Role of Admission Tests in Predicting Perinatal Outcome: A Prospective Study

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Abstract

**Background:** Predicting adverse outcome is important in low risk pregnancies also. We tried to determine the role of admission test on foetal and maternal outcome of pregnant women attending labour room as a part of promotion of institutional delivery.

**Methods:** It is a prospective study conducted for a period of 1 year 6 months, where 100 pregnant women attending labour room with gestational age between 37-42 weeks in early or pre labour are selected randomly. Admission tests were performed in them and the results were statistically analysed.

**Results:** For predicting the outcome in low risk pregnancy, we adopted combined admission tests, i.e., NST, AFI and Umbilical artery Doppler in low risk pregnant women. In our study NST shows a sensitivity of 57.89% and a specificity of 96.30%, while, Positive Predictive Value and Negative Predictive Value is 78.57% and 90.70%, respectively. This study indicates NST is a test with high specificity and negative predictive value, with diagnostic accuracy of 89%.

**Conclusion:** NST, AFI, Umbilical Artery Doppler can be done altogether as an admission test on pregnant patients, for prediction of perinatal outcome.

**Keywords:** Admission test; Perinatal outcome; Non-stress test; Amniotic fluid index; Umbilical artery doppler

**Abbreviations:** NST: Non-Stress Test; AFI: Amniotic Fluid Index; UA Doppler: Umbilical Artery Doppler; PPV: Positive Predictive Value; NPV: Negative Predictive Value; DA: Diagnostic Accuracy; LR: Likelihood Ratio; NICU: Neonatal Intensive Care Unit

**Introduction**

Pregnancy with no high risk constitutes a major part of the pregnant population and it is equally important to predict and prevent adverse events in them. For predicting the outcome in low risk pregnancy, we adopted admission test, in the form of combined tests of NST (Non stress test), AFI (Amniotic Fluid Index) and (UA) Umbilical Artery Doppler. NST is a non-invasive, easily performed, interpreted, and readily accepted by the patients. The test looks for the presence of temporary acceleration of the Foetal Heart Rate associated with fetal movement that involves the cerebral cortex and is affected by physiologic or pathologic influences on the foetal brain. Freeman (1975) and Lee and colleague [1] introduced the NST to describe the foetal heart rate acceleration in response to foetal movement, as a sign of foetal health. Suddenly diagnosed oligohydramnios in a low risk mother tells us the probability of meconium aspiration syndrome, neonatal death, and foetal malformation. Chronic severe placental insufficiency can cause oligohydramnios and in turn can lead to cord compression and foetal distress. The role of Doppler in the evaluation of the foetuses at high risk for poor outcome has been adequately assessed in randomized clinical trials, and the method has been found to be useful (a) in complementing other methods of foetal surveillance such as the NST or the Biophysical profile to determine more precisely the degree of foetal compromise (b) as a follow up test when other tests of foetal wellbeing give ambiguous results or the clinical conditions of the mother or the foetus is unstable (c) to determine with more precision the need to delivery (d) to identify a group of women at high risk of placental insufficiency and low risk for foetal complications, and (e) to evaluate the presence and severity of foetal anaemia. The evidence supporting the role of UA Doppler in surveillance of high risk pregnancy is robust. Randomized clinical trials and meta-analysis have conclusively demonstrated that the use of UA Doppler in high risk pregnancies results in an approximately 1/3 reduction in perinatal mortality [2-4]. Studies have also demonstrated a strong relationship between the results of UA velocimetry and the presence of foetal acidemia in blood samples obtained by cordocentesis or at the time of caesarean [5,6].

**Aims and Objective**

a. To determine the role of admission test on foetal and maternal outcome of pregnant women attend labour room as a part of promotion of institutional delivery.

b. To find out the implication of these tests on mode of delivery and perinatal outcome.

c. To find out the predictive power of these tests on perinatal outcome.

**Materials and Methods**

It is a prospective study conducted for a period of 1 year 6 months, where 100 pregnant women attending labour room with gestational age between 37-42 weeks in early or pre labour are selected randomly. Admission tests were performed in them.

**Inclusion criteria**

- Gestational age between 37-42 weeks.
• Singleton pregnancy.
• Cephalic presentation.

Exclusion criteria
Known case of high risk pregnancies like:
• Hypertensive disorders of pregnancy.
• Other medical disorders.
• Patients for elective cesarean section.
• Multiple pregnancies.
• Malpresentation.
• Ante partum hemorrhage
• Congenital anomalies

Study technique
1. Case selection according to inclusion criteria.
2. Informed consent taken.
3. Performa of history and examination.
5. Follow up for Immediate and delayed perinatal outcome.

The data were analysed using SPSS version 17.0. Chi-square test was applied to compare the nominal and ordinal variables with Yates correction wherever necessary.

Informed consent was obtained from the subjects. Detailed history and examination findings were recorded on a performa. Non-stress test was performed and results were interpreted as non-reassuring and ominous (put in abnormal group) and reassuring (put in normal group). After NST, we did AFI estimation. A value of less than 5 cm has been taken as oligohydramnios. Last of all, we did umbilical artery Doppler, where the waveforms were studied. UA S/D ratio should be under 3 after 30 weeks of pregnancy.

Results and Observations

The data collected were statistically analysed. Out of 100 cases, 86 had normal NST and 14 had abnormal NST. AFI was found <5 cm in 32 cases and 68 had AFI >5 cm. UA Doppler was analysed in terms of systolic diastolic ratio and diastolic flow resistance. Abnormal UA Doppler was found in 17 and 83 had normal Doppler (Table 1).

Discussion

For predicting the outcome in low risk pregnancy, we adopted combined admission tests, i.e., NST, AFI and Umbilical artery Doppler in low risk pregnant women. In our study NST shows a sensitivity of 57.89% and a specificity of 96.30%, while, Positive Predictive Value (PPV) and Negative Predictive Value (NPV) is 78.57% and 90.70%, respectively. This study indicates NST is a test with high specificity and negative predictive value, with Diagnostic Accuracy (DA) of 98%. In a study by Kulkarni and Shruti, [7] on predictive utility of Admission tests for perinatal outcome in High-risk labours, the incidence of operative delivery for foetal distress in reactive group is 5.17% which is 10.46% in our study and 28.5% in ominous group, which is 78.57% in our study (Table 1). The results differ because of the difference in study population, individualization of Institutional policy on operative intervention. Moreover, in our study low risk patients are selected, whereas they selected high risk patients. They have perinatal morbidity of 6.89% in the reactive group and 85.71% in ominous group, which closely resembles our study and in both studies, it is statistically significant.

In another study by Sandhu et al. [8], they screened high risk obstetrics patients at admission. They found 33% NICU admission from Abnormal NST group and most of them had APGAR score between 4-5 (<6 in 1 Minute). In our study NICU admission from abnormal NST group is 78.57% because of less number of patients in abnormal group. In their study PPV came to 73.3% which matched with

<table>
<thead>
<tr>
<th>NST</th>
<th>VAGINAL DELIVERY</th>
<th>LOWER SEGMENT CAESAREAN SECTION</th>
<th>STATISTICAL ANALYSIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>NORMAL 86</td>
<td>77 (89.53%)</td>
<td>9 (10.46%)</td>
<td>Chi-Square = 30.78 P &lt; 0.001 RR = 0.2393 95% CI = 0.087-0.951</td>
</tr>
<tr>
<td>ABNORMAL 14</td>
<td>3 (21.42%)</td>
<td>11 (78.57%)</td>
<td></td>
</tr>
<tr>
<td>AFI</td>
<td>VAGINAL DELIVERY</td>
<td>LOWER SEGMENT CAESAREAN SECTION</td>
<td>STATISTICAL SIGNIFICANCE</td>
</tr>
<tr>
<td>AFI &lt;= 5 (32)</td>
<td>18 (56.25%)</td>
<td>14 (43.75%)</td>
<td>Chi-Square = 16.59 P &lt; 0.001 RR = 0.61 95% CI = 0.45-0.84</td>
</tr>
<tr>
<td>AFI &gt; 5 (68)</td>
<td>62 (91.17%)</td>
<td>6 (8.82%)</td>
<td></td>
</tr>
<tr>
<td>UA DOPPLER</td>
<td>VAGINAL DELIVERY</td>
<td>LOWER SEGMENT CAESAREAN SECTION</td>
<td>STATISTICAL SIGNIFICANCE</td>
</tr>
<tr>
<td>Abnormal UA (17)</td>
<td>4 (23.52%)</td>
<td>13 (76.47%)</td>
<td>Chi-Square = 36.68 P &lt; 0.001 RR = 0.25 95% CI = 0.108-0.607</td>
</tr>
<tr>
<td>Normal UA (83)</td>
<td>76 (91.56%)</td>
<td>7 (8.43%)</td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Mode of delivery and admission tests.

<table>
<thead>
<tr>
<th>NST</th>
<th>CLEAR</th>
<th>MECONIUM STAINING</th>
<th>STATISTICAL ANALYSIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>NORMAL (86)</td>
<td>82 (95.34%)</td>
<td>4 (4.65%)</td>
<td>Chi-Square = 52.99 P &lt; 0.001 RR = 0.1498 95% CI = 0.041-0.541</td>
</tr>
<tr>
<td>ABNORMAL (14)</td>
<td>2 (14.28%)</td>
<td>12 (85.71%)</td>
<td></td>
</tr>
<tr>
<td>AFI</td>
<td>CLEAR</td>
<td>MECONIUM STAINING</td>
<td></td>
</tr>
<tr>
<td>AFI &lt;= 5 (32)</td>
<td>22 (68.75%)</td>
<td>10 (31.25%)</td>
<td>Chi-Square = 8.14 P &lt; 0.01 RR = 0.75 95% CI = 0.59-0.96</td>
</tr>
<tr>
<td>AFI &gt; 5 (68)</td>
<td>62 (91.17%)</td>
<td>6 (8.82%)</td>
<td></td>
</tr>
<tr>
<td>UA DOPPLER</td>
<td>CLEAR</td>
<td>MECONIUM STAINING</td>
<td></td>
</tr>
<tr>
<td>ABNORMAL (17)</td>
<td>3 (17.64%)</td>
<td>14 (82.35%)</td>
<td>Chi-Square = 61.27 P &lt; 0.001 RR = 0.18 95% CI = 0.064-0.505</td>
</tr>
<tr>
<td>NORMAL (83)</td>
<td>81 (97.59%)</td>
<td>2 (2.40%)</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Meconium stained liquor and admission tests.
our study (78.57%). Amena Khatun et al. [9] reports 82% caesarean rate from abnormal NST group which is 78.57% in our study and in both study it was statistically significant. Normal Vaginal Delivery rate was 18% from abnormal NST group which is 21.42% in our study. They got statistically non-significant data in abnormal NST and meconium staining liquor which is statistically significant in our study (P < 0.001) (Table 2). In perinatal outcome they have 42% of NICU admission for abnormal group and 76% required immediate resuscitation from abnormal group with a statistically non-significant P value for resuscitation. From normal NST group immediate resuscitation was required in 54% cases which are quite high in comparison to our study (9.30%) which might be because of inclusion of high risk pregnant patient also (Table 3). But NICU admission form normal CTG group is quite similar (10% vs. 9.3%). Sudip Dutta et al. [10] studied the role of admission NST in predicting foetal outcome in high risk obstetric patients. They found vaginal delivery of 64.2% from reacting group and 78.6% caesarean from ominus group (P < 0.001) which closely resembles our study (P < 0.001). They found 8.9% meconium stained liquor, 6.5% NICU admission and 6.5% with APGAR <7 at 5 minutes form reactive group. In our study 4.65% have meconium stained liquor, 9.30% NICU admission, 3.48% (APGAR <7 at 5 minutes) from reactive group. From abnormal group, incidence of meconium staining is 71.4%, NICU admission 57.1%, APGAR <7 at 5 minutes 64.3% (Table 4). In our study Meconium Staining is 85.71%, NICU admission 21.42% and APGAR <7 at 5 minutes is 28.57% from abnormal NST group (Table 5). But in both study p value was statistically significant. Dwarakanath L et al. [11] studied the efficacy of admission CTG to predict obstetric outcome, in which they found incidence of vaginal delivery and caesarean from reactive group is respectively 90.5% and 7.2% which is 89.53% and 10.46%, respectively in our study. While discussing the efficacy of admission test they got sensitivity of 75.8%, specificity of 76.6% PPV of 95.6%, NPV of 32.25% but in our study we got sensitivity of less than 6 and less than 7, respectively was more in group I, but non-significant P value, (P > 0.05) (Table 5). Lastly, predictive value of AFI calculated in respect to perinatal outcome, and it came to sensitivity = 36.84%, Specificity = 69.14%, PPV = 21.88%, NPV = 82.35%, LR (+) 1.19 and LR (-) 0.91 and diagnostic accuracy of 63% (Table 6).

In study of Maha M Al-Bayatti [13] on Amniotic fluid index predictor of perinatal outcome in patients with prolonged pregnancy, they found 27% case of caesarean belong to AFI <5 cm group with meconium staining in 42% case and 5 minutes APGAR of <7 in 16% case with NICU admission in 16% cases. Out of these findings meconium staining in AFI <5 cm group is statistically significant (P = 0.004) other parameter are not statistically significant. In our study 43.75% from group I (AFI <5 cm) underwent caesarean, (Table 1) at a significant P value of less than 0.001 [RR = 0.61, 95% CI = 0.45-0.84]. Incidence of NICU admission was also higher in Group I, but still it was a non-significant (P > 0.05) (Table 4). Incidence of 1 minute and 5 minutes APGAR score of less than 6 and less than 7, respectively was more in group I, but non-significant P value, (P > 0.05) (Table 5). Lastly, predictive value of AFI calculated in respect to perinatal outcome, and it came to sensitivity = 36.84%, Specificity = 69.14%, PPV = 21.88%, NPV = 82.35%, LR (+) 1.19 and LR (-) 0.91 and diagnostic accuracy of 63% (Table 6).

J M Morris et al. [14], found AFI <5cm was associated with severe adverse outcome in their study AFI had the sensitivity for predicting an adverse outcome of 28%, specificity of 91.9% and likelihood ratio of 3.5 in our study we got a sensitivity of 36.84% specificity of 69.14% and likelihood ratio of 1.19% (Table 6). The probable reason behind this difference is that they have a study population of 1584 patients and high as already other risk factors are excluded. In respect to specificity our study matched with study of Rose Jophy et al. [12].

After NST we had performed AFI. A cut off value of 5 cm was taken for division of abnormal (group I) and Normal (group II). 32 patients had AFI of less than or equal to 5 cm and included in group I, and 68 patients had AFI of more than 5 cm and included in group II. Incidence of meconium staining in group I is higher than group II (31.25% vs. 8.82%) (Table 2), which is statistically significant (P < 0.01) [RR = 0.75, 95%, CI = 0.59-0.96]. 43.75% patients from group I and 8.82% from group II underwent caesarean, (Table 1) at a significant P value of less than 0.001 [RR = 0.61, 95% CI = 0.45-0.84]. Incidence of NICU admission was also higher in Group I, but still it was a non-significant (P > 0.05) (Table 4). Incidence of 1 minute and 5 minutes APGAR score of less than 6 and less than 7, respectively was more in group I, but non-significant P value, (P > 0.05) (Table 5). Lastly, predictive value of AFI calculated in respect to perinatal outcome, and it came to sensitivity = 36.84%, Specificity = 69.14%, PPV = 21.88%, NPV = 82.35%, LR (+) 1.19 and LR (-) 0.91 and diagnostic accuracy of 63% (Table 6).

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all are at or beyond 40 weeks. In our study (n = 100) we have taken gestational age of 37-42 weeks.

In another study by Assavari Ashok Bachhav et al. [15], they did AFI measurement on uncomplicated pregnancy. They got 66% caesarean rate \([X^2 = 21.36, P < 0.001]\) from AFI <5cm group. They got a sensitivity of 82% specificity of 63.3% PPV of 51% and NPV of 90%, in which specificity and NPV is close to our study (specificity = 69.14%, NPV = 82.35%).

In a study by Nighat Sultana et al. [16] in oligohydramnios group, incidence of meconium staining is 31% \((P < 0.05)\) caesarean is 37% \((P < 0.05)\) which is closely related to our study.

Masoome Mirteymouri et al. [17] reported predictive value of AFI, Biophysical Profile, NST and foetal movement chart for meconium stained amniotic fluid in prolonged pregnancy they got 62% sensitivity and 42% specificity for NST, and for AFI (<5 cm) 38% sensitivity and 83% specificity. In our study we got sensitivity of 57.89% and specificity of 96.30% in case of NST and in AFI (<5 cm) sensitivity of 36.84% and specificity of 69.14% (Table 6). Here, specificity of our study differs because they had chosen cases with prolonged pregnancy with meconium stained amniotic fluid. In our case low risk patients are selected, so number of true negative is high in our case.

Razek and Mohey EI-Din [18] studied the role of labour admission test in the prediction of the perinatal outcome in high risk pregnancy. They got a sensitivity of 45.1% specificity of 87.13%, PPV = 35.2%, NPV of 91.6% and diagnostic accuracy of 82%. Except PPV, all other findings are quite similar to our study (Table 6).

### Table 5: APGAR and admission tests.

<table>
<thead>
<tr>
<th>Test</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>PPV</th>
<th>NPV</th>
<th>LR+</th>
<th>LR-</th>
<th>DA</th>
</tr>
</thead>
<tbody>
<tr>
<td>NST</td>
<td>57.89%</td>
<td>96.30%</td>
<td>78.57%</td>
<td>90.70%</td>
<td>15.63</td>
<td>0.44</td>
<td>89%</td>
</tr>
<tr>
<td>AFI</td>
<td>36.84%</td>
<td>69.14%</td>
<td>21.88%</td>
<td>82.35%</td>
<td>1.19</td>
<td>0.91</td>
<td>63%</td>
</tr>
<tr>
<td>UA S/D</td>
<td>57.89%</td>
<td>92.59%</td>
<td>64.71%</td>
<td>90.36%</td>
<td>7.82</td>
<td>0.45</td>
<td>82%</td>
</tr>
</tbody>
</table>

### Table 6: Comparison between 3 tests in respect to predictive values.

**Conclusion**

NST, AFI, Umbilical Artery Doppler can be done altogether as an admission test on pregnant patients, for prediction of perinatal outcome. NST can be done as a single best test among these three, with high specificity and high negative predictive value, particularly in poor resource settings.

### References

8. Sandhu GS, Raju R, Bhattacharyya TK, Shaktivardhan (2008) Admission...
Cardiotocography Screening of High Risk Obstetric patients. Medical Journal Armed Forces India 64:43-45.