ORIGINAL RESEARCH

A Comparison of Different Methods of Induction of Labor in Patients of Previous Cesarean Section

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Received on: 29 January 2023; *Accepted on*: 07 April 2023; *Published on*: 31 October 2023

Abstract

Introduction: The alarming rise of cesarean deliveries in the past decades has even questioned the ethics of the medical fraternity. This study was conducted to reduce the burden of morbidities associated with repeat cesarean deliveries. In this study, we compared the safety and efficacy of different methods of induction of labor (IOL) in cases with previous one cesarean section.

Materials and methods: After following strict exclusion criteria, 78 patients were found to be eligible to participate in the study. After history, examination and investigations, and USG, patients were assigned to any one of the methods for the IOL. (PGE2 group) ($n = 31$). Patients with Bishops score >4, with cervical dilatation >1.5 cm, middle/anterior position of cervix, were 31 in number. For these patients, Prostaglandin E2 (PGE2) gel was inserted in the posterior fornix. PGE2+ Foley catheter ($n = 22$). In some patients with similar Bishops score, after instillation of PGE2, intracervical Foley catheter was inserted and inflated with 30 mL saline. Patients with intrauterine death of fetus, or multiple congenital malformations were diagnosed on USG, 200 mg of Mifepristone was administered orally, followed by PGE2 gel after 8 hours (Mifepristone + Foley + PGE2 ($n = 12$) Similarly, in 12 patients with intrauterine death/multiple congenital malformations, after 8 hours of 200 mg of Mifepristone, intracervical foley catheter balloon and PGE2 were instilled in post-fornix. In all cases, oxytocin augmentation was done with an infusion set as per protocol. Labor was immediately terminated by performing immediate cesarean in the following circumstances. Severe maternal distress, severe fetal distress, non-progress of labor, signs of impending scar dehiscence.

Results: We observed an overall success rate of TOLAC as 68% by various methods of induction. Maximum success was observed in group D by using mifepristone along with PGE2 and Foleys, in which fetal prognosis was not desired. Our greatest predictor of success was a previous vaginal delivery (Odds Ratio, OR = 24.4), followed by initial Bishops score >5, (OR = 20.3), and BMI <28 (OR = 5.3). We encountered a scar dehiscence rate of 2.5%, which presented as rent in the uterus which was not bleeding. Both patients were managed conservatively with uneventful puerperium.

Conclusion: This study compared different conventional methods of induction in patients with previous one lower segment cesarean section (LSCS). The most important predictor of a successful trial of labor after cesarean deliveries (TOLAC) is a vaginal delivery before or after a cesarean and a favorable preinduction Bishops score >5. On comparing various methods of induction, the addition of mifepristone in cases where fetal prognosis is not desired, accelerated and completed vaginal birth after cesarean section safely. The combination of chemical and mechanical methods of induction resulted in increasing the success rate of TOLAC without increasing any complications. The most common indication of repeat cesarean was non-progress of labor causing cervical dystocia and non-decent of the head. Strict, vigorous, and vigilant intrapartum maternal and fetal monitoring and judicious use of mechanical and chemical methods have definitely, substantially resulted in successful TOLAC deliveries.

Keywords: Bishop score, Foley catheter, Intrauterine death, Mifepristone, Previous caesarian section, Prostaglandin E-2, Preinduction cervical ripening, Scarred uterus, Scar tenderness, Trial of labor.

Journal of South Asian Federation of Obstetrics and Gynaecology (2023): 10.5005/jp-journals-10006-2287

National Family Health Survey-5(NFHS-5) documents, 2019–2021, India has a total of 21.5% births delivered by cesarean (32.3% in Urban and 17.6% in rural population), compared with 17.2% in NFHS 4 (2015–2016).[1] Also, the World Health Organization (WHO) documents that cesarean section use continues to rise globally and is now accounting for more than 1 in 5 (21%) of all childbirths.[2]

The alarming rise of cesarean deliveries in past decades have questioned the ethics of medical fraternity. This is the time we study methods to reduce the rate of both primary cesareans and even repeat cesarean sections.

This study was conducted to reduce the burden of morbidities associated with repeat cesarean deliveries such as hemorrhages and adherent placentas. Women with a prior cesarean section (PCS) are more frequent in our clinical practice and 17.6% of them require labor induction.[3]

Unfortunately, a previous uterine scar seems to be linked to a higher risk of having a cesarean delivery and complications such as uterine rupture in subsequent pregnancies, events that are more common when there is no spontaneous onset of labor.[4] There has always been apprehensions regarding the induction of labor (IOL) in the previous cesarean section (PCS).

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How to cite this article: Sharma DY, Garg R, Agarwal R, *et al*. A Comparison of Different Methods of Induction of Labor in Patients of Previous Cesarean Section. J South Asian Feder Obst Gynae 2023;15(5):580–584.

Source of support: Nil

Conflict of interest: Dr Ruchika Garg is associated as the Joint editor of this journal and this manuscript was subjected to this journal's standard review procedures, with this peer review handled independently of this editorial board member and her research group.

Mechanical methods of induction are becoming an option to improve outcomes in women with PCS. In women with a PCS, the use of mechanical methods may be associated with a lower rate of uterine rupture.[5,6] Data suggest that the IOL with vaginal dinoprostone (PGE_2) in pregnant women with a previous cesarean section does not appear to be associated with worse obstetric or neonatal outcomes compared with IOL in pregnant women without a previous cesarean section.[7]

It has also been studied that IOL is facilitated in term women with PCS by using anti-prostaglandin mifepristone. This induction agent appears safe and useful with no adverse events on the fetus or mother.[8] Intracervical Foley catheter combined with intravaginal dinoprostone was associated with more rapid cervical ripening, shorter induction to vaginal delivery interval, and greater number of vaginal deliveries within 24 hours.[9]

In this study, we compared the safety and efficacy of different methods of IOL in cases with previous one cesarean section.

Materials and Methods

This study was conducted in labor room emergency department with tertiary care facility. Facility of emergency caesarean with blood bank, and Intensive care for mother and neonate was available round the clock. Permission was obtained from the Ethical Committee of the Institute.

A total of 121 cases were registered in 1 year from 1 June 2020 to 31 May 2021, who came to emergency department with previous one cesarean section, with absent of labor pains with a need for the IOL. About 109 patients were willing to participate in the study. After proper consent, written and verbal, following protocol was followed.

- Proper and detailed history was obtained especially pertaining to previous caesarean (antepartum, intrapartum, and postpartum complications and indication of previous cesarean).
- All routine blood investigations along with color Doppler ultrasound (USG), by senior radiologist for placental localization, scar thickness, expected fetal weight and fetal well-being.
- Detailed examination was performed, general and obstetric.
- All patients were assessed regarding pelvimetry and Bishop's score.

Exclusion Criteria

- Patients with recurrent indication of cesarean like contracted pelvis.
- Patients with <18 months interval with previous cesarean.
- Patients scar thickness <2 mm on USG.
- Obstetric indication for Elective Repeat Cesarean Section (ERCS) like cephalopelvic disproportion, placenta previa, malpresentations.

After following strict exclusion criteria, 78 patients were found to be eligible to participate in the study.

After history, examination and investigations, USG, patients were assigned to any one of the methods for IOL.

- Group A (PGE2 group) ($n = 31$): Patients with Bishops score >4, with cervical dilatation >1.5 cm, middle/anterior position of cervix, were 31 in number. For these patients, under all aseptic conditions, sweeping of membranes was performed and Prostaglandin E2 (PGE2) gel was inserted in posterior fornix.[7]

Table 1: Characteristics of patients: total number of patients is 78

Patient profile	*Successful TOLAC*	*Unsuccessful TOLAC*	*Odds ratio*
Age <28	47 (%)	15 (%)	
Age >28	05	09	
BMI <25	56 (%)	12 (%)	
BMI >25	03	04	
POG >38	52 (%)	18 (%)	
POG <38	05	03	
Preinduction Bishop's score >5	61 (%)	09 (%)	
Preinduction Bishop's score <5	02	06	
EFW <3 kg	37	21	
Fetal weight >3 kg	09	11	
History of vaginal delivery ($n = 17$)	17 (100%)	–	

- Group B (PGE2 + Foley catheter) ($n = 22$): In some patients with similar Bishops score, intracervical Foley catheter was inserted and inflated with 30 mL saline[5,6] after sweeping of membranes and instillation of PGE2.[9]
- Group C (Mifepristone + PGE2) ($n = 13$): Patients with intrauterine death of fetus, or multiple congenital malformations diagnosed on USG, 200 mg of Mifepristone was administered orally, followed by PGE2 gel after 8 hours.
- Group D (Mifepristone + Foley + PGE2) ($n = 12$) in 12 patients with intrauterine death/multiple congenital malformations, after 8 hours of 200 mg of Mifepristone, intracervical Foley catheter balloon and PGE2 was instilled in post-Fornix.

All patients were very strictly monitored for all signs of impending scar dehiscence, and continuous fetal heart rate was monitored.[10]

In all cases, oxytocin augmentation was done with infusion set as per protocol.[11]

Progress of labor was charted on partograph[12] and labor was immediately terminated in the following circumstances:

- Severe maternal distress
- Severe Fetal distress
- Nonprogress of labor, defined by guidelines[11,12]
- Signs of impending scar dehiscence[13]

Baseline maternal data and perinatal outcomes were recorded for a descriptive, bivariate, and multivariate analysis. A p-value <0.05 was considered statistically significant.

Results

As given in Table 1, more patients with successful trial of labor after cesarean (TOLAC) deliveries were of age <25 years (73%, $p < 0.05$), non-obese their BMI was <22 (79.5%, $p < 0.05$). Trial of labor after cesarean was significantly successful ($p < 0.05$) in patients with term pregnancies (75.6%), with favorable cervix (Bishop's score >5) in 84%. All patients who had history of at least one vaginal birth underwent successful induction and vaginal birth after cesarean section (VBAC).

As illustrated in Table 2, the most common indication of induction in our study was post-dated pregnancy (37.1%). These patients have been waiting for spontaneous onset of labor. the

next common indication for induction was intra-uterine fetal death (IUD), (21%). Fetal congenital malformations not compatible with life like anencephaly, other neural tube defects, and multiple heart disease were 13%. Eight patients (10%) had a history of term IUD in previous pregnancy which was extracted by lower segment cesarean section (LSCS), now came for induction and safe delivery. Pregnancy induced hypertension (PIH) with obstetric indication of induction was observed in 7.7% cases. About 6.5% of patients had oligohydramnios and 2.5% of patients had other indications.

Different methods of induction were used for different patients (Table 3). The patients of group A had 55% successful TOLAC, while patients in group B had 59% success in TOLAC. In group C, patients were induced by Mifepristone and PGE2 gel, the success rate of TOLAC was 85%, with significant *p*-value ($p = 0.0449$). Group C had 100% success of VBAC where cervical priming and induction was performed using Mifepristone followed by PGE2 along with Foleys. A total of 68% success rate of TOLAC is observed in our study.

As given in Table 4, the most common indication for cesarean was non-progress of labor (60%) defined by slow cervical dilatation <1 cm/hour or a failure of decent of head.[11,12] the next common indication was fetal distress (28%). Fetal tachycardia was more common than bradycardia. Some patients (8%) became apprehensive during labor and wanted to quit from the study. They underwent cesarean on self-request. Table 5 presents the mean induction to delivery interval in all four groups and induction to decision of cesarean interval. This interval was maximum in group D.

Table 2: Indication of induction $n = 78$

Post-dated pregnancy	29 (37.15%)
Intra uterine fetal death	17 (21.25%)
Fetal congenital malformations, not compatible with life	11 (13.75%)
Previous term intrauterine death	08 (10%)
PIH	06 (7.7%)
Oligohydramnios	05 (6.5%)
Others	02 (2.5%)

Table 3: Methods of inductions

Method of induction		*Successful TOLAC*	*Unsuccessful TOLAC*	*p-value*
Group A – Sweeping stretching + Prostaglandin E2 gel	31	17/31 (55%)	14/31 (45%)	0.8258
Group B – Sweeping stretching + PGE2 + Foley s	22	13/22 (59%)	9 (41%)	0.6628
Group C – Mifepristone + PGE2	13	11/13 (85%)	2/13 (15%)	0.0449
Group D- Mifepristone + PGE2 + Foley	12	12/12 (100%)	–	0.0087
Total		53/78 (68%)	25/78 (32%)	0.0136

Discussion

While a cesarean section can be an essential and life-saving surgery, it can put women at risk of short- and long-term health problems.

This study intended to reduce the apprehensions related to inducing the labor in a patient with previous one LSCS. Induction had been attempted since long in scarred uterus with variable success rates. We observed an overall success rate of TOLAC as 68% (Table 3) by various methods of induction. Maximum success was observed in group D (Table 3), in which fetal prognosis was not desired using Mifepristone and Foley induction. Our

Table 4: Indication of cesarean $n = 25$

Indication of cesarean	*Indication of cesarean*	
1	Non-progress of labor	15/25 (60%)
2	Fetal distress Scar tenderness	07/25 (28%)
3	Patient request	02/25 (08%)
4.	Others	01/25 (4%)

Table 5: Induction delivery interval $n = 53$

Method of induction	*Successful TOLAC: unsuccessful TOLAC*	*Average induction to vaginal delivery interval*	*Average induction to decision of cesarean*
Group A sweeping stretching + Prostaglandin E2 gel ($n = 31$)	17:14	11.5 hours	09.5 hours
Group B Sweeping stretching + PGE2 + Foley s ($n = 22$)	13:9	10.3 hours	10.0 hours
Group C Mifepristone + PGE2 ($n = 13$)	11:2	19.00 hours	23.0 hours
Group D Mifepristone + PGE2 + Foley ($n = 12$)	12:12	20.5 hours	22.0 hours
Total $n = 78$	53:25		

Table 6: Complications during TOLAC

Group	*Labor pains >10 hours*	*PPH (postpartum hemorrhage)*	*NICU admission*	*Scar dehiscence*	*χ2*	*p-value*
PGE2 Group ($n = 31$)	19	2	1	1	24.83	<0.0001
PGE2+ Foley Group ($n = 22$)	10	1	1	1	14.10	0.0028
Mifepristone + PGE2 Group C ($n = 13$)	10	2	NA	–	15.52	0.0014
Mifepristone + PGE2 + Foley Group ($n = 12$)	09	1	NA	–	15.48	0.0014
78	48 (61.5%)	6 (7.6%)	2 (2.5%)	2 (2.5%)	73.55	<0.0001

greatest predictor of success was a previous vaginal delivery (100%), followed by initial Bishop's score >5, (84.6%), and BMI < 25 (79.5%) (Table 1). We encountered a scar dehiscence rate of 2.5% (Table 6), which presented as rent in uterus which was not bleeding. Both the patients were managed conservatively, with uneventful puerperium.

Locatelli et al.[3] reported a uterine rupture rate of 0.3% in the previous cesarean section – induction group. They concluded that IOL is not associated with significantly higher rates of uterine rupture compared with spontaneous labor in patients with previous LSCS, provided a consistent protocol with strict criteria for intervention is adopted.

AC Rocci documented uterine rupture/dehiscence (OR 1.62; 95% CI, 1.13–2.31), and postpartum hemorrhage[4] (OR 1.57; 95% CI, 1.20–2.04).

In a retrospective study by Rossard et al.,[5] from 214 women with a previous cesarean section, cervical ripening with balloon catheter improved Bishop's score before the IOL from 3.54 ± 1.23 to 5.38 ± 1.47 ($p = 0.02$). About 64.1% of women had a vaginal delivery. Concerning the predictive factors for vaginal delivery, they only found significant influence of a body mass index less than 30 kg/m^2.[5]

A review article published by Sven Kehl et al.[6] included 16 studies with 1447 women (single-balloon catheter: $n = 1329$, double-balloon catheter: $n = 118$) and documented the rate of uterine rupture after the labor induction was low ($n = 18$, 1.2%).

López-Jiménez et al.[7] used PGE2 induction in patients with previous LSCS. The percentage of cesarean sections during TOLAC was 44.7% (21),[7] The percentage of cesarean sections in the TOLAC group was 44.7%. Uterine rupture rate was documented as 4.3%. They concluded that the IOL with vaginal dinoprostone (PGE_2) in patients with a previous history of cesarean section was not associated with worse obstetric or neonatal outcomes compared with the group of patients without a history of cesarean section.[7]

C Lelaidier et al.[8] evaluated the efficacy and tolerance of mifepristone in women undergoing IOL at term after previous cesarean section. They concluded that IOL is facilitated in term women with PCS by using mifepristone. This induction agent appears safe and useful with no adverse events on the fetus or mother.[8]

Flamm BL et al.[10] studied to precisely estimate the effect of maximum oxytocin dose on uterine rupture risk in patients attempting VBAC by considering timing and duration of therapy. Among 804 patients, they reported about 62 cases of uterine rupture. The maximum dose of oxytocin was above 20 mU/minute increased the risk of uterine rupture four-fold or greater. So they concluded that a maximum oxytocin dose of 20 mU/minute in VBAC trials to avoid an unacceptably high risk of uterine rupture.

The success rate of IOL leading to VBAC has been 51.4% by Carlos et al. using double-balloon catheter for IOL for TOLAC.[14] Five cases of intrapartum uterine rupture (1.2%) occurred. In their study, the main risk factors for repeated cesarean section were dystocia in the previous pregnancy, the absence of previous vaginal delivery, suspected fetal macrosomia, and duration of oxytocin induction period.

In a latest study, Sugandha et al. in 2021[15] documented a success rate of 60% for TOLAC in which they used tailored induction in each case. They highlighted that the IOL in previous LSCS can be offered unless contraindicated. They favored mechanical induction and PGE2 along with judicious use of oxytocin in cases of unfavorable cervix (Bishops Score <6).

The strength of our study is that it is a novel study of its kind. The morbidity and pain of the first cesarean can always be rectified in the index pregnancy by giving the patient a trial of the induction after the previous cesarean. A new visionary of once a cesarean is not always a cesarean is to be intended.

The weakness of the study is that the sample size is small and patients with intrauterine death of fetus were confounders.

Conclusion

Childbirth has been traditionally considered a new birth of a woman. The number of cesarean deliveries are continuously increasing over the coming decade, with nearly a third (29%) of all births likely to take place by cesarean section by 2030.[2] In our study, we observed that the most important predictor of a successful TOLAC is a vaginal delivery before or after a cesarean and a favorable preinduction Bishops Score >5. The most common indication of induction was post-dated pregnancy. On comparing various methods of induction, the addition of mifepristone in cases where fetal prognosis is not desired, Accelerated, and completed VBAC safely. The combination of chemical and mechanical methods of induction resulted in increasing the success rate of TOLAC without increasing complications.

Preinduction scar thickness and flow in fetal middle cerebral artery can anticipate untoward incidents. The most common indication of repeat cesarean was non-progress of labor causing cervical dystocia and non-decent of the head. Continuous fetal heart rate monitoring diagnosed acute fetal distress and a timely cesarean was performed. Strict, vigorous and vigilant intrapartum maternal and fetal monitoring and judicious use of mechanical and chemical methods have definitely, substantially resulted in successful TOLAC deliveries.

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