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Value of Transvaginal Ultrasonographic Assessment of Cervical Length in Predicting Duration of Second Trimester Pregnancy Termination

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ABSTRACT

Background: Cervical length can be measured transvaginally to help determine whether vaginal delivery will occur within 24 hours following induction. The objective of the current study is to investigate the accuracy of transvaginal ultrasound measurement of cervical length as a prediction of the time needed for a medically assisted pregnancy termination in the second trimester that occurs within 24 hours.

Patients and methods: In a case series at Ain Shams University Maternity Hospital, Transvaginal ultrasonography was used to measure the cervical length in 100 women between 14 and 24 weeks of gestation, who had singleton pregnancies that were recommended for elective pregnancy termination. All participants received the same regimen of medical termination of second trimester pregnancy by misoprostol.

Results: A positive correlation was found between cervical length measured by transvaginal ultrasound and duration of termination of second trimetric abortion. Results revealed an equation (Cervical length – Parity + Fetal demise – Rupture of membranes) that can predict duration of termination **Conclusion**: Transvaginal ultrasonographic cervical measurements has a significant correlation with duration of termination of second trimetric abortion and can be used as a predictor of time of induction of abortion by misoprostol in the second trimester termination of pregnancy.

Keywords: Transvaginal Ultrasound, Cervical Length, Termination of Pregnancy, Misoprostol.

INTRODUCTION

As the pregnancy progresses, abortion-related morbidity and death considerably rise. Abortions beyond 14 weeks of pregnancy account for ten to fifteen percent of all abortions, but they also account for two-thirds of all complications and fifty percent of all abortion-related fatalities [(1)].

A significant clinical problem is the development of safe and efficient abortion methods for second-trimester pregnancy terminations and fetal death. The primary goal of inducing an abortion is the quick, painless, and successful delivery of the fetus. Several methods, including as prostaglandin analogues, hydroscopic dilatators, and Foley balloon traction, can end second-trimester pregnancies. Due to uterine unresponsiveness and an unfavorable cervix, the time between the start of induction and the birth of the products of conception might be prolonged during the second trimester of pregnancy [(2)].

The lady experiences discomfort and increased anxiety as a result of the prolonged administration of various ways and the reduced response rate to oxytocin infusion. Cervical priming is therefore a crucial component of second trimester pregnancy termination. The administration of the prostaglandin analogue misoprostol is the most often used technique of termination of pregnancy (TOP). The term "medical induction of abortion" refers to the process of terminating a pregnancy using methods other than surgery. It frequently involves the use of abortion-inducing substances (prostaglandins, RU486, Methotrexate). A total of 400 mcg of misoprostol can be injected vaginally and repeated after 4 hours. The recommended dose of misoprostol for inducing abortion in the second trimester is 800 mcg given after the initial dose [(3)].

Cervical length can be measured transvaginally to help determine whether vaginal delivery will occur within 24 hours following induction [(4)].

The supravaginal part of the cervix typically accounts for around 50% of cervical length; however this is extremely variable across people, making transvaginal ultrasonographic measurement theoretically a more reliable evaluation of the cervix than digital examination. This area is challenging to digitally measure, especially if the cervix is closed. Additionally, effacement is subjective and can vary greatly across examiners [(4)].

The purpose of this study was to assess the efficacy of transvaginal ultrasound assessment of cervical length as a predictor for the time required for a medically assisted second trimester pregnancy termination within 24 hours.

PATIENTS AND METHODS

Study design and setting:

In a case series study at Ain Shams University Maternity Hospital 100 participants between 14 and 24 weeks of gestation, with singleton pregnancy indicated for elective pregnancy termination were examined by transvaginal ultrasonography to assess the cervical length before medical second trimester pregnancy termination.

Inclusion criteria:

- Age: 17-40 years old.
- Non-scar uterus (primigravida or multipara).
- Singleton pregnancy.
- 14-24 weeks GA according to WHO classification [(5)].

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- Indication for elective pregnancy termination such as structural anomalies incompatible with life, fetal demise, and premature rupture of membranes.

These parameters were statistically analyzed in subgroups.

Exclusion criteria:

- Multiple pregnancies.
- Previous caesarean sections and other uterus procedures in the past.
- Inevitable abortion.
- Placenta covering internal os.
- Incompetent cervix (using TVUS revealing funneling cervix, cervical length <25 mm and inner to inner >1 cm) or previous history of preterm labor or passage of fresh live abortus or patients with previous cerclage or cervical surgeries.
- Patients contraindicated for misoprostol.

Methods:

All patients enrolled in the research received verbal consent before to participation, as well as the standard written informed consent required by hospital regulations, after being fully told of the study's aim.

A) History taking: Personal history, obstetric history (Previous cerclage parity, preterm labor as well as abortions), past medical history as (Chronic adrenal insufficiency and misoprostol-induced hypersensitivity), and cesarean history or other operations as (Hystorotomy and myomectomy).

B) Medical examination: General as well as abdominal examination; uterine contractions, presence of scar of previous operations, as well as fundal level). Local vaginal examination; rupture of membranes, effacement, consistency, cervical position, vaginal bleeding dilatation (cm).

C) Investigations: Laboratory, and pelvic US: fetal viability, alcohol use, gestational age, and placenta position are all evaluated.

Trans vaginal Ultrasound:

Women who volunteered to take part in the research had their cervical length measured transvaginally. An empty bladder was used for the transvaginal ultrasonographic examination, which was done in the dorsal lithotomy posture.

A single-use condom was placed over the transvaginal probe before it was gently inserted into the lower vagina and progressed until the cervical canal could be seen clearly. The interior and exterior os of the cervix were clearly defined by enlarging the photograph. The usual sagittal plane was used to assess cervical length.

The cervical canal and the internal and external os were measured as a straight line. Three separate measurements were taken, and a mean was calculated and utilized for analysis.

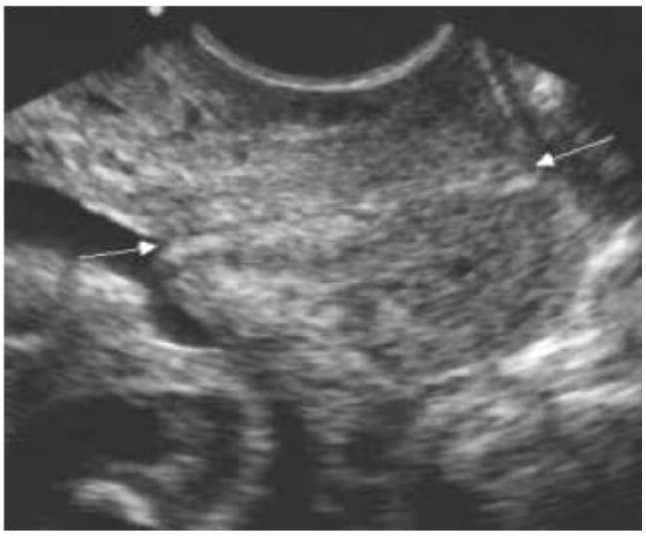

Figure (1): Measurement of cervical length by transvaginal sonography.

Pregnancy termination was carried out within the patient, as per Ain Shams University Maternity Hospital regulation. The misoprostol pills (Misotac® Sigma 200mcg per tablet) were used to end the pregnancy.

Misoprostol pills were first distributed through vaginal methods (total 400 mcg). After the first treatment, up to a total of four doses of a misoprostol tablet (200 mcg) were placed into the vagina. The same regimen will be repeated over the following 24 hours without the loading dosage in the event that the lady didn't have enough contractions within 8 hours of the last dose; same dosages for both live and deceased fetuses.

The interval from the start of misoprostol till fetal ejection without caregiver fetal traction was referred to as the "induction to expulsion phase." The usual placental curettage technique was not used. The patients administered 30 units of oxytocin on 500 cc Ringer solution slowly over the course of 30 minutes after the fetus was out in order to expel the placenta.

Surgical evacuation was done in the following conditions [6]: Excessive bleeding, failure of spontaneous expulsion or incomplete expulsion of the placenta after 60 minutes, and after the expulsion of the conceived goods, patients were released after six uneventful hours of monitoring.

Primary outcome: Duration between the first dose of misoprostol and the fetal expulsion.

Secondary outcome: Determination of total dose of misoprostol, the number of patients terminated within 24 hours, duration of hospital stay, and side effects of misoprostol (e.g. shivering, fever, nausea, vomiting and diarrhea at 2 and 24 h postpartum) **[7].**

Ethical considerations:

An approval of the study was obtained from Faculty of Medicine, Ain Shams University Academic and Ethical Committee. Every patient signed an informed written consent for acceptance of

participation in the study. This work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Statistical analysis:

The collected data were coded, processed and analyzed using the SPSS (Statistical Package for Social Sciences) version 20 for Windows® (IBM SPSS Inc, Chicago, IL, USA). Data were tested for normal distribution using the Shapiro Walk test. Qualitative data were represented as frequencies and relative percentages. Quantitative data were expressed as mean and standard deviation (SD). Independent samples t-test was used to compare between two independent groups of normally distributed variables (parametric data). Spearman's correlation test was used for non-parametric data. Linear regression analysis was used to study factors affecting duration of TOP in the studied cases P value $\leq$ 0.05 was considered significant.

RESULTS

Mean patients age was 27.8 (SD 4.5) years, mean BMI was 28.1 (SD 1.6) kg/m2 , mean parity was 2.4 (SD 0.5), mean gestational age was 19.5 (SD 2.7) weeks and mean cervical length was 25.2 (SD 4.7) mm.

Table (1):Age, Gestational age, BMI, Parity and Cervical length of the studied cases.

Variable	Mean ± SD	Range
Age (years)	**27.8 ± 4.5**	**17-40**
BMI (kg/m^2)	**28.1 ± 1.6**	**23.6-32.6**
Parity	**2.4 ± 0.5**	**0.0-7**
Gestational age (weeks)	**19.5 ± 2.7**	**14-24**
Cervical length (mm)	**25.2 ± 4.7**	**11-38**

Table 2 shows that there is a significant strong linear positive correlation between duration of termination and cervical length as well as a a significant strong linear negative correlation between duration of termination and parity.

Table (2):Correlation between duration of termination and other factors.

Factor	r	P
Age	**-0.025**	**0.807**
BMI	**0.047**	**0.641**
Parity	**-0.815**	**<0.001***
Gestational age	**0.111**	**0.272**
Cervical length	**0.931**	**<0.001***

Figure 2 shows that duration of induction was significantly shorter among cases with than without Rupture of membranes (ROM).

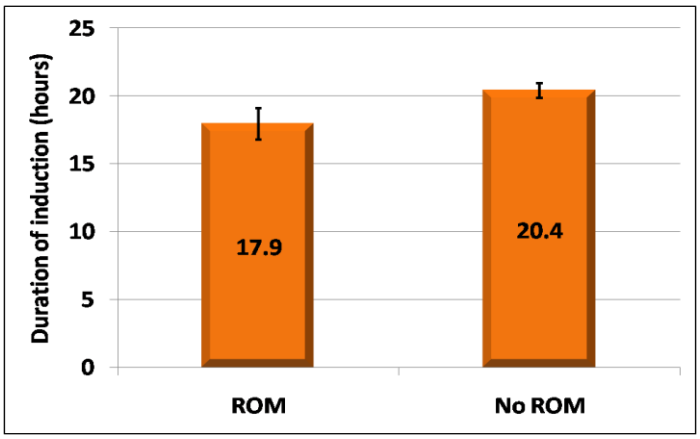

Figure (2): Comparison between cases with and without ROM regarding different studied parameters.

Figure 3 shows that duration of induction was significantly shorter among cases with than without fetal demise.

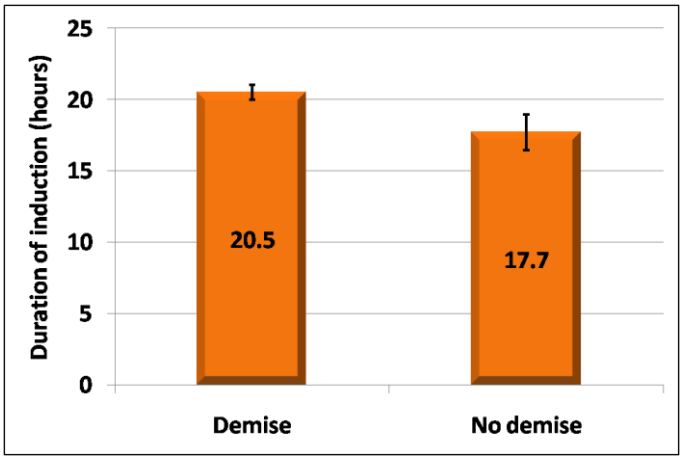

Figure (3): Comparison between cases with and without fetal demise regarding different studied parameters.

Using linear regression model to study factors affecting duration of termination in the studied cases; fetal demise and cervical length were found to be factors that increase the duration of termination, while parity and ROM were found to be factors that decrease the duration of termination.

Table (3): Factors affecting duration of termination in the studied cases

Variable	B	SE	P	95% CI	R^2
Cervical length	0.833	0.015	**<0.001***	0.804–0.862	0.994
Parity	-0.680	0.090	**<0.001***	-0.858–-0.502	
Fetal demise	0.645	0.383	0.096	-0.116–1.406	
ROM	-0.518	0.390	0.187	-1.292–0.255	

Figure 4 shows that the majority of cases could be expected with a bias less than ±2.0 hours by the suggested equation.

The predicting equation is as following: Duration of termination = 0.833 (Cervical length) - 0.68 (Parity) + 0.645 (Fetal demise) - 0.518 (ROM).

Where: Duration of termination to be expressend in hours. **Cervical length** to be expressend in mm. **Fetal demise** is 1 if occurs, 0 if not. **ROM** is 1 if occurs, 0 if not.

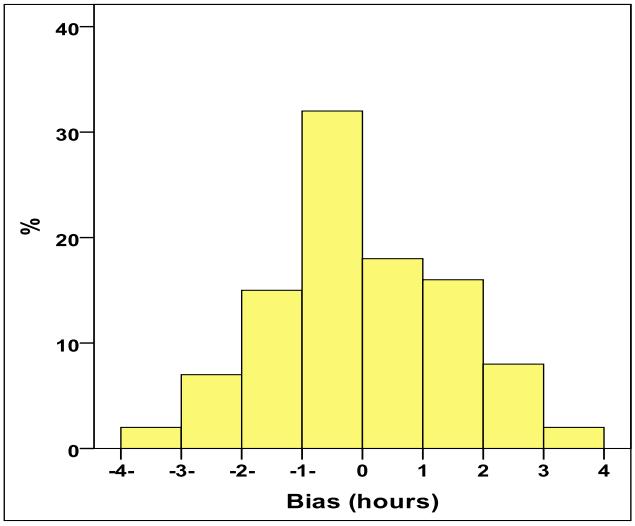

Figure (4): Bias of expected value by the suggested equation from actual duration of TOP.

Table 4 shows that the majority of cases received less than 1500 mcg.

Table (4): Total vaginal misoprostol doses (mcg).

Vaginal misoprostol	Mean ± SD	Range
Total dose	**1298 ± 260**	**600–2000**
Categories	**N**	**%**
600 –	**7**	**7.0**
1000 –	**76**	**76.0**
1500 – 2000	**17**	**17.0**

Figure 5 shows that vomiting was present at 16% of cases followed by diarhea 11% and finally fever 8% of cases while othe side effects represented 24% of patients.

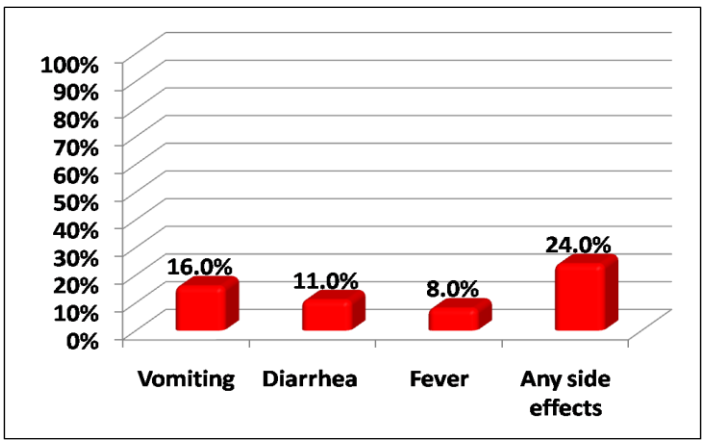

Figure (5): Side effects of vaginal misoprostol at 2 hours post-termination.

Table 5 shows that misoprostol doses (1558.3 ± 176.7 mcg), cervical length (29.1 ± 3.4 mm) and duration (24.7 ± 3.9 hours) are significantly higher among cases developed side effects, while parity (1.3 ± 0.2) is significantly lower among cases with side effects (P value <0.001). On the other hand, misoprostol doses (1215.8 ± 225.7 mcg), cervical length (24.0 ± 4.3 mm) and duration (18.3 ± 4.3 hours) are significantly lower among cases with side effects, while parity (2.7 ± 0.5) is significantly higher among cases with side effects (P value <0.001).

Table (5): Comparison between cases with and without side effects regarding different studied parameters.

Variable	Present (N=24)	Absent (N=76)	P-value
Age (years)	**28.4 ± 4.6**	**27.6 ± 4.5**	**0.492**
BMI (kg/m^2)	**28.3 ± 1.3**	**28.1 ± 1.7**	**0.524**
Parity	**1.3 ± 0.2**	**2.7 ± 0.5**	**<0.001 ***
Gestational age (weeks)	**20 ± 2.3**	**19.4 ± 2.8**	**0.341**
Cervical length (mm)	**29.1 ± 3.4**	**24.0 ± 4.3**	**<0.001 ***
Duration (hours)	**24.7 ± 3.9**	**18.3 ± 4.3**	**<0.001 ***
Misoprostol doses (mcg)	**1558.3 ± 176.7**	**1215.8 ± 225.7**	**<0.001 ***

DISCUSSION

About 10 to 15% of all pregnancy terminations (TOP) occur in the second trimester. However, TOP is to blame for 50% of all abortion-related fatalities and 2/3 of all serious complications. As gestational age grows, the risk of complications rises. Numerous mechanical and pharmaceutical methods, including as laminaria, Foley balloon traction, and prostaglandin analogues, have been tried. Prostaglandins, either alone or in combination with mifepristone, constitute the backbone of medical terminations performed after 13 weeks of pregnancy [8].

A total of 100 participants between 14 and 24 weeks of gestation, with singleton pregnancy indicated for elective pregnancy termination were examined by transvaginal ultrasonography to assess the cervical length before medical second trimesteric pregnancy termination. All participants received the same regimen of medical termination of second trimester pregnancy by misoprostol.

The outcomes were duration between the first dose of misoprostol and the fetal expulsion as a primary outcome, determination of total dose of misoprostol, the number of patients terminated within 24 hours and side effects of misoprostol as secondary outcomes.

The average age of participants was 27.8 years, whereas the average BMI was 28.1 kg/m2. The average

parity was 2.4 and average gestational age was 19.5 weeks. Average cervical length was 25.2 mm. Of the included 100 women; 84 women (84%) expelled the fetus within 24 hours, while 16 women (16%) needed more than 24 hours for expulsion of the fetus. Regarding correlation between duration of termination and the different demographic parameters, the following data were found. No statistical significant difference between age, gestational age and BMI and duration of termination as P values are 0.807, 0.272 and 0.641, respectively.

There is statistical significance between cervical length and parity and duration of termination as P value is <0.001. There is significant relationship between duration of induction and ROMs as 23 patients with ROMs and 77 patients without ROMs were terminated. Average duration of induction was significantly shorter among cases with ROM (17.9 ± 5.5 hours) than without ROMs (20.4 ± 4.8 hours) as P value is 0.037. ROM causes production of prostaglandins which increase and speed up contractions. In addition, there is a statistically significant relationship between duration of induction and fetal life as 23 patients with dead fetuses and 77 patients with living fetuses were terminated. Average duration of induction was significantly longer among cases with fetal demise (20.5 ± 4.5 hours) than without fetal demise (17.7 ± 6.1 hours) (P value 0.046). As regards side effects of misoprostol, 24 patients developed side effects (16 patients developed vomiting, 11 developed diarrheas, 8 developed fever and 24 developed any of the previous side effects) and 76 patients had no side effects. Misoprostol doses (1558.3 ± 176.7 mcg), cervical length (29.1 ± 3.4 mm) and duration (24.7 ± 3.9 hours) are significantly higher among cases developed side effects, while parity (1.3 ± 0.2) is significantly lower among cases with side effects (P value <0.001). On the other hand, misoprostol doses (1215.8 ± 225.7 mcg), cervical length (24 ± 4.3 mm) and duration (18.3 ± 4.3 hours) are significantly lower among cases with side effects, while parity (2.7 ± 0.5) is significantly higher among cases with side effects (P value <0.001).

Using linear regression model to study factors affecting duration of termination in the studied cases; fetal demise and cervical length are found to be factors that increase the duration of termination, while parity and ROM are found to be factors that decrease the duration of termination. Finally, an equation is derived; cervical length – parity + fetal demise – ROM can predict duration of termination.

In agreement with the current study, **Bueno *et al.*** [9] 196 pregnant women were enrolled to predict the success of labor induction using cervical length measurement by transvaginal ultrasound. Researchers found that cervical length was a good indicator of labor induction success, with the best cut-off points for cervical length being 16.5mm and 27mm (P value 0.001) in the prediction of a successful vaginal delivery within 24 hours of induction.

Park *et al.* [10] have discussed the value of obstetric history in determining its effect on success of induction of labor and nulliparity was a significant predictor of failed labor induction. 15 of the 110 pregnant women who attempted labor induction failed (14%). The Bishop score and prior obstetric history were shown to be important and independent contributing variables for unsuccessful labor induction using logistic regression. Given that multiparous patients were considerably more likely to be expelled from the trial within 24 hours, there is a negative link between parity and the length of termination in the current study.

In agreement to the current study, **Dilek *et al.*** [6] who recruited 163 pregnant women between 14 and 26 weeks concluded that Pregnant women with preinduction cervical lengths less than 36 mm required a lower total misoprostol dosage to reach TOP than those with cervical lengths greater than 36 mm, and their induction times were shorter (P value 0.027 and P value 0.011, respectively). In contrast to the current study, **Dilek *et al.*** [6] concluded that with effective TOP within 24 hours, transvaginal assessment of cervical length prior to prostaglandin analogue delivery is not statistically significant. In view of their findings, it cannot be utilized as a predictor. However, in the current investigation, there is statistically significant correlation between transvaginal ultrasound measurement of cervical length and length of termination (P value <0.001).

Contrary to the current study, **Abd-El-Maeboud *et al.*** [11] recruited 110 women with a gestational age between 14 and 26 weeks and discovered that the likelihood of an abortion occurring within the first 24 hours was higher among those with a gestational age of less than 21 weeks compared to those with a gestational age of 21 weeks or more (49 out of 53 vs. 44 out of 57, or 92.5 percent vs. 77.2 percent, while in the current study there is no statistically significant relation between gestational age (19.5 ± 2.7 weeks) and duration of termination (P value 0.272).

In contrast to the current study, **Dickinson and Doherty** [12] nulliparity, a younger mother age, and longer gestation were found to be related with the extension of abortion. 19.5 weeks was the median gestational age at termination (IQR 17.9, 21). A 16.1-hour median abortion break was observed (IQR 12, 23.5). Lower maternal age (median duration 17.6 vs 15.2 vs 13.6 h, age 30 vs 30-39 vs > 40 years), nulliparity (median duration 19 vs 14.3 h, nulliparous vs parous), and growing gestation (median duration 13 vs 17.8 h, 16 vs >20 weeks) were linked to abortion prolongation, but the current study's findings showed that gestational age did not affect the duration of termination.

Goh and Thong [13] recruited 386 pregnant women, whose median induction to abortion interval was 6.7 hours (range: 1.4 - 73.8 hours) and recorded that 97.9% and 99.5% of the women they included in their study aborted within 24 and 36 hours respectively. In the

current study, the mean induction to expulsion interval was 19.8 hours (range: 4.9 - 32.6 hours), whereas, of the included 100 women; 84 women (84%) expelled the fetus within 24 hours, while 16 women (16%) needed more than 24 hours for expulsion of the fetus. **Goh and Thong** [13] recruited a larger population and used mifepristone with misoprostol.

In conclusion, transvaginal ultrasonographic cervical measurements has a significant correlation with duration of termination of second trimeteric abortion and can be used as a predictor of time of induction of abortion by misoprostol in the second trimester TOP. There is an equation that can be used as a predictor of duration of induction that includes cervical length, parity, ROMs and fetal demise.

Conflict of interest: The authors declare no conflict of interest.

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Author contribution: Authors contributed equally in the study.

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