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Original Article

Prostaglandin E1 versus Intrauterine Catheter for Termination of Pregnancy in Patients with Previous Cesarean Section

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Abstract

Background: Safe and effective methods of pregnancy termination are essential in women with previous cesarean sections (CS) or intrauterine surgeries ,though this issue was debatable for many decades and international guidelines didn't reach to sharp recommendations about the safe methods for termination of pregnancy in those very critical group of patients , given the increased risk of complications. This study compared prostaglandin E1 analogue (misoprostol) and intrauterine catheter for first- and second-trimester termination, and sought to establish specific dosing regimens and intervals for misoprostol.

Methods: This prospective, randomized, controlled trial enrolled 400 women aged 20–40 years with gestational ages of 11–18 weeks and a history of at least one CS or intrauterine surgery. Participants were randomized 1:1 to receive either transcervical Foley catheter insertion or misoprostol. For pregnancies ≤12 weeks, misoprostol was given as an initial 400 µg dose (by vaginal route), repeated every 3 hours if required. For 13–18 weeks, 200 µg was administered every 3 hours until expulsion these doses are according to FIGO 2023.

Results: In the misoprostol group, the mean number of doses was 5.3 ± 2.41, with the vaginal route . No significant differences were found in bleeding or transfusion needs. However, both time of occurrence of abortion and failure of the procedure were significantly lower in the misoprostol group compared with intrauterine catheter ($P < 0.001$). Retained placenta was also less frequent with misoprostol ($P = 0.002$).

Conclusions: Misoprostol is more effective and safer than intrauterine catheter for termination in women with scarred uterus, providing shorter duration, less failure rate, and fewer complications.

Keywords: misoprostol, intrauterine catheter, pregnancy termination, caesarean section, abortion

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Introduction:

Cesarean section (CS) rates in Egypt have risen markedly over the past two decades, increasing from approximately 28% in 2008 to 51.8% in the 2014 Egypt Demographic and Health Survey (EDHS), and reaching nearly 72% in the 2021 Egypt Family Health Survey (EFHS). This trend has created a rapidly expanding population of reproductive-age women with at least one uterine scar.[1,2] More recent national data indicate considerable variation, with CS rates differing by more than 50% between rural and urban regions, and an overall national prevalence of 54% . [3]

Globally, the rising frequency of CS has presented obstetricians with complex challenges, particularly the management of pregnancy complications in women with scarred uterus. Of particular concern is the management of second-trimester miscarriages and induced abortions in this high-risk group.[4]

Termination of pregnancy specially in high order previous cs arouse to search about the safest methods for termination of pregnancy, specially the FIGO, 2023 didn't highlight upon this category of patients and left the ball in the stadium of local protocol.[5]

Prostaglandins (PGs) represent a cornerstone in induction of abortion. Among these, misoprostol, a synthetic prostaglandin E1 (PGE1) analogue, was originally approved for gastric mucosal protection in patients receiving NSAIDs, non steroidal anti inflammatory drugs but is now extensively utilized in obstetric practice for pregnancy termination. It can be administered via oral, vaginal, sublingual, or rectal routes, with pharmacokinetics varying by route; oral administration peaks within 20–30 minutes, while sublingual use results in more rapid absorption and higher peak concentrations. Despite widespread clinical application, there is still no consensus regarding optimal dosage regimens.[6]

Although highly effective, PGs are not without risk. Their use in labor induction and abortion has been associated with maternal fever and, more critically, uterine rupture (UR).[7] UR is uncommon but potentially catastrophic, with second-trimester medical terminations in scarred uterus carrying a higher absolute risk; estimated between 0.3% and 1%, depending on gestational age and the regimen employed.[8]

Misoprostol-induced uterine contractions may precipitate scar dehiscence or rupture in women with prior CS, thereby increasing maternal morbidity.[9]

International guideline including the International Federation of Gynecology and Obstetrics (FIGO) and the World Health Organization (WHO), recognize this elevated risk. They recommend individualized patient assessment, cautious application of uterotonics, and the availability of surgical backup when undertaking medical termination in women with previous CS. However, they do not endorse a universally applicable reduced misoprostol dosage, leaving regimen modification to clinical judgment and local protocols .[10, 11]

Thus, this work compared the efficacy and safety of prostaglandin E1 analogue (misoprostol) versus intrauterine catheter for first- and second-trimester pregnancy termination and to establish specific dosing regimens and intervals for prostaglandin E1.

Patients and Methods:

This prospective, randomized, controlled trial included 400 pregnant women aged 20–40 years, with gestational ages of 11–18 weeks of gestation with a history of at least one CS or intrauterine surgery. Gestational age was assessed from the menstrual history and confirmed by measurement of fetal crown–rump length at a first-trimester scan. This research took place from 30, August 2024 to 30, April 2025, following approval from the ethical committee of Sohag University Hospitals (approval code: Soh-Med-24-06—05PD), with all women providing informed written consent.

Women were excluded if they were primigravida, abnormal placentation like low implanted placenta, congenital uterine malformation, multiple pregnancy uterine infection and sepsis, anaemic or had a bleeding tendency and medical morbidities in which misoprostol is contraindicated like chronic renal failure, severe coronary diseases, bronchial asthma.

All selected cases underwent thorough medical and surgical history evaluation, including obstetric history and details of previous CS or intrauterine surgeries, along with routine laboratory investigations [blood group, Rhesus factor (Rh), complete blood count (CBC), coagulation profile, fasting blood sugar (FBS), serum creatinine, liver function tests (LFTs), and serology] and both transabdominal and transvaginal two-dimensional (2D) ultrasounds (US) (EDAN Diagnostic Ultrasound System, Model: Acciarix LX3, 2021-12-26, 100V-240V- 50HZ/60HZ 2.5A-1.2A,Shanghai) to

evaluate gestational age and confirm viability of foetus.

Randomization and blinding

To maintain the integrity of the study, a random allocation process was utilized, employing computer-generated numbers (https://www.randomizer.org/). Each participant's code was placed in an opaque, sealed envelope to preserve blinding. Women were then assigned in a 1:1 ratio into two groups: the Intrauterine Catheter Group, in which pregnancy termination `was induced by transcervical insertion of a Foley catheter , and the Prostaglandin E1 Group, in which termination was induced using misoprostol.

Intrauterine Catheter Group: Termination was performed using a Foley catheter (18 Fr) inserted trans cervically under complete aseptic conditions. The balloon was inflated with10–15mL sterile saline and gentle traction applied; the catheter was left in situ and patients were observed for up to 24 hours or until expulsion.

Prostaglandin E1 Group: Misoprostol (Cytotec Pfizer company, 200mcg misoprostol) was administered vaginally (posterior fornix). For pregnancies ≤12 weeks an initial 400 µg dose was given vaginal every 3 hours. For pregnancies 13–18 weeks, 200 µg misoprostol was given every 3 hours until complete expulsion doses were repeated up to five times. The chosen route and all doses were recorded. Dosing intervals were extended or treatment withheld for marked uterine hyperstimulation, severe scar pain, hemodynamic instability.

After expulsion of the foetus 10 units of syntocinon was given through intravenous infusion to assist in expulsion of the placenta in those patients with gestational age from (13-18 weeks).

Retained placenta was considered if not occurred 30 minutes from expulsion of foetus

The study's primary outcome was the incidence of occurrence of abortion, while secondary outcomes encompassed the time needed for occurrence of abortion ,cervical dilation and need for dilation length of hospital stay, incidence of retained products of conception, need for surgical evacuation, vital signs, occurrence of bleeding and need for blood transfusion and adverse events.

Statistical analysis

Statistical analysis was done by SPSS v26 (IBM Inc., Chicago, IL, USA). Shapiro-Wilks test and histograms were used to evaluate the normality of the distribution of data. Quantitative parametric variables were presented as mean and standard deviation (SD) and compared between the two groups utilizing unpaired Student's t- test. Quantitative non-parametric data were presented as median and interquartile range (IQR) and were analyzed by Mann Whitney-test between two groups and were analyzed by Kruskal-Wallis test with Mann-Whitney test to compare among three groups. Qualitative variables were presented as frequency and percentage (%) and were analyzed utilizing the Chi-square test or Fisher's exact test when appropriate. A two tailed P value < 0.05 was considered statistically significant. Correlation between various variables was done using Pearson moment correlation equation for linear relation of normally distributed variables and Spearman rank correlation equation for non-normal variables/non-linear monotonic relation.

Results

Figure (1) presents the enrolment flow chart: out of 470 candidates assessed for eligibility, 40 weren't eligible based on inclusion criteria, and 30 refused to participate in the study. This process resulted in 400 participants being randomized into two groups for subsequent evaluations.

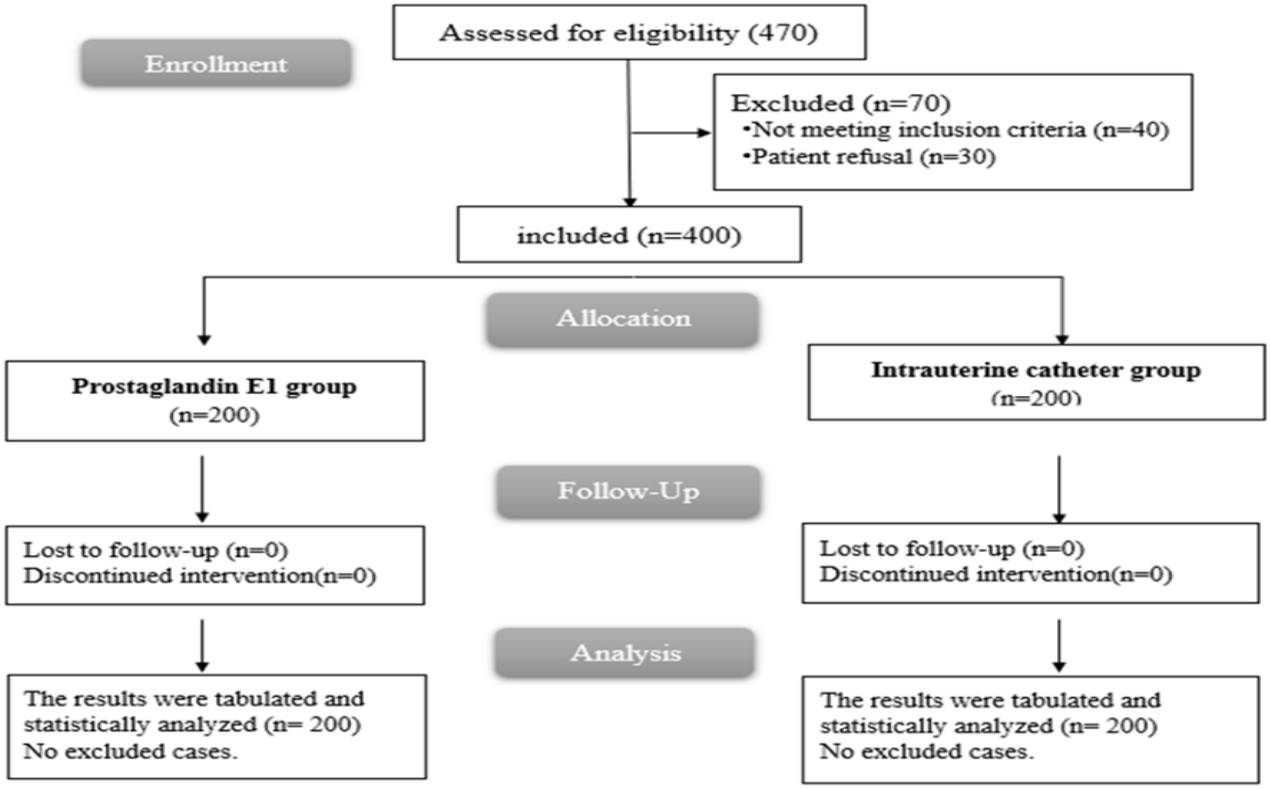

Figure 1: CONSORT flow chart of the enrolled patients.

Table 1 indicated that both groups had comparable demographics and obstetric data.

Table 1: Demographic and obstetric data of the studied groups

		Prostaglandin E1 group (n=200)	Intrauterine catheter group (n=200)	P
Age (years)		28.56 ± 4.26	29.27 ± 3.18	0.061
Parity		2 (1-3)	2 (2-3)	0.086
Hysterotomy		4 (2%)	10 (5%)	0.103
Number of cesarean sections	**1**	64 (32%)	46 (23%)	0.104
	2	84 (42%)	89 (44.5%)	
	3	52 (26%)	65 (32.5%)	
Gestational age (weeks)		13 ± 2.13	11.84 ± 1.06	0.356

Data are presented as mean ± SD or median (IQR) or frequency (%).

Table 2: Abortion-related clinical parameters of the studied groups

	Prostaglandin E1 group (n=200)	Intrauterine catheter group (n=200)	P
Number of doses	5.3 ± 2.41	---	---
Bleeding	5 (2.5%)	11 (5.5%)	0.126
Blood transfusion	6 (3%)	2 (1%)	0.153
Percentage of success of the procedure	194 (97%)	83 (41.5%)	<0.001
2ry outcome(failure of procedure)	6 (3%)	117 (58.5%)	
Occurrence of abortion (hours)	38.86 ± 30.63	65.64 ± 18.71	<0.001

Data are presented as mean ± SD or median (IQR) or frequency (%).

Table 2 indicated that the Prostaglandin E1 group achieved a significantly higher success rate compared with the intrauterine catheter group as regards expulsion of fetus (passed: 194/200 (97%) vs. 83/200 (41.5%); failed: 6/200 (3%) vs. 117/200 (58.5%); P<0.001). The mean time of occurrence of abortion was significantly shorter in the Prostaglandin E1 group (38.86 ± 30.63 hours) compared with the intrauterine catheter group (65.64 ± 18.71 hours, P<0.001). No significant differences were observed between the groups regarding bleeding (2.5% vs. 5.5%, P=0.126) or blood transfusion (3% vs. 1%, P=0.153).

Table 3: Surgical and obstetric outcomes of the studied groups

	Prostaglandin E1 group (n=200)	Intrauterine catheter group (n=200)	P
Retained products of conception	41 (20.5%)	68 (34%)	0.002
Occurrence of bleeding	5 (2.5%)	11 (5.5%)	0.126
Need for blood transfusion	4 (2%)	8 (4%)	0.153

Data are presented as mean ± SD or median (IQR) or frequency (%).

Table 3 showed that retained placenta was significantly more common in the intrauterine catheter group (68/200 (34%)) compared with the Prostaglandin E1 group (41/200 (20.5%), P=0.002) which then need for surgical evacuation.
There was no significant difference as regards vaginal bleeding and need for blood transfusion.

Table 4: Relation between number of cesarean section and (time of abortion and retained placenta) of prostaglandin E1 group

	One (n=64)	Two (n=84)	Three (n=52)	P	Post hoc
Time of occurrence of abortion (hours)	24 (18 – 36)	36 (24 – 48)	36 (24 – 48)	0.004	P1=0.058 P2=0.004 P3=0.068
Retained products of conception	11 (17.19%)	16 (19.05%)	14 (26.92%)	0.395	---

Data are presented as median (IQR) or frequency (%).

Table 4 Indicated that an increasing number of previous CS was associated with a longer time of occurrence of abortion in the Prostaglandin E1 group (median 24 (18–36) hours with one CS, 36 (24–48) hours with two CS, and 36 (24–48) hours with three CS; P=0.004). Post hoc analysis showed significance between one and two CS (P2=0.004), but not between one and three CS (P1=0.058) or between two and three CS (P3=0.068). The frequency of retained placenta did not differ significantly according to the number of CS (17.19%, 19.05%, and 26.92% respectively; P=0.395) but increase in increase number of previous cs.

Discussion

We noted that, misoprostol vastly outperformed transcervical Foley catheter in first- and second-trimester terminations among women with previous uterine surgery. There was no significant correlation between the route of administration of Prostaglandin E1 and the time to abortion (r = 0.039, P = 0.588). The misoprostol group achieved a 97% complete abortion rate vs. only 41.5% in the Foley group (P<0.001). Misoprostol also induced expulsion much faster (38.86 ± 30.63 vs 65.64 ± 18.71 hours, P<0.001) and yielded fewer retained placentas (20.5% vs. 34%, P=0.002). Bleeding complications and transfusion requirements were similarly low in both groups.
These results agreed with recent reports of very high efficacy for misoprostol in mid-trimester abortion as Pongsatha and co-authors . [12] found that intravaginal misoprostol was highly effective for second-trimester termination in women with or without cesarean scars. Our success rate (97%) is even higher mostly as we were stuck to the correct dose and time and close monitoring. No case of uterine rupture occurred.
This aligns with Henkel and co-authors[8] who stated that uterine rupture risk with prior cesarean birth was 1.1% (10/874) (95% CI 0.6-2.1) and without prior cesarean birth was 0.01% (2/6,244) (95% CI 0.0-0.12). The risk difference was 1.23% (95% CI 0.46-2.00, I2 =0%). Of the 12 reported uterine ruptures, three resulted in hysterectomy.

Misoprostol induces abortion via pharmacologic uterine stimulation. It binds myometrial prostaglandin (EP) receptors: activation of EP_1 and EP_3 receptors causes strong smooth-muscle contractions, while EP_2/EP_4 mediate relaxation. [13] The net effect is increased contraction strength and frequency plus collagen degradation in the cervix, accelerating expulsion. In contrast, the Foley catheter works by mechanical dilation. It applies direct pressure to the internal os and induces membrane separation, which secondarily releases endogenous prostaglandins. [14] Thus, Foley dilation gradually softens the cervix and can augment contractions to a limited extent. However, without exogenous prostaglandins, this process is slower and less potent.

Our regimen used half of the recommended dose in FIGO, 2023 in non scarred uterus misoprostol dose (400 µg every 3 hours, either vaginally and sublingually. This aligns with recent guidelines (Society of Family Planning, 2023) recommending multi-hundred-microgram doses for effective mid-trimester abortion. [15]

We chose these doses to maximize uterotonic effect and shorten time to expulsion. By contrast, the Foley group received no drug, explaining its much longer induction intervals and higher residual placental tissue.

Our results are in agreement with Wisanumah-imachai and co-authors [16], who reported a failure rate of 9.4% (103/1,094 cases) and a success rate of 90.6% for second-trimester termination using misoprostol alone, confirming its high effectiveness.

Similarly, Jayaweera and co-authors [17] observed a 98% success rate for first-trimester misoprostol regimens, concluding that misoprostol alone is a highly effective method of pregnancy termination.

Our findings are also in agreement with Pongsatha and co-authors .[12] who demonstrated success within 48 h in 91.3% of women with prior CS and 93.0% without scars (p=0.622), with a mean induction-to-delivery interval of 1,531 minutes vs 1,279 minutes, and a uterine rupture rate of 1.3% in scarred uteri.

In terms of regimen optimization, Meyer and co-authors.[18] found that a 12-h mifepristone–misoprostol interval reduced median abortion time to 24.5 h (95% CI, 25.7–32.4) compared to 33.0 h (95% CI, 34.2–41.9) with a 24-h interval (P<.001). Although complete abortion at 24 h was higher in the 24-h group (90.0% vs 75.0%, P=.139), both regimens achieved high overall success.

Other authors highlighted the value of adjunctive methods. Ali and co-authors. [19] reported that adding amniotomy to Foley catheter expulsion shortened the balloon-expulsion-to-abortion time to 6.89 ± 2.02 h versus 9.22 ± 1.98 h without amniotomy (p<0.001), while reducing oxytocin requirements (57.55 ± 16.88 IU vs 76.61 ± 15.78 IU, p<0.001).

In contrast, Kara and co-authors [20] found no significant difference in total abortion time, hospital stay, or 24-h success among groups receiving misoprostol, Foley catheter, or combined therapy. This divergence may reflect their lower misoprostol doses (100–400 µg) and inclusion of gestations up to 24 weeks, compared with our higher initial dosing (800 µg). Thus, the cause of Foley's inferior performance in our study may be attributable to insufficient uterotonic stimulation in mechanical-only protocols.

This study has several limitations. It was conducted in a single tertiary centre, which may limit the generalizability of the findings to other populations. The follow-up period was limited to in-hospital outcomes, without long-term evaluation of reproductive health or recurrence risk in subsequent pregnancies. Subgroup analysis by gestational age and previous uterine surgery type was underpowered, warranting larger multicentre studies for confirmation.

Conclusions:

Prostaglandin E1 analogue (misoprostol) was more effective and safer than intrauterine catheter for pregnancy termination in women with prior CS or intrauterine surgery.

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