Sonographic measurement of cervical length in preterm prelabor amniorrhexis

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ABSTRACT

Objective *To determine whether sonographic measurement of cervical length in pregnancies complicated by preterm prelabor amniorrhexis helps distinguish between those women who deliver within 7 days and those who do not.*

Methods *In 101 women with singleton pregnancies presenting with preterm prelabor amniorrhexis at 24–36 (median, 32) weeks of gestation cervical length was measured by transvaginal ultrasound. Exclusion criteria were active labor defined by the presence of cervical dilatation of ≥ 3 cm and iatrogenic delivery for fetal or maternal indication when not in active labor. The clinical management was determined by the attending obstetrician. The primary outcome of the study was delivery within 7 days of presentation.*

Results *Delivery within 7 days of presentation occurred in 58/101 (57%) pregnancies. Logistic regression analysis demonstrated that significant independent contribution in the prediction of delivery within 7 days was provided by cervical length (odds ratio (OR) = 0.91, 95% CI 0.86–0.96, P = 0.001), gestation at presentation (OR = 1.35, 95% CI 1.14–1.59, P = 0.001) and presence of contractions at presentation (OR = 3.07, 95% CI 1.05–8.92, P = 0.039) with no significant independent contribution from ethnic origin, maternal age, body mass index, parity, previous history of preterm delivery, cigarette smoking, vaginal bleeding or the administration of tocolytics, antibiotics or steroids.*

Conclusion *In women with preterm prelabor amniorrhexis prediction of delivery within 7 days is provided by cervical length, gestation and presence of contractions at presentation. Copyright © 2004 ISUOG. Published by John Wiley & Sons, Ltd.*

INTRODUCTION

Delivery before 37 completed weeks of gestation occurs in less than 10% of pregnancies but accounts for more than 60% of all neonatal deaths. Approximately one-third of preterm deliveries are associated with preterm prelabor amniorrhexis[1]. The major risk of preterm prelabor amniorrhexis is the progression to preterm delivery.

In women with threatened preterm labor and intact membranes true labor resulting in delivery within 7 days occurs in only about 10–15% of cases[2,3]. Sonographic measurement of cervical length helps distinguish between true and false labor. Thus, in a study involving 216 women with singleton pregnancies presenting with regular and painful uterine contractions at 24–36 weeks of gestation, spontaneous delivery within 7 days occurred in only 1/173 with cervical length ≥ 15 mm, compared to 16/43 (37%) with cervical length < 15 mm[3].

The aim of this study was to investigate whether sonographic measurement of cervical length in pregnancies complicated by preterm prelabor amniorrhexis helps distinguish between those women who deliver within 7 days and those who do not.

METHODS

This was a prospective observational study of sonographic measurement of cervical length in women with singleton pregnancies presenting to the labor ward with preterm prelabor amniorrhexis at 24–36 weeks of gestation. In all cases gestation was calculated from the menstrual history and by an ultrasound scan in early pregnancy. Women in active labor, defined by the presence of cervical dilatation ≥ 3 cm, and those in whom delivery was iatrogenic for fetal or maternal indications before active labor at less than 7 days were excluded. The study was undertaken in four centers (Harold Wood and King George Hospitals,

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Essex; Homerton Hospital, London, UK and Charité Campus Virchow Clinic, Berlin, Germany) during the period August 2000–March 2003.

Transvaginal sonography was carried out by appropriately trained doctors. A sagittal view of the cervix, with the echogenic endocervical mucosa along the length of the canal, was obtained and the calipers of the machine were used to measure the distance of the cervical canal between the furthest points at which the cervical walls were juxtaposed[4,5]. Three measurements were obtained and the shortest, technically best measurement in the absence of uterine contractions was recorded.

The management of the women, including hospitalization and administration of tocolytics, antibiotics and steroids, was determined by the attending obstetricians. The ultrasound findings did not influence the management of the women. The primary outcome measure was delivery within 7 days of presentation.

Statistical analysis

Logistic regression analysis was used to investigate the effect of maternal age, ethnic origin (Caucasian, Afro-Caribbean, Asian), parity (parous, nulliparous), gestation at presentation, cigarette smoking (yes or no), body mass index, history of previous preterm delivery or second-trimester miscarriage (yes or no), presence of uterine contractions at presentation (yes or no), use of tocolytics (yes or no), antibiotics (yes or no) or steroids (yes or no), bleeding at presentation (yes or no) and cervical length, on delivery within 7 days of presentation. The final logistic regression model was used to calculate the probability score for delivery within 7 days for each woman. For different probability cut-offs the sensitivity, specificity, positive and negative predictive values were calculated.

RESULTS

During the study period (August 2000–March 2003) we examined 110 women with singleton pregnancies who presented with preterm prelabor amniorrhexis and who were not in active labor. Nine cases were excluded from further analysis because in these patients iatrogenic delivery was carried out for fetal or maternal indications before active labor at less than 7 days. Specifically, in six cases presenting after 33 weeks' gestation an emergency Cesarean section was performed for breech presentation

Table 1 Logistic regression for delivery within 7 days of presentation in the study population ($n = 101$)

		Univariate analysis			Multivariate analysis		
Variable	n (%) or median (range)	OR	95% CI	P	OR	95% CI	P
Cervical length (mm)	19 (1–46)	0.88	0.84–0.93	< 0.001	0.91	0.86–0.96	0.001
Maternal age (years)	29 (17–42)	0.97	0.91–1.04	0.379	0.98	0.89–1.07	0.689
Gestational age (weeks)	32 (24–36)	1.43	1.23–1.66	< 0.001	1.35	1.14–1.59	0.001
Ethnic origin				0.038			0.063
Caucasian	78 (77%)	1.00			1.00		
Afro-Caribbean	12 (12%)	10.9	1.35–89.34		21.2	1.6–281	
Asian	11 (11%)	2.67	0.66–10.8		1.57	0.29–8.52	
Body mass index	25 (19–39)	0.87	0.77–0.97	0.016	0.89	0.87–1.01	0.059
Cigarette smoking				0.455			0.340
No	81 (80%)	1.00					
Yes	20 (20%)	0.68	0.26–1.84		0.55	0.16–1.88	
Parity				0.647			0.296
Nulliparae	52 (51%)	1.00					
Parae	49 (49%)	0.83	0.37–1.83		1.80	0.59–5.42	
Uterine contractions				< 0.001			0.039
Yes	47 (47%)	6.27	2.57–15.28		3.07	1.05–8.92	
No	54 (53%)	1.00					
Use of tocolytics				0.002			0.059
No	67 (66%)	1.00					
Yes	34 (34%)	0.25	0.11–0.59		0.36	0.12–1.04	
Use of antibiotics				0.480			0.481
No	31 (30%)	1.00					
Yes	70 (70%)	0.73	0.30–1.75		0.65	0.19–2.17	
Use of steroids				0.116			0.959
No	27 (27%)	1.00					
Yes	74 (73%)	0.47	0.18–1.21		0.97	0.27–3.38	
Bleeding				0.049			0.444
No	82 (81%)	1.00					
Yes	19 (19%)	0.35	0.13–0.99		0.59	0.16–2.25	
Previous preterm delivery				0.838			0.299
Yes	11 (11%)	0.87	0.25–3.08		0.44	0.09–2.04	
No	90 (89%)						
Delivery within 7 days	58 (57%)						

OR, odds ratio.

($n = 3$), suspicion of placental abruption ($n = 1$), a previous history of a stillbirth ($n = 1$) or abnormal fetal heart rate pattern ($n = 1$). In another three cases, with amniorrhexis at 28, 32 and 35 weeks, respectively, induction of labor was carried out because of a clinical suspicion of chorioamnionitis.

The demographic characteristics of the 101 patients are shown in Table 1. All women were hospitalized, 74 received corticosteroids for fetal lung maturity, 34 received tocolytics (β-mimetics intravenously) and 70 also received antibiotics.

Delivery within 7 days of presentation occurred in 58/101 (57%) pregnancies. Logistic regression analysis demonstrated that significant independent contribution in the prediction of delivery within 7 days was provided by cervical length (odds ratio (OR) = 0.91, 95% CI 0.86–0.96, $P = 0.001$; Figure 1), gestation at presentation (OR = 1.35, 95% CI 1.14–1.59, $P = 0.001$; Figure 2) and presence of contractions (OR = 3.07, 95% CI 1.05–8.92, $P = 0.039$) (Table 1). The sensitivity, specificity, positive and negative predictive values of the different cut-offs of probability for delivery within 7 days are shown in Table 2.
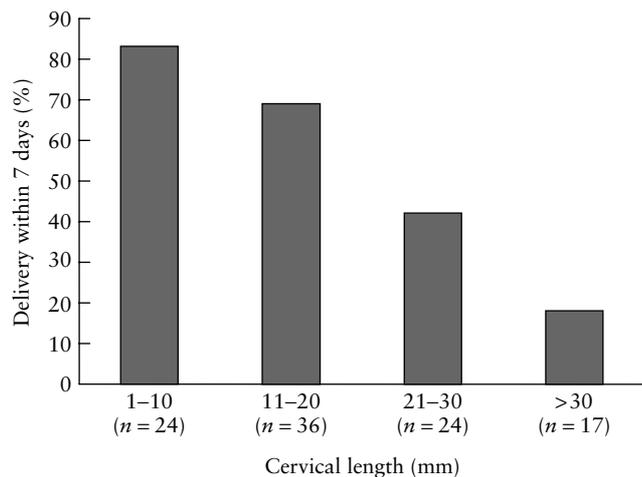
Table 2 Sensitivity, specificity, positive and negative predictive values for different cut-offs of probability for delivery within 7 days

Predicted probability	Screen-positive (%)	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
≥ 0.20	79	95	44	70	86
≥ 0.40	68	91	63	77	84
≥ 0.60	53	81	86	88	77
≥ 0.80	38	60	93	92	63

NPV, negative predictive value; PPV, positive predictive value.

DISCUSSION

The finding that about 60% of pregnancies complicated by preterm prelabor amniorrhexis deliver within 7 days of presentation is in agreement with previous reports. Thus, in a multicenter, randomized trial on the use of antibiotics for preterm prelabor amniorrhexis involving more than 4800 women, delivery within 7 days of presentation occurred in 63% of cases[1]. Furthermore, the findings demonstrate that the rate of delivery within 7 days of amniorrhexis is related to cervical length, gestation and presence of contractions at presentation.

There are two previous studies that examined the relation between sonographic measurement of cervical length and the latency period in preterm prelabor amniorrhexis. Rizzo *et al.* examined 92 women and reported that the median interval to delivery was 2 days in those with cervical length < 20 mm, compared to 6 days in those with a longer cervix[6]. In contrast, Carlan *et al.* examined 45 women and found no significant difference in latency period between those with cervical length > 30 mm and those with a shorter cervix at presentation[7].

We found an inverse association between cervical length and rate of delivery within 7 days of amniorrhexis. This is similar to that found in women with threatened preterm labor and intact membranes. Furthermore, this finding is compatible with the previously reported association between short cervical length at 20–23 weeks in asymptomatic women and subsequent spontaneous early preterm delivery[3,4]. We also found an association between the rate of delivery within 7 days and the gestation at amniorrhexis. Previous studies in patients with preterm prelabor amniorrhexis have demonstrated that first, in about one-third of such pregnancies there is evidence of intrauterine infection and the incidence is inversely related to the gestation at amniorrhexis; second, the interval between amniorrhexis and delivery is substantially shorter in patients with evidence of intrauterine infection than in those with no infection; and third, in patients with no infection there is an inverse correlation between gestation at amniorrhexis and the interval to delivery[8–12].

In patients with infection the suggested mechanism for the association between infection and labor is release of cytokines, which stimulate production of prostaglandins that induce uterine contractions. In the non-infected group, the finding of an inverse correlation between gestation at amniorrhexis and the latency period suggests

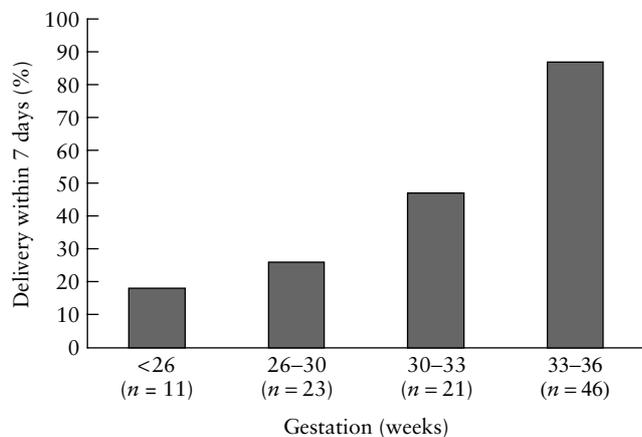**Figure 1** Relationship between cervical length and incidence of delivery within 7 days of amniorrhexis.

Figure 2 Relationship between gestation at presentation and incidence of delivery within 7 days of amniorrhexis.

that with advancing gestation there is an increase in uterine sensitivity to the trigger of labor that is not mediated by infection. Our finding of an association between the rate of delivery within 7 days and the presence of contractions at presentation suggests that the inflammatory processes, both infective and non-infective, that accompany amniorrhexis are more advanced in patients presenting with contractions than in those with no contractions.

In patients presenting with amniorrhexis, clinical examination is directed at the confirmation of membrane rupture but is not useful in assessing the likelihood of delivery within the next few days[13]. Furthermore, there is evidence to suggest that digital vaginal assessment of the cervix shortens the latency period and is therefore contraindicated in the absence of active labor[14]. In contrast, transvaginal ultrasound has been proven to be safe in cases with preterm prelabor amniorrhexis[7]. In the management of such patients prediction of the risk of delivery within the subsequent 7 days can help optimize the neonatal care for the potentially preterm infant, through referral to a specialist center. However, in premature prelabor amniorrhexis, unlike preterm labor with intact membranes, measurement of cervical length needs to be combined with other parameters in order to derive a reliable risk. For example, in our multiparameter model the likelihood of delivery within the next 7 days in a woman at 28 weeks who presents with contractions and ruptured membranes is 32% if the cervical length is 28 mm and 64% if the cervical length is 14 mm. Conversely, if a woman presents at 26 weeks with ruptured membranes and no contractions when the cervical length is 30 mm the likelihood of delivery within the next 7 days is only 6%.

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