Scientific Foundation SPIROSKI, Skopje, Republic of Macedonia
Open Access Macedonian Journal of Medical Sciences. 2023 Jan 18; 11(B):162-165.
https://doi.org/10.3889/oamjms.2023.11396
eISSN: 1857-9655
Category: *B - Clinical Sciences*
Section: *Gynecology and Obstetrics*

Macrosomia Risk Factors and Perinatal Outcomes: A 1-year Cohort Study

Merita Isaku*, Enxhi Vrapi, Ina Cala, Kizjona Perdja, Astrit Bimbashi

Department of Obstetrics and Gynecology, S.U.O.GJ "Koco Gliozheni", Tirana, Albania

Edited by: Mirko Spiroski
Citation: Isaku M, Vrapi E, Cala I, Perdja K, Bimbashi A. Macrosomia Risk Factors and Perinatal Outcomes: A 1-year Cohort Study. Open Access Maced J Med Sci. 2023 Jan 18; 11(B):162-165. https://doi.org/10.3889/oamjms.2023.11396
Keywords: Macrosomia risk factors; Perinatal outcomes; One-year cohort study
***Correspondence:** Merita Isaku, S.U.O.GJ "Koco Gliozheni", Tirana, Albania.
E-mail: merita.isaku@hotmail.com
Received: 14-Dec-2022
Revised: 19-Dec-2022
Accepted: 09-Jan-2023

Funding: This research did not receive any financial support
Competing Interests: The authors have declared that no competing interests exist

Abstract

AIM: This study aims to identify possible risk factors and concurrently investigates how macrosomia impacts mothers and neonates.

STUDY DESIGN: The study is a retrospective cohort of data obtained in a large tertiary obstetrics and neonatal unit over 1 year, from anuary 1, 2019 to December 31, 2019. Data of all deliveries conducted at the institution were accessed. In addition, singleton and term pregnancies were included for further analysis. Multiple pregnancies, premature births, stillbirths, non-vertex presentations, and being lost to follow-up served as exclusion criteria. A database of the cases was constructed and data regarding maternal constitutional parameters, mode of delivery, shoulder dystocia, perineal trauma, and postpartum hemorrhage were collected. Further on, pregnancies were divided accordingly into two groups: Macrosomic fetuses (>4000 g) and non-macrosomic fetuses (<4000 g). The two groups were compared to assess possible macrosomia risk factors and maternal-neonatal outcomes. Statistical analysis is done using the Mann–Whitney-U and Chi-square tests. Significance was set as $p < 0.05$.

RESULTS: A total of 3408 deliveries met the inclusion criteria of the study. The macrosomia rate is 10.3%. The mean age (30.1 ± 5.17 years vs. 28.9 ± 8.4 years, $p < 0.05$) and, body mass index (29.2 ± 3.54 vs. 26.1 ± 2.78, $p < 0.05$) was significantly higher in the macrosomia group. Women that gained more than 12.5 kg have nearly twice the odds of delivering a big baby (odds ratio [OR] 1.86, confidence interval [CI] 1.47–2.36, $p < 0.001$). No statistically significant differences were noted regarding cases of gestational diabetes ($p = 0.56$). Cesarean sections were preferred to vaginal deliveries in the macrosomic group (39.3% vs. 29.7%, OR 1.53, CI 1.2–1.9, $p = 0.001$). The risk of undergoing an emergency procedure is 6-fold higher in pregnancies with macrosomic newborns (20.5% vs. 13.6%, OR 6.1, CI 4.45–8.36, $p < 0.001$). Both episiotomy rate (40.45% vs. 31.9%, OR 1.44, CI 1.15–1.81, $p = 0.001$) and lacerations (3.13 % vs. 1.44%, OR 2.21, CI 1.13–4.33, $p = 0.02$) were higher in the macrosomic group.

CONCLUSION: The study concludes that macrosomia is associated with an increase in maternal and neonatal adverse outcomes.

Introduction

Macrosomia, defined as a fetus weighing more than 4000 g, promotes a range of adverse maternal and neonatal outcomes [1], [2]. While its early recognition at term can dictate the best mode of delivery, identifying early risks of macrosomia would be of fundamental importance in preventing a range of complications.

This study aims to identify possible risk factors and concurrently investigates how macrosomia impacts mothers and neonates.

Methods

The study is a retrospective cohort of data obtained in a large tertiary obstetrics and neonatal unit at UHOG "Koco Gliozheni" over 1 year, from January 1, 2019 to December 31, 2019.

Data of all deliveries conducted at the institution were accessed. In addition, singleton and term pregnancies were included for further analysis. Multiple pregnancies, premature births, stillbirths, nonvertex presentations, and being lost to follow-up served as exclusion criteria.

A database of the cases was constructed and data regarding maternal constitutional parameters, such as age, parity, body mass index (BMI), and weight gain, were collected. Other retrieved data included data regarding mode of delivery, shoulder dystocia, perineal trauma, and postpartum hemorrhage (PPH, defined as blood loss of 500 ccs or more in vaginal deliveries or 1000cc in cesarean sections).

Further on, pregnancies were divided accordingly into two groups: Macrosomic fetuses (>4000 g) and non-macrosomic fetuses (<4000 g).

The two groups were compared to assess possible macrosomia risk factors and maternal-neonatal outcomes.

Statistical analysis is done using the Mann–Whitney-U and Chi-square tests for continuous and

cardinal variables, respectively. Significance was set as $p < 0.05$.

The institutional board approved the study.

Results

A total of 3408 deliveries met the inclusion criteria of the study. The macrosomia rate is 10.3%, with 351 newborns weighing more than 4000 g.

The baseline characteristics of the study subjects are presented in Table 1.

Table 1: Baseline characteristics

Characteristics	Macrosomia (n = 351)	Normal birth weight (*n* = 3058)	p-value
Age (years)	30.1±5.17	28.9±8.4	< 0.05
BMI	29.2±3.54	26.1±2.78	< 0.05
Weight gain >12.5 kg, *n* (%)	240 (68.37)	1642 (53.7)	< 0.001
Primiparous, *n* (%)	136 (38.74)	1403 (45.9)	0.01
Gestational diabetes, *n* (%)	9 (2.56)	64 (2.1)	0.56
Gestational age at delivery	40.4±2.17	39.5±2.23	< 0.05

BMI: Body mass index.

The mean age was significantly higher in the macrosomia group (30.1 ± 5.17 years vs. 28.9 ± 8.4 years, $p < 0.05$).

Women presenting with higher BMI had higher odds of delivering a macrosomic baby (29.2 ± 3.54 vs. 26.1 ± 2.78, $p < 0.05$).

Another predisposing factor for macrosomia is excessive weight gain, with women that gained more than 12.5 kg having nearly twice the odds of delivering a big baby (odds ratio [OR] OR 1.86, confidence interval [CI] 1.47–2.36, $p < 0.001$). Another difference noted is that pluriparous women e macrosomic babies more frequently (OR 1.34, CI 1.06–1.68, $p = 0.01$).

No statistically significant differences were noted regarding cases of gestational diabetes ($p = 0.56$).

Cesarean sections were preferred to vaginal deliveries in the macrosomic group (39.3% vs. 29.7%, OR 1.53, CI 1.2–1.9, $p = 0.001$). Controversy, elective C-sections are not higher in the macrosomic group, but the risk of undergoing an emergency procedure is 6-fold higher in pregnancies with macrosomic newborns (20.5% vs. 13.6%, OR 6.1, CI 4.45–8.36, $p < 0.001$) (Table 2).

Table 2: Maternal and neonatal outcomes

Characteristics	Macrosomia (n = 351), n (%)	Normal birth weight (n = 3058), n (%)	p-value
Vaginal birth	213 (60.7)	2149 (70.3)	0.002
Cesarean section	138 (39.3)	909 (29.7)	
Elective C/S	66 (18.8)	785 (25.67)	< 0.001
Emergency C/S	72 (20.5)	124 (13.6)	
Episiotomy	142 (40.45)	978 (31.9)	0.001
Laceration	11 (3.13)	44 (1.44)	0.02
Forceps	3 (0.85)	0	0.006
PPH	18 (5.12)	110 (3.6)	0.15
Shoulder dystocia	17 (4.84)	33 (1.07)	< 0.001

PPH: Postpartum hemorrhage, C/S: Cesarean section.

Both episiotomy rate (40.45% vs. 31.9%, OR 1.44, CI 1.15–1.81, $p = 0.001$) and lacerations (3.13 % vs. 1.44%, OR 2.21, CI 1.13–4.33, $p = 0.02$) were higher in the macrosomic group.

Forceps were only used in three deliveries, all in the macrosomia group (0.006).

Nor PPH nor shoulder dystocia was more frequent in the macrosomia group.

Discussion

The rate of macrosomia is 10.4% in our study. This result is comparable with international studies that report an increase in macrosomic deliveries, now accounting for 9.4% worldwide [1], [2]. The previous full-scale studies on macrosomia in Albania are lacking, thus limiting comparisons and trend analysis. Parity, high BMI, age, and excessive weight gain significantly increase the risk of macrosomia.

It is well known that these maternal constitutional factors influence the development of macrosomia in the newborn [3]. Studies conclude that excess pre-pregnancy weight is associated with a birth weight of 4000 g or more [4], [5], [6], [7].

Being overweight or obese promotes weight gain outside the pregnancy recommendation [8], [9], [10]. In addition, an expert review published in 2016 finds that women with high BMI variation are more likely to develop macrosomia [11]. Therefore, monitoring weight gain should be critical for every prenatal visit.

Often the monitoring of maternal weight is neglected during visits. Therefore, prenatal care protocols must include this as well. In addition, obstetricians should educate women regarding a healthy diet and lifestyle. Recommended weight gain differs according to pre-pregnancy BMI. In general, women with normal pre-pregnancy weight should gain between 12.5 and 16 kg, while overweight and obese women should not gain more than 11.5 kg and 9 kg, respectively [12].

Women with BMI higher than 25 are also more prone to develop gestational diabetes and gestational hypertension [13], [14].

Elevated glucose increases insulin, which circulates from the mother to the baby. The fetal hyperinsulinemic state promotes fat deposition in the fetus and, as a result, macrosomia [15], [16].

Our cohort did not ascertain this correlation, unlike studies that link diabetes to macrosomia.

Such results were partly attributed to the fact that in the presence of known gestational diabetes, women are hospitalized, and the delivery is done early to prevent possible adverse outcomes.

The risk of morbidity for women and newborns increases drastically when the birth weight exceeds 4500 g [1], [17], [18].

Spontaneous deliveries occurred less frequently in the macrosomia group, where elective cesarean sections were higher.

These findings are supported by medical literature, which states that cesarean sections are more frequent in women who deliver macrosomic babies [15], [19], [20], [21].

Instrumental delivery through vacuum or forceps is also more pronounced in macrosomic fetuses.

Vaginal traumas, either episiotomies or lacerations, were noticeably higher in the macrosomia group. The occurrence of such is well-documented in the literature which state that macrosomia is associated with a marked rate of injuries during labor [17], [19].

Similarly, macrosomic fetuses are more prone to shoulder dystocia. This correlation has also been established in the previous studies [20], [22], [23].

The evidence of traumatic deliveries has encouraged the consideration of prophylactic cesarean section deliveries in the presence of suspected macrosomia [24], [25], [26].

The sample size limits the representation of data. The study reports unadjusted odd ratios and absolute risks without adjusting for other factors that may contribute to such complications.

Another limitation is the retrospective nature of the study. Data such as pre-pregnancy weight are collected at admission by a questionnaire, and the weight gain dynamic has not been monitored prospectively. The difference in study populations and management policies also limits comparing our results to the literature.

On the other hand, the study's results emphasize the importance of recognizing macrosomia. This would increase the preparedness of the staff in managing possible obstetrical emergencies that may arise. They may also pinpoint the importance of discussing and preventing excessive weight gain during pregnancy.

Conclusion

The study concludes that macrosomia is associated with an increase in maternal and neonatal adverse outcomes.

References

1. American College of Obstetricians and Gynecologists' Committee on Practice Bulletins-Obstetrics: William H. Barth Jr Practice bulletin no. 173 summary: Fetal macrosomia. Obstet Gynecol. 2016;128:1191-2.
2. Boulet SL, Alexander GR, Salihu HM, Pass M. Macrosomic births in the United States: Determinants, outcomes, and proposed grades of risk. Am J Obstet Gynecol. 2003;188(5):1372-8. https://doi.org/10.1067/mob.2003.302
   PMid:12748514
3. Agudelo-Espitia V, Parra-Sosa BE, Restrepo-Mesa SL. Factors associated with fetal macrosomia. Rev Saude Publica. 2019;53:100. https://doi.org/10.11606/s1518-8787.2019053001269
   PMid:31800911
4. Koyanagi A, Zhang J, Dagvadorj A, Hirayama F, Shibuya K, Souza JP, *et al*. Macrosomia in 23 developing countries: analysis of a multicountry, facility- based, cross-sectional survey. Lancet. 2013;381(9865):476-83. https://doi.org/10.1016/S0140-6736(12)61605-5
   PMid:23290494
5. Baugh N, Harris DE, Aboueissa AM, Sarton C, Lichter E. The impact of maternal obesity and excessive gestational weight gain on maternal and infant outcomes in Maine: Analysis of pregnancy risk assessment monitoring system results from 2000 to 2010. J Pregnancy. 2016;2016:5871313. https://doi.org/10.1155 / 2016/5871313
   PMid:27747104
6. Cunha AJ, Sobrino Toro M, Gutiérrez C, Alarcón Villaverde J. Prevalencia y factores asociados a macrosomía en Perú, 2013. Rev Peru Med Exp Salud Publica. 2017;34(1):36-42. https://doi.org/10.17843/rpmesp.2017.341.2765
   PMid:28538844
7. Pacce S, Saure C, Mazza CS, Garcia S, Tomzig RG, Lopez AP, *et al*. Impact of maternal nutritional status before and during pregnancy on neonatal body composition: A cross-sectional study. Diabetes Metab Syndr. 2016;1 1 Suppl 1:S7-12. https://doi.org/10.1016/j.dsx.2015.08.015
   PMid:26431950
8. Lima RJ, Batista RF, Ribeiro MR, Ribeiro CC, Simões VM, Lima Neto PM, *et al*. Prepregnancy body mass index, gestational weight gain, and birth weight in the BRISA cohort. Rev Saude Publica. 2018;52:46. https://doi.org/10.11606/S1518-8787.2018052000125
   PMid:29723385
9. Godoy AC, Nascimento SL, Surita F. A systematic review and meta-analysis of gestational weight gain recommendations and related outcomes in Brazil. Clinics (Sao Paulo). 2015;70(11):758-64. https://doi.org/10.6061/clinics/2015(11)08
   PMid:26602524
10. Yang S, Peng A, Sheem W, Wu J, Zhao J, Zhang Y, *et al*. Pre-pregnancy body mass index, gestational weight gain, and birth weight: A cohort study in China. PLoS One. 2015;10(6):e0130101. https://doi.org/10.1371/journal.pone.0130101
    PMid:26115015
11. Kominiarek MA, Peaceman AM. Gestational weight gain. Am J Obstet Gynecol. 2017;217(6):642-51. https://doi.org/10.1016/j.ajog.2017.05.040
    PMid:28549978
12. Luke B, Hediger ML, Nugent C, Newman RB, Mauldin JG, Witter FR, *et al.* Body mass index-specific weight gains associated with optimal birth weights in twin pregnancies. J Reprod Med. 2003;48:217-24.
    PMid:12746982
13. Lozano Bustillo A, Betancourth Melendez WR, Turcios Urbina LJ, Cueva Nuñez JE, Ocampo Eguigurems DM, Portillo Pineda CV, *et al*. Sobrepeso y obesidad en el embarazo: Complicaciones y manejo. Arch Med. 2016;12(3):11.
14. Claros Benítez DI, Mendoza Tascón LA. Impacto de los

trastornos hipertensivos, la diabetes y obesidad materna sobre el peso, la edad gestacional al nacer y la mortalidad neonatal. Rev Chil Obstet Ginecol. 2016;81(6):480-8. https://doi.org/10.4067/S0717-75262016000600005

15. Turkmen S, Johansson S, Dahmoun M. Foetal macrosomia and foetal-maternal outcomes at birth. J Pregnancy. 2018;2018:4790136. https://doi.org/10.1155 / 2018/4790136
PMid:30174954
16. Santangeli L, Sattar N, Huda SS. Impact of maternal obesity on perinatal and childhood outcomes. Best Pract Res Clin Obstet Gynaecol. 2015;29(3):438-48. https://doi.org/10.1016/j.bpobgyn.2014.10.009
PMid:25497183
17. Spellacy WN, Miller S, Winegar A, Peterson PQ. Macrosomia–maternal characteristics and infant complications. Obstet Gynecol. 1985;66(2):158-61. PMid:4022478
18. Nesbitt TS, Gilbert WM, Herrchen B. Shoulder dystocia and associated risk factors with macrosomic infants born in California. Am J Obstet Gynecol. 1998;179(2):476-80. https://doi.org/10.1016/s0002-9378(98)70382-5
PMid:9731856
19. King JR, Korst LM, Miller DA, Ouzounian JG. Increased composite maternal and neonatal morbidity associated with ultrasonographically suspected fetal macrosomia. J Matern Fetal Neonatal Med. 2012;25:1953-9. https://doi.org/10.3109 / 14767058.2012.674990
PMid:22439605
20. Irion O, Boulvain M. Induction of labour for suspected fetal macrosomia. Cochrane Database Syst Rev. 2000;(2):CD000938. https://doi.org/10.1002 / 14651858.CD000938
PMid:10796221
21. Najafian M, Cheraghi M. Occurrence of fetal macrosomia rate and its maternal and neonatal complications: A 5-year cohort study. ISRN Obstet Gynecol. 2012;2012:353791. https://doi.org/10.5402 / 2012/353791
PMid:23209925
22. Boulvain M, Senat MV, Perrotin F, Winer N, Beucher G, Subtil D, *et al*. Induction of labour versus expectant management for large-for-date fetuses: A randomised controlled trial. Lancet. 2015;385(9987):2600-5. https://doi.org/10.1016/S0140-6736(14)61904-8
PMid:25863654
23. Lurie S, Insler V, Hagay ZJ. Induction of labor at 38 to 39 weeks of gestation reduces the incidence of shoulder dystocia in gestational diabetic patients class A2. Am J Perinatol. 1996;13(5):293-6. https://doi.org/10.1055/s-2007-994344
PMid:8863948
24. Gregory KD, Henry OA, Ramicone E, Chan LS, Platt LD. Maternal and infant complications in high and normal weight infants by method of delivery. Obstet Gynecol. 1998;92(4)507-13. https://doi.org/10.1016/s0029-7844(98)00224-5
PMid:9764620
25. Ecker JL, Greenberg JA, Norwitz ER, Nadel AS, Repke JT. Birth weight as a predictor of brachial plexus injury. Obstet Gynecol. 1997;89(5):643-7. https://doi.org/10.1016/s0029-7844(97)00007-0
PMid:9166293
26. Menticoglou SM, Manning FA, Morrison I, Harman CR. Must macrosomic fetuses be delivered by a caesarean section? A review of outcome for 786 babies greater than or equal to 4,500 g. Aust N Z J Obstet Gynaecol. 1992;32(2):100-3. https://doi.org/10.1111/j.1479-828x.1992.tb01917.x
PMid:1520190