Original Article

Role of Occiput Spinal Angle-A Novel Sonographic Index to predict the outcome of labour

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Author's Contribution

[1,2] Conception of study
[1,2] Experimentation/Study conduction
[1,2] Analysis/Interpretation/Discussion
[1,2,3,4,6] Manuscript Writing
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Abstract

Introduction: The attitude (relationship of head of a fetus to the cervical spine) in the first stage of labour has a significant impact on the outcome of labour. Deflexion of the fetal head is determined by digital vaginal examination during labour. However, different ultra-sonographic indexes have been developed to predict labour outcomes. Occiput spine angle (OSA) is a novel ultra-sonographic marker which can be used to predict operative delivery.

Objective: To determine the effect of the occipital spinal angle measured through transabdominal ultrasound during the first stage of labour on the labour outcome.

Materials and Methods: This prospective cross-sectional study was carried out at Department of Obstetrics and Gynecology Unit 2, Holy Family Hospital, Rawalpindi from June 2020 to Dec 2020 which included 380 low-risk pregnant women in the first active stage of labour. Occipital-spine angle (OSA) was defined as the angle formed by the fetal occiput and the cervical spine on the sagittal plane at the transabdominal ultrasound. For each case, the angle was calculated twice and independently by the 2 radiologists who were unaware of labour outcome to minimize intra and inter-observer error. Data were analyzed using SPSS version 23.0. P-value ≤ 0.05 was considered significant.

Results: Incidence of operative delivery was 17.2%. A cut-off value of 1260125.50 of OSA had a sensitivity of 92.3% and specificity of 98.1% to predict operative delivery. Binary Logistic Regression showed that gestational age, OSA, and Head station are significant with the OR= 1.15, 0.711, and 0.32 respectively.

Conclusion: OSA is a good predictor of operative delivery at a cut-off value of 1260. It should be determined at routine ultrasound booking during pregnancy. More studies should be conducted to highlight its importance.

Keywords: C-section, Occiput spinal angle, Operative delivery, Intrapartum ultrasound, failure to progress.

Introduction

Cesarean section is the commonest surgical procedure being done by gynaecologists worldwide.[1] The global rate of Cesarean Section is 18.6% and is highest in South America, 42.9%.[2] Despite being associated with significant morbidity, it is still a common elective and rescue procedure. According to a study in India, the rates of Elective and Emergency caesarian section is 62.08% and 37.92% respectively.[3] Elective Cesarean requests are based on varying rationales and life experiences.[4] Abnormally slow progress of labor is responsible for 60% of cesarean sections.[5] Failure of progression of labor cannot be predicted by fetal weight alone, other factors like malpresentation can also lead to obstructed labor.[6,7]

Different maternal and fetal factors have been studied to predict the labor outcome in terms of operative delivery. Pre-gestational obesity, infertility treatment, previous caesarean section, and hypertension had a significant effect on the outcome of labor with regards to the mode of delivery.[8] With the recent advancement and prevailing use of ultrasonography in obstetrics, various sonographic indices have been used in this regard. For example, Intrapartum head circumference and estimated fetal weight are good predictors of operative delivery and they also correlate with the second stage of labour.[9] Measurement of the perineum-fetal skull ultrasound distance is a reproducible and predictive index of the difficulty of instrumental extraction.[10,11] Fetal thigh adiposity and abdominal wall thickness during sonographic assessment in late pregnancy is also a predictor of cesarean section.[12]

Similarly, a new sonographic index; Occipital spinal angle (OSA) has also been reported to be a predictor of operative delivery. In the later course of pregnancy, the fetus gets folded on itself assuming a characteristic attitude with its spine becoming convex, the head becoming sharply flexed and the chin being in contact with the chest. Deviations to this attitude can occur and the spinal contour may change from convex to concave. This 'Deflexion of the fetal head' can lead to labor arrest. In addition to major degrees of head deflexion, there can be minor degrees of fetal head deflexion that are unable to be detected clinically.[13,14] The use of transabdominal ultrasound to measure fetal occiput-spine angle during the first stage of labor can predict the progress and outcome of labor in cases of minor degrees of head deflexion. A study by Ghi T et al. concluded that fetuses with smaller occiput-spine angles (<125°) are at increased risk for operative delivery.[15] However, much literature across different centers is still not available to support this. Therefore the aim of our study was to determine the significance of occipital spinal angle to predict the labor outcome in our local setting where the patient burden is a huge problem and theatre and labor room availability is a big issue.

Objective: "To determine the effect of occiput- spinal angle measured through transabdominal ultrasound during the first stage of labor on the labor outcome."

Materials and Methods

This prospective cross-sectional study was carried out at the Department of Obstetrics and Gynecology –removed for blind review---from June 2020 to Dec 2020 which included 380 low-risk pregnant women in the first active stage of labor. Ethical approval was taken from Institutional Research Forum, Rawalpindi Medical University. Informed written consent was obtained from the study participants. Women in the first active stage of labor who had cervical dilatation between 3 and 6 cm, fetal head station above the ischial spine (level 0), and regular uterine contractions were included in the study. Women in whom fetal occiput was posterior (between the 4- and 8-clock position), with pre-labor rupture of membranes, obvious signs of deflexed presentation or asynclitism at the digital examination, or abnormal cardiotocography were excluded from the study. The fetal head position was ascertained by mean of transabdominal sonography and described as on a clock face. Variables like Body mass index, Gestational age, Length of labor in stage 1 and 2, Occipital spine angle, Head station, mode of labor (induced or spontaneous) and premature rupture of membrane, parity, Weight of fetus, APGAR score at birth, and 5 minutes, were noted. Occipital-spine angle was defined as the angle formed by the fetal occiput and the cervical spine on the sagittal plane at transabdominal ultrasound (Figure 1). For each case, the angle was calculated twice and independently by the two radiologists who were unaware of labor outcome to minimize Intra and inter-observer error.

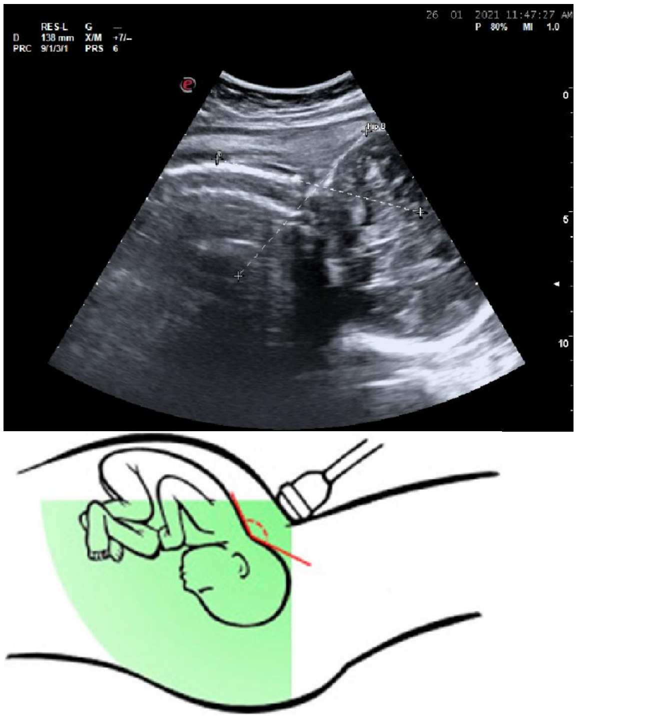

Figure 1: Occipital-spine angle (OSA)-The angle formed by the fetal occiput and the cervical spine on the sagittal plane at transabdominal ultrasound.[14]

Data were analyzed via SPSS version 23.0. Numerical data were represented as mean and standard deviation. An independent sample t-test was used to compare the difference of means of variables across modes of delivery. Categorical variables were represented as frequencies (%). The distribution of frequencies across modes of delivery was compared by the Chi-Square test. ROC curve was plotted to determine the cut-off point for an operative mode of delivery. Boxplot was used to show the maximum, minimum, and median point of OSA with respect to Operative delivery where 'No' shows the Vacuum or Normal delivery. Binary logistic regression was applied to predict the labor outcome from OSA and other variables. P-value ≤ 0.05 was considered significant.

Results

Out of 380 pregnant women, a larger angle (OSA > 125) was observed in 311 (81.8%), operative delivery occurred in 65 cases, induced labor was observed in 97 (25.5%), PROM has existed in 62 (16.3%). 227 (59.7%) women were nulliparous, Apgar score <7 was observed in 31 cases. The overall BMI, Gestational age, Length of stage 1, Length of stage 2, OSA, and fetus weight was recorded 27.6566±2.06888, 275.07±16.320 days, 32.71±18.265, 282.92±121.958, and 129.66±6.236 and 3.17±0.363 kg respectively. A detailed comparison of demographic variables with respect to the mode of delivery is mentioned in Table 1.

Table 1: Descriptive Analysis and Comparison of Demographic Variables against Mode of Delivery

VARIABLE	*NORMAL*	*OPERATIVE*	*TOTAL*	*P-VALUE*
	(N=315)	(N= 65)	(N=380)	
BMI	27.6904±2.121	27.4930±1.79991	27.6566±2.06888	0.484
Gestational Age (days)	274.90±17.632	275.89±7.150	275.07±16.320	0.655
Length Of Stage 1(min)	38.12±13.858	6.46±13.771	32.71±18.265	0.000*
Length of stage 2 (min)	250.05±88.431	442.20±136.487	282.92±121.958	0.000*
Occiput-spine angle	131.93±3.506	118.68±4.711	129.66±6.236	0.000*
Head station	-1.51±0.879	-2.85±0.507	-1.74±0.967	0.000*
Weight of fetus(kg)	3.18±0.373	3.15±0.312	3.17±0.363	0.611
Apgar score at birth	7.84±0.705	7.32±1.426	7.75±0.891	0.000*
Apgar score at 5 min	9.99±0.113	9.57±1.250	9.92±0.548	0.000*
Parity				
• Nulliparous	194 (61.6%)	33 (50.8%)	227 (59.7%)	0.105
• Multipara	121 (38.4%)	32 (49.2%)	153 (40.3%)	
Induction of labor				
• Induced	79 (25.1%)	18 (27.7%)	97 (25.5%)	0.66
• Spontaneous	236 (74.9%)	47 (72.3%)	283 (74.5%)	
APGAR SCORE <7 AT 0 OR 5 MIN				
• Yes	17 (5.4%)	14 (21.5%)	31 (8.2%)	0.000**
• No	298 (94.6%)	51 (78.5%)	349 (91.2%)	

Premature Rupture Of Membranes				
• Present	52 (16.5%)	10 (15.4%)	62 (16.3%)	0.823
• Absent	263 (83.5%)	55 (84.6%)	318 (83.7%)	
Occiput Spinal Angle				
• Shorter angle (126^0)	8 (2.5%)	61 (93.8%)	69 (18.2%)	0.000**
• Larger angle (≥126^0)	307 (97.5%)	4 (6.2%)	311 (81.8%)	

**Independent sample t-test applied and significant at 5% level of significance.*
***Chi-square test applied and significant at 5% level of significance.*

The ROC curve covers the area under the curve of 0.967 which shows that occiput spine angle is an excellent instrument for diagnosis the operative delivery as shown in Figure 1. The best cut of the point is 125.5 for operative delivery where sensitivity is 92.3% and specificity 98.1%.

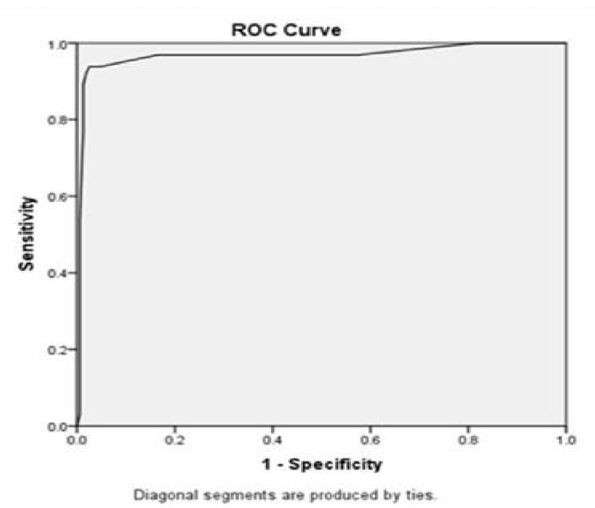

Figure 1: ROC Curve for Occiput –Spinal Angle for Detecting Operative Delivery

The boxplot in Figure 2 shows the maximum, minimum, and median point of OSA with respect to Operative delivery where 'No' shows the Vacuum or Normal delivery. Both the categories have 4 outliers from which 2 are mild and 2 are extreme outliers shows through ° and * respectively. The box plot shows that OSA is low in operative delivery cases.

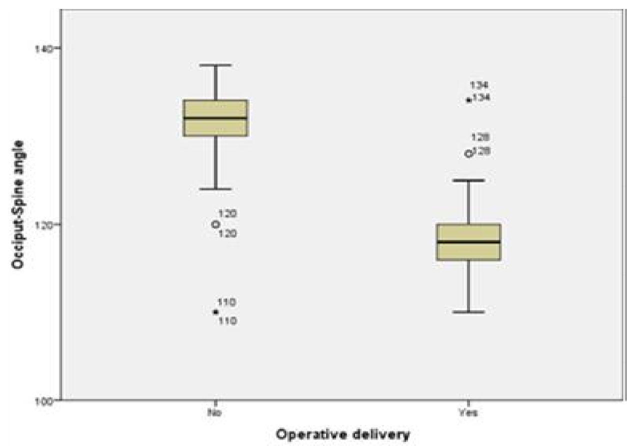

Figure 2: Boxplot for Occiput–Spinal Angle for Operative Delivery

Table 2 shows the binary logistic regression. Gestational age, OSA, and Head station included which are significant at a 5% level of significance with the odds ratios 1.15, 0.711, and 0.32 respectively. The model covers 86.3% variation in a model of delivery with the final three independent variables with the correct diagnosis of normal/vacuum delivery 98.3% while the correct diagnosis of operative delivery is 81.5%. The overall diagnostic accuracy is observed at 95.5% which is excellent.

Table 2: Binary Logistic Regression Model for Prediction of Operative Delivery

VARIABLES	*REGRESSION COEFFICIENT*	*ODDS RATIO*	*95% CONFIDENCE INTERVAL OF ODDSRATIO*		*P-VALUE*
			Lower	Upper	
Gestational Age	.141	1.152	1.094	1.213	.000
OSA	-.370	.691	.619	.771	.000
Head Station	-.891	.410	.185	.909	.028

Discussion

This study aimed to recognize the Occiput-spinal angle as a predictor for the outcome of labor in terms of operative delivery. In the present study, out of 380 cases, 65 (17.1%) had operative delivery. As of 2016, the United States' cesarean rate was 31.9%.[16] In the UK, caesarean section deliveries have increased from 19.7% of births in 2000 to 26.2% in 2015.[17] However the World Health Organization concludes that at the population level, caesarean section rates higher than 10% are not associated with reductions in maternal and newborn mortality rates.[18]

In the present study, there was no significant difference between the BMI of women undergoing normal and operative delivery. This is in contrast to a study done by Murphy DJ et al. who concluded that BMI>30 increased the likelihood of caesarean section.[19] Khalid MA et al reported that vaginal deliveries were associated with higher APGAR scores at five minutes than those delivered by cesarean section.[20] This is in accordance with our study in which 5.4% of babies who were delivered normally and 21.4% who had cesarean section had APGAR score<7 at 0 or 5 min.

Regarding Occiput spine angle, a larger angle is associated with normal delivery. Mean OSA for normal delivery was 131.93 ± 3.506^0 and 118.68 ± 4.711^0 for operative delivery. The ROC curve shows the best cut-off point is 125.5^0 for operative delivery with the sensitivity of 92.3% and specificity of 98.1%. This is consistent with the study done by Maged AM et al. who concluded that there 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 cesarean section (46.3 versus 5.7%), perineal tears (10.4 versus 5.1%), vaginal tears (22.4 versus 6.3%), need for oxytocin augmentation (47.8 versus 21.3%) when compared to those with OSA ≥126. OSA at a cut-off value of 126° had a sensitivity, specificity, and accuracy of 8264.6 and 78.4% and 93.79 and 92% in prediction of the mode of delivery and overall complications, respectively.[21]

Ghi T et al reported that multivariable logistic regression analysis showed that narrow occiput-spine angle values (OR 1.08; 95% CI 1.00−1.16; P = .04) and nullparity (OR 16.06; 95% CI 1.71−150.65; P = .02) were independent risk factors for operative delivery.[15] In our study, binary logistic regression showed that gestational age, OSA, and Head station are significant with the OR= 1.15, 0.711, and 0.32 respectively.

OSA is a good parameter to predict operative delivery as determined by our study. Hence we recommend determining this during routine ultrasound bookings. However, the exclusion of fetuses in frank occiput posterior position and the limitations of ultrasound only may be considered as a limitation of this study. Therefore more studies should be conducted to highlight the value of OSA on the outcome and progress of labor.

Conclusion

Occiput –spinal angle is a good predictor of operative delivery. Fetuses having smaller occiput-spine angles (<126°) are at increased risk for operative delivery. We recommend reporting this sonographic index at routine ultrasound bookings during pregnancy so that patient is managed accordingly.

References

1. Madsen K, Grønbeck L, Rifbjerg Larsen C, Østergaard J, Bergholt T, Langhoff-Roos J, Sørensen JL. Educational strategies in performing cesarean section. Acta obstetricia et gynecologica Scandinavica. 2013 Mar;92(3):256-63.
2. Betrán AP, Ye J, Moller AB, Zhang J, Gülmezoglu AM, Torloni MR. The increasing trend in caesarean section rates: global, regional and national estimates: 1990-2014. PloS one. 2016 Feb 5;11(2):e0148343. DOI: https://doi.org/10.1371/journal.pone.0148343.
3. Gupta M, Garg V. The rate and indications of caesarean section in a tertiary care hospital at Jaipur, India. Int J Reprod Contracept Obstet Gynecol. 2017 May;6(5):1786-92. DOI: http://dx.doi.org/10.18203/2320-1770.ijrcog20171530.
4. Eide KT, Morken NH, Bærøe K. Maternal reasons for requesting planned cesarean section in Norway: a qualitative study. BMC pregnancy and childbirth. 2019 Dec;19(1):1-0. DOI: https://doi.org/10.1186/s12884-019-2250-6.
5. American College of Obstetricians and Gynecologists. ACOG Practice Bulletin Number 49, December 2003: dystocia and augmentation of labor. Obstet Gynecol. 2003;102(6):1445-54. DOI: 10.1016/j.obstetgynecol.2003.10.011.
6. Cunningham F, Leveno K, Bloom S, Spong CY, Dashe J. Williams obstetrics, 24e. New York, NY, USA: Mcgraw-hill; 2014. In: https://accessmedicine.mhmedical.com/content.aspx?bookid=1918&sectionid=185051261.
7. Marinelli E, Beck R, Stark M, Zaami S. Intrapartum Ultrasonography and Medicolegal Issues. InIntrapartum Ultrasonography for Labor Management 2021 (pp. 669-685). Springer, Cham.
8. Shams-Beyranvand M. Predictors of caesarean section-a cross-sectional study in Hungary. The journal of maternal-fetal & neonatal medicine: the official journal of the European Association of Perinatal Medicine, the Federation of Asia and Oceania Perinatal Societies, the International Society of Perinatal Obstetricians. 2020 Jun;33(12):2134.
9. Rabei NH, El-Helaly AM, Farag AH, El-Naggar AK, Etman MK, El-Moteily MM. Intrapartum fetal head circumference and estimated fetal weight as predictors of operative delivery.

International Journal of Gynecology & Obstetrics. 2017 Apr;137(1):34-9.
10. Kasbaoui S, Séverac F, Aïssi G, Gaudineau A, Lecointre L, Akladios C, Favre R, Langer B, Sananès N. Predicting the difficulty of operative vaginal delivery by ultrasound measurement of fetal head station. American journal of obstetrics and gynecology. 2017 May 1;216(5):507-e1.
11. Dall'Asta A, Angeli L, Masturzo B, Volpe N, Schera GB, Di Pasquo E, Girlando F, Attini R, Menato G, Frusca T, Ghi T. Prediction of spontaneous vaginal delivery in nulliparous women with a prolonged second stage of labor: the value of intrapartum ultrasound. American journal of obstetrics and gynecology. 2019 Dec 1;221(6):642-e1. DOI: 10.1016/j.ajog.2019.09.045. Epub 2019 Oct 4. PMID: 31589867.
12. Hehir MP, Burke N, Burke G, Turner MJ, Breathnach FM, Mcauliffe FM, Morrison JJ, Dornan S, Higgins J, Cotter A, Geary MP. Sonographic markers of fetal adiposity and risk of Cesarean delivery. Ultrasound in Obstetrics & Gynecology. 2019 Sep;54(3):338-43.
13. Ghi T, Maroni E, Youssef A, Cariello L, Salsi G, Arcangeli T, Frasca C, Rizzo N, Pilu G. Intrapartum three-dimensional ultrasonographic imaging of face presentations: report of two cases. Ultrasound in obstetrics & gynecology. 2012 Jul;40(1):117-8.
14. Akmal S, Tsoi E, Kametas N, Howard R, Nicolaides KH. Intrapartum sonography to determine fetal head position. The Journal of Maternal-Fetal & Neonatal Medicine. 2002 Jan 1;12(3):172-7.
15. Ghi T, Bellussi F, Azzarone C, Krsmanovic J, Franchi L, Youssef A, Lenzi J, Fantini MP, Frusca T, Pilu G. The "occiput–spine angle": a new sonographic index of fetal head deflexion during the first stage of labor. American journal of obstetrics and gynecology. 2016 Jul 1;215(1):84-e1. DOI: 10.1016/j.ajog.2016.02.020. Epub 2016 Feb
16. Martin JA, Hamilton BE, Osterman MJ, Driscoll AK. Births: Final Data for 2019. National Vital Statistics Reports: From the Centers for Disease Control and Prevention, National Center for Health Statistics, National Vital Statistics System. 2021 Apr 1;70(2):1-51.
17. Wise, J., 2018. Alarming global rise in caesarean births, figures show. BMJ, p.k4319.
18. World Health Organization and Human Reproduction Programme: WHO Statement on CaesareanWHO/RHR/15.02.http://www.who.int/reproductivehealth/publications/maternal_perinatal_healt h/cs-statement/en/. Accessed 20 Mar 2018.
19. Murphy DJ, Liebling RE, Verity L, Swingler R, Patel R. Early maternal and neonatal morbidity associated with operative delivery in second stage of labour: a cohort study. The Lancet. 2001 Oct 13;358(9289):1203-7.
20. Khalid MA, Ghani R, Khalid MF, Malik MS, Waqas A. Association of delivery procedure with APGAR scores among neonates born to healthy Pakistani mothers: a pilot study. F1000Research. 2018 Mar 21;7(346):346.
21. Maged AM, Soliman EM, Abdellatif AA, Nabil M, Said OI, Mohesen MN, Raslan AN, Elbaradie SM. Measurement of the fetal occiput-spine angle during the first stage of labor as predictor of the progress and outcome of labor. The Journal of Maternal-Fetal & Neonatal Medicine. 2019 Jul 18;32(14):2332-7. DOI: 10.1080/14767058.2018.1432589