Taiwanese Journal of Obstetrics & Gynecology 57 (2018) 374–378

Contents lists available at ScienceDirect

Taiwanese Journal of Obstetrics & Gynecology

journal homepage: www.tjog-online.com

Original Article

Amniotic fluid index, single deepest pocket and transvaginal cervical length: Parameter of predictive delivery latency in preterm premature rupture of membranes

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ARTICLE INFO

Article history:
Accepted 10 August 2017

Keywords:
Amniotic fluid index
Cervical length
Latency
Preterm premature rupture of membranes
Single deepest pocket

ABSTRACT

Objective: Prediction of delivery latency complicated with preterm premature rupture of membrane (PPROM) is crucial for reducing maternal and neonatal complications. Therefore, we investigated the correlations between latency period and cut-off values of ultrasonographic parameters, ultimately predicting delivery latency.

Materials and methods: The retrospective study was performed on 121 PPROM patients enrolled between March 2010 and July 2015. Parameters including amniotic fluid index (AFI), single deepest pocket (SDP) and transvaginal cervical length (TVCL) were measured in 99 singleton pregnancies with PPROM. Latency was defined as the period from sonographic measurements to delivery day. The parameters were analyzed independently by Wilcoxon rank sum test and Fisher's exact test. Cut-off values were determined using a receiver operating characteristic (ROC) curve.

Results: In delivery latency within 3 days, AFI and SDP were decreased with significantly shorter TVCL. AFI and SDP had the highest sensitivity (82.2%) and SDP combined with TVCL showed the highest specificity (75.9%) in area under curve (AUC) value. The predicted median latency period was less than 2 days within the cutoff value of parameter (AFI $\leq$ 7.72, SDP $\leq$ 3.2 and TVCL $\leq$ 1.69).

Conclusion: AFI and SDP combined with TVCL could be useful predictive parameters of the latency interval from PPROM to delivery.

Introduction

Preterm premature rupture of membranes (PPROM) is defined by spontaneous rupture of the fetal membranes before 37 completed weeks and prior to labor onset [1]. The incidence of PPROM is approximately 3% of all pregnancies [2]. In a term pregnancy, membrane rupture can result from shearing force due to uterine contractions and weakened state by physical stretching [3,4]. However, PPROM can be caused by pathologic mechanisms such as intra-amniotic infection and uterine overdistension, both of which have been widely observed in preterm gestational age. And another well-known risk factor is the history of PPROM in prior pregnancy. Additional risk factors are short cervical length, low body mass index (BMI), nutritional deficiency, cigarette smoking, and low socioeconomic status [5–7].

Most pregnancies complicated with PPROM require hospitalization because spontaneous labor or birth occurs within 1 week from the onset of PPROM in half of the cases [3]. Chorioamnionitis is one of the major maternal complications that can affect the morbidity and mortality of mother and neonate. Its incidence is 15–25% and closely related to the duration of membrane rupture [8]. Neonates born to women complicated with chorioamnionitis have a higher incidence of sepsis and other complications such as respiratory distress syndrome (RDS) and neurological injury [9,10].

Advanced gestational age, oligohydramnios or cervical dilatation >1 cm at admission, and twin gestation have been associated with shorter duration of the latency period [11,12]. In preterm birth, transvaginal cervical length (TVCL) has been reported as a good predictor because relative risk of preterm delivery is increased as

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https://doi.org/10.1016/j.tjog.2018.04.008

cervical length is decreased [13,14]. Accordingly, several studies have addressed the relationship between TVCL and latency to delivery to explore the predictive value of delivery latency according to TVCL. Rizzo et al. reported that abnormally short cervical length was associated with short delivery interval [15]. Shorter TVCL and amniotic fluid index (AFI) ≦ 5 predicted delivery latency within 7 days in women who presented with PPROM [16]. Oligohydramnios, defined as the decrease of the deepest vertical pocket of amniotic fluid ≦ 2 or AFI ≦ 5, is related to shorter latency period [17–20].

The foregoing findings indicate the importance of specific and appropriate prediction of delivery latency in order to reduce maternal and fetal complications via proper management. However, no studies have addressed the correlations between AFI, single deepest pocket (SDP), TVCL, and latency interval to delivery. Therefore, we investigated the latency period from PPROM to delivery according to AFI, SDP and TVCL, and we assessed the predicted delivery latency according to the cut-off values of these parameters.

Materials and methods

The retrospective study was performed on patients who visited the obstetrics clinic from March 2010 to July 2015. We investigated women diagnosed as PPROM by history taking and physical examination with singleton pregnancy, between the gestational ages of 23^{+0} weeks to 36^{+6} weeks. Twenty two of the 121 patients were excluded because of inconsistency with diagnostic criteria (n = 2), cervical cerclage (n = 8), delivery before ultrasound measuring (n = 1), and twin pregnancies (n = 11). For the data analyses, we included 99 pregnant women in study and flowchart of the study design is shown in Fig. 1.

PPROM was diagnosed by physical examination confirmed by gross vaginal leakage and nitrazine test of vaginal fluid samples. If the patient showed no gross leakage but had a positive nitrazine test, a placental alpha microglobulin-1 protein test (Amnisure®; QIAGEN Corp., Valencia, CA, USA) was performed. All women diagnosed as PPROM were hospitalized, and then we measured AFI, SDP and TVCL. AFI was estimated by a four quadrant technique, which was sum of deepest, unobstructed, and vertical length of pocket of fluid in each quadrant. SDP was defined as the pocket of maximal depth of amniotic fluid free of umbilical cord and fetal parts [21,22] and we measured TVCL at admission using the CLEAR (Cervical Length Education and Review) guidelines with ultrasonography (Accuvix XQ; Medison, Seoul, Korea) [23]. Blood samples for determining of C-reactive protein (CRP) level were drawn at admission and within 24 h prior to delivery and measured using a TBA200FR apparatus (TOSHIBA Corp., Tokyo, Japan).

Generally, ampicillin is mainly used for group B streptococcus prophylaxis, but *Escherichia coli* are also highly identified in pregnant women with PPROM [24]. Thus, the patients in this study were administered with the second-generation cephalosporin for this coverage. We continued intravenous antibiotics until delivery day and azithromycin 500 mg was given additionally for 3 days to the patient who had *Mycoplasma* or *Ureaplasma* in vaginal culture. Patients received dexamethasone 6 mg given intramuscularly 4 times, 12 h apart for fetal maturation. All retrieved placenta was sent to the pathology department and categorized by the grade of chorioamnionitis using established diagnostic criteria [25].

The time of delivery was determined by individual circumstances. When following conditions are observed, induction of labor was initiated or cesarean delivery was performed: signs of overt infection or chorioamnionitis, including fever or elevated CRP; active labor progression; and/or non-reassuring of fetal well-being. However, we followed up with expectant management if the obvious signs of infection or fetal distress were absent.

The SAS® version 9.3 software (SAS Institute, Cary, NC, USA) was used for the statistical analyses. All data were entered into a database and verified by a second independent person. The statistical analyses involved demographics, maternal parameters, neonatal outcomes, and placental histology by delivery latency at three days (the median latency of our patients was found to be three days when 24 h had passed from the final administration of the steroid) with significance ≦5% and each median level was determined by IQR (interquartile range) using a two-tailed test. Parameters with statistically significant differences between the two groups were identified using the Wilcoxon rank sum test and Fisher's exact test. Cut-off values were estimated using a receiver operating characteristic (ROC) curve and the Youden index to investigate the correlations of TVCL, AFI, and SDP with the latency period. Based on these results, we predicted the median latency period depending on the cut-off value of each parameter.

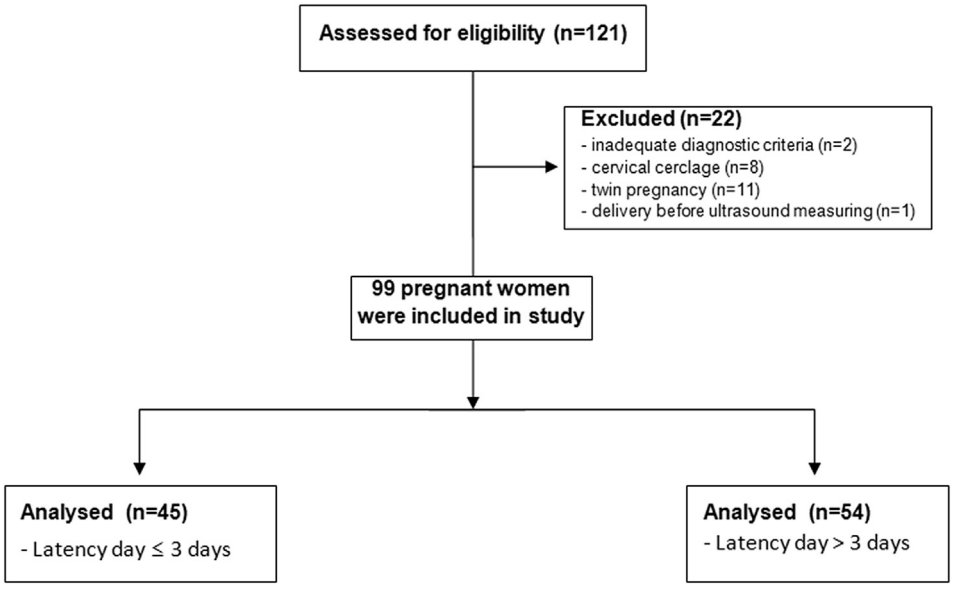

Fig. 1. Flow-chart of the study population.