Journal of Research in Applied and Basic Medical Sciences 2021; 7(2): 71-75

Original Article

RABMS Journal of Research in Applied and Basic Medical Sciences

Correlation of Mode of Delivery with Ultrasonic Measurement of Obstetric Conjugate

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Abstract

***Background & Aims*:** To use ultrasonography to assess obstetric conjugate in pregnant women at term, and to study its relationship with mode of delivery and birth weight.

***Materials & Methods*:** Hundred women at term, in early labor or admitted for induction of labor, entered the study. Longitudinal ultrasonic scanning by transabdominal 3.5 MHz curvilinear probe was performed for measurement of obstetric conjugate from a site most adjacent to pubic symphysis to the sacral promontory. Based on this obstetric conjugate measurement, women were divided into three groups namely those with obstetric conjugate < 10 cm, 10.1-12 cm, and > 12 cm. Mode of delivery and birth weight was noted. Mode of delivery and birth weight were correlated with ultrasonic obstetric conjugate. Ordinary least square method and logistic regression analysis were used for statistical analysis.

Results: The mean age of the women was 26.68 years. The mean obstetric conjugate of the women under study was 11.32 cm and the mean birth weight of newborns was 3.145 kg. The relation between birth weight of newborns of patients and ultrasound obstetric conjugate was a linear co-relation with p value < 0.001. The cesarean delivery rate was 58.3%, 5%, and 14% when ultrasonic obstetric conjugate was < 10 cm, 10.1-12 cm, and >12 cm respectively. The rate of cesarean delivery was higher in patients with ultrasonic obstetric conjugate < 10 cm as compared to others and the difference was statistically significant (p<0.001).

Conclusion: Ultrasonic obstetric conjugate measurement is a simple, noninvasive and safe method of assessing the anteroposterior diameter of the pelvic inlet. An ultrasonic obstetric conjugate of less than 10 cm should alert the obstetrician for a possibility of cesarean delivery.

***Keywords*:** Ultrasound, Obstetric Conjugate, Mode of Delivery

Received 03 May 2021; accepted for publication 10 September 2021

Introduction

One of the greatest challenges of current obstetric practice is the identification of women who are able to achieve a successful vaginal delivery. One of the common causes of failure of vaginal delivery is cephalopelvic disproportion (1). The term cephalopelvic

disproportion (CPD) is used to describe a disparity between the dimensions of the fetal head and maternal pelvis, which translates into a slowing or halting rate of cervical expansion and descent of the fetal head, despite the presence of adequate uterine contractions, thereby preventing a vaginal delivery (2).

For many years, obstetricians have studied methods to measure the pelvic inlet in order to be prepared for a possible cephalopelvic disproportion (2). Clinical pelvimetry has been widely used, but patient discomfort and subjective variability are common concerns (4). X-ray pelvimetry may be harmful to the mother due to radiation exposure and increased risk of caesarean section (1,6). CT and MRI pelvimetry are costly, and routine availability and patient's willingness to undergo a scan limit their application in clinical practice. Ultrasound has potential advantages as it is readily available at the bedside and there are no adverse fetal effects (1,5). However, the role of ultrasound to assess the pelvic inlet has not been extensively studied.

Most morphological disorders of the pelvis result from a small anterior-posterior or obstetric conjugate diameter (7). The clinically important obstetric conjugate is the shortest distance between the sacral promontory and the symphysis pubis (3). The ultrasonic measurement of obstetric conjugate is a simple, cost-effective, and clinically useful tool to diagnose women with suspected inlet contraction (8,9).

Materials & Methods

This study was a prospective observational study carried out over 10 months from August 2017 to May 2018 in the Department of Obstetrics and Gynecology, Sri Ramakrishna Hospital which is a tertiary care hospital in Coimbatore, Tamil Nadu. Permission to conduct this study was obtained from the Ethical Committee of our hospital.

A total of 100 pregnant women at term gestation, in labor or for elective induction of labor were included in the study. Pregnant women which were excluded from the study were those with previous history of caesarean deliveries**,** classical hysterectomies**,** myomectomy and trachelectomy, those with malpresentations (breech and transverse lie), abnormal placentations, big babies (>3.75 kg), and women not eligible for vaginal delivery (severe FGR, severe pre-eclampsia, genital tract obstructive mass like carcinoma cervix, genital HSV, etc.).

Written informed consent was taken from all patients after proper counseling. Detailed history taking and physical examination were done for all patients. A transabdominal ultrasonic scan was done (GE LOGIQ Book XP). A 3.5MHz transabdominal curvilinear probe was used for the measurement of the obstetric conjugate. Longitudinal tomographic imaging was performed at a site most adjacent to the pubic symphysis above the pubic bone on left or right side. The internal end of the superior periphery of pubic bone to sacral promontory was measured as the ultrasound obstetric conjugate as described by Katanozakaet et al. (9) and it is demonstrated in Figure 1.

Based on the obstetric conjugate measurement, pregnant women were divided into three groups viz., A B and C having ultrasound obstetric conjugate < 10 cm, 10.1-12 cm, and > 12 cm respectively. The mode of delivery, vaginal or cesarean section, and birth weight were recorded. The relationships between ultrasound obstetric conjugate and mode of delivery and birth weight were evaluated statistically.

Statistical methods used were ordinary least square method and logistic regression analysis, and a correlation between these parameters was attempted.

Results

In our study, the mean age of the participants was 26.68 years. Out of 100 women, 70 women were primigravida (70%) and 30 women were multigravida (30%).

The patients were divided into three groups based on ultrasound obstetric conjugate, as shown in Table 1. Group A constituted of 12 women with ultrasound obstetric conjugate ≤ 10 cm (12%). Group B had 60

women with ultrasound obstetric conjugate between 10.1-12 cm (60%) and Group C consisted of 28 women with ultrasound obstetric conjugate> 12 cm (28%).

As shown in Table 2, out of 100 women, birth weight of newborns of 71 women was between 3.1-3.5 kg (71%), birth weight of 26 newborns was between 2.5-3 kg (26%) and birth weight of 3 newborns was more than 3.5 kg (3%).

The mean obstetric conjugate of the women under study was 11.32 cm and the mean birth weight of newborns was 3.145 kg.

As shown in Table 3, 86 were delivered by vaginal delivery (86%), and 14 women underwent cesarean section (14%). Among vaginal deliveries, vacuum-assisted vaginal delivery was done in 5 women (5%).

The mean values of the birth weight of the newborns of the three groups were compared, as shown in Table 4. The difference in the mean values amongst the three groups was statistically significant ($p<0.001$).

We observed the relation of birth weight of newborns of patients with ultrasound obstetric conjugate. The relation between birth weight of newborns of patients and ultrasound obstetric conjugate, as shown in graph 1, was a linear co-relation with a pvalue < 0.001.

As shown in Table 5 and graph 2, we studied the association between the mode of delivery and ultrasound obstetric conjugate of three groups of women under study. The incidence of cesarean section in Group A (UOC ≤ 10 cm) was 58.3% (7/12), in Group B (UOC 10.1-12cm) was 5% (3/60), and in Group C (UOC>12cm) was 14% (4/28). Thus, there was a higher incidence of vaginal delivery and lower incidence of LSCS in Group B and C as compared to group A and the difference was statistically significant ($p<0.001$).

Discussion

Contracted pelvis and cephalopelvic disproportion involving an absolute or relative mechanical disparity between the fetal size and birth canal continue to be a serious cause of maternal and perinatal morbidity and mortality. The pelvic inlet is considered to be contracted when its shortest anteroposterior diameter or obstetric conjugate diameter is less than 10.0 cm and the transverse diameter is less than 12 cm. When both diameters are contracted the obstetric difficulty further increases (8). Most morphological disorders of the pelvis, however result from a small anterior-posterior diameter or obstetric conjugate diameter (OCD). Different methods are used to measure this diameter including clinical examination, X-ray pelvimetry, CT scan, and MRI (7). Ultrasound (US) is another technique to measure OCD. It is also accessible in many centers and it is considered as an exact way to determine OCD (7,10).

In our study the mean age of the women under study was 26.68 years which was comparable to the study by Sonal B et al. (8) who reported a mean age of 22.65±3.14 years. It was also comparable to the study by Daghighi MH et al. (7) who reported a mean age of 24.12 ± 4.94 years. Out of 100 women, 70 women were primigravida (70%) and 30 women were multigravida (30%). Our observations were comparable to the study of Sonal B et al. (8) in whose study primigravida constituted 72.73%.

In this prospective study, the patients were divided into three groups based on ultrasound obstetric conjugate (UOC). Group A constituted of 12 women with UOC ≤ 10 cm (12%). Group B had 60 women with UOC between 10.1-12 cm (60%) and Group C consisted of 28 women with UOC> 12 cm (28%). Our results were similar to the study of Sonal B et al. (8) who reported a distribution of 10.9%, 58.18%, and 30.9% in the three groups, respectively.

The ultrasound obstetric conjugate of the women under study varied from 9.6 to 13.6 cm with a mean of 11.32 cm. Our results were comparable to the study of Sonal B et al. (8) who reported ultrasound obstetric conjugate between 9.4 to 12.9 cm with a mean of 11.4±1.07 cm.

Out of 100 women, birth weight of newborns of 71 women was between 3.1-3.5 kg (71%), birth weight of 26 newborns was between 2.5-3 kg (26%), and birth

weight of 3 newborns was more than 3.5 kg (3%). The mean birth weight of newborns was 3.145 kg which is similar to the results of the study conducted by Sonal B et al. (8) who reported mean birth weight of 2.77 ± 0.35 kg.

86 women had vaginal delivery (86%) and 14 underwent cesarean section (14%). Vacuum-assisted vaginal delivery was observed in 5 patients (5%). Our results were similar to the study of Sonal B et al. (8) who reported a cesarean delivery rate of 10.9% and forceps assisted vaginal delivery of 5.4%.

We compared the birth weight of newborns and ultrasound obstetric conjugate. The difference in the mean birth weight of neonates in the three groups based on ultrasound obstetric conjugate was statistically significant ($p<0.001$). We also observed that the relation between birth weight of newborns and ultrasound obstetric conjugate of women was a linear correlation with high statistical significance ($p < 0.001$). Our results were similar to the study of Sonal B et al. (8) who also observed a linear correlation between birth weight of newborns and ultrasound obstetric conjugate of women ($p< 0.001$).

In this prospective study, we observed the association between mode of delivery and ultrasound obstetric conjugate of three groups of women under study. The incidence of cesarean section in Group A (UOC ≤ 10 cm) was 58.3% (7/12), in Group B (UOC 10.1-12cm) was 5% (3/60) and in Group C (UOC>12cm) was 14% (4/28). More than half of the women in Group A (UOC ≤10 cm) underwent caesarean delivery. There was a higher incidence of vaginal delivery and lower incidence of caesarean deliveries in Group B and C as compared to group A and the difference was statistically significant ($p<0.001$).

Our results were similar to the study of Sonal B et al. (8). They observed that cesarean delivery rates were higher (50%) in women with UOC ≤ 10 cm, while cesarean rates were lower in women with UOC 10.1-12cm (3.12%) and UOC > 12cm (11.7%). Katanozaka M et al. (9) reported a 50% incidence of cesarean delivery in women with UOC <12 cm and 7.1% in those with UOC ≥ 12 cm. These variations in results might be attributed to the differences in racial characteristics and/or disparity in birth weights in their study population. Daghighi MH et al. (7) found that all the women with UOC < 10cm needed cesarean section. They also observed that in women with UOC ≥12 cm, 11.9% needed cesarean section, while in women with UOC < 12 cm, 62.2% needed cesarean section. Again this difference may be due to different racial characteristics or disparity in birth weight of the population.

It is evident from our study as well as the other studies quoted above that although cesarean delivery is indicated in true CPD, at the same time, adequacy of pelvis alone is not the sole criteria for achieving successful vaginal delivery. Mode of delivery is influenced by certain other factors like Bishop's score at the time of admission, psychological factors like patient preparedness and co-operation for undergoing vaginal delivery, place of birth and setup, nature of care provider including obstetrician and nursing staff, adequate labor analgesia, hospital policies and service availabilities. This also explains the rationale for giving trial of labor in mild to moderate degrees of CPD.

Conclusion

Ultrasound pelvimetry is a simple, cheap, and easily available method to assess pelvic inlet and predict outcome of labor in pregnant women. The routine use of ultrasound pelvimetry for prediction of labor outcomes should be encouraged among obstetricians. The use of ultrasound pelvimetry, as an adjunct to modified Bishop's score, can assist obstetricians in making rational decisions about the mode of delivery. Ultrasound obstetric conjugate would be especially valuable in case of suspected CPD where undue prolongation of labor can be avoided. However, studies with a larger study population are needed to further validate the utility of ultrasound as a pelvimetric tool in pregnant women. Future research should focus on

assessing fetal-pelvic compatibility by providing more information about the pelvic configuration and the shape of the pelvic inlet.

Acknowledgement

The authors would like to express their deepest thanks to all participants that without their cooperation the present work could not be carried out.

Funding

The authors received no financial support for the research, authorship, and/or publication of this research article.

Declaration of Competing Interest

All authors report no conflicts of interest relevant to this article.

Abbreviations

CPD: Cephalopelvic disproportion, CT: Computed Tomography, MRI: Magnetic Resonance Imaging, US: Ultrasound, OCD: Obstetric Conjugate Diameter, UOC: Ultrasound Obstetric Conjugate

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