The impact of sweeping the membranes on cervical length and labor: a randomized clinical trial

Wpływ oddzielenia błon płodowych na długość szyjki macicy i poród: randomizowane badanie kliniczne

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Abstract

Objectives: *The aim of the study was to investigate to what extent sweeping of the membranes contributes to cervical shortening and if cervical shortening is related to the time to onset of labor and duration of the active phase of labor.*

Methods: *This prospective randomized clinical trial was performed at Baskent University between February and March 2011. Women were randomly assigned to receive membrane sweeping (Sweeping Group) (n=69) or no membrane sweeping (Control Group) (n=71). Cervical length was measured (cervix1) in both groups by examiner 1 and the Bishop Score was determined in the control group and sweeping was performed in the sweeping group by examiner 2. Two days later the patients had another cervical length measurement (cervix 2) by examiner 1, blinded to the group and results of the examiner 2. t test, Mann-Whitney U test and Chi-square test were used for statistical analyses.*

Results: *Cervix 1 was 27.4±8.4 mm and 29.6±8.9 mm (p= 0.14), cervix 2 was 23.3±8.8 mm and 23.8±8.5mm (p= 0.28) and cervical shortening was 5±4 mm and 5±4mm (p= 0.446), time to onset of labor was 6.3±4.6 and 5.7±4.1 (p= 0.38) and duration of labor was 5.8± 2.89 and 5.7± 2.4 (p= 0.82) for the sweeping and the control groups, respectively.*

Conclusions: *Sweeping of the membranes does not reduce cervical length and does not shorten time to onset of labor and duration of the active phase of labor.*

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Key words: **cervical length** / **sweeping** / **pregnancy** / **duration of labor** / **time to labor** /

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Streszczenie

Cel pracy: *Celem pracy była ocena w jakim stopniu oddzielenie błon płodowych wpływa na skrócenie szyjki macicy oraz czy skrócenie szyjki macicy jest związane z czasem do rozpoczęcia porodu i czasem trwania aktywnej fazy porodu.*

Metoda: *To propektywne, randomizowane badanie zostało przeprowadzone na Uniwersytecie w Baskent pomiędzy lutym a marcem 2011 roku. Kobiety przydzielano do grupy, której oddzielano błony płodowe od szyjki macicy (Grupa badana) (n=69) lub do grupy bez wykonywania dodatkowych procedur (Grupa kontrolna) (n=71). Długość szyjki macicy mierzono w obu grupach (szyjka 1), ocenę szyjki wg skali Bishopa wykonywano w grupie kontrolnej a oddzielenie błon płodowych od szyjki macicy wykonywano w grupie badanej. Dwa dni później wykonywano ponowny pomiar długości szyjki macicy (szyjka 2) w obu grupach zaślepionych pod względem przynależności do grupy i efektów przeprowadzonego masażu szyjki macicy. Do celów statystycznych użyto testu t, U Manna-Whitneya i Chi-kwadrat.*

Wyniki: *Szyjka 1 wynosiła 27,4±8,4mm i 29±8,9mm (p=0,14), szyjka 2 wynosiła 23,3±8,8mm i 23,8±8,5 (p=0,28) a skrócenie szyjki macicy wyniosło 5±4mm i 5±4mm (p=0,446), czas do rozpoczęcia porodu wyniósł 6,3±4,6mm i 5,7±4,1mm (p=0,38) a czas trwania porodu wyniósł 5,8±2,89 i 5,7±2,4 (p=0,28) dla grupy badanej i grupy kontrolnej, odpowiednio.*

Wnioski: *Oddzielanie błon płodowych nie zmniejsza długości szyjki macicy, nie przyspiesza rozpoczęcia porodu ani nie skraca aktywnej fazy porodu.*

Słowa kluczowe: **długość szyjki macicy** / **oddzielanie błon płodowych** / **ciąża** / / **czas trwania porodu** / **czas do porodu** /

Introduction

Induction of labor (IOL) is commonly performed in obstetric clinics to reduce the risk of perinatal morbidity and mortality associated with post-term pregnancy, shoulder dystocia, meconium aspiration syndrome and preeclampsia [1, 2]. As physicians aim to minimize the maternal and fetal risks associated with continuation of pregnancy, the IOL rate has doubled over the past decade [3]. However, there are undesirable consequences of labor induction, such as increased caesarean [4] and instrumental vaginal delivery rates [5], increased postpartum hemorrhage [4] and longer labor [4], when compared to spontaneous labor. Therefore, it has become necessary for physicians to predict which woman will deliver vaginally after IOL in order to inform them what to expect from IOL and about the possible risk. Prelabor cervical status, traditionally evaluated by the Bishop Score [6], and more recently by the measurement of the cervical length, correlates with the probability of successful vaginal delivery after IOL [7].

Sweeping of the membranes has been shown to shorten pregnancy and reduce post-term pregnancy [8]. It can help to avoid induction of labor for one in eight women [9]. National Institute of Health and Clinical Excellence Induction of Labor guidelines recommend offering sweeping to women who will have formal IOL [10].

Tan et al., investigated the effect of sweeping on cervical length. They performed sweeping at 40 weeks of gestation and measured the pre- and post-sweep cervical lengths [11]. They sought to evaluate immediate changes in cervical length occurring after sweeping and demonstrated that, in most cases, cervical length increased after sweeping and that a shortened cervix was independently predictive of vaginal delivery.

Objective

Our aim was to investigate cervical length change after a latency period of 2 days and to determine if the changes were related to the time to onset and duration of labor. The primary outcome is cervical length change after sweeping and the secondary outcomes are the time to onset of labor and duration of the active phase of labor.

Material and Methods

This was a prospective, randomized, parallel-group study conducted at Baskent University, Adana, Turkey, between February and March 2011. One hundred and fifty six low-risk women at 38+0-39+0 weeks of gestation were enrolled into this study. Gestational age was confirmed with dating ultrasound by sonographic measurement of the crown rump length in the first trimester. Eleven women were excluded because they did not fulfill the predefined criteria and five women refused to participate. A written informed consent was obtained from all participants. The study protocol was approved by the local ethics committee (KA08/160). All procedures were performed in accordance with the ethical standards of the responsible local or national committee on human experimentation and with the Helsinki Declaration.

Exclusion criteria were: history of uterine surgery including caesarean section, presentations other than cephalic, multiple pregnancy and contraindications to membrane sweeping, which included placenta previa, placental abruption, rupture of the membranes, active bleeding and labor. Sealed envelopes which included treatment allocations were prepared. At the initial examination, women in both groups selected an envelope. Then the patients were asked to empty the bladder and they were placed at the dorsal lithotomy position. The cervix was visualized at the sagittal plane by avoiding pressure to the cervix by Examiner

Table I. Characteristics and pregnancy outcomes of sweeping vs. control groups.

	Sweeping Group (n=69)	Control Group (n=71)	*P*
Age (range), y	26 (17-40)	28 (19-41)	0.30
Nulliparity (%)	34 (49.2)	31 (43.6)	0.12
Gestation at recruitment (range), wks.	38.5 (38-39)	38.2 (38-39)	0.13
Bishop Score ≥ 5(%)	43 (62.3)	44 (61.9)	0.91
Cervix 1 (range), mm	26.8 (9.3-48)	29.1 (8-51)	0.14
Cervix 2 (range), mm	22 (5-46)	25 (6-43)	0.28
Cervical shortening (range), mm	3.7 (-1.8-16)	5 (-1.3-17)	0.45
Time to onset of labor (±SD), days	6 (2-19)	4 (2-19)	0.38
Duration of active phase of labor (±SD), hrs	5.2 (2.8-15)	5 (2.1-15)	0.82
Birth weight (±SD), g	3400 (2160-4100)	3390 (2540-4300)	0.30
Mode of delivery			
Vaginal (%)	57 (82.6)	57 (80.3)	0.14
Cesarean section (%)	12 (17.4)	14 (19.7)	
Delivered after 41+0 weeks (%)	4 (5.8)	5 (7)	0.85
Induction of labor (%)	14 (20.3)	9 (12.7)	0.22
Indications for IOL			
41+0 weeks (%)	4/14 (28.6)	5/9 (55.6)	0.2
Hypertension (%)	4/14 (28.6)	2/9 (22.2)	0.73
IUGR (%)	2/14 (14.3)	1/9 (11.1)	0.82
Oligohydramnios (%)	3/14 (21.4)	1/9 (11.1)	0.52
Intrahepatic cholestasis (%)	1/14 (7.1)	0/9 (0)	0.41
Indications for cesarean section			
Failed induction (%)	2/12 (16.7)	3/14 (21.4)	0.76
Failure to progress (%)	3/12 (25)	2/14 (14.3)	0.50
Fetal distress (%)	5/12 (41.6)	6/14 (42.8)	0.95
Antenatal bleeding (%)	-	1/14 (7.2)	0.40
Maternal request (%)	2/12 (16.7)	2/14 (14.3)	0.50

Data are mean ± SD for continuous data and number (%) for categorical data.

1 (HAP) with more than 10 years of scanning experience. The cervix was magnified until the external and internal ostium and the cervical canal were visualized clearly and measured from the internal to the external ostium. Three measurements were taken and mean of these was considered as the cervical length. Voluson® 730 Expert, GE Healthcare, UK equipped with a 3.7-.9.3 MHz vaginal probe was used for transvaginal scanning. Later, the patients gave the envelopes to examiner 2 (CY). Examiner 2 opened the envelopes, assessed the Bishop Score in the control group and swept the membranes in the sweeping group, by separating the lower membranes as much as possible from their cervical attachment, with 360 degree pass of the examining fingers. The patients in both groups were called back for the second assessment of the cervical length two days later. Examiner 1, blinded to the groups which the patients were allocated to, measured the cervix transvaginally with the same technique and ultrasound. The patients were also blinded to the group they were allocated to. However, because of the discomfort women felt during sweeping, total blinding was not possible. The women who had labor pain, leakage of fluid or vaginal bleeding were admitted to the labor ward. The others were followed until the 41+0 weeks of pregnancy and if there was no indication of labor starting, it was induced. When the Bishop Score was ≥5, amniotomy was performed and oxytocin (Synpitan 5 IU, Deva İlaç, Turkey) was started at a dose of 1-2 mU/min and increased after 15 minutes by 2 mU until 4 contractions in 10 minutes were commenced. When the Bishop Score was <5, misoprostol 25 mcg (Cytotec , Ali Raif İlaç, Turkey) was administered intravaginally every 4 hours until the Bishop Score was ≥5, at a maximum of 4 doses. After the completion of 4 doses, when the Bishop Score was still <5, induction was deemed a failure. Time to onset of labor was calculated in days, from pelvic examination or sweeping to the start of the active phase of labor or to the start of the caesarean section. If the patient required a caesarean section while in labor, time to the start of the active phase of labor was calculated. Duration of the active phase of labor was calculated

from 3 cm cervical dilation with 80% effacement of the cervix, with regular contractions to the delivery of the baby in hours. Data on delivery were retrieved from patient files and in cases of missing data, the women were contacted by the phone and other hospital records were searched.

Statistical analysis: A study by Vankayalapati P et al., showed that mean cervical length at term was 25±8.3 for patients who delivered spontaneously and 29.7±8.5 for those who needed IOL (12). Setting p< 0.05 as the level of significance with 80% power, we calculated that 54 people per group were required for a suitably powered study. Taking into account the women who would be lost to follow up, we decided to include 140 women. Win Episcope 2.0 was used for sample size calculation.

Student *t* test was used to compare the means for normally distributed continuous data. When data were not normally distributed, Mann-Whitney U test was used to compare the groups. Chi square and Fisher exact test were used for categorical data. Continuous data were expressed as medians with their ranges. Categorical data were expressed as a percentage. Data analysis was performed with SPSS 17.0 (SPSS Inc., Chicago, IL, USA). *p* values were two sided. $p<0.05$ was considered statistically significant.

Results

One hundred and fifty-six women were deemed eligible for the study (Figure 1). Sixteen were excluded because they did not fulfill the predefined criteria (n=11) or refused to participate (n=5). One hundred and forty were randomized. Sixty-nine received sweeping and 71 received only pelvic examination to determine the Bishop Score. All women had the cervical scan before and 2 days after pelvic examination or sweeping. Two women delivered in another hospital and their birth records were obtained by telephone interview. Clinical characteristics and obstetric outcomes are presented in Table 1. Age, parity and gestational age at recruitment were similar in both groups. The distribution of the women with the Bishop Score of ≥5 was similar in both, the sweeping and the control groups. The median cervical length before sweeping (cervix1) was 26.8 mm (range: 9.3-48) and 29.1 mm (range: 8-51) ($p= 0.14$) for the sweeping and control groups, respectively. The cervix shortened in both groups (3.7 (range: -1.8-16) for sweeping and 5 mm (range: -1.3-17) for control groups) ($p= 0.45$), and the cervical length after sweeping (cervix 2) was 22 mm (range: 5-46) for the sweeping and 25 mm (range: 6-43) for the control groups ($p= 0.28$). Time to onset of labor was 6 (range: 2-19) days and 4 days (range: 2-19) ($p= 0.38$), the duration of the active phase of labor was 5.2 (range: 2.8-15) and 5 hours (range: 2.1-15) ($p= 0.82$) and the mean neonatal birth weight was 3400g (range: 2160-4100) and 3390g (range: 2540-4300) ($p=0 .30$) for the sweeping and control groups, respectively.

Eighty-two point six percent of the sweeping group and 80.3% of the women in the control group delivered spontaneously and vaginally ($p=0.14$). Five point eight percent of the sweeping group and 7% of the control group delivered after 41+0 weeks ($p=0.85$).

Twenty-three women needed induction of labor. Indications for induction of labor are presented in Table 1. IOL was necessary in 20.3 % of the sweeping group and 12.7% of the control group ($p= 0.22$).

Caesarean section was performed in 17.4% of the sweeping group and 19.7% of controls ($p=0.14$). The indications for caesarean delivery are presented in Table 1. IOL failed in 16.7% of the sweeping and 21.4% of the control groups ($p= 0.76$). Failure to progress was the indication for caesarean section in 25% of the sweeping and 14.3 % of the control groups ($p= 0.5$).

Two subgroup analyses were made to investigate 1) characteristics of the women who delivered within 7 days of sweeping or pelvic examination and 2) characteristics of the women whose active phase of labor lasted less than 5 hours (Table 2).

Fifty-three point five percent of the women delivered in ≤ 7 days and 46.5% delivered in >7 days. Sweeping was performed in 45.3% of the women in the former group and 53.8% of the women in the latter group. The distribution of nulliparity and the women with the Bishop Score of ≥5 were similar, as were cervix 1, cervix 2 and cervical shortening.

Forty-two point eight percent of the women delivered in ≤ 5 hours and 57.2% in > 5 hours. Sweeping was performed at a similar rate: 45% for the former group and 52.5% for the latter group. In the group of women whose active phase of labor lasted ≤ 5 hours, the percentage of the women with the Bishop Score of ≥5, cervix 1, cervix 2 and cervical shortening was similar. Only nulliparity was significantly more common (30% vs. 42.6%) ($p<0.001$) in the group whose active phase of labor lasted >5 hours, as expected.

Mild bleeding and cramping were more common in the sweeping group (10.8% vs.5.6%), though the difference was not statistically significant ($p=0.35$). No other adverse effects were reported. Antenatal bleeding occurred during the active phase of labor in the control group in 1 patient who required caesarean delivery, and was considered to be unrelated to the examination.

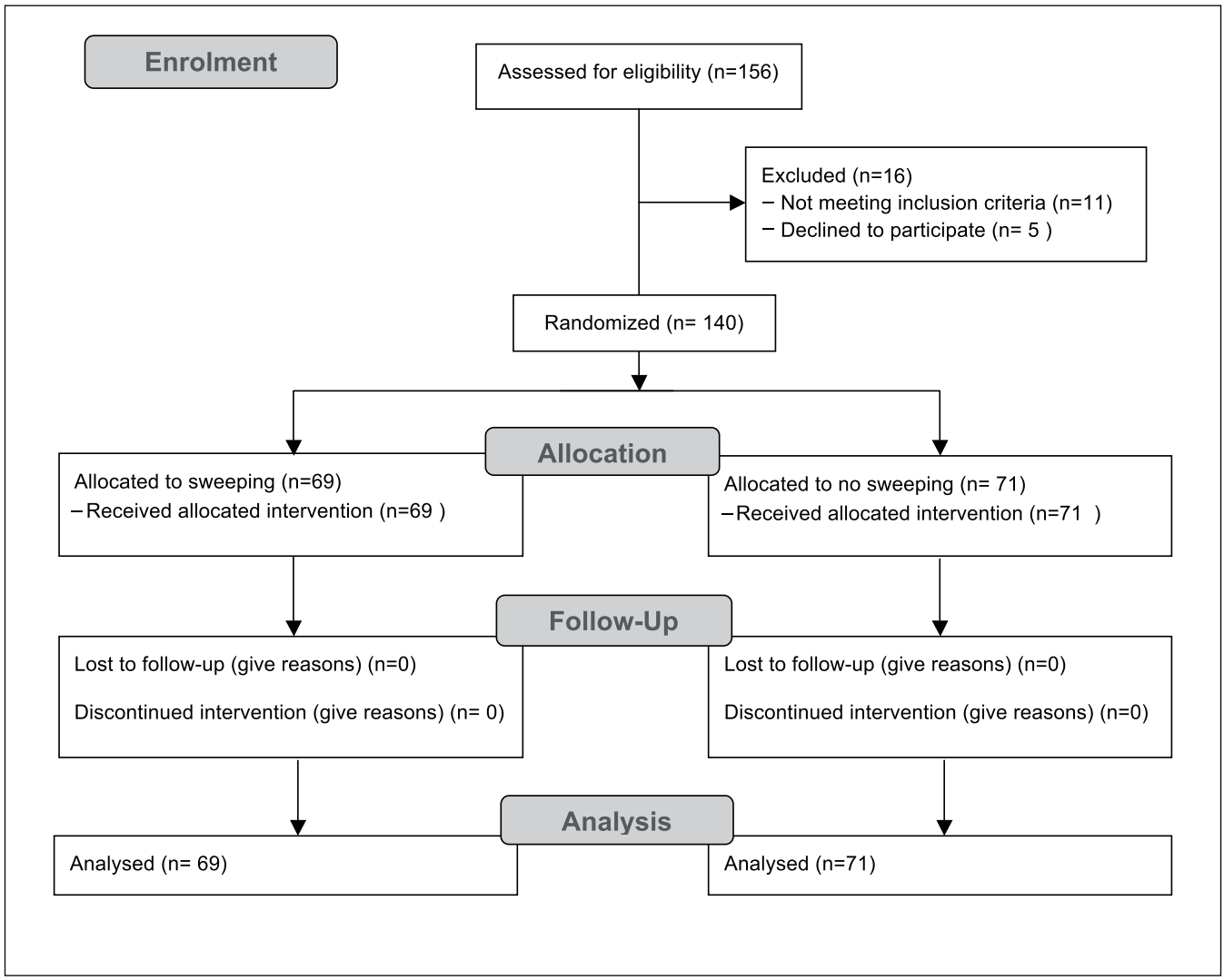
Discussion

The cervix prepares for labor and gradually shortens with the advancement of gestational age [13, 14]. Consistent with previously published reports, our study demonstrated that cervical remodeling can cause a detectable change in sonographically measured cervical length even in the course of two days. Upon commencement of the study, we hypothesized that cervical shortening should be more prominent in the cervical sweeping group due to mechanical disruption of the cervix. However, despite the lack of statistical significance, cervical shortening turned out to be less prominent in the sweeping group. A study by Tan et al., examined the cervix after sweeping. They measured cervical length before and immediately after sweeping and reported lengthening of the cervix after sweeping, stating that lengthening of the cervix might have been due to alleviation of the head compression on the cervix since the fetal head was pushed off the cervix during membrane sweeping [11]. Sweeping does not cause cervical shortening but the question whether it reduces the duration of pregnancy remains. A Cochrane meta-analysis concluded that sweeping of the membranes reduced pregnancy duration and the number of pregnancies continuing beyond 41 weeks [9]. However, there are other reports which contradict this meta-analysis. Tan, Kashanian and Hamdan et al., reported that sweeping does not reduce time to delivery [8, 15, 16]. In our study, sweeping did not shorten the time to onset of labor and did not decrease the proportion of pregnancies continuing beyond

Table II. Data on women who delivered before and 5 days after the second examination and women whose active phase of labor lasted less and more than 5 hours

	Delivered ≤7 days (53.5%)	Delivered >7 days (46.5%)	p	Labor ≤5hours (42.8%)	Labor >5 hours (%) 57.2	*P*
Nulliparity (%)	38.6	46.1	0.42	30	42.5	<.001*
Bishop score ≥5 (%)	62.6	66.1	0.56	66.6	65	0.93
Cervix1 (±SD), mm	28.4 ± 8.3	28.7 ±9.4	0.80	28.1±9.1	28.9 ±8.6	0.62
Cervix2 (±SD), mm	22.5± 8.6	24± 8.9	0.30	22.3 ± 8.4	23.7 ±8.9	0.28
Cervical shortening (±SD), mm	5.8 ±4.1	4.7 ±4.6	0.12	5.8 ±4.4	5±4.3	0.25
Sweeping performed (%)	45.3	53.8	0.31	45	52.5	0.47

*Statistically significant



41 weeks. We intended to find out if the Bishop Score, cervix 1, cervix 2 or cervical shortening predict delivery within 7 days of pelvic examination or sweeping. None of the parameters were significantly associated with delivery within 7 days. Moreover, sweeping did not change the duration of the active phase of labor. Cervical lengths before and during sweeping and cervical shortening were also useless in predicting the active phase of labor lasting ≤5 hours. Only nulliparity was significantly more common (p=.001) in the group with active phase of labor lasting more than 5 hours as compared to those with the active phase of labor lasting ≤ 5 hours. Chanrachakul et al., also reported that sweeping did not reduce the first, second and third stages of labor [17].

The influence of cervical length on spontaneous or induced labor has been studied extensively. Cervical shortening is a less popular and less commonly studied subject. Kang et al., investigated cervical shortening in patients who had failure of induction on the first day and reported that it was as valuable as

cervical length in predicting the success of IOL on the second day [20]. Tan et al., examined the cervical length immediately before and after cervical sweeping and showed that cervical shortening was not associated with a decrease in labor induction, but was significantly associated with a reduction in the caesarean section rate [11].

Our study enrolled low-risk pregnant women. Therefore, our results can be of considerable use and importance to clinics which follow up and deliver low-risk pregnant women. The examiners, one of whom performed pelvic examination and sweeping, and the other who performed cervical scan, were blinded to each other's findings. Both, the caregiver staff working during labor and the women were also blinded to the groups to which the women were allocated. However, because of the discomfort felt during sweeping, total blinding of the women was not possible. Our IOL protocol was standardized to minimize inaccuracy originating from the use of different ripening agents. The factors mentioned above increased the power of the study.

However, the present study was not without limitations. Firstly, the time of pelvic examination or sweeping was considered as the starting point to calculate the time to onset of labor to the start of the active phase of labor. However, four of the caesarean sections for fetal distress and all four of the caesarean sections for maternal request were performed before the women were in the active phase of labor. In these women, time to onset of labor was considered as the time elapsing from pelvic examination or sweeping to the start of the operation. Therefore, these may have affected the time elapsing to onset of labor and the caesarean rate. Nevertheless, caesarean deliveries for fetal distress and maternal request were unavoidable. Secondly, we might have performed the second cervical scan too early. If we had measured the cervix at a later time, we could have found more significant results. However, a significant number of women would have delivered by that time, rendering the second cervical scan impossible.

Conclusions

Cervical shortening is a dynamic process which continues until labor. However, sweeping of the membranes does not bring any further reduction in cervical length and does not shorten time to onset of labor and duration of the active phase of labor. Nulliparity is the only significant parameter in defining the length of the active phase of labor. More studies on cervical length are necessary to better understand cervical dynamics.

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Full details of the trial protocol can be found in the Supplementary Appendix, available with the full text of this article at www.clinical.gov.tr

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Authors' Contribution:

1. Huriye A. Parlakgumus – gathering of the data, concept, analysis and interpretation of data, article draft, corresponding author.
2. Cem Yalcinkaya – gathering of the data.
3. Bulent Haydardedeoglu – gathering of the data.
4. Ebru Tarim – revised article critically.

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