1): Demographic characteristics and occiput-spinal angle of the studied cases

Findings	Mean±SD	Range
Age (years)	23.8±4.5	20.0–35.0
BMI (kg/m^2)	26.0±2.6	20.0–29.0
GA (weeks)	38.8±1.0	37.0–40.0
Occiput-spinal angle (º)	124.6±14.0	95.0–154.0
Occiput-spinal angle grades	**N**	**%**
• **<120.0**	20	30.8
• **120.0–129.0**	18	27.7
• **≥130.0**	27	41.5

Total=65

Table (2) shows delivery findings among the study cases with a duration of active and second phases of labor.

Table (2): Mode of delivery findings among the studied cases.

Findings		N	%
^Mode of delivery	**LSCS**	11	16.9
	NVD	52	80.0
	IVD	2	3.1
		Mean±SD	**Range**
#Active phase duration (hours)		6.3±1.9	3.0–10.0
#Second phase duration (hours)		1.1±0.3	0.5–2.0

^Total=65. #Total=54

Table (3) shows that there were significant negative correlations between occiput-spinal angle and labor duration. No significant correlation between occiput-spinal angle and APGAR scores and there were significant positive correlations between occiput-spinal angle and GA with a p-value (0.008).

Table (3): Correlation between occiput-spinal angle and age, BMI and GA, labor duration & APGAR scores.

Variables	r	P-value
Age	-0.071	0.568
BMI	0.033	0.790
GA	0.322	**0.008***
#Active phase duration	-0.381	**0.004***
#Second phase duration	-0.299	**0.028***
^APGAR 1	-0.105	0.397
^APGAR 5	-0.164	0.185

^Total=65. #Total=54. Pearson correlation.
*Significant

Table (4) shows that GA and occiput-spinal angles were significantly lower among cases that underwent CS delivery. Occiput-spinal angle had significantly high diagnostic performance in predicting CS delivery. GA had significantly low diagnostic performance in predicting CS delivery.

Table (4): Comparison according to the mode of delivery regarding demographics and occiput-spinal angle. With the diagnostic performance of occiput-spinal angle in predicting CS delivery

Findings	CS (N=11)	VD (N=54)	p-value
Age (years)	25.0±4.7	23.6±4.5	^0.356
BMI (kg/m^2)	26.0±2.4	26.0±2.6	^0.983
GA (weeks)	38.2±0.9	38.9±1.0	**^0.028***
Occiput-spinal angle (º)	106.3±9.0	128.2±11.9	**^<0.001***
Angle grades			
• <120.0	10 (90.9%)	10 (18.5%)	**#<0.001***
• 120.0–129.0	1 (9.1%)	17 (31.5%)	
• ≥130.0	0 (0.0%)	27 (50.0%)	

Factors	AUC	SE	P	95% CI	Cut off
Angle	0.922	0.033	**<0.001***	0.858–0.987	≤118.0

AUC: Area under the curve, SE: Standard error, CI: Confidence interval, *significant

Table (5) shows that occiput-spinal angle ≤118.0º had high diagnostic characteristics in the negative prediction of CS delivery.

Table (5): Diagnostic characteristics of occiput-spinal angle ≤118.0º in predicting CS delivery.

Characters	Value	95% CI
Sensitivity	90.9 %	58.7%–99.8%
Specificity	83.9 %	71.7%–92.4%
Diagnostic accuracy (DA)	85.1 %	74.3%–92.6%
Youden's index	74.8 %	55.3%–94.4%
Positive Predictive value (PPV)	52.6 %	28.9%–75.6%
Negative Predictive value (NPV)	97.9 %	88.9%–99.9%
Positive likelihood ratio (LR+)	5.66	3.02–10.59
Negative likelihood ratio (LR-)	0.11	0.02–0.70
Diagnostic odd ratio (LR)	52.22	5.93–460.04
Kappa	0.579	0.355–0.803

CI: Confidence interval

DISCUSSION

Spontaneous vaginal delivery without intervention is the ideal route for most pregnancies. Failure of progression in some women may need interventions including Caesarian section or instrumental delivery **[8].**

The arrest of labor progression is the leading cause of obstetric interventions, including cesarean delivery and instrumental vaginal delivery **[9].**

The maternal risks of second-stage Cesarean section include major hemorrhage, greater risk of bladder trauma, and extension tears of the uterine angle leading to broad ligament hematoma **[9].**

A parameter derived from ultrasound examination (the occiput-spine angle) has a relationship with the course and outcome of labor **[9].**

This study aimed to quantify the degree of fetal head deflection via the use of Ultrasound during the first stage of labor and to determine whether a parameter derived from ultrasound examination (the occiput-spine angle) has a relationship with the course and outcome of labor.

2D transabdominal ultrasound was done during the first stage of labor by the same sonographer for all cases.

If fetal position is occiput anterior and fetal presentation is vertex, a two-dimensional sagittal picture of the fetal head and upper spine was acquired and stored in the ultrasound machine. In this image, the offline measurement of the angle formed by a line tangential to the occipital bone and a line tangential to the first vertebral body of the cervical spine (occiput-spine angle) was performed to quantify the degree of fetal head flexion concerning the trunk.

The sonographer was not involved in the patient's care and the managing obstetrician was blinded to the ultrasound findings as regards the occiput-spine angle. The mode of delivery was assessed as the primary outcome and progress of labor using a partogram (cervical dilation, effacement, consistency, position, and station) during the first and the second stages of labor as well as maternal and fetal complications as the secondary outcome.

Studied cases recruited from the prelabor Unit in Ain Shams University Maternity Hospital with the following demographic, (100) pregnant ladies all were primigravidas, age between (20-35) years with gestational age between (37-40) weeks, their body mass indices up to (30)kg/m^2 attending emergency unit in labor during 1st stage, (30) of the cases had been excluded as they did not fulfill the including criteria, while (5) from the remaining (70) refused to participate in our study.

Fetal occipto-spinal angle for all patients was measured and it ranged between (95 - 154) degrees after the routine obstetric ultrasound.

The total number of cases included in the study was (65), after following their progress of labor and postnatal events it was found that (11) of the patients underwent cesarean section which represents (16%) of the patients, (54) delivered vaginally which represents (80%) of the patients and (2) from total number delivered instrumentally (one vacuum and one forceps delivery) which represents (3%) only.

As result shown in the study (20) of the patient's OSA was less than (120) degrees representing (30%) of cases, (18) of our patients had OSA between (120-129) representing (27%) of patients while the remaining (27) patients (41%) had OSA more or equal to (130) degrees. The correlation between the OSA and duration of the 1st and the 2nd stage of labor was shown clearly with a significant P-value (0.004)-(0.0028) respectively in both the 1st and the 2nd stage of labor with inverse correlation.

It is found a significant relationship between occipt-spinal angle and mode of delivery. The cutoff was more than (118) degrees which had a high negative predictive value in predicting caesarian section was (97.7%) while less than or equal to (118) degrees had a positive predictive value for caesarian section and instrumental delivery of (52.6%) only.

Regarding the relationship between fetal occipt-spinal angle and advanced gestational age, the p-value (0.008) was significant for gestational age as it advance.

The gestational age and OSA had a significant correlation with the mode of delivery, as it was lower among cases who underwent cesarean delivery, the P-value (0.028) and < 0.001 respectively.

Demonstrated the diagnostic performance of OSA in the prediction of cesarean delivery with the same cutoff angle < 118.

Occiput-spinal angle ≤118.0º had high diagnostic characteristics in predicting CS delivery, sensitivity (90.9%), specificity (83.9%), positive predictive value (52.6%), and negative predictive value (97.9%). The diagnostic odds ratio was (52.22) with a confidence interval of (95%).

Our study proved the correlation between OSA and mode of delivery, duration of 1st and 2nd stage of labor in cut-off value of <118.

So according to the recorded results our study was in agreement with the following studies:

Ghi *et al.* [9] performed in the maternity unit of the University of Bologna and Parma (South Africa) in November 2016, a study on a total of (108) pregnant women were recruited, (79) of them underwent a spontaneous vaginal delivery and 29 were submitted to obstetric intervention (19 cesarean delivery and 10 instrumental vaginal deliveries).

The mean value of the occiput-spine angle measured in the active phase of the first stage was 126+9.8 (SD). The occiput-spine angle measurement showed a very good intraobserver (r = 0.86; 95% confidence interval [95% CI] (0.80-0.90) and a fair-to-good inter observer (r =0.64; 95% CI (0.51-0.74) agreement. The occiput-spine angle was significantly narrower in women who underwent obstetric intervention (cesarean or vacuum delivery) due to labor arrest (121 +_ 10.5vs127+_9.4, P =.03). A larger occiput-spine angle width (i.e., >125_) showed to be significantly associated with a shorter duration of labor (hazard ratio = 1.62; 95% CI 1.07_2.45; P =.02).

He described the occiput-spine angle, a new sonographic parameter to assess fetal head deflection during labor. Fetuses with smaller occiput-spine angles (<125_) are at increased risk for operative delivery.

Maged *et al.* [7]study done in the maternity unit in Cairo University Hospital in November 2017, which was a prospective cohort study conducted on 400 women with term uncomplicated singleton pregnancy with occipitoanterior position during active labor. The angle between two tangential lines to the occipital bone and the vertebral body of the first cervical spine was measured during active labor. Follow up till delivery was done. The primary outcome parameter was the labor duration. Secondary outcomes included the mode of delivery and the occurrence of maternal and fetal complications.

The result was a significantly longer duration of both first and second stage of labor among women with OSA <126° when compared to those with OSA ≥126° (6.8±2.1 and1.89±0.85 versus 4.16±1.63 and 0.92±0.43, respectively). Women with OSA <126° had a higher incidence of CS (46.3 versus 5.7%), perineal tears (10.4 versus 5.1%), vaginal tears (22.4 versus 6.3%), and need for oxytocin augmentation (47.8 versus 21.3%) when compared to those with OSA ≥126. OSA at a cutoff value of 126° had a sensitivity, specificity, and accuracy of 8264.6 and (78.4%) and 93.79 and (92%) in the prediction of the mode of delivery and overall complications, respectively.

There was a significantly longer duration of both first and second stages of labor with higher rates of CS and maternal and fetal complications in women with OSA <126.

So these studies are in agreement with our study as they proved the relationship between the fetal OSA and the mode of delivery at the same time we did not find any study that proves that no relationship between the fetal OSA and the mode of delivery.

There are many studies preceding **Ghi *et al.* [9]** trying to correlate the degree of fetal head deflexion and rate of CS based on clinical findings, not ultrasound findings but They were not proven to be clinically useful in predicting the occurrence of CS among these studies:

A study by Dupuis *et al.* [10] which was done in France in December 2005, compared the digital vaginal examination and transabdominal ultrasonographic assessment of the fetal head position during the second stage of labor in (110) patients carrying a singleton fetus in a cephalic presentation. In (70%) of cases, both clinical and ultrasound examinations indicated the same position of the fetal head. Agreement between the two methods reached (80%) when allowing a difference of up to 45º in the head rotation. Caput succedaneum tended to diminish the accuracy of clinical examination. In (20%) of the cases ultrasonographic and clinical results were significantly different (i.e., >45º).

Akmal *et al.* [11] had a study done in London in September 2002 and they reported that digital pelvic examination failed to determine the fetal head position in 34% of laboring women, and incorrectly determined the head position in 51% of patients in whom the position could be defined. The rate of correct identification of the fetal position by digital examination increased with cervical dilatation, and if there was an absence rather than the presence of caput.

The difference in the cut-off value of the OSA between our study and previous studies may be related to the different criteria that were included in this study or due to the difference in the ultrasound machine used to measure the angle in addition to the difference in the obstetrician who attended the delivery of the patients.

At the end of this study, we concluded a significant correlation between the OSA and the mode of delivery. So, we can correlate the OSA with the mode of delivery which is requiring obstetric intervention. The degree of fetal head defluxion in the first stage of labor may be quantified accurately in fetuses with occiput anterior position by transabdominal ultrasound. The occiput-spine angle seems significantly related to the risk of obstetric intervention.

Our study has limitations regarding the correlation between the advanced gestational age in

increasing the fetal occipt-spinal angle due to the wide range of GA and OSA with small numbers of cases.

CONCLUSION

OSA equal to or less than (118) degrees correlates with a significant increase in the rate of cesarean delivery and prolongation of the active and second stages of labor. There is no correlation between the angle and maternal or fetal complications.

The data in this study seem to support the obstetric notion that a deflexed fetal attitude may interfere with the fetal head descent because of an increase in the presenting diameter and a relative cephalo-pelvic disproportion and this may ultimately increase the risk of arrested labor and obstetric intervention.

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