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Comparison of the Duo of Insulin-Like Growth Factor Binding Protein-1/Alpha Fetoprotein (Amnioquick Duo+®) and Nitrazine Test for Diagnosing Query Rupture of Fetal Membranes

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ABSTRACT

Background: premature rupture of membranes (PROM) constitutes one of the most important dilemmas in the obstetric practice. It could be defined as rupture of membranes before the onset of labour, irrespective of the gestational age. It is associated with infectious morbidity in mother and fetus, cord accidents, imminent term or preterm labour. For these reasons, its correct diagnosis is very important. A novel test used for diagnosing rupture of membranes (ROM) is Amnioquick duo+® (Biosynex, Strasbourg Cedex, France). Amnioquick duo+® is a rapid strip test with immunoassay that is simple, easy to perform, quick and noninvasive. It is an immunochromatographic test that identifies even trace amounts of both alpha fetoprotein (AFP) and insulin-like growth factor binding protein-1 (IGFBP-1). On other hand the traditional methods for diagnosis of PROM are through the patient's history, leakage, ferning test and nitrazine test. **Aim of the Work:** the aim of this study is to compare the accuracy of the duo of insulin-like growth factor binding protein-1/alpha fetoprotein (Amnioquick duo+®) and nitrazine test for diagnosing query rupture of fetal membranes in pregnant women with query PROM. **Patients and Methods:** this comparative cross sectional study was carried out at Ain Shams University Maternity Hospital between November 2017 to June 2018. **Results:** a total of one hundred and thirteen pregnant women > 24 weeks of gestation were included in the study with age ranging between 18 and 42 years (mean ± SD, 27 ± 6 years). Thirty eight (33.6%) women were primigravidae and 75 (66.4%) were multigravidae. Forty (35.4%) women were primiparas while 63 (64.6%) were multiparas. Twenty five (22.1%) women experienced one or more previous abortion. The Amnioquick duo+® test was more specific and accuracy in diagnosing rupture of membranes than Nitrazine test. The sensitivity and the specificity of Amnioquick duo+® test in diagnosing PROM was 100% and 97.3% respectively as compared to Nitrazine test which was 100% and 83%. The PPV and NPV of Amnioquick duo+® test were 98.7% and 100% as compared to Nitrazine test which were 92.7% and 100%. **Conclusion:** this study concluded that IGFBP-1/AFP (AmnioQuick® Duo+) test is rapid reliable non-invasive, easy and accurate bedside immunoassay test, better than nitrazine test and can used as complementary test to improve the management of women with women premature fetal membranes rupture.

Keywords: Amnioquick duo+®, Nitrazine, PROM, IGFBP-1/AFP

INTRODUCTION

Premature (prelabor) rupture of membranes (PROM) is defined as rupture of the fetal membranes spontaneously prior to the onset of uterine contractions[(1)]. It is a relatively frequent obstetric phenomenon occurring in 2–18% of pregnancies[(2)]. When it is preterm, it is often associated with prematurity-related complications including premature birth, pulmonary hypoplasia, fetal deformities and infectious materno-fetal morbidity [(3)]. The diagnosis of PROM is straight forward in the presence of obvious rupture of membranes. However, several factors such as urine, vaginal discharge or semen may interfere with traditional clinical assessment (TCA), leading to high levels of false negative and positive results. Such results may lead to inappropriate interventions such as hospitalization and stimulation of labor[(3)]. On the other hand, misdiagnosis of PROM may cause providers to withhold appropriate therapy[(4)]. A novel test used for diagnosing rupture of membranes (ROM) is Amnioquick duo+® (Biosynex, Strasbourg Cedex, France). Amnioquick duo+® is a rapid strip test with immunoassay that is simple, easy to perform, quick and noninvasive. It is an immunochromatographic test that identifies even trace amounts of both alpha fetoprotein (AFP) and insulin-like growth factor binding protein-1 (IGFBP-1). The protein markers, though abundant in amniotic fluid, are present in far lower concentrations or undetectable in the maternal blood or in cervicovaginal secretions in the genuine absence of rupture of membranes[(5)]. Thus, such a differential concentration between amniotic fluid and cervicovaginal secretions of the biomarkers makes Amnioquick duo+® an excellent marker for PROM. The test can be performed even when fluid is not obvious in the vagina and its execution does not require laboratory specialized equipment or specially trained personnel[(3, 5)]. On other hand the traditional methods for diagnosis of PROM are through

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the patient's history, leakage, ferning test and nitrazine test. The histories told by the patients are sometimes subjective, and the statements may not be elaborate. The obvious leakage of amniotic fluids from the cervical os can indicate PROM, but we cannot always identify enough fluid to confirm, and sometimes there is no visual leakage in the vagina. The ferning test and the nitrazine test are two generally used methods for diagnosis of PROM. The ferning test has been associated with false positive results in 5–30% of patients and false negative results in 5–12.9% of patients. The nitrazine test is easily contaminated by other fluids, such as semen, urine, blood, and antiseptic solution. PROM is an important dilemma in clinical practice, and we urgently require alternative, accurate and fast methods to help us solve the problem[6].

AIM OF THE WORK

The aim of this study is to compare the accuracy of the duo of insulin-like growth factor binding protein-1/alpha fetoprotein (Amnioquick duo+®) and nitrazine test for diagnosing query rupture of fetal membranes in pregnant women with query PROM.

PATIENTS AND METHODS

- **Type of Study:** Evaluation of the accuracy of diagnostic test, cross sectional.
- **Study Setting:** Ain Shams university maternity hospitals.
- **Study Period:** The study was started at November 2017 to June 2018.
- **Study Population**

Inclusion Criteria: 1. Pregnancy duration of 24 weeks or more. 2. Consenting pregnant women with symptoms, signs or complaints suggestive of membrane rupture. ***Exclusion Criteria:*** 1. Women with vaginal bleeding. 2. Uterine contractions. 3. Fetal anomalies. 4. Placental pathology that could cause oligohydramnios including intrauterine growth restriction. **Sample size justification:** The required sample size has been calculated using the Power Analysis and Sample Size 2008 software version 08.0.15 (PASS© 2008, NCSS, LLC, Keysville, Utah, USA). A previous study reported that the nitrazine test had a sensitivity of 90.1% and a specificity of 69% for diagnosis of PROM. In contrast, the sensitivity and specificity of Amnioquick duo+® were 97.6% and 97.9%, respectively. That study reported that approximately 73% of women presenting with symptoms suspicious of PROM proved to actually have PROM[7]. So, it is calculated that a sample size of 96 women suspected of PROM would include 70 (73%) patients who actually have PROM. This sample achieves 83% power (type 2 error = 0.17) to detect a difference of 8% between the sensitivities of the 2 tests (98% versus 90%) and a power of 100% to detect a difference of 29% between the specificities of the 2 (98% versus 69%) tests using a two-sided binomial test with type I error of 0.05 (i.e., confidence of 95%). **Ethical considerations: The study was approved by the Ethics Board of Ain Shams University and an informed written consent was taken from each participant in the study.**

Study procedures: ***History taking:*** **Personal history:** it includes name, age, occupation, marriage and special habits. **Obstetric history:** it includes parity, last menstrual period, expected date of delivery, gestational age, previous preterm labor and vaginal bleeding. **Medical history:** it includes diabetes mellitus, hypertension and hepatic or renal disease. **Surgical history:** it includes history of previous pelvic or abdominal surgeries. ***Examination:*** **General examination:** it includes blood pressure, arterial pulse and temperature. **Abdominal examination:** it includes fundal level, fundal grip, pelvic grip, uterine contractions, tenderness and scars of previous operations. **Local examination:** all women were putted in dorsal lithotomy position, using a proper light source and sterile gloves; sterile speculum free of gel will placed into vagina.

The Amnioquick duo+ immunoassay (Manufacturer company: Bio-synex) was performed according to the manufacturer's instructions (Biosynex, 12 rue Ettore Bugatti-CS 28006 67038, Strasbourg Cedex, France). By using Amnioquick duo+®, a sample of vaginal secretion was collected using a vaginal swab entwined with Sterile Nylon® positioned in the posterior fornix or in the cervical canal for 60 s. Subsequently, the swab was either bathed in a buffer tube for 10 s or the swab tip broken off into the vial buffer and the mixtures shaken together. Three drops of the resultant liquid content were dropped in the specimen well on the cassette (supplied by the manufacturers) stick containing monoclonal antibodies to AFP and IGFBP-I, which absorbs the extracted specimen. The pink line appeared on the A and B zones on the cassette, respectively when the amniotic fluid contained AFP and IGFBP-1. The result was interpreted within 10 min. There were three distinct zones on the cassette for AFP (A), IGFBP-1(B) and control (C). The interpretation of the results was

based on the manufacturer's predetermined criteria, classified as positive, negative or doubtful for ROM. The test was positive when the C and the B lines were both present or when the A and the C lines were both present for cases with gestational age ≥ 24 weeks. The test was negative when both the A and the B lines were absent. Lines were evaluated as positive if a continuous line was observable, even if faint [6].

Fig. (1): Amnioquick duo+ immunoassay.

Nitrazine test (McolorPhast[TH]): The pH test strip was inserted into the posterior vaginal fornix for about 30s, then removed from the vagina. A blue strip indicated PROM and other colors indicated no PROM.

Fig. (2): Nitrazine test.

Statistical Methods: Data were analyzed using SPSS© Statistics version 17 (SPSS© Corp., Armonk, NY, USA) and XLSTAT© Version 2016.02.28451 (Addinsoft©, Paris, France). Continuous numerical variables were presented as mean ± SD with range and categorical data as number and percentage. Diagnostic accuracy of the nitrazine test or AmnioQuick Duo+® test was examined by contrasting the test result versus that of speculum examination as the gold-standard for diagnosis. The following diagnostic indices were calculated: sensitivity and specificity, positive and negative predictive value, positive and negative likelihood ratio, and overall accuracy. Inter-method agreement between the nitrazine test and AmnioQuick Duo+® test was examined using Cohen's kappa coefficient (κ), Scott's bias-adjusted kappa coefficient (BAK) and Bennet's prevalence adjusted and bias-adjusted kappa coefficient (PABAK). The kappa coefficients are interpreted as follows:

Kappa coefficient	Strength of agreement
-1.0 to 0.0	No or poor agreement
0.0 - 0.2	Slight
0.21 - 0.40	Fair
0.41 - 0.60	Moderate
0.61 - 0.8	Substantial
0.81 -1.00	Nearly perfect

The McNemar test was used to compare paired categorical data. P-value <0.05 was considered statistically significant.

RESULTS

In this study, one hundred thirteen cases were enrolled and tested for PROM through: Sterile Cusco speculum examination (Golden standard test) where 76 patients were positive for rupture of membranes and 37 were negative for rupture of membrane, Nirazine test, AmnioQuick Duo+® test. In this analysis, the comparison between Nitrazine versus AmnioQuick Duo+® test for PROM diagnosis judged by sterile Cusco speculum examination (golden standard for PROM).

Table 1. Characteristics of the study population

Variable	***Mean ± SD] (minimum – maximum) / n (%)***
Age (years)	27 ± 6 (18 – 42)
Gestational age (weeks)	35.0 ± 4.3 (23.3 – 40.6)
Gravidity	
PG	38 (33.6%)
G1	0 (0.0%)
G2	24 (21.2%)
G3	19 (16.8%)
G4	18 (15.9%)
G5 or higher	14 (12.4%)
Parity	
P0	40 (35.4%)
P1	27 (23.9%)
P2	22 (19.5%)
P3	16 (14.2%)
P4	7 (6.2%)
P5 or higher	1 (0.9%)
Previous abortion	
Nil	88 (77.9%)
One abortion	16 (14.2%)
Two abortions	6 (5.3%)
Three abortions	2 (1.8%)
Four or more abortions	1 (0.9%)

Data are mean ± SD (minimum – maximum) or number (%).

Table 1 shows the characteristics of the study population. The age ranged between 18 and 42 years (mean ± SD, 27 ± 6 years). 38 (33.6%) women

were primigravidae and 75 (66.4%) were multigravidae. 40 (35.4%) women were primiparas while 63 (64.6%) were multiparas. 25 (22.1%) women experienced one or more previous abortion.

Table 2. Results of the nitrazine test, AmnioQuick Duo+® test and speculum examination

Variable	*n (%)*
Nitrazine test	
Negative	31 (27.4%)
Positive	82 (72.6%)
AmnioQuick Duo+® test	
Negative	36 (31.9%)
Positive	77 (68.1%)
Speculum examination	
Negative	37 (32.7%)
Positive	76 (67.3%)

Data are number (%).

Table 2 shows the results of the nitrazine test, AmnioQuick Duo+® test and speculum examination. Eighty two (72.6%) patients were positive for ROM by the nitrazine test while only 77 (68.1%) patients were positive by the AmnioQuick Duo+® test. By speculum examination (gold-standard test), 37 (32.7%) patients were negative and 76 (67.3%) patients were positive for ROM.

Table 3. Accuracy of the nitrazine test examined versus speculum examination as the gold-standard for diagnosis of ROM

	Speculum examination		
Nitrazine test	***Positive***	***Negative***	***Column Total***
Positive	76	6	82
Negative	0	31	31
Total	76	37	113
		95% CI	
Statistic	**Value**	**Lower bound**	**Upper bound**
Correct classification	94.7%	90.6%	98.8%
Misclassification	5.3%	1.2%	9.4%
Sensitivity	100.0%	94.1%	100.0%
Specificity	83.8%	68.4%	92.6%
False positive rate	16.2%	4.9%	27.5%
False negative rate	0.0%	0.0%	0.0%
Prevalence	67.3%	58.6%	75.9%
Positive predictive value (PV+)	92.7%	87.0%	98.3%
Negative predictive value (PV-)	100.0%	100.0%	100.0%
Positive likelihood ratio (LR+)	6.17	2.96	12.83
Negative likelihood ratio (LR-)	0.00		

Data are counts.

Table 3 shows a cross-tabulation of the results of the nitrazine test examined versus those of speculum examination as the gold-standard for diagnosis of ROM. Eighty two patients tested positive by the nitrazine test. Of these, 76 were truly positive and 6 were falsely positive by speculum examination. Thirty one patients were negative by the nitrazine test, all of whom were truly negative by speculum examination. These findings are illustrated in **Figure 3.** From these values, it is estimated that the nitrazine test has an accuracy (correct classification rate) of 94.7%, sensitivity of 100%, specificity of 83%, positive predictive value (PV+) of 92.7%, negative predictive value (PV-) of 100%, Positive likelihood ratio (LR+) of 6.17 and negative likelihood ratio (LR-) of 0.0.

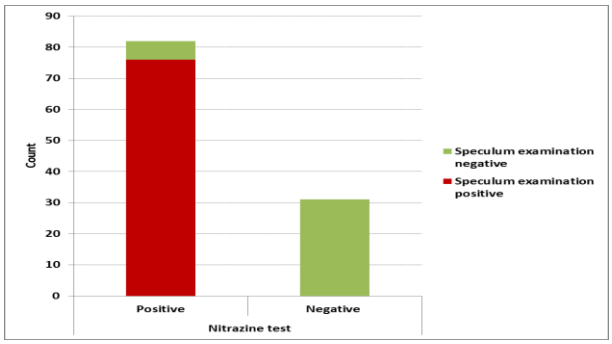

Figure 3. Results of the nitrazine test examined versus speculum examination as the gold-standard for diagnosis of ROM.

Table 4. Accuracy of the AmnioQuick Duo+® test examined versus speculum examination as the gold-standard for diagnosis of ROM

	Speculum examination		
AmnioQuick Duo+® test	**Positive**	**Negative**	**Column Total**
Positive	76	1	77
Negative	0	36	36
Total	76	37	113
		95% CI	
Statistic	**Value**	**Lower bound**	**Upper bound**
Correct classification	99.1%	97.4%	100.0%
Misclassification	0.9%	0.0%	2.6%
Sensitivity	100.0%	94.1%	100.0%
Specificity	97.3%	84.7%	100.0%
False positive rate	2.7%	0.0%	7.7%
False negative rate	0.0%	0.0%	0.0%
Prevalence	67.3%	58.6%	75.9%
Positive predictive value (PV+)	98.7%	96.2%	100.0%
Negative predictive value (PV-)	100.0%	100.0%	100.0%
Positive likelihood ratio (LR+)	37.00	5.35	255.75
Negative likelihood ratio (LR-)	0.00		

Data are counts.

Table 4 shows a cross-tabulation of the results of the AmnioQuick Duo+® test examined versus those of speculum examination as the gold-standard for diagnosis of ROM. 77 patients tested positive by the AmnioQuick Duo+® test. Of these, 76 were truly positive and only 1 was falsely positive by speculum examination. 36 patients were negative by the AmnioQuick Duo+® test, all of whom were truly negative by speculum examination. These findings are illustrated in **Figure 4.** From these values, it is estimated that the AmnioQuick Duo+® test has an accuracy (correct classification rate) of 99.1%, sensitivity of 100%, specificity of 97.3%, positive predictive value (PV+) of 98.7%, negative predictive value (PV-) of 100%, Positive likelihood ratio (LR+) of 37.0 and negative likelihood ratio (LR-) of 0.0. **Figure 5** shows a summary of the diagnostic performance of the AmnioQuick Duo+® and nitrazine tests.

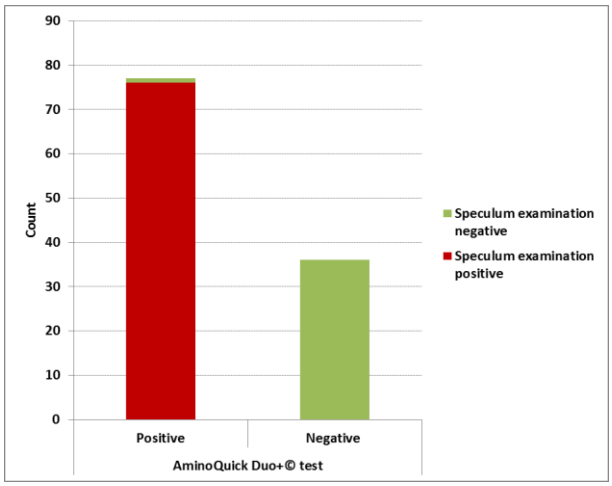

Figure 4. Results of the AmnioQuick Duo+® test examined versus speculum examination as the gold-standard for diagnosis of ROM.

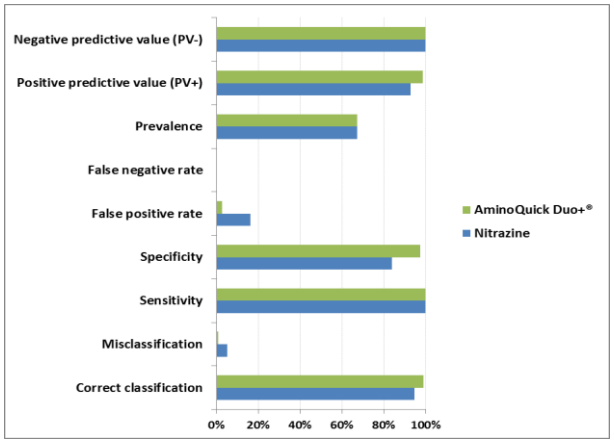

Figure 5. The diagnostic performance of the AmnioQuick Duo+® and nitrazine tests.

Table 5. Agreement between the AmnioQuick Duo+® test and nitrazine test

	AmnioQuick Duo+® test		
Nitrazine test	**Positive**	**Negative**	**Column Total**
Positive	76	6	82
Negative	1	30	31
Total	77	36	113
Measures of agreement			
Cohen's kappa	0.85		
Scott's kappa (BAK)	0.85		
Bennett's kappa (PABAK)	0.88*		

Data are counts.

A Bennett's kappa (PABAK) of 0.88 denotes nearly perfect agreement between the AmnioQuick Duo+® and nitrazine tests. **Table 6** represents a cross-tabulation of the results of the AmnioQuick Duo+® test versus those of the nitrazine test. 76 patients tested positive and 30 patients tested negative by both tests. 1 patient tested positive by the AmnioQuick Duo+® test and negative by the nitrazine test. Conversely, 6 patients tested negative by the AmnioQuick Duo+® test and positive by the nitrazine test. These findings are illustrated in **Figure 6.** From these figures, the Bennett kappa coefficient (Prevalence-adjusted bias-adjusted kappa coefficient, PABAK) is estimated to be 0.88 which denotes nearly perfect agreement between both tests.

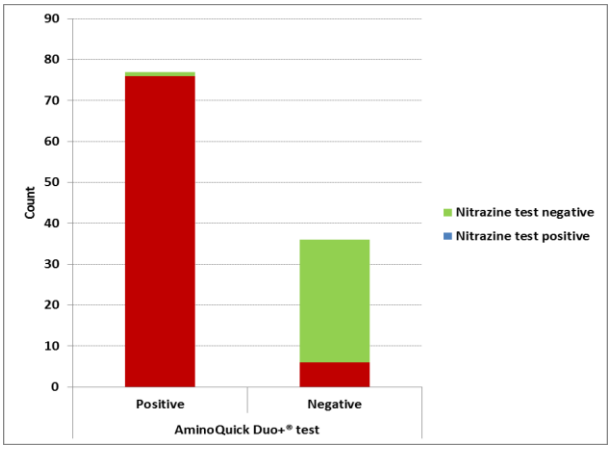

Figure 6. Results of the AmnioQuick Duo+® test examined versus the nitrazine test.

Table 6. Cross-tabulation of the results of the AmnioQuick Duo+® test versus that of the nitrazine test in the subgroup of patients.

	AmnioQuick Duo+® test		
Nitrazine test	**Negative**	**Positive**	**Column Total**
Negative	30	1	31 (83.8%)
Positive	6	0	6 (16.2%)
Total	36 (97.3%)	1 (2.7%)	37
McNemar test			
Difference	13.51%		
95% CI	0.19% to 26.84%		
p-value	0.125		

Data are counts and percentages.

Table 6 shows a cross-tabulation of the results of the AmnioQuick Duo+® test versus that of the nitrazine test in the subgroup of patients with negative speculum examination which is the gold-standard for diagnosis of ROM. Of the 37 patients who tested negative by speculum examination, 30 patients tested negative by both the AmnioQuick Duo+® test and the nitrazine test. One patient tested positive by the AmnioQuick Duo+® test but was negative by the nitrazine test. In contrast, 6 patients tested negative by the AmnioQuick Duo+® test but were negative by the nitrazine test. These findings are illustrated in **Figure 7.** To compare the specificities of both tests, the McNemar test was conducted on this paired data and showed no statistically significant difference in the percentage of patients testing negative by either test (97.3% for the AmnioQuick Duo+® test versus 83.8% versus the nitrazine test, difference = 13.51%, 95% CI = 0.19% to 26.84%, p-value = 0.125).

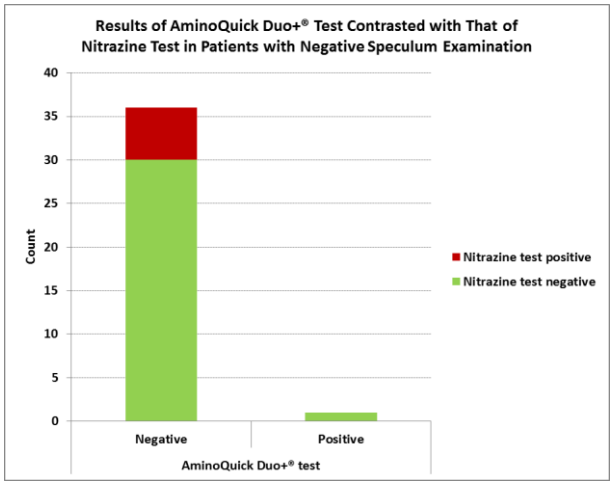

Figure 7. Results of the AmnioQuick Duo+® test contrasted with that of the nitrazine test in the subgroup of patients with negative speculum examination.

Table 7. Cross-tabulation of the results of the AmnioQuick Duo+® test versus that of the nitrazine test in the subgroup of patients.

	AmnioQuick Duo+® test		
Nitrazine test	**Negative**	**Positive**	**Column Total**
Negative	0	0	0 (0%)
Positive	0	76	76 (100%)
Total	0 (0%)	76 (100%)	76
McNemar test			
Difference	0%		
95% CI	NA		
p-value	NA		

Data are counts and percentages. NA=test not applicable.

Table 7 shows a cross-tabulation of the results of the AmnioQuick Duo+® test versus that of the nitrazine test in the subgroup of patients with positive speculum examination. Of the 76 patients who tested positive by speculum examination, all were positive by both the AmnioQuick Duo+® test and the nitrazine test. These findings are illustrated in **Figure 8.** The McNemar test could not be conducted on this paired data in order to compare the sensitivity of either test, since all patients (n=76) tested positive by both tests.

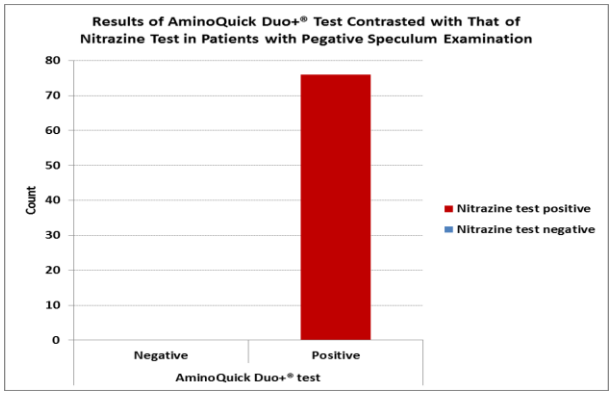

Figure 8. Results of the AmnioQuick Duo+® test contrasted with that of the nitrazine test in the subgroup of patients with positive speculum examination.

DISCUSSION

Premature (prelabor) rupture of membranes (PROM) is defined as rupture of the fetal membranes spontaneously prior to the onset of uterine contractions [(1)]. PROM is preterm (PPROM) when it occurs before 37 weeks gestation [(8)]. It is a relatively frequent obstetric phenomenon occurring in 2–18% of pregnancies. When it is preterm, it is often associated with prematurity-related complications including

premature birth, pulmonary hypoplasia, fetal deformities and infectious materno-fetal morbidity **(9).** Accurate diagnosis of PROM remains a frequent clinical problem in obstetrics. Unfortunately, a non-invasive standard diagnostic test is not available at this time. The diagnosis of PROM is usually based on the patient's history, identification of gross pooling of amniotic fluids from the cervical canal during sterile speculum examination, after microscopic examination and the Nitrazine test **(10).** Despite the theoretic advantages of using Amnioquick duo+® as a marker of ROM, there is still a deficiency of prospective data on the performance matrix of the immunoassay **(5).** There are many new bedside biological tests that were developed to detect certain biochemical markers that are highly present in the amniotic fluid but not in the vaginal fluid. Some of the biochemical markers that are used to detect membranes leakage such as alpha-fetoprotein (AFP), insulin-like growth factor-binding protein-1 (IGFBP-1), placental alpha-microglobulin-1 and fibronectin are targeted **(11).** The approach to the diagnosis of rupture of membranes is clinical, with over 90% of cases being confirmed based on the presence of a suspicious history or ultiasonographic finding followed by documentation of fluid passing from the cervix or the presence of a nitrazine/ ferning positive vaginal pool of fluid. Various methods are used to diagnose PROM such as nitrazin and ferning test but have low sensitivity and specificity, or injection of intra-amniotic dye, although are very reliable test but are invasive with serious complications **(12).** This study was trying to investigate a non-invasive, simple, rapid, easy and cheap method for diagnosis of premature rupture of membrane. We demonstrated that Amnioquick duo+ was superior to traditional clinical assessment (nitrazine test) for diagnosing premature rupture of fetal membranes (PROM) in pregnant women presenting with symptoms or signs of drainage of liquor. We found a diagnostic accuracy of 99.1% for Amnioquick duo+ versus 94.7% for TCA. The sensitivity and the specificity of Amnioquick duo+ test in diagnosing PROM was 100% and 97.3% respectively as compared to Nitrazine test which was 100% and 83%. The PPV and NPV of Amnioquick duo+ test were 98.7% and 100% as compared to Nitrazine test which were 92.7% and 100%. The sensitivity of the Amnioquick duo+ test was high in detecting ROM. The reason for this is because the IGFBP-1/AFP test can detect low levels of both IGFBP-1 (10 ng ml^{-1}) and AFP (5 ng ml^{-1}). Patients with intact membranes will not have any IGFBP-1/AFP in the cervicovaginal secretions **(11).** The IGFBP-1/AFP had a false-positive rate of 2.7% in present study. It is unclear what factors contribute to these false-positives. It is possible that there was a microleakage of the amniotic fluid in the vagina that could not be detected with a physical examination, bedside laboratories and ultrasonography (11). **AbuFaza *et al.*(5)** compar Amnioquick duo+ with traditional clinical assessment (TCA) (nitrazin and ferning test) found Amnioquick duo+ more superior in diagnosing PROM but the difference was not statistically significant between the individual tests of TCA **(5).** Our study, agree with **Abdelazim *et al.*(13)** study which did not show significant differences in the diagnostic accuracy between Amnioquick duo+ and TCA. The sensitivity and specificity of the IGFBP-1/AFP test in this study was high agree with study done by **Thomasino *et al.* (14)** evaluated the diagnostic values for monoclonal/polyclonal immunoglobulin to detect IGFBP-1/AFP (ROM+). The sensitivity and specificity were 99% and 91%, respectively, in the study by Thomasino et al. versus 100% and 97.3% in our current study. The performance of two rapid tests for the diagnosis of PROM based on the detection of IGFBP-1/AFP and placental alpha-microglobulin-1 (PAMG-1) in cervicovaginal secretions were compared by **Eleje *et al.* (9).** Sensitivity, specificity, and accuracy for Amnioquick duo+ were 97.9%, 97.6%, and 97.9%, which were higher than the levels for PAMG-1, of 95.3%, 90.0%, and 95.7%, respectively (not significant). Accuracy of Amnioquick duo+ versus PAMG-1 in equivocal (pooling = negative) cases was (98.4% vs 96.8%) at ≥34 GW but each was 100.0% at <34 GW (not significant). **Eleje *et al.*(9)** concluded that both amnioquick duo+ and PAMG-1 have a comparatively high diagnostic accuracy in identifying women with PROM, with a concordance rate of 97.0%. In this study the high sensitivity, specificity and accuracy of Amnioquick duo+ agree with **Eleje *et al.*(7)** study in which two hundred and thirty-six women were recruited. Three women were excluded from the final analysis due to lack of follow-up data and failure to meet inclusion criteria. Two hundred and thirty-

three women had complete data for analysis. The specificity and sensitivity values for TCA were 76.2% and 85.2%, which were lower than those of Amnioquick duo+, which were 97.6% and 97.9%, respectively. The accuracy of Amnioquick duo+ was statistically higher 97.9% vs. 83.7%. In equivocal cases (pooling = negative), the accuracy of Amnioquick duo+ vs. TCA was 98.4% vs. 69.4% at ≥ 34 weeks gestation and 100.0% vs. 71.4% at < 34 weeks gestation. **Eleje *et al.*[(7)]** concluded the performance matrix of Amnioquick duo+® was superior to that of TCA for diagnosing PROM even in equivocal cases. Our study high sensitivity, specificity and accuracy of Amnioquick duo+ higher than previous study done by **Ruanphoo and Phupong[(11)],** in which one hundred patients were recruited. The mean gestational age was 37.6 weeks (range 25 to 41 weeks). Twenty-six percent were preterm and 74% were at term. IGFBP-1/AFP immunoassay had a sensitivity of 94.1%, specificity of 87.5%, positive predictive value of 97.5%, negative predictive value of 73.7% and accuracy of 93% in diagnosing ROM. **Ruanphoo and Phupong [(11)],** concluded IGFBP-1/AFP immunoassay is a rapid immunoassay test for diagnosing ROM with a high sensitivity and specificity. This test can be used as an alternative method for diagnosis of ROM.

CONCLUSION

This study concluded that IGFBP-1/AFP (AmnioQuick® Duo+) test is rapid, reliable, non-invasive, easy and accurate bedside immunoassay test, better than nitrazine test and can used as complementary test to improve the management of women with premature fetal membranes rupture.

CONFLICTS OF INTEREST

There are no conflicts of interest.

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