E-ISSN 2250-0944
ISSN 2250-1150
doi: 10.31838/ijprt/16.01.812

Research Article

Role of Induction of Labor in Trial of Vaginal Delivery after Cesarean Section

Sadaf Saher[1*], Zunaira Bajwa[2], Sheeba Rehman[3], Amna Mahvish Haider[4], Zainab Azam[5]
[1*]Rai Medical College and Teaching Hospital, Sargodha, Pakistan.
[2]Rai Medical College and Teaching Hospital, Sargodha, Pakistan.
[3]Razia Rehman Hospital, Bhalwal, Pakistan.
[4]KRL Hospital, Islamabad, Pakistan.
[5]Rai Medical College Teaching Hospital, Sargodha, Pakistan.
Email: [1*]dr.sadafsahar@yahoo.com
Received: 06-04-2026, Revised: 12-06-2026, Accepted: 17-06-2026

ABSTRACT
Introduction: Vaginal delivery after cesarean is an option for women who are eligible, and can help them avoid the complications of repeat cesarean deliveries. For women who have had cesarean delivery, induction may be indicated if it is not desirable to continue the pregnancy, and the success and safety of the procedure are important clinical issues.
Objective: To compare induction of labor in women who had a previous cesarean delivery and were considering trial of vaginal delivery with its association to successful vaginal delivery and maternal outcomes.
Materials and Methods: A prospective observational study of 120 women with previous lower segment transverse cesarean section who had undergone induction of labor at term. Data on maternal, obstetric, induction, delivery and neonatal factors were collected and evaluated.
Results: 68.3 % of the women had a successful VBAC, with 31.7 % undergoing emergency repeat cesarean delivery. Positive cervical status and previous vaginal delivery and appropriate patient selection were associated with successful vaginal delivery. The intrapartum monitoring was closely followed and maternal and neonatal outcome was generally satisfactory.
Conclusion: Induction of labor is a possible option in a trial of labor following cesarean section in selected women with standardized protocols, continuous assessment and emergency intervention facilities and appropriate obstetric care.

Keywords: TOLAC, Vaginal birth after cesarean, VBAC, Previous cesarean section, Labor induction, Maternal outcomes.

INTRODUCTION

Induction of labor has become an important part of modern obstetrics because the birth may be delayed, but the risks of doing so are minimized by delivering the baby. However, success following induction is dependent on maternal, fetal and cervical factors, such as parity, BMI, estimated fetal weight, gestational age and previous vaginal delivery[1]. Today, induction is no longer only considered a technique to initiate labor, but rather a process that involves balancing indications for delivery, the risk of vaginal delivery, the mother's choice, and risks to the mother and baby overall[2]. This balance is especially significant in women who have been cesarean sectioned. Trial of labor after cesarean delivery (TOLAC) is a chance for the right women to have a vaginal delivery without having to undergo another abdominal surgery and some complications from repeated surgery[3]. Results from term populations indicate that induction does not invariably result in operative delivery, and that there are many factors to consider in this relationship, as it is more complex than had been previously thought, including baseline risk, timing, cervical status and clinical setting[4].

Effect of induction also depends on the characteristics of the population. Systematic evidence in women with obesity, for instance, has investigated whether full-term induction influences cesarean rates when compared with expectant management, emphasising the need for individual counselling, as opposed to assuming a uniform risk for all women[5]. Likewise, in large studies, elective induction at 39 weeks has been related to certain patterns of maternal labor and neonatal outcomes, lending further evidence that if properly

timed and managed, well-selected induction can be compatible with favorable perinatal outcomes. When women try to have a vaginal birth after a low-transverse cesarean, the choice is the key to success. Based on observational data, factors such as previous vaginal birth, nonrecurrent indication for the previous cesarean, favorable cervical examination, membrane status and fetal station may impact the likelihood of a successful VBAC[7]. Cervical assessment prior to induction is clinically useful, as there is a correlation between cervical readiness and the outcome of induction and it has been examined whether Bishop score or ultrasound assessment of the cervix is a good indicator of the likelihood of a vaginal delivery[8].

There have also been changes to induction practice, with evidence from the ARRIVE trial to support elective induction at 39 weeks in selected low-risk women leading to increased induction following the findings from the ARRIVE trial[9]. However, women who have had uterine scars are a unique population as the outcomes of an unsuccessful TOLAC and emergency cesarean delivery could be different than women who have not had a cesarean delivery. Cautious trials of labor have been assessed, even in women who have had two cesareans, emphasising the need for individual selection of trial of labor, resources, and intrapartum monitoring[10]. Successful Vaginal Birth After Cesarean (VBAC) has been shown to be possible in routine hospital practice in clinical experience, with varying success rates across institutions and populations[11].

There are multiple maternal and obstetric factors that contribute to failure of TOLAC, and population-based studies have revealed factors linked to failure after a single cesarean delivery. The results highlight the importance of identifying women at high risk for vaginal delivery from those who are at high risk for induction to increase the risk of emergency operative delivery or other poor outcomes[12]. The technique for cervical ripening and induction is also a very important factor. Randomized studies have compared the effectiveness and safety profile of mechanical balloon catheter to vaginal prostaglandins for the induction of labour in women who need cervical ripening[13]. Data regarding predictors of VBAC success also support counseling and candidate selection prior to TOLAC[14]: previous vaginal delivery, cervical dilatation, spontaneous membrane rupture, and other obstetric factors that may help counsel and select candidates for VBAC. Fetal indications are also appropriate for induction, such as suspected excessive fetal growth, when there is a benefit to inducing earlier than normal, but possible risks of induction and the potential for operative delivery must be considered[15].

One of the related challenges is to determine when the induction has truly failed. Recent studies warn against early diagnosis of failed induction and suggest giving enough time for cervical ripening and labor to start when the maternal and fetal status is reassuring, to avoid unnecessary cesarean deliveries and to maintain the opportunity for a vaginal birth in appropriate candidates[16]. In conclusion, the pros and cons of a successful VBAC versus the risks of a failed VBAC, uterine rupture, emergency cesarean versus elective repeat cesarean delivery must be carefully balanced when considering induction for TOLAC. Systematic comparisons of the TOLAC approach with elective repeat cesarean delivery point out that there are no risk-free options and informed choice is critical[17]. In addition, prediction studies of induction outcome indicate that cesarean risk is associated with a combination of multiple maternal and fetal factors, rather than a single factor, and therefore, an overall evaluation of the factors should be performed when considering cesarean section after induction[18].

Objective: To assess the role of induction of labor in women who have had cesarean section in the past and have been offered a trial of vaginal delivery (TOL) and to identify its correlation with successful vaginal delivery and maternal outcomes.

MATERIALS AND METHODS

Study Design: Prospective observational study.

Study Setting: Rai Medical College and Teaching Hospital, Sargodha.

Study Duration: Six months, from March, 2025 to August, 2025.

Sample Size: 120 women.

Sample Technique: Consecutive non-probability sampling.

Prospective observational study was carried out in the Rai Medical College and Teaching

Hospital, Sargodha. The study period lasts for six months from March, 2025 to August, 2025. Eligible women were sampled using consecutive non-probability sampling methods and a sample of 120 was recruited.
Inclusion Criteria: Women aged 18-40 years who have had one lower-segment transverse cesarean section, have a clinically adequate pelvis, a reassuring fetal status, an indication for induction of labor, and desire a trial of labor after cesarean was included following informed consent.
Exclusion Criteria: Women with 2 or more previous cesarean deliveries, classical or unknown uterine scar, previous uterine rupture, placenta previa/accreta, malpresentation, multiple pregnancy, major fetal anomaly, intrauterine fetal death, cephalopelvic disproportion, or any maternal or fetal anomaly which would require immediate cesarean delivery was excluded. Eligible participants were monitored as per standard intrapartum monitoring within the institution during induction and active labour.

Methods

Demographic data and obstetric data were documented on a structured proforma, after registration: maternal age, parity, gestational age, indication for previous cesarean section, prior vaginal delivery, Bishop score, indication for induction. Maternal vital signs and fetal heart rate was measured as baseline prior to induction. Cervical ripening and induction were done as per institutional protocol with the use of Foley catheter, amniotomy and oxytocin when clinically indicated. Fetal monitoring was continued or intermittent based upon risk status, and continuous assessment of uterine contractions, cervical dilatation, fetal descent and maternal condition was done. Successful vaginal birth after cesarean was main outcome. Secondary outcomes consist of failed induction, emergency repeat cesarean section, indication for cesarean delivery, uterine rupture, postpartum hemorrhage, neonatal birth weight, Apgar scores, and neonatal intensive care admission. Descriptive and inferential statistical test was used to analyse the data and the level of significance was set at $p<0.05$ for all analyses.

RESULTS

During the study period, 120 women with previous lower-segment cesarean section (LSCS) had induction of labour and trial of labour (TOL). The mean maternal age at delivery was 28.7 ± 4.6 years, and the mean gestational age at induction was 39.1 ± 1.1 weeks. The majority were multiparous and 32 women had undergone previous vaginal delivery. The mean Bishop score prior to induction was 5.6 ± 1.8. Table 1 below shows the baseline maternal and obstetric characteristics by final mode of delivery. This was the baseline profile.

Table 1. Baseline maternal and obstetric characteristics by delivery outcome

Characteristic	Total (n=120)	Successful VBAC (n=82)	Emergency CS (n=38)	p-value
Maternal age, years	28.7 ± 4.6	28.3 ± 4.3	29.5 ± 5.0	0.18
Gestational age, weeks	39.1 ± 1.1	39.0 ± 1.0	39.3 ± 1.2	0.16
Previous vaginal delivery	32 (26.7%)	28 (34.1%)	4 (10.5%)	0.006
Bishop score >6	54 (45.0%)	46 (56.1%)	8 (21.1%)	<0.001
Mean Bishop score	5.6 ± 1.8	6.2 ± 1.5	4.3 ± 1.7	<0.001

Overall, successful vaginal birth after cesarean was achieved in 82 of 120 women, giving a VBAC success rate of 68.3%. Emergency repeat cesarean section was required in 38 women, representing The study population consisted of 31.7% of the population. After enrollment, no woman had an elective cesarean, since all women were initially deemed to be good candidates for induction and TOLAC. The distribution shows that over two thirds of those women who were appropriately selected had a vaginal delivery after induction. The distribution of the overall mode of delivery of the study participants is shown in Figure 1 below. This facilitated monitored TOLAC practice.

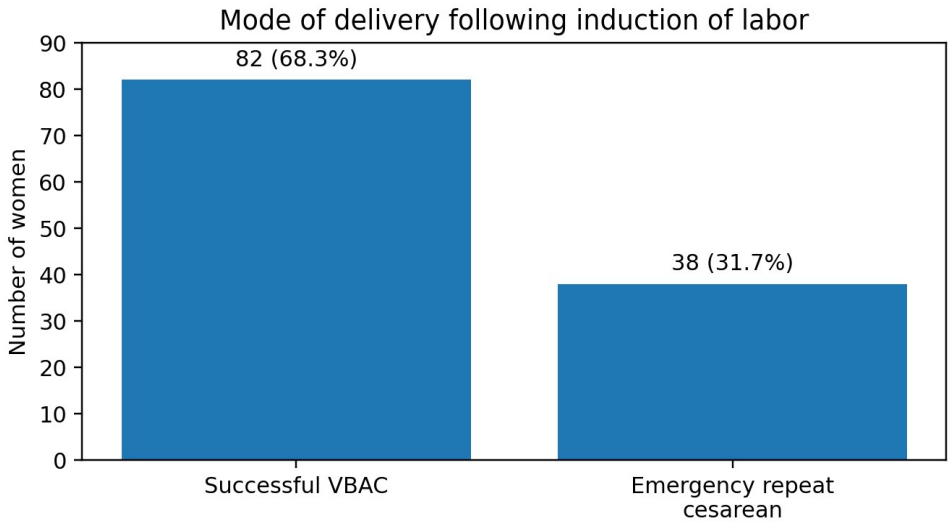


Figure 1. Overall mode of delivery following induction of labor

As for the induction process, 72 women had their cervixes induced with a Foley catheter and 48 women had a sufficiently favorable cervix for amniotomy with or without oxytocin augmentation. Women who successful VBAC had a higher mean pre-induction Bishop score than those who had cesarean delivery. Successful VBAC cases were more likely to have had a previous VBAC and a Bishop score > 6. Women who had a failed TOLAC had longer induction-to-delivery intervals. Induction and delivery characteristics by outcome are shown in table 2. These patterns preferred for vaginal delivery.

Table 2. Induction and delivery characteristics according to final outcome

Characteristic	Total (n=120)	Successful VBAC (n=82)	Emergency CS (n=38)	p-value
Foley catheter used	72 (60.0%)	46 (56.1%)	26 (68.4%)	0.20
Amniotomy ± oxytocin as initial approach	48 (40.0%)	36 (43.9%)	12 (31.6%)	0.20
Oxytocin augmentation	92 (76.7%)	61 (74.4%)	31 (81.6%)	0.38
Induction-to-delivery interval, hours	11.9 ± 4.5	10.8 ± 3.9	14.2 ± 4.7	<0.001
Previous vaginal delivery	32 (26.7%)	28 (34.1%)	4 (10.5%)	0.006

Of the 38 women who needed emergency repeat cesarean delivery, the most common reason was non-reassuring fetal heart rate in 13 cases. Eleven women failed to induce despite good cervical ripening and oxytocin, and nine had arrest of labor, which accounted for nine cesarean deliveries. Five women were cesarean due to tenderness of the scar and/or clinical doubt about the integrity of the scar. There was no report of complete rupture of the uterus. Figure 2 shows the distribution of indications for emergency repeat cesarean section in women who had an unsuccessful TOLAC by percentage. These findings were used to inform intervention.

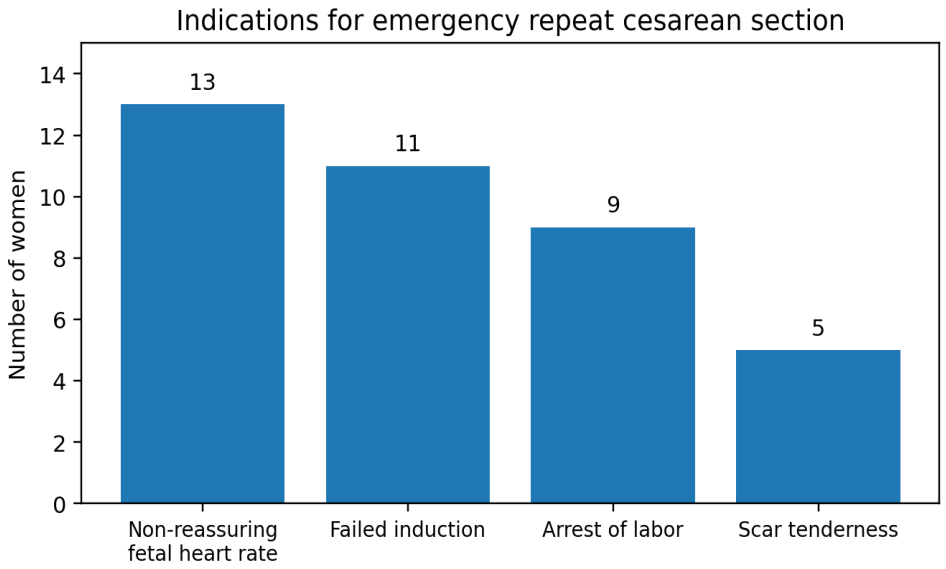


Figure 2. Indications for emergency repeat cesarean section (n=38)

The maternal and neonatal outcomes were overall good for both groups. Six women, three of whom had successful VBAC and three who had emergency cesarean delivery, experienced postpartum hemorrhage. There was one case of blood transfusion in each group. No maternal deaths or hysterectomies or confirmed uterine ruptures were reported. Nine babies required admission to neonatal intensive care and four had a low 5-minute Apgar score. The mean birth weight of the neonates was 3.18 ± 0.42 kg. A comparison of selected maternal and child health indicators. The details of neonatal outcomes are shown in Table 3. Clinical morbidity was not significantly elevated.

Table 3. Maternal and neonatal outcomes by mode of delivery.

Outcome	Total (n=120)	Successful VBAC (n=82)	Emergency CS (n=38)	p-value
Postpartum hemorrhage	6 (5.0%)	3 (3.7%)	3 (7.9%)	0.38
Blood transfusion	2 (1.7%)	1 (1.2%)	1 (2.6%)	0.53
Confirmed uterine rupture	0	0	0	—
NICU admission	9 (7.5%)	4 (4.9%)	5 (13.2%)	0.13
Five-minute Apgar score <7	4 (3.3%)	1 (1.2%)	3 (7.9%)	0.08
Birth weight, kg	3.18 ± 0.42	3.15 ± 0.40	3.25 ± 0.46	0.22
Note: Data are presented as mean ± SD or n (%). VBAC: vaginal birth after cesarean; CS: cesarean section; NICU: neonatal intensive care unit.				

DISCUSSION

The current study was designed to compare the induction rates for women with a previous cesarean section who attempted to deliver vaginally. The rate of successful vaginal birth after cesarean (VBAC) was 68.3% and 31.7% needed an emergency repeat cesarean section. This implies that induction may be considered as a reasonable option in appropriately selected women who had one previous lower-segment cesarean scar, giving a reasonable probability of vaginal delivery. Factors that affect induction success include maternal characteristics, cervical status, parity and obstetric history, and require careful pre-induction evaluation[1]. Induction is also accepted as a valid procedure in modern obstetric practice when there are benefits to delivery that outweigh the benefits of continued pregnancy[2]. The observed VBAC rate is adequate to support the option of TOLAC for eligible women who have had a prior cesarean. Repeat abdominal surgery is avoided with successful VBAC and cumulative morbidity from multiple cesarean sections may be decreased[3]. In women who have a uterine scar, however, caution is needed since failed labor may have important maternal and fetal implications.

Data from term pregnancies suggest that induction does not always lead to higher cesarean rates if sufficient intrapartum monitoring and standardized protocols are used and appropriate patients are selected for induction[4]. Other maternal factors are associated with the likelihood of successful vaginal delivery after induction. In other obstetric populations, obesity, advanced maternal age and poor cervical examination have been linked to higher rates of operative delivery. A systematic review of women with obesity revealed that the results of induction differ based on baseline characteristics and delivery time[5]. Comparisons with elective induction at 39 weeks and with expectant management also suggest that planned induction may be linked to acceptable maternal and neonatal outcomes and may therefore be appropriate for individual clinical decisions[6]. In the current study, women with good cervical exam and prior vaginal delivery seemed to be more likely to have a VBAC. This is consistent with studies showing that previous vaginal delivery, nonrecurrent reason for cesarean delivery, and good labor history are associated with increased rates of TOLAC[7].

Assessment of the cervix is thus still important prior to induction. The bishop score and ultrasound assessment of cervical characteristics have both been studied as predictors of induction success and could be used to help the clinician make an informed guess about the chances of a vaginal birth prior to induction[8]. The rise of induction at term has had an impact on the modern management of labour. After the ARRIVE trial, induction at 39 weeks increased in several clinical scenarios, indicating increased acceptance of appropriate timing of induction[9]. However, women who have had a cesarean scar should be taken into account, as the integrity of the scar, the number of prior cesareans and access to emergency obstetric care have an impact on safety. Careful selection and close intrapartum monitoring in women with scarred uteri are additionally highlighted in studies that investigated TOLAC following two previous cesarean deliveries[10].

In this study, the percentage of women needing emergency repeat cesarean is emphasised as a reminder of the need to identify predictive factors for failed TOLAC. The institutional experience has demonstrated that VBAC can be practiced with appropriate selection of patients for VBAC, patient monitoring during labor, and successful practices[11]. On the other hand, failed TOLAC has been linked to poor cervical status, advanced maternal age, and elevated BMI, as well as some factors for the previous cesarean delivery. There is population-based evidence to consider using these characteristics in counseling and clinical decision making prior to the commencement of induction[12]. How the induction is given can have an impact on the effectiveness and safety of the induction. Mechanical cervical ripening with balloon catheters is generally suggested when women have a previous cesarean section since it offers an alternative to pharmacological cervical ripening.

Comparative randomized evidence has been used to compare balloon catheters and vaginal prostaglandins, and found clinically significant differences such that choice of induction technique should be based on these differences.[13] The evidence for predictors of VBAC also suggests that a one-size-fits-all approach to induction should not be used for all women, and instead should be individualized based on obstetric history, cervical examinations, and the woman's prior vaginal delivery[14]. Care must also be taken in considering indications for induction. When there is no contraindication, fetal size, post-dated pregnancy, maternal disease and other obstetric conditions may be indications to deliver without going against the vaginal birth option. In the case of suspected LGA fetuses, the approach of randomizing evidence demonstrates attempts to assess if induction can reduce obstetric complications without unnecessary augmentation of the operative birth rate[15]. If induction is slow, then clinicians should also refrain from making a diagnosis too early. When mom and baby are okay, a prolonged period of cervical ripening and active labor could avoid a repeat cesarean[16].

The results are generally consistent with the induction of labor being a viable part of TOLAC in women who have had one prior LSCS who are carefully selected. The decision should be individualized, since the benefits of having a successful VBAC are great, whereas, if the TOLAC fails, the emergency surgery and scarring may be a drawback. Informed counseling is needed

as comparative evidence suggests that both TOLAC and elective repeat cesarean (ERC) have unique maternal and neonatal risks[17]. Patient selection using prediction models that include both maternal and fetal characteristics could also be improved and women who are most likely to have a vaginal birth after induction (VBAI) could be identified.

CONCLUSION

Induction of labor may be a feasible and effective alternative in carefully selected women who have had a cesarean delivery and are in a trial of labor. A relatively high percentage of women had a successful vaginal delivery and a smaller percentage had an emergency repeat cesarean delivery. Having a favorable cervical status, having previously given birth vaginally, case selection and monitoring closely during labor and delivery seem to be significant factors in increasing the chances for a successful VBAC. Induction should not, therefore, be automatically recommended for women with one lower-segment cesarean scar. But the decision should be individualized and reflect careful consideration of maternal, fetal and obstetric factors, and facilities available for emergency intervention. It is important that counselling is provided about the potential benefits and risks of TOLAC. Vigilant monitoring and rapid identification of failed labour or complications, and induction of labour is safe and can be used to support vaginal delivery after cesarean, when labour is induced under standardized protocols.

REFERENCES

1. Kamlungkuea T, Manonai J, Suriyawongpaisal P, Hansahiranwadee W. Factors predicting successful vaginal delivery following induction of labor in term pregnancy. International Journal of Women's Health. 2022 Feb 19:245-55.
2. Grobman WA. The role of labor induction in modern obstetrics. American journal of obstetrics and gynecology. 2024 Mar 1;230(3):S662-8.
3. Landon MB. Vaginal birth after cesarean delivery. Queenan's Management of High-Risk Pregnancy: An Evidence-Based Approach. 2024 Jan 2:415-24.
4. Butler SE, Wallace EM, Bisits A, Selvaratnam RJ, Davey MA. Induction of labor and cesarean birth in lower-risk nulliparous women at term: a retrospective cohort study. Birth. 2024 Sep;51(3):521-9.
5. Krogh ML, Glavind MJ, Henriksen MT, Thornton MJ, Fuglsang MJ. Full-term induction of labor vs expectant management and cesarean delivery in women with obesity: systematic review and meta-analysis. American journal of obstetrics & gynecology MFM. 2023 May 1;5(5):100909.
6. Hong J, Atkinson J, Roddy Mitchell A, Tong S, Walker SP, Middleton A, Lindquist A, Hastie R. Comparison of maternal labor-related complications and neonatal outcomes following elective induction of labor at 39 weeks of gestation vs expectant management: a systematic review and meta-analysis. JAMA network open. 2023 May 12;6(5):e2313162.
7. Tesfahun TD, Awoke AM, Kefale MM, Balcha WF, Nega AT, Gezahegn TW, Alemayehu BA, Dabalo ML, Bogale TW, Azene Z, Nigatu S. Factors associated with successful vaginal birth after one lower uterine transverse cesarean section delivery. Scientific reports. 2023 May 31;13(1):8871.
8. Abdullah ZH, Chew KT, Velayudham VR, Yahaya Z, Jamil AA, Abu MA, Ghani NA, Ismail NA. Pre-induction cervical assessment using transvaginal ultrasound versus Bishops cervical scoring as predictors of successful induction of labour in term pregnancies: A hospital-based comparative clinical trial. PLoS One. 2022 Jan 26;17(1):e0262387.
9. Wood R, Freret TS, Clapp M, Little S. Rates of induction of labor at 39 weeks and cesarean delivery following publication of the ARRIVE trial. JAMA Network Open. 2023 Aug 10;6(8):e2328274.
10. Horgan R, Hossain S, Fulginiti A, Patras A, Massaro R, Abuhamad AZ, Kawakita T, Graebe R. Trial of labor after two cesarean sections: A retrospective case–control study. Journal of Obstetrics and Gynaecology Research. 2022 Oct;48(10):2528-33.
11. Chen YT, Hsieh YC, Shen H, Cheng CH, Lee KH, Torng PL. Vaginal birth after cesarean section: Experience from a regional hospital. Taiwanese Journal

of Obstetrics and Gynecology. 2022 May 1;61(3):422-6.
12. He X, Dai Q, Wu X, Zhou J, Li J. Outcomes and risk factors for failed trial of labor after cesarean delivery (TOLAC) in women with one previous cesarean section: a Chinese population-based study. BMC Pregnancy and Childbirth. 2022 Sep 3;22(1):676.
13. Jones MN, Palmer KR, Pathirana MM, Cecatti JG, Moraes Filho OB, Marions L, Edlund M, Prager M, Pennell C, Dickinson JE, Sass N. Balloon catheters versus vaginal prostaglandins for labour induction (CPI Collaborative): an individual participant data meta-analysis of randomised controlled trials. The Lancet. 2022 Nov 12;400(10364):1681-92.
14. Mekonnen BD, Asfaw AA. Predictors of successful vaginal birth after a cesarean section in Ethiopia: a systematic review and meta-analysis. BMC Pregnancy and Childbirth. 2023 Jan 26;23(1):65.
15. Gardosi J, Ewington LJ, Booth K, Bick D, Bouliotis G, Butler E, Deshpande S, Ellson H, Fisher J, Gornall A, Lall R. Induction of labour versus standard care to prevent shoulder dystocia in fetuses suspected to be large for gestational age in the UK (the Big Baby trial): a multicentre, open-label, randomised controlled trial. The Lancet. 2025 May 17;405(10491):1743-56.
16. Ayala NK, Rouse DJ. Failed induction of labor. American Journal of Obstetrics and Gynecology. 2024 Mar 1;230(3):S769-74.
17. Qiu L, Zhu J, Lu X. The safety of trial of labor after cesarean section (TOLAC) versus elective repeat cesarean section (ERCS): a systematic review and meta-analysis. The Journal of Maternal-Fetal & Neonatal Medicine. 2023 Dec 31;36(1):2214831.
18. Quach D, Ten Eikelder M, Jozwiak M, Davies-Tuck M, Bloemenkamp KW, Mol BW, Li W. Maternal and fetal characteristics for predicting risk of Cesarean section following induction of labor: pooled analysis of PROBAAT trials. Ultrasound in Obstetrics & Gynecology. 2022 Jan;59(1):83-92.