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Morphological Spectrum of Extrachorial Placentas: A Descriptive Gross Anatomical Study

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ABSTRACT

Introduction: Placenta extrachorialis, encompassing circumvallate and circummarginate placentas, is a condition where fetal membranes insert inside the placental margin, potentially affecting pregnancy outcomes. Reported prevalence varies widely due to differences in diagnostic methods and populations. This study aimed to determine the prevalence of placenta extrachorialis and its subtypes in a contemporary cohort and compare findings with existing literature.

Methodology: This hospital-based cross-sectional study at S.V. Medical College, Tirupati, India, examined placentas from singleton pregnancies collected post-delivery via convenience sampling. Placentas were fixed in 10% formalin and macroscopically analyzed for shape, weight, chorioamniotic membrane insertion and umbilical cord characteristics. Maternal details were recorded from hospital records. Data were recorded in an approved proforma, and analyzed using SPSS for descriptive statistics.

Results: A total of 950 placentas from singleton pregnancies at S.V. Medical College, Tirupati were examined. The mean maternal age was 25.48 ± 3.4 years, and the mean maternal hemoglobin level was 11.57 ± 0.95 g/dL. The prevalence of extrachorial placentas was 5.8%. Of these, circumvallate placentas accounted for 2.7% and circummarginate placentas for 3.1%.The mean weight of extrachorial placentas was 448.7 ± 76.3g, while the mean weight of normal placentas was 445.3± 76.8 ($p>0.05$). No association was found between placenta extrachorialis and previous history of abortion, preterm deliveries, or low birth weight ($p > 0.05$).

Conclusion: Our study determined a 5.8% prevalence of placenta extrachorialis, with 2.7% circumvallate and 3.1% circummarginate placentas. These findings enhance understanding of this condition's occurrence in our population. Further research is needed to standardize diagnostic criteria and explore clinical implications.

Key words: *Placenta Extrachorialis, Circumvallate placenta, Circummarginate placenta, Placental abnormalities*.

1. INTRODUCTION

The placenta is a vital organ that performs multiple functions, including endocrine, immune, and physiological roles.[1] Its morphological and functional diversity reflects adaptations to varying physiological demands and pathological conditions[2]. Among the spectrum of placental morphologies, extrachorial placentas represent a distinct subset characterized by the extension of the chorionic plate beyond the fetal surface of the placenta, forming a marginal zone devoid of villous tissue[3]. This morphological variant, encompassing conditions such as circumvallate and circummarginate placentas, has garnered attention due to its association with adverse pregnancy outcomes, including preterm birth, placental abruption, and intrauterine growth restriction[4,5].

Extrachorial placentas are identified macroscopically by a raised or folded rim of membranes at the placental margin, with the chorionic plate extending beyond the villous parenchyma[4]. The circumvallate placenta is distinguished by a

complete, elevated ring of membranes, while the circummarginate placenta lacks the pronounced fold, presenting a flatter marginal zone[2]. These structural anomalies are reported in approximately 1 - 25% of term placentas[6,7], though their prevalence may be underestimated due to inconsistent diagnostic criteria and underreporting in routine obstetric practice. The pathogenesis of extrachorial placentas remains poorly understood, with hypotheses suggesting contributions from abnormal trophoblast invasion, altered uterine vascular dynamics, or inflammatory processes[4].

The clinical significance of extrachorial placentas lies in their potential to disrupt optimal placental function, leading to complications that impact maternal and fetal health. Previous studies have linked these morphologies to increased risks of antepartum hemorrhage, premature rupture of membranes, and perinatal mortality[7]. However, the gross anatomical characteristics of extrachorial placentas, including their size, shape, and marginal features, remain underexplored in the literature. A detailed descriptive study of these features is essential to establish standardized diagnostic criteria and to elucidate their implications for placental function and pregnancy outcomes.

This study aims to systematically describe the gross anatomical features of extrachorial placentas, focusing on their morphological spectrum and variability. By documenting these characteristics, we seek to contribute to a better understanding of their clinical relevance and to provide a foundation for future histopathological and molecular investigations. This descriptive approach will enhance the recognition of extrachorial placentas in clinical practice and support the development of targeted interventions to mitigate associated risks.

2. MATERIALS AND METHODS

Study Design and Setting

This hospital-based cross-sectional study was conducted in the Department of Anatomy and OBG at S.V. Medical College, Tirupati, India, a tertiary care referral teaching hospital. Ethical approval was obtained from the Institutional Ethics Committee of S.V. Medical College

Sample Collection:

Convenience sampling method was adopted. Placentas were collected from the Department of Obstetrics and Gynecology at S.V. Medical College, Tirupati, immediately following spontaneous vaginal deliveries or cesarean sections. Inclusion criteria comprised singleton pregnancies with gestational age ≥ 32 weeks. Exclusion criteria included pregnancies < 32 weeks, those with gestational diabetes, pregnancy-induced hypertension, pre-eclampsia, eclampsia, hypo/hyperthyroidism, IVF pregnancies, TORCH infections, or multiple gestations. Post-delivery, placentas were cleaned of blood clots, rinsed with normal saline, and fixed in 10% formalin solution in the Department of Anatomy for a minimum of 48 hours to preserve tissue integrity.

Gross Anatomical Examination:

Fixed placentas were examined macroscopically by trained anatomists. The following parameters were recorded:

1. **Placental Shape and Weight**: Shape (oval, round, irregular) was noted, and weight was measured post-fixation after removing the umbilical cord, chorioamniotic membranes, and residual blood, using a calibrated digital weighing scale.

2. **Chorioamniotic Membrane Insertion**: The attachment of chorioamniotic membranes was evaluated to confirm extrachorial placentation (circumvallate or circummarginate). The distance from the placental edge to the membrane insertion point was measured using an inch tape to quantify the extrachorial zone.

3. **Umbilical Cord Characteristics**: Cord insertion was classified as central, eccentric, marginal/battledore (≤ 2 cm from the placental edge), velamentous, or furcate. Cord length and diameter were measured using an inch tape and digital vernier caliper, respectively. The number of umbilical vessels was assessed after transverse sectioning at the placental end.

Data Collection and Analysis:

Data were recorded in a proforma approved by the Institutional Research Advisory Committee, focusing on placental and umbilical cord characteristics. Maternal data (e.g., age, hemoglobin) were collected from case sheets. Descriptive statistics were used to summarize findings, with continuous variables (e.g., placental weight) reported as mean ± standard deviation and categorical variables (e.g., shape, cord insertion) as frequencies and percentages. Data were analyzed using SPSS version 20.0.

3. RESULTS

A total of 950 placentas from singleton pregnancies at S.V. Medical College, Tirupati, meeting the inclusion criteria were examined. The mean maternal age was 25.48 ± 3.4 years, and the mean maternal hemoglobin level was 11.57 ± 0.95 g/dL.

The prevalence of extrachorial placentas was 5.8% (55/950 cases). Of these, circumvallate placentas accounted for 2.7% (26/950) (Fig 1) and circummarginate placentas for 3.1% (29/950) (Fig 2).The mean weight of extrachorial placentas was 448.7 ± 76.3g, while the mean weight of normal placentas was 445.3± 76.8 ($p>0.05$)

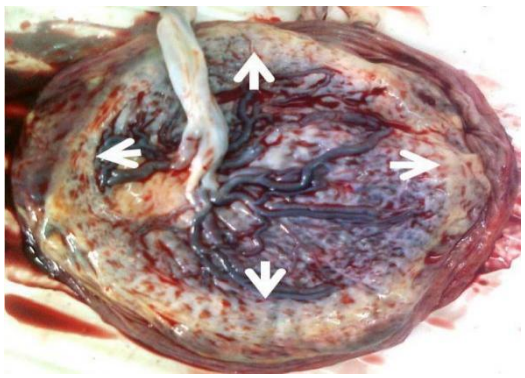

Fig 1: Circumvallate Placenta. White arrow heads showing complete, elevated ring of membranes

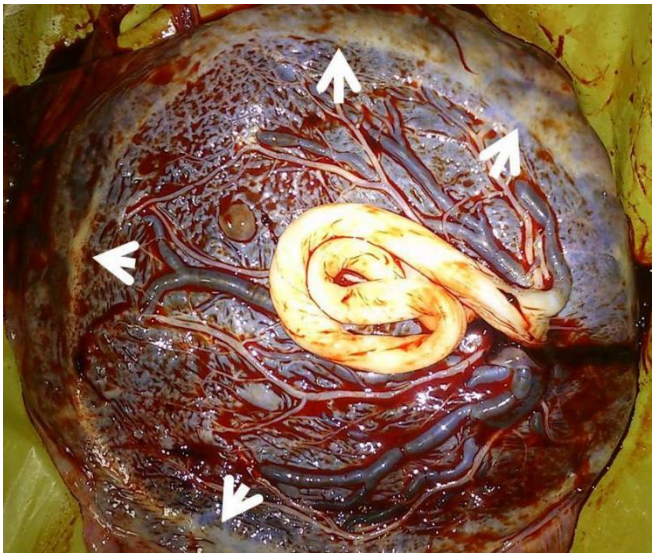

Fig 2: Circummarginate Placenta: White arrow heads showing very thin or a flatter marginal zone

Among the 55 extrachorial placentas, the majority exhibited a round shape (70.9%, 39/55), followed by oval (23.6%, 13/55) and pyriform (5.45%, 3/55) shapes. Umbilical cord insertion was normal (eccentric and central) in 76.3% (42/55), marginal/battledore in 21.8% (12/55) (Fig 3), and long umbilical cord in 1.8% (1/55). Other umbilical cord abnormalities were not related.

No association was found between placenta extrachorialis and previous history of abortion, preterm deliveries, or low birth weight ($p > 0.05$).

4. DISCUSSION

The prevalence of placenta extrachorialis in the present study was found to be 5.8%, with 2.7% identified as circumvallate placenta and 3.1% as circummarginate placenta. These findings contribute to the understanding of placental morphological variations and their potential clinical implications. Placenta extrachorialis, encompassing both circumvallate and circummarginate types, is a developmental anomaly characterized by the transition of membranous to villous chorion at a distance from the placental edge, resulting in an uncovered placental area known as the extrachorialis layer. This study's results are compared with various existing studies to contextualize the prevalence and clinical significance of these conditions. Findings of present study align closely with some prior studies but diverge from others, reflecting variability in reported prevalence and clinical associations across different populations and diagnostic methodologies.

Our prevalence rate of 5.8% for placenta extrachorialis is comparable to the 6.9% reported by Benson et al[8] in a large cohort of 18,926 white patients, where 3.6% were circumvallate and 3.3% were circummarginate placentas. The similarity in overall prevalence and the near-equivalent distribution between circumvallate and circummarginate subtypes suggests

consistency in the occurrence of this condition across diverse populations. However, our slightly lower prevalence may reflect differences in diagnostic criteria, population demographics, or sample size. In contrast, Robert D. Harris et al[9] reported a significantly higher prevalence of placenta extrachorialis at 21% in a sonographic study of 62 patients, with 19% partial circumvallate and 2% complete circumvallate placentas. This elevated rate may be attributed to the use of ultrasonography, which likely enhances detection sensitivity compared to gross pathological examination used in our study and that of Benson et al[8]. The small sample size in Robert D. Harris et al[9] study may also introduce selection bias, potentially skewing prevalence estimates. Additionally, their focus on partial versus complete circumvallate placentas highlights a nuanced classification not consistently reported in other studies, which may further explain the discrepancy.

Our circumvallate placenta prevalence of 2.7% is notably higher than the 1.8% reported by Suzuki S et al[10] and the 0.65% by Hermann A. Ziel et al[11]. Suzuki S et al[10] study, while not detailing the total prevalence of placenta extrachorialis, suggests a lower incidence of circumvallate placentas, potentially due to differences in diagnostic thresholds or population-specific factors. Suzuki S et al's[10] remarkably low incidence of 0.65% for circumvallate placentas may reflect stricter diagnostic criteria or a focus on clinically significant cases, as their study associated this condition with antepartum bleeding and premature delivery rather than congenital anomalies. This association with adverse outcomes contrasts with our findings, where no significant clinical correlations were noted, possibly due to differences in study design or population characteristics.

The variability in prevalence across these studies underscores the influence of diagnostic methods, sample size, and population demographics on reported rates of placenta extrachorialis. Ultrasonography, as used by Robert D. Harris et al[9] may detect subtler cases missed by macroscopic examination, while clinical versus pathological definitions may further contribute to discrepancies. Additionally, the lack of standardized diagnostic criteria for circumvallate and circummarginate placentas complicates direct comparisons. Future studies should aim to harmonize these definitions and incorporate both imaging and pathological assessments to improve accuracy and comparability.

Our findings contribute to the understanding of placenta extrachorialis prevalence and highlight the need for larger, multicenter studies to clarify its clinical implications. While our data align closely with Benson et al[8], the higher prevalence in sonographic studies and lower rates in others suggest that diagnostic modality and population factors play critical roles. Future Indian studies should aim to include larger, multicenter cohorts and incorporate both ultrasound and histopathological assessments to improve diagnostic accuracy. Comparative studies with global populations could further elucidate whether genetic, environmental, or healthcare access factors contribute to the observed differences in prevalence.

In conclusion, the prevalence of placenta extrachorialis in this study (5.8%, with 2.7% circumvallate and 3.1% circummarginate) is lower than some global estimates but aligns with the range for circumvallate placenta. The limited Indian data highlights the need for more robust studies to establish regional prevalence and clinical implications. These findings contribute to the growing body of knowledge on placental anomalies and underscore the importance of standardized diagnostic approaches and clinical correlation in obstetric practice.

5. CONCLUSION

This study identified a 5.8% prevalence of placenta extrachorialis (2.7% circumvallate, 3.1% circummarginate), with no significant differences in placental weight or association with adverse outcomes like preterm delivery, or low birth weight and not associated with previous history of abortion. The majority of extrachorial placentas were round with normal umbilical cord insertion, suggesting typical morphological characteristics. Further research is warranted to standardize diagnostic criteria and investigate potential clinical implications of this condition.

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