



“Early rupture of membranes” after the spontaneous onset of labor as a risk factor for cesarean delivery

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ABSTRACT

Objective: The objective of this study was to examine if patients with “early rupture of membranes (ROM)” after spontaneous onset of labor are at increased risk of cesarean section.

Study design: The rate of cesarean section was examined in 447 term singleton nulliparas who were admitted after the spontaneous onset of labor. The cases were divided into 2 groups: (1) “early ROM”, defined as ROM at a cervical dilatation <4 cm ($n = 109$); and (2) “late ROM”, ROM at a cervical dilatation ≥ 4 cm ($n = 338$).

Results: (1) “Early ROM” occurred in 24.4% of the cases and the overall cesarean section rate was 5.6%; (2) there were no significant differences in the clinical characteristics including prepregnancy BMI, proportion of complicated pregnancies, total duration of labor, proportion of regional anesthesia, gestational age at delivery, and birthweight between the two groups of cases. However gravidas with “early ROM” were of advanced maternal age and had less cervical dilation on admission, shorter duration of 1st stage of labor, and more frequent use of oxytocin augmentation; (3) patients with “early ROM” had a threefold higher rate (11.9% vs. 3.6%) of cesarean section and a fourfold higher rate (11.9% vs. 3.0%) of cesarean section due to failure of progress than did those with “late ROM” ($p < 0.005$ for each); (3) 92% (23/25) of cesarean sections were performed due to failure to progress; and (4) there was no significant difference in the rate of histologic chorioamnionitis between the two groups of cases.

Conclusion: “Early ROM” after the spontaneous onset of labor is a risk factor for cesarean section in term singleton nulliparas.

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1. Introduction

Cesarean delivery is associated with increased maternal risks such as puerperal infection, hemorrhage, thromboembolism and death [1–5]. Well-known risk factors for cesarean delivery include advanced maternal age, nulliparity, high body mass index, labor induction, diabetes, fetal macrosomia, occipitoposterior position and cephalopelvic disproportion [6–10].

Several investigators have suggested that premature rupture of membranes (PROM) is also a risk factor for cesarean section, although the exact mechanism of this association is not well determined [6,11–13]. Suggested explanations include increased risk of infection due to prolonged duration of rupture of membranes (ROM), physician bias, increased rate of labor induction and occult cephalopelvic disproportion (CPD) [12,14].

In terms of the timing of ROM during labor, it has been theorized that early spontaneous ROM is more likely in women with a contracted pelvis that precludes the passage of the fetus,

because the entire force of labor converges on the portion of the membranes that overlies the cervix [15]. However, there is a paucity of data about the relationship between the timing of ROM after spontaneous onset of labor and the risk of cesarean section, supporting this mechanism of dystocia. This relationship is important, because the risk of dystocia cannot be easily predicted even though many investigators have tried to identify risk factors for dystocia [6–8,16–21], and the timing of ROM during labor course is the kind of information that clinicians can easily get.

To address this issue, we classified ROM into two categories according to the timing of ROM after the spontaneous onset of labor and examined if patients with spontaneous “early ROM” are at increased risk of cesarean delivery.

2. Materials and methods

2.1. Study design

This retrospective cohort study included the term singleton nulliparous women who were admitted to Seoul National University Hospital after the spontaneous onset of labor between

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January 2004 and December 2006. Patients in whom vaginal delivery was contraindicated (i.e., Previous uterine surgery, breech presentation, or placenta previa) or those with an intrauterine fetal demise were excluded. The Institutional Review Board of Seoul National University Hospital approved the study.

Cases were classified into either the “early ROM” group or the “late ROM” group according to the timing of ROM and the rate of cesarean section was compared between the two groups of cases.

2.2. “Early ROM” and “late ROM”

“Early ROM” was defined as spontaneous ROM before the onset of active labor (ROM before a cervical dilatation of 4 cm) during the course of labor and “late ROM” was defined as ROM not occurring before the onset of active labor (ROM occurring at a cervical dilatation of 4 cm or more, either spontaneous or artificial). Cases with PROM were excluded from the data and the distinction between PROM and “early ROM” was made according to the time sequence between the onset of labor and ROM. The onset of labor was defined as regular painful uterine contractions, based on history taking from the patients. The distinction between PROM and ROM after the onset of labor has been routinely performed by the attending physician at the time of admission and the diagnosis (PROM vs. ROM after the onset of labor) has been recorded in the medical documents in our institution.

2.3. Clinical management

The diagnosis of failure to progress or fetal distress and the decision to perform cesarean section during the course of labor was made by the attending physician, in accordance with the ACOG recommendations [22]. The decision to perform amniotomy or oxytocin augmentation was also at the discretion of the attending physician. Elective early amniotomy is not a routine practice in our institution.

2.4. Histologic chorioamnionitis

Histologic chorioamnionitis was defined as the presence of acute inflammatory changes on examination of a membrane roll and chorionic plate of the placenta; funisitis was diagnosed as the presence of neutrophil infiltration into the umbilical vessel walls or Wharton's jelly, according to the criteria previously described in detail [23].

2.5. Statistical analysis

Proportions were compared with Fisher's exact test and comparisons of continuous variables between groups were performed with Mann–Whitney *U*-test. Logistic regression was conducted for multivariate analysis. A probability value <0.05 was considered significant.

3. Results

3.1. Characteristics of the study population

Of 2193 singleton pregnancies delivered at term during the study period, a total of 483 gravidas met the inclusion criteria (nulliparas, term singleton gestation, and spontaneous onset of labor without contraindication to vaginal delivery or intrauterine fetal demise). Among these gravidas, five were excluded (four because artificial ROM was performed before a cervical dilatation of 4 cm and one because emergency cesarean section was performed due to fetal distress before a cervical dilatation of 4 cm). The timing of ROM was not available in 31 cases (17 women were admitted after a cervical dilatation of 4 cm with ROM, in 6 women the distinction between PROM and “early ROM” was not clear by history taking and in 8 women the exact timing of ROM during the course of labor was not available in

Table 1
Demographics and intrapartum characteristics and pregnancy outcomes of patients with early vs. late ROM.

Characteristics	Early ROM (n = 109)	Late ROM (n = 338)	p-Value*
Maternal age (years) [†]	31.1 ± 3.5	30.0 ± 3.4	<0.05
Advanced maternal age (≥35 years)	20 (18.3%)	33 (9.8%)	<0.05
Prepregnancy BMI (kg/m ²) [†]	20.3 ± 2.9 (available in 97 women)	20.1 ± 2.4 (available in 285 women)	NS
Hypertensive disease in pregnancy	2 (1.8%)	7 (2.1%)	NS
Diabetes	2 (1.8%)	3 (0.9%)	NS
Fetal anomalies	9 (8.3%)	35 (10.4%)	NS
Cervical dilatation on admission (cm) [†]	1.4 ± 0.8	2.6 ± 1.9	<0.001
ROM on admission	78 (71.6%)	0 (0%)	<0.001
Duration of ROM (h) [†]	13.1 ± 9.2	2.0 ± 2.0	<0.001
Total duration of labor (h) ^{†,‡}	4.8 ± 3.6	5.1 ± 3.0	0.064
Duration of 1st stage of labor (h) ^{†,‡}	3.2 ± 3.0	3.8 ± 2.6	<0.005
Duration of 2nd stage of labor (h) ^{†,‡}	1.4 ± 1.2	1.3 ± 0.9	NS
Oxytocin augmentation	62 (56.9%)	129 (38.2%)	<0.005
Epidural analgesia	66 (60.6%)	197 (58.3%)	NS
Gestational age at delivery (weeks) [†]	39.7 ± 0.9	39.9 ± 0.9	NS
Birthweight (g) [†]	3277 ± 340	3231 ± 386	NS
Cesarean section	13 (11.9%)	12 (3.6%)	<0.005 [§]
Cesarean section due to failure to progress	13 (11.9%)	10 (3.0%)	<0.005 [§]
Cesarean section due to fetal distress	0 (0%)	2 (0.6%)	NS
Operative vaginal delivery	24 (22.0%)	64 (18.9%)	NS
Histologic chorioamnionitis	31/106 (29.2%)	110/331 (33.2%)	NS
Funisitis	11/106 (10.4%)	27/331 (8.2%)	NS
1-min Apgar score < 7	6 (5.5%)	12 (3.6%)	NS
5-min Apgar score < 7	1 (0.9%)	2 (0.6%)	NS

ROM: rupture of membranes, BMI: body mass index, and NS: not significant.

[†] Values are given as the mean ± standard deviation.

[‡] Duration of labor was analyzed only in cases who were admitted before cervical dilatation of 4 cm; duration of 1st stage of labor was defined as duration of cervical dilatation from 4 cm to 10 cm; duration of 2nd stage was defined as duration between full cervical dilatation and fetal delivery.

* Proportions were compared with Fisher's exact test and comparisons of continuous variables between groups were performed with Mann–Whitney *U*-test.

[§] Significant after adjustment for maternal age, prepregnancy BMI, presence of hypertensive disease in pregnancy, diabetes, or fetal anomalies, cervical dilatation on admission, use of oxytocin augmentation, epidural analgesia, gestational age at delivery, birthweight, and the presence of histologic chorioamnionitis (logistic regression analysis).

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