Short communication

Comparison of fern and evaporation tests for detection of ruptured fetal membranes

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المقارنة بين اختباريْ التَّسَرْخُس والتبخر في اكتشاف تمزق أغشية الجنين

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الخلاصة: يعتبر تشخيص تمزق أغشية الجنين في الوقت المناسب خلال مدة الحمل من الأمور المهمة. وتقارن هذه الدراسة التي أُجريت في جمهورية إيران الإسلامية بين حساسية ونوعية كل من اختبار التبخر الذي لا يتطلب معدات خاصة، واختبار التَّسَرْخُس الذي يستلزم وجود مجهر. وقد دُرست مجموعتان تشتمل كلٌّ منهما على 50 سيدة حامل: تم في أولاهما تمزيق الأغشية (المعيار الذهبي)، أما المجموعة الثانية فكانت لديها أغشية سليمة. فوجد أن القيم الإيجابية والسلبية المتكهن بها لاختبار التَّسَرْخُس كانت 92٪ و96٪، في حين بلغت 89٪ و98٪ في حالة اختبار التبخر، مما يدل على أن اختبار التبخر يمكن أن يُعَدَّ اختباراً بسيطاً غير مكلّف لتشخيص تمزق الأغشية.

ABSTRACT Timely diagnosis of ruptured fetal membranes during the pregnancy is important. This study in the Islamic Republic of Iran compared the sensitivity and specificity of the evaporation test that requires no special equipment with the standard fern test requiring a microscope. Two groups of 50 pregnant women were studied: 1 with artificially ruptured membranes (gold standard) and 1 with intact membranes. The positive and negative predictive values of the fern test were 92% and 96% and for the evaporation test were 89% and 98%. The evaporation test is a simple, easy and non-expensive diagnostic test for ruptured membranes.

Comparaison du fern test et du test d'évaporation dans la détection de la rupture des membranes fœtales

RÉSUMÉ Au cours d'une grossesse, il est important de diagnostiquer à temps la rupture des membranes fœtales. La présente étude, menée en République islamique d'Iran, a comparé la sensibilité et la spécificité du test d'évaporation, qui ne nécessite aucun équipement particulier, à celles du fern test classique (épreuve de l'arborisation cervicale) qui requiert un microscope. Deux groupes de chacun 50 femmes enceintes ont été évalués : le premier ayant subi une rupture provoquée des membranes (méthode de référence), le second présentant des membranes fœtales intactes. Les valeurs prédictives positives et négatives du fern test ont été respectivement de 92 % et 96 %, et celles du test d'évaporation de 89 % et 98 %. Le test d'évaporation constitue un test diagnostique simple, facile à pratiquer et peu coûteux de la rupture des membranes.

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Introduction

The timely and accurate diagnosis of ruptured fetal membranes during pregnancy is of utmost importance for indicating the appropriate approach towards treatment. Premature rupture of membranes (PROM) may be associated with increased risk of fetal mortality or maternal morbidity. Ruptured membranes may be complicated by prolapse of cord, chorioamnionitis, fetal pulmonary hypoplasia, etc. [*1*]. Meanwhile, it should be noted that premature rupture of membranes is the most common cause of preterm delivery [*2*], potentially leading to early neonatal death or even irreversible physical or mental disorders [*3*]. Decisions about surgery, administration of antibiotics or tocolytic agents, continuous fetal monitoring or even termination of pregnancy are all based on timely diagnosis of PROM.

While a variety of diagnostic tools are used to detect PROM, there is still no reliable standard [*3*]. In 1984, Iannetta first described a new rapid, easy and inexpensive technique called the evaporation test [*4*], which uses heating of endocervical secretions. The presence of amniotic fluid is determined by the colour change. Blood tests, which are nowadays common, need both a microscope and a professional within reach round the clock. The evaporation test, however, can be done easily with slides and a lamp which are available even in under-resourced areas in developing countries.

The aim of this study was to compare the sensitivity and specificity of the evaporation test with the conventional fern test in a sample of pregnant women attending Imam Hossein Hospital affiliated to Shahid Beheshti University of Medical Sciences, Tehran, Islamic Republic of Iran. The test results on women with ruptured membranes were used as the gold standard. Although similar studies have been done before [*3,5*], further studies are useful to confirm the accuracy and reliability of the test and raise awareness of the test in developing countries.

Methods

A sample of 100 Iranian women between 36–42 weeks gestation were selected for this clinical trial in late September 1998 to early March 1999; gestational age was confirmed via ultrasonography. All women were admitted in the active phase labour of labour, with dilatation greater than 4 cm. Overall, 500 women attended during the study period: the exclusion criteria were as follows: history of irregular menses, pregnancy during the breastfeeding period, previous consumption of oral contraceptives, history of PROM during the present or past pregnancies, unusual vaginal secretions (bacterial or trichomonad), application of vaginal drugs, sexual intercourse the previous night, and the presence of blood or meconium in vaginal samples.

Two groups of women were studied: 50 women with intact membranes documented by history and physical examination, and 50 hospitalized women for whom artificial rupture of membranes had been performed on medical indications (the gold standard).

Two endocervical samples were obtained from each woman, 1 for fern test and 1 for evaporation test, and smeared onto slides. The fern sample was air-dried on a slide within 10–30 minutes and observed by microscope (× 40) for the presence of crystalline fern-like pattern (due to the concentration of sodium chloride, proteins and carbohydrates in the fluid). For the evaporation test, samples were heated with an alcohol burner for 30–40 s and those that turned brown or gray were considered as ruptured membranes and samples that turned white

were considered as intact membranes. The same observer examined all fern and evaporation test samples.

Special forms were designed to record the women's demographic and clinical data. Finally, positive and negative predictive values were calculated.

Results

The mean (standard deviation) age of the women was 24.3 (SD 5.3) years and the mean abortion rate was 0.22 (SD 0.55). Most (91%) of the women were housekeepers and had complete high school level. They were all between 36–42 weeks gestation; however, 71% of them were at 40–41 weeks gestation. The mean parity of the candidates was 2.29 (SD 1.40).

Table 1 shows that the fern test detected 48/50 women with ruptured membranes (the gold standard) and the evaporation test 49/50. False positives were 4 for the fern test and 6 for the evaporation test. The fern test thus had a sensitivity and specificity of 96% and 92%, whereas these figures for the evaporation test were 98% and 88% respectively (Table 2). The positive predictive value and negative predictive value of fern test were 92% and 96% (Table 2). These were 89% and 98% for the evaporation test. Finally, the overall accuracy of fern and evaporation tests was 94% and 93%, respectively.

Table 1 Comparison of fern and evaporation tests in diagnosis of ruptured fetal membranes in 100 Iranian women

Test	Ruptured membrane	
	Positive No. of cases	Negative No. of cases
Fern test		
Positive	48	4
Negative	2	46
Evaporation test		
Positive	49	6
Negative	1	44

Discussion

Our results have revealed that the negative predictive value of the fern and evaporation tests in diagnosis of ruptured membrane were clinically satisfactory (96%). However, the positive predictive value of the fern test was 92% and for the evaporation test was 89%. Friedman and McElin have reported an accuracy of 96.8% for the fern test [*5*]. Moreover, Reece et al. and Tricomi et al. have reported accuracies of 97.1% and 95.2%, respectively [*6,7*]. Tricomi et al. described a sensitivity of 98% and a specificity of 88.2% for the fern test that are comparable to our results [*7*].

The evaporation test was first described by Iannetta in 1984 as a specific and easy test [*4*]. Although his sample size was quite small, he reported an accuracy of 100%. In 1987, Schiotz re-evaluated the evaporation test and reported a sensitivity of 89.5% [*8*]. Dalkalitsis at al. calculated a specificity of 100% and false positive rate of 10.6% for the evaporation test [*9*]. It should be noted that the high sensitivity may be due to sampling since it was achieved right after rupturing of the membrane.

Our main goal was to determine whether the evaporation test could be a suitable alternative for the fern test. The positive and negative predictive values for the evaporation test were 89% and 98%, respectively. It means that if the evaporation test were positive for ruptured membranes it would be true in 89% of the cases whereas 11% might have intact membranes. Furthermore, if this test notified intact membranes in a pregnant woman she might have intact

Table 2 Sensitive, specify and predictive values of fern and evaporation tests in diagnosis of ruptured fetal membranes

Test	Sensitivity %	Specificity %	Positive predictive value %	Negative predictive value %	Overall accuracy %
Fern test	96	92	92	96	94
Evaporation test	98	88	89	98	93

membranes with a high probability (98%). The lower positive predictive value of the evaporation test as compared to the fern test (89% versus 92%) may be explained by exposure of vaginal secretions to amniotic fluid or the heating period of the slide.

We strongly recommend the evaporation test in diagnosis of ruptured membranes since it is a rapid, easy, and non-expensive tool. If the test is positive then further diagnostic tests could be applied; otherwise, it is a reliable test if it reveals a negative result.

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