

Full Length Research Paper

# Electrolyte changes in obstructed labour in Kano northern Nigeria

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**Background:** Obstructed labour in developing countries is a major cause of feto-maternal morbidity and mortality. Unlike normal labour, obstructed labour is commonly associated with electrolyte derangements which could cause maternal death. In order to appreciate this, there is a need to compare the electrolyte changes in obstructed labour with that of normal labour. **Objective:** To compare the electrolyte changes and feto-maternal outcomes in obstructed labour and normal labour. **Methodology:** The study is a comparative prospective study involving 100 consenting pregnant women in labour at term. Fifty pregnant women who had obstructed labour were compared with another fifty who had normal labour at Murtala Muhammed Specialist Hospital, Kano Nigeria. **Main outcome measures.** Electrolyte changes: Maternal deaths, mode of delivery, **Results:** There is a statistically significant difference in electrolyte changes and feto-maternal outcomes between obstructed and normal labour. **Obstructed labour is associated with severe electrolyte changes and maternal deaths. Conclusion:** Obstructed labour is associated with adverse feto-maternal outcomes.

**Key words:** Electrolyte changes, feto-maternal outcomes, obstructed labour, Kano.

## INTRODUCTION

Modern obstetric care and increasing rarity of severely contracted pelvis have led to gradual elimination of obstructed labour in the Western world<sup>(1)</sup>. But in Sub-Saharan Africa, obstructed labour still occur and continues to be a major cause of maternal and fetal mortality contributing about 500,000 maternal deaths each year according to WHO estimates.<sup>(2-6)</sup>

Obstructed labour is defined as a labour where no further progress is possible without assistance or intervention.<sup>(2)</sup> Majority of the cases are due to cephalo-pelvic disproportion<sup>(2)</sup>, followed by impacted transverse lie. Other causes include mento-posterior face presentation, brow compound presentations and uncommonly shoulder dystocia.<sup>(2)</sup> Soft tissue tumors such as uterine fibroids, ovarian tumor and fetal tumors (sacroccygeal tumor) rarely obstruct labour.<sup>(2)</sup>

Most of the victims are unbooked nulliparous ladies

with poor socio-economic background and lack western education.<sup>(3)</sup> Thus obstructed labour tends to be the leading cause of operative delivery in developing countries including Nigeria.<sup>(4-6)</sup>

Electrolytes derangement is a common complication of obstructed labour. Other complications include fetal distress, intra uterine fetal death (IUFD), severe birth asphyxia, maternal exhaustion, ruptured uterus, vesico-vaginal fistula (VVF), recto-vaginal fistula (RVF) and maternal death.<sup>(1,2,3,25)</sup>

Electrolyte abnormalities can cause cardiac arrhythmias or cardiopulmonary arrest. Life threatening arrhythmias are associated most commonly with potassium disorders particularly with hyperkalemia, and less commonly with disorders of serum calcium and magnesium.<sup>(7)</sup> Among the electrolyte derangements, hyperkalemia is the most common disorders associated with cardiopulmonary arrest.<sup>(7)</sup> It is usually caused by increased potassium release from cells, impaired excretion by the kidney or accidental potassium chloride administration.<sup>(7)</sup> In some cases, therapy for life threatening electrolyte disorders is urgent – and

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**TABLE 1:** COMPARISON OF SOCIO DEMOGRAPHIC CHARACTERISTICS AMONG CASES AND CONTROLS

Variable	Cases (%)	Control (%)	All (%)	$\chi^2$	P value
Age (years)					
Less than 15	22 (44.0)	6 (12.0)	28 (20.0)	11.781	0.30
15-19	17 (34.0)	25 (50.0)	42 (42.0)		
20-24	2 (4.0)	15 (30.0)	17 (17.0)		
25+	9 (18.0)	4 (8.0)	13 (13.0)		
Educational status					
None				0.056	0.812
Primary	39 (78.0) 11 (22.0)	38 (76.0) 12 (24.0)	77 (77.0) 23 (23.0)		
Social class					
IV	45 (90.0)	46 (92.0)	91 (91.0)	0.122	0.727
V	5 (10.0)	4 (8.0)	9 (9.0)		

Summary: The characteristics of the participants in both groups which could influence outcome were similar with no statistical difference.

should start before laboratory requests become available.<sup>(7)</sup>

Maternal mortality due to obstructed labour continues to remain high in the developing countries, particularly sub-Saharan Africa, with several studies reporting figures ranging from 11-20/1000<sup>(16,24,29)</sup>

It is therefore important to study and compare the electrolyte changes in obstructed with that of normal labour in order to the need for early intervention so as to prevent the adverse effect of electrolyte changes in obstructed labour which could cause deaths.

## METHODS

This is a comparative prospective study involving one hundred consenting pregnant women in labour at Murtala Muhammed Specialist Hospital, Kano. Fifty were pregnant women who had obstructed labour (cases) and the remaining fifty were pregnant women (controls) who had normal labour. Patients with chronic renal failure (CRF) and those who refused consent were excluded from the study. Those who had clinically diagnosed obstructed labour were included as the cases and those with normal labour were included as the controls. Sampling technique was by simple random sampling. Cases and controls were matched for age, parity gestational age, educational and social class. We obtained personal history, history of present pregnancy, past obstetric history, past medical history, family and social history and review of the systems. Social class was determined using Olunsanya protocol for social class (classes I&II, III, IV, V).<sup>23</sup> General and systemic physical examinations were carried out on every patient. After cleaning the volar surface of the arm with cotton wool and moistened with methylated spirit, about 5mls of blood was taken from every client ante cubital vein and analyzed for electrolytes, urea and creatinine within one hour of taking the sample. Dip stick urine

analysis to check for ketones was done using combi-9. Fetal weighing scale was used to estimate babies' birth weight. To the best of our knowledge, this is the first study on this subject from Nigeria. Data were entered into statistical software (SPSS version 18, Illinois) and analyzed. The data were presented using tables and descriptive statistics were used as absolute numbers, measures of central tendency and dispersion. The Chi-Square test was used to test significant of association. A P-value < 0.05 was considered significant.

## RESULTS

Table 1 shows the comparison of socio demographic characteristics among cases and controls. A higher proportion of the cases were less than 15 years of age (44.0%) compared to controls (12.0%). This was also the cases for those 25 years and above, (18.0% for cases and 8.0% for controls). There was a higher proportion of controls aged 15-19 years (50.0%) and 20-24 years (30.0%) compared to cases (34.0% and 4.0%) respectively; but this observed difference was not statistically significant (p=0.30). There were also no significant differences between the cases and controls as regards educational status (p=0.812) and social class (p=0.727).

Comparison of obstetric history among cases and controls is shown in table 2. The obstetric histories were similar with no statistically significant difference between the cases and the controls in terms of the obstetric parameters. The mean age of the cases was  $17.4 \pm 6.0$  years compared to controls with mean age of  $18.7 \pm 3.4$ ; this is not statistically significant (P value = 0.183). The mean parity of the cases was  $0.7 \pm 1.4$  but,  $0.5 \pm 1.1$  in control. The difference was not statistically significant (P value 0.585).  $39.6 \pm 1.2$  weeks and  $38.6 \pm 1.3$  weeks were the mean gestational age at delivery in the cases and controls respectively with no

**TABLE 2: COMPARISON OF OBSTETRICS HISTORY AMONG CASES AND CONTROLS**

Variable	Cases Mean (SD)	Control Mean (SD)	All Mean (SD)	P value
Age	17.4 (6.0)	18.7 (3.4)	18.1 (5.0)	0.183
Parity	0.7 (1.4)	0.5 (1.1)	0.6 (1.3)	0.585
EGA	39.6 (1.2)	38.6 (1.3)	39.1 (1.3)	0.42

Variable	Cases (%)	Control (%)	All (%)	$\chi^2$ / fishers exact	P value
Booking status Booked Unbooked	8 (16.0) 42 (84.0)	12 (24.0) 38 (76.0)	20 (20.0) 80 (80.0)	1.000	0.317
Referral status Referred Not referred	6 (12.0) 44 (88.0)	10 (20.0) 40 (80.0)	16 (16.0) 84 (84.0)	1.190	0.275

Summary: Characteristics which could influence outcome among cases shows no statistical significant difference in both groups

**TABLE 3: COMPARISON OF OBSTETRIC/FETAL OUTCOMES**

Variable	Cases (%)	Control (%)	All (%)	$\chi^2$ / fishers exact	P value
Mode of delivery C/S SVD	50 (100) 0 (0)	7 (14.0) 43 (86.0)	57 (57.0) 43 (43.0)		<0.001
Fetal outcome Alive FSB/MSB	12 (24.0) 38 (76.0)	50 (100) 0 (0)	62 (62.0) 38 (38.0)		<0.001
Maternal outcome Dead Alive	7 (14.0) 43 (86.0)	0 (0) 50 (100.0)	7 (7.0) 93 (93.0)		0.012
Maternal complications VVF RVF	10 (20.0) 2 (4.0)	0 (0) 0 (0)	10 (10.0) 2 (2)		0.001

Summary: Above table 3 shows statistical significant difference between cases and controls in terms of obstetrics/fetal outcomes

statistically significant difference (P value = 0.42). Similarly there was also no statistically significant difference in the observed differences in referral and booking status between the cases and the controls.

Table 3 compares obstetric/fetal outcomes between cases and controls. All cases ended up having a caesarean section (100%) while majority of the controls had spontaneous vaginal deliveries (86.0%) with only 7 (14.0%) controls having caesarean section, ( $p < 0.001$ ). All the babies belonging to mothers in the control group were alive while only 12 (24.0%) among the cases were alive, ( $p < 0.001$ ). None of the controls lost their lives compared to cases where 7 (14.0%) died, ( $p = 0.012$ ). Obstetric fistulae were common in the cases but none in the control (P value < 0.001)

Table 4 shows the difference in mean maternal characteristics and obstetric/fetal outcomes between

cases and controls. There were significant differences in the mean maternal and obstetric outcomes with cases having a longer labour duration ( $44.3 \pm 19.3$ ) hours and higher birth weight of the babies ( $3.9 \pm 0.3$ ) Kg compared to controls shorter labour duration ( $7.8 \pm 2.0$ ) hours and lower birth weight of the babies ( $3.0 \pm 0.5$ ) Kg, ( $p < 0.001$ ). There was also a significant difference in the mean Apgar score with controls having higher Apgar scores at 1 minute ( $8.2 \pm 1.0$ ) and 5 minutes ( $10.0 \pm 0.2$ ) compared to cases with Apgar scores at 1 minute ( $0.5 \pm 1.4$ ) and 5 minutes ( $0.6 \pm 1.4$ ), ( $p < 0.001$ ).

Table 5 shows the difference in electrolyte levels between cases and controls. Significant differences were recorded for all electrolyte parameters with that of the cases being higher than that of the controls ( $p < 0.001$ ). Of particular interest is the mean potassium

**TABLE 4:** COMPARISON OF MEAN MATERNAL AND OBSTETRIC/FETAL OUTCOMES

Variable	Cases Mean (SD)	Control Mean (SD)	All Mean (SD)	P value
Labour duration	44.3 (19.3)	7.8 (2.0)	26.0 (22.9)	<0.001
Apgar at 1 minute	0.5 (1.0)	8.2 (1.0)	4.3 (4.0)	<0.001
Apgar at 5 minutes	0.6 (1.4)	10.0 (0.2)	5.3 (4.8)	<0.001
Birth weight	3.9 (0.3)	3.0 (0.5)	3.4 (0.6)	<0.001

Summary: statistical difference between cases and controls in terms of maternal/fetal outcome in above table 4

**TABLE5:** COMPARISON OF MEAN ELECTROLYTE LEVELS BETWEEN CASES AND CONTROLS.

Variable	Cases Mean (SD)	Control Mean (SD)	All Mean (SD)	P value
K	6.1 (0.6)	4.0 (0.6)	5.0 (1.2)	<0.001
Na	151.7 (8.4)	136.7 (3.2)	144.2 (9.9)	<0.001
Cl	111.8 (6.8)	99.0 (3.0)	105.4 (8.3)	<0.001
Urea	11.1 (4.4)	4.5 (1.1)	7.8 (4.6)	<0.001
CO <sub>3</sub>	17.9 (3.1)	23.6 (2.3)	20.7 (3.9)	<0.001
Cr	111.2 (13.5)	60. (14.4)	85.6 (29.3)	<0.001

Ketonuria Present	50 (100)	0 (0)	50 (50.0)		<0.001
Absent	0(0)	50 (100)	50 (50.0)		

Summary: statistical difference between cases and controls in terms of electrolyte changes

m level of  $6.1 \pm 0.6$  mmol/l in the cases which was significantly high. Also ketonuria were present in all the cases but absent in the controls, (P value < 0.001)

We were unable to estimate calcium and magnesium level in this study, due lack of laboratory facilities but we believe is a subject to be looked at in future follow-up studies.

## DISCUSSION

The major cause of obstructed labour is cephalo-pelvic disproportion, which may be due to small pelvis, a large baby, fetal malpresentation, a tight perineum or abnormalities or tumors of the uterus, vagina or ovary.<sup>(8-12)</sup> Actual obstruction is usually preceded by prolonged labour which usually results in dehydration and acidosis. In addition prolonged rupture of the membranes combine with frequent vaginal examinations makes intrapartum infection almost the rule.<sup>(13,14,15,16)</sup> All these significantly lead to increase maternal and prenatal morbidity and mortality in obstructed labour.

In West Africa the latest estimate of maternal mortality was 1020 maternal death per 100,000 live births a ratio 38 times higher than in most developed nations. Data on the incidence and characteristics leading to this higher rate are extremely scarce, in spite of growing awareness of their value.<sup>(28,30)</sup>

Electrolyte derangement is a common complication of obstructed labour. Other complications include fetal distress, intra uterine fetal death (IUFD), severe birth asphyxia, maternal exhaustion, ruptured uterus, vesico-vaginal fistula (VVF), recto-vaginal fistula (RVF) and maternal death.<sup>(1,2,3,25)</sup>

Electrolyte abnormalities can cause cardiac arrhythmias or cardiopulmonary arrest. Life threatening arrhythmias are associated most commonly with potassium disorders particularly with hyperkalemia, and less commonly with disorders of serum calcium and magnesium.<sup>(7)</sup> Among the electrolyte derangements, hyperkalemia is the most common disorders associated with cardiopulmonary arrest.<sup>(7)</sup>

Table one shows comparison of the socio demographic characteristics. The Olunsanya social class classification<sup>23</sup> using the woman educational status and husband occupation was used to categorize the women, they were mostly in classes IV and V. There was a higher number of teenage Primigravidae 44% with obstructed labour. In a study from the eastern part of Nigeria the incidence of obstructed labour was found to be 59% in Primigravidae that were unbooked.<sup>(16,24)</sup> Similar results have been reported from other parts of Nigeria<sup>(16,24,27,28)</sup>

Though the route of delivery is not the subject of this study, most women were delivered by caesarean section. Delivery of the fetus at caesarean section is always difficult, especially if the fetal head is impacted in the pelvis. Where the fetus is dead and the uterus

has not ruptured, vaginal destructive operation is preferable to caesarean section. If the uterus has ruptured caesarean hysterectomy is the recommended action.<sup>(22,24)</sup> The majority of the women who sustained obstructed labour in the study group were mostly unbooked patient that ended with poor outcome, similar to the studies in other parts of West Africa sub region<sup>(30)</sup>

Obstructed labour is common obstetric complication in Nigeria associated with poor and maternal outcome. Nigeria has a population of 150million and very few trained health personnel's compared to the existing population. Majority of the women have no easy access to functional health facility and even where they come early the staff are inadequate and overworked. Childhood under nutrition is not uncommon resulting in the women having small pelvises resulting in obstructed labour.<sup>(29,30)</sup> In a study over a period of five years in the southern part of Nigeria<sup>(18,20)</sup> the incidence of obstructed labour was found to be 4.7% and in a previous study from Kano by Yakasai et-al they found the incidence of obstructed labour to be 10% .<sup>(27)</sup>

In a study from Gombe in Nigeria maternal mortality rate from obstructed labour was found to be 76/1000 and perinatal mortality rate of 63/100<sup>(28)</sup>. In this study the perinatal mortality rate was significantly lower 29/100 though similar to that reported from Enugu in the eastern part of Nigeria . This may be because both Enugu and Kano are more cosmopolitan than Gombe in the same country.

All the babies belonging to mothers in the control group were alive while only 12 (24.0%) among the cases were alive, ( $p < 0.001$ ). None of the controls lost their lives compared to cases where 7 (14.0%) of the mothers died, ( $p = 0.012$ ). Babies in women with obstructed labour died because they suffer anoxia and hypoxemia due to abnormal electrolyte changes in the mother. This leads to accumulation of hydrogen ions in the maternal circulation that pass on to the fetus leading to fetal acidemia and death. Fourteen percent (14 %) of the women with obstructed labour died because they came late to the hospital and severely septicaemic and with severe electrolyte derangement, despite attempts at correcting these electrolytes abnormalities and intravenous antibiotics these women eventually died because of the irreversible systemic changes and overwhelming infection. The maternal mortality is much higher than that from Enugu, and Calabar<sup>(18,23,24)</sup> which may well be the women in the Southern part of the country have better health seeking behavior than their counter part from the north.<sup>(17,19,21,26)</sup>

## CONCLUSIONS

Obstructed labour is clearly associated with electrolyte derangements and poor feto-maternal outcomes compared to normal labour. It is recommended that

obstructed labour should be prevented but when it occurs, electrolyte imbalance should be corrected urgently to forestall its deleterious effects on maternal health.

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