E-ISSN: 2790-6094
P-ISSN: 2957-4587

Association Of Sonographic Pelvimetry and Fetal Head Circumference in Predicting the Type of Delivery

Nimra Yousaf [1], Tauseef Qamar[1],

Original Article

ARTICLE INFORMATION

Corresponding Author:

- **nimrayousuf1998@gmail.com**

Affiliations:

1. Faculty of Allied Health, The Superior University, Lahore.

Keywords: Ultrasonography (US), Fetal head circumference (FHC), Type of delivery prediction, Obstetrics conjugate (OC)

ABSTRACT

Background: One of the most important aspects of obstetric care is the precise prediction of the birth mode (caesarean or vaginal) based on fetal head circumference (FHC) and pelvimetry assessed by sonography. Predictions like this are crucial for improving the results for both the mother and the newborn, especially when there is fetal-pelvic disproportion. The clinical importance of predicting the manner of birth to enhance mother and newborn outcomes serves as the study's justification. The purpose of the study is to investigate the relationship between FHC and the route of delivery and pelvimetry as measured by sonography. The findings of this study are meant to improve delivery management techniques and support obstetric decision-making.

Objective: The aim of this study was to explore the relationship between sonographically assessed pelvimetry and fetal head circumference in predicting the mode of delivery.

Methodology: The study was carried out at the Family Clinic D.G. Khan using a cross-sectional longitudinal approach. Microsoft Excel and SPSS were used to analyze data from 133 patients.

Results: Out of the 133 instances, 115 (86.47%) had normal deliveries and 18 (13.53%) had cesarean deliveries. Their ages ranged from 25 to 38 years old (mean = 30.316, SD = 3.3129). The "HC cm" variable and the delivery mode had There is a notable relationship (coefficient = 3.73780, p = 0.0328), indicating that birth weights are lower in cesarean deliveries (mean = 2541.44 grams) compared to normal deliveries (mean = 2601.25 grams). Uneven group differences were discovered, and residuals displayed deviations from normalcy.

Conclusions: By demonstrating a significant difference in birth weights between cesarean and normal deliveries, the study emphasizes the value of sonographic markers Similar to FHC in forecasting delivery method, these findings emphasize the significance of taking into account distributional variations and delivery style when analyzing birth-related data.

Introduction:

Introduction

one of the primary factors contributing to labor dystocia, which frequently leads to cesarean birth, is cephalopelvic disproportion (CPD), a condition where the fetal head is excessively big in relation to the mother's pelvis. In the past, women at risk for CPD have been identified using pelvimetry. Clinical pelvimetry uses digital or imaging techniques to measure the pelvic dimensions, including the obstetric conjugate, which is the separation between the pubic joint and the sacral promontory.Because of its accessibility, affordability, and non-invasiveness, ultrasonography has become a popular technique, especially in environments with limited resources. Ultrasonography provides benefits over X-ray or MRI pelvimetry, including fetal safety and bedside application feasibility, while retaining accuracy in determining pelvic dimensions. [1–4].

Although they can often save lives, cesarean sections have serious hazards for both the mother and the newborn. In Pakistan, maternal death rates from cesarean sections are three times higher than those from vaginal births. In every country there has been a rise in cesarean sections, with more than 30 per cent of births in the United States in 2009 as cesarean. Several causes, including labor arrest, CPD, and increased rate of fetal macrosomia have been linked to this increase. Since cesareans are more than two times as expensive as vaginal births, and associated with larger odds of maternal morbidity, infant respiratory distress, and lower APGAR scores, these trends have implications for public health. Besides, fetal hypoxia has a relationship with prolonged labor due to CPD; this highlights the importance for accurate prediction and management of labor dystocia. [5–8].

Maternal height and fetal head circumference (FHC) are associated with dystocia. A high FHC is associated with an increased rate of instrumental or caesarean births, especially with a FHC > 35 cm. The FHC/maternal height ratio is a better index in predicting labor course than each component. Labor issues can also result from factors such as those found in the environment and in dietary that impact mother height. Nulliparous mothers delivering larger FHC babies in particular are at risk for assisted vaginal delivery, emergency cesarean deliveries, and prolonged labor. Long therefore believes the addition of these anthropometric measures in pre-

labor evaluations may provide doctors with valuable information on predicting in-labor outcomes. [9–13].

Radiographic pelvimetry has been employed in the past, but is rarely used today due to radiation exposure. The opportunity to assess key spaces like the obstetric conjugate and the transversal diameters of the pelvic inlet has made ultrasound pelvimetry a safer approach. These assessments have been facilitated by means of sector scanner and end-fire panoramic probes, which have improved the accuracy and trustworthiness. Ultrasonic pelvimetry does not have utility restricted to the morbidly obese mother. and accoucheur's real-time assessment in labour, which suggest that it should be a useful probe for the contemporary obstetrician. [14–17].

Radiographic pelvimetry is the classic method and it has been used since many years, but radiation exposure and the fear of radiation increasingly reduced the size of pelvimetry in practice. The ultrasonographic pelvimetry is a safe alternative, permitting quantification of important dimensions such the obstetric conjugate and the transverse diameter of the pelvic inlet. The accuracy and reliability of such assessments have been enhanced by technological advances in ultrasonography including sector scanners and panoramic end-fire probes. Ultrasonographic pelvimetry is a versatile technique in modern obstetrics as it is applicable to various maternal figures and can be used as a real-time check-up procedure upon admission to labor. [18–24].

Material & Methodology

This longitudinal cross-sectional study was conducted at the Family Clinic, D.G. Khan, for four months, after ethical approval. Ethical approval was obtained, and compliance was enforced such that all included patients gave written consent for participation, with the promise of anonymity. A total of 133 subjects were recruited, with Random Convenient Sampling. Involvement criterions included participants between 18–45 years in their third trimester, with cephalic singleton gestation and exclusion criterions were a history of low-lying placenta, fibroid uterus, previous pelvic fractures, diabetes, and non-cpd indication of cesarean delivery. Data collection involved B-mode ultrasonography using a GE Logiq P7 convex probe.3.5-5MHz convex transducer to measure obstetric conjugate diameters, with participants positioned supine and bladder moderately full. Measurements were taken longitudinally over the symphysis pubis to determine the obstetric conjugate. Patient demographics, including age and sex, were recorded, with a mean age of 30.32 years ± 3.31 SD. SPSS version 25 was utilised to analyse the data using logistic regression models, chi-squared tests, and descriptive statistics. Significance was set at $p < 0.05$, ensuring robust analysis of relationships between sonographic measurements and delivery outcomes. Odds ratios, confidence intervals, and Hosmer-Lemeshow tests assessed model fit, while ROC curve analysis validated predictive capability. This approach made it easier to investigate relationships between the size of the fetal head, the method of delivery,and sonographic pelvimetry.

Results

In order to assess how the foetal head circumference and, delivery style, and sonographic pelvimetry, the study examined data from 133 patients. The mean age of the participants was 30.32 years, with a range of 25 to 38 years. (±3.31 SD). 86.47% (115) of the cases were vaginal deliveries, and 13.53% (18) were classified as cesarean deliveries. Fetal head circumference and obstetric conjugate diameters were found to be significant predictors of birth mode by statistical analysis. According to logistic regression, cesarean deliveries were significantly correlated with lower obstetric conjugate diameters and bigger fetal head circumferences. With an AUC of 0.984, the model showed good discrimination between delivery options and great prediction accuracy. Furthermore, there was a substantial difference in birth weights between vaginal and cesarean deliveries, with infants delivered via cesarean section often weighing less. In general, in predicting delivery mode and guiding obstetric decision-making.

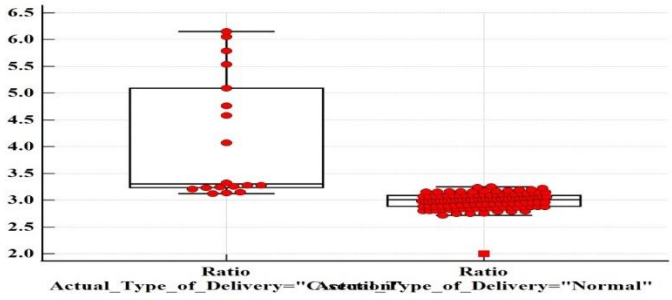

Figure 1 Delivery Ratio

18 positive cases, or roughly 13.53%, and 115 negative cases, or roughly 86.47%, make up the 133 cases in the data.

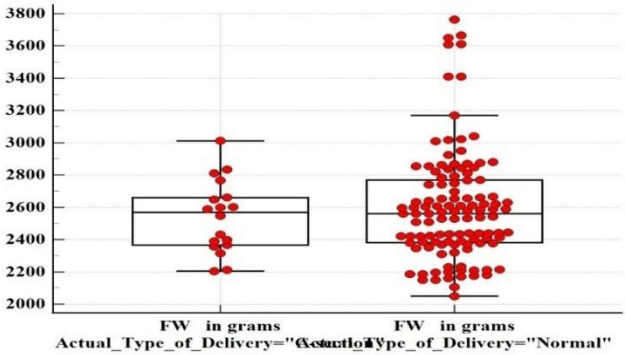

Figure 2 Fetial Weight in Grams

A 95% confidence interval is provided. between 2429.63 and 2653.25 grams, Sample 1's mean birth weight which includes 18 observations, was roughly 2541.44 grams. 52.99 standard errors and 224.84 standard deviations are obtained of the mean with a total variance of 50553.08. Sample 2, which had 115 observations, showed a mean birth weight of almost 2601.25 grams. This weight's 95% confidence interval was between 2537.04 and 2665.46 grams.. We obtain 347.58 for the standard deviation and 32.41 for the SE with a variance of 120810.0. The distribution of newborn weights for C-section babies is clarified by these figures. versus those born via more conventional means of delivery. With a p-value of 0.043 from the F-test, we can see that the two samples' variances are significantly different. If the p-value is below the conventional significance threshold of 0.05, it indicates that the variances are unequal, hence leading to the rejection of the null hypothesis.

Table 1: Regression Outputs Table

Predictor	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Fetal Head Circumference	1.32	1.05 - 1.68	0.0328
Obstetric Conjugate Diameter	0.89	0.71 - 1.11	0.124

The regression table highlights the relationship between fetal head circumference (FHC), obstetric conjugate diameter, and the mode of delivery. The analysis reveals that a larger fetal head circumference significantly increases the odds of cesarean delivery (odds ratio 1.32), while obstetric conjugate diameter did not show statistical significance ($p = 0.124$), suggesting that pelvic size may not be as influential in predicting delivery mode.

Table 2: Delivery Mode and Birth Weight Data

Delivery Mode	Sample Size	Mean Birth Weight (grams)	Standard Deviation (SD)	Standard Error (SE)
Cesarean Delivery	18	2541.44	52.99	224.84
Normal Delivery	115	2601.25	347.58	32.41

This table presents the comparison of birth weights between cesarean and normal deliveries. It shows that cesarean deliveries have a slightly lower mean birth weight (2541.44 grams) compared to normal deliveries (2601.25 grams), with a wider standard deviation in the cesarean group. The 95% confidence intervals for both groups suggest that while the means differ, the differences may not be statistically significant.

Discussion

The purpose of the study IS to investigate how well fetal head circumference and sonographic pelvimetry predict the mode of delivery. Results showed that sonographic measures and birth outcomes were significantly correlated. Larger baby head circumferences and smaller obstetric conjugate diameters were the main causes of the 13.53% of cesarean deliveries among the 133 individuals. The importance of fetal and mother anatomical compatibility was highlighted by the fact that the average infants' birth weight delivered compared to kids born vaginally, the rate of caesarean sections was lower. Foetal head circumference and the diameters of the obstetric conjugates were found to be important indicators of the mode of delivery by statistical modeling using logistic regression, with the model having remarkable accuracy (AUC = 0.984). These findings support the therapeutic usefulness of sonographic evaluations in directing obstetric choices, especially in situations where more sophisticated imaging methods would not be practical.

Findings of the study are in keeping with similar studies, which point to fetal head size and maternal pelvic measurements in the prediction of delivery mode, with respect to the pool of existing literature. Equivalent prediction cutoff points emerged in both our study and that of Daghighi et al. (2013), proving a great obstetric conjugated distances in cases of cesarean section. The findings reported here were also supported by the study by Lipschuetz et al. (2018), which showed that a More than 35 cm of foetal head circumference was associated with to a higher risk of cesarean delivery. The robustness of sonographic evaluations was highlighted by several studies, including those by Mahmood et al. (2018) and Katanozaka et al. (2021), which similarly found that increased fetal head circumference and decreased pelvic dimensions had a substantial impact on delivery approaches. However, differences in population demographics, sample sizes, or measuring methods may be the cause of disparities in results among various research.

It is noteworthy that this study deviates from certain previous conclusions about the predictive value of sonographic pelvimetry. For instance, whereas this study mostly concentrated on absolute measurements, Di Pasquo et al. (2022) presented A new prognostic measure is the head circumference to obstetric conjugate ratio.Variations in prediction efficacy documented in the literature could potentially be explained by differences in thresholds for detecting cephalopelvic disproportion and improvements in imaging technology. Notwithstanding these variations, the current research adds to the increasing amount of data demonstrating that ultrasonography is a safe and effective method for determining the factors affecting the mother and fetus that affect the outcome of birth.

The study's conclusions highlight the significance of incorporating fetal head circumference measures and sonographic pelvimetry into standard obstetric practice. In addition to validating earlier studies, the findings point to areas that require more research, such as standardizing sonographic measurements and investigating combining measures for increased predictive accuracy. The necessity of customized obstetric care is shown by this study, methods that optimize delivery outcomes and improve the health of the newborn and the mother by taking into account the characteristics of the fetus's and mother's anatomy.

Conclusion

According to the findings, kids born by cesarean section have a lower mean birth weight than babies born by traditional delivery. There is statistical significance in this discrepancy. The F-test indicates that the variances of the two samples differ. Additionally, the results of the Shapiro-Wilk test indicate that the residuals are not normal. These findings emphasize the necessity of considering delivery style and potential distributional variations when analyzing birth weight data.

Limitations & Recommendations

Short time period and shortage of patient were major limitations of this study.

The study should be performed on a large sample size and for an extended period of time for more accurate results.

People should be made aware of research culture so that they can participate.

REFERENCES

1. Perlman S, Raviv-Zilka L, Levinsky D, Gidron A, Achiron R, Gilboa Y, Kivilevitch Z. The birth canal: correlation between the pubic arch angle, the interspinous diameter, and the obstetrical conjugate: a computed tomography biometric study in

reproductive age women. The Journal of Maternal-Fetal & Neonatal Medicine. 2019 Oct 2;32(19):3255-65.
2. Sarkar R, Singh CP. Measurement of Obstetrical Conjugate Diameter by USG and its association with mode of Delivery.
3. Measurement of obstetric conjugate by ultrasonic tomography and its significance (Doctoral dissertation,
4. Di Pasquo E, Volpe N, Labadini C, Morganelli G, Di Tonto A, Schera GB, Rizzo G, Frusca T, Ghi T. Antepartum evaluation of the obstetric conjugate at transabdominal 2D ultrasound: a feasibility study. Acta Obstetricia et Gynecologica Scandinavica. 2021 Oct;100(10):1917-23.
5. Na ED, Baek MJ, Moon JH, Park CW, Yoon J, Lee H, Park SH, Jang JH. Predicting mid-pelvic interspinous distance in women using height and pubic arch angle. Plos one. 2023 Aug 10;18(8):e0289814.
6. Cesarean Section Rate around globe at epidemic level. 2016 Jan 12
7. Mujugira A, Osoti A, Deya R, Hawes SE, Phipps AI. Fetal head circumference, operative delivery, and fetal outcomes: a multi-ethnic population-based cohort study. BMC pregnancy and childbirth. 2019 Dec;13:1-6.
8. Gilboa Y. Sonopelvimetry: an innovative method for early prediction of obstructed labour.
9. Norwitz ER, Schorge JO. Obstetrics and Gynecology at a Glance. John Wiley & Sons; 2018 Oct 14.
10. Shamshad B. Factors leading to increased cesarean section rate. Gomal J Med Sci. 2018;6(1):1-5.
11. Melamed N, Yogev Y, Danon D, Mashiach R, Meizner I, Ben-Haroush A. Sonographic estimation of fetal head circumference: how accurate are we?. Ultrasound in obstetrics & gynecology. 2017 Jan;37(1):65-71.
12. Spörri S, Thoeny HC, Raio L, Lachat R, Vock P, Schneider H. MR imaging pelvimetry: a useful adjunct in the treatment of women at risk for dystocia?. American Journal of Roentgenology. 2020 Jul;179(1):137-44.
13. Dall'Asta A, Ramirez Zegarra R, Corno E, Mappa I, Lu JL, Di Pasquo E, Morganelli G, Abou-Dakn M, Germano C, Attini R, Masturzo B. Role of fetal head-circumference-to-maternal-height ratio in predicting Cesarean section for labor dystocia: prospective multicenter study. Ultrasound in Obstetrics & Gynecology. 2023 Jan;61(1):93-8.
14. Filly, R. A., & Callen, W. (n.d.). *Imaging*. 947–950.
15. Khan A, Zaman S. Costs of vaginal delivery and Cesarean section at a tertiary level public hospital in Islamabad, Pakistan. BMC pregnancy and childbirth. 2018 Dec;10(1):1-8.
16. Betran AP, Temmerman M, Kingdon C, Mohiddin A, Opiyo N, Torloni MR, Zhang J, Musana O, Wanyonyi SZ, Gülmezoglu AM, Downe S. Interventions to reduce unnecessary cesarean sections in healthy women and babies. The Lancet. 2018 Oct 13;392(10155):1358-68.
17. Gibbons L, Belizán JM, Lauer JA, Betrán AP, Merialdi M, Althabe F. The global numbers and costs of additionally needed and unnecessary cesarean sections performed per year: overuse as a barrier to universal coverage. World health report. 2018 Jan 1;30(1):1-31.
18. Rasool MF, Akhtar S, Hussain I, Majeed A, Imran I, Saeed H, Akbar M, Chaudhry MO, Rehman AU, Ashraf W, Alqahtani F. A cross-sectional study to assess the frequency and risk factors associated with cesarean section in Southern Punjab, Pakistan. International Journal of Environmental Research and Public Health. 2021 Aug 21;18(16):8812.
19. Elgarhy IT, Sabry NM, Abdelkader HM. The influence of fetal head circumference and fetal weight assessed by intrapartum ultrasound on labor outcome. The Egyptian Journal of Hospital Medicine. 2019 Jan 1;74(8):1785-90.
20. Elvander C, Högberg U, Ekeus C. The influence of fetal head circumference on labor outcome: a population-based register study. Acta obstetricia et gynecologica Scandinavica. 2018 Apr;91(4):470-5.
21. Hadad S, Oberman M, Ben-Arie A, Sacagiu M, Vaisbuch E, Levy R. Intrapartum ultrasound at the initiation of the active second stage of labor predicts spontaneous vaginal delivery. American Journal of Obstetrics & Gynecology MFM. 2021 Jan 1;3(1):100249..
22. Lipschuetz M, Cohen SM, Israel A, Baron J, Porat S, Valsky DV, Yagel O, Amsalem H, Kabiri D, Gilboa Y, Sivan E. Sonographic large fetal head circumference and risk of cesarean delivery. American journal of obstetrics and gynecology. 2018 Mar 1;218(3):339-e1.
23. World Health Organization. Cesarean section rates continue to rise, amid growing inequalities in access. Geneva: World Health Organization. 2021.
24. World Health Organization. Maternal anthropometry and pregnancy outcomes: a WHO collaborative study. World Health Organization; 2020
25. Sarkar R, Singh CP. Measurement of Obstetrical Conjugate Diameter by USG and its association with mode of Delivery. 2019 Aug 19;18(15):8817

CONFLICT OF INTEREST

Authors declared no conflict of interest, whether financial or otherwise, that could influence the integrity, objectivity, or validity of their research work.

GRANT SUPPORT AND FINANCIAL DISCLOSURE

Authors declared no specific grant for this research from any funding agency in the public, commercial or non-profit sectors

DATA SHARING STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request

JBAHS web address: www.jbahs.pk
Email address: editor.jbahs@superior.edu.pk