Original Article

PREDICTORS OF CEPHALOPELVIC DISPROPORTION IN LABOUR A TERTIARY HOSPITAL IN BAYELSA STATE, NIGERIA.

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ABSTRACT

Background: Cephalopelvic disproportion (CPD) is a disparity between the fetal head and maternal pelvis, usually in the absence of fetal or maternal jeopardy. It is a very common complication during labour, and it is associated with a very high caesarean section rate. Delay in intervention could lead to obstructed labour. Short stature, fetal macrosomia and pelvic abnormalities are common risk factors. The aim of this study was to determine the influence of maternal height, age, clinical pelvimetry, and birth weight on cephalopelvic disproportion in the Niger Delta University Teaching Hospital, Bayelsa State.

Materials and Methods: This is a retrospective case controlled analysis of 5,205 parturients who received antenatal care, and delivered at the Niger Delta University Teaching Hospital, from January 2010 to December 2015. Of these, 588 patients who had cephalopelvic disproportion were identified. Data concerning their maternal age, parity, height, pelvimetry, gestational age at delivery, and fetal demographic characteristics were collected and analyzed. This was compared to a control group of 588 parturients who were randomly selected among parturients who had spontaneous vaginal delivery (SVD) during the study period.

Results: A total of 5,205 women delivered during the period of study, out of these, 588 women had cephalopelvic disproportion, giving a rate of 11.3%. Majority of the women who had CPD were nulliparous (47.6%). Women who were 150.0 cm tall or less were 3 times more likely to have cephalopelvic disproportion in labour than those who were over 150.0cm tall. P = 0.001, Odds Ratio = 3.69 [CI, 2.49 -5.47]. Women who delivered babies with birth weight ≥ 4000 grams had significantly more cephalopelvic disproportion, than those who delivered babies with birth weights of 2501 – 3999 grams. Odds Ratio = 0.22, p = 0.001 [CI, 0.14 -0.33]. There is a significant negative correlation between maternal height and parity with cephalopelvic disproportion. [r = -295, p = 0.001] and [r = -197, p = 0.001] respectively. There is also a significant positive correlation between birth weight and gestational age at delivery with CPD [r = 0.24, p = 0.001] and [r = 0.149, p = 0.001]. Linear regression analysis of the independent variables reveal that maternal height was the biggest predictor to CPD. Coefficient of determination R2 = 0.089(8.9%), F= 112.2, p = 0.001.

Conclusion: Short stature is independently associated with an increased risk of intrapartum caesarean section in Nigerian women. We advocate for an early recourse to caesarean section to avoid undue morbidity.

Key words: maternal height, parity, age, birth weight, cephalopelvic disproportion, caesarean section.

Synopsis: Short stature is independently associated with an increased risk of intrapartum caesarean section in Nigerian women.

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INTRODUCTION

Cephalopelvic disproportion (CPD) is a disparity between the foetal head and maternal pelvis[1], usually in the absence of foetal or maternal jeopardy. CPD is a very common condition diagnosed daily in maternity units across the globe. Cephalopelvic disproportion accounted for 20.2% of Caesarean sections in Enugu.[2] the incidence in Malawi is 2.3%.[3]

Several factors have been identified as causes of CPD in both mother and the foetus. The most predominant foetal factor is fetal macrosomia[4], while the most important maternal contributor to CPD is contracted pelvis. Contracted pelvis is defined as shortness of one or more of the pelvic diameters by 0.5cm. In the tropics, it is commonly caused by impairment of growth by ill- health and malnutrition in childhood and adolescence. This in conjunction with genetic factors may produce small or women with short stature.

Various studies have established a strong association between pelvic inlet contraction and short stature [5,6]. Short stature is typically defined as an adult height that is more than two standard deviations below the mean for age and gender. In developed countries, women who are less than 5 ft or 153 cm tall are said to be short. However in Africa, a height of ≤ 150 cm has been assumed by some studies.[6]

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Another important cause of CPD in the tropics is pelvic deformity.[7] It may result from diseases of the pelvic bones and joints, and they include: rickets, osteomalacia, diseases of the pubic and sacroiliac joints, and fracture of the pelvis from trauma. Also, pelvic deformity may result from spinal cord disease such as: kyphosis, scoliosis and spondylolithesis.[8]

A great majority of women with cephalopelvic disproportion are diagnosed during labour.[9] It is usually recognized when in the presence of poor progress in labour, there is moderate to severe caput and molding. A condition very frequently encountered during labour is occipito-posterior position. In direct occipito-posterior position, inadequate flexion of the fetal head presents a wider diameter, which could lead to disparity between the fetal head and maternal pelvis, cephalopelvic disproportion then results.[10] Deep transverse arrest or arrest of the fetal head in second stage labour may suggest mid-pelvic disproportion. Failure to recognize cephalopelvic disproportion in labour may result in obstructed labour, with its sequelae. Studies have revealed that about 99% of women with CPD in labour end up with emergency caesarean section.[1,10]

Antenatal diagnoses involve the use of clinical pelvimetry and magnetic resonance imaging.[6] In addition, absence of engagement of the fetal head at term, abnormal presentation, and very big baby may suggest CPD. Evidence has demonstrated beyond reasonable doubt that labour outcome does not correlate linearly with pelvimetry findings[6,11,12], therefore trial of labour is advocated when there is no contraindication to vaginal delivery.

This study intends to determine whether maternal height, age, parity and birth weight have significant influence on cephalopelvic disproportion among women in the Niger Delta University Teaching Hospital, Bayelsa State.

MATERIALS AND METHODS

The study was carried out in the Department of Obstetrics and Gynaecology, Niger Delta University Teaching Hospital in Bayelsa state, Nigeria. It is case control study involving 5,205 parturients who received antenatal care, and delivered at the Niger Delta University Teaching Hospital between January 2010 and December 2015. Out of these, 588 patients who had cephalopelvic disproportion (CPD) were identified. Also included were booked paturients who had grossly contracted pelvis, diagnosed by clinical pelvimetry, and had elective caesarean section.

Ethical approval was obtained from the ethical committee of the Niger Delta University Teaching Hospital for the conduct of this study.

Data on their sociodemographic characteristics, maternal height and weight at booking, and their foetal characteristics were obtained from their antenatal, labour ward and theater records and analyzed. This was compared to a control group of 588 parturients who were randomly selected among the women who had spontaneous vaginal delivery (SVD) during the study period.

Data collected were coded and entered into a spreadsheet using SPSS version 22 for windows® statistical software which was also used for analysis. The mean, standard deviation and percentages of variables were calculated. Significant differences between the two groups were determined using Chi square test to compare categorical variables. Means of categorical variables were compared using the student's t - test. Pearson correlation coefficient, and linear regression analysis were also carried out. Confidence interval was set at 95%, differences were considered significant at a P value < 0.05.

RESULTS

A total of 5,205 women delivered during the period of study, out of these, 588 women had cephalopelvic disproportion, giving a rate of 11.3%. Majority of the women who had CPD were nulliparous (47.6%). Majority of the women were aged 25 -29 years (37.4% for CPD and 44.3% for SVD), and most of the patients attained secondary education (44.6% for CPD and 47.2% for SVD).

Table 1 shows the mean values in the independent variables There was statistically significant difference in the mean parity p = 0.001 [CI, 0.55 – 0.89], maternal height P =0.001 [CI, 7.43 – 9.01], gestational age at delivery p = 0.01 [CI, 0.07 – 0.53], and birth weights p = 0.001 [CI, 0.47 – 0.59], among the women who had CPD when compared to those who had normal delivery. The mean maternal age for the study group was 28.1 ± 5.4 years, and 28.53± 4.9 years for the control, The difference was not significant, p = 0.15 [CI, 0.16 – 1.02]. However among the teenagers, (age ≤ 19 years), 56 (6.1%) had CPD, while 16 (2. 7%) delivered normally. The difference was statistically significant. Z = 2.70, p = 0.003 [CI, 0.89 – 5.95.]

Table 1: Difference in mean values among the independent variables

Parameter	CPD	SVD	t -test	p-value	95% CI
Mean age	28.1 ± 5.4years	28.53± 4.9 years	1.40	0.15	[CI, 0.16 – 1.02]
Mean parity	1.31 ± 1.82	2.03 ± 1.77	8.19	0.001	[CI, 0.55 – 0.89]
Mean height	152.58 ± 7.21cm	160.8 ± 6.5cm	20.50	0.001	[CI, 7.43 – 9.01]
Mean GA	39.0 ± 1.83 weeks	38.7 ± 2.17 weeks	2.56	0.01	[CI, 0.07 – 0.53]
Birth weight	3.57 ± 0.54kg	3.04 ± 0.59kg	16.07	0.001	[CI, 0.47 – 0.59]

Table 2 shows the relationship between with cephalopelvic disproportion. Women who were 150.0 cm tall or less were 3 times more likely to have cephalopelvic disproportion in labour than those who were over 150.0cm tall. P = 0.001, Odds Ratio = 3.69 [CI, 2.49 - 5.47]. Women whose fetuses were in direct occipitoposterior position (DOP) had more CPD than those in right occipitoposterior position. Odds Ratio = 0.59, p = 0.001, [CI, 0.43 -0.81]. All the women with contracted pelvis (100%) had CPD. Women with borderline pelvis did not have significantly more CPD than those with contracted pelvis. Odds Ratio = 0.89, p = 0.31, [CI, 0.67 - 1.12].

Table 2: Maternal height, fetal position, and clinical pelvimetry parameter

	CPD (n=588)	SVD (n= 588)	Total (n = 1176)	OR	p value	95% CI
Maternal height						
≤ 150.0 cm	114(19.4)	474(80.6)	588(100)			
> 150.0 cm	36(6.1)	552(93.9)	588(100)	3.69	0.01	[CI, 2.49 - 5.47]
Fetal Position						
ROA	246(41.8)	273(46.4)	519(44.1)			
LOA	187(31.8)	204(34.7)	391(33.2)			
DOP	140(23.8)	92(11.6)	232(19.7)	0.59	0.001	[CI, 0.43 -0.81]
Not documented	15(2.6)	19(3.2)	34(2.9)			
Clinical Pelvimetry						
Adequate pelvis	234(39.8)	280(52.7)	514(87.4)			
Borderline pelvis	208(35.4)	216(31.6)	424(36.1)	0.89	0.31	[CI, 0.67 -1.12]
Contracted pelvis	76(12.9)	nil	76(12.9)			
Not done	70(11.9)	92(15.6)	162(13.8)			

Significantly more women who had prolonged pregnancy (GA >40 weeks) had CPD, when compared to women whose GA was ≤ 40 weeks. Yates corrected X^2 = 21.04, p = 0.005 [CI, 0.37 - 0.67].

Fetal sex had no significant influence on CPD, Odds Ratio = 0.87, P = 0.23, [CI, 0.69 -1.10] (Table 3). Women who delivered babies with birth weight ≥ 4000 grams had significantly more cephalopelvic disproportion, than those who delivered babies with birth weights of 2501 – 3999 grams. Odds Ratio = 0.22, p = 0.001 [CI, 0.14 -0.33]. Babies delivered by women with cephalopelvic disproportion had more severe birth asphyxia, (APGAR score of 0 – 3 in one minutes) than those who had normal delivery. Odds Ratio = 2.01 p = 0.008 [CI, 1.21 -3.35].

Table 3: Fetal demographic characteristics

Parameter	CPD (n=588)	SVD (n= 588)	Total (n = 1176)	Odds Ratio	p value	95% CI
Fetal sex						
Females	234(39.8)	254(43.2)	488(41.5)			
Males	354(60.2)	334(56.8)	688(58.5)	0.87	0.23	[CI, 0.69 -1.10]
Birth weight						
<1500 grams	nil	8(1.4)	8(0.7)			
1500 – 2500 grams	28(4.8)	60(10.2)	88(7.4)			
2501 – 3999 grams	430(73.1)	488(83.0)	910(78.1)			
≥ 4000 grams	130(22.1)	32(5.4)	162(13.8)	0.22	0.001	[CI, 0.14 -0.33]
APGAR score at one Minute						
0 – 3	46(7.8)	24(4.1)	70(5.9)	2.01	0.008	[CI, 1.21 -3.35]
4 – 6	105(17.9)	91(15.5)	196(16.7)			
7 – 10	429(72.9))	470(79.9)	899(76.4)			
Fresh still birth	8(1.4)	3(0.5)	11(0.9)			

There is a significant negative correlation between maternal height and parity with cephalopelvic disproportion. [r = -295, p = 0.001] and [r = -197, p = 0.001] respectively (Table 4). There is also a significant positive correlation between birth weight and gestational age at delivery with CPD [r = 0.24, p = 0.001] and [r = 0.149, p = 0.001]. There was no significant correlation between maternal age and CPD.

Table 4: Pearson Correlation

		Maternal height	Age	parity	GA	fetal weight
CPD	Pearson Correlation	- 295	- 034	- 197	0. 149	0.24
	Sig. (2 - tailed)	0.001	0.224	0.001	0.001	0.001
	N	1176	1176	1176	1176	1176

Linear regression analysis (Table 5) of the independent variables reveal that maternal height was the biggest predictor to CPD. Coefficient of determination R^2 = 0.089(8.9%), F= 112.2, p = 0.001. The next predictor was fetal weight, parity, coefficient of determination R^2= 00.056 (35.6%), F = 68.9, p = 0.001. parity was next, 3.9%, followed by gestational age at delivery predicted 2%. Maternal age did not make any significant impact, coefficient of determination R^2 = 0.001 (1%), F = 1.36, p = 0.24. Multiple regression analysis (Table 5) reveals that all the above variables predicted only 20.8% of CPD among the women. The coefficient of determination R^2= 20.8(3.9%), F = 61.36, and p = 0.0001.

Table 5: Regression analysis

		Independent variable	R^2	mean square	F	p value
<u>**Linear Regression analysis**</u>						
Dependent variable						
	CPD	Maternal height	0.089	25.64	112.2	0.001
		Age	0.001	0.34	1.36	0.244
		Parity	0.039	11.37	47.22	0.001
		GA at Delivery	0.022	6.53	26.7	0.001
		Fetal weight	0.056	16.31	68.9	0.001
<u>**Multiple regression analysis**</u>						
Dependent variable						
	CPD	All the variables above	20.8	12.22	61.36	0.0001

DISCUSSION

Disparity between the fetal head and the maternal pelvis is a very common complication in labour. In the absence of timely intervention, labour could become obstructed. Obstructed labour, a frequent calamity in developing countries, is highly associated with maternal and perinatal mortality and morbidity. Studies have proven beyond reasonable doubt that identification of women with cephalopelvic disproportion (CPD), and early intervention could prevent most cases of obstructed labour. In Gombe State in Northern Nigeria, by far, the leading cause of obstructed labour was CPD, accounting for 83%.[12] The prevalence of CPD in this study was 11.3%; this higher than the 2.3% reported in Malawi.[3] It is possible that the women in that locality were constitutionally taller. The value from this study correlates more with the findings in Enugu[2], Nigeria as the women there are similar in stature.

Various studies have established a link between fetal macrosomia and advanced maternal age. The risk of diabetes mellitus, a notorious cause of fetal macrosomia is increased. Maternal age does not seem to have influence on CPD in this region, as there was no significant difference in the mean maternal age between the study group and controls. However, this was not the case in Zimbabwe, where advanced maternal age (≥35 years) was associated with a relative risk of 2.7.[13]

The inverse correlation between parity and CPD has long been established by various studies. Studies carried out by Omer Kandemir et al, 2015 showed that primiparous women in labour have a higher occurrence of CPD than women with high parity.[14] Majority of the women who had CPD in this study were nulliparous. This result was not surprising because there were many teenage pregnancies (age ≤ 19 years) in this study. Among the teenagers, 56 (77.8%) had CPD, while 16 (22.2%) delivered normally. The difference was statistically significant ($p = 0.003$).

Adverse pregnancy outcome has been associated with women of short stature by various researchers. Short stature is typically defined as an adult height that is more than two standard deviations below the mean for age and gender. While women in developed countries whose height was < 153 cm were regarded as short, in developing countries, there is no clear cut-off mark. However various studies have assumed different cut-off marks, ranging from 155 – 145 centimeters.[15, - 17] In this study women who were ≤ 150cm were classified as short statured. It was established in this study that women of short stature were 3 times more likely to development CPD than those who delivered normally.

A well documented risk factor for CPD is occipitoposterior position, it usually occur when the occiput fail to rotate to the anterior position, often resulting in deep transverse arrest. Labour may be unduly prolonged, and very often results in CPD. More commonly, internal rotation may be accomplished, resulting in spontaneous vaginal delivery. Studies done by Wendy J. Carseldine in Australia in 2013 have proven that occipitoposterior position was responsible for 68% of cases of caesarean section in labour[10]. In this study, only 19.7% were found, but it was statistically significant.

The value of clinical pelvimetry as a veritable tool to predict cephalopelvic disproportion is often in doubt. Many studies have infact disputed its usefulness; as labour outcome often does not correlate with its findings. However clinical pelvimetry is being practice routinely in most centers in the world.[6,11] In this study, 100% of the women with contracted had CPD, and were delivered by caesarean section. However women with borderline pelvis did not have significantly more CPD than those with normal pelvis.

When pregnancy has exceeded 40 weeks gestation, the fetal weight tends to increase exponentially. Studies have established a clear link between CPD and gestational age >40 weeks, and caesarean section for cephalopelvic disproportion was indicated in 60% of operations among women with postdate in Chicago [Carl Cucco et al] [18]. This concept has been vindicated in this study, as there was statistically significant difference in the rate of CPD between women whose pregnancies were prolonged, and those who delivered at 40 weeks or less.

One of the most documented factors that militate against successful Spontaneous vaginal delivery is the weight of the fetus. Fetal macrosomia very often pose wider dimensions of the fetal skull on the maternal pelvis, leading to disparity and cephalopelvic disproportion. Studies carried out by Hong J.U et al has demonstrated that fetal macrosomia was associated with a high rate of labour complications, such as CPD and increased caesarean section rate.[5] In this study, Babies with birth weight ≥4000 grams were assumed to be macrosomic, and women who delivered babies with birth weight ≥ 4000 grams had significantly more cephalopelvic disproportion than those who delivered babies with birth weights of 2501 – 3999 grams. This is in conformity with what was obtained in other studies[1]. This study has also demonstrated that fetal sex has no significant influence on CPD.

Linear regression analysis was done to determine the extent to which the independent variables predict cephalopelvic disproportion among the parturients. Maternal height was found to be the biggest culprit, accounting for 8.9% of the cases. This was similar to the findings obtained by Liselele el al[5], where maternal height was found to be the most associated variable. The next predictor variable was birth weight, accounting for 5.6%, followed by parity 3.9%. Gestational age at delivery predicted 2%, while maternal age did not make any significant impact.

Multiple regression analysis revealed the all the above mentioned variables combined, could predict only 20.8% of CPD among the parturients. It is possible that contracted pelvis and occipitoposterior position could be the biggest predictors in this study, but linear regression could not be done because data on these variables was incomplete. Data concerning 162(13.8%) parturient on clinical pelvimetry, and 34(2.9%) cases of fetal position was not documented in the case notes.

CONCLUSION

The prevalence of cephalopelvic disproportion in our study 11.3%. Short stature is independently associated with an increased risk of cephalopelvic disproportion and intrapartum caesarean section in Nigerian women. It is the most important predictor of cephalopelvic disproportion. Other identified predictors include prolonged pregnancy, foetal macrosomia and nulliparity. We advocate for an early recourse to caesarean section to avoid undue morbidity.

REFERENCES

1. Tsvieli O, Sergienko R, Sheiner E. Risk factors and perinatal outcome of pregnancies complicated with cephalopelvic disproportion: a population-based study. Arch Gynecol Obstet. 2012; 285(4):931-6.
2. Ugwu EO[1], Obioha KC, Okezie OA, Ugwu AO. A five-year survey of caesarean delivery at a Nigerian tertiary hospital. Ann Med Health Sci Res. 2011 Jan;1(1):77-83.
3. Brabin L, Verhoeff F, Brabin BJ. Maternal height, birthweight and cephalo pelvic disproportion in urban Nigeria and rural Malawi. Acta Obstet Gynecol Scand. 2002 Jun;81(6):502-7.
4. Ju H, Chadha Y, Donovan T, O'rourk, P. Fetal macrosomia and pregnancy outcomes. Australian and New Zealand Journal of Obstetrics and Gynaecology, 2009; 49: 504–509. doi: 10.1111/j.1479-828X.2009.01052.x
5. Liselele HB, Tshibangu CK, Meuris S. Association between external pelvimetry and vertex delivery complications in African women. Acta Obstet Gynecol Scand. 2000 Aug;79(8):673-8.
6. Liselele H B, Boulvain M, Tshibangu K C, Meuris S. Maternal height and external pelvimetry to predict cephalopelvic disproportion in nulliparous African women: a cohort study. BJOG: An International Journal of Obstetrics & Gynaecology, 2000;107: 947–952. doi:10.1111/j.1471-0528.2000.tb10394.x
7. Cox ML. Contracted pelvis in Nigeria. BJOG: An International Journal of Obstetrics & Gynaecology, 1963; 70: 487–494. doi:10.1111/j.1471-0528.1963.tb04937.x
8. Micozzi MS. Skeletal Tuberculosis, Pelvic Contraction, and Parturition. Am J Phys Anthropol 58 (4), 441-445. 8 1982. DOI: 10.1002/ajpa.1330580412
9. Hanzal E[1], Kainz C, Hoffmann G, Deutinger J. An analysis of the prediction of cephalopelvic disproportion. Arch Gynecol Obstet. 1993;253(4):161-6.
10. Carseldine WJ, Phipps H, Zawada SF, Campbell NT, Ludlow JP, Krishnan SY, De Vries BS. Does occiput posterior position in the second stage of labour increase the operative delivery rate? Aust N Z J Obstet Gynaecol. 2013 Jun;53(3):265-70. doi: 10.1111/ajo.12041. Epub 2013 Jan 24.
11. S. T. Sule and B. I. Matawal. Antenatal clinical pelvimetry in primigravidae and outcome of labour. Annals of African Medicine. Vol. 4, No. 4; 2005:164 – 167.
12. Melah GS, El-Nafaty AU, Massa AA, Audu BM. Obstructed labour: a public health problem in Gombe, Gombe State, Nigeria. Journal of Obstetrics & Gynaecology. Volume 23, 2003 - Issue 4
13. TSU VD. Maternal Height and Age: Risk Factors for Cephalopelvic Disproportion in Zimbabwe. Int J Epidemiol (1992) 21 (5): 941-946. DOI: https://doi.org/10.1093/ije/21.5.941
14. Kandemir O, Dede H, Yalvac S, Aldemir O, Yirci B, et al. (2015) The Effect of Parity on Labor Induction with Prostaglandin E2 Analogue (Dinoprostone): An Evaluation of 2090 Cases. J Preg Child Health 2:149. doi: 10.4172/2376-127X.1000149.
15. Liselele HB, Boulvain M, Tshibangu KC, Meuris S. Maternal height and external pelvimetry to predict cephalopelvic disproportion in nulliparous African women: a cohort study. BJOG. 2000 Aug;107(8):947-52.
16. Wongcharoenkiat N, Boriboonhirunsarn D. Maternal height and the risk of cesarean delivery in nulliparous women. J Med Assoc Thai. 2006 Oct; 89 Suppl 4:S65-9.
17. Mahmood TA, Campbell DM, Wilson AW. Maternal height, shoe size, and outcome of labour in white primigravidas: a prospective anthropometric study. BMJ. 1988 Aug 20-27;297(6647):515-7.
18. Cucco C, Osborne MA, Cibils LA. Maternal-fetal outcomes in prolonged pregnancy. American Journal of Obstetrics & Gynaecology. Volume 161, Issue 4, October 1989, Pages 916-920.