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Correlation of Labor Patterns and Perinatal Outcome with Birth Weight

Bhupesh H. Gaikwad[1], Ujjwala D. Nikam[2], Rahul P. Maskar[3]
[1,2,3](Department Of Obstetrics & Gynaecology, R.C.S.M. Govt.Medical College, Kolhapur, MUHS Nashik, India)

Abstract
Background: *In nulliparous women dystocia is the most common obstetric problem and its etiology is largely unknown. The conventional view is that dystocia may be caused by abnormalities of either the passage, power or the passenger. In the past, the importance of passage and power has been highlighted, but the role of passenger (the fetus) in the etiology of dystocia has received less attention.*
Aims and Objectives : *To study the association between labor pattern and birth weightandto evaluate the impact of birth weight on maternal and neonatal outcome.*
Material and Methods : *This was a prospective observational study conducted in RCSM,GMC, Kolhapur. 1531 Primigravidaes with single live fetus with cephalic presentation who delivered after 37 weeks of gestation, were enrolled in the study. On admission, demographic data were recorded and labor was monitored with CTG and partograph charting. Birth weight of babies were categorized into 5 categories. Women were followed up for labor outcomes and various perinatal complications.*
Results: *The prevalence of adverse perinatal outcomes increased gradually as the birth weight increased.*
Discussion: *Women with high birth weight infants had significantly increased incidence of prolonged labor, postpartum hemorrhage, perineal tears and neonatal morbity. The incidence for instrumental delivery and Cesarean section were also increased.*
Conclusion: *High birthweight deliveries in the present study had high perinatal morbidity. Antenatal prediction of high birth weight, close surveillance and judicious use of Operative delivery are needed to reduce the perinatal morbidity in developing countries.*
Keywords*: Birth weight, laborpatterns, perinatal outcome*

I. Introduction

Labor refers to the chain of physiological events that allows a fetus to undertake its journey from the uterus to the outside world. Fetal birth weight is one of the many factors affecting these physiological events. Increasing birth weight is associated with many labor complications such as need for induction, prolonged and dysfunctional labor, failure to progress, cephalopelvic disproportion, instrumental delivery, need for Cesarean section and increased risk for perinatal morbidity.[1,2]

Although the concept of abnormal fetal growth is basic to modern ideas of perinatal medicine, there is limited information concerning the birth-weight threshold at which morbidity and mortality increase significantly. This study analyzes the birth-weight thresholds associated with a significant increase in adverse perinatal outcomes.

As there is paucity of data on high birth weight babies in developing countries like India, we decided to undertake the present study which describes the labor pattern as well as the maternal and perinatal outcomes associated with them. The conclusions derived from this study may help us to make informed decisions regarding obstetric and neonatal care guidelines for delivering high birth weight babies in our population. It may also help us to define the birth weight threshold for which these risks begin to increase.

II. Material and Methods

This prospective study was conducted in Department of Obstetrics and Gynaecology in RCSM, CPR, Kolhapur over a period of one year from 1st September 2015 to 31stAugust 2016.

The study included all primigravidas after 37 weeks of gestation with single live cephalic presentation. A detailed history of all primigravidas who were in labor was taken and followed by a thorough clinical examination. Those patients who came in labor were observed for spontaneous progress of labor. In patients who came for induction of labor and with prelabor rupture of membranes (PROM), labor was induced with prostaglandins or oxytocin infusion or amniotomy. According to uterine activity labor was augmented with amniotomy or an oxytocin infusion. Intrapartum fetal heart rate monitoring and partogram charting was done in all patients.

Progress of labor was measured in the first stage by cervical dilatation and in the second stage by descent of the presenting part. Duration of labor was defined as the time from the onset of labor until the infant was born.

The diagnosis of arrested progress was made if cervix fails to dilate after reaching ≥4 cm dilatation in first stage of labor or on the failure of descent of presenting part after one hour in second stage of labor. Protracted active phase was defined as rate of cervical dilatation less than 1.2 cm/hour for nulliparous patients and 1.5 cm/hour for multiparous patients.Protracted second stage was defined as a second stage longer than 2 hours in nulliparas and longer than 1 hour in multiparas. Birth weights were stratified at 500 grams interval and data was analysed using Chi-square test and One-way Analysis of Variance (ANOVA)

The outcomes studied were induction of labor, progress of labor, duration of labor, mode of delivery, incidence of instrumental and Cesarean delivery, postpartum complications and neonatal complications.

Table 1: Study population

Groups	Birth weight (gms)	Infants (%)
Group 1	<2500	100(6.5%)
Group 2	2500-2999	629(41.1%)
Group 3	3000-3499	605(39.5%)
Group 4	3500-3999	170(11.1%)
Group 5	≥ 4000	27(1.8%)

III. Results

There were total 1531 deliveries over the study period, 27 (1.8%) weighed ≥4000 grams100(6.5%) weighed below 2500 grams while the remaining weighed between 2500 and 3999 grams. Our study in a large cohort was performed to demonstrate how birth weight influences the labor pattern and the perinatal outcome of these pregnancies. Both low and high birth weight are associated with increased obstetric and neonatal complications.

Table 2: Onset of labor

Onset of labour	Birth weight groups, n (%)				
	Group 1	Group 2	Group 3	Group 4	Group 5
Spontaneous	66 (66.0)	487 (77.4)	433 (71.6)	122 (71.8)	17 (63.0)
Induced	34 (34.0)	142 (22.6)	172 (28.4)	48 (28.2)	10 (37.0)

p value 0.029

Table 3: Total duration of labor

Total duration of labor	Birth weight groups				
	Group 1 (n=65)	Group 2 (n=447)	Group 3 (n=386)	Group 4 (n=102)	Group 5 (n=16)
	5.0±2.4	5.8±2.4	5.8±2.6	7.6±2.5	8.9±3.3

Values are Mean ± Standard Deviation in hours, p value = 0.001

Table 4: Labor abnormality

Labor abnormality	Birth weight groups, n (%)				
	Group 1	Group 2	Group 3	Group 4	Group 5
Nil	96 (96.0)	565 (89.8)	467 (77.2)	103 (60.6)	4 (14.8)
Prolonged labor	4 (4.0)	61 (9.7)	125 (20.7)	57 (33.5)	15 (55.5)
Arrest disorder	0	3 (0.5)	13 (2.1)	10 (5.9)	8 (29.7)

p value = 0.001

Table 5: Partogram

Partogram	Birth weight groups, n (%)				
	Group 1	Group 2	Group 3	Group 4	Group 5
Left of alert line	98 (98.0)	603 (95.9)	556 (91.9)	127 (74.7)	13 (48.1)
Alert to action line	2 (2.0)	25 (4.0)	40 (6.6)	31 (18.2)	5 (18.5)
Right of action line	0	1 (0.2)	9 (1.5)	12 (7.1)	9 (33.3)

p value 0.001

It was seen that majority of women in all groups had a spontaneous onset of labor, however the incidence of induction of labor was more often seen in Group 1 (34%) and Group 5 (37%) compared to other groups due to higher rates of IUGR and GDM in respective groups. (Table 2)

In our study, the mean duration of labor increased significantly from 5 hours to 8.9 hours in < 2500 gms and ≥4000 gms infants group respectively.(Table 3) There was an increasing trend towards protracted labor

and arrest disorders as the birth weight increased (Table 4). The incidence of prolonged labor and arrest disorder was highest in Group 5. (p- Value=0.001)

In the current study, the action line was crossed in more number of women in Group 4 and Group 5, which showed that intervention was required more often in women with infants weighing ≥3500 gms.(Table 5) Most of the patients in our study had vaginal deliveries. We found that as the birth weight increased to ≥ 3500 gms, the rate of Cesarean section increased significantly. (p-value=0.008). It was 40% and 40.7% in Group 4 and Group 5 and 35%, 28.9% and 36.2 % women in Group 1, Group 2 and Group 3 respectively. The rate of instrumental delivery was not found to increase significantly with increasing birth weight.(Table 6)

Table 6: Mode of delivery

Mode of delivery	Birth weight groups, n (%)				
	Group 1	Group 2	Group 3	Group 4	Group 5
Normal	63 (63.0)	434 (69.0)	364 (60.2)	93 (54.7)	16 (59.3)
Cesarean section	35 (35.0)	182 (28.9)	219 (36.2)	68 (40.0)	11 (40.7)
Instrumental	2 (2.0)	13 (2.1)	22 (3.6)	9 (5.3)	0

p value 0.008

In the current study, there were more third and fourth degree perineal tears and PPH in Group 5 (11.1% each) as compared to the other groups (p- Value=0.001).

Table 7: Postpartum complications

Postpartum Complications	Birth weight groups, n (%)				
	Group 1	Group 2	Group 3	Group 4	Group 5
PPH	4 (4.0)	14 (2.2)	31 (5.1)	16 (9.4)	3 (11.1)
$3^{rd}/4^{th}$degree laceration	0	6 (1.0)	8 (1.3)	4 (2.4)	3 (11.1)
Urinary retention	1 (1.0)	3 (0.5)	5 (0.8)	5 (2.9)	0
Infections	1 (1.0)	14 (2.2)	15 (2.5)	7 (4.1)	0

p value 0.001

In the current study(Table 8), the incidence of shoulder dystocia and hypoglycemia was highest in infants with birth weight ≥3500 gms. It was 2.4% and 7.6% in Group 4 and 3.7% and 29.6% in Group 5 respectively. Hyperbilirubinimia also showed an increasing trend as the birth weight increased to ≥3500 gms, but this difference did not achieve statistical significance. In our study newborns with birth weight ≥3500 gms required NICU admissions more often compared to newborns of other groups.

Table 8: Neonatal complications

Neonatal Complications	Birth weight groups, n (%)				
	Group 1	Group 2	Group 3	Group 4	Group 5
NICU admission	25 (25.0)	103(16.4)	73(12.1)	51(30.0)	15(55.6)
Asphyxia	3 (3.0)	7 (1.1)	10 (1.7)	1 (0.6)	1 (3.7)
Shoulder dystocia	0	0	2 (0.3)	4 (2.4)	1 (3.7)
Erb's Palsy	0	0	0	2 (1.2)	0
Hypoglycemia	10 (10.0)	11 (1.7)	10 (1.7)	13 (7.6)	8 (29.6)
Hyperbilirubinimia	10 (10.0)	70 (11.1)	42 (6.9)	26 (15.3)	5 (18.5)
Meconium aspiration	0	3 (0.5)	2 (0.3)	3 (1.8)	0
Sepsis	1 (1.0)	6 (1.0)	5 (0.8)	1 (0.6)	0

p value 0.001

IV. Discussion

Birth weight is known to have impact on obstetrical and perinatal risks. In this study, the incidence of induction of labor was more often seen in Group 1 (34%) and Group 5 (37%). In a study of high birth weight babies, Boulet et al found that labor induction increased among the 4000 to 4499 gms and 4500 to 4999 gms groups.[2] Similarly Gurel et al found the rate of induction increases from 5.8% in AGA infants to 10.9% in Large for Gestational Age (LGA) infants, but this difference was not statistically significant.[3]

Our results showed that mean duration of labor and labor abnormalities increased significantly with increasing birth weight. Elvander et al in his study confirmed that the incidence of prolonged labor increased from 14% to 38% when the birth weight of the infant increased from 3000 gms to 4200 gms respectively.[4]

Turner et al in a study showed that the mean duration of total labor increased significantly from 3.8 hours to 7.7 hours in < 2500 gms and >4500 gms infants group respectively ($p<0.01$). They also found that this direct relationship was present whether or not Oxytocin was used for augmentation of labor and was independent of gestational age.[5] In Israel, Feinstein et al found that high birth weight (>4000 gms) was associated with significantly high incidence of arrest of descent during second stage of labor.[6]

Our study concluded that with increasing birth weight of infant, more number of patients crossed the action line. A study by Lavender et al compared a 2 hour action line partogram and a 4 hour action line partogram and found that 44% of women with high birth weight infant had crossed the action line (52% in 2 hour action line and 38% in 4 hour action line partogram.[7]

Similar to our study, Gurel et al, found that LGA infants had a significantly higher rate of Cesarean section (43.5%) compared to AGA infants (24.5%), whereas the type of vaginal delivery was similar in the two groups.[3] Similar conclusions were drawn from other studies on the rate of Cesarean section.[2,8,9]In Nigeria, a study by Onalo et al concluded that most (70.7%) of the high birth weight infants (≥4000 gms) were delivered vaginally. Although Cesarean section was recorded in only 29.3% deliveries even in babies who weighed >4000 gms.[10]

Brenner et al in their study found an association between PPH and birth weight, the incidence being 0.34%, 0.42%, 0.61% and 1.74% in birth weight categories of < 4000 gms, 4000-4250 gms, 4251-4500 gms and >4500 gms respectively. However the risk was statistically significant only with birth weight >4500 gms. However, no differences were found in the frequency of extensive perineal tears between AGA infants and high birth weight infants.[11] Similar associations between birth weight, PPH and perineal lacerations were found in other studies.[8,9]

In the current study, infants with birth weight ≥3500 gms had more complications as compared to normal weight infants. A study in Israel found that the incidence of shoulder dystocia and hypoglycemia increases significantly when the birth weight increases.[11] Onalo et al found that high birth weight infants (≥4000 gms) have higher incidence of adverse outcomes like hypoglycemia (7.6%), hyperbilirubinimia (4.5%), sepsis (8.9%), birth trauma (5.1%) and still birth (6%).[10] Similarly many other studies found that the risk of shoulder dystocia and neonatal hypoglycemia increased as the birth weight increased both in diabetic and non diabetic pregnancies.[11, 9]

V. Conclusion

The fact that birth weight of the fetus affects labor and perinatal outcome has been widely described in developed countries. This concept is recently gaining widespread attention in developing countries. In our study, we identified the risk factors including the abnormal labor patterns contributed by high birth weight so that we can increase the surveillance and thus reduce the adverse outcomes.

Although, macrosomia is defined as birth weight >4500 gms, in our study women whose neonate had a birth weight ≥3500 gms had a higher incidence of adverse perinatal outcomes. Thus, in developing countries like India, birth weight of 3500 gms seems to be a better cut off for the Obstetrician to optimize the labor management and ultimately improve the perinatal outcome.

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