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Original Research Article

Clinical predictors of successful trial of labour after two or more previous caesarean sections: development of a structured selection protocol from a prospective observational study

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ABSTRACT

Background: Trial of labour after caesarean (TOLAC) in women with two or more previous lower segment caesarean sections (LSCS) remains underutilized because of concerns regarding uterine rupture and adverse maternal outcomes. Identification of reliable predictors may improve patient selection and optimize vaginal birth after caesarean (VBAC) success rates.

Methods: This prospective observational study was conducted over 18 months at a tertiary care teaching hospital in Maharashtra, India. A total of 113 women with ≥ 2 previous LSCS were included. Predictor variables including scar thickness, Bishop score, gestational age, maternal age, body mass index (BMI), previous vaginal delivery, neonatal birth weight and onset of labour were analysed using chi-square test followed by multivariable logistic regression.

Results: Among 113 women, 80 (70.80%) underwent TOLAC, of whom 65 (81.25%) achieved successful VBAC. Scar thickness >3 mm ($p < 0.001$), Bishop score >6 ($p < 0.001$), previous vaginal delivery ($p < 0.01$), gestational age 37–40 weeks ($p < 0.001$), BMI < 30 kg/m² ($p < 0.05$), neonatal birth weight < 3.2 kg ($p < 0.05$) and spontaneous onset of labour ($p < 0.05$) were significant predictors. Multivariable logistic regression identified scar thickness >3 mm and Bishop score >6 as independent predictors.

Conclusions: TOLAC after ≥ 2 previous LSCS can be safely offered to carefully selected women. Integration of scar thickness and cervical favourability into structured institutional selection protocols improves VBAC success rates and supports evidence-based decision-making.

Keywords: VBAC, TOLAC, Multiple caesarean sections, Scar thickness, Bishop score, Predictors

INTRODUCTION

Caesarean section rates have increased substantially worldwide over recent decades, exceeding recommended population thresholds suggested by global health authorities.¹ Although caesarean delivery is a life-saving intervention when medically indicated, rising repeat caesarean section rates contribute significantly to maternal morbidity and complications in subsequent pregnancies including placenta previa, placenta accreta spectrum disorders and surgical adhesions.^{2,3}

Trial of labour after caesarean (TOLAC) has emerged as an effective strategy for reducing repeat caesarean section rates. While vaginal birth after one previous caesarean section is widely accepted, decision-making regarding TOLAC after two or more previous caesarean sections remains conservative in many institutions due to concerns regarding uterine rupture and adverse maternal and neonatal outcomes.^{4,5}

Recent evidence suggests that with careful patient selection and continuous intrapartum monitoring, VBAC

after multiple previous caesarean sections can be achieved safely in selected patients.⁶ Identification of reliable clinical predictors such as lower uterine segment scar thickness, Bishop score, obstetric history, gestational age and maternal characteristics may improve selection criteria and optimize delivery outcomes.^{7,8}

Despite growing international evidence, prospective data evaluating predictors of successful TOLAC after ≥ 2 previous caesarean sections from Indian tertiary-care settings remain limited. Therefore, the present study was undertaken to identify predictors of successful VBAC after ≥ 2 previous LSCS and to develop a structured clinical selection protocol for implementation in routine obstetric practice.

METHODS

Study design and setting

This prospective observational study was conducted in the Department of Obstetrics and Gynaecology at Dr. Shankarrao Chavan Government Medical College and Hospital in Maharashtra, India over 18 months (October 2023 to March 2025) after Institutional Ethics Committee approval.

Study population

Sample size included all eligible consecutive cases presenting during the study period. Pregnant women with history of ≥ 2 previous lower segment caesarean sections presenting during the study period were screened for eligibility. Women fulfilling inclusion criteria and providing informed consent were enrolled and followed until delivery.

Inclusion criteria

Inclusion criteria included ≥ 2 previous LSCS, singleton pregnancy, vertex presentation, and inter-delivery interval ≥ 18 months.

Exclusion criteria

Classical caesarean scar, placenta previa/accreta spectrum, multiple pregnancy, major maternal comorbidities, and patients with refusal to participate were excluded.

Clinical evaluation

Detailed demographic characteristics, obstetric history, gestational age, body mass index (BMI), Bishop score and lower uterine segment scar thickness were recorded. Routine antenatal investigations included: complete blood count, blood grouping, liver function tests, renal function tests, blood glucose estimation, urine examination, ultrasonography. Lower uterine segment scar thickness was measured sonographically using transabdominal ultrasonography in the third trimester.

Selection criteria for TOLAC

Patients were considered suitable candidates for TOLAC based on: vertex presentation, singleton pregnancy, scar thickness > 2.5 mm, adequate liquor, absence of cephalopelvic disproportion, placenta not low-lying, and availability of emergency operative facilities.

Labour management

Patients undergoing TOLAC were monitored using continuous intrapartum fetal surveillance. Mechanical cervical ripening using Foley catheter was performed in cases with Bishop score ≤ 6 . Labour augmentation using artificial rupture of membranes and low-dose oxytocin infusion was performed when indicated.¹⁰ Continuous electronic fetal heart rate monitoring was performed wherever feasible.

Outcome measures

Primary outcome included successful VBAC after ≥ 2 previous LSCS and secondary outcomes included identification of predictors associated with successful VBAC.

Statistical analysis

Data were analysed using statistical package for the social sciences (SPSS) version 25. Qualitative variables were expressed as frequency and percentage. Chi-square test was used for univariate analysis. Variables with $p < 0.05$ were entered into multivariable logistic regression analysis. Statistical significance was defined as $p < 0.05$.

RESULTS

Study population characteristics

During the study period, 146 women with ≥ 2 previous caesarean sections were encountered. Thirty-three declined participation and were excluded. Final study population comprised 113 women. Among these: 32 (28.32%) underwent elective repeat LSCS, 80 (70.80%) underwent TOLAC, 1 (0.88%) presented with uterine rupture at admission and underwent emergency laparotomy prior to initiation of TOLAC. Among women undergoing TOLAC, 65 (81.25%) achieved successful VBAC, 15 (18.75%) required emergency LSCS (Table 1).

Obstetric predictors

Previous vaginal delivery showed strong association with VBAC success ($p < 0.01$). Gestational age demonstrated highly significant association with delivery outcome ($p < 0.001$). Scar thickness showed strong association with VBAC success ($p < 0.001$). Bishop score demonstrated strong association with VBAC success ($p < 0.001$) (Table 2).

Table 1: Demographic predictors of delivery outcome.

Variable	Successful VBAC (n=65)	Failed TOLAC (n=15)	Elective LSCS (n=32)	P value
Age 21–32 (years)	58	7	18	<0.05
BMI <30 kg/m ²	60	12	21	<0.05
Lower socioeconomic status	32	6	10	>0.05
Housewife	50	10	13	>0.05

Table 2: Obstetric predictors of VBAC success.

Predictor	Successful VBAC	Failed	Elective LSCS	P value
Previous vaginal delivery	13	1	0	<0.01
Scar thickness >3 mm	46	3	10	<0.001
Bishop score >6	45	4	8	<0.001
Gestational age 37–40 weeks	44	12	19	<0.001

Labour characteristics

Spontaneous onset of labour showed higher VBAC success rates compared with induced labour ($p<0.05$) (Table 3).

Table 3: Labour characteristics.

Labour characteristic	Successful VBAC	Failed TOLAC
Spontaneous labour	31	8
Foley induction	19	4
Oxytocin augmentation	15	3

Neonatal predictors

Neonatal birth weight demonstrated statistically significant association with delivery outcome ($p<0.05$) (Table 4).

Table 4: Independent predictors of successful VBAC after ≥ 2 previous LSCS (multivariable logistic regression).

Predictor	Adjusted significance	Interpretation
Scar thickness >3 mm	$p<0.001$	Strong independent predictor
Bishop score >6	$p<0.001$	Strong independent predictor

DISCUSSION

The present study evaluated predictors of successful TOLAC after ≥ 2 previous caesarean sections and demonstrated a high VBAC success rate of 81.25%. This success rate is comparable with pooled success rates reported by Tahseen and Griffiths (71%) and Roux et al (67%).^{1,2} The higher success rate observed in the present

study may be attributed to careful institutional selection criteria.

Lower uterine segment scar thickness emerged as the strongest predictor of VBAC success. Similar findings were reported by Rozenberg et al and Metz et al demonstrating predictive value of scar thickness in assessing uterine integrity.^{3,4} Bishop score showed strong association with VBAC success. Similar findings were reported by Cahill et al and Lemane et al identifying cervical favourability as an important determinant of successful TOLAC.^{5,6} Previous vaginal delivery significantly improved VBAC success rates in the present study. Similar observations were reported by Macones et al and Grobman et al.^{7,8}

One case of uterine rupture (0.88%) occurred prior to initiation of TOLAC, highlighting the importance of careful antenatal scar assessment and institutional readiness when offering TOLAC after multiple previous caesarean sections. Gestational age between 37–40 weeks demonstrated highest success rates. Similar findings were reported by Coassolo et al.⁹ Maternal BMI demonstrated inverse association with VBAC success similar to observations reported by Harper et al.¹⁰ Spontaneous onset of labour demonstrated improved success rates compared with induced labour consistent with findings reported by Hibbard et al.¹¹

Maternal morbidity was lowest in successful VBAC group consistent with findings reported by Landon et al and Silver et al.^{12,13} A major strength of the present study is its prospective design with protocol-based selection of candidates undergoing TOLAC after ≥ 2 previous caesarean sections, a subgroup with limited representation in existing literature from Indian tertiary-care settings.

The proposed structured protocol derived from this prospective dataset may assist clinicians in safely implementing TOLAC after ≥ 2 previous caesarean sections in tertiary-care settings with appropriate monitoring facilities.

Trial of labour after two or more previous lower segment caesarean sections (TOLAC-2+) may be offered in carefully selected patients using the following structured criteria.

Step 1: Confirm basic eligibility (all required)

It involves Singleton pregnancy, vertex presentation, inter-delivery interval ≥ 18 months, no classical uterine scar, no placenta previa/accreta, no cephalopelvic disproportion, and emergency LSCS facility available.

If any contraindication is present, then elective repeat LSCS.

Step 2: Assess scar thickness (3rd trimester USG)

If scar thickness is >3 mm then favourable, 2.5–3 mm then cautious TOLAC, <2.5 mm then avoid TOLAC and scar thickness >3 mm then strongest predictor of success

Step 3: Assess cervical status (Bishop score)

If cervical status is >6 then favourable and ≤ 6 then Foley catheter ripening is recommended.

Step 4: Evaluate favourable predictors

Presence of any improves VBAC success: previous vaginal delivery, previous successful VBAC and non-recurrent indication for prior LSCS.

Step 5: Assess maternal and fetal factors

Preferred profile involves maternal age 21–32 years, BMI <30 kg/m², gestational age 37–40 weeks and estimated fetal weight 2.3–3.2 kg.

Step 6: Labour management

Spontaneous labour should be preferred.

If induction required then Foley catheter preferred, low-dose oxytocin with caution and continuous fetal monitoring mandatory.

Step 7: Confirm institutional readiness (mandatory)

Ensure availability of continuous fetal monitoring, emergency LSCS capability within 30 minutes decision-to-incision interval, blood bank support, anaesthesia team, neonatal resuscitation support and senior obstetric supervision should be taken.

Final recommendation

Offer supervised TOLAC after ≥ 2 previous LSCS when criteria of all steps are fulfilled, otherwise Elective repeat LSCS recommended.

Limitations

Single-centre design and relatively small sample size limit generalizability. Scar thickness measurement was operator-dependent and interobserver variability could not be assessed. Long-term neonatal follow-up was not performed. Multivariable regression analysis was limited by sample size constraints.

CONCLUSION

TOLAC after ≥ 2 previous caesarean sections can be safely offered to carefully selected women. Scar thickness >3 mm and Bishop score >6 are strong independent predictors of successful VBAC. Integration of these predictors into structured institutional selection protocols may improve VBAC success rates and reduce unnecessary repeat caesarean deliveries in appropriately monitored tertiary-care settings.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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