Fetal macrosomia

Risk factors and outcome

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ABSTRACT

Objectives: To determine the risk factors predisposing to fetal macrosomia and assess the maternal and perinatal outcome in these patients.

Methods: This was a retrospective analysis of all macrosomic deliveries in the Department of Obstetrics and Gynecology, Sultan Qaboos University Hospital, Sultanate of Oman, during a 3-year period from January 2001 - December 2003. The maternal and neonatal records of infants with birth weight of ≥4000 g (n=275) were reviewed. Outcome variables included demographic profile, antenatal risk factors, mode of delivery and maternal and perinatal complications.

Results: A total of 7367 deliveries occurred during the study period. The rate of macrosomic deliveries was 3.75% and the rate of deliveries ≥4500 g was 0.48%. The mean birth weight of the study group was 4230 ± 220 g. Obesity, diabetes, prolonged gestation and postpartum hemorrhage were significantly higher in the study group. The cesarean section rate was 25.8% for the study group compared to the general incidence of 13.1% during the study period (p<0.0001). The incidence of shoulder dystocia was 7.6% compared to the general incidence of 0.48% during the study period (p<0.0001). There were 7 cases of Erb's palsy, all except one recovered without sequelae by 3 months of age.

Conclusion: Gestational diabetes, maternal obesity, increasing age and parity were the main risk factors for fetal macrosomia. The incidence of shoulder dystocia, birth injuries and neonatal morbidity increased in this group.

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Birth weight is one of the important factors affecting perinatal morbidity and mortality. The birth weight is the main criterion for macrosomia. Newborns weighing 4000 g or more are defined as macrosomic. The incidence of macrosomia has increased in recent years; being reported as 9% in a general hospital population. [1]

Risk factors associated with fetal macrosomia have been reported by various authors as previous macrosomia, advanced maternal age, multiparity, obesity, excess maternal weight gain, diabetes, post-datism, protracted labor and disproportionate fetal growth.[2,3] During labor, cephalo-pelvic disproportion can result in fetal distress and difficult deliveries are more frequent with macrosomic fetuses. Such fetuses are at an increased risk of birth asphyxia and traumatic injury at delivery, particularly as a consequence of shoulder dystocia, with possible long-term sequelae like brachial plexus injury and even fetal death.[2] In addition, maternal complications may occur due to difficult labor and delivery. It has been suggested that delivery by routine cesarean section (CS) for fetuses with an estimated weight of greater than 4500 g may be necessary to avoid potential litigation.[4] The objective of this study was to detect the risk factors

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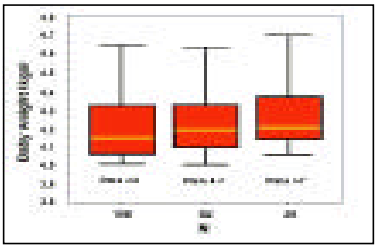

Figure 1 - Weight of baby according to parity.

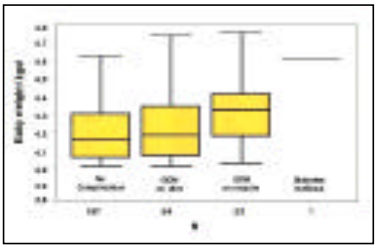

Figure 2 - Antenatal risk factor. GDM - Gestational diabetes mellitus.

associated with fetal macrosomia, and the perinatal and maternal outcome in such pregnancies.

Methods. A retrospective analysis of macrosomic deliveries at Sultan Qaboos University Hospital, Muscat, Oman was performed from January 2001 - December 2003. Two hundred and seventy-five infants with birth weight of at least 4000 g were identified during this period. The total macrosomic group represented 3.73% of the infants delivered (275 of 7367 deliveries) during the study period. Charts were reviewed for demographic and medical characteristics, gestation and mode of delivery, Apgar scores, birth weight and gender of the newborn and maternal and perinatal complications. Neonatal records were reviewed if shoulder dystocia, birth asphyxia or birth trauma were documented. Shoulder dystocia was considered to have occurred, if delivery of the shoulders required further intervention other than downward traction and episiotomy. An Apgar score of less than 7 at 5 minutes, cord arterial pH below 7.2 and hypoxic convulsions were considered as criteria for birth asphyxia. Persistent birth injury was defined as an injury clinically evident at the age of 6 months as documented in the pediatric medical records.

Statistical analysis was performed with the use of Statistical Package for Social Sciences, z and *p* values were calculated, where *p* value of <0.05 was considered significant.

Results. A total of 7367 deliveries occurred during the study period. The rate of macrosomic deliveries was 3.73% (275/7367). The rate of deliveries with babies weighing 4500 g and more was 0.48% and this constituted 12.8% of macrosomic babies. Approximately 70% of our patients were Omanis and the rest were from various countries. The mean birth weight was 4230 g and the heaviest newborn in the study group was 4980 g, born to a 12th para at 40 weeks of gestation by normal vaginal delivery. The mean age of the mothers was 30.4 years. There was an increase in fetal weight with rising maternal age. Mothers who were 35 years and older formed 21.1% of the study group. Distribution of body mass index (BMI) in the study group at the time of delivery showed that only 3.3% had a BMI of <25 and 35.3% were morbidly obese.

The average gestational age at delivery was 39.5 weeks. Seventeen percent of macrosomic deliveries occurred after 40 weeks of gestation. We have a policy of inducing labor at 40 weeks for mothers with well controlled gestational diabetes and at 40 + 12 days for other low risk mothers. The analysis of parity distribution and fetal weight revealed a rising trend in the fetal weight with increasing parity (**Figure 1**). Forty percent of our patients were para 4 and above and the highest parity was 12. Only 13.5% were nulliparae, compared to the general incidence of 23% during the study period ($p<0.001$, z=3.69). **Figure 2** depicts the antenatal risk factors in the study group and the relation with body weight. Incidence of gestational diabetes in this group was 28% out of this 75% patients were only on diet control. The general incidence of gestational diabetes during the study period was 7% ($p<0.0001$, z=12.78). There was only one mother with pre-existing diabetes mellitus, she was a para 9 and her baby weighed 4620 g and was born vaginally without any problems. When the mode of delivery was evaluated, the rate of CS was found to be 25.8% in comparison to the general incidence of 13.1% during the study period ($p<0.0001$, z=6.03). Out of these, 43% had elective CS for various indications and 57% had emergency CS. The high emergency CS rate was mainly due to failure to progress as a result of large babies. Of the study

Table 1 - Outcome of macrosomic babies with Erb's palsy.

Case number	Trauma	MW	Parity	GD	Mode of delivery	BW	5 minute Apgar	Outcome
1	Erb's palsy	105	1	+	SVD	4.700	9	recovered on discharge
2	Erb's palsy	77	6	-	SVD	4.160	9	physiotherapy
3	Erb's palsy	95	2	+	SVD	4.140	9	physiotherapy
4	Erb's palsy	83	3	-	SVD	4.150	9	physiotherapy
5	Erb's palsy	60	3	-	SVD	4.265	8	physiotherapy
6	Erb's palsy	80	8	-	SVD	4.240	9	recovered on discharge
7	Erb's palsy	69	10	-	SVD	4.890	10	physiotherapy

MW- maternal weight, GD – gestational diabetes, BW - birth weight, SVD - spontaneous vaginal delivery
+ - positive for gestational diabetes, - - negative for gestational diabetes

Table 2 - Macrosomic newborns requiring admission to SCBU.

Reasons	N of babies
Congenital anomalies	2
Shoulder dystocia	3
Meconium aspiration	3
Blood sugar monitoring	14
Low Apgar score	1
Grunting	2
Observation	5

SCBU - Special Care Baby Unit

group, 5.5% had instrumental deliveries, compared to the general incidence of 2.76% (p<0.01, z=2.66). Most of these were ventouse deliveries. Postpartum hemorrhage was documented in 22.2% of cases, out of these 11.5% had a blood loss of 1 liter or more and most of them were following cesarean sections. The general incidence of postpartum hemorrhage during the study period was 6.52% (p<0.0001, z=9.95). Gender distribution of macrosomic babies showed a male pre-ponderance; 60.73% were males. The incidence of shoulder dystocia was 7.6% in the study group, whereas the general incidence was only 0.48% (p<0.0001, z=13.90). Most cases of shoulder dystocias were managed by liberal episiotomy, directional supra-pubic pressure and Mc Robert's maneuver. Of the 21 babies with shoulder dystocia 7 had Erb's palsy. Seventy-six percent of shoulder dystocia and all cases of Erb's palsy occurred in male babies. There was only one case of birth asphyxia and no fractures were reported in these babies. **Table 1** shows the outcome of the babies with Erb's palsy. For varying reasons, 10.9% of babies were admitted to Special Care Baby Unit (SCBU) as shown in **Table 2.** There was one neonatal death in this group, which was a severely hydrocephalic baby with minimal brain tissue, which expired on 12th day. There was only one baby with 5 minute Apgar score less than 7; this baby weighing 4790 g was born to a para 1, by emergency cesarean section for fetal distress with a cord pH of 7.17. The baby was admitted in SCBU for 12 days with thrombocytopenia and polycythemia.

Discussion. A cutoff range between 4000-4500 g is generally accepted to define macrosomia in the literature.[4] The American College of Obstetricians and Gynecologists reported 4500 g as the cutoff value for macrosomia.[5] Spellacy et al[6] classified macrosomia into a mild form in the weight range of 4000-4999 g and a severe form weighing 5000 g and more. In our study, the most accepted cutoff value of 4000 g was used as the criterion for macrosomia. The incidence of macrosomia is reported to be approximately 7-10% and newborns that are 4500 g or heavier constituted 1-2% of all the newborns.[7] Oral et al[1] reported an incidence of 6.21% and 1.04%. In our study, we found a lower incidence of 3.73% and 0.48%. 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. Women who delivered a macrosomic infant tend to be older, of increased parity and to have one or both of 2 problems, obesity and diabetes. Macrosomia is expected in obese and diabetic pregnant women as the principal substrate for fetal growth is glucose.[8] The presence of glucose excess, especially the fasting blood glucose, will greatly increase the risk of shoulder dystocia.[8]

It has been shown that multiparity and maternal age older than 35 years are significant risk factors for macrosomia.[9] In our study, there was an increase in fetal weight with rising maternal age and parity, 21.1% of our women were more than 35 years of age and 86.5% were parous. Other important risk factors for macrosomia include obesity, excess weight gain and postdated (>40 weeks) gestation.[2] An analysis of BMI shows that 96.7% of our study groups were overweight or obese, 35.3% of our mothers in this group had a BMI of more than 35. We could not assess the weight gain as pre-pregnancy weight was not available in many cases due to late booking. In the study of Spellacy et al,[6] the frequency of postdated pregnancy was 10.8% among infants with macrosomia. Berad et al[2] report an incidence of 17%, which was the same with our series, as 17% of the patients delivered after 40 weeks gestation. Nowadays, the incidence of postdated gestation is decreasing due to elective induction at an earlier date.

The incidence of macrosomia in gestational diabetic mothers was reported as 12.39% in our institution.[10] In the current study, 28% of mothers had gestational diabetes and were either on diet control alone or diet control and insulin. The mean birth weight of 4230 g found in our study was similar to that of Oral et al.[1] Male babies tend to be heavier by an average of 150-200 g.[11] In our study, 60.73% of macrosomic babies were males. Shoulder dystocia is also reported to be more common in male babies. Of the 21 cases of shoulder dystocia, 16 were male babies. Both sonographic as well as clinical estimates of fetal weight in macrosomic fetuses are associated with a mean error of ±15% of actual birth weight,[12] which translates into a large absolute value at term. Applying this standard error to an estimate of 4500 g, the possible weight range is 3825-5175 g.[4] Volume measurements obtained by 3-dimensional ultrasound have the potential to assess the fetal birth weight more accurately, when compared to the conventional 2-dimensional techniques.[13] Delivery by CS of suspected macrosomic fetuses has been proposed as a possible means of preventing birth injuries and shoulder dystocia. O'Leary and Leonetti[8] suggest a liberal policy of CS if found on a solid basis of known risk factors included in the pneumonic diabetes, obesity, post-datism and excess fetal weight or maternal weight gain (DOPE). Several authors adopt a similar policy of routine CS if the estimated fetal weight is >4500 g. Menticoglou et al[14] do not justify a policy of routine CS for all macrosomic babies. Instead, they feel that a prudent supervised trial of vaginal delivery is the preferred approach. According to their study, most large babies are delivered without shoulder dystocia, and if shoulder dystocia develops, it is usually resolved by an experienced obstetrician without trauma to the baby, and even if trauma develops it is usually temporary.

Cesarean section rate in our study group was 25.8%, which double the general incidence during this period. Many fetuses weighing >4500 g delivered vaginally without complications, the largest baby in the study group was born vaginally. The risk of postpartum hemorrhage and genital tract injury are approximately 3-5 times higher in macrosomic deliveries.[15] In our study, the rate of uterine atony and postpartum hemorrhage were significantly higher when compared to the general incidence during the same period.

In conclusion, antenatal risk factors for fetal macrosomia include obesity, diabetes, increasing maternal age and parity, excess weight gain and gestation more than 40 weeks. Meticulous antenatal care consisting of glucose screening, stringent control of diabetes and frequent ultrasonic examination should help to reduce the incidence of macrosomia and to properly identify women at greatest risk. A liberal policy of CS for macrosomic babies will decrease the frequency of maternal and fetal complications but significantly increases the CS rate. Having the labor and delivery staff prepared and drilled in the management of shoulder dystocia seems a reasonable way to maintain vigilance and competency.

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