

# Amniotomy and postpartum endometritis: a case-control study

## ORIGINAL ARTICLE BY

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## ABSTRACT

### OBJECTIVE

To assess the whether amniotomy is the risk for postpartum endometritis.

### METHODS

This is a case-control study to identify risk factors for postpartum endometritis in patients underwent vaginal delivery. Cases were patients who had postpartum endometritis after vaginal delivery, including spontaneous vaginal delivery or assisted vaginal delivery between 2010 and 2014 at Khon Kaen Hospital. Each case was matched to four controls for age and parity on consecutive delivery. Controls were patients who had vaginal delivery including spontaneous vaginal delivery or assisted vaginal delivery but were not diagnosed as postpartum endometritis.

### RESULTS

We selected 46 cases and 184 age and parity matched controls. There was no association between amniotomy and postpartum endometritis (crude odds ratio [COR], 1.55; 95% confidence interval [CI], 0.81 to 2.96, adjusted odds ratio [AOR], 1.71; 95% CI, 0.61 to 4.76). Retained piece of placenta (COR, 35.86; 95% CI, 7.73 to 166.25; AOR, 19.75; 95% CI 2.10 to 186.12), postpartum hemorrhage (COR, 48.53; 95% CI, 10.62 to 221.88; AOR, 101.03; 95% CI 7.54 to 1353.14) and body mass index (BMI)  $\geq 30$  (COR, 3.78; 95% CI, 0.796 to 18.13, AOR, 9.18; 95% CI, 1.11 to 76.08) were the three factors that increased the risk for postpartum endometritis.

### CONCLUSION

Our study found that amniotomy was not significantly associated with the occurrence of postpartum endometritis but retained piece of placenta, postpartum hemorrhage, and BMI  $\geq 30$  increased the occurrence of postpartum endometritis were associated with higher risk of postpartum endometritis.

## INTRODUCTION

Postpartum endometritis is an infection of endometrium in pregnant women after delivery.<sup>1</sup> This condition is one of the morbidities in patients with postpartum fever.<sup>2</sup> Risk factors for postpartum endometritis include bacterial vaginosis, prolonged labor, many vaginal examinations, prolonged rupture of membranes, amniotic membrane infection, operative birth, anal sphincter laceration, meconium staining, and also procedures performed during labor such as amniotomy.<sup>3-6</sup>

Amniotomy, also known as artificial rupture of membranes, is one of the most common induction procedures which breaking of membranes of amniotic sac.<sup>7</sup> Rupture of amniotic membranes lead to be the release of prostaglandin E<sub>2</sub> and oxytocin, so it may induce labor and shorten the duration of labor.<sup>8</sup> However, the procedure might be a risk factor for many complications such as intrauterine infection.<sup>9</sup>

Nonetheless, there is no study that shows the association between amniotomy and risk for postpartum endometritis in patients with vaginal delivery. Therefore, we conducted a case-control study to identify the association between amniotomy and postpartum endometritis in patients with vaginal delivery. In addition, we also adjusted for other risk factors that might associate with postpartum endometritis including age, parity, body-mass index, positive HBsAg, pharmacological induction, antibiotics prophylaxis, gestational diabetes mellitus,

meconium stain, mode of vaginal delivery, number of vaginal examination, retained piece of placenta, and postpartum hemorrhage.

## METHODS

This is a case-control study to identify risk factors for postpartum endometritis in patients with vaginal delivery. This study was conducted in Khon Kaen Hospital, Thailand. Cases were patients who had body temperature  $\geq 38.0$  degree Celsius and uterine tenderness or foul smell lochia after vaginal delivery, including spontaneous vaginal delivery or assisted vaginal delivery.<sup>10</sup> We defined the date of admission as the index date. We included both early postpartum endometritis (<48 hours after delivery) and late postpartum endometritis (3 days-6 weeks after delivery).<sup>11</sup> Each case was matched to four controls for age and parity on consecutive delivery. Controls were patients who had the vaginal delivery, including spontaneous vaginal delivery or assisted vaginal delivery, but were not diagnosed as postpartum endometritis.

The mother's demographic characteristics were obtained from selected information of labor and delivery records from women who delivered during the period from 2010 and 2014 at Khon Kaen Hospital. The data record included date of birth, estimated gestational age, parity, newborn number, body-mass index, positive HBsAg, reactive HIVAb, reactive VDRL, pharmacological induction, antibiotics prophylaxis for prolonged premature

**Table 1. Characteristics of controls and case patients with odds ratios for risk factors for postpartum endometritis**

Characteristic	Controls (N=184)	Cases (N=46)	Crude odds ratio	Adjusted odds ratio
	no. (%)		95% Confidence interval	
<b>Age-yr</b>				
10-19	56 (30.4)	14 (30.4)	1	1
20-29	84 (45.7)	21 (45.7)	1.00 (0.47-2.13)	0.86 (0.27-2.77)
30-39	44 (23.9)	11 (23.9)	1.00 (0.41-2.42)	0.21 (0.03-1.55)
<b>Estimated gestational age*</b>				
Preterm	31 (16.8)	9 (19.6)	1	NA
Term	151 (82.1)	36 (78.3)	0.82 (0.36-1.88)	NA
Postterm	2 (1.1)	1 (2.2)	1.7 (0.14-21.24)	NA
<b>Parity</b>				
Nulliparous	108 (58.7)	27 (58.6)	1	1
≥1	76 (41.3)	19 (41.3)	1.00 (0.52-1.93)	0.98 (0.28-3.38)
<b>Newborn number</b>				
Singleton	183 (99.5)	45 (97.8)	1	NA
≥2	1 (0.5)	1 (2.2)	4.1 (0.25-66.27)	NA
<b>Body-mass index†</b>				
<18.5	34 (20.7)	9 (22.5)	1	1
18.5 - 22.9	83 (50.6)	18 (45.0)	0.82 (0.34-2.00)	0.90 (0.27-3.06)
23 - 24.9	23 (14.0)	6 (15.0)	0.99 (0.31-3.15)	1.89 (0.39-9.13)
25 - 29.9	20 (12.2)	3 (7.5)	0.57 (0.14-2.34)	0.39 (0.05-3.19)
≥30	4 (2.4)	4 (10.0)	3.78 (0.79-18.13)	9.18 (1.11-76.08)
Positive HBsAg	4 (2.2)	2 (4.3)	2.01 (0.36-11.34)	2.61 (0.23-29.59)
Reactive HIVAb	1 (0.6)	0	NA	NA
Reactive VDRL	1 (0.6)	0	NA	NA
<b>Pharmacological Induction</b>				
Misoprostol	13 (7.1)	6 (13.0)	1.97 (0.68-5.73)	2.31 (0.50-10.56)
Oxytocin	64 (34.8)	14 (30.4)	0.93 (0.45-1.94)	0.51 (0.15-1.75)
Both misoprostol and oxytocin	9 (4.9)	3 (6.5)	1.42 (0.36-5.66)	3.05 (0.46-20.17)
Antibiotics prophylaxis‡	34 (18.5)	6 (13.0)	0.66 (0.26-1.69)	0.26 (0.06-1.25)

**Table 1. (Continued)**

Characteristic	Controls (N=184)	Cases (N=46)	Crude odds ratio	Adjusted odds ratio
	no. (%)		95% Confidence interval	
Amniotomy	80 (43.5)	25 (54.3)	1.55 (0.81-2.96)	1.71 (0.61-4.76)
Gestational diabetes mellitus	7 (3.8)	1 (2.2)	0.56 (0.07-4.69)	0.30 (0.00-255.23)
Premature rupture of membranes¶				
≤24 hr	9 (4.9)	2 (4.3)	0.85 (0.18-4.09)	NA
>24 hr	6 (3.3)	0	NA	NA
Meconium stained amniotic fluid	26 (14.1)	6 (13.0)	0.91 (0.35-2.36)	0.63 (0.14-2.81)
Mode of vaginal delivery				
Spontaneous	176 (95.7)	42 (91.3)	1	1
Vacuum extraction	8 (4.3)	4 (8.7)	2.10 (0.60-7.29)	7.95 (0.96-65.73)
Lacerations				
None	158 (85.9)	36 (78.3)	1	NA
First	14 (7.6)	5 (10.9)	1.57 (0.53-4.63)	NA
Second	8 (4.3)	4 (8.7)	2.19 (0.63-7.69)	NA
Third	3 (1.6)	1 (2.2)	1.46 (0.15-14.48)	NA
Fourth	1 (0.5)	0	NA	NA
Rupture of membranes to delivery time				
≤24 hr	177 (96.2)	46 (100.0)	NA	NA
>24 hr	7 (3.8)	0	NA	NA
Vaginal examination				
<3	52 (28.3)	10 (21.7)	1	1
≥3	132 (71.7)	36 (78.3)	1.42 (0.66-3.07)	1.39 (0.42-4.61)
Retained piece of placenta	2 (1.1)	13 (28.3)	35.86 (7.73-166.25)	19.75 (2.10-186.12)
Postpartum hemorrhage	2 (1.1)	16 (34.8)	48.53 (10.62-221.88)	101.03 (7.54-1353.14)

\* By ultrasound or last menstrual period.

† The body-mass index is the weight in kilograms divided by square of height in meter.

‡ Antibiotics prophylaxis for prolonged PROM (PROM > 24hrs.) or third- to fourth- degree perineal laceration included penicillin, cephalosporins, aminoglycosides, metronidazole and macrolides.

¶ Patient who is beyond 37 weeks' gestation and has presented with rupture of membranes (ROM) prior to the onset of labor.

rupture of membranes (PROM) > 24 hours or third- to fourth-degree perineal laceration, amniotomy, gestational diabetes mellitus, prolonged rupture of membranes, meconium stain, mode of vaginal delivery, degree of laceration, rupture of membranes to delivery time, number of vaginal examination, retained piece of placenta, and postpartum hemorrhage. We excluded cases and controls with abortion or those with any previous history of endometritis.

We imputed data by double entry and cleaned all data before analysis. Frequency tables for all variable were generated to identify wild value. All statistical analyses were performed using the Statistical Package for the Social Science (SPSS) software. We described variables using number and percentage for categorical variables. For inferential statistics, we used binary logistic regression analysis to identify whether amniotomy was one of the risk factors for postpartum endometritis where the model adjusted for age, parity, body-mass index, positive HBsAg, pharmacological induction, antibiotics prophylaxis, amniotomy, gestational diabetes mellitus, meconium stain, mode of vaginal delivery, number of vaginal examination, retained piece of placenta, as well as postpartum hemorrhage.<sup>12-14</sup> The association between risk and the outcomes was presented in term of crude odds ratio (COR), adjusted odds ratio (AOR) and its 95% confidence Interval (95% CI).

## RESULTS

We selected 46 cases and 184 matched controls by age and parity. The average age of patients was

24 years (range, 14-37 years). There were 135 nulliparous women and 95 parous women. About 80% of them had term delivery. Almost patients gave birth to a singleton (98.7%). Only two of them gave birth to twins (1.3%). About a half of them had BMI 18.5 to 22.9 kg/m<sup>2</sup> (47.8%). Six patients had positive HBsAg (3.25%). Only one had reactive VDRL and HIVAb (0.6%) each. Less than half gave birth without pharmacological induction (46%), 10% received misoprostol, 32.6% received oxytocin, 11.4% received both misoprostol and oxytocin as pharmacological induction. Nearly half of them underwent amniotomy (49%). Eight patients had gestational DM (3%). Seventeen of them had PROM (6.25%), eleven had PROM less than 24 hours (4.6%), six had PROM more than 24 hours (1.65%). Meconium-stained amniotic fluid was found in 13.6% of the patients. The majority gave birth spontaneously (93.5%). Few patients gave birth using vacuum extraction (6.5%). Nobody had performed forceps extraction. Four-fifths of patients did not have perineal laceration (82.1%). Almost everybody had rupture of membranes to delivery time less than 24 hours (98%). Three-fourths had vaginal examination more than 3 times (75%). About a quarter of them had retained the piece of placenta (14.3%) and postpartum hemorrhage (18.0%).

There was no association between amniotomy and postpartum endometritis (COR, 1.55; 95% CI 0.81 to 2.96; AOR, 1.71; 95% CI, 0.61 to 4.76) (Table 1). Risk for postpartum endometritis was substantially higher in patients who had retained piece of placenta (COR, 35.86; 95% CI, 7.73 to 166.25, AOR, 19.75; 95% CI

2.10-186.12), postpartum hemorrhage (COR, 48.53; 95% CI, 10.62 to 221.88; AOR, 101.03; 95% CI, 7.54 to 1353.14), and BMI $\geq$ 30 (AOR, 9.18; 95% CI, 1.11 to 76.08). However, gestational diabetes mellitus, prolonged rupture of membranes, meconium-stained amniotic fluid, mode of vaginal delivery (included spontaneous and vacuum extraction), perineal lacerations, vaginal examination were not associated with postpartum endometritis.

## DISCUSSION

In this study, we found that amniotomy was not significantly associated with the occurrence of postpartum endometritis but postpartum hemorrhage, retained piece of placenta, and BMI $\geq$ 30 increased the occurrence of postpartum endometritis after input data into the logistic regression analysis.

In the comparison to other studies: One study supports our finding, the occurrence of postpartum endometritis was not statistically significantly associated with amniotomy and spontaneous rupture of membranes, in low transverse cesarean section.<sup>4</sup> One study support, retained placenta increased the risk factor for postpartum endometritis, in cows.<sup>15</sup> There was a study of retrospectively reviewed on women that supported postpartum hemorrhage increased the risk for postpartum endometritis.<sup>16</sup> There was a randomized trial study shown that early amniotomy increased the rate of intrauterine infection comparing to late amniotomy.<sup>9</sup> In another study, intrauterine infection was no statistically significant between early amniotomy and late

amniotomy in nulliparous women.<sup>17</sup> Our study did not analyze for early and late of amniotomy so we were unable to define an association between early or late of amniotomy and postpartum endometritis.

The study has two strengths. Firstly, this is the first study that analyzed about an association between amniotomy and postpartum endometritis in patients with vaginal delivery. Secondly, we reviewed the medical record of cases to make sure that they actually had postpartum endometritis. However, our study has some limitations. Firstly, the case was matched to four controls that sample size smaller than sample size calculation, which reduced the power of the study, increasing the risk for a type II error. Secondly, included cases and controls may have other conditions or diseases without postpartum endometritis that we did not include to analyze. Thus, they may be risks or confounding factors for the occurrence of postpartum endometritis. Third, we included both early and late postpartum endometritis but we did not separate the outcome as early or late postpartum endometritis. Amniotomy may not be a risk for late endometritis. Late endometritis may be caused by other risk factors, such as retained placenta.<sup>16</sup> Last, our study did not separate early and late amniotomy.

From our case-control study, we suggested to increase sample size in control groups for reduction of type II error and separate intervention of the early and late amniotomy to identify the association with risk for postpartum endometritis. In the further study, we recommend studying about the risk factors for early and late postpartum endometritis separately.

In conclusion, our study found that amniotomy was not significantly associated with the occurrence of postpartum endometritis but retained piece of placenta, postpartum hemorrhage and BMI $\geq$ 30 were found to be associated with the significant increasing the occurrence of postpartum endometritis. Like

amniotomy, our study found gestational diabetes mellitus, prolonged rupture of membranes, meconium-stained amniotic fluid, mode of vaginal delivery (included spontaneous and vacuum extraction), perineal lacerations and vaginal examination were not associated with postpartum endometritis.

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