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Perinatal and maternal outcomes of fetal macrosomia

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Abstract

Objective: To determine the perinatal and maternal outcome of the macrosomic infants. *Study Design*: A case-control, retrospective study is performed in the Department of Gynecology and Obstetrics, Istanbul University Cerrahpasa Medical Faculty, between 1988–1992. The maternal and neonatal records of infants with birthweight of at least 4000 g ($n = 1000$) were reviewed. Another 1000 cases amongst the newborns delivered in the same period between 2500 and 3999 g formed the control group. The obstetrical outcome variables of the groups including mode of delivery and the incidence of maternal and perinatal complications were compared. *Results*: A total of 16,112 deliveries occurred during the study period. The rate of macrosomic deliveries was 6.21% and the rate of the deliveries (4500 g or heavier) was 1.04%. The mean birthweight of the study group was 4272 ± 239 and 3277 ± 316 g of the control group ($P < 0.001$). While the cesarean section rate was 28.8% for the study group and it was 16.6% for the control group ($P < 0.001$). In the study group, 17 cases of brachial plexus palsy (2.4%), 16 cases of clavicular fracture (2.3%) and one case of humeral fracture were observed ($P < 0.001$). The rate of perinatal mortality was 0.8% in the study group. No perinatal mortality was recorded in the control group. There were 14 cases (1.4%)of asphyxia related to delivery in the study group($P < 0.01$). The rate of maternal complications, were significantly higher in the study group ($P < 0.01$). *Conclusion*: The macrosomic infants are in increased risk for birth trauma and asphyxia. The risk of birth trauma for the infants weighing 4500 g or more is even greater.

Keywords: Macrosomia; Birth trauma; Asphyxia

1. Introduction

The birth weight is one of the important factors affecting the perinatal morbidity and mortality. The ''heavy baby'' is defined as the one that is heavier than 90% of the estimated birth weight [1]. The birth weight is the main criterion for macrosomia. For practical reasons, the newborns weighing 4000 g or heavier are defined as macrosomic [2]. The incidence of macrosomia has increased in the last 50 years, now being reported in 9% in general hospital population [3–5].

Macrosomia may result in perinatal mortality and irreversible sequela because of fetal asphyxia and birth trauma [6]. Recently, developing obstetric techniques and neonatal intensive care conditions have reduced the rate of perinatal mortality and morbidity, especially for the premature and the growth retarded newborns, however, perinatal mortality is still five times higher in macrosomic infants [6]. Meanwhile, macrosomic births may cause maternal mortality and morbidity as a result of genital tract trauma and postpartum bleeding.

Even though, macrosomic births form 10% of all births, the subject is not cited in the literature [7]. The objective of this study is the determination the significance of maternal and neonatal complications due to macrosomic births.

2. Materials and method

The study was performed and completed in the Department of Obstetrics and Gynecology of Cerrahpasa Medical Faculty of Istanbul University between July 1988 and August 1992. The study group was formed of newborns 4000 g or heavier and mothers of these babies ($n = 1000$). During the same period, concurrent births between 2500 and 3999 g, formed the control group ($n = 1000$). The selection criteria for the control group were singleton pregnancy with birth occurring between 37 and 42 weeks. Twin pregnancies and the pregnancies complicated with growth retardation were excluded from the control group. The data have been derived from maternal, neonatal and autopsy records. The data about parity and maternal age were obtained from the

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maternal history. The gestational age was determined according to the first day of the last menstrual period if the menstruation was regular. If it was unknown, the gestational age was determined with respect to the evidence in the first or second trimester ultrasonography. The maternal complications were classified into four groups: genital laceration, uterine atony, placental retention and infection. All of the newborns were examined in the first hour following delivery in the neonatal care unit. The data of the newborns were obtained from the neonatal care unit records. Metabolic complications of the newborns were classified into four groups: hypoglycemia, hypocalcemia, hyperbilirubinemia and polycythemia. The data about neonatal loses were derived from the autopsy records. The fifth minute apgar score below 7, cord arterial pH below 7.20 and hypoxic convulsions were taken into account as the criteria for asphyxia. The cases of meconium aspiration were diagnosed clinically and radiologically within 24 h following the delivery. Brachial and facial paralysis were taken into account, if the problem persisted during the discharge from the hospital. The fractures were verified clinically and radiologically.

The statistical analysis was performed with chi-square, Fisher's exact test and Students *t*-test, using the Quattro Pro (Version 4.0, Borland Inc.) and Epi Info (Version 5.0, Public Domain Software) and $P < 0.05$ considered significant.

3. Results

A total of 16,112 deliveries had been recorded during the study period. The rate of macrosomic deliveries (4000 g and higher) was 6.21% (1000/16,112). The rate of the deliveries with 4500 g and heavier was 1.04% (167/16,112) and 5000 g or heavier was 0.11% (17/16,112)(Table 1). The mean birth weight was 4272 ± 239 g (4000–6325) and 3277 ± 316 g (2500–3930) in the study and control group respectively ($P < 0.001$). The heaviest newborn of the study group was 6325 g, the third baby of a 33-year-old woman and whose previous babies weighted 4900 g.

The mean age of the mothers was 27.6 ± 5.1(16–43) and 25.2 ± 4.6 (16–40) in the study and control groups, respectively ($P < 0.001$). Those 35 years and older formed 6.9% of the study group and 2.4% of the control group ($P < 0.001$).

The analysis of the parity distribution revealed that the rate of nulliparity was significantly higher in control group than study group ($P < 0.001$). However, the rate of grand-multiparity was higher in the study group than the control group ($P = 0.002$).

In our institution, 40 gestational weeks and 10 days (40w, 10d) is the accepted limit for post-term pregnancy and the cases exceeding 40w, 10d are induced for labor. So the post-term pregnancy rate reveals the cases between 40w, 10d and 42w, 0d and it was 15.1% in the study group and 7% in the control group ($P < 0.001$).

The macrosomic delivery history was recorded 26.9% in the study group and 5% in the control group ($P < 0.001$). On the evaluation of the obstetric history, the rate of previous delivery with 4500 g or heavier was significantly more common in the study group (7.2%, 48/665) than the control group (0.4%, 2/422) ($P < 0.001$).

Gestational diabetes screening was performed as 50 g oral glucose test in 579 of the cases (study group = 302) (control group = 277). While the screening test resulted with abnormal results in 4.3% of the study group, there was no abnormal result detected in the control group.

When the mode of delivery was evaluated (Table 2), the rate of cesarean delivery was found to be 28.8% in the study group and 16.6% in the control group ($P < 0.001$). The most common indication for cesarean delivery was cephalopelvic disproportion in the study group (36.5%), followed by the elective indications (16.7%) and fetal distress (15.3%). In the control group, the most common indication for cesarean delivery was determined to be fetal distress (31.9%), and the rate of cesarean delivery with the indication of disproportion was only 1.2%. While the incidence of cesarean delivery

Table 1
The distribution of the cases according to birthweight ($n = 2000$)

Birthweight (g)	*n*
Macrosomia	1000
4000–4249	530
4250–4499	303
4500–4749	107
4750–4999	43
≥5000	17
Control	1000
2500–2749	58
2750–2999	143
3000–3249	202
3250–3499	270
3500–3749	286
3750–3900	41

Table 2
The distribution of the modes of delivery ($n = 2000$)

Modes of delivery	Macrosomia ($n = 1000$)	Control ($n = 1000$)	*P*
Vaginal birth	659	784	<0.001
Cesarean section	288	166	<0.001
Disproportion	105	2	<0.001
Elective	48	25	>0.05
Fetal distress	44	53	<0.001
Breech presentation	15	19	<0.02
Pre-cesarean	75	36	>0.05
Elective	48	25	>0.05
Others	1 (Uterine rupture)	31	
Operative vaginal delivery	53	50	>0.05
Vacuum extraction	36	35	>0.05
Forceps extraction	17	15	>0.05

Table 3
The distribution of birth traumas according to birth weight between 4400–4499 g and the ≥4500 g groups[a]

	Macrosomia ($n = 997$)						Control ($n = 1000$)	
	4000–4499 ($n = 830$)		≥4500 ($n = 167$)		Total			
	n	%	n	%	n	%	n	%
Trauma positive	27	3.2	19	11.3	46	4.6	21	2.1
Fracture	9	1.0	8	4.7	17	1.7	2	0.2
Clavicle	9		7		16		2	
Humerus	0		1		1		0	
Paralysis	8	0.9	10	5.9	18	1.8	6	0.6
Brachial	7		10		17		5	
Facial	1		0		1		1	
Cephalohematoma	11	1.3	5	2.9	16	1.6	14	1.4
Combined	1[b]	0.1	3[c]	1.7	4	0.4	1[d]	0.1

[a] The cases which were stillbirth were not calculated.
[b] One case clavicular fracture and brachial paralysis.
[c] One case clavicular fracture and brachial paralysis.
[d] One case clavicular fracture, humeral fracture and brachial paralysis, one case brachial paralysis and subdural hematoma.

was 27.5%(229/288) for the cases of 4499 g or lower, it was 35.5%(59/288) for cases of 4500 g or heavier ($P < 0.05$).

The observed birth traumas were summarized in Tables 3 and 4. The incidence of birth trauma was 4.9% in the study group and 1.9% in the control group ($P < 0.001$). Brachial plexus paralysis was the most common birth trauma in the study group, followed by the isolated fracture of clavicle. The rate of traumatic delivery excluding cephalohematoma was 2.8% for the cases 4499 g or lower and 16.6% for the cases 4500 or heavier ($P < 0.001$). The incidence of birth trauma was 5.4% at normal vaginal delivery and 18.8% at operative vaginal delivery in the study group ($P < 0.001$).

Hypoglycemia was noted significantly more frequent in the study group (11%) than the control group (2.9%) ($P < 0.001$). There was a positive correlation between frequency of hypoglycemia and the birth weight. There was no difference between the groups with respect to the incidence of hypocalcemia and polycythemia ($P > 0.05$). Hyperbilirubinemia was observed significantly more frequent in the control group ($P < 0.001$).

The incidence of perinatal morbidity was determined to be more frequent in the study group. Perinatal asphyxia was 4.5 times more frequent in the study group. There was no significant difference between the two groups with respect to the incidence of meconium aspiration and infection (Table 5). There were three stillbirths in the study group. The perinatal and early neonatal mortality were 0.8 and 0.5% respectively. No perinatal mortality was recorded in the control group. All of the complications like atony and genital lacerations were significantly common in the study group (Table 6).

4. Comment

The cutoff range between 4000 and 4500 g is generally accepted to define the macrosomia in the literature [8]. ACOG reported 4500 g as the cutoff value for macrosomia in 1991 [8]. Spellacy et al. classified macrosomia by dividing the newborns into two groups as a mild form in the range

Table 4
The distribution of birth traumas due to modes of delivery between groups[a]

	Macrosomia ($n = 997$)						Control ($n = 1000$)						P[c]
	Normal ($n = 656$)		Operative[b] ($n = 341$)		Total		Normal ($n = 784$)		Operative[b] ($n = 216$)		Total		
	n	%	n	%	n	%	n	%	n	%	n	%	
Trauma positive	36	5.4	10	2.9	46	4.6	17	2.1	4	1.8	21	2.1	<0.001
Fracture	15	2.3	2	0.5	17	1.7	2	0.2	0	0	2	0.2	<0.001
Paralysis	17	2.6	1	0.2	18	1.8	5	0.6	1	0.4	6	0.6	<0.003
Hematoma	8	1.2	8	2.3	16	1.6	11	1.4	3	1.2	14	1.4	>0.05
Combined	3	0.6	1	0.2	4	0.4	1	0	0	0	1	0.1	>0.05

[a] The cases which were stillbirth were not calculated.
[b] Vacuum or forceps extraction and cesarean delivery.
[c] Statistical analysis was performed between the total values of the groups.

Table 5
The distribution of the perinatal complications between the groups

	Macrosomia ($n = 1000$)		Control ($n = 1000$)		P
	n	%	n	%	
Mortality					
Stillbirth	3	0.3	0		
Asphyxia	2	0.2	0		
Pneumonia and subarachnoid bleeding	1	0.1	0		
Congenital heart disease	2	0.2	0		
Morbidity					
Perinatal asphyxia	14	1.4	3	0.3	<0.01
Meconium aspiration	9	0.9	3	0.3	>0.05
Infection	2[a]	0.2	4[b]	0.4	>0.05
Anomaly	14	1.4	5	0.4	<0.05

[a] One case septicemia and one case of pneumonia.
[b] One case septicemia and three cases of pneumonia.

of 4000–4999 g and a severe form 5000 g and heavier [9]. In our study, the most accepted cutoff value of 4000 g was used as the macrosomia criterion.

The incidence of macrosomia is reported to be approximately 7–10% [2]. The newborns that are 4500 g or heavier constituted 1–2% of all of the newborns [2]. The incidence of macrosomia was reported as 9.8% in a study from Turkey [11]. However, this rate was determined as 6.21% in our study. The ratio of the newborns 4500 g and heavier was 1.04%.

The rates of perinatal and maternal morbidity and mortality can be reduced by the antenatal diagnosis of macrosomia. The risk factors leading to macrosomia must be thoroughly evaluated by the clinician. The most common cause of macrosomia is the increased intrinsic growth potential in approximately 50–60% of the cases. While the risk of birth trauma is increased, the incidence of fetal asphyxia is minimal in this group. Maternal glucose intolerance results in macrosomia in 40% of the cases. These fetuses are prone to the risk of fetal asphyxia and birth trauma as well. The incorrect calculation of the gestational age causes less than 5% of the cases with no increased risk of fetal asphyxia and birth trauma.

Table 6
The distribution of the maternal complications

	Macrosomia ($n = 1000$)		Control ($n = 1000$)		P
	n	%	n	%	
Complication positive	106	10.6	43	4.3	<0.001
Genital laceration	42	4.2	19	1.9	0.002
Bladder injury	1	0.1			
Placental retention	18	1.8	8	0.8	0.04
Uterine atony	8	0.8			0.003
Infection	37	3.7	16	1.6	0.004
Incision	25		12		
Endometritis	6		1		
Urinary	5		3		
Pulmonary	1		–		

The macrosomia is reported significantly more frequent with grandmultiparity than nulliparity. The rate of grandmultiparity was four times higher in the study group. In agreement with our study, there are many studies reporting that the history of previous macrosomic baby to be the most common leading maternal factor to macrosomia [12]. Our study revealed that the history of previous macrosomic baby was five times higher in the macrosomic birth group. In the cases of 4500 g or higher, the history of previous macrosomic baby was 18 times higher.

It is shown that maternal age older than 35 is a significant risk factor [13]. It was also found that the ratio of women elder than 35 in the study group was three times higher.

The incidence of gestational diabetes is about 1–3% in the population [10]. In another study from Turkey, it was recorded as 1% [14]. The incidence of gestational diabetes is reported 1–2% in the mothers of macrosomic babies. This incidence is about 5–7% with births of 4500 g and heavier [2,12]. Gestational diabetes was diagnosed in 4.3% of the cases screened and confirmed 100 g glucose tolerance test ($n = 302$) in our study.

The newborns and their mothers both have the risk of birth trauma in the macrosomic pregnancies. Although the perinatal mortality was assumed five times higher in macrosomic pregnancies, the recent studies have not verified this subject [2,6,12]. Nelson et al. reported on a perinatal mortality of 0.164% in 1958 [15]. This rate was determined as 0.5% by Goldithch and Kirkman in 1978 [16]. While the overall perinatal mortality is 0.35% in our clinic in the same period, this rate was 0.8% in the study group [17].

There has been an argument over the relation between asphyxia and macrosomia. Though there are many studies reporting that there does not exist an increased risk of asphyxia and meconium aspiration in macrosomic births, there are some studies claiming the opposite. Even though the incidence of asphyxia was significantly increased in the study group and meconium aspiration was common but the difference between groups was not statistically significant in our study [2,12].

Our study pointed out that the incidence of birth trauma was increased 2.5 times in the study group. The newborns with birth weight 4500 g or heavier carried six times higher risk. Cesarean delivery is suggested as the mode of delivery to minimize the risk of birth trauma but it is not always appropriate to perform cesarean delivery to all macrosomic pregnancies [9,18]. If cesarean delivery is preferred, it results in 588 useless cesarean deliveries to avoid only one case of brachial plexus palsy [19]. The rate of cesarean was about 29% in the study group. When the influence of method of delivery on perinatal morbidity was studied, it was observed that four of the 14 perinatal asphyxia cases (28%) and six of the nine meconium aspiration cases (67%) might have been delivered and probably avoided with

cesarean delivery but in contrast it is important to note that the mode of delivery was cesarean section in two neonatal deaths related to perinatal asphyxia. In the studies to define the risk factors for brachial paralysis, it was detected that the highest rate occurred in the births above 4500 g [20]. In a study completed in Parkland Hospital, the rate of brachial paralysis was 4/737 in deliveries between 4000–4500 g and 4/118 in the deliveries of 4500 g and over in a total of 1162 macrosomic births [21]. These rates were determined as 7/601 and 10/108 in our study. Contrary to the literature, no relation was found between the birth traumas and the operative vaginal delivery [22]. Meanwhile, the rate of birth trauma was lower whereas the rate of cesarean delivery was same. This may be because of the preference for spontaneous birth instead of induction of delivery in our institution. Fewer facial nerve injuries were detected in our study compared to the literature, which is probably related to the fact of less application of middle pelvis forceps. The rate of neonatal hypoglycemia was 11% in the macrosomia group which is compatible with the data in the literature [23].

The risk of postpartum bleeding and genital tract injury is about 3–5 times higher in macrosomic deliveries [24]. In our study, the risk of genital laceration and atony was observed to be significantly higher.

In conclusion, the macrosomic births have a higher frequency of birth traumas, genital laceration and atony. These complications are observed more frequently, especially when the birth weight is 4500 g or heavier.

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