Ref: Ro J Med Pract. 2023;18(4)
DOI: 10.37897/RJMP.2023.4.2

# Comparative study of the efficacy of fetal Admission test alone and non-stress test done antenatally with fetal Admission test to evaluate fetal outcome

Thota Anusha REDDY, K Sravanthi REDDY, Manchala HINDUMATHI

Department of Obstetrics and Gynaecology, Santhiram Medical College & General Hospital, Nandyal, Andhra Pradesh, India

## ABSTRACT

***Aim.*** *The current study evaluated the efficacy of fetal admission test alone and nonstress test (NST) antenatally with fetal admission test in both low and high risk pregnancy in relation to the fetal outcome in order to decrease the fetal morbidity and mortality.*

***Methods and material.*** *The study included 240 pregnant women after 34 weeks of pregnancy who were categorized into low and high risk groups. The fetal outcome following Antenatal NST and Admission test was studied based on Apgar score of <7 at 5 minutes, Meconium stained liquor, NICU requirement, and mortality.*

***Result.*** *Apgar score <7 at 5 min seen in 8 babies (13.33%), meconium stained liquor in 14(23.33%) and NICU admission in 11 (18.33%) cases in whom both antenatal NST and fetal admission tests were done together. Apgar score <7 at 5 min seen in 14 (23.33%) babies, meconium stained liquor in 18 (30%) and NICU admission in 19 (31.66%) cases in which only the admission test was done. The Antenatal NST for antenatal fetal surveillance shows 96.88% of specificity, 29.17% of sensitivity, 70% of positive predictive value (PPV) and 84.55% of negative predictive value (NPV). The admission test for intrapartum fetal distress shows 99.38% of specificity, 32.91% sensitivity, 75.12% NPV and 96.3% PPV. Both NST and fetal admission test done together significantly decreased the incidence of fetal distress as early intervention was taken to prevent further fetal compromise in high-risk pregnancies. NST strongly correlate with admission test result in high-risk pregnancies.*

***Conclusion.*** *NST and the fetal admission test in high risk pregnancies help with early detection of fetal distress and help with taking the necessary measures to improve fetal outcome.*

**Keywords:** Fetal heart rate, non-stress test, birth asphyxia, admission test, normal vaginal delivery

## INTRODUCTION

Most important concern in obstetric practice should consist of detection methods, avoid and manage the fetal asphyxia. Preterm and postterm births were associated with increased proportions of neonatal morbidity [1,2].

It is known that pure intrapartum hypoxia contributes to less than 10%, whilst the combination of an antenatal and intrapartum insult may contribute to about 25% of those who suffer from neonatal encephalopathy [3]. Sweden, having a stable population have revealed that nearly 28% of the babies had some asphyxia con-

*Corresponding author:*
Thota Anusha Reddy
*E-mail:* thotaanushareddy89@gmail.com

*Article History:*
Received: 11 November 2023
Accepted: 27 November 2023

tributing for their injury at peripartum period [4-6]. Fetus experiences hypoxia injuries caused by stress which leads to mental retardation, cerebral palsy, and paralysis to neonate [7,8].

Advanced noninvasive methods make easy access for intrauterine by the obstetrician. The non-stress test is a widely accepted method for the examination of antepartum fetal surveillance. It will look into the temporary accelerations of the fetal heart and movement. The Nonstress test works based on hypothesis of intact neurologic coupling between fetal heart and the nervous system [10].

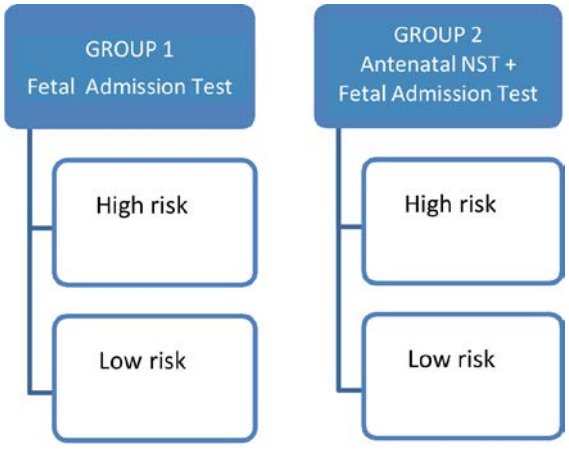
The Admission test assesses the ability of the fetus to withstand the functional stress of uterine contractions [11]. It is a simple, noninvasive, and rapid procedure to examine all patients in labor to predict neonate's health status at early hours [12,13].

The aim of this study is developed to evaluate the reliability of fetal admission test alone or nonstress test done antenatally with fetal admission test for decreasing fetal morbidity and mortality by intervention and treatment.

## PATIENTS & METHODS

**Source of data:** In this study, 240 pregnant and parturient women attending the Department of OBG of Santhiram General Hospital from the duration of December 2015 to June 2017 were considered and divided into two groups (Table 1).

***TABLE 1.*** *Distribution of groups and their interventions*




**Inclusion criteria:**

1. Antenatal reproductive age group
2. Gestational age of 34-42 weeks
3. Singleton pregnancy with cephalic-presentation
4. Patients in first stage of labor for admission test

**Exclusion criteria:**

1. Patients for elective cesarean section
2. Multiple pregnancy
3. Malpresentations
4. Antepartum hemorrhage
5. Congenital anomalies
6. Fetal distress at the time of admission

**Methods of collection of data:**

Based upon the inclusion criteria patients allocated into 2 groups as mentioned above.

**High-risk group included patients with:**

1. Hypertensive disorders of pregnancy
2. Diabetes mellitus
3. Anemia and other hematological diseases
4. Cardiac disorders
5. Collagen vascular disorders like SLE, Systemic sclerosis
6. Renal disease
7. Thyroid disorders
8. BOH
9. Post-dated pregnancy
10. Oligohydramnios
11. Polyhydramnios
12. Reduced fetal movements
13. Intrauterine growth restriction (IUGR)
14. Abnormal FHR by auscultation
15. Rh – Isoimmunization
16. PROM
17. PPROM
18. Grand multiparity

### Method of study

Demographics and clinical history including age, parity, obstetric history, menstrual history, GPE, P/A, P/S, P/V findings were noted.

Baseline investigations were done such as: Hemoglobin%, Urine routine, Blood grouping, HIV, HBsAg, HCV, and Ultrasonography.

Group I: Fetal Admission test was done on admission at labor room, with patient in 1st stage of labor.

Group II: Antenatal NST along with Fetal Admission test on admission at labor room was done.

If the Antenatal NST was reactive, the test was repeated weekly until the patient went into labor and the fetal admission test was done on admission to the labor room.

If the Antenatal NST was non-reactive, the patient was treated appropriately for the underlying cause and the test repeated weekly until admission at labor room. If the test continued to be non-reactive, then Modified Biophysical Profile was done. If the score was low, the patient was informed of the prognosis of the baby, and the pregnancy was terminated.

Further decision made upon:

1. Quality of trace.
2. Cervical dilatation & effacement.
3. Station & Position of presenting part.

A normal admission test permits to encourage mobilization with no further need to perform EFM for 3-4 hrs or until signs of late 1st stage of labor are apparent.

When the Admission test shows a suspicious or pathological category, then continuous EFM is continued & the cause is ruled out first and conservative measures tried, if it is found.

The following measures were taken after checking out the clinical situation;

a. If there was any evidence of hyperstimulation Immediate steps to diminish uterine activity were taken
   - By stopping oxytocics
   - Giving tocolytics (terbutaline or Magnesium sulfate).
   - Inj terbutaline 0.25 mg sc/iv was given
b. Maternal tachycardia or fever were ruled out by
   - Checking maternal pulse, BP and temperature
   - Maternal infection if any was treated
   - Tocolysis stopped / reduced accordingly
   - Patient was hydrated if an epidural analgesia has been given to correct hypotension
c. General resuscitative measures to improve fetal oxygenation & uteroplacental blood flow were taken;
   - Maternal posture was changed to left lateral decubitus position if supine
   - IV fluids were administered (if not contraindicated)
   - Maternal oxygen inhalation was started
d. If suspecting umbilical cord compression the following measures were taken
   - Repositioning of the mother.
   - Amnioinfusion.
   - Manual elevation of presenting part if there was cord prolapse while preparing for immediate delivery.

If the suspicious trace continues, review the clinical situation to simultaneously evaluate the suspected cause with continuous close monitoring.

If it reverts to normal, labor is allowed to progress and if it is progressed to pathological pattern, labor terminated either

1. Operative vaginal delivery (ventouse or outlet forceps application)
2. Cesarean section

Outcome of the result was studied with:

1. Evidence of fetal distress indicated by
   a. Meconium-stained-liquor
   b. APGAR less than 7 at 5 min
   c. NICU requirement
2. Mode of delivery
3. Need for resuscitation
4. Perinatal mortality if any

The baby and mother followed up until discharge.

Equipment-BPL-FM-9853 Fetal monitor includes:

A. Doppler transducer
B. The tocotransducer
C. Event marker
D. The trace and the paper

## Procedure

**Duration:** 20-40 minutes.

Patient seated either in semi-fowler's position/in reclining chair. Should take care to avoid supine hypotension and hence a pillow placed below the right hip. Blood pressure must be recorded. Doppler ultrasound transducer placed onto the abdomen to measure fetal heart rate. Tocodynamometer used to detect uterine contractions.

Reactive test is preferred if there are two accelerations in fetal heart rate of 15 bpm amplitude and of 15 seconds duration noted about 20 min. If no fetal movement noted at initial 20 min, it is continued upto 20 minutes of extension. If there is no acceleration, during a 40-minutes period, the test is considered Non-reactive (Table 2, Table 3).

***TABLE 2.*** *Classification of Fetal heart rate Features based on Intrapartum care guidelines of National Institute for Clinical Excellence 2007*

| Feature | Baseline | Variability | Accelerations | Decelerations |
|---|---|---|---|---|
| Re-assuring | 110-160 bpm | ≥5 | Present | No |
| Non-reassuring | 100-109 bpm | <5 for >40 min but <90 min | Absence of accelerations with an otherwise normal CTG is of uncertain significance | Typical variable decelerations with 50% of contractions occurring >90 min |
| | 161-180 bpm | | | |
| | | | | Single prolonged deceleration <80 bpm upto 3 min |
| Abnormal | <100 bpm | <5 for ≥90 min | | Atypical variable or late or both decelerations occurring 50% of contractions in 30 min period |
| | >180 bpm | | | |
| | Sinusoidal pattern >10 min | | | Single prolonged deceleration <80 bpm for >3 min |

***TABLE 3.*** *Classification of cardiotocography features based National Institute for Clinical Excellence 2007 Guidelines*

| Category | Definition |
|---|---|
| Normal | CTG all 4 features are "reassuring" |
| Suspicious | CTG one feature is "non-reassuring" and other features are reassuring |
| Pathological | CTG two or more features are classified as non-reassuring |

**Statistical analysis:**

The data collected in MS Excel 2019 and analysis was carried out using statistical software SPSS version. 24.0 (IBM, US). Various finding of both Group A, B, C and Group D were compared with percentage. One-way ANOVA F-test was done is between two groups that were used to identify the significance of means. Chi square used to identify the significance of the difference in proportions. P value <0.05 is considered as statistically significant.

**Calculated:**

NPV=True negatives/True Negatives+False negatives, PPV=True positives/True positives+False positives, sensitivity=True positives/True positives+False negatives, specificity=True negatives/True negatives+-False positives.

## RESULTS

All 240 patients were categorized into:

Group A: Antenatal NST with admission test – High Risk;

Group B: Antenatal NST with admission test – Low Risk Group;

Group C: Admission test only – High Risk;

Group D – Admission test only – Low Risk.

Each group consisting of 60 women.

**Parity:** There were equal distribution of parity in each group.

Primigravida in 26 cases, multigravida in 34 cases of group A; Primigravida in 28 cases, multigravida in 32 cases of group B; Primigravida in 25 cases, multigravida in 35 cases of group C; and Primigravida in 23 cases, multigravida in 37 cases of group D respectively.

**Risk factors:**

The high-risk groups consisted of 120 patients each. Pre-eclampsia is the common risk factors in group A and B (16.66% & 18.33%), followed by postdated pregnancy (13.33% & 18.33%), anemia (11.66% & 13.33%), Gestational hypertension (10% & 8.33%), oligohydramnios (10% & 6.66%), Polyhydramnios (8.33% & 8.33%), PROM (6.66% &3.33%), Rh Negative pregnancy (6.66% & 3.33%), Thyroid disorder( 5.0 % & 3.33%), and gestational diabetes mellitus (1.68% & 5.01%).

**Pattern of delivery:** The pattern of delivery in group-A and group-C were compared. 36 women (60%) in Group-A and 38 women (63.4%) in group-C had vaginal delivery. 17 women (28.34%) in group A and 18 women (30%) in group C had delivery by cesarean section. 3 women (5%) in group A and 2 women (3.3%) in group C had outlet forceps delivery. 4 women (6.66%) in group A and 2 women (3.3%) in group C had delivery by ventouse application. The difference of modes of delivery in group-A and group-C was not statistically significant (Table 4).

***TABLE 4.*** *Distribution of mode of delivery and CTG pattern in Group A (High risk)*

| Mode of delivery | NST number | Reactive % | NST No | Nonreactive % |
|---|---|---|---|---|
| Vaginal | 27 | 75 | 9 | 25 |
| LSCS | 11 | 64.7 | 6 | 35.3 |
| Outlet forceps | 1 | 33.3 | 2 | 66.7 |
| Ventouse | 1 | 25 | 3 | 75 |
| Total | 40 | | 20 | |

**Distribution of mode of delivery and CTG pattern in Group A:**

In study Group-A, 27 women (75%) with reactive Antenatal NST and 9 women (25%) with non-reactive Antenatal NST, delivered vaginally. 11 (64.7%) with reactive Antenatal NST and 6 (35.3%) with non-reactive Antenatal NST delivered by LSCS. 1 woman (33.3%) with reactive Antenatal NST and 2 (66.7%) with non-reactive Antenatal NST delivered by outlet forceps. 1 (25%) with reactive Antenatal NST and 3 (75%) with non-reactive Antenatal NST delivered by ventouse application. Of the patients delivered vaginally, 29 (80.6%) had normal admission test, 7 (19.4%) had suspicious-pattern and none had pathological-pattern. Of the patients delivered by LSCS, 7 (41.2%) had normal-pattern, 8 (47.1%) had suspicious-pattern and 2 (11.7%) had pathological-pattern. Of the patients delivered by outlet forceps, 1 (33.3%) had suspicious pattern and 2 (66.7%) had pathological-pattern. Of the patients delivered by ventouse, 1 (25%) had suspicious-pattern and 3 (75%) had pathological-pattern. This shows that operative deliveries (LSCS) are more following suspicious and pathological patterns of admission test. The NST results strongly correlated with the admission test results (Table 5).

**Distribution of mode of delivery and CTG pattern in Group C:**

Among Group-C, 25 (65.8%) women with normal pattern, 11 (28.9%) with suspicious pattern and 2 (5.3%) with pathological pattern delivered vaginally. Of the women undergoing LSCS, 4 (22.2%) had normal pattern, 7 (38.9%) had suspicious pattern and 7 (38.9%) had pathological pattern. Of the 2 women who delivered by outlet forceps, both had a pathological pattern. Of the two women who delivered by ventouse application for

***TABLE 5.*** *Distribution of delivery mode and CTG pattern in Group A (high risk), and Group-C (high risk)*

| Mode of delivery | Admission test | | | | | | Total |
|---|---|---|---|---|---|---|---|
| | Normal | | Suspicious | | Pathological | | |
| | n | % | n | % | n | % | |
| **Group-A** | | | | | | | |
| Vaginal | 29 | 80.6 | 7 | 19.4 | - | - | 36 |
| LSCS | 7 | 41.2 | 8 | 47.1 | 2 | 11.7 | 17 |
| Outlet forceps | - | - | 1 | 33.3 | 2 | 66.7 | 3 |
| Ventouse | - | - | 1 | 25 | 3 | 75 | 4 |
| Total | 36 | | 17 | | 7 | | 60 |
| **Group-C** | | | | | | | |
| Vaginal | 38 | 25 | 65.8 | 11 | 28.9 | 2 | 5.3 |
| LSCS | 18 | 4 | 22.2 | 7 | 38.9 | 7 | 38.9 |
| Outlet forceps | 2 | - | | - | | 2 | 100 |
| Ventouse | 2 | - | | 2 | 100 | - | |
| Total | 60 | 29 | | 20 | | 11 | |

prolonged 2nd stage, had a suspicious pattern. This shows that operative deliveries (LSCS) are following more suspicious and pathological patterns of admission test.

**Indication for LSCS in Group A & C:**

The common indications for LSCS in Group A and Group C were CPD (29.43%, 33.35%) had fetal distress (35.29%, 38.88%), failed induction of labor (17.64% & 16.66%), and unfavorable cervix (17.64% & 11.11%) (Table 6).

***TABLE 6.*** *Comparison of the indicators of fetal distress and Risk factors in group-A & C (High risk)*

| Indicators of fetal distress | Group A | | Group C | | p value |
|---|---|---|---|---|---|
| | n | % | n | % | |
| Apgar score at 5 min <7 | 8 | 13.33 | 14 | 23.33 | 0.0001 |
| Meconium stained liquor | 14 | 23.33 | 18 | 30.00 | 0.0002 |
| NICU admission | 11 | 18.33 | 19 | 31.66 | 0.0001 |
| Risk factors | | | | | |
| Birth asphyxia | 7 | 63.63 | 8 | 42.10 | |
| Early onset sepsis with respiratory distress | 2 | 18.19 | 2 | 10.52 | |
| Meconium aspiration syndrome | 1 | 9.09 | 4 | 21.05 | |
| Prematurity with HMD | 1 | 9.09 | 5 | 26.33 | |

**Indicators & Risk factors of fetal distress in group A & C:**

It was observed that Apgar score at 5 min <7 was seen in 8 (13.33%) babies in Group A & 14 (23.33%) babies in Group-C. This difference was statistically significant. Meconium stained liquor was seen in 14 (23.33%) women in Group-A & 18 (30.00%) in Group-C, which was statistically significant. NICU admission was done for 11 (18.33%) babies in Group-A and 19 (31.66%) babies in Group-C, the difference again being statistically significant.

The common indication for NICU admission in Group A & C was Birth asphyxia (63.63%, 42.10%), early onset sepsis with respiratory distress (18.19% & 10.52%), meconium aspiration syndrome (9.09% & 21.05%), prematurity with hyaline membrane disease (9.09% & 26.33%) (Table 7).

***TABLE 7.*** *Distribution of mode of delivery and CTG pattern in Group-B (Low risk)*

| Mode of delivery | Total | Admission test | | | | | |
|---|---|---|---|---|---|---|---|
| | | Normal | | Suspicious | | Pathological | |
| | | No | % | No | % | No | % |
| Vaginal | 55 | 51 | 92.73 | 4 | 7.27 | - | |
| LSCS | 2 | 1 | 50 | 1 | 50 | - | |
| Ventouse | 2 | - | | 1 | 50 | 1 | 50 |
| Forceps | 1 | - | | - | | 1 | 100 |
| Total | 60 | 52 | | 6 | | 2 | |

**Delivery Mode low risk (group-B and D):**

In Group-B, 55 (91.66%) delivered vaginally, 2 (3.33%) by LSCS and 2 (3.33%)by ventouse and one by outlet forceps(1.68%). In Group-D, 54 (90%) delivered vaginally, 3 (5%) by LSCS and 2 (3.33%) by ventouse and one by outlet forceps (1.67%). The difference was not significant in both groups (Table 8).

**Mode of delivery and CTG pattern in Group-B & D:**

In Group-B, of the vaginal deliveries, 51 (92.73%) had reactive NST,4 (7.27%) had non-reactive NST, Out of which 51 had normal 4 had suspicious admission test. Of the two LSCS both had reactive NST and one each had normal and suspicious admission test. Of the two ventouse both had reactive NST and one each suspicious and pathological admission test. Of the one delivery by outlet forceps, NST is reactive and had pathological pattern on admission test.

In Group-D, of the vaginal deliveries 43 (79.62%) had normal and 11 (20.38%) had suspicious admission

***TABLE 8.*** *Mode of delivery and CTG pattern in Group-D and group-B*

| Mode of delivery | Total | Admission test | | | | | |
|---|---|---|---|---|---|---|---|
| | | Normal | | Suspicious | | Pathological | |
| | | No | % | No | % | No | % |
| **Mode of delivery and CTG pattern in Group-D** | | | | | | | |
| Vaginal | 54 | 43 | 79.62 | 11 | 20.38 | - | - |
| LSCS | 3 | 1 | 33.33 | 1 | 33.33 | 1 | 33.34 |
| Ventouse | 2 | - | - | 1 | 50 | 1 | 50 |
| Outlet forceps | 1 | - | - | - | - | 1 | 100 |
| **Mode of delivery and CTG pattern in Group-B** | | | | | | | |
| Vaginal | 55 | 51 | 92.73 | 4 | 7.27 | | |
| Lscs | 2 | 1 | 50 | 1 | 50 | | |
| Ventouse | 2 | | | 1 | 50 | 1 | 50 |
| Forceps | 1 | | | | | 1 | 100 |

test. Of the 3 LSCS, one each had a normal suspicious and pathological patterns. Of the 2 ventouse, one each had suspicious and pathological patterns. Of the one delivery by outlet forceps, had pathological pattern (Table 9).

***TABLE 9.*** *Indications for LSCS and indicators of fetal distress in Group B & D. Indication for NICU admission*

| | Group B | | Group D | |
|---|---|---|---|---|
| | n | % | n | % |
| **Indications for LSCS** | | | | |
| CPD | 1 | 50 | 1 | 33.34 |
| Fetal distress | 1 | 50 | 2 | 66.66 |
| Failed Induction of labor | - | - | - | - |
| Unfavorable cervix | - | - | - | - |
| **Indicators of fetal distress** | | | | |
| Apgar score at 5 min <7 | 2 | 3.33 | 3 | 5.0 |
| Meconium stained liquor | 8 | 13.33 | 9 | 15.0 |
| NICU admission | 4 | 6.66 | 5 | 8.33 |
| **Indication** | | | | |
| Birth asphyxia | 2 | 50 | 3 | 60 |
| Early onset sepsis with respiratory distress | 1 | 25 | 1 | 20 |
| Meconium aspiration syndrome | 1 | 25 | 1 | 20 |

The indication for LSCS in Groups-B and D were Borderline CPD and fetal distress.

It was observed that Apgar-score 5 min <7 was noted in 2 (3.33%) babies in Group-B & 3 (5.0%) babies in Group-D without significant difference. Meconium stained liquor was seen in 8 (13.33%) babies in Group-B and 9 (15.0%) babies in Group D. There was no significant difference observed among Apgar-score 5 min <7, meconium stained liquor and NICU-admission in low risk group. The indications for NICU admission in Group B and D were Birth asphyxia (50% & 60%) and remaining were early onset sepsis with respiratory distress, and meconium aspiration syndrome in group-B and group-D respectively (Table 10).

***TABLE 10.*** *Comparison between the modes of delivery in Group A & B (High risk & Low risk)*

| | Group A | | Group B | | P value |
|---|---|---|---|---|---|
| | n | % | n | % | |
| **Mode of delivery** | | | | | |
| Vaginal | 36 | 60 | 55 | 91.66 | 0.0003 |
| LSCS | 17 | 28.34 | 2 | 3.33 | 0.0001 |
| Outlet forceps | 3 | 5 | 1 | 1.68 | 0.3 |
| Ventouse | 4 | 6.66 | 2 | 3.33 | 0.2 |
| **Indicators of fetal distress** | | | | | |
| Apgar score at 5 min <7 | 8 | 13.33 | 2 | 3.33 | 0.02 |
| Meconium stained liquor | 14 | 23.33 | 8 | 13.33 | 0.001 |
| NICU admission | 11 | 18.33 | 4 | 6.66 | 0.02 |

In this study, the modes of delivery between Groups A and B were compared. In Group-A, 36 (60%) delivered vaginally and 17 (28.34%) delivered by LSCS.

In Group-B 55(91.66%) delivered vaginally and 2 (3.33%) delivered by LSCS. In Group-A, 3(5%) delivered by outlet forceps and 4 (6.66%) delivered by ventouse. In Group-B, 1 (1.68%) had delivered by forceps and 2 (3.33%) delivered by ventouse.

**Association between indicators of fetal distress and modes of delivery in Group A & B:**

8 (13.33%) babies in Group-A and 2 (3.33%) babies in Group-B had Apgar score 5 min <7, the difference is statistically significant. Meconium stained liquor seen in 14 (23.33%) cases in group-A and 8 (13.33%) cases in Group-B, the difference is statistically significant. 11 (18.33%) babies in Group-A and 4 (6.66%) in Group-B admitted in NICU, the difference is statistically significant. It was shown that fetal distress common in the high-risk pregnant when compared to low risk (Table 11).

***TABLE 11.*** *Comparison between delivery mode in Group C & D (High risk & Low risk)*

| Mode of delivery | Group C | | Group D | | P value |
|---|---|---|---|---|---|
| | n | % | n | % | |
| **Mode of delivery** | | | | | |
| Vaginal | 38 | 63.34 | 54 | 90 | 0.002 |
| LSCS | 18 | 30.00 | 3 | 5 | 0.005 |
| Outlet forceps | 2 | 3.3 | 1 | 1.67 | 0.32 |
| Ventouse | 2 | 3.3 | 2 | 3.33 | 0.15 |
| **Indicators of fetal distress** | | | | | |
| Apgar score at 5 min <7 | 14 | 23.33 | 3 | 5 | 0.02 |
| Meconium stained liquor | 18 | 30 | 9 | 15 | 0.0019 |
| NICU admission | 19 | 31.66 | 5 | 8.33 | 0.008 |

**Comparison between the delivery mode in group C & D:**

The mode of delivery in Group C and D were compared. 38 (63.34%) women in group C delivered vaginally and 18 (30%) delivered by LSCS. In Group-D, 54 (90%) delivered vaginally and 3 (5%) delivered by LSCS. 2 (3.3%) women in group-C delivered by outlet forceps and 2 (3.3%) women delivered by ventouse. 1 (1.67%) women in group-D delivered by outlet forceps and 2 (3.33%) women delivered by ventouse.

This difference was statistically significant for LSCS. But the difference was not significant for outlet forceps and ventouse delivery. This indicates that the incidence of LSCS is high in the high-risk group.

The incidence of fetal distress in Groups C and D were compared. In Group-C, 14 (23.33%) babies and Group-D 3 (5%) babies had Apgar score 5 min <7, with statistically significant difference. Meconium stained liquor was present in18 (30%) cases in Group-C and 9 (15%) cases in Group-D, with statistically significant difference. NICU admission was seen in 19 (31.66%) babies in Group-C and 5 (8.33%) babies in Group-D difference is statistically significant. It shows fetal distress is common in high-risk group (Table 12).

***TABLE 12.*** *APGAR Vs NST results*

| | Reactive | | Non-reactive | |
|---|---|---|---|---|
| | n | % | n | % |
| APGAR score at 5 min | | | | |
| Apgar >7 | 93 | 96.87 | 17 | 70.83 |
| Apgar <7 | 3 | 3.13 | 7 | 29.17 |
| Meconium stained liquor | | | | |
| Absent | 88 | 91.66 | 10 | 41.66 |
| Present | 8 | 8.33 | 14 | 58.34 |
| NICU Admission | | | | |
| No | 92 | 93.9 | 13 | 61.9 |
| Yes | 4 | 6.1 | 11 | 38.1 |

In women with a reactive Antenatal NST, 3 (3.13%) babies had Apgar score 5 min <7, where as in women with non-reactive Antenatal NST, 7 (29.17%) babies had Apgar score 5 min <7. The nonreactive Antenatal NST group showed significant difference in the incidence of Apgar score <7 at 5 min. Specificity was 96.88%, Sensitivity was 29.17%, PPV of 70%, and NPV was 84.55%.

Sensitivity defined as an ability of any test to identify babies who truly suffered fetal distress (True positive).

Specificity defined as any test to identify babies without any fetal distress (True Negative).

Positive predictive value is the probability in which the baby of women with a positive test (non-reactive / suspicious / pathological) really has fetal distress (False positive).

Negative Predictive value is the probability that the baby of women with negative test (reactive or normal) really does not have fetal distress (False negative).

The incidence of meconium-stained liquor is high with a non-reactive Antenatal NST. Specificity is 91.67%, Sensitivity is 58.33%, PPV was 63.64%, and NPV was 89.80%.

**NICU Admission V/s Antenatal result:**

Significantly more babies born to non-reactive Antenatal NST group, 11(38.1%) required NICU admission whereas only 4(6.1%) in the reactive group had NICU admission. The sensitivity is 45.83%, Specificity is 95.83%, PPV is 73.33% and NPV is 87.62% (Table 13).

***TABLE 13.*** *Association between APGAR and Admission test & Meconium stained liquor and Admission test & NICU admission and Admission test result*

| | Normal | | Suspicious | | Pathological | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| APGAR score at 5 min | | | | | | |
| Apgar >7 | 160 | 99.37 | 44 | 78.57 | 9 | 39.13 |
| Apgar <7 | 1 | 0.63 | 12 | 21.43 | 14 | 60.87 |
| Meconium stained liquor | | | | | | |
| No | 152 | 94.40 | 37 | 66.07 | 2 | 8.70 |
| Yes | 9 | 5.60 | 19 | 33.93 | 21 | 91.30 |
| NICU admission | | | | | | |
| No | 155 | 96.27 | 43 | 76.78 | 3 | 13.04 |
| Yes | 6 | 3.73 | 13 | 23.22 | 20 | 86.96 |

**Association between APGAR and Admission test:**

In women with normal test, 1 (0.63%) had baby with Apgar score at 5 min <7, whereas 12 (21.43%) in the suspicious group and 14 (60.87%) in the pathological groups had low Apgar scores. Sensitivity is 32.91%, Specificity is 99.38%, PPV was 96.30%, and NPV was 75.12%.

**Meconium stained liquor V/s Admission test:**

The Meconium stained liquor incidence is significantly higher in group with suspicious and pathological pattern when compared to normal pattern. The sensitivity is 50.63%, Specificity is 94.41%, PPV was 81.63%, and NPV was 79.58%.

**NICU admission V/s Admission test:**

Significantly higher number of babies born to women with suspicious, 13 (23.22%) and pathological, 20 (86.96%) pattern had NICU admission when compared to women with normal admission test pattern. Sensitivity was 41.77%, Specificity was 96.27%, PPV was 84.62%, and NPV was 77.11% (Table 14).

Prenatal mortality was 2 in Group-A, in which both of them had a nonreactive NST and pathological admission test pattern. 2 babies, delivered by outlet forceps, had birth asphyxia. The perinatal mortality was 2 in Group-C, both of whom had an pathological admission

***TABLE 14.*** *Perinatal mortality in group A & C*

| | | NST | AT | Mode of delivery | APGAR | | Outcome | Cause |
|---|---|---|---|---|---|---|---|---|
| Group A | 1 | NR | Pathological | Outlet forceps | 4 | 5 | Died after 3 days | Birth asphyxia |
| | 2 | NR | Pathological | Outlet forceps | 1 | 3 | Died within 24hrs | Birth asphyxia |
| Group C | 3 | - | Pathological | Outlet forceps | 3 | 5 | Died within 48hrs | Birth asphyxia |
| | 4 | - | Pathological | LSCS | 3 | 6 | Died within 48hrs | MAS |

test , one baby, delivered by LSCS had meconium aspiration syndrome & other baby delivered by outlet forceps had birth asphyxia.

## DISCUSSION

Comparison of abnormal CTG & perinatal outcome:

In our study, Abnormal CTG was 33%, MSL in 20.4%, LSCS in 16.6%, Apgar score at 5 min <7 was 11.25%, NICU admission was 16.25%, and Perinatal mortality was 1.6% When compared to Hafizur Rahman et al study [15] we have lesser percentage of decreased Apgar scores & lesser operative deliveries but no much difference in NICU admissions. This is because of early active & timely intervention.

**Comparison of NST results in low and high risk group:**

Our study shows more Non-reactive NST's in high risk groups when compared to Swati Garg et al study. Swati Garg et al [16] show Non-reactive in 12% cases. This shows that Antenatal NST is good predictor of fetal compromise during antenatal period in high risk groups which helps in early intervention & treatment.

No significant difference found between NST results in both studies in low risk groups.

**Comparison of NST-APGAR results:**

In the present study Sensitivity and NPV are low and specificity and PPV are high when compared to Himabindu et al and Abhijit Biswas et al studies and sensitivity is higher when compared to Swati Patel et al study and specificity, PPV, NPV are similar (Table 15).

**Comparison of NST-MSL results:**

In our study, the sensitivity is low when compared to Himabindu et al study and higher when compared to Swati Patel et al study. Specificity is high when compared to Himabindu et al study and almost similar when compared to Swati Patel et al study. The PPV is higher when compared to both studies. NPV is low when compared to Himabindu et al study and high when compared to Swati Patel et al study. So this shows that active timely intervention has been taken accordingly.

***TABLE 15.*** *Comparison of NST- APGAR results, NST- MSL results, NST- NICU results*

| | Present study | Himabindu et al [17] | Abhijit Biswas et al [18] | Swati Patel et al |
|---|---|---|---|---|
| **NST-APGAR score** | | | | |
| Sensitivity | 29.17 | 82 | 85 | 22.38 |
| Specificity | 96.88 | 81 | 76 | 97.87 |
| Positive predictive value | 70 | 47 | 42 | 71.42 |
| Negative predictive value | 84.55 | 96 | 96 | 84.19 |
| **NST-MSL** | | | | |
| Sensitivity | 58.33 | 84 | - | 32.8 |
| Specificity | 91.67 | 85 | - | 92.2 |
| Positive predictive value | 66.64 | 53 | - | 50 |
| Negative predictive value | 89.80 | 96 | - | 85.29 |
| **NST-NICU admission** | | | | |
| Sensitivity | 45.83 | 92 | - | - |
| Specificity | 95.83 | 79 | - | - |
| Positive predictive value | 73.33 | 40 | - | - |
| Negative predictive value | 87.62 | 98 | - | - |

**Comparison of NST-NICU results:**

In the present study Sensitivity and NPV are low and specificity and PPV are high when compared to Himabindu et al & Begum MA et al study groups. Begum MA et al [19] study NST-NICU results shows 57.14%, 86.66%, 40%, and 92.85% of Sensitivity, Specificity, PPV, and NPV. In Present study, specificity and PPV were higher than compared to Himabindu et al, Begum MA et al study groups (Table 16).

Our study shows that operative deliveries are more in both high risk groups. Whereas APGAR score, Meconium stained liquor, NICU admission were low in group where both tests are done when compared to the group where only single test is done. Therefore early detection antenatally by abnormal test results followed by early appropriate intervention decreased perinatal

***TABLE 16.*** *Test results between group where NST& AT are done together and where only AT is done in low and high risk group*

| | NST + Admission test | Admission test |
|---|---|---|
| **High risk** | | |
| LSCS | 28% | 30% |
| APGAR<7 AT 5 min | 13% | 23% |
| MSL | 23% | 30% |
| NICU admission | 18% | 32% |
| **Low risk** | | |
| LSCS | 3.3% | 5% |
| APGAR<7 AT 5 min | 3.3% | 5% |
| MSL | 13.3% | 15% |
| NICU admission | 6.6% | 8.3% |

morbidity in high risk groups where both tests are done together when compared to group where only admission test is done. Hence it is observed that doing both Antenatal NST and fetal admission test together, significantly decreased the incidence of fetal distress. So therefore both antenatal NST & fetal admission test done together is a good predictor of fetal outcome.

Hence from our study it is observed that no significant difference found between group where antenatal NST & fetal admission test done together and in group where only Fetal admission test alone is done in view of operative deliveries, Apgar scores & NICU admissions. Hence no significant difference found in perinatal outcome in both groups in low risk pregnancies (Table 17).

***TABLE 17.*** *Comparison of AT-APGAR score and of AT - NICU results*

| AT-APGAR score | Present study | Mohd Rasheed et al [20] |
|---|---|---|
| Sensitivity | 32.91 | 77 |
| Specificity | 99.38 | 93 |
| Positive predictive value | 96.30 | 80 |
| Negative predictive value | 75.1 | 91 |
| **CTG-NICU** | **Present study** | **Hafizur Rahman et al** |
| Sensitivity | 41.77 | 63 |
| Specificity | 96.27 | 91 |
| Positive predictive value | 84.62 | 55 |
| Negative predictive value | 77.11 | 93 |

When comparing AT-APGAR score results, our study shows high specificity and PPV and low sensitivity & NPV when compared to Rasheed et al study.

*Conflict of interest:* no conflict of interest between authors
*Financial support:* none

When comparing AT - NICU score results, our study shows high specificity and PPV and low sensitivity & NPV when compared to Hafizur Rahman et al study. Hence NICU admissions are decreased by early intervention.

**Comparative study of admission test results:**

As compared to Kansal et al (12.4% & 7.4%), our study showed higher percentage of both suspicious and pathological test results (23.33% and 9.58%) [21]. This may probably be due to the fact that our hospital is a tertiary referral center where most of the complicated deliveries were referred from PHCS and District hospital.

The present study showed an incidence of 67.08% normal patterns, 23.33% suspicious pattern and 9.58% pathological pattern as compared to Sandhu et al [22] which showed 67% normal pattern 23% suspicious pattern, and 10% pathological pattern on Admission testing which is almost similar.

But these tests have their limitations, as they cannot, predict an acute asphyxia event. Thus they serve as screening tests and definitely help us to improve the fetal outcome.

## CONCLUSION

The Antenatal NST is a valuable test for fetal surveillance during pregnancy. The admission test is a good test to screen for intrapartum fetal distress. In patients with a suspicious or abnormal pattern, the incidence of fetal discomfort and LSCS is much higher. Antenatal NST and fetal admission test performed simultaneously significantly reduced the incidence of fetal distress because early intervention was taken to prevent further fetal impairment, particularly in the high-risk group. In the high-risk category, the NST values substantially correspond with the admission test outcomes.

The current study also shows that doing both antenatal NST and fetal admission tests in high risk groups definitely aids in the early detection of fetal distress and prompts us to take active and essential intervention to improve fetal outcome. These tests, however, have limitations in that they cannot anticipate an acute asphyxia episode.

Hence, they function as screening tests and undoubtedly aid in improving fetal outcomes.

## REFERENCES


1. Sharma P, Gandotra N, Rana D, Rasheed S, Sharma AK. Correlation of admission labour admission test in low risk pregnancies with pregnancy outcome. *Int J Reprod Contracept Obstet Gynecol.* 2019;8(5):1880-4. https://doi.org/10.18203/2320-1770.ijrcog20191936
2. Lohana RU, Khatri M, Hariharan C. Correlation of Nonstress test with fetal outcome in term pregnancy (37-42 Weeks). *Int J Reprod Contracept Obstet Gynecol.* 2013;2(4):639-45. doi: 10.5455/2320-1770.ijrcog20131229
3. Practice bulletin no. 145: antepartum fetal surveillance. *Obstet Gynecol.* 2014;124(1):182-92. doi: 10.1097/01.AOG.0000451759.90082.7b
4. Itakura A, Satoh S, Aoki S, Fukushima K, Hasegawa J, Hyodo H et al. Guidelines for obstetrical practice in Japan: Japan Society of Obstetrics and Gynecology and Japan Association of Obstetricians and Gynecologists 2020 edition. *J. Obstet. Gynaecol Res.* 2023;49(1):5-3. https://doi.org/10.1111/jog.15438
5. McDonnell S, Chandraharan E. Fetal heart rate interpretation in the second stage of labour: pearls and pitfalls. *Br J Med Med Res.* 2015;7(12):957-70. doi: 10.9734/BJMMR/2015/17022
6. Himmelmann K, Uvebrant P. The panorama of cerebral palsy in Sweden part XII shows that patterns changed in the birth years 2007–2010. *Acta paediatrica.* 2018;107(3):462-8. https://doi.org/10.1111/apa.14147.
7. Euliano TY, Darmanjian S, Nguyen MT, Busowski JD, Euliano N, Gregg AR. Monitoring fetal heart rate during labor: a comparison of three methods. *J Pregnancy.* 2017. https://doi.org/10.1155/2017/8529816
8. Bayes S, Whitehead L. Cardiotocography vs. Intermittent auscultation in assessing fetal well-being. *Amer J Nurs.* 2018;118(6):23. doi: 10.1097/01.NAJ.0000534845.27761.cc
9. Hamelmann P, Vullings R, Kolen AF, Bergmans JW, van Laar JO, Tortoli P et al. Doppler ultrasound technology for fetal heart rate monitoring: a review. *IEEE Trans Ultrason Ferroelectr Freq Control.* 2019;67(2):226-38. doi: 10.1109/TUFFC.2019.2943626
10. Karmakar C, Kimura Y, Palaniswami M, Khandoker A. Analysis of fetal heart rate asymmetry before and after 35 weeks of gestation. *Biomed Signal Process Control.* 2015;21:43-8. https://doi.org/10.1016/j.bspc.2015.05.010
11. Blix E, Øian P. Labor admission test: an assessment of the test's value as screening for fetal distress in labor. *Acta Obstet Gynecol Scand.* 2001;80(8):738-43. doi: 10.1080/j.1600-0412.2001.080008738.x
12. Gurung G, Rana A, Giri K. Detection of intrapartum fetal hypoxia using admission test (AT). *N J Obstet. Gynaecol.* 2006;1(2):10-3.
13. Mohan M, Ramawat J, La Monica G, Jayaram P, Fattah SA, Learmont J et al. Electronic intrapartum fetal monitoring: a systematic review of international clinical practice guidelines. *AJOG Glob. Rep.* 2021;1(2):100008. https://doi.org/10.1016/j.xagr.2021.100008
14. Ayres-de-Campos D, Spong CY, Chandraharan E. FIGO consensus guidelines on intrapartum fetal monitoring: Cardiotocography. *Int J Reprod Contracept Obstet Gynecol.* 2015;131(1):13-24. https://doi.org/10.1016/j.ijgo.2015.06.020
15. Rahman H, Renjhen P, Dutta S, Kar S. Admission cardiotocography: Its role in predicting foetal outcome in high-risk obstetric patients. *Australas Med J.* 2012;5(10):522-7. doi: 10.4066/AMJ.2012.1267
16. Garg S, Gupt A, Madhavan J.Non-stress test as an admission test to assess the outcome in high-risk pregnancy. *Int J Reprod Contracept Obstet Gynecol.* 2016;5:3993-4000.
17. Himabindu P, Sundari MT, Pavani S. Evaluation of non stress test in monitoring high risk pregnancies. *IOSR J Dent Med Sci.* 2015;14(4):40-2. doi: 10.9790/0853-14474042
18. Abhijit Biswas, Walliullah M d, Biswas Soma, Mukhopadhyay A K, Ghia Canna J, VedJignesh K. Role of Nonstress Test in Monitoring High Risk Pregnancy. *Indian Medical Gazette.* 2013 Feb;147(2):43-8.
19. Begum MA, Khatun S. Nonstress test in high-risk pregnancy: Evaluation and Management. *The Orion.* 2002 May;12.
20. Mohd Rasheed, Ajay K. Srivastava Labour admission test: a screening test for foetal distress in labour Mohd R et al. *Int J Reprod Contracept Obstet Gynecol.* 2017;6(2):452-6.
21. Kansal R, Goel G, Mangala D, Garg P, Verma K. Geetika. Correlation of admission test with neonatal outcome. *Peoples J Sci Res.* 2014;7(1):27-31.
22. Sandhu GS, Raju R, Bhattacharyya TK. Admission cardiotocography screening of high risk obstetric patients. *Med J Armed Forces India.* 2008;64(1):43-5. https://doi.org/10.1016/S0377-1237(08)80145-1