The Effects of Placental Location on Fetal Ultrasonographic Parameters and Course of Labour in Term Primigravid Low Risk Pregnancies

Düşük Riskli Term Primigravid Gebeliklerde Plasental Yerleşimin Fetal Ultrasonografik Parametreler ve Doğum Eyleminin Gidişatına Olan Etkileri

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ABSTRACT Objective: We investigated the possible effects of placental location on various fetal intrauterine sonographic parameters and labour course in low risk term primigravid pregnancies. **Material and Methods:** Placental locations were determined via ultrasonography among 232 primigravid pregnant women between 38-41 weeks gestation hospitalized for labor and who had no medical risk factors. Placentas were grouped into two groups as lateralized and centralized placentas. Fetal biometric measurements were also obtained. Course of labor was followed for every patient until delivery. Statistical power analysis of the study was made based on a previous study conducted with an a:0.05 error margin and minimum 80% power for statistical significance. **Results:** Eighty-one percent of placentas were centrally and 19% were laterally located. Intrapartum fetal distress was seen in 19.5% of laterally and 10.2% of centrally located placentas. The mean birthweight was 2880 g and 3020 g for laterally and centrally located placentas respectively. Occiput posterior fetal presentation, prone to delivery complications, was mostly seen in anteriorly (39%) and left laterally (40%) located placentas although occiput anterior fetal presentation was the leading presentation type in all placental locations. Patients with left lateral placental location had higher caesarean rates than all other locations and 80% of the indications for sectio were fetal distress. **Conclusion:** Although laterally located placentas have a lower incidence in low risk pregnancies, some amount of intrapartum risks can be attributed to these lateralized placentas. The risk of intrapartum fetal distress is slightly increased in laterally located placentas and dysfunctional labor causing cephalopelvic disproportion and arrested labor risk is slightly increased in centrally located placentas. Further randomized controlled studies are needed to evaluate possible effects of placental localization on fetal biometric development and labour.

Key Words: Uterine diseases; placental circulation; placentation; ultrasonography, prenatal; maternal-fetal relations

ÖZET Amaç: Düşük riskli term primigravid gebeliklerde plasental lokalizasyonun bazı fetal intrauterin sonografik parametrelere ve doğum eyleminin gidişatına olan muhtemel etkilerini araştırdık. **Gereç ve Yöntemler:** Plasental lokalizasyonlar gebelik için risk faktörü olmayan ve doğum eylemi için hospitalize edilen 38-41 gebelik haftası arasındaki 232 primigravid gebe kadında ultrasonografi ile belirlenmiştir. Plasentalar karşılaştırma amacıyla lateralize ve sentralize olarak iki grup altında gruplandırılmıştır. Fetal biyometrik ölçümler de aynı zamanda belirlenmiştir. Hastaların doğum eylemleri doğuma kadar takip edilmiştir. İstatistiksel anlamlılık için çalışmanın istatistiksel güç analizi a=0,05 yanılma payı ve minimum %80 güç ile önceki yapılmış bir çalışmadan faydalanılarak yapılmıştır. **Bulgular:** Plasentaların %81'i santral ve %19'u lateral yerleşimliydi. İntrapartum fetal distres lateral yerleşimli plasentaların %19.5'unda ve santral yerleşimli plasentaların %10.2'sinde görülmüştür. Ortalama doğum ağırlığı lateral ve santral yerleşimli plasentalarda sırasıyla 2880 ve 3020 gramdı. Oksiput anterior prezentasyon tüm plasental lokalizasyonlar ele alındığında en sık prezentasyon şekli olsa da doğum komplikasyonlarına yatkın olan oksiput posterior prezentasyon en sık anterior (%39) ve sol lateral (%40) yerleşimli plasentalarda görülmüştür. Sol lateral plasental lokalizasyonlu hastalar diğer tüm yerleşimlere göre daha yüksek sezaryen oranlarına sahipti ve sezaryen endikasyonlarının %80'i fetal distresti. **Sonuç:** Düşük riskli gebeliklerde lateral yerleşimli plasentaların insidansının daha düşük olmasına rağmen intrapartum risklerin bir kısmı bu lateral yerleşimli plasentalarla ilişkili olabilir. Lateral yerleşimli plasentalarda intrapartum fetal distres riski bir miktar artmıştır ve baş pelvis uygunsuzluğuna ve eylem arrestine neden olan disfonksiyonel doğum eylemi ise santral yerleşimli plasentalarda bir miktar artmıştır. Plasental lokalizasyonun fetal biyometrik gelişim ve doğum eylemi üzerine muhtemel etkilerini değerlendirmek için randomize kontrollü çalışmalara ihtiyaç vardır.

Anahtar Kelimeler: Uterus hastalıkları; plasental dolaşım; plasentasyon; ultrasonografi, prenatal; maternal-fetal ilişkiler

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Placental implantation disorders causing poor obstetric outcome like preeclampsia, fetal demise in utero, recurrent pregnancy losses, placental ablation are under investigation currently. There were limited studies about the effect of placental location on birth process and fetal indices. Its location could be an important factor as it reflects signals between fetal and maternal circulations.[1,2] Laterally invading trophoblasts may have adverse effects on vascular structures of pregnant uterus. Some studies have been made about fetal presentation in different placental locations.[3,4] There was a significant overpresentation of anterior placental locations in occiput posterior fetuses.[4] Placenta previa and cornual placental localization is suggested as possible causes for breech presentation.[3] In a study performed in Hungary, it was found that there was a relationship between placental location and cervical ripening, duration of labour, prognostic value of intrauterine pressure during labour, complications at the third stage of labour, fate of the newborn and success of of labour induction. These authors concluded that the fundal placenta was an unfavourable location causing an increase in the number of different deviations from normal labour.[5] Placental aging and its significance on developing fetus were also investigated and no effect on fetus was seen provided these are low risk pregnancies and placental changes are not infarction, villitis or severe structural or localisation anomaly.[6] Placental location and its possible effects on obstetric outcomes has not been widely investigated in low risk pregnancies before. There are some evidence about the relationship between laterally located placenta and preeclampsia.[7] Increased resistance index in uterine artery doppler blood flow was seen in fetuses having laterally located placentas and suffering from IUGR.[8] The paucity of randomized controlled studies considering placental biophysical properties like placental location directed us to design this study for determining simple diagnostic methods during labour management. The aim of this study was to explain whether there is a possible relationship between placental location and obstetric outcome among low risk pregnancies. Whether the course of labour possibly affected by placental location could affect the antenatal surveillance of 38-41 weeks primigravid low risk patients was the other objective of this study.

MATERIAL AND METHODS

This cross- sectional study was performed in delivery unit of Zekai Tahir Burak Women's Health and Training Hospital between 08/2002 and 04/2003. The fetal ultrasonographic biometric parameters and localization of placenta had been established via giving extra attention and time on placental location by three well-trained sonographers. Two hundred and thirtytwo vertex presented primigravid patients without previous medical, surgical and obstetric risk factors accepted to low risk delivery unit for various indications between 38-41 weeks gestation were included randomly to study. Non-vertex presentations, multiparous patients, high risk obstetric patients, patients with no possibility of normal labour were excluded. Labours of these 232 patients were followed till delivery by experienced physicians on obstetrics blind about the study. During the follow up, nonstress test, fetal presentation, cervical bishop score, meconium staining, duration of labour, delivery route and indication for abdominal delivery of each patient were evaluated by the same physician. Fetal presentation was defined via sonographically and confirmed by digital examination of physicians.

A total of 14 patients were also excluded after they were admitted to the low risk delivery unit due to risk factors; 6 of 14 patients had preeclampsia, 3 of 14 patients had placenta previa, 3 of 14 patients had cord prolapsus and the remaining 2 developed intrapartum placental abruption.

After exclusion of 14 patients, 218 patients remained. Sonographies were done by using GE Medical Systems, Germany Logic Pro 200 Alpha 3,5 mHz convex probe. When there was a conflict about placental location, the location on which the most part of placenta has lied was accepted as its actual localization site. There were five locations as anterior, posterior, fundus, right and left lateral positions respectively. Placentas were grouped into

two groups for comparing lateralized and centralized placentas. Centralized placentas were defined as nonlateralized placentas. Patients having combined localizations having equal areas were excluded during sonographic examination.

Statistical power analysis of the study was made based on the previous study performed by Kara et al. on 1999 that was conducted among 224 patients with an a:0.05 error margin and minimum 80% power for statistical significance. Simple randomization technique was used by including one of each two eligible patients who were accepted to the delivery ward. Ethic committee of the hospital accepted our study and informed consent was obtained from all patients who participated to the study.

The obstetric records of these 218 patients were investigated after delivery. The results were analyzed by using SPSS version 10.0 for Windows. Anova table and eta value were used for birthweight means of laterally and centrally located placentas, for comparing the duration of labour for all placental locations, for contraction frequency and amplitude of all placental locations. Chi-square values were used for other statistical evaluations. Eta values close to 1 was considered as high association. P value <0,05 was considered as statistically significant.

RESULTS

Among 218 patients the mean age was 24 (minimum 16, maximum 39) years. Diagnosis of patients was classified as follows; 69% were term pregnant women with intact membranes, 12% were term pregnant women with ruptured membranes, 8% were pregnant women with premature rupture of membranes, 9% had oligohydramnios and 2% were diagnosed as nonreactive nonstresss test. Seventy five percent of the patients delivered via vaginal route and 25% were delivered via abdominal route for several clinical indications (50%: fetal distress, 25%: cephalopelvic disproportion, 15%: arrest disorder of labour). The mean birthweight among all patients were 3490 grams (range 2490-4150).

Eighty one percent of the placental locations were central and 19% were laterally located. Thirty seven percent of the placentas had fundal location, 36% of them had anterior location, 12% right lateral, 8% posterior and 7% left lateral location respectively.

Ninety two percent of the babies were appropriate for gestational age, 5% were macrosomic and 3% were small for gestational age. Postnatal evaluation of SGA or macrosomic babies and their mothers confirmed no medical conditions like gestational diabetes or any other disease to induce these fetal conditions. All of the babies were examined by the same pediatrician immediately at birth and apgar scores were recorded at 1. and 5. minutes. Apgar scores at the fifth minute ranged between 7 and 10. None of the babies needed extra resuscitative effort even abdominally delivered ones justified for fetal distress.

Intrapartum fetal distress was seen in 19.5% of laterally and 10.2% of centrally located placentas (Table 1). There was an increase in intrapartum fetal distress in laterally localized placentas. The mean birthweight was 2880 g and 3020 g for laterally and centrally located placentas when adjusted for last menstrual date as term respectively (p>0.05) (Table 1). When analyzed for all 5 types of placentas, there wasn't any statistical significance considering birthweight.

Occiput posterior fetal presentation, prone to delivery complications, when compared between all placental locations, was mostly seen in anterior (39%), and left lateral (40%) located placentas (p=0.09) although anterior fetal presentation was the leading presentation type in all locations (Table 2).

When cases diagnosed as premature rupture of the membranes, oligohydramnios, nonreactive nonstress test were excluded, there were 177 patients remaining for the evaluation of the bishop scores. Fifty eight percent of patients with right lateral placentas had scores >7. The same score for other locations were 47% for anterior, 40% for posterior, 23% for left lateral and 27% for fundus respectively (p:0.06) (Table 3).

Intrapartum meconium staining was seen in 23% of right lateral and 6.7% of left lateral placentas, former the most and latter the least in all loca-

TABLE 1: Obstetric outcomes for lateral and central placental localizations.

Obstetric outcome	Lateral (n:41)	Central (n:177)	P value & eta
Mean birthweight (grams)	2880±830	3020±830	0.22* (NS)**(eta: 0.08)
Meconium staining (%)	7 (17%)	23 (13%)	0.49 (NS)
Oligohydramnios (%)	14 (34%)	46 (26%)	0.32 (NS)
Intrapartum fetal distress (%)	8 (19%)	18 (10%)	0.22 (NS)
Nonreactive+distressed fetuses (%)	11 (27%)	26 (15%)	0.07 (NS)
Abdominally delivered fetuses (%)	12 (29%)	43 (24%)	0.55 (NS)
Mean duration of active labour (hours±SD) ****	6.29±4.11	4.12±2.35	0.04(S)***(eta:0.26)

*Anova table p value
**(NS) Not significant
***(S) Significant
****Patients of whom bishop scores were equivalent to 6-7 points and delivered via vaginal route without induction

tions (p>0.05) (Table 1). Meconium staining was seen in 17% of patients having laterally located placentas and 13% of centrally located placentas (p>0.05) (Odds ratio: 1.3 95% CI 0.6-2.8).

When we studied the patients with intact membranes, those having left lateral placentas significantly had the greatest ratio of oligohydramnios (50%) than all other locations although limited case number without significance. Thirty five percent of laterally located placentas and 25% of centrally located placentas showed oligohydramnios (p>0.05) (OR:1.3 95% CI 0.7-2.4) (Table 1).

Left lateral location showed the greatest caesarean section ratio than all other locations (47%) and 80% of the indications for sectio were fetal distress (p>0.05). Caesarean delivery ratios of centrally and laterally located placentas were similar (Table 1).

Patients having laterally located placentas had 28% and those having centrally located placentas had 24% sectio ratios respectively.

DISCUSSION

Clinical consequences of placentation abnormalities can manifest during the first trimester or later in the pregnancy till its connection uterus ends with delivery. Adequate trophoblastic invasion to spiral arteries of uterus plays an extremely important role building a suitable microcirculatory environment to the fetus. Great uterine vessels enter the uterus laterally and spread other regions of it by giving arcuate, radial and spiral arteries respectively. One can imagine that invading a small artery for trophoblasts can be easier than a greater one. Inability of trophoblasts in performing this mission could result an inadequate microcirculatory environment for the fetus. However this is not the only mechanism for placentation abnormalities, laterally implanted placentas merit to take attention on clinical and obstetric consequences. Its location could be an important factor as it reflects

TABLE 2: Fetal presentations according to placental locations.

Placental localization	Occiput anterior	Occiput posterior	Occiput transverse	Total N: 218
Anterior	45 (58%)	30 (39%)	3 (3%)	78
Posterior	10 (56%)	4 (22%)	4 (22%)	18
Right lateral	18 (69%)	6 (23%)	2 (8%)	26
Left lateral	7 (47%)	6 (40%)	2 (13%)	15
Fundus	55 (68%)	22 (28%)	4 (4%)	81

Pearson chi- square test P value: 0.035.

TABLE 3: Bishop scores at admission to labour unit for various placental locations.

Placental localization	<6 points	6-7 points	>7 points	TotalN: 177
Anterior	7 (12%)	24 (41%)	28 (47%)	59
Posterior	3 (20%)	6 (40%)	6 (40%)	15
Right lateral	-	10 (42%)	14 (58%)	24
Left lateral	2 (16%)	8 (61%)	3 (23%)	13
Fundus	10 (16%)	38 (57%)	18 (27%)	66

Pearson chi-square test P value:0.06.

signals between fetal and maternal circulations.[2] There is some evidence about the relationship between laterally located placenta and preeclampsia.[7] Increased resistance index in uterine artery doppler blood flow was seen in fetuses having laterally located placentas and suffering from IUGR.[8] There were limited studies about the effects of placental location on birth process and fetal indices even in low risk pregnancies. This study revealed clinically important and useful results that should take attention of obstetricians to the awareness of placental location and its possible clinical consequences.

Low incidence of laterally located placentas in low risk pregnancies in our population did not surprise us because the possible relationship between lateral placentas and some obstetric adverse consequences has been determined before.[9] Non-central placental location in the second trimester has been found to be associated with an increased risk of adverse obstetric outcome.[7,8] However, we investigated and established various adverse clinical results for laterally located placentas even in low risk pregnancies.

Direct exposure to maternal great uterine vessels in laterally located placentas may expose the fetus and the mother to intrinsic circulatory changes of each other and probably could trigger the labour mechanism.

Intrapartum fetal distress has been seen in 19.5% of laterally and 10.2% of centrally located placentas in our study (Table 1). Approximately 2 fold increase seen here could not be proven as statistically significant because of limited case number. The reflection of changes in uterine blood supply to the nonstress test can be easier for laterally located placentas than central ones. None of the babies delivered abdominally due to fetal distress were depressed. Relatively short period between the caesarean decision and delivery of the baby can be the reason or perhaps we must perform more accurate intrapartum diagnostic tests like fetal scalp blood sampling for babies with nonreassuring nonstress tests especially for those having laterally located placentas so overdiagnosis of fetal distress with unnecessary abdominal deliveries could be avoided.

Left lateral location showed the greatest caesarean sectio ratio (47%) than all other locations and 80% of the indications for sectio were fetal distress. Caesarean delivery ratios of centrally and laterally located placentas were similar (Table 1). Patients having laterally located placentas had 28% and those having centrally located placentas had 24% sectio ratios respectively. Fetal distress incidence was greater in laterally located placentas and disfunctional labours like cephalopelvic disproportion and arrested labour were the leading sectio indications for centrally located placentas.

A previous record in the literature assumed the possible relationship between anteriorly located placentas and fetal occiput posterior presentation.[4] Fetal occiput posterior presentation, prone to delivery complications, when compared to all placental locations, was mostly seen in left lateral (40%) and anterior (39%) placentas although anterior fetal presentation was the leading presentation type in all locations (p=0.09) (Table 2). Left lateral placental location seems to be a risk factor like anterior location for increased incidence of occiput posterior fetal presentation near term. Although abdominal delivery ratio was higher in patients having left laterally located placentas, cephalopelvic disproportion was the leading cause of sectio for anteriorly located placentas and fetal distress was the leading cause for laterally located placentas.

Intrapartum meconium staining as a possible indicator of fetal distress was seen in 23% of right lateral and 6.7% of left laterally located placentas, former the most and latter the least in all locations. Relatively small number of patients with left laterally located placentas in these individuals may cause this conflicting result. Meconium staining has been seen in 17% of patients having laterally located placentas and 13% of centrally located placentas (Table 1).

When we looked at the patients with intact membranes, those having left lateral localized placentas significantly had the greatest ratio of oligohydramnios (50%) than all other locations although limited case number without significance. Thirty five percent of laterally located placentas and 25% of centrally located placentas showed

oligohydramnios. Here again we can emphasize the unsuccessful lateral placentation resulting diminished amniotic fluid index via a lateral placental circulatory network insufficient to maintain fetal blood supply during changes in maternal circulation. However, Contro et al. found that patients with unilaterally abnormal uterine artery pulsatility, but normal mean PI, do not seem at increased risk for obstetric and perinatal complications, irrespectively of placental location.[9] Papageorghiou et al. demonstrated that failure of trophoblastic invasion of spiral arteries resulting with increased impedance to blood flow in the uterine arteries in pregnancies attending for routine antenatal care carries high risk for preeclampsia and intrauterine growth restriction.[10]

We know a little about underlying mechanisms of placentation.[11] But we know that a placenta; either inadequately implanted or implanted on an inadequate region of uterus like a submucous myoma, previous caesarean scar and probably lateral portion results unfavourable obstetric outcome for both the fetus and mother.[12] Evaluation of the pregnancies with laterally located placentas and without establishment of any adverse clinical consequences and seeming nonproblematic during antenatal care was worth to investigate. There could still remain some low risk pregnancies potentially amenable to adverse clinical outcomes when high risked ones were excluded.

Analysing the five different placental implantation site among term primigravidas; anterior, posterior, right lateral, left lateral, fundal; they did not show a significant difference for obstetric outcome and labour course between each other except the increased incidence of occiput posterior presentation in anteriorly and left laterally located placentas. Future studies with greater patient numbers may determine statistically significant relationship between placental location and adverse labour outcomes. Simple and easy ultrasonographic clues about fetal placenta can give relevant ideas to clinicians during labour. This is the first study in the current English literature that shows this association. In this study, we also demonstrated the close relationship between laterally located placenta and nonreassuring nonstress test results. This is another topic about placental location and its reflections to active labour management that is worth to investigate.

Randomized and well-controlled trials are needed to determine the possible relationship with laterally implanted placentas and adverse obstetric outcomes like intrapartum fetal distress, meconium staining, oligohydramnios, occiput posterior presentation and preterm labour even in low risk term primigravid pregnancies.

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