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The effects of amniotomy on labor duration, cesarean section rates, and maternal and fetal outcomes

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Abstract

Objective: We aimed to investigate the effects of amniotomy during spontaneous labor on the durations of labor stages, cesarean section (C/S) rates, and maternal and fetal outcomes.

Methods: This prospective study was performed through basic randomization to investigate the effects of amniotomy on labor duration, delivery type, morbidity/mortality rates during puerperal period and premature newborn outcomes in pregnant women with low risk who admitted to Obstetrics Clinic of Zekai Tahir Burak Women's Health Training and Research Hospital and delivered at our hospital.

Results: There was no statistically significant difference between pregnant women who underwent and did not undergo amniotomy in terms of the period elapsed until cervical dilation was 6 cm, until 10 cm after cervical dilation was 6 cm and until delivery after it reached 10 cm and total labor duration (p>0.05). The C/S rate (p=0.030) and hospitalization duration (p=0.04) of pregnant women who underwent amniotomy was significantly higher than those who did not undergo amniotomy. There was no difference between two groups in terms of morbidity/mortality during puerperal period and premature newborn outcomes.

Conclusion: Amniotomy does not reduce the labor duration in the management of spontaneous labor; as it increases the rate of C/S and hospitalization duration of mother, it should not be performed as a routine practice in training and research hospitals.

Keywords: Labor duration, amniotomy procedure, cesarean section, first stage of labor, second stage of labor.

Özet: Amniyotominin eylem süresi, sezaryen oranları, maternal ve fetal sonuçlar üzerine etkisi

Amaç: Spontan başlayan doğum eyleminde amniyotominin doğum evrelerinin sürelerine, sezaryen (C/S) oranlarına ve maternal, fetal sonuçlar üzerine etkileri araştırıldı.

Yöntem: Prospektif, basit randomizasyon ile gerçekleştirilen çalışmada Zekai Tahir Burak Kadın Sağlığı Eğitim ve Araştırma Hastanesi Doğum Ünitesine kabulü yapılan ve doğurtulan düşük riskli gebelerde, amniyotominin, doğum eylemi süresine, doğum şekline ve puerperal döneme ait morbidite/mortaliteye ve erken yenidoğan sonuçlarına etkisinin değerlendirilmesi amaçlanmıştır.

Bulgular: Amniyotomi uygulanan ve uygulanmayan gebeler arasında kabulden servikal açıklık 6 cm oluncaya kadar geçen süre, servikal açıklık 6 cm olduktan sonra 10 cm oluncaya kadar, 10 cm olduktan sonra doğuma kadar geçen süre ve toplam doğum süresi açısından istatistiksel anlamlı farklılık saptanmadı (p>0.05). Amniyotomi uygulanan gebelerin C/S ile doğum yapma yüzdesi (p=0.030) ve hastanede kalma süreleri (p=0.04) amniyotomi uygulanmayanlardan anlamlı olarak yüksekti. Puerperal dönemde morbidite/mortalite ve erken yenidoğan sonuçları arasında farklılık belirlenmedi.

Sonuç: Spontan başlayan doğum eyleminin yönetiminde amniyotomi eylem süresini kısaltmamaktadır; C/S oranında artış ve annenin hastanede daha uzun süre yatışına yol açtığından eğitim hastanelerinde rutin uygulanmamalıdır.

Anahtar sözcükler: Doğum eylemi süresi, amniyotomi prosedürü, sezaryen, doğumun ilk evresi, doğumun ikinci evresi.

Introduction

Amniotomy, which is considered to intensify and raise the frequency of uterine contractions by increasing the production and release of prostaglandins and oxytocins and therefore to shorten the labor duration, is the most common procedure in obstetric practice;[1–3] however, the literature contains controversial reports whether amniotomy during a spontaneous labor shortens the labor duration or not, and if it shortens, whether it improves maternal and fetal outcomes or not, or whether it causes maternal and/or procedure-related

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fetal complications or not.[3–6] The evidences showing that amniotomy shortens the labor duration or improves obstetric outcomes are not based on high quality meta-analyses, systematic reviews of randomized controlled studies, or randomized controlled studies with low bias risk. Therefore, asserting that the procedure provides absolute healthcare benefits and the benefits overweigh the risks is not possible since current data are not Grade A evidence.[7]

In our study, we aimed to investigate the effects of amniotomy on labor duration, labor, delivery, morbidity/mortality rates during puerperal period and premature newborn outcomes in pregnant women with low risk who admitted to Obstetrics Clinic of Zekai Tahir Burak Women's Health Training and Research Hospital and delivered at our hospital.

Methods

This prospective randomized controlled study was performed between August 2016 and November 2016 by obtaining approval of the Ethics Committee no. 7 for Clinical Researches (Decision No. 38/2016) of Zekai Tahir Burak Women's Health Training and Research Hospital.

Pregnant women who were hospitalized at Obstetrics Clinic, had no problem during their routine gestational follow-up visits, whose labors started spontaneously, on 36 6/7 weeks of gestation with singleton pregnancy and on vertex presentation, had intact amniotic membrane, no fetal malformation and maternal disease and who had currently no obstacle for normal vaginal delivery were included in the study. The pregnant women who had planned cesarean indication and were required to undergo emergency cesarean section were excluded from the study.

Biostatistical pre-assessment was carried out before selecting the population, and via PASS 11 (Power and Sample Size, version 11, for Windows), 220 individuals were selected with a population size of 80.12% testing power in total as a result of power analyses performed for t-test in the independent groups.

For the control and study groups, equal numbers of closed opaque envelopes were prepared which were 220 in total. Right after the pregnant women, who were determined according to the criteria, were admitted to the clinic, a simple randomization was conducted by letting pregnant women to choose an opaque envelope from the box. Pregnant women who were separated as amniotomy and non-amniotomy groups were admitted to the labor.

Vaginal examination was performed to the pregnant women included in the study with intervals not exceeding two hours. Contraction sufficiency was evaluated in the follow-ups. At least three regular contractions, being 200 units and more, within 10-minute period in 20 minutes were considered as sufficient contractions.[8,9] Pregnant women found to have insufficient contraction were administered 2 mlU/min oxytocin in accordance with low dose protocol regardless of their groups. The dose was increased regularly until sufficient contraction was obtained. The labor was followed up by the assistants of obstetrician and gynecologist under the management of obstetrician and gynecologist.

In both groups, the pregnant women were administered hyoscine-n-butylbromide in the dose of 20 mg/ml and pethidine in the dose of 100 mg/2 ml during labor. Medicated pregnant women were recorded. The durations (in minutes) from admission up to cervical dilation being 6 cm, from 6 cm up to full cervical dilation and full cervical dilation up to the moment when delivery was performed were recorded. Amniotomy contraindications were evaluated in the group to be performed amniotomy. The amniotomy was performed after confirming that there was no contraindication in the pregnant women who were selected for the amniotomy group as a result of vaginal examination, fetal heartbeat trace and ultrasonographic findings. The dilation for amniotomy procedure was determined as minimum 4 cm. Procedure time was recorded in pregnant women who underwent amniotomy.

Cesarean section indications of pregnant women who were decided to perform cesarean section in their follow-ups were evaluated.

Hemoglobin and hematocrit values before and after delivery were recorded for the assessment of postpartum hemorrhage. The decrease of 10 units in hematocrit value was considered to be postpartum hemorrhage. The patients who had postpartum hemorrhage and underwent transfusion were evaluated. Their intrapartum and postpartum fevers were monitored and postpartum hyperthermia was investigated. White blood cell values were screened in the hemogram results. Postpartum breastfeeding was investigated. In the newborn results, 1-minute and 5-minute Apgar scores, birth weight, pH levels of cord blood, hospitalization at newborn intense care unit, hospitalization indication and the duration (in hour) for hospitalization at newborn intense care unit were recorded. The hospitalization durations of pregnant women were also recorded in hours.

The Analysis and Statistics of the Data

The data of the study was evaluated in computer environment by uploading via SPSS (Statistical Package for Social Sciences) for Windows 22.0 (SPSS Inc, Chicago, IL, USA). The definitive statistics were presented as mean±standard deviation (minimum–maximum), frequency distribution and percentage. Pearson chi-square test and Fisher's exact test were used for the assessment of categorical variables. The concordance of variables to normal distribution was evaluated by using visual (histogram and probability graphics) and analytical methods (Kolmogorov-Smirnov/Shapiro-Wilk tests). It was found that all measurement variables were not concordant with normal distribution. As statistical method, Mann-Whitney U test was used for the statistically significance between two independent groups and Kruskal-Wallis test was used between three independent groups. When significant difference was found between three independent groups, post-hoc Bonferroni correction was performed to identify the reason of difference. $p<0.05$ was defined as statistically significant level.

Results

A total of 220 pregnant women were included in the study. While 110 (50%) of 220 pregnant women underwent amniotomy, it was not performed for the remaining 110 (50%) pregnant women. Mean age of the group was 26.54±5.98 (min: 15 – max: 46) years. The ages, BMI values, weeks of gestation and parity conditions of pregnant women who underwent and did not undergo amniotomy were presented in **Table 1**. No statistically significant difference was found between the groups ($p>0.05$). According to the examination at the time of admission, there was no statistical difference between amniotomy and no-amniotomy groups in terms of the cervical dilation, fetal heartbeat sample at follow-up (Category I, Category II), white blood cells, hemoglobin and hematocrit values, oxytocin administration, cervical dilation upon oxytocin administration, and application of hyoscine-n-butylbromide and pethidine (**Table 2**).

Table 1. The distribution of definitive characteristics in groups which underwent and did not undergo amniotomy.

	Amniotomy (-) (n=120)	Amniotomy (+) (n=118)	p*
	$\bar{x}$±S	$\bar{x}$±S	
Age (year)	26.84±6.56	26.44±5.36	0.581
BMI (kg/m²)	28.57±4.41	27.88±3.92	0.444
Parity			
Nulliparous	35 (31.8)	51 (46.4)	0.073†
Multiparous	75(68.2)	59 (53.7)	
Week of gestation	39.12±1.47	39.14±1.30	0.832

*Mann-Whitney U test; †Pearson chi-square test. $\bar{x}$: Mean; S: Standard deviation

Table 2. Delivery type and maternal parameters during and after delivery in groups which underwent and did not undergo amniotomy.

	Amniotomy (-) (n=110)	Amniotomy (+) (n=110)	p
Delivery type, n (%)			
C/S	2 (1.8)	9 (8.2)	**0.030***
Vaginal delivery	108 (98.2)	101 (91.8)	
C/S indication (n=11), n (%)			
Fetal distress	1 (50.0)	2 (22.2)	
Cord prolapse / presentation	0	2 (22.2)	-----
Other	1 (50.0)	5 (55.6)	
Postpartum hemorrhage			
No	109 (99.1)	105 (95.5)	0.212†
Yes	1 (0.9)	5 (4.5)	
Fetal weight	3.96±0.44	3.84±0.50	0.058‡
Placental weight (g), $\bar{x}$±S	544.1±68.8	542.1±66.0	0.854‡
Elevated white blood cell count, n (%)			
No	109 (99.1)	107 (97.3)	0.622†
Yes	1 (0.9)	3 (2.7)	
Decreased hemoglobin, n (%)			
No	108 (98.2)	103 (93.6)	0.171†
Yes	2 (1.8)	7 (6.4)	
Maternal hospitalization duration (hour), ±S	28.84±16.57	33.39±21.20	**0.037‡**

*Pearson chi-square test; †Fisher's exact test; ‡Mann-Whitney U test. $\bar{x}$: Mean; S: Standard deviation

Table 3. The distribution of clinical characteristics of pregnant women in groups which underwent and did not undergo amniotomy.

	Amniotomy (-) (n=110)	Amniotomy (+) (n=110)	p
Cervical dilation at the time of admission (cm), $\bar{X}$±S	4.61±1.51	4.47±1.47	0.478*
<4 cm, n (%)	32 (29.1)	37 (33.6)	0.712†
4–<6 cm, n (%)	50 (45.5)	49 (44.5)	
≥6 cm, n (%)	28 (25.5)	24 (21.8)	
Contraction at the time of admission, n (%)			
Insufficient	9 (8.2)	25 (22.7)	**0.003**†
Sufficient	101 (91.8)	85 (77.3)	
Cardiotocography, n (%)			
Category I	106 (96.4)	105 (95.5)	1.000‡
Category II	4 (3.6)	5 (4.5)	
White blood cell (/mm³), $\bar{X}$±S	11670.0±2995.9	11537.4±2857.9	0.468*
Hemoglobin (g/dL), $\bar{X}$±S	11.98±1.28	11.79±1.25	0.239*
Hematocrit (%), $\bar{X}$±S	36.65±3.66	36.10±3.44	0.338*
Oxytocin administration, n (%)			
Not administered	71 (64.5)	61 (55.5)	0.169†
Administered	39 (35.5)	49 (44.5)	
Cervical dilation when oxytocin was administered (cm) (n=88), $\bar{X}$±S	4.96±0.99	4.60±0.95	0.082*
Hyoscine-n-butylbromide administration, n (%)			
Not administered	50 (45.5)	43 (39.1)	0.339†
Administered	60 (54.5)	67 (60.9)	
Pethidine administration, n (%)			
Not administered	108 (98.2)	108 (98.2)	1.000†
Administered	2 (1.8)	2 (1.8)	
Epidural anesthesia, n (%)			
Applied	1 (0.9)	0	------
Not applied	109 (99.1)	110 (100)	

*Mann-Whitney U test; †Pearson chi-square test; ‡Fisher's exact test. $\bar{X}$: Mean; S: Standard deviation

The labor durations of both groups are shown in the **Table 3**. Between the two groups, the duration elapsed until cervical dilation is 6 cm (p=0.15), the duration elapsed until cervix reaches full dilation from 6 cm (p=0.80), the duration elapsed from full dilation up to delivery (p=0.55) and total labor duration (p=0.13) did not demonstrate any statistical difference.

When the distribution of delivery-related characteristics (**Table 4**) is evaluated between two groups, the delivery type demonstrated statistical difference (p=0.03). The number of cesarean section procedure (9 C/Ss) in the amniotomy group was significantly higher than those (2 C/Ss) who did not undergo amniotomy. While C/S indications were cord presentation (2), fetal distress (2) and non-progressive labor (5) in the amniotomy group, they were fetal distress (1) and abruptio placentae (1) in those who did not undergo amniotomy. Between two groups, no statistically significant difference was found in terms of birth weights of newborns, Apgar scores, pH levels of cord blood gas and the need for newborn intense care (p>0.05) (**Table 5**). While no difference was found between the groups in terms of placental weight, reduced hemoglobin, postpartum hemorrhage, elevated white blood cell count and breastfeeding status, the maternal hospitalization duration was longer in the amniotomy group (p=0.04).

Table 4. The distribution of labor durations in groups which underwent and did not undergo amniotomy.

	Amniotomy (-)		Amniotomy (+)		p*
	n	Median (min–max)	n	Median (min–max)	
The period elapsed until cervical dilation is 6 cm (minute)	81	112 (12–1033)	82	172.5 (10–1380)	0.157
The period elapsed until cervical dilation reaches 10 cm from 6 cm (minute)	108	90 (5–430)	101	90 (5–480)	0.803
The period elapsed until delivery from cervical dilation being 10 cm (minute)	108	15 (3–55)	101	20 (3–55)	0.055
Total duration (minute)	109	189 (10–1238)	105	220 (10–1785)	0.134

*Mann-Whitney U test.

Discussion

O'Driscoll et al. used amniotomy within the active management of labor in order to ensure controlled and fast labor and to assist both labor induction and labor;[10] however, the literature is controversial on the acceleration of labor by amniotomy. There are publications asserting that amniotomy shortens the first stage of labor while others report that amniotomy does not make a difference.[3,11,12] It also could not be shown that labor acceleration or the detection of meconium in the amnion by amniotomy improves fetal/maternal outcomes based on evidence.[3] In the meta-analysis of 5583 cases without any parity discrepancy which included 15 studies and published in 2013 by Cochrane Collaboration, the labor durations were evaluated in groups which underwent and did not undergo amniotomy, and it was reported in the results for the first stages of 1127 women that 20.43 minutes of reduction in the amniotomy group did not demonstrate statistically significant difference. In our study, we found 60.5 minutes of extension in the first stage of labor in the amniotomy group, but there was no statistically significant difference. In 1993, Garite et al. compared 235 pregnant women who underwent amniotomy at 5.5 cm with 224 pregnant women who were followed up without any amniotomy procedure until 8 cm to investigate the effects of elective amniotomy on fetal heartbeat, and they reported that elective amniotomy shortened active phase and decreased oxytocin need.[13]

The meta-analysis series of Cochrane Collaboration in 2013 on eight studies to evaluate the second stage of labor found 1.33 minutes of difference in a total of 1927 women in the amniotomy group, 5.43 minutes of difference in primiparous cases in the sub-group analysis, and 1.19 minutes of difference in multiparous cases; but it was reported that the results did not demonstrate any statistical significance.[3]

In 1992, Barret et al. assessed pregnant women who underwent amniotomy and had intact amniotic membrane until the second stage of labor and they reported that there was no difference during the second stage.[14] In another meta-analysis of Cochrane Collaboration published in 2001, a total of 2566 pregnant women were evaluated who underwent amniotomy for labor induction as well as oxytocin infusion. Pregnant women who underwent only amniotomy, those who underwent amniotomy together with oxytocin infusion, and those who received only prostaglandin were compared to placebo. When the group which underwent amniotomy only was compared to the group which underwent amniotomy together with oxytocin infusion, it was shown that labor durations were shorter in the amniotomy + oxytocin group than the group which underwent amniotomy only. Postpartum hemorrhage was higher in the amniotomy + oxytocin group than the placebo group.[15] In our study, we evaluated the pregnant women in terms of the sufficiency of contractions, and we tried to establish contraction homogeneity by administering oxytocin due to the difference between the groups. While there were insufficient contractions in 9 pregnant women who did not undergo amniotomy, we provided oxytocin support to a total of 39 pregnant women in their follow-ups and obtained sufficient contractions; in the amniotomy group, a total of 25 pregnant women had insufficient contractions at the time of admission, and we obtained sufficient contractions in 49 pregnant women by oxytocin support in their follow-ups. There was no statistically significant difference between the groups after the procedure.

Table 5. The distribution of newborn characteristics in groups which underwent and did not undergo amniotomy.

	Amniotomy (-) (n=110)	Amniotomy (+) (n=110)	p
Birth weight of baby (g), $\bar{X}$±S	3264.9±383.1	3278.7±342.0	0.687*
Apgar score, n (%)			
8–10	100 (90,9)	100 (90.9)	1.000*
7–9	9 (8.2)	9 (8.2)	
6–8	1 (0.9)	1 (0.9)	
pH, $\bar{X}$±S	7.37±0.06	7.36±0.06	0.652†
Need for newborn intensive care, n (%)			
No	106 (96.4)	109 (99.1)	0.369‡
Yes	4 (3.6)	1 (0.9)	
Hospitalization duration in newborn intensive care unit (hour) (n=5), $\bar{X}$±S	24.00±10.95	3	-----

*Pearson chi-square test; †Mann-Whitney U test; ‡Fisher's exact test. $\bar{X}$: Mean; S: Standard deviation

In the meta-analysis of Cochrane Collaboration performed in 2013, the data of 5021 pregnant women related with their delivery types were evaluated and it was shown that C/S risk increased in the amniotomy group but the results were not significant.[12] In our study, we performed cesarean section to 9 cases in the amniotomy group and 2 cases in the group which did not undergo amniotomy. While C/S rate demonstrated statistically significant increase in the amniotomy group, there was no statistical difference in terms of C/S indications. Goffinet et al. assessed the adverse effects of premature amniotomy on fetal heartbeat in their studies in 1997 and they compared the group which underwent early amniotomy with the group which had intact membranes. They found severe variable decelerations and late decelerations in the amniotomy group more frequently, but there was no significant difference in newborn outcomes. They did not find any difference between C/S rates of both groups; they observed that the number of fetal distress as C/S indication was higher in the amniotomy group.[14] In 1995, Mercer et al. investigated the effects of premature amniotomy which was performed for labor induction, and they performed premature amniotomy to 106 pregnant women and late amniotomy (after 5 cm) to 103 pregnant women. While they found more cord compression findings in the early amniotomy, they did not identify any difference between premature newborn outcomes.[16] In another study where Gabbe et al. investigated the relationship between amniotomy and cord compression in 1975, the authors emphasized that amniotic fluid has a protective significance for normal cord blood flow.[17] In our study, we observed Category II fetal electrocardiotocography more frequently in the amniotomy group, but the difference was not statistically significant.

While 4 out of 5 cases with postpartum hemorrhage diagnosis were in the amniotomy group in our study, lack of significant result related with postpartum hemorrhage between the groups is in agreement with the literature.[18] A total of two patients underwent transfusion due to postpartum hemorrhage. In consideration of other maternal outcomes, there was no significant difference between the groups in terms of postpartum infection, maternal morbidity and mortality. The groups also did not have any difference in terms of postpartum breastfeeding. The results are concordant with the literature.

In terms of fetal outcomes, there was no significant difference in terms of pH levels of newborn cord blood gas, Apgar scores, need for newborn intense care unit, indication for hospitalization at newborn intense care unit and hospitalization durations, and these results are in agreement with the literature.[3,11,12]

In terms of maternal postpartum hospitalization duration, we found that the duration was extended for 9 pregnant women in the amniotomy group due to C/S, and mean hospitalization duration after C/S procedure was 53 hours. While the hospitalization duration for the amniotomy group was 28.84 hours, it was 33.9 hours for the group which did not undergo amniotomy.

In the meta-analysis conducted by Consortium on Safe Labor in 2010, 62,415 women from 19 hospitals were evaluated and it was seen that cervical dilation was accelerated after 6 cm in both multiparous and nulliparous pregnant women.[19] According to Zhang et al., the labor duration between 4 and 6 cm is longer than the previous definitions. The cesarean sections to be performed with the diagnosis of non-progressive labor may decrease by the new labor curve created by Zhang et al.[20] After the dilation reaches 6 cm, the labor rapidly proceeds as defined by Zhang et al. The duration between 6 and 10 cm accelerates independent from amniotomy.[20] Our study also supports the labor duration independent from amniotomy.

Conclusion

In the standard management of labor beginning spontaneously, amniotomy should not be recommended due to the lack of difference in the duration of labor stages between the groups which undergo and do not undergo amniotomy, increasing rates of C/S and extension of hospitalization duration in the amniotomy group according to the comparison. The results should be confirmed with multi-centered, prospective, randomized series including many cases and minimizing bias possibility which classify according to the number of parity and separate pregnant women into groups in which labor is assisted and not assisted pharmacologically, categorize the severity and frequency of uterine contractions according to cervical dilation and effacement, and evaluate newborn complications and especially infections in detail.

Conflicts of Interest: No conflicts declared.

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