Risk Factors for Macrosomia and Neonatal Complication in the Provincial Hospital Mohamed V of Chefchaouen, Morocco

M. El Bakkali[1], F. El Khlifi[2], B. El Houssain[3], A. Reda Daoud[4]

[1, 2] Faculty of Sciences, University Ibn Tofail, Kenitra,
[3, 4] Mohamed V provincial Hospital of Chefchaouen,
MOROCCO.

[1] elbakkalibio@gmail.com, [2] Farid2400@yahoo.fr

ABSTRACT

The aim of the present work was to identify the prevalence and risk factors for macrosomia plus their impact on Maternal and Foetal Outcome.

This retrospective study was carried out in the Mohamed V provincial Hospital of Chefchaouen, Morocco from September 1st, 2013 to august 30 st, 2014.Women who gave birth to ≥ 4,000 or 2500–3,499 g babies and gestational age ≥ 37 years were recruited. Variables recorded were fetal sex and birth weight, gestational age, maternal age, gestity, mother's body mass index (BMI), weight gain during pregnancy, fundal height and neonatal complications.

Approximately 4,4% % of the studied cases were macrosomic babies. The respiratory distress was associated with delivery cesarean section. But the Brachial plexus injury with those vaginally delivered translated by Fetal-pelvic disproportion.

In the multivariate logistic regression model adjusted for fetal sex, fundal height and obesity, the risk for macrosomia was in women which had fundal height to ≥ 33 cm, almost three times ($OR_{ajusted}$=2,64) in case of male sex. Furthermore, after adjustment for sex-fundal height and BMI, the analyses revealed that patients having BMI normal: always gave birth to an eutrophic child ($OR_{ajusté}$=0,17 female vs 0,38 male sex). Moreover, in patients with obesity this risk was twice given birth a macrosomic child ($OR_{ajusted}$=1,80).

Macrosomia by maternal obstetrical factor risk (excessive weight, diabete…) or fetal as sex, could be frequent perinatal complications that can be prevented by better management recognized risk factors.

Keywords: macrosomie, facteurs de risque, complications néonatales, Chefchaouen

INTRODUCTION

Macrosomia characterizes birth weight ≥ 4,000 gor above the 90th percentile (Blondel, 2001). This is a heterogeneous frame because macrosomic newborns have anthropometric and body composition differences.It has implications for maternal and neonatal morbidity including increased risk of dysfunctional uterine contractions, prolonged labor, increased risk of cesarean section, uterine rupture, spontaneous symphysiotomy, obstetrical neuropathy, and lower genital tract lacerations (Ezegui et al, 2011; Alsammani et Ahmed, 2012). On the other hand, shoulder dystocia, Erb's palsy, fracture of the clavicle or humerus, neonatal asphyxia, hypocalcaemia, hypoglycaemia, hypomagnesaemia, hyperbilirubinemia,increased risk of neonatal infection (due toprolonged labor), and sometimes perinatal death (Ezegui et al, 2011;Bérard et al; 1998; Nassar et al, 2003).

These complications explain the increased risk of maternal and neonatal morbidities associated with macrosomic babies. No recent study has evaluated the risk factors for macrosomia in our setting. Knowing risk factors for macrosomiain our environment might help us reducing its prevalence during antenatal care, consequently reducing the prevalence of the many complications above mentioned. The aim of this study therefore was to identify risk factors for macrosomia and neonatal complication in our country.

PATIENTS AND METHODS

This is a retrospective study carried out on 299 cases of birth that happened in the provincial hospital Mohamed V (Chefchaouen in northern, Morocco) from September 1st, 2013 to august 30 st, 2014. Among these cases, 87werea macrosomic babies.

The data was collected from patients' folders.All women who just gave birth to neonates weighing ≥ 4000 g were reviewed. Patients were included in this study if the following criteria were satisfied:

1. Maternal characteristics evaluated were age,single gestation, gestity,pattern of spontaneous and instrumental delivery or caesarean section gestational age, uterine size, mode of delivery,cesarean section history, weight, height pre-pregnancy and diabetes and BMI. Body mass index (BMI): it is defined as the weight in kilogramme divided by the square of the height in metres (kg/m²).Bodymass index (BMI) less than 19.8 kg/m² was used to define underweight, whereas BMI 25,1 to 30 kg/m² defined overweight, and BMI greater than 30 kg/m² was obese. BMI 19.8 to 25 kg/m² was considered normal. spontaneous or induced delivery, The results were compared with those of control group with birth weight between 2500 and 3944 g the same period.
2. Fetal characteristics evaluated were gestational age at delivery, singleton live births, fetal sex, full-term infant, foetus presentation during labour, Apgar score.
3. The neonatal complications evaluated were shoulder dystocia, brachial plexus injury and respiratory distress.

Exclusion criteria were gemellary pregnancy, no cephalic presentation

According to the statistical analysis, we used the Khi-square test to compare absolute frequencies between categories and student t-test to compare continuous variables.

After a descriptive study of fetal or maternal characteristics and birth weight outcomes, we performed logistic regression analysis. Birth weight was included as a dichotomous variable (lower or greater than 4000 g). Other variables with p values < 0.2 in the univariate analysis, or known risk factors of macrosomia were entered into the multivariate logistic regression model. We investigated the association between birth weight was included as a dichotomous variable (lower or greater than 4000) and each studied variable through odds ratio (OR) computed by regression binary logistic. Model 1 includes only the univariate association between dichotomous and each studied variable (crude model). Model 2 includes the simultaneous multivariate analysis of risk factors for macrosomia. Model 3 includes an adjustment for sex-size uterin to≥33cm interaction effect. Model 4 is additionally adjusted for obesity. Level of significance was $P \leq 0.05$.

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RESULTS

During the study period, 112 mothers who delivered macrosomic babies. Only87 cases macrosomia were available for study. It represented 4, 36% of the infants delivered (112of 2567). Birth weights varied between 4000 and 5200 g with mean of 4315±274,1 g in the macrosomic group as against a range from 2500 to 3900 with mean of 3181±489,3 g in the control group (p <0.0001).The mean age of study population was 26 years old, with extreme age from 16 to 45 years. Obstetrical and demographic characteristics of mothers delivering macrosomic babies and those who gave birth to neonates eutrophic child are summarized in the table 1.

For patients with normal BMI, the rate of macrosomia was 4,2% (BMI ≤ 24,9), 32,2% in those who are with BMI 19,8 to 25 kg/m², and 26,7% in those who are BMI greater than 30 kg/m².When compared with patient with normal body mass index in univariate logistic analysis (table 1).Mothers classified as overweight were at increased risk for macrosomia, as were those who were obese. Patient age was not significantly associated with macrosomia. Nevertheless, there was a trends increase of macrosomia risk in the women with age old. Furthermore, the age less than 20 years old, is a protector factor almost significant. Mutigestity was also a risk factor of macrosomia but no significant. Other risk factor for macrosomia included term more than 41 amenorrhoea weeks, and male gender. Regarding to fundal height, the association to macrosomia was where this more than 33 cm.

The analysis of neonatal complications show that thirty-three babies macrosomic had respiratory distress witch twenty-two of them were in the cesarean section delivery, and eleven in vaginal delivery (p <0,05). Furthermore, other complication such as brachial plexus injury was only from normal delivery.

Table 1. Logistic regression univariate model for risk macrosomia

		MacrosoBabies N= 87	*Eutrophic Child N= 212*	*Exp(B)*	*95% CI*	*P-Value*
Obesity Grades	Normal BMI	1 (4%)	23 (96%)	0,09	0,013-0,719	0,023
	Overweight	74 (32%)	156 (68%)	2,04	1,52-3,96	0,035
	Obesity	12 (27%)	33 (73%)	8,3	1,34-52	0,05
Age	< 20 years	8 (18%)	36 (82%)	0,5	0,219-1,107	0,087
	[20-29 years]	51 (27%)	137 (73%)	0,77	0,459-1,277	0,305
	[30-38 years]	21 (40%)	31 (60%)	1,8	0,992-3,440	0,053
	≥ 40 years	7 (50%)	7 (50%)	2,56	0,867-7,502	0,089
Gestity	Pre.gety	3 (15%)	17 (85%)	0,265	0,074-0,943	0,040
	Multgy	56 (41%)	82 (59%)	2,439	0,987-6,025	0,053
	Gd. Multy.	4 (33%)	8 (67%)	0,839	0,242-2,907	0,782

		MacrosoBabies N= 87	*Eutrophic Child N= 212*	*Exp(B)*	*95% CI*	*P-Value*
Fundal Height (F.H)	< 28 cm	2 (17%)	10 (83%)	0,475	0,102-2,215	0,344
	[28-32 cm]	46 (21%)	177 (79%)	0,222	0,127-0,387	0,000
	≥ 33 cm	39 (61%)	25 (39%)	6,077	3,356-11	0,000
Gestational Age	> 41AW	13 (46%)	15 (54%)	2,356	1,65-5,196	0,034
Sex	Female	35 (24%)	109 (76%)	0,636	0,383-1,055	0,080
	Male	52 (34%)	103 (66%)	1	-	-

Where Pre.gety: primer gestity, Multgy: mutigestity, Gd. Multy.:grandmutigestity
AW: amenorrhoea weeks

Results of the multivariate analysis are shown in table 2,3 and 4. In the adjusted model for sex and fundal height effect, risk was in the patients who had fundal height to ≥ 33 cm, 2,64 (OR_{adj}=2,64)gave birth to neonates macrosomic babies when male sex. However, after adjusting for confounding factor, sex-fundal height to ≥33cm-obesity, when including normal BMI, single gestation, the mothers gave birth to neonates eutrophic babies (OR_{adj}=0,17 vs 0,38 male sex), table 3.Moreover, in patients with obesity this risk was twice given birth a macrosomic babies (OR_{adj}=1,80), tableau (4).

Table 2. Logistic regression multivariate model for risk macrosomia

		β	*S.E.*	*Wald*	*p*	*Exp(B)*	*95% CI*
Etape 1[a]	F.H ≥33 cm	0,99	0,38	6,90	0,009	2,71	1,288-5,701
	Constant	-1,23	0,22	30,4	0,000	0,29	
Etape 2[b]	F.H≥33 cm	1,02	0,39	7,02	0,008	2,79	1,306-5,971
	sex	0,82	0,37	4,83	0,028	2,28	1,094-4,737
	Constant	-1,70	0,32	27,4	0,000	0,18	

a. Variable(s) entred on step 1 : fundal height ≥33 cm.
b. Variable(s) entred on step 2 : sex.

Table 3. Logistic regression multivariate model after adjustment for interaction effect of sex-fundal height to ≥33cm

		β	*S.E.*	*Wald*	*p*	*Exp(B)$_a$*	*95% CI*
S. 1[a]	S.U	1,34	0,30	19,4	0,000	3,807	2,101-6,901
	Constant	-1,52	0,17	80,2	0,000	0,218	

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		β	*S.E.*	*Wald*	*p*	*Exp(B)$_a$*	*95% CI*
S. 2[b]	sex	0,73	0,29	6,27	0,012	2,080	1,172-3,692
	S.U ≥33cm	1,36	0,31	19,4	0,000	3,900	2,130-7,142
	Constant	-1,94	0,25	59,4	0,000	0,143	
S. 3[c]	Normal BMI	-1,93	1,04	3,4	0,064	0,145	0,019-1,116
	sex	0,75	0,29	6,48	0,011	2,117	1,188-3,773
	F.H ≥33cm	1,30	0,31	17,58	0,000	3,688	2,004-6,787
	Constant	-1,85	0,25	53,2	0,000	0,157	

a. Variable(s) entred on step 1 : obesity grades, age, Gestity, Fundal height,
b. Variable(s) entred on step 2: gestational age, Sexand obesity * age ≥ 40 years.
*: interaction
$Exp(B)_a$: $Exp(B)_{ajusted}$
S: step

Table 4. Logistic regression multivariate model after adjustment for interaction effect of sex-fundal height to ≥33cm-obesity

		β	*S.E.*	*Wald*	*P*	*Exp(B)*	*IC à 95%*
E. 1[a]	F.H≥33* obesity*sex	1,96	0,44	19,5	0,000	7,07	2,970-16,9
	Constant	-1,38	0,15	83,9	0,000	3,98	
E. 2[b]	F.H≥33	0,83	0,38	4,8	0,029	2,29	1,091-4,83
	F.H≥33* obesity*sex	1,27	0,53	5,57	0,018	3,55	1,240-10,2
	Constant	-1,52	0,17	80,2	0,000	4,59	

a. Variable(s) entred on step 1: fundal height*obesity*sex.
b. Variable(s) entered on step 2: fundal height.

DISCUSSION

The prevalence of macrosomia in this study is 4,36%. Results from batallan et al. (2002), indicate that this rate varied between 2.5 and 4,5 % .Birth weights varied from 4000 to 5200 g. This has already being shown by some authors (Batallan et al., 2002; Das et al., 2009).Macrosomia was more encountered among male sex than among female sex. Some authors also found that male sex was more involved inmacrosomia than female sex (Batallan et al., 2002; Carlus et al., 2000). But the literature does not display elements to explain this tendency.

Our study has shown that macrosomia has an influence on the occurrence of respiratory distress. In fact, macrosomic babies were more prone to respiratory distress than those of normal weight. This is similar to trends observed in other part of Esakoff et al, in a study carried out in 2009, in no diabetic patients. Regarding diabete, Esakoff et al. also reported a higher macrosomia among diabetic mothers. In our series we observed that only two diabetic patients. Whereas, most of the mothers not had a screening of diabete during pregnancy period. Unknown, past or gestational diabete during pregnancy cannot be eliminated however. Nevertheless, it is possible that these women giving birth to macrosomic infants were indeed prediabetic, since in a 12-year follow-up by Nickel et al, 60% of the women giving birth to macrosomic infants have become diabetic. Thus, it is important that maternal diabete should be identified and addressed early in pregnancy to prevent the occurrence of macrosomic babies' outcomes.

Furthermore, the delivery route is an important risk factor. Indeed, cesarean section, in particular the Prophylactic cesarean section expose new-borns at increased risk of respiratory distress syndrome at the lack of secretion of catecholamines during labor to reduce fetal alveolar fluid at 70 to 90% (Berger et al., 1996). Also per partum acidosis, genderand maternal-fetal infections known as risk factors for lung function (Gagné et al, 2013; Berger et al, 1996; Le Guen Gras & Laugier, 2006). It is known that the male gender is risk factor of respiratory distress due to the androgen action on the synthesis of surfactant, delaying lung maturation in male sex compared to female sex (Gagne and al., 2013). Therefore, while we elucidated this association with respiratory distress among macrosomic babies, we could not account for these confounding factors in multivariate analysis model. So, this might be due to possible confusion factor.

Analysis of other macrosomia-associated complications, showed the occurrence of the brachial plexus injury during normal delivery. These results are reported in the literature (Saleh et al., 2008; Bérard et al., 1998). This could be due to fetal-pelvic disproportion. The lack of proper monitoring of pregnancies and screening fetal-pelvic disproportion explain the high rate of caesarean urgent in our series.

After adjusting for sex and fundal height, the risk was twice as high among obese mothers as compared to normal weight. In another studies, this risk was almost three times in moderately obese patients and nine times in severely obese mothers respectively, as compared to mothers normal BMI (Berard et al., 1998; Yogev & Catalano, 2009). Prior studies have demonstrated the presence of obesity among 30 to 40% of mothers with children weighing more than 4000 g (Yogev & Catalano, 2009).The gestational diabete did not appear to be a risk factor in the birth of macrosomic babies in this study. However, the increased risk of macrosomia in obese patients could be due to altered glucose metabolism if the statistical power was large enough in our study.

Finally, we found an increased risk of caesarean section in patients of fundal height≥ 33 cm. but, we have not found in the literature threshold value predicting a risk of caesarean section from fundal height. Further, we acknowledge that antenatal screening for macrosomia affects the delivery route and the cesarean rate is doubled when macrosomia has been suspected before the birth (Weiner et al., 2002).In addition, the chances of vaginal birth is better when testing is clinical and non-ultrasound (Weiner et al., 2002).

These finding are not in favour of vaginal delivery, which is not consistent with the recommendations of the American College of Obstetricians and Gynecologists, not to achieve a programmed systematic cesarean section for fetal weight <5000g in the absence of diabetes

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or 4500g if insulin diabetes (Chatfield, 2001). He could have prevented against complications such as respiratory distress if the care of pregnant women in our series was in good sense.

CONCLUSION

Macrosomia by maternal obstetric risk factors (excessive weight, diabetes...) or as fetal sex could be frequent perinatal complications that can be prevented by better management of the recognized risk factors.

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