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Predictors of vaginal delivery in nulliparous mothers

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Abstract

Background: Nulliparity is an obstetric high-risk group whose labor, compared with multiparae, are more likely to develop labor abnormalities that requires intervention. The aim of this report is todetermine factors that influence vaginal delivery in nulliparae.

Materials and Methods: A prospective cross-sectional study was done on 286 eligible booked nulliparae in labor, to determine factors associated with vaginal delivery. Information about each patient's social demographic factors, and physical characteristics such as height and weight, events in labor and mode of delivery were recorded in the data sheet. Bivariate analysis was done using Chi square, while multivariate analysis was done using logistic regression. Level of significance was put at $P < 0.05$.

Results: Of a total of 944 primigravidae delivered in the unit during the study period, 286 (30.3%) were eligible for the study. Vaginal delivery was achieved in 214 (74.8%) of the eligible parturient, while 72 (25.2%) had emergency caesarean delivery. Indications for the caesarean delivery were: failure to progress (46; 63.9%), fetal distress (20; 27.8%), maternal distress (5; 8.0%), and rapidly developing pre-eclampsia in labor (1, 0.3%). The birth weight of the baby ranged between 2.0 and 4.5 kg with mean weight of 3.1 ± 0.4 kg. Birth weight (odd ratio [OR] = 0.40, 95% confidence interval [CI] = 0.21-0.78), fetal head engagement in early labor (OR = 10.30, 95% CI = 1.35-78.69), and maternal body mass index (BMI) (odd ratio [OR] = 2.08, 95% confidence interval [CI] = 1.03-4.20) were found to be predictors of vaginal delivery.

Conclusion: Normal range of maternal BMI, fetal head engagement and normal range of fetal birth weight were found to be the factors associated with vaginal delivery in nulliparae. Variations in these three factors may be the underlying reason for failure to progress, which is the most common indication for caesarean section among this population of parturient.

Keywords: Emergency caesarean section, labor, nulliparae, primigravidae, vaginal delivery

Résumé

Contexte : Nulliparité est un groupe à haut risque obstétrique dont labor, comparé à multiparae, est plus susceptible de développer des anomalies de travail qui nécessite une intervention. L'objectif de ce rapport est pourdéterminer les facteurs qui influencent l'accouchement par voie basse en nulliparae.

Matériaux et méthodes :Étude transversale prospective A était fait sur 286 admissibles réservés à nulliparae dans le travail, afin de déterminer les facteurs liés à l'accouchement par voie basse. Informations sur les facteurs démographiques sociales de chaque patient et des caractéristiques physiques telles que la hauteur et de poids, d'événements dans le travail et le mode de livraison ont été enregistrés dans la feuille de données. Analyse bivariée a été fait à l'aide de Chi carré, tandis que l'analyse multivariée a été réalisée à l'aide de la régression logistique. Seuil de signification a été mis à $P < 0.05$.

Résultats: Of un total de 944 primigestes livré à l'unité au cours de la période d'étude, 286 (30,3 %) étaient admissibles à l'étude. Accouchement par voie vaginale a été atteint en 214 (74,8 %) de l'admissibles à la parturiente, tandis que 72 (25,2 %) avaient une césarienne d'urgence. Indications pour la césarienne étaient: ftraduction au progrès (46,

63,9 %), la souffrance fœtale (20, 27,8 %), détresse maternelle (5; 8,0 %) et qui se développe rapidement une prééclampsie durant l'accouchement (1, 0,3 %). Le poids du bébé à la naissance variait entre 2,0 et 4,5 kg avec un poids moyen de 3,1 ± 0,4 kg. Poids à la naissance (odd ratio [OR] = 0,40, 95 % intervalle de confiance [IC] = 0,21-0,78), foetus tête engagement en prétravail (RC = 10 h 30, [IC95: = 1.35-78,69) et indice de masse corporel maternel (IMC) (odd ratio [OR] = 2,08, 95 % intervalle de confiance [IC] = 1.03-4.20) se sont avéré pour être des prédicteurs de l'accouchement par voie basse.

Conclusion : Plage normale de maternelle IMC, tête fœtale l'engagement et la plage normale de poids à la naissance fœtale se sont avérés pour être les facteurs associés à un accouchement par voie basse en nulliparae. Variations de ces trois facteurs est peut-être la raison sous-jacente de l'incapacité à progresser, qui est l'indication la plus courante de césarienne chez cette population de parturientes.

Mots-clés: Césarienne d'urgence, nulliparae, primigravidae, travail, accouchement par voie basse

Introduction

Primigravidae and nulliparae are obstetric high-risk group, especially, the very young and the elderly, whose pregnancy and labor must be supervised by well-trained personnel.[1,2] Pregnancy complications that have been found to be common with primigravidae are anemia, pregnancy induced hypertension, preeclampsia and eclampsia, preterm labor, and malpresentations.[3-5]

Compared with multiparous women, nulliparae are more likely to develop labor abnormalities that require intervention;[6] because more uterine force is required to overcome the resistance in the reproductive tract, and the uterus tends to be less effective in maintaining uterine contractions. Whereas in multiparous women, less uterine force is required because the tissues of the reproductive tract been stretched by the previous delivery, have less resistance, and as a result the myometrium of the multipara usually maintains effective contractile activity.[6] The foregoing may explain why dystocia is a common reason for intervention in nulliparous parturient, and it is said that about 50% of all caesarean deliveries in nulliparae are related to dystocia.[7,8]

Furthermore, studies have shown that labor augmentation with oxytocin, and operative deliveries are most common in nulliparae.[9,10]

Several studies have investigated the causes of dystocia in nulliparae.[7-10] The present study was designed to prospectively determine the factors influencing eventual vaginal delivery among nulliparae. This information will be helpful in patient education and counseling in the prenatal period.

Materials and Methods

This is a prospective cross-sectional study of eligible booked primigravidae presenting in labor in our tertiary health institution located in Osogbo, a semi-urban capital city of Osun state, Nigeria, from 1st July, 2009 to 30th June, 2011. Ethical approval was obtained from the institution ethics committee, and informed consent was obtained from the patients. Exclusion criteria were: Medical conditions in pregnancy, fetal abnormality (e.g., fetal malformation, intrauterine growth restriction, and fetal death), breech presentation in labor, patient whose labor was well advanced (cervical dilatation greater than 4 cm) on admission into the labor ward, other indications for induction of labor, except for postdate pregnancy. At presentation in the labor ward, the patients were reviewed by the labor ward senior registrar (trained research assistant) to ascertain the eligibility for the study. Subsequently, partographic monitoring of active phase of labor is commenced by the labor ward registrar who also enters patients' information into the proforma. Patients' weight and height were determined to calculate the body mass index (BMI) = weight in kg/height^2 in m. Fetal head engagement at presentation was determined using fifths palpable per abdomen. In this study fetal head engagement is defined as two-fifths or less palpable per abdomen.

Every patient was managed as per the unit's active labor management protocol. Being a high-risk group, fetal heart rate and contractions were monitored once in every 15 min by labor ward nurses, house officers and labor ward registrar; and vaginal examination was done every 2 hours. Augmentation of labor is commenced when cervical dilatation is not progressing at the rate of 1 cm per hour due to inadequate uterine contraction. Analgesia in labor was achieved with parenteral pentazocin. An indication for Cesarean section was confirmed by labor ward senior registrar and/or the consultant on call prior to the surgery.

Information of each patient's age, marital status, gestational age at booking, height, weight, fetal head engagement, mode of delivery, use of oxytocic, birth weight and Apgar scores of the baby were recorded in the data sheet. Data was analyzed using

SPSS version 15. Bivariate analysis was done using Chi-square, while multivariate analysis was done using logistic regression. Level of significance was put at $P < 0.05$.

Definitions:

- Gravidity: Number of pregnancies, whether carried or not carried to term
- Parity: Number of previous pregnancies carried to or beyond age of viability
- Primigravida: A woman carrying her first pregnancy ever
- Nullipara: A woman who had previous pregnancy (or pregnancies) but do not carry it to the age of viability
- Primipara: A woman with one previous delivery experience
- Multipara: A woman with more than one previous delivery experience.

Note: Since both nulliparae and primigravidae had no parous experience, they were used interchangeably in this study.

Results

There were 2072 deliveries during the study period, of which primigravidae/nulliparae constituted 944 (45.6%); 434 (46.0%) were booked, however, 286 (65.9%) of the booked patients were eligible for the study. One hundred and forty-eight (34.1%) of the booked primigravidae were excluded from the study due to: Hypertensive disorders of pregnancy (40, 9.2%), diabetes mellitus (3, 0.6%), sickle cell disease in pregnancy (2, 0.5%), antepartum hemorrhage (5, 1.2%), maternal request for caesarean section before labor (2, 0.5%), contracted maternal pelvis (1, 0.3%), fetal malpresentations (10, 2.3%), intrauterine fetal death (5, 1.2%), and 80 (18.4%) were well advanced in labor (cervical dilatation between 5 and 10 cm).

The age of the studied population ranged between 18 and 41 years with mean age 27.7 ± 3.4 years. Two hundred and eighty five (99.7%) were married, and only one woman (0.3%) was single. The gestational age at booking ranged between 6 and 41 weeks, with a mean of 21.3 ± 7.2. The height of the women ranged between 1.46 and 1.87 m, with a mean height of 1.61 ± 0.07 m; while their weight ranged between 40 and 110 kg with a mean weight of 65.2 ± 12.4 kg.

Labor onset was spontaneous in 193 (67.5%), however, labor was augmented with oxytocin in 105 (54.4%) of the parturient and 43 (15.0%) women had induction of labor on account of postdate pregnancy. There was fetal head engagement in 27 (9.4%) of the parturient in early labor (cervical dilatation ≤4 cm), while 259 (90.6%) had no fetal head engagement.

Vaginal delivery was achieved in 214 (74.8%) of the parturient, while 72 (25.2%) had emergency caesarean delivery [Figure 1]. Indications for the caesarean delivery were: Failure to progress (46; 63.9%), fetal distress (20; 27.8%), maternal distress (5; 8.0%), and rapidly developing preeclampsia in labor (1, 0.3%). The birth weight of the baby ranged between 2.0 and 4.5 kg with mean weight of 3.1 ± 0.4 kg.

Bivariate analysis showed that fetal head engagement significantly influenced vaginal delivery ($\chi^2 = 7.297$, df = 1, $P = 0.007$); likewise, the maternal BMI significantly influenced vaginal delivery ($\chi^2 = 6.944$, df = 1, $P = 0.008$). Although there was a trend towards increasing vaginal delivery with increasing maternal height, this was not statistically significant [Table 1].

After adjusting for other factors, birth weight, fetal head engagement, and BMI were the significant predictors for vaginal delivery. The smaller the birth weight, the more likely was vaginal delivery (OR = 0.40, 95% CI = 0.210-0.78). Patients with fetal head engagement in early labor were more likely to achieve vaginal delivery compared with those with no fetal head engagement (OR = 10.30, 95% CI = 1.35-78.69). Women who were of normal BMI (18.5-24.9 kg/m^2) were more likely to achieve vaginal delivery compared with overweight or obese (OR = 2.08, 95% CI = 1.03-4.20) as shown in Table 2.

Discussion

Nulliparae mean age of 27.3 ± 3.4 years in this study was similar to the 28.7 years found by Kjaergaard *et al*.[11] Maternal age did not significantly affect vaginal delivery in nulliparae, and this agreed with previous finding by Verma and Das[3] that there

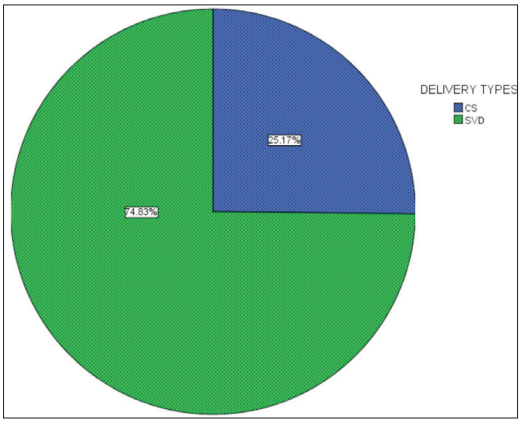

Figure 1: Mode of delivery among nulliparae

Table 1: Bivariate analysis of factors associated with vaginal delivery

Variables	Delivery types		χ^2	df	*P* value
	EMLSCS* (%)	VD** (%)			
Head engagement					
Not engaged	71 (27.4)	188 (72.6)	7.297	1	0.007
Engaged	1 (3.7)	26 (96.3)			
BMI					
Normal	53 (22.2)	186 (77.8)	6.944	1	0.008
Overweight/obese	19 (40.4)	28 (59.6)			
Height (m)					
≤1.50	4 (36.4)	7 (63.6)			0.477
≥1.51	68 (24.7)	207 (75.3%)			

*EMLSCS=Emergency lower segment caesarean section, **VD=Vaginal delivery, BMI=Body mass index

Table 2: Logistic regression of factors influencing vaginal delivery in primigravidae

Variables	*B*	SE	Wald	*P* value	OR	95% CI
Maternal age (in years)	−0.078	0.044	3.165	0.075	0.925	0.849-1.008
Birthweight (in grams)	−0.907	0.333	7.432	0.006	0.404	0.210-0.775
Head engagement						
Not engaged (ref)/engaged	2.332	1.037	5.058	0.025	10.303	1.349-78.693
BMI						
Overweight (ref)/normal	5.389	1.738	9.618	0.042	2.077	1.026-4.204

SE=Standard error, CI=Confidence interval

was no statistically significant difference in the rate of vaginal delivery in teenagers and the older primigravidae. Similarly, Kjaergaard *et al*.[11] found that maternal age did not significantly affect dystocia in nulliparous women.

More than 50% of the women with spontaneous onset of labor had oxytocin augmentation of labor. This was not surprising because primigravidae had been found to be characterized by prolonged or slowly progressing labor.[9,12] It had been argued if this period of slow progress in labor among primigravidae is pathological and therefore justifies treatment or is a normal variation in the physiological process leading to delivery.[11] Studies had shown that nulliparae compared with multiparae, had lower rates of labor onset and higher rates of inadequate uterine contractions, hence the higher rates of induction and augmentation of labor among them.[12,13] The 54.4% rate of oxytocin augmentation of labor in this study was similar to the 52.4% by Iqbal and Sumaira.[14]

The caesarean section rate among the studied population was 25.2%, and this is quite high when compared with the recommended 10-15% by the WHO in the general population.[15] Previous studies had shown that when compared with multiparae, nulliparous women had been shown to have a higher rate of caesarean section,[12,13] and significantly contributed to high rate of primary caesarean section.[16] The caesarean-section rate of over 25% in this study is of great concern because of its implication on the future reproductive career of these women. The 25.2% caesarean section rate in the present study was comparable to the 22.4% rate of the 1992 data from Glasgow Royal Maternity Hospital.[16]

Failure to progress in labor, maternal distress, fetal distress, and rapidly progressing preeclampsia in labor were the indications for emergency caesarean section in this study. Failure to progress (due to cephalo-pelvic disproportion, maternal BMI >25, unengaged fetal head and birth weight >4.0 kg) was the most common indication for caesarean section in nulliparae in this study and other studies,[8,16] and it has been a focus for much studies.[17-19] Despite active management of labor in this study, the caesarean-section rate was still high. This is contrary to the previous studies that showed that active management of labor actually reduced caesarean-section rate to as low as 5.2% in primigravidae.[18,20] However, there have been conflicting reports on the outcome of active management of labor in that conclusions reached from the work of advocates of active management of labor have not been reproduced consistently.[21,22] Therefore, to increase the rate of vaginal delivery and reduce the caesarean-section rate in primigravidae, more research is needed to unravel the main reasons for poor progress in labor.

Maternal distress leading to a request for caesarean section in labor contributed a small but an important

indication for caesarean section. Therefore maternal fortitude to bear the labor pain may influence vaginal delivery in primigravidae. Onah *et al*.[23] showed that primigravidae had highest perceived mean pain score in labor when compared with multiparae and grandmultiparae. Relieving pain in labor with epidural analgesia may contribute to increase rate of vaginal delivery in this studied population.

The fetal head was not engaged in early labor in the majority of the studied primigravidae, and this agreed with earlier studies in this group of parturient.[24,25] Unengaged fetal head in early labor had been associated with high rate of caesarean section,[25,26] and the present study showed that engagement significantly predicted vaginal delivery in nulliparae. The unengaged fetal head may result in poor contact between the fetal head and the cervix, a factor that had been found to be associated with increased risk of dystocia in nulliparae.[11]

The birth weight of the baby was also a significant factor in vaginal delivery. Babies whose weights were within the normal range of birth weight were more likely to be delivered vaginally compared with macrosomic infants. Ju *et al*.[27] showed that macrosomia was associated with nearly two times higher risk of emergency caesarean section. Compared with normal weight babies, macrosomic infants had also been associated with unengaged fetal head, malpositioning and prolonged labor in nulliparae.[11,24,25,28]

Maternal weight was another factor influencing vaginal delivery in nulliparae. Normal range of BMI (18.5-24.9 kg/m^2) was found to be associated with vaginal delivery, whereas overweight or obesity was more likely to result in emergency caesarean section. Increasing degrees of maternal obesity had been found to be associated with increasing incidence of caesarean section.[29]

One of the limitations of this study was the proportions of the booked patients (18.5%) who reported at the labor ward when the labor was already well advanced, and made it impossible to determine fetal head engagement in early labor, which might have further strengthened the study. Secondly, the factors found to predict vaginal delivery in nulliparae need to be validated by a case-controlled study with multiparae.

Conclusion

Normal range of maternal BMI, fetal head engagement, and normal range of fetal birth weight were the factors found to be associated with vaginal delivery in nulliparae. Variation in these three factors may be the underlying cause of the failure to progress which is the most common indication for caesarean section among this population of parturient. However, these factors need be validated with a case controlled study.

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