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Prevalence and Clinical Outcome of Neonates with Macrosomia Admitted in the Special Care Baby Unit of the Rivers State University Teaching Hospital, Nigeria

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ABSTRACT

Background: Macrosomia, now an emerging public health problem in the world has significant maternal and neonatal morbidity and mortality.

Objectives: To determine the prevalence and clinical outcome of macrosomic babies admitted into the neonatal unit of the Rivers State University Teaching Hospital, Nigeria.

Materials and Methods: It was a prospective study carried out from April 2019 to March 2020.

Results: There were 1,938 deliveries during the period of study of which 173 weighed ≥4000g giving a prevalence rate of 8.9%. Males predominated 43(59.7%) with a M: F ratio of 1.5: 1 and mode of delivery was majorly via Caesarean section 55(76.4%). Most mothers of macrosomic babies were aged, 27-36 years 46(63.9%) and were mainly multiparous 49(68.6%). The commonest indications of Caesarean section were cephalopelvic disproportion (34.0%), previous Caesarean section (28.3%) and big baby (18.9%) while the commonest morbidities observed were probable sepsis (48.6%), neonatal jaundice (31.9%), difficulty breathing (30.6%) and hypoglycaemia (25.0%). Probable sepsis, difficulty breathing, infants of diabetic mothers and transient tachypnea of the newborn were significantly associated with macrosomia (P<0.05). Neonates with macrosomia were 2times more likely to be infants of diabetic mothers (95% CI: 1.14-4.53) and had 2times the risk of having transient tachypnea of the newborn (95% CI: 1.19-3.46). Sixty-two (86.1%) babies were discharged and 2(2.8%) died.

Conclusion: The prevalence of macrosomia is high (8.9%) with male preponderance. A mortality of 2.8% therefore calls for a high index of suspicion during the antenatal and neonatal period so as to reduce both maternal and neonatal morbidity and mortality.

Key words: Neonates, Macrosomia, Prevalence, Outcome, Nigeria

INTRODUCTION

Macrosomia, a growing public health problem is an important cause of perinatal morbidity and mortality. It has no universally accepted definition as this term implies growth beyond an absolute birth weight. Various definitions of macrosomia include birth weights greater than 4000g or 4500g regardless of the gestational age or birth weights greater than the 90th percentile for the population and sex-specific growth curve.[1,2] The most accepted definition however is birth weight of or greater than 4000g.[3]

The prevalence of macrosomia varies among different geographic and ethnic groups, affecting about 1-10% of all pregnancies [2,4] and these rates are said to be higher in affluent/developed countries.[5] The prevalence of macrosomia has been shown to increase world-wide over the years.[6,7] The increased prevalence in developing countries is attributable to increasing maternal obesity and diabetes mellitus.[8,9]

The exact cause of fetal macrosomia is unknown however some predisposing factors implicated includes higher maternal age, maternal diabetes mellitus, previous delivery of a macrosomic baby, excessive weight gains during pregnancy, pre-pregnancy maternal obesity, prolonged pregnancy, multiparity, male fetus and parental stature.[10,11]

Macrosomia adversely affects the outcome of both the mother and the child.[12,13] It is worthy of note that these adverse effects increases as the birth weight of the fetus increases.[14] Maternal complications resulting from foetal macrosomia includes prolong labour, cephalopelvic disproportion with fetal distress, greater likelihood of instrumental and Caesarean section deliveries, postpartum haemorrhage and perineal lacerations while neonatal complications includes perinatal asphyxia, birth injuries (shoulder dystocia, brachial plexus injury, skeletal injuries), meconium aspiration, increased risk of premature rupture of membranes, hypoglycaemia, hyperbilirubinaemia, polycythaemia and an increased incidence of perinatal mortality.[15,16] Long term complications have been observed in macrosomic babies in adulthood and this includes certain cancers, coronary artery diseases, hypertension, obesity and insulin resistant diabetes mellitus.[17,18]

Maternal and neonatal complications can be minimised if diagnosis of macrosomia is made in the antenatal period as this would guide the obstetrician on the best mode of delivery. It is worthy of note however that diagnosis of fetal macrosomia can be problematic and inaccurate.[16] This is because ultrasound scan techniques are not highly reliable as the probability of a correct diagnosis is only 22-37%.[19]

Although several studies have been done on macrosomia mainly on the predisposing factors and maternal outcome, there is paucity of data on the neonatal complications especially in developing countries. The above study is therefore being carried out to determine the prevalence and clinical outcome of inborn neonates with macrosomia admitted in the special care baby unit of the Rivers State University Teaching Hospital, Nigeria. Adequate knowledge of these neonatal complications will give clinicians a high index of suspicion and thus better manage anticipated complications that may arise.

MATERIALS AND METHODS

It was a prospective study carried out in the special care baby unit (SCBU) of the Rivers State University Teaching Hospital (RSUTH) from 1st April 2019 to 31st March 2020. The RSUTH, a tertiary health facility owned by the Rivers State Government is a 375 bedded hospital which serves as referral for all the Primary Health Centres (PHC), General hospitals and private health facilities within and around the state. It comprises of various departments apart from the department of Paediatrics. These includes departments of Obstetrics and Gynaecology, Surgery, Internal Medicine, Family Medicine, Pathology, Physiotherapy, Pharmacy as well as nursing. The department of Paediatrics consist of various specialties such as neonatology, nephrology, endocrinology, infection and immunology, haem-oncology, cardiology, pulmonology, community, social and adolescent paediatrics.

The neonatology unit which is a 30 bedded unit, consist of two sections; inborn and outborn units. The unit is run by 2 consultants, resident doctors, house officers and nurses: patient ratio of 4:1. The inborn section consist of 23 infant cots, 7 incubators, 2 resuscitaire/warmers, 10 phototherapy machines, oxygen cylinders and oxygen concentrators. This unit admits all newborns whose mothers had antenatal care in RSUTH, any of the PHC centres and general hospitals owned by the Rivers State Government and delivery in any of these centres. The outborn unit which consist of 7 infant cots, 3 incubators, 1 resuscitaire /warmer, 4 phototherapy machines, oxygen concentrators and oxygen cylinders admits newborns whose mothers did not attend

antenatal clinic in RSUTH, PHC and any of the government owned general hospitals.

Ethical clearance was obtained from the Rivers State Health Research Ethics Committee before commencement of the study and informed consent from the parents/caregivers before recruitment of the neonates.

All inborn neonates with birth weights 4000g and above irrespective of their gestational age and whose parents/ caregivers gave consent were consecutively recruited into the study whereas all outborn neonates, neonates whose birth weights were less than 4000g and/or whose parents/caregivers did not give consent were excluded from the study.

A research proforma was administered to each neonate recruited. The neonatal information included birth weight, sex, gestational age obtained from the first day of the last menstrual cycle or from abdominal ultrasound scan done in the first trimester of pregnancy, age at presentation, birth order and time of commencement of feeds. Diagnosis was made based on the unit's protocol either clinically with or without the use of laboratory investigations where necessary. The outcome of the neonates were determined by close follow up from admission to either discharge, death, discharged against medical advice or referred to other centres for cases where desired services were unavailable in RSUTH. Maternal information obtained were age as at last birthday, marital status, parity, place of antenatal care, mode of delivery, mother's level of education and mother's occupation.

Data were entered into Microsoft Excel spreadsheet and thereafter analysed using SPSS version 23. The results were presented in frequency tables, percentages, bar and pie charts. Chi-square test of association and Fishers' exact test were carried out to determine if there were statistical significance between outcome variables and the independent variables. Statistical significance was considered if P value was <0.05 at 95% confidence interval. Relative risk was calculated to show the risk of macrosomia among babies with respect to the morbidity pattern and the socio-demographic characteristics.

RESULT

Socio-demographic / clinical characteristics of neonates with macrosomia

Table I: Socio-demographic/clinical characteristics of neonates with macrosomia

Variables	Frequency, n=72 (%)
Sex	
Male	43 (59.7)
Female	29 (40.3)
Age at presentation (hours)	
≤ 24	69 (95.8)
> 24	3 (4.2)
Birth order	
1st	26 (36.1)
2nd	18 (25.0)
3rd and above	28 (38.9)
Mode of delivery	
SVD	17 (23.6)
CS	55 (76.4)
Birth weight(kg)	
4000-4599	65 (90.3)
4600-4999	5 (6.9)
> 5000	2 (2.8)
Commencement of feeding	
Day 1	35 (48.6)
Day 2 and above	37 (51.4)
Temperature at presentation(°C)	
< 36	17 (23.6)
36-37.5	49 (68.1)
> 37.5	6 (8.3)
Duration of stay(days)	
< 1	7 (9.7)
1-7	27 (37.5)
≥ 7	38 (52.8)

There were 1,938 deliveries during the period of study of which 173 babies had birth weights 4000g and above giving a prevalence of macrosomic births as 8.9%. Of the 173 macrosomic babies delivered, 72 were admitted into the SCBU constituting a macrosomic admission rate of 42%. Total admission in the SCBU during the period of study was 468 of which 72 were macrosomic, constituting 15.4% of all admissions. Males predominated, 43 (59.7%) with a M: F ratio of 1.5:1. Majority presented within 24 hours of life 69 (95.8%), had a median age at presentation of 2 hours and were mostly of the 3rd birth order and above, 28 (38.9%). Delivery was mainly via Caesarean section, 55 (76.4%) and commenced feeds majorly on day 2 and above 37 (51.4%). Most macrosomic babies

were of birth weights 4000-4599kg (90.3%), had temperature at presentation of 36-37.5^{o}C 49 (68.1%) with duration of stay on admission being greater than 7 days 38 (52.8%), Table I.

Maternal Socio-demographic characteristics

Neonates with macrosomia were delivered mostly by mothers aged 27-36 years, 46 (63.9%) and were mainly married, 69 (95.8%). They were multiparous 49 (68.1%), had antenatal care mainly in RSUTH, 48 (68.6%) and had complications of pregnancy, 41 (56.9). Most mothers had tertiary level of education, 41 (56.9%) and were mainly business women 24 (33.3%), Table II.

Table II: Maternal Socio-demographic characteristics

Variables	Frequency, n=72 (%)
Mother's age (years)	
17-26	11 (15.3)
27-36	46 (63.9)
> 36	15 (20.8)
Marital status	
Married	69 (95.8)
Single	3 (4.2)
Parity	
Primiparous	23 (31.9)
Multiparous	49 (68.1)
Place of antenatal care	
PHC	22 (31.4)
RSUTH	48 (68.6)
Presence of pregnancy complications	
Yes	31 (43.1)
No	41 (56.9)
Mother's level of education	
No formal education	0 (0.0)
Primary	4 (5.6)
Secondary	27 (37.5)
Tertiary	41 (56.9)
Mother's occupation	
Housewife/unemployed	20 (27.8)
Civil/Public servant	23 (31.9)
Business	24 (33.3)
Professionals	5 (7.0)

Indications of Caesarean section in mothers of neonates with macrosomia

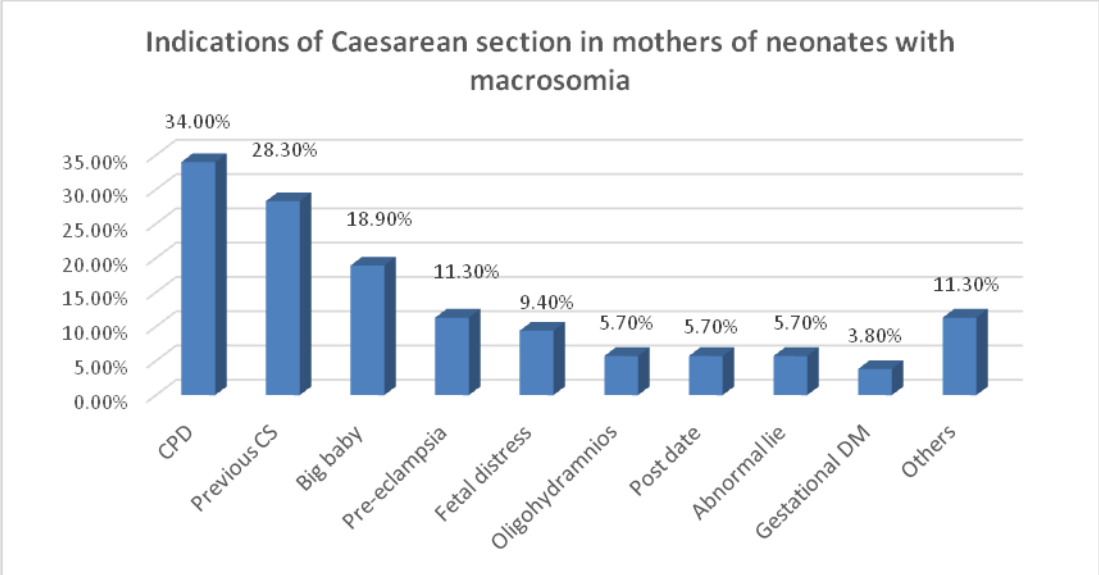

Figure 1: Indications of Caesarean section in mothers of neonates with macrosomia

The commonest indications of Caesarean section among mothers of neonates with macrosomia were cephalopelvic disproportion 18 (34.0%), previous Caesarean section 15 (28.3%), big baby 10 (18.9%) and pre-eclampsia 6 (11.3%), Figure 1.

Association of morbidity pattern in neonates with macrosomia

The commonest morbidities observed in neonates with macrosomia were probable sepsis 35 (48.6%), neonatal jaundice 23 (31.9%), difficulty in breathing 22 (30.6%) and hypoglycaemia 18 (25.0%).

Neonatal sepsis (P value-0.002), difficulty in breathing (P value-0.010), Infants of diabetic mothers (P value-0.017) and transient tachypnea of the newborn (P

value-0.043) were significantly associated with macrosomia.

Neonates with macrosomia were 2 times more likely to be infants of diabetic mothers (95% CI: 1.14-4.53) and have 2 times the risk of having transient tachypnea of the newborn (95% CI: 1.19-3.46), Table III.

Table III: Association of morbidity pattern in neonates with macrosomia

Morbidity Pattern	Macrosomia n = 72 (%)	No Macrosomia n = 396 (%)	P value	RR (95% CI)
Probable sepsis	35 (48.6)	230 (58.1)	0.155	0.7 (0.47-1.11)
Neonatal jaundice	23 (31.9)	206 (52.0)	0.002*	0.5 (0.31-0.77)
Difficulty in breathing	22 (30.6)	186 (47.1)	0.010*	0.5 (0.34-0.87)
Hypoglycaemia	18 (25.0)	83 (21.0)	0.534	1.2 (0.75-1.97)
IDM	12 (16.7)	30 (7.6)	0.017*	2.0 (1.19-3.46)
Congenital malaria	8 (11.1)	34 (8.6)	0.501	1.3 (0.65-2.46)
TTN	6 (8.3)	12 (3.0)	0.043*	2.3 (1.14-1.16)
Birth asphyxia	4 (5.6)	50 (12.6)	0.107	0.4 (0.14-1.16)
Severe anaemia	3 (4.2)	36 (9.1)	0.244	0.5 (0.16-1.45)
Neonatal meningitis	1 (1.4)	6 (1.5)	1.000	0.9 (0.15-5.77)
Birth trauma	2 (2.8)	8 (2.0)	0.656	1.31 (0.37-4.61)
Congenital abnormalities	2 (2.8)	13 (3.3)	1.000	0.9 (0.23-3.19)

Association between selected variables and macrosomia

Birth weight, gestational age and temperature at presentation were significantly higher in neonates with macrosomia (P value < 0.05) Table IV.

Table IV: Association between selected variables and macrosomia

Variables	Macrosomia Mean ± SD	No macrosomia Mean ± SD	T test/ P value
Packed cell volume (%)	47.68 ± 6.11	46.24 ± 8.21	0.209
Birth weight (kg)	4290 ± 290	2550 ± 790	< 0.001*
Gestational age (weeks)	38.63 ± 2.20	36.16 ± 3.63	< 0.001*
Mother's age (years)	31.57 ± 4.69	31.84 ± 5.48	0.664
Temperature at presentation (°C)	36.33 ± 0.74	36.07 ± 1.10	0.049*

Outcome of neonates with macrosomia

Of 72 neonates with macrosomia, 62 (86.1%) were discharged home while 2 (2.8%) died, Table IV.

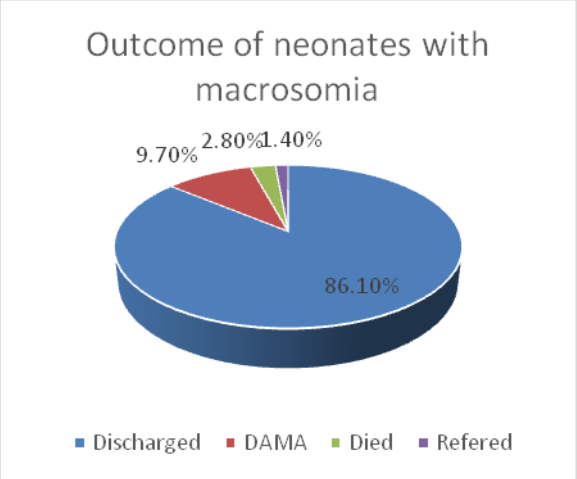

Figure 2: Outcome of neonates with macrosomia

DISCUSSION

The prevalence of macrosomic deliveries in Rivers State University Teaching Hospital of 8.9% was comparable with the 8.6%, 8.1%, 8.0% and 7.4% observed in Turkey, [20] Enugu [21] (South-East Nigeria), Edo [22] (South-South Nigeria) and a previous study in Port Harcourt [23] (South-South Nigeria). It was lower than the 10.5%, 11.8%, 12.1%, 15.8% and 29.2% documented in Ghana, [24] Iran, [25] Nepal, [26] Tunisia [27] and Canada [28] respectively but however higher than the 5.5%, 4.7%, 2.3% and 2.1% documented in Benin [29] (South-South Nigeria), Sagamu [30] (South-West Nigeria), Tanzania [31] and Sokoto [32] (North-West Nigeria) respectively. The high prevalence observed in the present study as compared to the previous study in Port Harcourt done a decade ago is in keeping with the fact that the prevalence of macrosomia is increasing and has been predicted to keep rising in the future. [26] This is not surprising as

macrosomia in the present study constituted about 15.4% of all admissions in the SCBU. The varying prevalence observed could be attributable to the geographic and ethnic differences, different inclusion criteria, difference in the socio-economic factors of the study populations as well as the variation over time.

Macrosomia is said to be an emerging public health problem both in the developed and developing countries. [8] This is evidenced in the present study which showed an admission rate of 42% of all macrosomic babies delivered in RSUTH. This was comparable to the 43.3% reported in Abuja [33] but lower than the 69% reported in Tanzania. [34] Macrosomia is thus of great concern to clinicians as it is a cause of significant morbidity and mortality if not properly managed. [35]

There was a male preponderance with M: F ratio of 1.5: 1 in the present study. Similar observations were made in other parts of Nigeria, [22,23,30,32,33] Turkey, [20] Ghana, [21] Iran [25] Tanzania, [31] Ethiopia [36] and Nepa. [37] Macrosomia has been observed more commonly in the male gender than the female gender as male fetuses are usually about 150g heavier than their female counterparts. Ricart et al [38] in their study also showed that maternal glucose tolerance status was a significant predictor of fetal macrosomia in the male gender.

More than three quarters of macrosomic neonates were delivered via Caesarean section in the present study as observed in other parts of Nigeria, [21,22,29,30,32] Turkey, [20] Nepal [26] and Tanzania. [31] The previous study in Port Harcourt [23] carried out over a decade ago reported a preponderance of vaginal delivery as observed also in Libya. [37] This difference could be because of varying units' protocols or guidelines adopted by the various health facilities, low practice of instrumental deliveries as well as varying acceptance of operative deliveries. It is however important to note that operative deliveries are not uncommon in macrosomic babies due to the prevalence of pregnancy complications observed in these mothers such as cephalopelvic disproportions(CPD) with fetal distress.

Commonest indication of Caesarean section (CS) in the present study was cephalopelvic disproportion followed by previous Caesarean section and antenatal diagnosis of big baby. Similar observation was made by Basher et al [37] in Libya. Contrary to the present study however, Akindele et al [33] in Abuja, Nigeria reported antenatal diagnosis of macrosomia as the commonest indication for Caesarean section followed by CPD and other elective indications whereas Said and Manji [31] in Tanzania reported previous CS as the commonest indication followed by CPD (obstructed labour), and fetal macrosomia. It is pertinent to note that macrosomia could predispose to cephalopelvic disproportion due to their large size leading to complications in the mother and child thereby increasing the probability of operative delivery. [14] The risk for Caesarean section thus increases with increase in the birth weight.

In the present study, mothers of higher maternal age delivered more neonates with macrosomia. Mothers aged 27-36 years in the present study accounted for the highest number of macrosomic babies followed by mothers > 36 years while the least was observed in younger mothers < 26 years. This pattern was also reported by Onankpa and Nauzo, [32] Akindele et al [33] and Basher et al. [37] Some other studies [21,23,25,26,30,31] also reported macrosomia being commoner with higher maternal age. This can be explained by the fact that increased maternal age usually affects maternal metabolism which increases the growth velocity in the fetus.

More than 2/3rd of the macrosomic babies were delivered by multiparous women. Nkwabong et al [39] reported that women with parity > 3 were prone to have macrosomic babies. This is because there is usually an increase in the weights of babies by 100-150g with each pregnancy thereby

increasing the risk of macrosomia. Also, increased parity has been associated with reduced sensitivity of insulin resulting in increased glucose availability for placental glucose transport which leads to more adipose tissue deposition in the fetus and increased weight. [40,41] Other studies [23,25,26,29,31,32,42] corroborated same findings.

Mothers with tertiary level of education accounted for more than half of the cases of macrosomia and mothers whose occupation was business also had most macrosomic babies. This can be said to be in line with the fact that macrosomia can be positively influenced by affluence and the social status of the parents as documented by Akindele et al [33] who observed that high social classes I & II were significantly associated with macrosomic deliveries. Contrary to the present study however, Bedu-Addo et al [42] in Ghana reported predominance of primary level of education among the mothers. This difference could be because the latter study was carried out in a rural community and thus the possibility of lower level of education being prevalent.

The commonest morbidity observed in macrosomic babies in the present study was probable sepsis followed by neonatal jaundice, difficulty in breathing and hypoglycaemia. Similarly, Shah et al [26] in Nepal documented neonatal sepsis and neonatal jaundice as the commonest morbidities. In contrast, birth asphyxia was documented as the leading morbidity by Onyaerugha & Ugboma, [23] Ogunfowora et al[30] and Onankpa & Nauza, [32] in various parts of Nigeria whereas hypoglycaemia was documented as the commonest morbidity by Kayode-Adedeji et al, [22] Akindele et al [33] and Said & Manji [31] in Nigeria and Tanzania respectively. These varying morbidities could be attributable to varying geographic locations, pregnancy complications as well as varying diagnostic criteria in the various health facilities. Surprisingly, Birth trauma/injuries was the least common among macrosomic babies in the present study accounting for only 2.8% of all morbidities. This was also the case by Ezegwui et al [21] in Enugu, Nigeria where only 2.3% of macrosomic babies had birth trauma while Kayode-Adedeji et al [22] and Said & Manji [31] in Edo state (Nigeria) and Tanzania respectively recorded birth trauma as the least common morbidity observed. This low prevalence of birth trauma could be attributed to the high rate of Caesarean section deliveries as also observed in the present study. Birth trauma is observed commonly in babies delivered vaginally possibly secondary to shoulder dystocia. Akindele et al [33] in their study reported no birth injuries in babies delivered via elective Caesarean section whereas in women who delivered vaginally, 17.9% had shoulder dystocia. The present study also showed that neonatal sepsis, difficulty in breathing, infants of diabetic mothers and transient tachypnea of the newborn were significantly associated with macrosomia. Thus a high index of suspicion is required in neonates with macrosomia. Also, macrosomic babies had twice the risk of developing transient tachypnea of the newborn and also 2X the likelihood of being infants of diabetic mothers. Maternal diabetes in pregnancy has been observed to be significantly associated with macrosomia. [29,31,33] This is attributed to the fact that maternal diabetes which is associated with obesity causes fetal hyperglycemia and concomitant hyperinsulinaemia leading to excessive fetal growth.

In the present study, 86.1% of macrosomic babies were discharged home with a mortality rate of 2.8%. There was however zero mortality recorded in Sokoto [32] (North-West Nigeria) and Sagamu [30] (South-West Nigeria). Bedu-Addo et al [42] in Ghana also did not report any perinatal mortality among macrosomic babies. In contrast however, a much higher mortality of 14.4% was reported by Said & Manji [31] in Tanzania. Thus a high index of suspicion is of essence to facilitate early diagnosis of macrosomia during antenatal period and a prompt treatment of anticipated

morbidities thereby reducing maternal and neonatal morbidity and mortality.

CONCLUSION

The prevalence of macrosomia in Rivers State University Teaching Hospital is high being 8.9% with male predominance. Probable sepsis, neonatal jaundice and difficulty in breathing were the commonest morbidities observed. Probable sepsis, difficulty in breathing, infants of diabetic mothers and transient tachypnea of the newborn were significantly associated with macrosomia. Macrosomic babies had 2times the risk of being Infants of diabetic mothers and 2 times the risk of having transient tachypnea of the newborn. Macrosomic babies had a mortality of 2.8% in RSUTH thus a high index of suspicion is vital during antenatal and neonatal period to facilitate early diagnosis and prompt treatment in order to reduce both maternal and neonatal morbidity and mortality.

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