Research Article

Prospective evaluation of clinical and ultrasonic feto-maternal parameters as predictors of caesarean delivery after induction of labour

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Abstract

Objectives: A prospective study was conducted in the department of obstetrics & Gynaecology, Kamla Nehru State Hospital for mother and child, Indira Gandhi Medical College, Shimla from 1st july 2010 to 30th april 2011 on 150 pregnant women. The aim was to evaluate the clinical and ultrasonic feto-maternal parameters which can predict the success of induction of labour.

Methods: Gestational age, maternal height, weight, BMI, Bishop score, investigations including ultrasound, transabdominal scan to assess the fetal biometric parameters (BPD,HC,AC and FL), EFW, AFI & fetal head position and transvaginal scan to measure cervical length and cervical funnelling in all recruited subjects before initiating induction of labour (IOL) was done. After delivery, the women were allotted to one of the following groups: Group 1: women having caesarean delivery for non-progress of labour and failed induction of labour (non successful IOL group), Group 2: women having normal vaginal delivery (successful IOL group). Their clinical and ultrasonic parameters were compared.

Results: Out of 150 pregnant women, 32 underwent caesarean delivery (21.33%).The t-test was used for quantitative data and Pearson Chi square or fisher's exact test was used for categorical databases. The four variables which can significantly predict the failure of IOL in the present study were nulliparity, Bishop Score of < 3, Occipito-Posterior fetal head position on TAS and Birth weight ≥ 2.5 Kg.

Conclusion: Clinical parameters nulliparity, Bishop score < 3, birth weight ≥ 2.5 kgs and ultrasonic parameter i.e. Occipito-Posterior fetal head positions are the 4 most significant parameters to predict the failure of IOL. Out of these parameters, the three best predictors were parity, birth weight and fetal head position. This can be useful in pre-induction counseling.

Keywords: Bishop score, Nulliparous women, Labour induction, Occipito-Posterior fetal head position

1. Introduction

Passage through the birth canal is the shortest but probably the most hazardous journey made by any individual in his or her life. Hypoxia, trauma and infection are inherent risks. The risks are increased if they are associated with preterm and post-term birth, prelabour rupture of membranes or antepartum haemorrhage and when labour is induced as a consequence of medical or obstetric disorders of pregnancy.

The frequency of induction of labour has increased over the last two decades and now accounts for up to 20%[1-2]. Among these, 20% end up with emergency caesarean delivery[2]. Labour induction was started in view of benefits of delivery to the mother or fetus outweighing the potential risks of continuing the pregnancy[1]. However, the consequences of labour induction should always be considered carefully. For the mother, these include the possibility of failed labour induction leading to caesarean delivery (the risk is approximately increased two fold compared with spontaneous labour) and for the fetus, iatrogenic prematurity[1].

Women demand more involvement and choice in decisions regarding their management, and many who are advised to have an induction of labour will ask, what is their risk of caesarean delivery. Recent data have shown that emergency and intrapartum caesarean delivery is associated with a higher risk of maternal and fetal complications than elective delivery. Risks of induction include increased rates of operative vaginal delivery, excessive uterine activity with abnormal fetal heart rate patterns, delivery of preterm infant due to incorrect estimation of gestational age and increased rate of caesarean sections.

In view of above considerations, there arises a need to accurately identify the women who will respond to labour induction successfully. This will decrease the rate of unscheduled caesarean delivery and thus the consequent risks to the mother and fetus. This also helps to give information about the measure of probability of any intervention like caesarean delivery, so that those women can make informed choice about their own mode of delivery.

Many clinical parameters like maternal age, parity, height, maternal body mass index (BMI), amniotic fluid index (AFI) have been shown to influence the success of IOL[1,2,3,4,5,6].

The prevalence of persistent occiput posterior position in term, cephalic singleton is about 5%. Persistent occiput posterior posterior position is associated with prolonged labour, assisted vaginal delivery, use of epidural analgesia, caesarean delivery and significant perineal trauma. Hence, transabdominal determination of fetal head position prior to induction helps in determining malposition[13]. A few studies have attempted to evaluate a combination of important clinical and ultrasonic parameters to increase the efficacy of prediction of caesarean delivery in women undergoing IOL[1,2,3,4].

2. Materials and methods

This is a prospective observational study conducted in the Department of Obstetrics and Gynaecology, Kamla Nehru State Hospital for mother and child, Shimla from 1st july 2010 to 30th april 2011 which included 150 pregnant women who fulfill the following criteria

2.1 Inclusion Criteria

1. Women willing to participate in the study.

2. Gestational age between 36-42 weeks as determined by last menstrual period or by ultrasound scan upto 20 weeks.

3. Singleton viable fetus.

4. Cephalic presentation.

5. No contraindication to vaginal delivery.

2.2 Exclusion Criteria

1. Women with an intrauterine fetal death, known lethal fetal anomaly.

2. Multifetal gestation.

3. Abnormal placentation.

4. PROM > 12 hours.

5. Women with previous caesarean section and previous uterine surgeries.

6. Any other indication for caesarean delivery.

A written informed consent was taken. Detailed history was taken and specifically maternal age (years), parity, gestational age as calculated from first day of last menstrual period (LMP) and/or ultrasound performed upto 20 weeks was noted. A thorough general physical examination, systemic examination and obstetric examination were conducted with special reference to maternal height, weight, BMI, Bishop score. Investigations including ultrasound, transabdominal scan to assess the fetal biometric parameters (BPD, HC, AC and FL), EFW, AFI & fetal head position and transvaginal scan performed in dorsal position using 6 MHZ curvilinear probe to measure cervical length and cervical funnelling in all recruited subjects before initiating induction of labour was done.

The labour induction was done as per the hospital protocol (misoprostol/ARM+oxytocin/dinoprostone gel).

Patients were monitored by WHO partogram. The outcome of labour, delivery and neonate's details was obtained from the clinical notes after delivery. Based upon delivery outcome, women were allotted to two groups:

Group 1: women having caesarean delivery for non-progress of labour and failed induction of labour (non successful IOL group)

Group 2: women having normal vaginal delivery (successful IOL group)

The two groups will be compared for their clinical and ultrasonic parameters to give a probability score which will predict the caesarean delivery after induction of labour.

2.3 Statistical analysis of the data

The percentage of each qualitative variable and the mean, standard deviation, minimum and maximum values for the quantitative variables were measured.

Data were entered into statistical software package SPSS version 17. The t-test was used for quantitative data and Pearson Chi square or fisher's exact test was used for categorical databases. Multivariant logistic regression was performed using all the significant variables with p value < 0.05 in the univariate test.

3. Results

Out of the subjects who were enrolled initially, 22 were excluded for fetal distress and a total of 150 subjects who fulfilled the inclusion and exclusion criteria and planned for IOL were recruited in the study. During the study period the incidence of IOL in our institution was 20%. Of the 150 women, 32 underwent caesarean section (Group 1) and 118 underwent normal delivery (Group 2). The total caesarean section rate in our institution during the study period was 19.86% and of the present study was 21.33%. Indication for caesarean section were non progress of labour 20 (62.5%) and 12 (37.5%) patients out of 32 had caesarean section for failed induction. Indications of labour induction were postdated pregnancy (n=130), IUGR (n=26), PIH (n=24), PROM (n=2) as shown in table 1.

Indication for induction of labour in the present study

Table 1: Indication of induction of labour

Indication of induction of labour	Group 1 n (%)	Group 2 n (%)
Postdated pregnancy	24 (75)	106 (70.66)
IUGR	4 (12.5)	22 (14.66)
PIH	4 (12.5)	20 (13.22)
PROM	0	2 (1.33)

Table 2: Characteristics of women involved in the study

Parameter	Group 1	Group 2	p value
Age (yrs)	25.56	25.80	0.57
Height (cms)	157.71	158.05	0.49
Weight (Kgs)	65.12	64.16	0.79
BMI (kg/m2)	26.01	24.48	0.28

Parity [n (%)]
  Nulliparous
  Multiparous
	
	30 (93.75)
	2 (6.25)
		
		55 (46.61)
		63 (53.38)
			
			<0.001

Gestational age (wks)	40+1	40+2	0.06
Bishop score [n (%)] < 3 ≥ 3	 14 (43.75) 18 (56.25)	 6 (5.08) 112 (94.91)	 0.045

Baseline characteristics of both the groups are presented in table 2. There were no statistically significant differences in age, maternal height, weight and BMI, gestational age (Table 2). Nulliparity was significantly associated with failure of IOL as more than 90% of group 1 was constituted by nulliparous women (p<0.001). The mean Bishop score in group 1 was 2.68 and in group 2 was 3.83. There was significant correlation of a score of < 3 with failure of IOL (p=0.045).

Table 3: Comparison of ultrasound parameters between the two groups

Parameter	Group 1, n (%)	Group 2, n (%)	p value
TAS Fetal head position Occipitoposterior	15 (46.87)	8 (6.77)	<0.001
Non Occipitoposterior	17 (53.12)	110 (93.22)	
TVS Cervical length (mm) mean±SD	21.68±4.53	20.36±4.76	0.096
Cervical funnelling (mm) mean±SD	1.625±2.13	1.948±2.60	0.617

Table 3 shows the comparison of ultrasonic parameters between the two groups. Presence or absence of occipito-posterior position was noted and compared between the two groups. 15 (46.87%) subjects and 8 (6.77%) subjects in group 1 and 2 respectively had occipito-posterior fetal head position at the beginning of IOL. 17 (53.12%) subjects in group 1 and 110 (93.22%) in group 2 had non occipito-posterior fetal head position. The occipito posterior fetal head position was strongly associated with unsuccessful outcome in the present study (p=0<001). Though the mean cervical length was slightly shorter and cervical funnelling was more pronounced in group 2 who had normal vaginal delivery, but this difference did not reach any statistical significance (Table 3).

Table 4: Comparison of labour characteristics between the two groups

Parameter	Group 1 n (%)	Group 2 n (%)	p value
Induction delivery interval			<0.001
< 18 hrs	0	0	
> 18 hrs	32 (100)	118 (100)	
Duration of rupture of membrane			< 0.001
< 10 hrs	2 (6.25)	117 (99.15)	
> 10 hrs	30 (93.75)	1 (0.84)	
Third stage duration (mins) Mean ± SD	5.56±0.66	5.39±0.70	0.189

Table 4 shows comparison of labour characteristics between the two groups. Subjects who had caesarean delivery took significantly longer induction to delivery interval (24.183±4.573 hours) as compared to subjects who had normal vaginal delivery (9.698±2.825 hours). An IDI of ≥ 10 hrs has a significant negative correlation with failure of IOL. Induction to delivery interval of ≥ 18 hours was strongly associated with failure of IOL. A cut off value of 18 hours has a 100% sensitivity and specificity to predict failure of IOL. In the present study duration of more than 10 hours of rupture of membranes has a strong negative correlation with success of IOL. A value of 10 hours is taken as cut off as it has a sensitivity of 100% and a specificity of 93.7% to predict failure of IOL. Mean birth weight in group 1 was 2.93±0.398 kgs and in group 2 was 2.64±0.316 kgs (Table 5). Significant number of women in group 1 who had caesarean delivery had neonatal birth weight above 2.7 Kg which was statistically significant as compared to group 2 women who had normal vaginal delivery (p<0.001). Thus in the present study neonatal birth weight had a negative correlation with success of IOL.

Table 5: Comparison of neonatal birth weight between the two groups

Baby weight	Group 1 n (%)	Group 2 n (%)	p value
< 2.5 kg	4 (12.5)	18 (15.25)	
2.5-3.5 kgs	13 (40.62)	84(7.18)	<0.001
3.1-3.5kgs	14 (43.75)	15(12.71)	
> 3.5 kgs	1 (3.12)	1(0.84)	

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4. Discussion

The frequency of induction of labour and intrapartum/emergency caesarean delivery has increased has increased over the last two decades and is found to be associated with higher risk of fetal and maternal morbidity[1,2]. Antenatal detection of women likely to end up in failed IOL and consequent emergency caesarean section is essential for their appropriate management and pre-induction counselling. Maternal parity, Bishop score, fetal head position on TAS and birth weight have been found to be best predictors defining the risk of caesarean delivery in pregnant population undergoing IOL.

The incidence of IOL in the present study is about 20%. The women in the present study were in the age group of 18-38 years with the mean age of 25 years. No correlation has been found between any particular maternal age group and success of IOL. Primigravidae and nulliparous women were significantly more prone to have failure of induction and requiring emergency intrapartum caesarean section in the present study. Similar results have been shown by David and Johnson in 1977 in their two year study, where they concluded that IOL in nulliparous women, especially those with an unfavourable cervix is associated with increased risk of caesarean delivery[7]. There was no correlation between gestational age, BMI and success of IOL (p=0.065). Literature at maternal height is an independent predictor of labour induction success, as taller women are more likely to have vaginal delivery. Similarly maternal weight has been shown to be associated with success of IOL. However our study fails to show any such correlation between these clinical parameters as the number of women recruited with BMI <19 and >35 are very less to produce any statistical results.

Our study has once again confirmed the existing data and has shown a positive correlation between Bishop score and success of IOL among women in two study groups. Recent studies have shown that bishop score alone is a poor predictor of success of IOL as it is subjected to a higher intra and interobserver variations[9-10]. This can be explained by the virtue of fact that different induction protocols were followed in different studies. Mean EFW and AFI was not found to be a significant risk factor in the present study. 45% of group 1 women who had caesarean delivery had occipitoposterior fetal head position on TAS examination as compared to 6% women in group 2 who had normal vaginal delivery, thus fetal head position being the significant parameter for predicting success of IOL. Also along with other factors like transvaginal cervical length and posterior cervical angle, it has a strong positive predictive value for success of IOL[12]. Though the cervical length was found to be slightly shorter in group 2 women, no significant difference was found between the two groups. However most studies have demonstrated the association between cervical length and duration of latent phase of labour[9-11]. In the study birth weight has been found to be an independent risk factor for caesarean delivery as in many other studies as well[14-16].

5. Conclusion

a. Clinical parameters viz: nulliparity, Bishop score < 3, birth weight ≥ 2.5 kgs and ultrasonic parameter i.e. Occipito-Posterior fetal head position are the 4 most significant parameters to predict the failure of IOL.

b. Out of these parameters, the three best predictors i.e. parity, birth weight and fetal head position on TAS were used to construct a 'Risk model' which can predict success/failure of IOL in 85% of women accurately. This risk model will help us in pre-induction counselling of antenatal women and enable them

to make choices about their own mode of delivery, thus, will help to reduce the incidence of emergency/intrapartum caesarean deliveries and associated maternal and perinatal mortality and morbidity.

c. IDI ≥ 18 hrs and DROM ≥ 10 hrs can predict the failure of IOL with 100% accuracy

References

1. Peregrine E, O'Brien P, Omar R, Jauniaux E. Clinical and ultrasound parameters to predict the risk of caesarean delivery after induction of labour. *Obstet Gynecol* 2006; 107: 227-33.
2. Tan PC, Suguna S, Vallikkannu N, Hassan J. Ultrasound and clinical predictors for caesarean delivery after labour induction at term. *Aust NZ J Obstet Gynaecol* 2006; 46: 505-9.
3. Lazanakis M, Marsh MS, Brockbank E, Economides DL. Assessment of the cervix in the third trimester of pregnancy using transvaginal ultrasound scanning. *Eur J obstet Gynaecol Reprod Biol* 2002; 105: 31-5.
4. Reis MF, Gervasi MT, Florio P, Bracalente G, Fadalti M, Severi FM et al. Prediction of successful induction of labour at term: Role of clinical history, digital examination, ultrasound assessment of the cervix and fetal fibronectin assay. *Am J Obstet Gynecol* 2003; 189: 1361-7.
5. Sheiner E, Levy A, Katz M, Mazor M. Short stature – an independent risk factor for caesarean delivery. *Eur J obstet Gynaecol Rerpod Biol* 2005; 120: 175-8.
6. Bueno B, Sanfrutos L, Salazar F, Perez-Medina T, Engels V, Archilla B et al. Variables that predict the success of labour induction. *Acta Obstet Et Gynaecol Scand* 2005; 84: 1093-7.
7. Johnson DP, Davis NR, Brown AJ. Risk of caesarean delivery after induction at term in nulliparous women with an unfavourable cervix. Am *J Obstet Gynecol*. 2003; 188: 1260-1.
8. O'Leary JA, Ferrell RE. Comparison of ultrasonographic and digital cervical evaluation. *Obstet Gynecol* 1986; 68: 718-9.
9. Boozarjomehri F, Timon-Tritsch I, Chao CR, Fox HE. Transvaginal ultrasonographic evaluation of the cervix before labour: Presence of cervical wedging is associated with shorter duration of induced labour. *Am J Obstet Gynecol* 1994; 171: 1081-7.
10. Ware V, Raynor D. Transvaginal ultrasonographic cervical measurement as a predictor of successful labour induction. *Am J Obstet Gynecol* 2000; 182: 1030-2.
11. Pandis GK, Papageorghiou AT, Ramanathan VG, Thompson MO, Nicolaides KH. Preinduction sonographic measurement of cervical length in the prediction of successful induction of labour. *Ultrasound Obstet Gynecol* 2001; 18: 623-8.
12. Akmal S, Tsoi E, Nicholaides KH. Intrapartum sonography to determine fetal occipital position: interobservar agreement. *Ultrasound Obstet Gynecol* 2004; 24: 421-4.
13. Ponkey SE, Cohen AP, Heffner LJ, Lieberman E. Persistent fetal occiput posterior position: Obstetric outcomes. *Obstet Gynecol* 2003; 101: 915-20.
14. Crane JMG. Factors predicting labour induction success: A critical analysis. *Clin Obstet Gynecol* 2006; 49: 573-84.
15. Maslow AS, Sweeny AL. Elective induction of labour as a risk factor for cesarean delivery among low-risk women at term. *Obstet Gynecol* 2000; 95: 917-22.
16. Seyb ST, Berka RJ, Socol ML, Dooley SL. Risk of caesarean delivery with elective induction of labour at term in nulliparous women. *Obstet Gynecol* 1999; 94: 600-7.