

Trial of labor after Cesarean delivery for estimated large for gestational age fetuses: a retrospective cohort study

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Abstract

Objective: Estimated fetal weight, large for gestational age (eLGA) ([?]90th percentile) may be associated with failed trial of labor after Cesarean (TOLAC), like fetal macrosomia. The aim of this study was to evaluate obstetrical outcome and safety of TOLAC, for women with eLGA. **Design:** A retrospective cohort study. **Setting:** a single large tertiary care center. **Population or Sample:** all women with singleton pregnancy, gestational age [?] 37weeks, admitted for TOLAC between 2012 and 2017. **Methods:** Women with eLGA were compared to women with EFW < 90th percentile. **Main outcome measures:** the rate of successful vaginal delivery, adverse obstetrical outcomes. **Results:** 1949 women met inclusion criteria, including 78 (4%) eLGA and 1871 (96%) controls. Study group were older (35 vs. 33 year; $p=0.004$), with higher Body Mass Index (30.9 vs. 27.5 kg/m²; $p=0.001$) and higher gravidity (4 vs. 3; $p=0.001$) compared to the controls. Median fetal weight was [3887g (IQR 3718-4073) vs. 3275g (IQR 2995-3545); $p=0.001$ in the study vs. controls respectively]. 55 (70.5%) women in the study group had successful vaginal delivery compared to 1506 (80.5%) women in the control ($p=0.03$). The rate of obstetrical complications, including: scar dehiscence, uterine rupture, 3rd /4th degree perineal tear or shoulder dystocia were comparable. The rate of post-partum hemorrhage was increased in the study group compared to controls (7.7% vs. 1.7%; $p=0.001$). **Conclusion:** TOLAC for eLGA fetuses can be considered as safe, however, lower successful VBAC rates and increased PPH rate may be expected.

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Short Title: TOLAC for estimated LGA

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key words: Trial of labor after Cesarean delivery, Vaginal birth after Cesarean delivery, large for gestational age, uterine rupture, repeat Cesarean delivery.

Tweetable abstract:

TOLAC in singleton pregnancy with LGA fetus is a possible option taking in account a higher incidence of PPH.

Ethics Approval:

The study protocol was approved by the "Sheba Medical Center" Institutional Review Board (ID 4287-17-SMC) on the 28 of June 2017.

Introduction

Over the past fifty years there has been a remarkable increase in the rate of Cesarean deliveries (CD) (1). In order to reduce maternal and neonatal morbidity and mortality associated with Cesarean delivery and mostly with repeat Cesareans, in 2015, the World Health Organization (WHO) has recommended a maximum CD rate of 10-15% (2).

The substantial decrease in trial of labor after Cesarean deliveries (TOLAC) is one of the leading causes of the growing number of CD. The decline of TOLAC is primarily due to increased number of reported complications such as uterine rupture, as well as other factors including maternal request and decreased breech and operative vaginal deliveries (1, 3, 4).

However, since 1970, more studies evaluated the benefits of TOLAC compared to Cesarean delivery. In 2010 the National Institutes of Health stated that TOLAC is a reasonable option for most pregnant women who had prior low transverse Cesarean delivery (5).

Today, amongst women who attempt TOLAC, the rate of successful vaginal birth after Cesarean delivery; (VBAC) is beyond 70% (6, 7). It is associated with a lower maternal mortality rate and less overall morbidity for mothers and babies compared to Cesarean delivery.

Nevertheless, counseling women regarding the success rate of TOLAC is cumbersome. Several factors, including: increased maternal BMI, need for labor induction or augmentation, prior emergency Cesarean

and estimated fetal macrosomia (weight larger than 4000 g) are associated with failed TOLAC which in turn may lead to a greater maternal and perinatal risk than elective CD (8). Moreover physicians take safety margins and although ultrasonographic estimation of fetal weight, larger than 90th percentile was not considered to be associated with greater risk for uterine rupture (9), TOLAC is considered relatively contraindicated for macrosomic fetuses. Estimated fetal weight of 4000g is being used to consider avoidance of TOLAC and this may not suffice. Fetuses who are estimated to weigh more than the 90th percentile for the gestational age but are less than 4000 g may impose a risk for TOLAC as well.

To the best of our knowledge, literature regarding maternal and neonatal morbidity after TOLAC for eLGA ([?] 90th percentile) fetuses is scarce, and there are no recommendations regarding the preferred mode of delivery for mothers with eLGA and a history of CD. The aim of this study was to evaluate obstetrical outcome of TOLAC in women with large estimation of fetal weight in comparison to women with fetal weight smaller than 90th percentile.

Material and Methods

A retrospective cohort study including all women admitted to a single tertiary care center between January 2012 to July 2017 for TOLAC after one cesarean delivery. Women with eLGA were compared to women with EFW < 90th percentile. Inclusion criteria included singleton pregnancy, gestational age [?]37 weeks. Women with multiple gestation, a history of [?]2 Cesarean deliveries, non-vertex presentation, intrauterine fetal demise or maternal contra indication for vaginal delivery were excluded. Primary outcome was defined as successful vaginal birth after cesarean (VBAC).

Ultrasonographic fetal weight evaluations were performed at admission as part of routine care. Estimation of fetal weight was calculated using the Hadlock equation. Large estimation of fetal weight was defined as a fetal weight above the 90th percentile using the "Dolberg curves" for Israeli population (10).

Our center's policy is to offer TOLAC to every woman with a history of one Cesarean delivery taking into consideration her specific risks for adverse outcome.

Primary outcome was defined as the rate of successful VBAC, secondary outcomes included adverse obstetrical outcomes (scar dehiscence or uterine rupture, 3rd /4th degree perineal tear, shoulder dystocia, postpartum hemorrhage, and a need for blood transfusion). Data were collected from computerized medical records and included demographic characteristics, obstetric and medical history, delivery maternal and neonatal outcomes and early post-partum course.

Statistical analysis

Normality of the data was tested using the Shapiro-Wilk or Kolmogorov-Smirnov tests. Data are presented as median and inter-quartile range (IQR). Comparison between unrelated variables was conducted with Student's t-test or Mann-Whitney U test, as appropriate. The chi-square and Fisher's exact tests were used for comparison between categorical variables. Significance was accepted at $p < 0.05$. Statistical analyses were conducted using the IBM Statistical Package for the Social Sciences (IBM SPSS v.19; IBM Corporation Inc, Armonk, NY, USA).

The study protocol was approved by the "Sheba Medical Center" Institutional Review Board (ID 4287-17-SMC) on the 28 of June 2017.

Results

1949 women met inclusion criteria, 78 (4%) had eLGA (study group) and 1871 (96%) controls (figure 1).

Women in the study group were older (35 (31.7-37.0) vs. 33 (30.0-36.0) years; $p=0.004$), with higher BMI (30.9 (IQR27.7-33.3) vs. 27.5 (25.1-30.5) kg/m^2 ; $p=0.001$) and higher gravidity (4 (3-6) vs. 3 (2-4); $p=0.001$) compared to the controls. Women's demographics and characteristics are summarized in table 1.

The median Glucose challenge test (GCT) value was 105 (IQR 89-127) vs.106 (91-121) mg/dl for the study group and controls, respectively ($p=0.97$). Gestational diabetes was 12.5% in the study group compared to

14.9% in the controls ($p=0.68$). Median gestational age at birth was 39.3 for both groups. Estimated fetal weight was higher in the study group as expected [3900 (3800-4040) vs. 3200 (3050-3500) g; $p=0.001$], as well as neonatal weight [3887 (3718-4073) vs. 3275 (2995-3545) g; $p=0.031$].

The rate of successful vaginal delivery was lower in the study group 70.5% (55/78) compared to 80.5% (1506/1871) in the controls ($p=0.03$). No significant difference in the rate of scar dehiscence, uterine rupture, 3rd /4th degree perineal tear and shoulder dystocia was found between the groups. However, the rate of post-partum hemorrhage was increased in the study group compared to controls (7.7 vs.1.7%; $p=0.001$), with no difference in blood transfusion rate (Table 2).

Discussion

Main findings

1. Successful VBAC was achieved for 70.5% of women with estimated LGA compared with 80.5% for the control group. 2. The rate of post-partum hemorrhage (PPH) was significantly increased in the study group. 3. No significant difference in the rate of scar dehiscence, uterine rupture, 3rd /4th degree perineal tear and shoulder dystocia was found between the control and study group.

Results and Clinical implications

We present the obstetrical outcomes of vaginal delivery after Cesarean delivery in women with and without large estimated fetal weight. Only 70.5% of women in the study group compared to 80.5% of controls experienced successful vaginal delivery ($p=0.03$). This finding is in agreement with other series that examined the TOLAC's success rate, which showed that vaginal delivery can be achieved in 60-80% of women (8, 9). However, unlike our study, those studies did not separate eLGA and non eLGA fetuses and therefore the rate of successful TOLAC in cases of eLGA fetuses cannot be elaborated.

There are several possible explanations to the difference in success rate between the two groups. One can reasonably assume, that the larger the fetus the lower the chances for successful TOLAC and the current cutoff of 4000g does not suffice. Peaceman et al. (11) reviewed the pregnancy outcomes of women whose first CD was performed because of dystocia, and found that for each 100 gram increase in birthweight relative to the first pregnancy there was 3.8% decrease in the odds of successful TOLAC. Yet, while macrosomia is considered a relative contra-indication for TOLAC, eLGA alone is not.

Women in the study group were significantly older (35 vs. 33 years; $p=0.004$) and, as expected, with higher gravidity (4 vs. 3; $p=0.001$). Nevertheless, higher gravidity is also associated with higher birthweight (12), and hence, lower rates of TOLAC. As we excluded all women who underwent more than one CD, women in the study group had more previous vaginal deliveries which should have increased their chances for a successful TOLAC (7). However, as mentioned before, we found a lower rate of successful VBAC amongst women in the study group. One reasonable explanation is that eLGA may have a greater effect on the likelihood of a successful TOLAC.

Women in the study group had higher BMI compared to the controls (30.9 vs.27.5 kg/m²; $p=0.001$). This finding is in accordance with the findings of Shin et al. (13) who reported that high BMI is an independent risk factor for LGA infants (13). For women attempting TOLAC, both LGA fetuses and high BMI lower the chances of TOLAC success (11, 14). It should be noted that there was no significant difference in GCT nor in gestational diabetes (GDM) between the study group and controls ($p=0.97$ and $p=0.68$ respectively). Therefore, we deduced that GCT and GDM can be ruled out as confounders to our primary outcome.

The rate of PPH was significantly increased in the study group compared to controls (7.7 vs.1.7%; $p=0.001$). A possible explanation for the increased rate of PPH among women in the study group could be attributed to the effect of the LGA fetus on the uterus which may cause atony. This explanation correlates with a previous study where pregnancies with LGA infants were found at higher risk for PPH (15).

Strength and Limitations

Our study included a large cohort that was assembled from a single tertiary university affiliated medical center. To the best of our knowledge this is the first study to describe obstetrical outcome of women going through trial of labor after Cesarean delivery with large estimated fetal weight adjusted for gestational week.

An accurate estimation of fetal weight is important to clinical decision making. In our study, estimation of fetal weight were similar to neonatal weight both in the study group (median 3900g and 3887g, respectively) and in the control group (median 3200g and 3275g, respectively).

Our study is not without limitations. This is a retrospective study. The observational design limited our ability to infer a causal relationship between success rate and large estimation of fetal weight. Furthermore, lack of randomization due to study design might have introduced a bias. A small sample size may obscure our ability to define the rate of uterine rupture and uterine dehiscence in both groups.

Moreover, the ultrasound examinations performed in this study as a part of the routine care in our tertiary center are not routinely done in all medical centers, this might limit the applicability of our findings to different practice settings.

Interpretation

When considering TOLAC, one should assess the risk for possible complications, even more so, when the fetus is estimated LGA. Most complications occur when TOLAC fails and emergent CD is needed (8, 9, 16). Thus, successful TOLAC is associated with less maternal morbidity than elective repeat CD, whereas failed attempt is associated with a higher risk for maternal morbidity (17). To the best of our knowledge, to date, no study has focused on complications as a result of TOLAC for estimated LGA fetuses. With regard to macrosomic fetuses (weights greater than 4000 g), studies are inconsistent with whether it is associated with increased risk for uterine rupture or not (18, 19). Our study revealed no difference amongst women in the study and control group, in scar dehiscence or uterine rupture rate as well as in the rate of 3rd /4th degree perineal tear, shoulder dystocia, and need for blood transfusion.

Conclusions

We conclude that trial of labor after Cesarean delivery in women with singleton pregnancy at term with the presence of estimated large fetus for gestational age and a prior low transverse uterine incision, is a safe option, taking into consideration slightly lower success rate and a higher incidence of post-partum hemorrhage.

This information should be of value to physicians and patients alike. Assessment of fetal weight prior to counseling patients regarding TOLAC may be of value. Further larger randomized prospective investigation needs to be done to strengthen our findings.

Disclosure

The authors report no conflict of interest.

Author's contribution

Aya Mohr – Sasson- Conception, planning, carrying out, analyzing and writing up

Or Bercovich - Carrying out and writing up

Zohar Goichberg - Carrying out

Hadel Watad - Carrying out

Kiss Salim – Conception and carrying out

Shali Mazaki-Tovi- Planning

Eyal Sivan- Conception and planning

Israel Hendler- Conception. Planning, writing and carrying out

Ethics Approval

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Reference

1. Hamilton BE, Martin JA, Osterman MJ, Rossen LM. Births: provisional data for 2018. 2019.
2. Betran AP, Torloni MR, Zhang JJ, Gülmezoglu AM, Section WWGoC. WHO Statement on Caesarean Section Rates. *BJOG*. 2016;123(5):667-70.
3. Lee HC, El-Sayed YY, Gould JB. Population trends in cesarean delivery for breech presentation in the United States, 1997-2003. *Am J Obstet Gynecol*. 2008;199(1):59.e1-8.
4. Goetzinger KR, Macones GA. Operative vaginal delivery: current trends in obstetrics. *Womens Health (Lond)*. 2008;4(3):281-90.
5. National Institutes of Health Consensus Development conference statement: vaginal birth after cesarean: new insights March 8-10, 2010. *Obstet Gynecol*. 2010;115(6):1279-95.
6. Greene M, Hsiang-Hui DK, Hartenbach E, Shrider E, Ehrenthal D. Attempted and Successful VBAC Across Geographic Areas in the United States [25H]. *Obstetrics & Gynecology*. 2019;133:91S.
7. Fagerberg MC, Marsal K, Kallen K. Predicting the chance of vaginal delivery after one cesarean section: validation and elaboration of a published prediction model. *Eur J Obstet Gynecol Reprod Biol*. 2015;188:88-94.
8. Landon MB, Hauth JC, Leveno KJ, Spong CY, Leindecker S, Varner MW, et al. Maternal and perinatal outcomes associated with a trial of labor after prior cesarean delivery. *N Engl J Med*. 2004;351(25):2581-9.
9. Macones GA, Peipert J, Nelson DB, Odibo A, Stevens EJ, Stamilio DM, et al. Maternal complications with vaginal birth after cesarean delivery: a multicenter study. *Am J Obstet Gynecol*. 2005;193(5):1656-62.
10. Dollberg S, Haklai Z, Mimouni FB, Gorfein I, Gordon ES. Birth weight standards in the live-born population in Israel. *Isr Med Assoc J*. 2005;7(5):311-4.
11. Peaceman AM, Gersnoviez R, Landon MB, Spong CY, Leveno KJ, Varner MW, et al. The MFMU Cesarean Registry: impact of fetal size on trial of labor success for patients with previous cesarean for dystocia. *Am J Obstet Gynecol*. 2006;195(4):1127-31.
12. Gibson JR, Mc KT. Observations on all births (23, 970) in Birmingham, 1947. VII. Effect of changing family size on infant mortality. *Br J Soc Med*. 1952;6(3):183-7.
13. Shin D, Song WO. Prepregnancy body mass index is an independent risk factor for gestational hypertension, gestational diabetes, preterm labor, and small- and large-for-gestational-age infants. *J Matern Fetal Neonatal Med*. 2015;28(14):1679-86.
14. Ruhstaller K, Hoffman MK, Sciscione A. 661: Trial of labor after cesarean delivery: the impact of BMI. *American Journal of Obstetrics & Gynecology*. 2012;206(1):S295-S6.
15. Sheiner E, Sarid L, Levy A, Seidman DS, Hallak M. Obstetric risk factors and outcome of pregnancies complicated with early postpartum hemorrhage: a population-based study. *The Journal of Maternal-Fetal & Neonatal Medicine*. 2005;18(3):149-54.

16. Hibbard JU, Ismail MA, Wang Y, Te C, Karrison T, Ismail MA. Failed vaginal birth after a cesarean section: How risky is it?: I. Maternal morbidity. *American journal of obstetrics and gynecology*. 2001;184(7):1365-73.

17. ACOG Practice Bulletin No. 205: Vaginal Birth After Cesarean Delivery. *Obstet Gynecol*. 2019;133(2):e110-e27.

18. Elkousy MA, Sammel M, Stevens E, Peipert JF, Macones G. The effect of birth weight on vaginal birth after cesarean delivery success rates. *American journal of obstetrics and gynecology*. 2003;188(3):824-30.

19. Leung AS, Farmer RM, Leung EK, Medearis AL, Paul RH. Risk factors associated with uterine rupture during trial of labor after cesarean delivery: a case-control study. *Am J Obstet Gynecol*. 1993;168(5):1358-63.

Table 1: Patients' demographics and characteristics*

	eLGA fetus (n=78)	Non eLGA fetus (n=1871)	P value
Age (Years)	35(32-37)	33(30-36)	0.004
BMI (kg/m ²)	30.9 (27.7-33.3)	27.5 (25.1-30.5)	0.001
Gravidity (n)	4 (3-6)	3 (2-4)	0.001
Parity (n)	2 (1-4)	1(1-2)	0.001
Gestational age (weeks)	39.3(39.1-40.5)	39.3(38.1-40.5)	0.26
Estimated fetal weight (g)	3900 (3800-4040)	3200 (3050-3500)	0.001
GCT (mg/dl)	105(89-127)	106 (91-121)	0.97
Pathologic OGTT +	5/40 (12.5)	68/455 (14.9)	0.68

eLGA – estimated Large For Gestational age by ultrasound, BMI- Body Mass Index, GCT- Glucose Challenge Test, OGTT - Oral Glucose Challenge Test (By Carpenter and Cousten criteria)

n- number. G- grams

* Data are presented as median and inter-quartile range (IQR)

+Data are presented as n (%)

Table 2: Obstetric Outcome

	eLGA fetus (n=78)	Non eLGA fetus (n=1871)	P value
Neonatal weight (gram) *	3887 (3718-4073)	3275 (2995-3545)	0.031
VBAC	55 (70.5)	1506 (80.5)	0.004
Blood transfusion	3 (3.8)	17 (0.9)	0.06
3 RD /4 TH Perineal tear	0 (0)	9 (0.5)	0.54
Post-partum hemorrhage	6 (7.7)	32 (1.7)	0.001
Shoulder dystocia	2 (2.6)	14 (0.7)	0.08
Scar Dehiscence	1 (1.3)	5 (0.3)	0.11
Uterine rupture	0 (0)	15 (0.8)	0.43

eLGA –estimated fetal weight large for gestational age > 90th percentile

Non e LGA- estimated fetal weight smaller than 90thpercentile

Data are presented as n, (%)

*Data are presented as median and inter-quartile range (IQR)

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