Maternal and Neonatal Outcomes of Parturients with or without Amniotomy for Augmentation of Labor

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Objective: *To determine the maternal and neonatal outcomes of the low-risk term pregnancies with or without amniotomy for augmentation of labor.*

Material and Method: *A retrospective cohort study of term pregnant women in cephalic presentation with labor pain who delivered in Rajavithi Hospital between January 1 and December 31, 2014 was conducted. Those parturients whose membranes were ruptured by amniotomy were study cases and those whose amniotomy were not performed and delivered immediate after the study cases were assigned as the control cases.*

Results: *Five hundred ninety eight women with uncomplicated pregnancy were enrolled and divided equally into two groups, one of 299 cases with amniotomy and another 299 cases without amniotomy. The present study showed that pregnant women in amniotomy group had a significantly higher rate of cesarean delivery ($p<0.001$) and birth asphyxia ($p = 0.002$). The duration of labor, maternal complications, and neonatal complications were not significantly different between the two groups.*

Conclusion: *Rate of cesarean delivery and birth asphyxia were significantly higher in the amniotomy group compared with the non-amniotomy group.*

Keywords: *Amniotomy, Duration of labor, Cesarean delivery, Neonatal outcome, Uncomplicated pregnancy*

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Many methods were used for stimulation of labor including medical and surgical methods. Amniotomy, a simple surgical method, was widely used since AD 1758[1]. However, many complications such as chorioamnionitis and prolapsed umbilical cord could occur[1].

Previous studies showed that mothers who received amniotomy for augmentation had less duration of labor compared with the non-amniotomy group[2-8]. With the prevalence of cesarean delivery, maternal and neonatal complications were similar between groups[2-8]. However, all previous reports were studied in western countries. Different races and environment may influence the outcomes[2-10]. Therefore, the present study was conducted to determine the maternal and neonatal outcomes of Thai parturients with or without amniotomy for augmentation of labor in Rajavithi Hospital, Bangkok, Thailand; such as duration of labors, cesarean delivery rate, Apgar score at 1 and 5 minutes, neonatal infection, birth asphyxia rate, chorioamnionitis, postpartum hemorrhage, and prolapsed umbilical cord.

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Material and Method

A retrospective historical cohort was conducted in Rajavithi Hospital, Thailand, between January 1 and December 31, 2014. The present research was approved by the Rajavithi Ethics Committee. Healthy pregnant women who had 37 to 42 weeks of gestational age, singleton, and cephalic presentation with true labor pain (regular uterine contraction and cervical dilatation (of 3 cm or more) were enrolled. Patients were excluded from the study if they had high-risk pregnancy such as pregnancy induced hypertension, gestational diabetic mellitus, placenta previa, history of neurologic diseases, history of heart diseases, history of premature rupture of membrane, history of antepartum hemorrhage in current pregnancy, previous cesarean section, estimate fetal weight below the 10 percentile or above the 95 percentile, appointment for cesarean section, or abnormal fetal heart rate at first admission. The sample size was calculated by the following formula[11]:

$$N = \frac{(Z_\alpha + Z_\beta)^2 \sigma^2}{(\mu_A - \mu_0)^2}$$

N = sample size, Z_α = z-value for the type I error rate (α) at 5% (2-sided test) = 1.96, Z_β = z-value for the β power of the study (1 - β) at 90% = 1.28, σ = 9.6

Standard variation of duration of labor calculated from Macone's study 2012[8], μ_A = 19. Average duration of labor in amniotomy group (hour)[8], μ_0 = 21.3. Average duration of labor in non-amniotomy group (hour)[8].

$$N = \frac{(1.96+1.282)^2 \times (9.6)^2}{(19-21.3)^2}$$

= 184 cases

Then 10% was added to the calculated number for lost to follow-up cases, hence the total number was 203 cases.

The participants matched all criteria and were divided into amniotomy group and non-amniotomy group. Non-amniotomy group were selected in the ratio 1:1 by selecting the women who had spontaneous rupture of membrane and delivered right after the participants in amniotomy group. Maternal and neonatal outcomes were reviewed from the medical records.

Definition: 1) fetal non-assuring status means repetitive variable deceleration, late deceleration, fetal tachycardia, or minimal variability after intra-uterine resuscitation as diagnosed by external fetal monitoring[12]; 2) fetal distress means prolonged deceleration, bradycardia, or sinusidal pattern as recorded by external fetal monitoring[12]; 3) umbilical cord prolapse was diagnosed by pervaginal exam when umbilical cord was determined to be below fetal head[1]; 4) postpartum hemorrhage was defined as postpartum bleeding of 500 ml or more in vaginal delivery or 1,000 ml or more in cesarean delivery[1]; 5) chorioamnionitis was diagnosed by clinical signs and symptoms (body temperature greater than 37.8°C, maternal tachycardia; pulse rate greater than 120 bpm, fetal tachycardia; fetal heart rate greater than 160 bpm, purulent or foul smell amniotic fluid, or uterine tenderness)[1]; 6) neonatal infection was defined as a systemic infection occurring in infants during the first seven days of life, which was associated with maternal infection and colonization[13]; and 7) birth asphyxia was defined as newborn who had Apgar score at 1 minute of 7 or less[1].

All statistical analyses were performed by SPSS (version 17.0, SPSS Inc., USA). Descriptive analysis was used to evaluate maternal and neonatal outcomes. The qualitative data was analyzed using Chi-square test and Fisher's exact test when the number in each cell was less than 5 and the quantitative data was analyzed using independent t-test were used

Table 1. Maternal demographic characteristics between parturients with or without amniotomy

Characteristic	Total (n = 598), n (%)	Amniotomy, n (%)		*p*-value
		Yes (n = 299)	No (n = 299)	
Maternal age (years)				0.859[C]
<18	25 (4.2)	13 (4.3)	12 (4.0)	
18 to 35	538 (90.0)	270 (90.3)	268 (89.6)	
>35	35 (5.9)	16 (5.4)	19 (6.4)	
Mean ± SD	26.52±5.76	26.11±5.70	26.92±5.80	0.085[T]
Parity (G)				0.547[C]
1	275 (46.0)	143 (47.8)	132 (44.1)	
2	190 (31.8)	88 (29.4)	102 (34.1)	
3	92 (15.4)	45 (15.1)	47 (15.7)	
≥4	41 (6.9)	23 (7.7)	18 (6.1)	
Abortion (A)				0.441[C]
Yes	99 (16.6)	53 (17.7)	46 (15.4)	
Gestational age (weeks)				<0.001*[T]
Mean ± SD	39.03±1.09	39.19±1.04	38.87±1.11	
Cervical dilatation (cm)				0.490[C]
3	352 (58.9)	167 (55.9)	185 (61.9)	
4	111 (18.6)	63 (21.1)	48 (16.1)	
5	49 (8.2)	24 (8.0)	25 (8.4)	
6	61 (10.2)	33 (11.0)	28 (9.4)	
7	25 (4.2)	12 (4.0)	13 (4.3)	
Mean ± SD	3.82±1.19	3.86±1.20	3.78±1.19	
Effacement (%)				0.552[C]
10 to 40	22 (3.7)	10 (3.3)	12 (4.0)	
50 to 70	239 (40.0)	114 (38.1)	125 (41.8)	
≥80	337 (56.4)	175 (58.5)	162 (54.2)	

[C] *p*-value by Chi-square test, [T] *p*-value by independent t-test, * Statistically significant

to determine association of clinical variables and outcomes. Statistical significance was determined at *p*-value lower than 0.05.

Results

Between January 1 and December 31, 2014, 2,170 women with term pregnancy who had true labor pain and delivery in Rajavithi Hospital were enrolled, but 1,160 cases were excluded. The remaining 1,010 cases were selected in ratio 1:1 as previously described. Finally, 598 pregnant women were enrolled and divided equally into amniotomy group (299 cases) and non-amniotomy group (299 cases).

Maternal characteristics including age, parity, cervical dilatation, and effacement at admission were similar in both groups except mean gestational age ($p<0.001$) (Table 1). Although, the gestational age was statistically significantly different, there was no clinical significance since they were both term pregnancy.

Maternal outcomes and complications were shown in Table 2. Both cesarean delivery rate and abnormal pattern of labor in amniotomy group were significantly higher than those in non-amniotomy group ($p<0.001$). The duration of labor and maternal complications were similar between the two groups.

Table 2. Maternal outcomes of parturients with or without amniotomy

Outcome	Total (n = 598), n (%)	Amniotomy, n (%)		*p*-value
		Yes (n = 299)	No (n = 299)	
Oxytocin requirement				0.632[C]
Yes	143 (23.9)	74 (24.7)	69 (23.1)	
Route of delivery				
Normal delivery	520 (87.0)	241 (80.6)	279 (93.3)	<0.001*[C]
Forceps extraction	5 (0.8)	2 (0.7)	3 (1.0)	1.000[F]
Vacuum extraction	18 (3.0)	12 (4.0)	6 (2.0)	0.151[C]
Cesarean delivery	55 (9.2)	44 (14.7)	11 (3.7)	<0.001*[C]
Indication of cesarean delivery (n = 55)				
Fetal non-reassuring status	20 (3.3)	17 (5.7)	3 (1.0)	
Fetal distress	1 (0.2)	1 (0.3)	0 (0)	
Cephalopelvic disproportion	33 (5.5)	25 (8.4)	8 (2.7)	
Failed forceps extraction	1 (0.2)	1 (0.3)	0 (0)	
Indication of vacuum extraction (n = 18)				
Fetal non-reassuring status	6 (1.0)	3 (1.0)	3 (1.0)	
Maternal exhaustion	8 (1.3)	6 (2.0)	2 (0.7)	
Prolonged 2nd stage	4 (0.7)	3 (1.0)	1 (0.3)	
Indication of forceps extraction (n = 5)				
Fetal non-reassuring status	2 (0.3)	0 (0)	2 (0.7)	
Maternal exhaustion	2 (0.3)	1 (0.3)	1 (0.3)	
Prolonged 2nd stage	1 (0.2)	1 (0.3)	0 (0)	
Abnormal pattern of labor	55 (9.2)	42 (14.0)	13 (4.3)	<0.001*[C]
Protraction of dilatation	7 (1.2)	7 (2.3)	0 (0)	
Protraction of descent	15 (2.5)	10 (3.3)	5 (1.7)	
Secondary arrest of dilatation	30 (5.0)	24 (8.0)	6 (2.0)	
Arrest of descent	3 (0.5)	1 (0.3)	2 (0.7)	
Complications				
Umbilical cord prolapse	1 (0.2)	1 (0.3)	0 (0)	1.000[F]
Postpartum hemorrhage	20 (3.3)	11 (3.7)	9 (3.0)	0.649[C]
Chorioamnionitis	1 (0.2)	0 (0)	1 (0.3)	1.000[F]
Others	4 (0.7)	4 (1.3)	0 (0)	
- Bladder injury	1 (0.2)	1 (0.3)	0 (0)	1.000[F]
- Fever	1 (0.2)	1 (0.3)	0 (0)	1.000[F]
- Infected episiotomy	1 (0.2)	1 (0.3)	0 (0)	1.000[F]
- Retain placenta	1 (0.2)	1 (0.3)	0 (0)	1.000[F]
Duration of labor (hours), mean ± SD				
1st stage	7.97±3.44	7.83±3.20	8.09±3.63	0.376[T]
2nd stage	0.41±0.42	0.43±0.44	0.39±0.40	0.345[T]
Amniotomy-delivery		3.32±2.02		

[C] *p*-value by Chi-square test, [F] *p*-value by Fisher's exact test, [T] *p*-value by Student t-test, * Statistically significant

One case in amniotomy group was reported to have umbilical cord prolapsed.

In Table 3, the neonatal outcomes including birth weight and birth asphyxia rate were significantly higher in amniotomy group. Moreover, Apgar score at 1 minute of amniotomy group was significantly lower than the other group, but Apgar score at 5 minutes after birth did not show any statistically significant difference between the groups. In addition, neonatal infection rate and the rate of transfer to NICU were similar in both groups.

Discussion

Several studies found that augmentation of labor by amniotomy significantly decrease the duration of labor[2-8]. On the other hand, Fraser et al[9] and the present study found that the duration of labor was similar in both amniotomy and non-amniotomy groups. Mikki et al[6] and Fraser et al Cochrane review[9] reported that non-amniotomy group significantly required more oxytocin than amniotomy group, but the present study found no difference. Three studies[3,9,10] also reported a trend of higher oxytocin requirement in non-amniotomy group but without statistical significance. Although many studies[2-10] showed no difference of cesarean delivery rate between amniotomy and non-amniotomy groups, group than in non-amniotomy group by 1.26 folds, though not statistically significant. The present research showed a four-fold increase in cesarean delivery rate in amniotomy group. The indications for cesarean section were cephalopelvic disproportion (CPD), fetal non-reassuring status, fetal distress, and failed forceps extraction (56.8%, 38.6%, 2.3%, and 2.3%, respectively). The present data demonstrated that both CPD and fetal non-reassuring status were the major reasons of cesarean delivery. Even though, the average birth weight observed in the present study significantly higher in the amniotomy group than in the non-amniotomy group, there was no clinical significance because the average birth weight in both groups was over 3,000 grams. The fetal non-reassuring status might be a complication of amniotomy because this procedure reduced the amount of amniotic fluid and could lead to umbilical cord compression.

Previous studies[2-7,9,10] found no significant difference of Apgar score at 1 minute and 5 minutes in both groups. The present study showed Apgar score at 1 minute in the amniotomy group was significantly lower, but Apgar score at 5 minutes was not different. The birth asphyxia rate in amniotomy group was significantly higher than that in the non-amniotomy group. The different definition of birth asphyxia in previous studies might lead to different result.

For maternal complications, the present study found no difference between the two groups. Four studies[4,6,9,10] reported the same result, which was in contrast to the finding of an increase of chorioamnionitis and umbilical cord prolapse in amniotomy group by Macones et al[8].

One limitation of the present study is that it is a retrospective study, so selection bias could have occurred especially when there was no other specific indication for amniotomy except augmentation of labor. It was performed depending on the individual

Table 3. Selected neonatal outcomes of parturients with or without amniotomy

Outcome	Total (n = 598), n (%)	Amniotomy, n (%)		*p*-value
		Yes (n = 299)	No (n = 299)	
Birth weight (grams)				0.006*[C]
<2,500	31 (5.2)	12 (4.0)	19 (6.4)	
2,500 to 3,600	507 (84.8)	246 (82.3)	261 (87.3)	
>3,600	60 (10.0)	41 (13.7)	19 (6.4)	
Mean ± SD	3,111.95±373.04	3,160.78±282.90	3,063.12±355.83	0.001*[T]
Min to Max	2,042 to 4,356	2,146 to 4,356	2,042 to 3,964	
Apgar score at 1 minute				0.002*[C]
≤7	25 (4.2)	20 (6.7)	5 (1.7)	
Apgar score at 5 minutes				0.686[F]
≤7	6 (1.0)	4 (1.3)	2 (0.7)	
Complication				
Infection	9 (1.5)	7 (2.3)	2 (0.7)	0.176[F]
Birth asphyxia	25 (4.2)	20 (6.7)	5 (1.7)	0.002*[C]
Transfer to NICU	10 (1.7)	6 (2.0)	4 (1.3)	0.524[C]

NICU = neonatal intensive care unit

[C] *p*-value by Chi-square test, [F] *p*-value by Fisher's exact test, [T] *p*-value by independent t-test, * Statistically significant

selection and judgement of each doctor. Rajavithi Hospital is a tertiary center with many levels of obstetricians, and there was no guideline for anmiotomy in the clinical practice. Cervical dilatation at amniotomy and spontaneous membrane rupture were not recorded, so the efficiency of amniotomy in term of stimulation of labor could not be clearly evaluated. Durations of labor in first and second stages were not significantly different.

Conclusion

Cesarean delivery rate and birth asphyxia were significantly higher in the amniotomy group compared with the non-amniotomy group.

What is already known on this topic?

Amniotomy is a widely used surgical method for augmentation of labor. This procedure reduces the duration of labor. However, many complications such as chorioamnionitis and prolapsed umbilical cord could occur.

What this study adds?

The duration of labor in women who have undergone augmentation of labor by amniotomy was similar to the women who had spontaneous rupture of membrane. Cesarean delivery rate and birth asphyxia rate in the amniotomy group were significantly higher compared to the non-amniotomy group.

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Potential conflicts of interest

None.

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ผลลัพธ์ทางมารดาและทารกแรกเกิดของผู้คลอดที่ได้รับหรือไม่ได้รับการเจาะถุงน้ำคร่ำเพื่อการเร่งคลอด

สุกานดา ถิระวัฒน์, เอกชัย โควาวิสารัช

วัตถุประสงค์: *เพื่อวิเคราะห์ผลลัพธ์ต่อมารดาและทารกแรกเกิดของหญิงตั้งครรภ์ครบกำหนดความเสี่ยงต่ำที่ได้รับหรือไม่ได้รับการเจาะถุงน้ำคร่ำเพื่อเร่งคลอด*

วัสดุและวิธีการ: *การศึกษาเชิงวิเคราะห์แบบย้อนหลังของหญิงตั้งครรภ์ครบกำหนดซึ่งทารกอยู่ในท่าศีรษะและเจ็บครรภ์จริงที่คลอดในโรงพยาบาลราชวิถี ตั้งแต่วันที่ 1 มกราคม พ.ศ. 2557 ถึง 31 ธันวาคม พ.ศ. 2557 โดยหญิงตั้งครรภ์ที่ถุงน้ำคร่ำแตกจากการเจาะถุงน้ำคร่ำจะเป็นกลุ่มศึกษาและหญิงตั้งครรภ์ที่ไม่ได้รับการเจาะถุงน้ำคร่ำที่คลอดต่อจากคนที่อยู่ในกลุ่มศึกษาจะเป็นกลุ่มควบคุม*

ผลการศึกษา: *หญิงตั้งครรภ์ความเสี่ยงต่ำอยู่ในการศึกษาทั้งหมด 598 ราย ถูกแบ่งเป็นสองกลุ่มเท่า ๆ กัน คือ กลุ่มที่ได้รับการเจาะถุงน้ำคร่ำ 299 ราย และกลุ่มที่ไม่ได้รับการเจาะถุงน้ำคร่ำ 299 ราย ในการศึกษานี้พบว่าหญิงตั้งครรภ์ในกลุ่มที่ได้รับการเจาะถุงน้ำคร่ำมีอัตราการผ่าตัดคลอดสูงขึ้น ($p<0.001$) และภาวะขาดออกซิเจนของทารกแรกเกิดเพิ่มขึ้นอย่างมีนัยสำคัญทางสถิติ ($p = 0.002$) ส่วนระยะเวลาการรอคลอด ภาวะแทรกซ้อนต่อมารดาของทั้งสองกลุ่มไม่มีความแตกต่างกันอย่างมีนัยสำคัญทางสถิติ*

สรุป: *อัตราการผ่าตัดคลอดและภาวะขาดออกซิเจนของทารกแรกเกิดเพิ่มสูงขึ้นอย่างมีนัยสำคัญทางสถิติในกลุ่มที่ได้รับการเจาะถุงน้ำคร่ำเมื่อเทียบกับกลุ่มที่ไม่ได้รับการเจาะถุงน้ำคร่ำ*