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CLINICAL & BASIC RESEARCH

# Use of Intracervical Foley Catheter for Induction of Labour in Cases of Previous Caesarean Section

## Experience of a single tertiary centre in Oman

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# استخدام قثطار فولي داخل عنق الرحم لتحريض المخاض لحالات القيصرية السابقة

## تجربة أحد مراكز الرعاية الثالثية في عمان

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**ABSTRACT:** ***Objectives:*** This study aimed to evaluate rates of success and perinatal complications of labour induction using an intracervical Foley catheter among women with a previous Caesarean delivery at a tertiary centre in Oman. ***Methods:*** This retrospective cohort study included 68 pregnant women with a history of a previous Caesarean section who were admitted for induction via Foley catheter between January 2011 and December 2013 to the Sultan Qaboos University Hospital, Muscat, Oman. Patient data were collected from electronic and delivery ward records. ***Results:*** Most women were 25–35 years old (76.5%) and 20 women had had one previous vaginal delivery (29.4%). The most common indication for induction of labour was intrauterine growth restriction with oligohydramnios (27.9%). Most women delivered after 40 gestational weeks (48.5%) and there were no neonatal admissions or complications. The majority experienced no complications during the induction period (85.3%), although a few had vaginal bleeding (5.9%), intrapartum fever (4.4%), rupture of the membranes (2.9%) and cord prolapse shortly after insertion of the Foley catheter (1.5%). However, no cases of uterine rupture or scar dehiscence were noted. Overall, the success rate of vaginal birth after a previous Caesarean delivery was 69.1%, with the remaining patients undergoing an emergency Caesarean section (30.9%). ***Conclusion:*** The use of a Foley catheter in the induction of labour in women with a previous Caesarean delivery appears a safe option with a good success rate and few maternal and fetal complications.

***Keywords:*** Vaginal Birth after Cesarean; Induced Labor; Catheters; Pregnancy Complications; Oman.

**الملخص: الهدف:** تهدف هذه الدراسة إلى تقييم معدلات النجاح ومضاعفات فترة ما حول الولادة لتحريض المخاض باستخدام قثطار فولي داخل عنق الرحم بين النساء اللواتي ولدن سابقا بعمليات قيصرية في أحد مراكز الرعاية الثالثية في سلطنة عمان. **الطريقة:** شملت هذه الدراسة الاستعادية للاتراب على 68 امرأة من اللواتي خضعن لعمليات قيصرية في السابق و تم قبولهن للولادة المحرضة عبراستخدام قثطار فولي داخل عنق الرحم بين يناير 2011 وديسمبر عام 2013 بمستشفى جامعة السلطان قابوس، مسقط، عمان. **النتائج:** تم جمع بيانات المرضى من سجلات جناح الولادة. كانت معظم النساء من الفئة العمرية 25-35 سنة (76.5%) و 20 امرأة كان لها ولادة طبيعية سابقة (29.4%). إن المؤشرات الأكثر شيوعا لتحريض المخاض هو قلة وزن الجنين مع قلة السائل السلوي (27.9%). تمت الولادة في معظم النساء بعد 40 أسبوعا من الحمل (48.5%) ولم تتواجد اي مضاعفات لحديثي الولادة. لم تشهد معظم الحوامل أي مضاعفات خلال دور التحريض (85.3%)، ولكن حدثت بعض المضاعفات في عدد قليل وتضمنت النزيف المهبلي (5.9%)، والحمى أثناء الولادة (4.4%)، وتمزق الأغشية (2.9%) وهبوط الحبل السري بعد فترة وجيزة من إدخال قثطار فولي (1.5%). ومع ذلك، لم يلاحظ أي حالات تمزق الرحم أو تفزر الندبة. وعموما، كان معدل نجاح الولادة الطبيعية بعد الولادة القيصرية السابقة 69.1%، مع خضوع بقية المرضى لعمليات قيصرية طارئة (30.9%). **النتائج:** إن استخدام قثطار فولي في تحريض المخاض في النساء ذوات الولادات القيصرية السابقة يبدو خيارا آمنا مع نسبة نجاح جيدة ومضاعفات قليلة للأم والجنين.

**الكلمات المفتاحية:** الولادة المهبلية بعد القيصرية؛ ولادة محرضة؛ قثطار؛ مضاعفات الحمل؛ عمان.

### Advances in Knowledge

- *To the best of the authors' knowledge, this is the first time a study of this kind has been conducted in Oman.*
- *Pregnant women who have previously undergone a Caesarean section are at risk of various complications during subsequent labour. The findings of this study indicate that the use of a Foley catheter for induction of labour may be a safe option for this population.*

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- *Other centres in Oman use prostaglandins for the induction of labour in cases of previous Caesarean delivery. Further studies are required to compare modes of induction, success rates, complications and perinatal outcomes in order to inform delivery practices in Oman.*

**Application to Patient Care**

- *The results of this study may encourage obstetricians to use a Foley catheter as the main mode of induction of labour in patients who have previously had a Caesarean section.*
- *Thorough patient assessment and counselling is critical before deciding on the mode of delivery, as this choice may affect perinatal outcomes and future pregnancies.*

For subsequent pregnancies, women with a previous history of a Caesarean delivery may be offered either a trial of vaginal birth after Caesarean section (VBAC) or an elective repeat Caesarean section.[1] The former option is well accepted as a practical and safe means of decreasing Caesarean delivery rates.[2,3] Women who have previously delivered via Caesarean section have subsequent vaginal delivery rates of 50–85%.[4] The induction of labour in women with a prior Caesarean delivery is more likely to result in a subsequent Caesarean delivery.[5] In a prospective observational study of 11,778 women, induction of labour was associated with a significantly higher risk of unsuccessful VBAC (i.e. requiring an emergency Caesarean section) than spontaneous labour.[6] In contrast, a previous history of vaginal delivery and a favourable cervical status were found to significantly increase chances of success.[6]

Uterine rupture is a major concern for women with a prior Caesarean section; a population-based retrospective cohort study found that the rate of uterine rupture following a previous Caesarean delivery was 1.6 per 1,000 women.[7] Higher rates of rupture are associated with induced labour rather than spontaneous labour; other risk factors include an unfavourable cervix and the method of cervical ripening used.[5] The safest and most efficacious method of cervical ripening and/or induction of labour in women with previous Caesarean deliveries has not yet been established. Induction with oxytocin appears to have a lower risk of uterine rupture than prostaglandins.[7] Although data regarding mechanical methods of cervical ripening in this population are limited by low sample sizes and the retrospective nature of the analyses, favourable outcomes have been reported.[7] The advantages of a mechanical method include a decreased risk of uterine tachysystole and fetal distress, stability at room temperature and low cost.[8] Several trials have presented evidence of the efficacy of the intracervical Foley catheter in comparison to prostaglandins for pre-induction cervical ripening.[9,10] A meta-analysis of randomised trials comparing mechanical versus pharmacological methods showed mechanical devices to be associated with a lower risk of uterine hyperstimulation and fetal heart rate abnormalities.[11]

The guidelines of the Society of Obstetricians and Gynecologists of Canada state that "a Foley catheter may be safely used to ripen the cervix in a woman planning a trial of labour after Caesarean section".[4] In contrast, the American Congress of Obstetricians and Gynecologists believe that, given a lack of compelling data and the increased risk of mechanical dilatation, such interventions should only be an option for trial of VBAC delivery among candidates with an unfavourable cervix.[12] Therefore, the aim of the current study was to evaluate the safety and efficacy of induction of labour using an intracervical Foley catheter among pregnant women with a previous history of Caesarean delivery admitted to a tertiary centre in Oman.

## Methods

This retrospective cohort study included 68 pregnant women with a previous history of Caesarean delivery who were admitted from January 2011 to December 2013 to the Sultan Qaboos University Hospital, Muscat, Oman, for labour induction via Foley catheter for a VBAC trial. Women who refused trial of labour, those who were induced via other methods (e.g. oxytocin administration or artificial rupture of the membranes) and patients with missing data were excluded from the study. Patient data were collected from the hospital information system and delivery ward records, including: age; parity; body mass index (BMI); a prior history of vaginal delivery; Bishop scores at the time of insertion and removal of the catheter; indications for the induction of labour; mode of delivery; and the duration of labour. Postnatal outcomes were also noted, including the gestational age at delivery, birth weight and Apgar scores of the baby and the presence of any neonatal complications.

In all cases, a size 18 single balloon Foley catheter was used for induction of labour. The catheter was introduced under sterile conditions into the intracervical canal past the internal opening of the cervix and the bulb was inflated with 30–60 $cm^3$ of water. The catheter was kept in place for 24 hours unless

**Table 1:** Sociodemographic variables of pregnant women with a history of a previous Caesarean section admitted for induction via Foley catheter (N = 68)

| Variable | n (%) |
|---|---|
| **Age in years** | |
| <25 | 4 (5.9) |
| 25–35 | 52 (76.5) |
| >35 | 12 (17.6) |
| **BMI in kg/m²*** | |
| 18.5–24.9 | 7 (14.6) |
| 25.0–29.9 | 13 (27.1) |
| ≥30.0 | 28 (58.3) |
| **Gravidity†** | |
| Multigravida | 56 (82.4) |
| Grand multigravida | 12 (17.6) |
| **Parity‡** | |
| Primiparous | 43 (63.2) |
| Multiparous | 21 (30.9) |
| Grand multiparous | 2 (2.9) |
| Great grand multiparous | 2 (2.9) |
| **Previous vaginal delivery** | |
| Yes | 20 (29.4) |
| No | 48 (70.6) |
| **Gestational age at delivery in weeks** | |
| <37 | 6 (8.8) |
| 37–40 | 29 (42.6) |
| >40 | 33 (48.5) |

**Total dataset for this variable was 48 due to missing data.*

*† Women who had had two to four previous pregnancies were defined as multigravida while woman who had had five to six previous pregnancies were considered grand multigravida.*

*‡ Women who had delivered one live infant were defined as primiparous, while those who had had delivered two to four live infants, five to six live infants and seven or more live infants were considered multiparous, grand multiparous and great grand multiparous, respectively.*

it fell out spontaneously beforehand. The primary outcome measure of the study was the success rate of VBAC while the secondary outcomes were perinatal complications such as uterine scar dehiscence, uterine rupture and perinatal mortality. Uterine rupture was defined as a disruption of the uterine muscle extending to and involving the uterine *serosa* or disruption of the uterine muscle with extension to the bladder or broad ligament, while uterine dehiscence was defined as disruption of the uterine muscle with intact uterine *serosa*.[13] Factors affecting the success rate of VBAC, such as a previous normal vaginal delivery and Bishop scores, were also studied; the Bishop scoring system used included five determinants—dilatation, effacement, station, position and consistency.[14]

**Table 2:** Indications for labour induction and complications during induction among pregnant women with a history of a previous Caesarean section admitted for induction via Foley catheter (N = 68)

| | n (%) |
|---|---|
| **Indication for labour induction** | |
| Pregnancy duration of ≥40 gestational weeks | 18 (26.5) |
| IUGR with oligohydramnios | 19 (27.9) |
| IUFD | 5 (7.4) |
| GDM with polyhydramnios | 12 (17.6) |
| Poor BPP | 5 (7.4) |
| Uncontrolled epilepsy | 2 (2.9) |
| PIH | 6 (8.8) |
| Unknown | 1 (1.5) |
| **Complication during induction** | |
| None | 58 (85.3) |
| Rupture of membrane | 2 (2.9) |
| Fever | 3 (4.4) |
| Cord prolapse | 1 (1.5) |
| Vaginal bleeding | 4 (5.9) |

*IUGR = intrauterine growth restriction; IUFD = intrauterine fetal death; GDM = gestational diabetes mellitus; BPP = biophysical profile; PIH = pregnancy-induced hypertension.*

The Statistical Package for the Social Sciences (SPSS), Version 19 (IBM Corp., Chicago, Illinois, USA) was used for data entry and analysis. All data and field notes were first transcribed into the SPSS program. A *P* value of <0.050 was deemed to be statistically significant.

Ethical approval of this study was granted by the Medical Research & Ethics Committee of the College of Medicine & Health Sciences at Sultan Qaboos University (MREC #562). All women opted for induction of labour with a Foley catheter after appropriate counselling and assessment by a senior obstetrician.

## Results

A total of 68 women were included in the study. Most of the women were 25–35 years old (76.5%) and were primiparous (63.2%). Due to missing height records, BMI could only be calculated for 48 women; of these, 58.3% were obese and 27.1% were overweight. Only 20 women (29.4%) had had a previous vaginal delivery. Most women delivered after 40 gestational weeks (48.8%) [Table 1].

**Table 3:** Comparison of demographic, maternal and fetal variables between successful vaginal births versus emergency Caesarean section deliveries among pregnant women with a history of a previous Caesarean section admitted for induction via Foley catheter (N = 68)

| Variable | Successful VBAC | | Emergency Caesarean section | | *P* value |
|---|---|---|---|---|---|
| | n (%) | Mean ± SD | n (%) | Mean ± SD | |
| Age in years | 47 (69.1) | 29.62 ± 4.32 | 21 (30.9) | 33.66 ± 5.27 | 0.007 |
| BMI in kg/m$^{2}$* | 32 (66.7) | 32.34 ± 8.13 | 16 (33.3) | 31.09 ± 4.70 | 0.575 |
| Gestational age at delivery in weeks | 48 (70.6) | 38.89 ± 2.73 | 20 (29.4) | 38.86 ± 1.70 | 0.969 |
| Bishop score at insertion | 47 (69.1) | 2.40 ± 0.54 | 21 (30.9) | 2.19 ± 0.40 | 0.075 |
| Bishop score at removal | 47 (69.1) | 4.40 ± 1.10 | 21 (30.9) | 4.00 ± 1.18 | 0.175 |
| Parity† | 47 (69.1) | 1.98 ± 1.51 | 21 (30.9) | 1.62 ± 1.47 | 0.365 |
| Previous vaginal delivery | 47 (69.1) | 0.51 ± 0.91 | 21 (30.9) | 0.14 ± 0.36 | 0.019 |
| Birth weight in kg | 47 (69.1) | 3.05 ± 0.65 | 21 (30.9) | 3.16 ± 0.46 | 0.478 |
| Apgar score at 1 minute‡ | 44 (67.7) | 8.36 ± 1.98 | 21 (32.3) | 8.24 ± 1.30 | 0.792 |
| Apgar score at 5 minutes‡ | 44 (67.7) | 9.43 ± 2.12 | 21 (32.3) | 9.71 ± 0.64 | 0.553 |

*VBAC = vaginal birth after Caesarean section; SD = standard deviation; BMI = body mass index.*

**Total dataset for this variable was 48 due to missing data.*

*†Women who had delivered one live infant were defined as primiparous, while those who had had delivered two to four live infants, five to six live infants and seven or more live infants were considered multiparous, grand multiparous and great grand multiparous, respectively.*

*‡Total dataset for this variable was 65 due to missing Apgar data for three neonates.*

Table 2 shows the various indications for induction of labour and the complications observed during the induction period. Labour was most commonly induced due to intrauterine growth restriction with oligohydramnios (27.9%). No complications were noted during the induction period in the majority of women (85.3%). There were no cases of uterine rupture or scar dehiscence. Three women had intrapartum fever which subsided postpartum without evidence of chorioamnionitis on placental histopathology. Four women experienced vaginal bleeding following the insertion of the Foley catheter; three had minimal bleeding and subsequently underwent a successful VBAC, but one had heavy vaginal bleeding and fetal bradycardia, resulting in an emergency Caesarean section. There was no evidence of placenta *previa* or *abruptio* in the latter case. One patient had an emergency Caesarean section 30 minutes after the insertion of the Foley catheter due to rupture of the membranes and cord prolapse; this 26-year-old *gravida* 2, *para* 1 woman had had a Caesarean section two years previously due to fetal distress. She underwent labour induction with a Foley catheter at 38 gestational weeks and four days due to gestational diabetes with polyhydramnios (amniotic fluid index = 263 mm). Her Bishop score before the insertion of the catheter was 2.

All women went into labour when the catheter was removed; however, 46 women (67.6%) and 42 women (61.8%) required oxytocin and artificial rupture of the membranes, respectively, to augment labour. The overall success rate of VBAC was 69.1%, with 47 women successfully giving birth via vaginal delivery. For the remaining 21 women (30.9%), emergency Caesarean sections were performed due to failure to progress (n = 11; 52.4%), non-reassuring fetal status (n = 9; 42.9%) and cord prolapse (n = 1; 4.8%). Women with a successful VBAC had a mean duration of labour of 8.04 ± 4.57 hours (range: 3–25 hours) for stage one labour and 22.74 ± 27.00 minutes (range: 2–165 minutes) for stage two labour.

There was a significant difference in mean maternal age between women who had a successful VBAC and those who underwent an emergency Caesarean section ($P$ = 0.007). No significant differences were noted between the groups in terms of gestational age of delivery, Bishop scores at Foley's insertion and removal, mean neonatal birth weights or Apgar scores at one and five minutes. There was a significant difference in mode of delivery between those who had had a previous vaginal delivery and those who had not ($P$ = 0.019) [Table 3]. Table 4 shows the success rate of VBAC among patients who had had a previous vaginal delivery versus a previous Caesarean delivery in their earlier pregnancy. The VBAC success rate was 85.0% among those with a previous vaginal birth in comparison to 62.5% for those with a previous Caesarean section ($P$ = 0.067).

**Table 4:** Comparison of delivery modes between those with a previous vaginal versus Caesarean section delivery in earlier pregnancy among pregnant women with a history of a previous Caesarean section admitted for induction via Foley catheter (N = 68)

| Previous method of delivery | n (%) | | | *P* value |
|---|---|---|---|---|
| | Emergency Caesarean | VBAC | Total | |
| Caesarean | 18 (37.5) | 30 (62.5) | 48 (100.0) | 0.067 |
| Vaginal | 3 (15.0) | 17 (85.0) | 20 (100.0) | |
| **Total** | **21 (30.9)** | **47 (69.7)** | **68 (100.0)** | |

*VBAC = vaginal birth after Caesarean section.*

## Discussion

Among the various predictors for a successful VBAC, a previous vaginal birth is the most promising, yielding a success rate of 87–90%.[15,16] Other factors, such as induced labour or increased BMI, may reduce the success rate to 40%.[17] According to previous research, the overall success rate of VBAC is 72–76%.[18–20] Few studies have looked into the success rate of VBAC following induction of labour via Foley catheter. One recent study included 208 women with a previous history of Caesarean delivery who were induced using a Foley catheter; the success rate was 71%, with two perinatal deaths (1.0%), one of which was due to uterine rupture (0.5%).[21] In the current study, the success rate of VBAC was 69.1% with no cases of uterine rupture or perinatal death. All women who have previously undergone a Caesarean delivery should be counselled appropriately and offered both VBAC and an elective repeat Caesarean section as options for trial of labour. The risks and benefits of both approaches should be explained, including associated perinatal morbidity and mortality rates. Women who opt for a VBAC should be thoroughly assessed so as to better predict the chances of success with this method.

Maternal age, BMI, Bishop score at Foley insertion and removal, gestational age at delivery, birth weight and previous vaginal births were examined as predictors for successful VBAC in the present study. However, the only statistically significant differences noted were with maternal age and a previous vaginal birth. Patients who had a better Bishop score at insertion of the Foley catheter had slightly higher success rates for VBAC, but this association was not statistically significant. This could be attributed to the small sample size of the current study. In a case-control study of 101 successful VBAC cases and 103 unsuccessful controls at three major hospitals, Birara *et al.* found that a previous history of successful VBAC and cervical dilatation of more than 3 cm at admission were the best predictors for successful VBAC.[22] Srinivas *et al.* similarly investigated predictors of failed VBAC among 13,706 women; gestational age at delivery, maternal age, maternal race, labour type (spontaneous versus induced), lack of a prior vaginal delivery and cephalopelvic disproportion or failed induction as the prior Caesarean section indication were significantly associated with VBAC failure (failure rate: 24.5%).[23] Having a prior vaginal delivery was the factor most indicative of a successful VBAC attempt (odds ratio: 0.21, 95% confidence interval: 0.19–0.24) and labour induction had the highest association with VBAC failure.[23] Yokoi *et al.* also concluded that the best predictor for a successful VBAC was a previous VBAC in their study of 664 women with one previous Caesarean delivery.[24]

To the best of the authors' knowledge, this study is the first of its kind to be conducted in Oman. The Sultan Qaboos University Hospital was one of the first centres in Oman to induce labour using a Foley catheter in cases of previous Caesarean delivery; the majority of other centres in Oman use prostaglandins for the induction of labour. To this end, further research is necessary to compare success rates and complications of VBAC in patients induced with prostaglandins versus a Foley catheter. The current study was limited by its small sample size and retrospective nature. It is recommended that future prospective studies utilise a multicentre approach with a larger number of patients.

## Conclusion

Induction of labour via Foley catheter in women who have previously undergone a Caesarean section delivery appears to be a safe option with a good success rate and few complications for both mother and fetus.

### CONFLICT OF INTEREST

The authors declare no conflicts of interest.

### FUNDING

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