Association of Placental Localization with Outcome of Induction of Labor in Post Dated Uncomplicated Pregnancy

Dr Vaishali Gautam

Senior resident Department of obstetrics and gynaecology, Santosh medical college and hospital Santosh deemed to be university, Ghaziabad

Dr Anshul Tripathi

Senior resident Department of obstetrics and gynaecology, Santosh medical college and hospital Santosh deemed to be university, Ghaziabad

Dr Neelima Agarwal

Professor Department of obstetrics and gynaecology, Santosh medical college and hospital Santosh deemed to be university, Ghaziabad

Dr Manisha Gupta

Professor Department of obstetrics and gynaecology, Santosh medical college and hospital Santosh deemed to be university, Ghaziabad

Dr Alpana Agrawal

Professor Department of obstetrics and gynaecology, Santosh medical college and hospital Santosh deemed to be university, Ghaziabad

Corresponding author: Dr Vaishali Gautam

8866779128 vaishmbbs@gmail.com

Abstract

Aim: The aim of this study is to evaluate the association of placental localization and outcome of induction of labor in uncomplicated postdated pregnancy.

Methods: It was prospective observational study done over a period of one month. The women with uncomplicated postdated singleton pregnancy who failed to enter spontaneous labor and were willing to participate in the study and who met the inclusion and exclusion criteria were enrolled. A total of 70 women were recruited and underwent clinical and ultrasound examination. Eligible enrolled women were induced by an intravaginal prostaglandin according to hospital protocol. According to the type of response to induction, women were divided into two group responder and non responder group.

Results: Among 70 enrolled participants 47% (n=33) women had anteriorly located placenta, 47.1% (n=32) women had posteriorly located placenta and 7.1% (n=5) had fundal placenta. Women with advanced maternal age (p<0.032) and urban resident females (p<0.001) had higher rate of failed induction of labor. Women with anteriorly located placenta showed a higher incidence of failed induction of labor (p< 0.001) in postdated uncomplicated singleton pregnancies and had higher rate of cesarean section.

Conclusion: An ultrasound based predictive model has been framed through this study based on the fact that anteriorly placed placenta has a significant association with failed induction of labor and thus help to identify postdated pregnant females who might have poor outcome of labor induction.

Journal of Coastal Life Medicine

1. Introduction

Among all obstetric operations, induction of labour is undoubtedly one of the most common and regularly performed ones. The benefits of delivery are generally considered to outweigh the risks of expectant care for both the woman and foetus, and this is when an IOL is justified, according to universal consensus.

Induction of labour (IOL), which accounts for around 20% of all deliveries in clinical obstetrics, is a common intervention due to the increased risk of mother and foetal mortality and morbidity as pregnancy progresses past term[1].

The best way to handle pregnancies that continue over the intended date is still up for dispute. Maternal and perinatal morbidity are more common when the pregnancy is postdated. An appropriately timed start to labour is a difficult process that calls for the placenta, foetal membranes, decidua, uterine myometrium, and cervix to interact in the right ways. Labor is hampered by an inability to organise these relationships. Thus, postdate pregnancy may be brought on by a variety of pathogenic mechanisms3.

It has been demonstrated that, in a number of situations, labour induction increases the chance of caesarean delivery. Usually, the increase is warranted when the advantages of giving birth to a mother or child outweigh the risks of the operation for the mother[4].

Soon after implantation, the blastocyst starts to develop into the placenta, a temporary organ that will later become a foetal organ. It is a crucial endocrine organ that produces hormones that control both maternal and foetal physiology throughout pregnancy and performs crucial roles in regulating nutrition, gas, and waste exchange between the physically separate maternal and foetal circulations.

The location of the placenta and its interaction with the internal cervical os during pregnancy and labour have recently been examined by ultrasonography, revealing a "dynamic placentation"5. Throughout its development, the implanting blastocyst changes its original site. While much research on defective placentation (placenta accrete) and low placental implantation has been conducted, there have been relatively few studies examining the other features of placental localisation and their potential effects on pregnancy and the results of labour induction.[6]

Therefore, the aim of this pilot study is to evaluate the association of placental localization and outcome of induction of labor in uncomplicated postdated pregnancy.

2. Methodology

This is a prospective observational study conducted at one of prestigious tertiary care center of north india over a period of one month from September 15 - October 15 after taking clearance from ethical committee of the institute.

A total of 225 antenatal patient attended obstetrics department, out of which 70 women with postdated uncomplicated singleton pregnancy with gestational age 40-41week and cephalic presentation, intact fetal membranes and unfavourable bishop's score (<6) were recruited. Women with multifetal pregnancy, ruptured fetal membrane, fetal growth restriction, any associated maternal medical condition and any women with contraindication to vaginal delivery were excluded from the study.

Detailed history and examination were done after taking informed written consent. Relevant dates including period of gestation was calculated from last menstrual period and confirmed with the first trimester ultrasound reports if available with the patient.

Prior to induction, all patients had a transabdominal ultrasound performed with the patient in the supine position to determine the placental position, foetal presentation, and amniotic fluid index. The placenta's anterior and posterior locations were identified using a sagittal view of the uterus, and the fundal placenta was visible at the top wall of the uterus. Placentas were categorised as anterior or posterior depending on whether they were located along the left or right uterine wall.

After initial assessment and detailed history, induction of labour was done using dinoprostone (PGE$_2$) gel. "Assessment after the first dose of

Journal of Coastal Life Medicine

dinoprostone gel was done after 6 hours and a second dose was administered based upon the bishop's score".

The cervix was primed with a maximum of two gel dosages in accordance with uterine contractions and cervical favorability, and then an artificial membrane rupture to speed up labour using oxytocin was performed. According to hospital protocol, an induction was considered unsuccessful if the patient did not reach the active stage of labour ("cervical dilatation of 4 cm with regular uterine contractions") after two doses of dinoprostone gel and 12 hours of oxytocin administration following artificial membrane rupture. During labour, foetal heart rate was monitored, and any foetal distress detected by a non-stress test was assessed and managed appropriately. These ladies were monitored up to delivery, and the method of delivery was recorded.

The outcome of induction was measured in terms of responder and non-responders to induction of labor and the mode of delivery. Responder were those women who went into active labour with a cervical dilatation more than 4 cm and non-responder were those who required cesarean section for failed induction. The association of responders and non-responders with location of placenta were noted in each group.
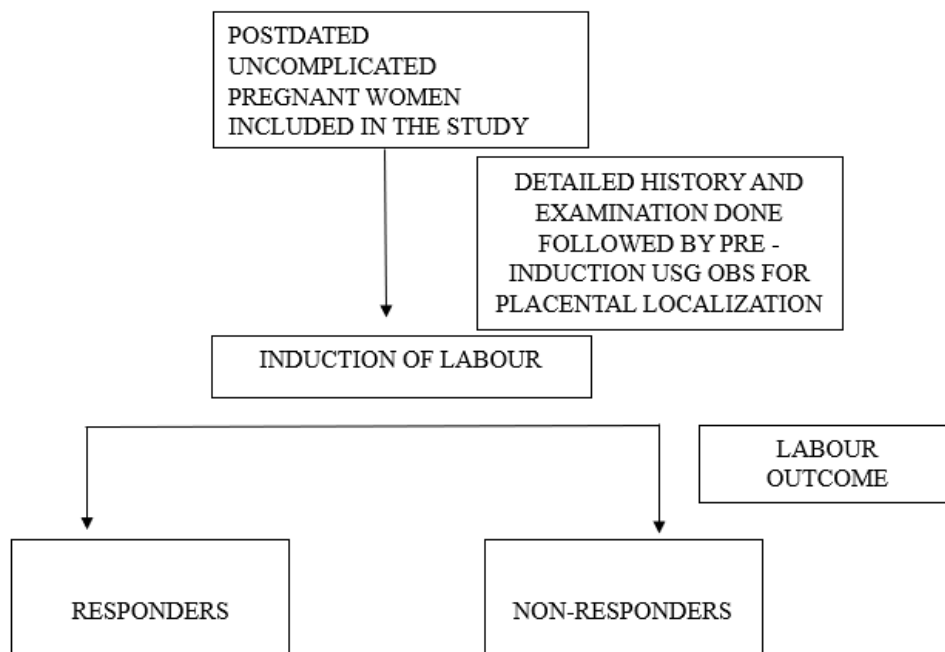
3. Statistical Analysis

"Categorical variables were presented in number and percentage (%) and continuous variables were presented as mean ± SD and median".

"Qualitative variables were compared using Chi-Square test /Fisher's exact test".

"A p value of <0.05 was considered statistically significant".

Figure1- flowchart showing follow up of patient in the study

4. Results And Observations

A total of 70 postdated uncomplicated pregnant women who failed to enter spontaneous labor and were willing to participate in this study who met the inclusion and exclusion criteria were enrolled. The mode of delivery and fetal outcomes were noted in both responder and non-responder group. Among the 70 enrolled pregnant females 41.4%(n=29) respond to induction and another 58.5%(n=41) women did not respond to induction of labor.

Journal of Coastal Life Medicine

Table 1: DEMOGRAPHIC CHARACTERISTICS OF THE STUDY POPULATION

Maternal age	Outcome of Induction			Chi-Squared Test	
	RESPONDERS	NON RESPONDERS	Total	χ2	P Value
18-25 Years	21 (72.4%)	17 (41.5%)	38 (54.3%)	6.878	0.032
26-30 Years	6 (20.7%)	15 (36.6%)	21 (30.0%)		
31-35 Years	2 (6.9%)	9 (22.0%)	11 (15.7%)		
Total	29 (100.0%)	41 (100.0%)	70 (100.0%)		
Parity	Outcome of Induction			Chi-Squared Test	
	RESPONDERS	NON RESPONDERS	Total	χ2	P Value
Primigravida	12 (41.4%)	25 (61.0%)	37 (52.9%)	2.618	0.106
Multigravida	17 (58.6%)	16 (39.0%)	33 (47.1%)		
Total	29 (100.0%)	41 (100.0%)	70 (100.0%)		
Residence	Outcome of Induction			Chi-Squared Test	
	RESPONDERS	NON RESPONDERS	Total	χ2	P Value
Urban	8 (27.6%)	35 (85.4%)	43 (61.4%)	23.933	<0.001
Rural	21 (72.4%)	6 (14.6%)	27 (38.6%)		
Total	29 (100.0%)	41 (100.0%)	70 (100.0%)		

"Chi-squared test was used to explore the association between 'outcome of induction' and 'maternal age'. There was a significant difference between two groups according to distribution of Age Group ($\chi2 = 6.878$, $p = 0.032$). Based on the statistical analysis it has been observed that women with advanced maternal age respond less to induction of labor and had higher rates of failed induction followed by cesarean section".

"There was no significant difference in the study group in terms of parity ($\chi2 = 2.618$, $p = 0.106$). In the responder group 41.4% (n=12) of the participants were primigravida and 58.6% (n=17) of the participants were multigravida. While in non-responder group 61% (n=25) of the participants were primigravida and 39% (n=16) of the participants in the non responder group were multigravida".

Most of the women enrolled in this study belongs to urban residence which constitute 61.4% of total population. Based on statistical analysis it has been observed that women who belongs to urban residence had higher rates of failed induction followed by higher rates of caesarean section in urban population as compared to rural population which constitutes 38.6% of total enrolled females. "There was a significant difference between the two groups according to distribution of residence ($\chi2 = 23.933$, $p = <0.001$) and the strength of association between the two variables is high (Cramer's V) = 0.58" **(Table 1)**

Journal of Coastal Life Medicine

Table 2: ASSOCIATION BETWEEN PLACENTAL LOCALISATION AND OUTCOME OF INDUCTION

Placenta Localisation	Outcome Of Induction			Fisher's Exact Test	
	Responder	No Responder	Total	χ2	P Value
Anterior	6 (20.7%)	27 (65.9%)	33 (47.1%)	17.315	<0.001
Posterior	18 (62.1%)	14 (34.1%)	32 (45.7%)		
Fundal	5 (17.2%)	0 (0.0%)	5 (7.1%)		
Total	29 (100.0%)	41 (100.0%)	70 (100.0%)		

Fisher's exact test was used to explore the association between 'Placental localisation' and 'Outcome Of Induction'. There was a significant difference between the various groups in terms of distribution of placental localisation ($\chi2$ =17.315, p = <0.001). It has been found that participants in the non responder group had the larger proportion of anteriorly located placenta while participants in the responder group had the larger proportion of posterior and fundal placental localization".

It has been observed in this current study that the women with fundal and posteriorly located placenta had higher rates of normal vaginal delivery as compared to those who have anteriorly located placenta thus localization of placenta may be used for prediction of successful induction of labor. **(Table 2, Figure2)**

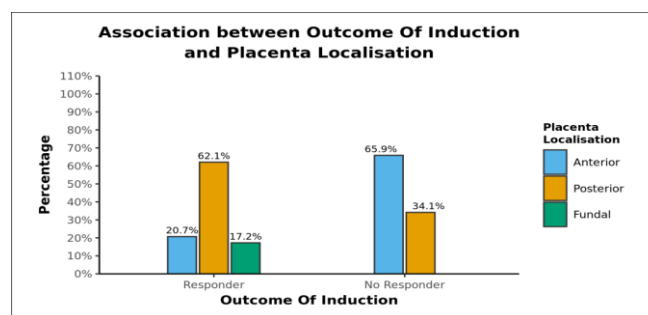**Figure2:** Association Between Placental Localisation And Outcome Of Induction

Table 3: DISTRIBUTION OF THE PARTICIPANTS ACCORDING TO MODE OF DELIVERY

Mode Of Delivery	Outcome Of Induction			Chi-Squared Test	
	Responder	No Responder	Total	χ2	P Value
Vaginal	22 (75.9%)	0 (0.0%)	22 (31.4%)	45.359	<0.001
LSCS	7 (24.1%)	41 (100.0%)	48 (68.6%)		
Total	29 (100.0%)	41 (100.0%)	70 (100.0%)		

In this study population 31.4% of the participants had vaginal delivery and 68.6% of the participants had cesarean section out which 72.9% (n=35) of the participants had cesarean delivery for failed induction and 27.1% (n=13) of the participants had cesarean delivery for other feto-maternal indication which include fetal distress, 2nd stage arrest and arrest of dilatation. **(Table3)**

5. Discussion

Induction of labour is done for various maternal or fetal indications. The incidence is gradually increasing with availability of good antenatal care. The ultimate goal of labour induction is to achieve a successful vaginal delivery. Induction of labour should be considered when the decision and benefits of prompt vaginal delivery outweigh the maternal and fetal risks of waiting for the spontaneous onset of labour because a failed induction ultimately land up with cesarean delivery as a final end point, utilising resources and investment, prolonged hospitalization and the risk associated with the surgical procedure. Because of risk of failed induction of labour, a variety of maternal and fetal factor as well as screening tests have been suggested to predict induction of labour success.

The response to labour is variable among different pregnant females therefore various clinical and ultrasound variables had been implicated in past to predict the success of induction of labour such as parity, body mass index, advanced maternal age, poor bishop score, cervical length, gestational age, estimated fetal weight, fetal gender, doppler indices of umbilical artery and fetal middle cerebral artery when pregnancy advances beyond 40 weeks of gestational age[2].

There is a continuum of risk for both mother and baby with rising maternal age with numerous studies reporting multiple adverse fetal and maternal outcomes associated with advanced maternal age.This has already been studied even in previous study done by Alessandro et al[7] and Mularz et al[8] which showed that advanced maternal age represents a significant independent risk factor for cesarean delivery as a result of failed induction similar to this current study.

In this current study women who belongs to urban residence had higher rates of failed induction as compared to rural population and the results are statistically significant among the two groups with p value<0.001. The probable explanation to this could be due to advanced maternal age and prevalence of obesity and more sedentary lifestyle in urban population. No studies have been conducted so far till date.

Based on our statistical analysis participants in the non responder group had the larger proportion of anteriorly located placenta (64.3%) while the participants in the responder group had the larger proportion of posteriorly located placenta (62.1%).

The reason why placental localization could have an important influence on the dynamics of labor onset and its progress is not clear so far. However, the findings in our study support the hypothesis that placental position may influence the contractility of myometrial layer of uterus during labor. Previously conducted studies have suggested the importance of placental position in triggering the normal electric impulse for initiation of uterine contraction and progress of labour[9].

Additionally, it is well established that anterior placental implantation influences uterine contractility as measured by transabdominal electromyography (EMG) through its impact on nearby myometrial cells. In example, it has been suggested in the past that placental hormones decrease the electrical activity of myometrial cells above the site of placental implantation10. These findings corroborate the study's findings, which showed a greater failure probability for induction in postdate pregnancies with anteriorly placed placentas.

Toricelli et al. [11] conducted a prospective study on 2354 singleton pregnancies in 2015 with the goal of evaluating placental location at term and its relationship to delivery outcome. The findings revealed that pregnant women with an anteriorly located placenta have lower labour induction rates and more caesarean deliveries. In particular, persistent occipito-posterior posture was seen much more frequently in postdated pregnancies and in the presence of a placenta that was anterior to the uterus,

Journal of Coastal Life Medicine

indicating a level of earlier insufficient myometrial contractility during labour.

In conclusion, the study for the first time, showed the influence of anterior placental location at term both on the onset and the progression of labor, similar results are supported from this study also which suggested that women with anteriorly located placenta have higher rates of failed induction and have more chances of cesarean delivery. Understanding and accurate assessment of underlying determinants of labor, like placental implantation site and risks associated with anteriorly located placenta, may add more information useful for an adequate management of labor both in terms of onset and progression of labor.

In terms of maternal age residency and placental localisation as predictors of unsuccessful labour induction, our findings were consistent with the body of research already in existence. This contributes fresh, valuable material to the literature that may be used for systematic reviews and the implementation of induction of labour guidelines and protocols, both domestically and globally. Additionally, future research in this area might be guided by our findings. It will be intriguing to look into whether there are any additional characteristics that may be used to forecast the outcome of the treatment in addition to the specific criteria already mentioned.

6. Conclusion

The proposed ultrasound based predictive model which primarily includes pre induction placental localization would allow us to detect the group of women who are less likely to respond to induction or might have failure of induction in uncomplicated postdated pregnancy and this information should be used to optimize the pre induction counselling and the clinical management of these women.

In this study a significant correlation has been found between anteriorly located placenta with failed induction of labour and also concluded that placental localization prior to induction of labor would be helpful to predict the response of induction and this represents a new finding in clinical obstetrics.

Taking this parameter in to an account in clinical practice a predictive model can be created taking in to account the maternal parameters such age, parity, residence and ultrasound based parameters such as location of placenta, cervical length, liquor for personalized counselling of pregnant females and their relatives and can be considered as a deciding factor to discuss the mode of termination of pregnancy. This information may guide us to know when is the best time to start the induction, how to facilitate the success of the procedure and how to best support the woman throughout the whole experience.

7. Acknowledgment

References

Naeye RL: Causes of perinatal mortality excess in prolonged gestations. Am J Epidemiol 108: 429, 1978

Bodner-Adler B1, Bodner K, Pateisky N, Kimberger O, Chalubinski K, Mayerhofer K, Husslein P. Influence of labour induction on obstetric outcomes in patients with prolonged Pregnancy. Wiener klinische Wochenschrift April 2005, 117(7–8), 287–292.

Osterman MJK, Martin JA. Recent declines in induction of labour by gestational age. NCHS data brief. 2014;155:1-8.

Heffner LJ, Elkin E, Fretts RC. Impact of labor induction, gestational age, and maternal age on cesarean delivery rates. Obstet Gynecol. 2003 Aug;102(2):287-93. doi: 10.1016/s0029-7844(03)00531-3. PMID: 12907101

Journal of Coastal Life Medicine

King DL. Placental migration demonstrated by ultrasonography. A hypothesis of dynamic placentation. Radiology 1973;109:167e70.

Zia S. Placental location and pregnancy outcome. J Turk Ger Gynecol Assoc 2013;1(14):190e3

Alessandro Favilli, Marta Maddalena Acanfora, Vittorio Bini, Roberta Radicchi, Gian Carlo Di Renzo & Sandro Gerli (2013) Single indication of labor induction with prostaglandins: is advanced maternal age a risk factor for cesarean section? A matched retrospective cohort study, The Journal of Maternal-Fetal & Neonatal Medicine, 26:7, 665-668, DOI: 10.3109/14767058.2012.746658

Mularz, Amanda MD; Gutkin, Rachel MD, MPH Maternal Age and Successful Induction of Labor in the United States, 2006–2010, Obstetrics & Gynecology: May 2014 - Volume 123 - Issue - p 73S doi: 10.1097/01.AOG.0000447388.42444.21

Harris VG. Relation between placental site and length of gestation. Br J Obstet Gynaecol 1975;82:581e4.

Buhimschi C, Boyle MB, Garfield RE. Electrical activity of the human uterus during pregnancy as recorded from the abdominal surface. Obstet Gynecol 1997;90:102e11.

Torricelli M, Vannuccini S, Moncini I, Cannoni A, Voltolini C, Conti N, Di Tommaso M, Severi FM, Petraglia F. Anterior placental location influences onset and progress of labor and postpartum outcome. Placenta. 2015 Apr;36(4):463-6. doi: 10.1016/j.placenta.2014.12.018. Epub 2014 Dec 27. PMID: 25573094.