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Original Research Paper

Radio-Diagnosis

A PILOT STUDY ON THE ROLE OF ESTIMATED PLACENTAL VOLUME IN PREDICTING ADVERSE PERINATAL OUTCOMES.

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ABSTRACT The placenta is crucial for fetal development, acting as the mother-fetus interface. This study investigates the role of estimated placental volume (EPV) in predicting adverse perinatal outcomes. Sixty patients with singleton pregnancies and no comorbidities underwent 2D ultrasound at 28-34 weeks. EPV was calculated, averaging 812 cc. Of 18 cesarean deliveries, 3 newborns had respiratory distress. Among 42 vaginal births, 9 had low APGAR scores. An EPV under 650 cc was significantly linked to adverse outcomes (p=0.004). Routine EPV assessment may help predict risks, with further research needed to refine prediction methods.

KEYWORDS : placental volume, perinatal outcome, adverse pregnancy outcome, stillbirth, preterm birth, low birth weight, neonatal morbidity.

INTRODUCTION

The placenta plays a vital role in the development of the fetus and acts as a crucial connection between the mother and the unborn baby.

The placenta is a dynamic and autonomous organ that undergoes its own distinct and parallel growth trajectory alongside the fetus. It is essential to recognize and evaluate the placenta independently. [1]

Despite its significance, the placenta is often overlooked during routine prenatal imaging evaluations. It is essential to conduct a thorough and systematic evaluation of the placenta using ultrasound, which is the standard imaging technique during pregnancy.

At present, assessing placental volume using sonography is time-consuming and requires expensive technology. The most effective approach so far involves using three-dimensional ultrasound measurements, which necessitates specialized training.

However, in this study, we calculate placental volumes using widely available two-dimensional ultrasound measurements and a mathematical equation.

Aims And Objectives

- To obtain estimated placental volume using 2D ultrasound.
- To investigate the role of estimated placental volume in predicting adverse perinatal outcomes.

MATERIALS AND METHODS

- Patients aged above 18 years with a singleton pregnancy and no comorbidities were chosen for this study.
- 2D ultrasound was performed between **28 to 34 weeks** of gestation.
- All ultrasounds were performed by the same operator using GE VOLUSON E8 and GE VOLUSON E10 machines.
- Placental location and shape were assessed primarily.
- Full sweeps were performed through the placenta until the maximum cross section was found.
- If the umbilical cord is centrally inserted, this can serve as a guide to both find the maximum cross section and help to maintain the probe perpendicular to the placental surface. [2]

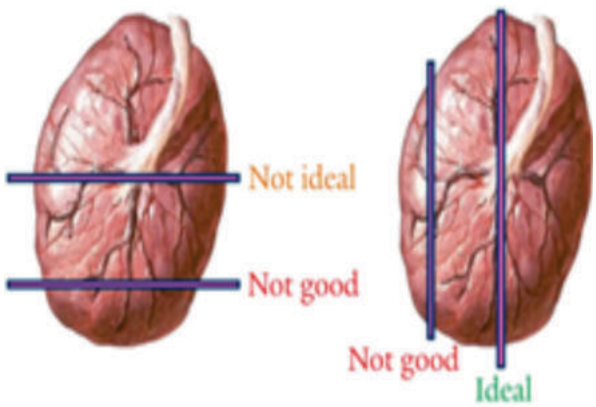

Figure 1: Correct and incorrect placental sections.

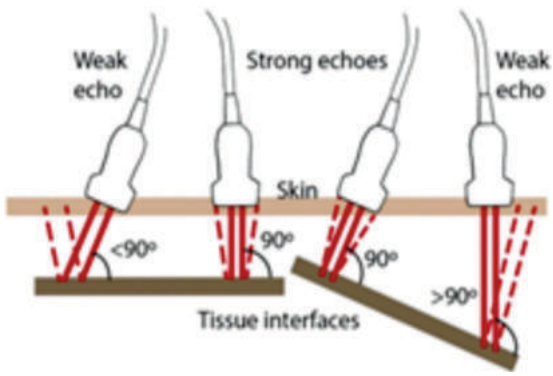

Figure 2: Proper Probe angles during EPV scan.

- Maximal width and height were acquired in an image of the placenta using the scheme illustrated in Fig. 1.
- If necessary, the probe was slightly angled to allow full visualization of both placenta edges simultaneously.
- Formula : V ¼ (pT/6) * [4H(W T) þW(W 4T) þ 4T2] .
- where V stands for volume; W for width; H for maximal height; T for thickness at maximal height.

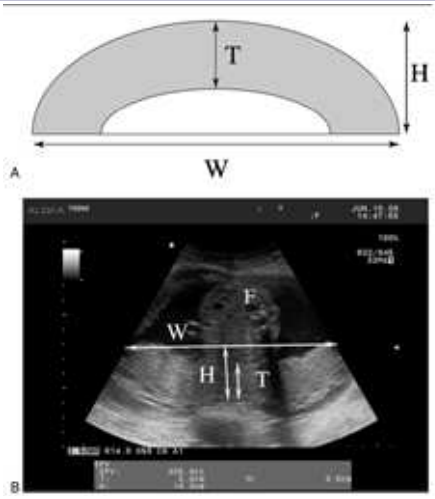

Figure 3: (A) Diagram showing parameters measured to calculate EPV, (B) Representative scan used to generate EPV, W, maximal width; H, Height at maximal height; T, Thickness at maximal height; F, Fetus.[2]

Figure 4: Correct measurement during EPV scan.

RESULTS

- A total of 60 patients met the inclusion criteria. Mean age of the study group was 26 years.
- Adverse perinatal outcomes included
- Instrumental / operative delivery due to foetal distress.
- Neonatal respiratory distress,
- Low APGAR at 5 minutes (less than 7)
- Stillbirth.
- The position of the placenta did not impact the measurement process.
- The average estimated placental volume (EPV) was determined to be 812 cc.
- The average EPV in 27 newborns with adverse perinatal outcomes was found to be 646 cc.
- Among the 60 patients, 18 underwent cesarean section due to unfavorable non-stress test results.
- Out of these 18 patients, one newborn experienced respiratory distress and required admission to the neonatal intensive care unit (NICU).
- Among the 42 newborns delivered normally, 9 of them exhibited poor crying efforts at birth and subsequently had an APGAR score of less than 7 at 5 minutes.
- An EPV of less than 650 cc was found to be associated with adverse perinatal outcome with a statistically significant p value of 0.004.
- Numerous previous studies have explored the reliability and precision of 2D ultrasound in determining placental volume.

DISCUSSIONS.

In 2008, Kurjak et al. conducted a comparative analysis of various techniques for estimating estimated placental volume (EPV) and found that manual tracing outperformed the other methods. [3]

Another study conducted by Humberto Azpurua, M.D., et al. involved 36 mothers who underwent 2D ultrasound examinations using the mathematical formula employed in our study. [2] The researchers discovered a statistically significant correlation between the obtained EPV and the actual weight of the placenta following birth.

A study by Isakov et al concluded that placental growth kinetics is an inherent feature of the placenta itself, unaffected by the patient population. Deviations from the expected growth pattern may indicate underlying issues with the placenta, such as reduced maternal blood flow, or a disparity between the size of the placenta and the fetus. [6] This observation aligns with our study, as outliers in placental growth could signal potential complications, emphasizing the importance of close monitoring for any discrepancies during pregnancy.

In a 2023 study by Murdaugh et al., it was found that EPV can be low even when estimated fetal weight (EFW), non-stress test (NST), and amniotic fluid index (AFI) are within normal limits, signaling the need for closer monitoring. In the third trimester, a small EPV can guide clinicians to induce labor when the risks of continuing the pregnancy equal or exceed those of delivery. Therefore, EPV should be used as a valuable tool to inform the need for increased surveillance and, if necessary, early delivery. [7]

Thompson et al. in 2023 investigated the relationship between dysmorphic chorionic villi and unexplained pregnancy loss. Their research focused on identifying abnormal placental structures, particularly dysmorphic villi, as potential markers for pregnancy complications. By analyzing placental samples from cases of unexplained loss, they aimed to establish a clearer link between these morphological abnormalities and adverse outcomes. Their findings suggest that dysmorphic chorionic villi may play a significant role in unexplained pregnancy loss, underscoring the importance of placental morphology in understanding and diagnosing such cases.[8]

In a 2007 study by Novak et al., the researchers compared the multiplanar and VOCAL (Virtual Organ Computer-aided AnaLysis) methods for assessing placental volume in the first trimester of pregnancy. Their work laid the foundation for the use of computed analysis in evaluating placental volume, opening the door for the development of more advanced datasets in the future to enhance predictive capabilities and improve pregnancy outcomes. [9]

In a 2001 study by Metzenbauer et al., the researchers explored the correlation between EPV and maternal serum screening parameters to enhance Down syndrome screening. This demonstrates that the role of EPV extends beyond monitoring fetal well-being, playing a valuable part in Down syndrome and aneuploidy screening as well.[10]

CONCLUSIONS

Assessing EPV using the method shown in our investigation during routine antenatal sonological care is a straightforward parameter. Based on this study, we can infer that in the absence of any additional medical conditions, a low EPV can indicate a potential risk for adverse perinatal outcomes. Conducting further research, including serial measurements at various stages of gestation and developing population based nomograms / datasets, can enhance the prediction of adverse perinatal outcomes

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