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ORIGINAL RESEARCH

Prediction of placenta previa from serial reading of serum HCG Late in first half of pregnancy

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Abstract

Introduction- An abnormally positioned placenta is a significant and potentially life-threatening problem for pregnant women. There is ongoing discussion over the early detection and treatment methods to reduce the risk of death and complications. The present study was done to evaluate the role of beta-human chorionic gonadotrophin (B-HCG) level in the first half of pregnancy as a marker for prediction of placenta previa.

Material and methods- The present prospective study was conducted among 60 pregnant women who reported to department of obstetrics and gynecology at a tertiary care center during the study period of one year. The study involved sampling all participating mothers between 14 and 18 weeks of gestational age. The results were analyzed using SPSS version 25.0.

Results– Out of total 60 women 15 (4%) had condition of placenta previa. The Mean age of patients was 33.45 years , gravid was 4.2 , parity was 2.9 and serum hCG was 90,981 IU. Mean serum HCG >104679 iu at 14 weeks of gestation is the ideal cutoff value. The sensitivity and specificity were determined to be 100% and 73.3%, respectively.

Conclusion- The measurement of B-HCG levels throughout the first half of pregnancy can serve as an indicator for predicting the occurrence of placenta previa.

Keywords- biomarker, first , placenta previa **,** pregnancy, trimester

Introduction

The placenta is a transient organ that develops in the uterus during pregnancy. It enables the transfer of substances between the mother and foetus. During pregnancy, the placenta carries out various duties, such as adjusting the mother's physiology, guaranteeing immunological compatibility, and supplying sustenance and support to the developing embryo [1]. The placental villi, which are submerged in maternal blood, function as transportation structures, supplying the foetus with nutrients and oxygen while eliminating waste products [2]. During the nine-month period of gestation, these villi experience substantial morphological alterations. [3]

Placenta previa is a significant contributor to maternal mortality and health issues. It is associated with both antepartum and postpartum haemorrhage, which can be severe. Placenta previa is characterised by the development of the placenta in the lower part of the uterus, specifically near or on the internal opening of the cervix. Based on this, it is classified as major placenta previa when the placenta completely or partially covers the internal opening,

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and minor placenta previa when it is implanted in the lower part of the uterus away from the opening. The prevalence of placenta previa at full term is approximately 0.5%.[4,5]
The traditional simple method for the diagnosis of placenta previa in addition to the clinical presentation of painless vaginal bleeding is the ultrasound and biomarkers. Human chorionic gonadotropin (HCG) is a glycoprotein with a molecular weight of 36,000 Daltons. It is made up of two subunits that are joined together without a covalent bond. The alpha subunit consists of 92 amino acids and shares structural similarities with luteinizing hormone, follicle-stimulating hormone, and thyrotropin. Recent study has uncovered a significant involvement of HCG in the process of implantation.[6] β-hCG controls villous angiogenesis in the early stages of pregnancy. During embryo implantation and the early stages of placenta formation, this hormone is crucial for vascular adaptation [7]. According to research by Berndt et al., hCG stimulates angiogenesis by encouraging the migration of uterine endothelial cells and the development of capillary structures in a three-dimensional angiogenesis model [8]. Furthermore, Reisinger et al. discovered that hCG affects angiogenesis-related factors, such as vascular endothelial growth factor.[9]
The reason why placenta sets in the lower segment in the uterus is not known but there are several factors to identify this situation and to prevent them. Hence the present study was done to evaluate the role of beta-human chorionic gonadotrophin (B-HCG) level in the first half of pregnancy as a marker for prediction of placenta previa.

Material and methods

The present prospective study was conducted among pregnant women who reported to department of obstetrics and gynecology at GMC, Jammu during the study period of one year. Ethical permission was taken from institutional ethics committee before commencement of study. Patients were asked to sign an informed consent form after explaining them the procedure.
Sampling was done and total 60 pregnant women were selected for the study on the basis of inclusion and exclusion criteria.
Inclusion criteria- Women between 20 and 30 years age, who have agreed to participate in the study with singleton pregnancy and remained free of any complication till the end of pregnancy apart from placenta previa.
Exclusion criteria- All women who have developed other high-risk pregnancy complications during routine follow-up like preeclampsia and diabetes.
The study involved sampling all participating mothers between 14 and 18 weeks of gestational age to quantify serum human chorionic gonadotropins in international units. Vaginal bleeding that occurred either late in the second trimester or early in the second trimester was used to diagnose patients with placenta previa. All patients had a standard ultrasound scan to establish the existence of placenta previa when they started experiencing vaginal bleeding. At the conclusion of the research, 60 women with complete data were enrolled, and 15 of the patients had complications related to placenta previa during pregnancy.
The standard deviation and mean were used to express continuous data. The Shapiro-Wilk test was used to verify that the data distribution was normal. The necessary sample size was examined for type II error (equal to 80%) and typeIerror(equivalentto95%). The large significant difference in the mean serum HCG between women with placenta previa and control women sampled between 14 and 18 weeks of gestation was demonstrated using the analysis of variance test. Significant P values were those with a value of less than 0.05.

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Results

Out of total 60 women 15 (4%) had condition of placenta previa as shown in figure 1.

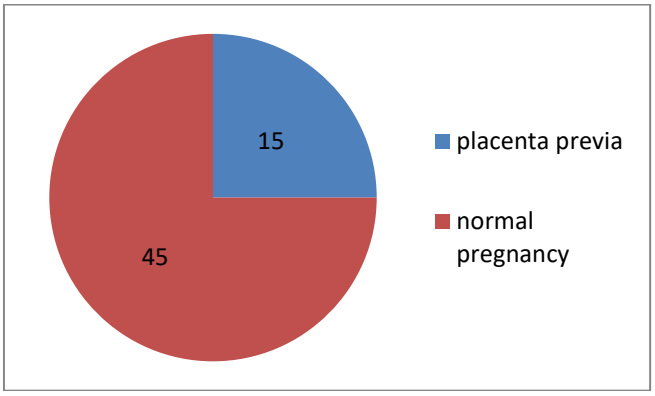

Figure: 1. incidence of placenta previa

The Mean age of patients was 33.45 years , gravid was 4.2 , parity was 2.9 and serum hCG was 90,981 as shown in table 1.

Table: 1 Baseline characteristics of all patients

Characteristics	Mean ±SD
Age	33.45±6.4
Gravida	4.2±1.9
Parity	2.9±1.7
Serum hCG	90,981±73,029.6155

ANOVA test was done for serum HCG difference between 45 pregnant women with normal pregnancy and 15 women with placenta previa and results were statistically significant with p <0.001.

Table: 2 showing a statistically significant difference between women with normal placenta and women with placenta previa

Source of variation	Sum of squares	df	P value
Between groups	197,278,987,234.21	1	<0.001
Within groups	110,678,098,677.76	56	

In order to determine the ideal cutoff value for serum HCG between women with placenta previa and normal women who were sampled between 14 and 18 weeks of gestation, a receiver operator characteristics curve was constructed. Mean serum HCG >104679 iu at 14 weeks of gestation is the ideal cutoff value. As shown in Fig. 2, the sensitivity and specificity were determined to be 100% and 73.3%, respectively.

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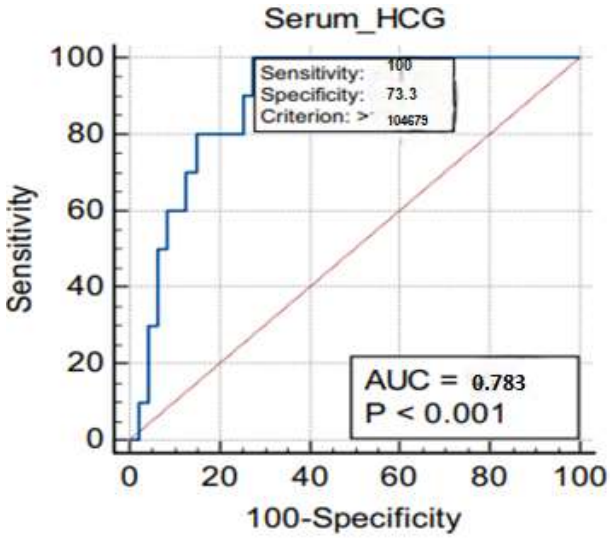

Figure: 2 Receiver operating characteristic curve (ROC) showing the cutoff value of HCG level between normal women and women with placenta previa

Discussion

Early pregnancy blood testing can detect high-risk conditions such as diabetes and hypothyroidism in pregnant women. This allows for prompt intervention and treatment steps to be implemented.[10] The primary source of HCG in a healthy pregnancy is the placental trophoblastic tissue, which also maintains the corpus luteum, which sustains the pregnancy by secreting hormones in the early stages of the first trimester. A lower-than-normal HCG level may indicate a pregnancy problem, such as miscarriage, extrauterine pregnancy, or fetal death [11]. Patients HCG levels can vary significantly, from one to another. HCG levels, however, fell into a perfect range during a typical pregnancy. A number of studies have attempted to establish a correlation between B-HCG and aberrant placentation, particularly placenta accreta. In the final two trimesters of pregnancy, Brett D. Einerson et al. assessed the significance of hyperglycosylated human chorionic gonadotropin (HCGH) and morbid adherent placenta. It was found that patients with accreta had lower levels of hyperglycosylated HCG than controls after examining 60 patients, half of whom were cases of accreta and the other half were controls [12].

In their study, Maad Mahdi Shalal et al. used hyperglycosylated human chorionic gonadotropin to predict accreta. The study included 90 cases, with one-third serving as the control group and two-thirds as the study group. All patients were in the third trimester and had been diagnosed with placenta accreta. The study found that the level of hyperglycosylated HCG was higher in cases of placenta accreta compared to placenta previa and normally situated placenta [13].

Both of the aforementioned investigations demonstrated a correlation between the level of HCG and placental spectrum syndrome, indicating a connection to the extent of invasion of trophoblastic tissue. In our latest study, we investigated the correlation between placenta previa and HCG levels, as well as the size and vascularity of the placenta at the site of implantation. Our findings suggest that hormonal changes may influence these factors, and vice versa.

Boulis et al. conducted a study to examine the correlation between B-HCG and another analyte in relation to placenta previa. They compared this relationship between two groups: the placenta previa group and the control group. The researchers concluded that there were no significant differences between the two groups in terms of first-trimester free β-HCG and second-trimester free β-HCG [14].

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The latest study revealed a significant statistical difference in the average serum HCG levels between normal women and women with placenta previa. The P value was less than 0.001, indicating a very significant difference. The optimal cutoff value for serum HCG levels in the 14th week of gestation was found to be greater than 104679 IU. The sensitivity and specificity were calculated as 100% and 73.3%, respectively.

Trophoblast cell function is influenced by various factors, including the extracellular matrix, endometrial materials, trophoblast products, maternal hormones, and utero-placental perfusion. The latter specifically regulates the availability of oxygen and nutrients. Various parameters, including those mentioned and others, are responsible for detecting the routes of trophoblast cell differentiation, as well as the endocrine function and secretion of hormones into the maternal blood arteries. These factors may be the reason for this significant difference [15].

The precise etiology of placenta praevia remains uncertain, however it is postulated to be associated with anomalous vascularization of the endometrium resulting from scarring or fibrosis due to prior trauma, surgery, or infection.

Conclusion

In summary, hCG has a specific ability to anticipate the location of the placenta. Enhancing the clinical monitoring of patients is crucial in promptly detecting unfavorable pregnancy outcomes and providing specific intervention.

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