MACROSOMIA; RISK FACTORS AND LABOR OUTCOME

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ABSTRACT

This is a case-control comparative study carried out in Al-Basrah maternity & child hospital to estimate the frequency of macrosomic newborns among all deliveries conducted in the study period (November 2008-September 2009) to identify demographic, medical and obstetrical risk factors that carry risk of macrosomia as well as to assess labor and neonatal outcome. All gravid women who delivered macrosomic newborns during the study period were included who constitute 208 cases. This case group was compared to 250 gravid women who were selected among those who delivered newborns with birth weight of 3.000gms and more and less than 4.000 gms as control group. Macrosomic newborns constitute 1.4% of all deliveries. Advanced maternal age, high parity and obesity were the main demographic risk factors. Other factors which carry risk for macrosomia include previous macrosomic infant, prolonged gestation, maternal D.M and hypertension and male sex of newborn. Macrosomic newborns were delivered more likely by cesarean section which was indicated commonly for cephalo-pelvic disproportion. Those who delivered macrosomic newborns had significantly higher obstetrical complications in term of meconium stained liquor, prolonged labor, postpartum hemorrhage and genital tract injury. Adverse neonatal outcome was reported among macrosomic newborns with significantly higher rate of stillbirth, shoulder dystocia and low apgar score.

In conclusion; macrosomia still represent a significant problem with increased maternal morbidity, neonatal morbidity and mortality.

INTRODUCTION

Two terms identify excessive fetal growth**;** either large for gestational age which means a birth weight equal to or greater than 90th percentile for a given gestational age [1] or fetal macrosomia which implies growth beyond specific weight usually 4000gms or 4500gms regardless of gestational age. [2] Macrosomia occurs in 6-10% of all deliveries, [3] while in other study it affects 9% of all deliveries**.**[4] Excessive fetal growth caused either by genetic factors as race & stature or environmental factors as altitude and availability of adequate nutrition, or the cause may be physiological as altered glucose metabolism and micro vascular integrity or pathological as hypertension, uterine malformation, pre-eclampsia and gestational diabetes.[5] The risks to both mothers and newborns increase significantly as fetal weight climbs beyond 4.0 Kgs including:-prolonged labor, shoulder dystocia, brachial plexus injury, bone injury, intrapartum asphyxia, maternal birth canal and pelvic floor injuries and postpartum hemorrhage.[6] As consequence there is an increase in frequency of operative vaginal delivery as well as cephalo-pelvic disproportion which contribute to higher rate of cesarean section compared to normal weight newborns. [7]

Macrosomia can be predicted by:-

1. Clinician's estimation of fetal weight [Leopold's maneuvers]:- It is the estimation of size of fetus by transabdominal wall palpation. Such estimation altered by physiological characters as**:** amniotic fluid volume, uterine size and configuration and maternal body habits. [8]

2. Risk factors assessment:- Systematic assessment of clinical risk factors including:- abnormal (50gms) glucose stress test, abnormal single (3) hours glucose tolerance test, maternal diabetes, maternal obesity, maternal height >5ft, pregnancy weight gain>35Ib, prolong gestation, maternal age>35 y, multiparty, male fetus, caucasion maternal race and previous macrocosmic infant**.** [9]

3. Obstetric ultrasound: - It has been proposed as more accurate method; its estimation of fetal weight and abdominal circumference correlate with diagnosis of 88% of macrosomia. [10] Little is known about prevention of macrosomia.The association between maternal weight, weight gain during pregnancy and macrosomia has led to a proposal that optimization of maternal weight before pregnancy and limitation of weight gain during pregnancy should be a useful strategies**.**[11] The management strategies for suspected fetal macrosomia include either elective cesarean section to prevent birth trauma [12] or early induction of labor; since the fetus continues to gain about 230 gms per week after 37 weeks [13]; elective induction of labor near term has been suggested to prevent macrosomia and its complications. [14]

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The aim of this study is to identify the incidence of macrosomia among deliveries conducted in Basra Maternity Hospital, to evaluate the maternal demographic, obstetrical and medical risk factors as well as to determine adverse outcome including labor complications and neonatal complications.

MATERIALS AND METHODS

A comparative case–control study was carried out over a period of ten months from the 1st of November 2008 till the 1st of September2009 in Basrah Maternity & Child Hospital. It includes 208 pregnant women who delivered macrosomic single term newborns as case group compared to 250 pregnant women who delivered single term newborns with normal birth weight as control group. Macrosomia was diagnosed on the bases of estimated birth weight of newborn to be ≥4.0 kgs, while normal birth weight range was between 3000-3999gms**.** A special printed questionnaire formula were used for all participants to collect data about age, parity, maternal body weight and height, gestational age, maternal gestational or established D.M., history of hypertension, previous macrosomic newborns, as well as mode of delivery, obstetrical complications, birth weight, sex of newborn and neonatal complications with apgar score. Body mass index (BMI) was estimated by measuring maternal weight in kilograms divided by height in meter squared (kg/m^2). It can be acceptable if it is ranged between 19–25, over weight if it is 25–30, obese if it is 30–40, and morbidly obese if it is > 40. [15] Evaluation of Apgar score including heart rate, respiratory effort, muscle tone, facial grimace and color was done within one minute and five minutes after birth. A score of 7-10 indicates the best possible condition of newborn, a score of 0-3 requires immediate resuscitation including intubations and admission. A score of 4-7 indicate use of some measures of resuscitation and newborn will be in favorable condition. [16] The (Z-test) was used to test the significant difference in proportions of maternal demographic and obstetrical risk character, obstetric complications and birth outcome. $P<0.05$ was considered statistically significant and $P<0.01$ was highly significant.

RESULTS

Out of 14797 gravid women who delivered in this hospital during the study period; 1.4% had delivered macrosomic newborns. Maternal demographic characters that contribute to high risk of macrosomia were shown in **(**Table-1). About 123 cases of the case group were aged above 30years compared to about 77 of the control group with statistically highly significant difference $P<0.01$**.** Those who delivered macrosomic newborns tend to have high parity mainly grand multiparae i.e.>5 deliveries who represented nearly one third of cases 34.2%, while about half of control group 48% had 1-4 deliveries with statistically highly significant difference $P<0.01$. Nearly half of cases 50.5% were heavier in their body weight than controls since they classified as obese and morbidly obese according to (BMI), whereas 90% of control group were classified as acceptable and over weight with statistically highly significant difference $P<0.01$.

Table 1. Maternal demographic risk factors

Risk factors	Cases (208)		Control (250)	
	No.	%	No.	%
1. Maternal age: < 18 years 18- 30years >30 years	6 79 123 **	2.8 37.9 59.3	15 158** 77	6 63.2 30.8
Total	208	100.0	250	100.0
2. Maternal parity: Nullipara 1–4 5–7 >7	40 47 77* 44**	19.2 46.6 13 21.2	50 119** 63 18	20 47.6 25.2 7.2
Total	208	100.0	250	100.0
3. B.M.I Acceptable. Over weight. Obese. Morbidly obese.	14 89 97** 8*	6.7 42.8 46.6 3.9	67 ** 158 ** 23 2	26.8 63.2 9.2 0.8
Total	208	100.0	250	100.0

***:P< 0.05** ****: P< 0.01**

(Table-2), shows the obstetrical risk factors that predispose to macrosomia. 35% of cases had previous history of delivery of macrosomic infant compared to only (7%) of the control group with highly significant difference P<0.01**.** Gestational age has been continued after the expected date of delivery in 42% of cases compared to 17% of control group P<0.01**.** Maternal D.M. whether established or gestational and hypertension whether chronic or pregnancy induced carry risk of macrosomia. 14% of the case group had D.M. compared to 4% in the control group while 25% of the case group had hypertension compared to 10% in the control group with statistically highly significant difference P<0.01**.** Macrosomic newborns were mainly of male sex, they constitute 64% of cases whereas 32**%** of the control group were of male sex with statistically highly significant difference P<0.01**.**

Table 2. Obstetrical risk factor

Risk factors	Cases (208)		Control (250)	
	No.	%	No.	%
1. Previous macrosomic infant.	73**	35.1	17	6.8
2. Prolong gestational age.	87**	41.8	42	16.8
3. Maternal D.M.:	29**	13.9	10	4
A .Gestational D.M.	15**	7.2	5	2
B. Chronic D.M.	14**	6.7	5	2
4. Maternal hypertension:	52**	25	24	9.6
a. Chronic hypertension.	22*	10.5	15	6
b. Gestational hypertension.	22**	10.5	7	2.8
c. Chr. hypertension with superimposed PE.	8*	3.8	2	0.8
5. Sex of infant:				
A. Male.	132**	63.5	81	32.4
B. Female.	76	36.5	169**	67.6

Labor outcome was shown in (Table-3), where the rate of C/S was significantly higher in cases 44.8%versus 15.6% in the control group. Delivery in the study cases tend to be complicated more with meconium stained liquor 29.8%, prolong labor 50.4%, postpartum hemorrhage 26.9% & genital tract injury 12.5% compared to 8%,6.4%,5.6% & 3.2% respectively in the control group with highly significant difference P<0.01**.** Uterine atony was the major cause of postpartum hemorrhage in both groups and it was complicated more cases in the case group compared to the control group 17.7% versus 4% while perineal and vaginal injuries were the commonest injuries of the genital tract in both groups and also they were more in the case group compare to the control group 9.6% versus 1.6%.

3. Obstetrical complications.

Events	Cases (208)		Control (250)	
	No.	%	No.	%
a. Mecouium stained liquor.	62**	29.8	20	8
b. Prolonged labor.	105**	50.4	16	6.4
c. Post partum hemorrhage.	56**	26.9	14	5.6
I- Uterine atony.	37**	17.7	10	4
II- uterine atony + injury.	19**	9.1	4	1.6
d- Genital tract injury.	26**	12.5	8	3.2
1. I-perineal + vaginal.	20**	9.6	4	1.6
2. II- vaginal alone.	4	1.9	2	0.8
III- cervical + vaginal.	2	0.9	2	0.8

Indications of C/S were listed in (Table-4), 86% of C/S in case group were done for cephlo-pelvic disproportion compared to only 36% in the control group while C/S for fetal distress and malpresentation were done more in the control group 30.8% and 12.9 versus 2.2%, 2.2% in the case group with statistically highly significant difference P<0.01.

Table 4. Mode of delivery& Indications of cesarean section.

	Cases (208)		Control (250)	
	No.	%	No.	%
1-Mode of delivery a. Normal vaginal delivery b. Cesarean section c. Instrumental	 113 93** 2	 54.3 44.8 0.9	 207** 39 4	 82.8 15.6 1.6
Indications C.P.D. Fetal distress Accidental hemorrhage Cord prolapse Malpresentation	 80* 5 4 2 2	 86 5.3 4.3 2.2 2.2	 14 12** 4 4** 5**	 35.9 30.8 10.2 10.2 12.9
Total	93	100.0	39	100.0

(Table-5), shows the neonatal outcome; still births whether fresh or macerated were more in the case group 6.25% & 2.8% compared to1.2% & 0.4% in the control group with highly significant difference P<0.01. Women in the case group delivered a neonate with body weight of 4000–4499gms in 64% while 22% weighed 4500–4999gms and 14**%** weighed >5000gms. 13.4% of macrosomic newborns had birth complication in term of shoulder dystocia; 1.9% of them developed brachial plexus injury. 19.2% of macrosomic newborns had low Apgar score **(i.e.0–3)** assessed by pediatrician compared to 4.8% of the control group with statistically highly significant difference P<0.01. About 43% of macrosomic newborns were admitted to NICU compared to only 8% of controls with statistically highly significant difference P<0.01.

Table 5. Neonatal outcome

Outcome	Cases (208)		Control (250)	
	No.	%	No.	%
1. Live	189	90.8	246**	98.4
Dead:- a. Fresh b. Macerated	19** 13** 6**	9.1 6.25 2.8	4 3 1	1.6 1.2 0.4
3. Birth weight:- 3000- 3499gms 3500- 3999gms 4000- 4499gms 4500- 4999gms >/5000	133 46 29	63.9 22.1 14	140 110	56 44
4. Birth injuries:- Shoulder dystocia Brachial plexus injury Skeletal & other injury	28 4 1	13.4 1.9 0.4	0 0 0	
5. Apgar score within 5 min. 0-3 4-7 >7	40** 50 118	19.2 24 56.8	12 90** 148**	4.8 39.2 56
6. Admission to NICU	89**	42.7	20	8

DISCUSSION

The incidence of macrosomia in this study was 1.4% which is lower than that reported by other studies 4.5%[17] and 9.1**%.**[18] this can be explained by small sample size of the studied group consequent to short duration during which this research had been done. The study group were significantly older in their age, higher in their parity as well as heavier in their body weight compared to the control group; this goes with the concept published by other studies that mothers who delivered macrosomic newborns were more likely to be older and less likely to be primiparus and <18years[19] but tend to be multiparous **(2-3)** times more.[20] Also it is

similar to the results of other studies which conclude that the chance of delivery of macrosomic newborns was **(3.5)** times more among women in upper quartile of BMI **(>25kg/m^2)** compared to those with lowest quartile **(<20kg/m^2).**[2 1] About one third of the study group had previous history of delivery of macrosomic newborn, so it goes with the concept that previous delivery of macrsomic infant increase the probability of macrosomia in subsequent pregnancies.[19] 42% of the study group had prolonged pregnancy beyond 40 weeks**;** this is similar to the results obtained by another study where about 10-30% of macrosomic newborns delivered beyond 40weeks.[20] Maternal D.M. is considered as strong risk factor since it results in **(two folds)** increase in incidence the of macrosomia,[3] so that 14% of the study group had D.M. approximated to that of 20% in other study.[19] From nearly one quarter of cases who had maternal hypertension**;** 14% had gestational hypertension, nearly similar to12.5% obtained by other studies.[19] Two third of macrosomic newborns were of male sex which is another risk factor confirmed by the concept that macrosomic infant were more often male with **1:0.5 ratio.** [18] About 45% of macrosomic newborns had been delivered by C/S which was approximated to the result of 50.6% reported by one study [19] & higher than the result of 14.2% [17] & 9.2% reported by another studies. [18] This difference may be due to the difference in the management protocols used for delivery of macrosomic fetus. One third of macrosomic newborns 29.8% had me conium stained liquor during labor approximated to 22.7% reported by one study**,**[19] while higher than the result of 12.1% reported by other study.[17] This difference can be explained by that 42% of the study group had prolonged pregnancy which is may complicated by me conium stained liquor. Nearly half of cases 50.4% had problems in the progress of labor that result in prolonged labor which is significantly higher than what has been reported by other study 14%.[19] Postpartum hemorrhage and genital tract injury were frequent complications during delivery of macrosomic newborns; 26.9% and 12.5% respectively**.** These percentages were higher than 3.3%[17] and 2.7 %[19] for postpartum hemorrhage and 2.6 %[19] and 0.8 %[18] for birth injuries reported by other studies. C.P.D. was the commonest indication for C/S in the case group which is similar to result obtained in previous study**.** [17] Adverse neonatal outcome in term of high stillbirths among macrosomic newborns is responsible for high prenatal mortality rate. About 2/3 of macrosomic newborns weighed 4.000-4499 gms which is classified as grade I as it identify labor and newborn birth complications; those who weighed 4.500-4999 gms classified as grade II and constitute 22% of all cases; these predict the neonatal mortality while those who weighed ≥5000gms classified as grade III which represent 14% of cases and it is a better indicator of infant mortality**.** [19] Shoulder dystocia complicates 13.4% of macrosomic newborns delivery higher than 2.8% reported in other study**.** [17] This difference can be explained by inability to assess fetal size by abdominal examination by the resident as well as deficient ultrasonographic information about fetal weight and shoulder diameter.

Significantly high percentage of macrosomic newborns 19.2% delivered with low Apgar score ≤ 3in5 min. compared to only 8% reported by other research. [19] 42.7% of macrosomic newborns admitted to neonatal intensive care unit not only because of low Apgar score but for follow up as they were at a risk to develop hypoglycemia.

***In summary*:** Macrosomia remains a significant problem. There is increase risk of both maternal and neonatal complications. No one management plan will be correct for all patients and physicians must be individualizing their clinical judgment.

Recommendation: One must be prepared for complications such as shoulder dystocia as they occur at any delivery. In some clinical situation; awaiting spontaneous labor; induction of labor and elective C/S, all may be reasonable management plans for mothers with suspected macrosomic newborns.

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