

# Diagnosis of Amniotic Fluid Leak by Nitrazine Indicator Impregnated in Diagnostic Pantyliner: Its Specificity and Sensitivity for Detection of Premature Rupture of Membranes

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## ABSTRACT

**Objective:** To check sensitivity and specificity of nitrazine test after modifying it with a non-invasive absorbent pad used as a pantyliner impregnated with nitrazine molecule.

**Materials and Methods:** This was a prospective cohort study conducted on 150 patients seeking medical advice in labor room of Darbhanga Medical College and Hospital. Study was done on 2 groups. Group 1 consisted of women presently with suspected leak without digital examination. Group 2 consisted of women with overt leak with digital examination. DPL was applied in both groups and results were compared with the standard speculum examination.

**Results:** Sensitivity of DPL test was 97.22% and specificity was 83.33% PPV was 89.7% and NPV was 95.24% accuracy of the test was 91.67%.

**Conclusion:** In the clinical challenge of diagnosing PPRM, non-invasiveness rapidity of testing and high accuracy rate of DPL test may provide a solution to the modern obstetrician.

**Keywords:** DPL, PPV, NPV, Amniotic Fluid, Premature Rupture of Membranes.

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## INTRODUCTION

Preterm premature rupture of membranes is rupture of membranes before term (37 weeks); accounts for about one fourth of all cases of PROM. Incidence of PROM is 5-10% of all pregnancies. A significant risk of PROM is that baby is very likely to be born within one week of rupture of membrane (50-60%) & 90% within next two weeks. Another major risk in development of chorioamnionitis. Although PROM is multifactorial but choriodecidual infection/inflammation appear to play important role in its etiopathogenesis. Preterm delivery, RDS cord compression abruption placentae intra ventricular haemorrhage, necrotizing enterocolitis, pulmonary hypoplasia, retained placenta & PPH are the major complications associated with PPRM.

Sterile speculum examination with visualization of amniotic fluid pooling in the posterior vaginal fornix is most accurate test but may give false negative result in cases of slow/intermittent leak. Ferning test showing fern pattern on amniotic fluid drying spread over slide has low sensitivity & specificity in the patients without labor. Ultrasonographic diagnosis of leak is time consuming; requires equipment & expertise, can only detect significant loss of amniotic fluid. Currently most reliable & accepted method for diagnosis of PROM is Nitrazine test of cervicovaginal secretion.

The test is designed to confirm an alkaline pH in amniotic fluid, demonstrated by color change of yellow nitrazine indicator to blue.<sup>1-3</sup>

False positive result may be found when vaginal secretion is contaminated with alkaline antiseptic solution, urine, blood, seminal fluid/infection altering vaginal pH.<sup>4-6</sup> False negative result may occur when there is minimal high/intermittent leak/severe oligohydramnios with no liquor. The nitrazine test has 12.7% false negative and 16.2% false positive result.<sup>7</sup>

## Non-Invasive Absorbent Pad

The test has undergone cytotoxicity and skin irritation and sensitization testing and it complies with the US Pharmacopoeia Guidelines.<sup>8</sup> The two studies of absorbent pad are currently available(8,9) suggest that a negative result indicates intact membranes in term and preterm gestations in 99% of cases. A positive result, however suggest only a 70% chance of rupture membranes and thereby warrants confirmation or further investigation to identify infections.<sup>8,9</sup> As women with negative pad check are unlikely to have rupture membranes, this would imply decreased need for an uncomfortable and intrusive speculum examination.<sup>7-10</sup>

**MATERIALS & METHODS**

The present study was conducted in the department of Obstetrics and Gynaecology of Darbhanga Medical College & Hospital, Darbhanga. This prospective cohort study was conducted on 150 patients seeking medical advice in labor room, during 15 months duration (July 2012 to September 2013).

**Principle of the Test**

The test is based upon the fact that nitrazine phenolate ion polymer acts as a pH indicator which changes color on contact with pH>5.2. The indicator strip remains assembled with a pantyliner, covered with two layers of one way perforated film. The indicator strip is removed from the pantyliner as soon as the patient feels wet(maximum 12hrs) and placed in the drying tray for 30 minutes before reading the test result. The pantyliner changes color from yellow to bluegreen upon contact with amniotic fluid with pH>5.2. In case of urine leakage, polymer matrix reverses the color back to yellow by detachment of conjugate based nitrazine molecules by urinary ammonium ions, when the strip dries. As the concentration of ammonium ion in the tested fluid increases, more and more ions attach to nitrazine molecule, reversing the color back to yellow. This happens in 30 minutes of drying time. Therefore DPL is able to distinguish urine from amniotic fluid despite a similar pH. The test is specially appropriate for the detection of minute volume of amniotic fluid leak. The patient will attach the diagnostic pantyliner to her underwear and continue with her daily routine activities. Patient can herself check for color change when she feels wet. If indicator is stained bluegreen, she is instructed to report to physician without delay. Further evaluation of the report will be done by clinical diagnosis. Any vaginal infection will be excluded with the help of standard procedure.<sup>13-15</sup>

**Inclusion Criteria**

Pregnant patients complaining of leaking, continuous/intermittent in whom provisional diagnosis was made clinically from the presenting signs & symptoms. These are:

1. Discharge of watery fluid(continuous/ intermittent)
2. With/without fever
3. With/without labor pain
4. USG showing normal liquor/oligohydramnios

**Exclusion Criteria**

1. Intermittent vaginal bleeding during second/third trimester.
2. Sexual intercourse within the past 12hours.
3. Diagnosis of Bacterial vaginosis/Trichomonal vaginitis within the past 3 days.
4. Use of vaginal product/antibiotic that reduces lactobacillus population.
5. Use of medicine such as tamoxifen that reduces estrogen level/antihistamine that dry mucous membrane.
6. Consumption of alkalinizing food (such as broccoli, beets, cabbage)that could elevate vaginal pH.
7. Unable/unwilling to cooperate with the study procedure.

A written consent was taken by all the patients. The study group was divided into two groups:

**Group 1:** Women presenting with suspected vaginal leak of fluid, without digital examination.

**Group 2:** Women with overt leak, with digital examination (control) Both the groups were examined, investigated and followed till delivery.

The DPL was applied in every woman in each group and results of the test were compared with the standard speculum examination. Fetal monitoring and maternal condition judged and termination of pregnancy done whenever indicated.

**Table 1: Showing patients presenting going into spontaneous labor within 24 hrs**

DURATION	CASES	CONTROL
<6hrs	5	10
6-12hrs	10	26
12-24hrs	25	13
>24hrs	20	11

**Table 2: Diagnosis of PROM in Group 1 with DPL And Per Speculum Examination**

DPL TEST	PER SPECULUM EXAMINATION		
	POSITIVE	NEGATIVE	TOTAL
POSITIVE	35	04	39
NEGATIVE	01	20	21
TOTAL	36	24	60

**Table 3: Diagnosis of PrROM in Group 2 with DPL and Per Speculum Examination**

DPL TEST	PER SPECULUM EXAMINATION	
	POSITIVE	
POSITIVE	59	
NEGATIVE	01	
TOTAL	60	

**Table 4: Showing Mode of Delivery in Two Groups**

Mode	Group1	Group2
Vaginal	50/83.33%	54/90%
L.S.C.S.	10/16.67%	6/10%

**Table 5: Showing Neonatal Morbidity In Two Groups**

Outcome	Group 1	Group 2
Still birth	02	03
RDS	04	03
Asphyxia	04	06
Bronchopneumonia	01	04
Septicemia	01	04
Prematurity	05	10
APGAR score<7	15	27

**Table 6: Incidence of Maternal Morbidity**

Maternal Outcome	Group 1	Group 2
Operative Delivery	10/16.67%	6/10%
Puerperal pyrexia	04/6.67%	8/13.33%
PPH	05/8.33%	11/18.33%

## RESULTS AND DISCUSSION

Table 1 shows period of latency in two groups. Period of latency was more in group 1, in which no digital examination was done until patient went into active labor. 50% of group 1 went into labor after 12 hours, 25% of went into labor after 24 hours. 60% of group 2 went into labor in <12hours. Lewis et al also found that digital vaginal examination performed on patients with PPRM significantly shortened the latency period at all the gestational ages.<sup>16</sup> They reported that performance of one or two digital examination during expectant management of PPRM was associated with median of two days shorter latency.<sup>16</sup> They found an incidence of 18% PROM in patients who had weekly vaginal examination after 37 weeks as compared to 6% of those who did not have vaginal examination at term.<sup>16</sup>

Latent period normally seems to have inverse relation to the period of gestation, being longest in those patients farthest from term. This is true in this study also. Donnelly et al (1957) stated the same as the length of latent period associated with premature rupture of membranes was related to the period of pregnancy and as term approaches, latent period become shorter.<sup>16</sup>

Table 2 showed sensitivity of DPL test 97.22% & specificity 83.33% with respect to per speculum examination in group1 patients. Out of 60 patients true positive cases were 35 & false negative was 1 case. Group in Table 3 showed that there were 59 patients true positive cases and 1 false negative case.

In table 4; incidence of vaginal delivery was 83.33% and 90% in group 1 & group 2 respectively. Incidence of caesarean was 16.67% & 10% group 1 and group 2 respectively. Joseph Revicsus (1968) stated that the incidence of normal spontaneous vaginal delivery with PROM occurred in 84.3% of cases, showing similarity with the above result.<sup>16</sup>

In table 5; apart from prematurity, RDS, still birth and fetal distress, other complications were bronchopneumonia, septicemia and asphyxia. Apgar score >7 in group1 was 71.67%, while in group 2 it was 45%. Preterm PROM & exposure to intrauterine inflammation/infection have been associated with increases risk of neurodevelopment impairment. Infection cord accidents and other factors contribute to 1-2% of intrauterine fetal demise. Other neonatal complications include fetal pulmonary hypoplasia, which develop in 26% of PPRM prior to 22 weeks. This complication was not seen in my study as no case belonged to this gestational age. Skeletal deformities, which complicate 12 % of PPRM,

which is related to severity & duration of PPRM, was also not evident in this study as babies of severe cases of PPRM were sent to higher centers, hence lost to follow up.

In table 6; incidence of maternal morbidity in group 1 was 31.67% while in group 2 it was 41.66%. In group 1 it was mainly due to operative delivery (16.67%) ( $p>0.05$ ) & in group 2 it was due to PPH (18.33%) ( $p<0.05$ ) & puerperal pyrexia (13.33%) ( $p>0.05$ ). The incidence of maternal morbidity was calculated to be 1.3% when latent period was less than 24 hrs & 4.8% when it was longer than 24 hrs (Breese,1961).<sup>17</sup> This is in conformity with the present series. Lebhrez and associates (1961) used a prospective double protocol when administering prophylactic antibiotics to mother with PROM.<sup>17</sup> Though perinatal death could not be altered, the postpartum maternal morbidity was reduced significantly. Most authors (Calkins, 1952 & Schultz, 1929)<sup>16</sup> were aware that vaginal examination and interferences increases the incidence of infection which is true in this present series where the maternal morbidity is increased to a significant level with the interference.

## SUMMARY AND CONCLUSION

120 cases of PROM were studied, of which 60 cases were of suspected rupture of membranes in whom only DPL was applied with no digital examination; and 60 patients were of overt leaking in whom DPL was applied along with digital examination.

Period of latency was more in group 1 (cases) than control group. 50% of group 1 went into labor after 12 hrs & 25% after 24 hrs whereas 60% of group 2 went into labor in <12hrs.

Incidence of PROM was more in >37 weeks of gestation (56.67%). Sensitivity of DPL test was 97.22% & specificity was 83.33%. PPV was 89.74%; NPV was 95.24%. Accuracy of the test was 91.67%.

Diagnostic accuracy is the key to successful management and improved perinatal outcome in cases of PROM. Prompt and accurate diagnosis of AF leak may reduce trips to the hospital and patient anxiety.

In cases of suspected slow or intermittent leak, DPL can be self-applied at home, collects AF continuously. DPL is suitable for use in the outpatient setting, as the results are easy for the subject to read and understand. In cases of negative results it avoids unnecessary hospitalization for observation or evaluation of suspected AF leak; thus reduces the burden of labor room. DPL is

sensitive tool for excluding ruptured membranes and for differentiating AF leak from other sources of vaginal discharge or urinary incontinence. It reduces the need for uncomfortable and intrusive vaginal or speculum examination; thus help in increasing the latency period by preventing infection. Overall maternal and neonatal outcome can be improved by using DPL in managing cases of PROM.

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