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Clinical Profile and Out Come of Pregnancies with NRFHR in Labor at Three Teaching Hospitals, Addis Ababa, Ethiopia

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ABSTRACT

Background: Intrapartum fetal heart rate monitoring with intermittent auscultation using fetoscope is still the method in use in Ethiopia and other developing countries. The purpose of this study was to evaluate the prevalence of NRFHR using intermittent auscultation and related operative intervention rates, perinatal out comes and factors associated.

Methodology: This is a cross-sectional study. Data was collected using pre-tested questionnaire June-September, 2005 at 3 teaching hospitals in Addis Ababa, Ethiopia. All laboring women with alive fetus at admission to the labor ward and developed NRFHR while followed with intermittent auscultation were included.

Result: There were 257 deliveries with NRFHR out of a total of 1379 deliveries during the study period. Prevalence of NRFHR in labor was 18.6% (257/1379). Bradycardia was the commonest FHR abnormality (65%). Cesarean section was the mode of delivery in 43% of cases with NRFHR and cesarean section rate for NRFHR was 7.5%. The positive predictive value of intermittent auscultation for low 1st and 5th minutes APGAR scores were 38.9% & 13.2% respectively. Low apgar score (LAS) rate was higher in those with no ANC follow-up (37.5% Vs 8.9%), address outside Addis Ababa (27.5% Vs 10.6%), referred in labor from other hospitals Vs health centers (23.8% Vs 8.9%), thickly meconium stained liquor Vs clear liquor (38.1% Vs 3.0%) and decision-delivery interval in cesarean section of >30 mins (18.6% Vs 3.8%).

Conclusions & recommendations: The prevalence of NRFHR and cesarean delivery rate for NRFHR are high compared to previous similar studies done locally and in other countries. The quality of intrapartum fetal monitoring needs to be improved and other supplementary tests or monitoring techniques, like selective use of EFM should be considered.

Key words: NRFHR, Fetal distress, FHR, Fetal monitoring, APGAR score

INTRODUCTION

Background & literature review

The concept of the fetus as a patient is fundamental to the contemporary practice of obstetricians (1). However because of intrauterine location of the fetus, evaluating fetal well being, or more

specifically fetal oxygen status, has been an ongoing and difficult challenge (2). Fetal heart rate (FHR) monitoring is the oldest and most widely used parameter of fetal well being assessment. The sound of fetal heart had first been detected by Marsae of France in the 1600s; and Kalian in the same period proposed that the FHR might be used to diagnose fetal distress and to indicate when the clinician should intervene on behalf of the fetus (2).

Although there are other less frequent causes of fetal injury and /or death in labour (such as infection, hemorrhage, etc), hypoxia is by far the most common etiology and the one for which medical and surgical interventions have the potential for preventing such injury and death (2). Prior to intensive intrapartum FHR monitoring relatively uniform intrapartum fetal death rates of 3 to 4 per 1,000 were reported (3). But now such reports are rare in monitored fetuses. On the other hand; fetal hypoxia that is severe and associated with metabolic acidosis, but not sufficient to result in death, may alternatively cause asphyxial injury to the fetus and new born (2). Such babies may develop cerebral palsy, varying degree of mental retardation and /or seizures (4).

Intrapartum fetal assessment by FHR monitoring is only one parameter of fetal well being monitoring. This includes evaluation of the pattern as well as the rate. This can be achieved by auscultation with fetoscope or a Doppler ultrasound device; or continuously by electronic (internal / external) monitoring (5). Today the vast majority of all women giving birth in developed countries use electronic fetal monitoring (EFM) while most developing countries still use intermittent auscultation with pinnard stethoscope to monitor FHR during labour. Almost all well controlled studies, fortunately, have shown that intermittent auscultation is equivalent to EFM in assessing fetal condition when performed at specific intervals with a 1:1 nurse to patient ratio (6). Hence American College of Obstetricians & Gynecologists(ACOG) has concluded that intermittent auscultation is equivalent to continuous electronic monitoring(CEM) in detecting fetal compromise if the following requirements are fulfilled (7):-

1. 1:1 nurse-to-patient ratio.
2. Auscultation after a uterine contraction.
3. Auscultation at least every 15 minutes in active first stage.
4. Auscultation at least every 5 minutes in second stage.

These requirements are part of the management protocol used by the three study hospitals. Non-reassuring fetal heart rate includes:-

1. Deceleration that persists after contraction for at least three contractions.
2. Tachycardia (>160 bpm).
3. Bradycardia (<120 bpm).

The requirements for intermittent auscultation are, infact, situations that are difficult to duplicate in everyday practice because of lower nurse/patient ratios and because emergencies with other patients often take attending physicians away from the bedside for long periods of time (2).

Transient and repetitive episodes of hypoxemia and hypoxia are extremely common during normal labour and are generally well tolerated by the fetus (5). Only when hypoxia and resultant metabolic acidemia reach extreme levels is the fetus at risk for long-term neurologic impairment (8). The main purpose of intra partum FHR monitoring is to detect hypoxia and metabolic acidosis. And the ideal target is to avoid operative intervention for simple hypoxia, but to

intervene in the presence of early metabolic acidosis before it could result in tissue damage or fetal death (2).

Prediction of most cases of intrapartum fetal asphyxia on the basis of FHR patterns is possible but difficult. Much controversy still exists regarding the value of intrapartum fetal monitoring for the prediction of brain damage. This is because approximately 9 of 10 predictive FHR patterns are false positive so that supplementary tests to confirm the diagnosis and prevent unnecessary intervention are essential (9). After analyzing several studies the ACOG promulgated a statement in 1992 that set forth criteria necessary for subsequent neurologic impairment to be related casually to an intrapartum insult (7). Although it is widely accepted that a newborn who fulfills all of these criteria has sustained an insult sufficient to cause permanent neurologic impairment, it must be acknowledged that some infants who lack one or another of these criteria may also have sustained such an insult (10).

In 1893, Von Winckel described the criteria for fetal distress that were to remain essentially unchanged until the arrival of electronic FHR monitoring (3). These included:-

- tachycardia (FHR > 160 bpm)
- bradycardia (FHR < 100 bpm)
- irregular heart rate.
- gross alteration of fetal movement (3,2).

These criteria were unquestioned until 1968, when Benson et. al. published the results of collaborative project (2,4). They revised the benefits of auscultation in over 24,000 deliveries and concluded, "... there was no reliable indicator of fetal distress in terms of FHR save in extreme degree". Thus it became apparent that other more sophisticated means of intrapartum evaluation were required.

Fetal scalp sampling was developed in an attempt to improve the predictive value of FHR monitoring and much research has been performed in the search for a continuous biochemical measurement of fetal distress; including continuous PH, PO₂ or PCO₂ and various combinations of these methodologies. None of these measurements are used in current clinical practice, mainly owing to technical problems and difficulties associated with the continuous direct measurement of these parameters in fetal blood through out labour. The promising new field of fetal pulse oxymetry has the potential to provide reliable, meaningful and reproducible data as shown in early cross sectional studies and more recent longitudinal studies (11).

Apart from the technical problems there is still no reliable method so far to diagnose fetal distress. This is because of the observation that in most cases when abdominal or forceps delivery was done for "fetal distress" the fetus was delivered without evidence of significant hypoxia or acidosis (2,14). This has led to the recommendation from ACOG to use the term "non- reassuring fetal status" to indicate a more accurate description of the indication for such interventions (14).

To test the ability of a clearly defined classification system of EFM to predict early neonatal outcome, Dellinger and Boechem defined and classified FHR pattern in 898 labouring patients as follows(12,13):-

- Fetal stress:-
1. Fetal tachycardia (>160 bpm).
 2. Moderate-to-severe variable decelerations with minimal-to moderate beat-to-beat variability.
 3. Late decelerations with minimal-to-moderate beat to beat variability.
 4. Sinusoidal FHR pattern.

- Fetal distress:-
1. Moderate-to-severe variable decelerations with absent beat to beat variability,
 2. Late decelerations with absent beat-to-beat variability.
 3. Fetal bradycardia.

[NRFHR includes both fetal stress and fetal distress.]

Using the definitions 70% of the patients were classified as having a normal FHR tracing in the hours prior to delivery, where as 29% were classified as having fetal stress and 1% as having fetal distress, i.e. 30% were having abnormal tracing.

In another study in Harare, Zimbabwe (1994); EFM, U/S and pinnard stethoscope follow up of FHR were compared (15). According to this study 54% of EFM group, 32% of U/S group and 15% of intermittent pinnard auscultation groups had FHR abnormalities with C/S rate of 28%, 24% and 10% respectively.

A normal FHR pattern can show a 99.7% predictive value for an APGAR score of 7 or more, where as an abnormal FHR confers a 50% prediction of an APGAR score of less than 7 (16). Even ominous FHR patterns are often associated with only a 50% - 65% predictive value for very low APGAR scores (17).

Metabolic acidosis in labour generally occurs approximately in 1-2 % birth, while moderate and severe asphyxial exposure with newborn morbidity occurs in 0.3 –0.4 % birth (2,18,9). However, although the prevalence of moderate and severe asphyxia is modest, prevention with appropriate intervention is important because of the serious implications of this complication to the child, family and society (9).

Whenever the fetus is determined to have a persistently non- reassuring FHR pattern and back up methods can't provide reassurance that the fetus is not acidotic, operative intervention is indicated to expeditiously deliver the baby to avoid further deterioration (2). The question of how much time is available to perform an operative intervention in the face of a non- reassuring FHR pattern is a complex one. The ACOG recommends “all hospitals have the capability of performing a cesarean delivery with in 30 minutes of decision to operate” but that “not all decisions for a cesarean delivery will require a 30 min response time” (19). Thus, a judgment made on the basis of the severity of the FHR pattern and the over all clinical status of the mother and baby must be integrated into this difficult decision (2).

Therefore allowing a lassitude for slightly early intervention and a modest degree of interpretation, generally C/S rates for NRFHRP should be in the range of 3%-4 % at most (2, 18). In a review based on 37 reports, each with more than 1000 patients and a total of 1,398,984 patients, the C/S rate for fetal distress was 3.1% (18) .In the Dublin randomized controlled trial

of intrapartum FHR monitoring (1984) C/S rate for fetal distress was 0.4% & 0.2%, while forceps delivery rate for fetal distress was 2.9 % & 1.2% in the EFM and intermittent auscultation groups respectively (20).

However physicians have often over diagnosed fetal distress in an attempt to deliver women safely and to avoid medico legal malpractice litigation. This practice has caused a progressive rise in C/S rate; and rates of 10% for NRFHR are common (18). Such trends and high rates are being reported by several local and international studies.

- In USA from 1974 to 1991, the incidence of C/S for fetal distress increased 15 fold, from 0.6% to 9.2% of all C/S performed (13).
- Reports from Australia, 1997 (21); England, 1998 (22); USA, 1999 (23); and USA, 2000(24) have shown C/S rates for NRFHR of 15.0, 11.2, 6.7 & 7.3 respectively.
- In a retrospective study done in Tikur Anbessa Hospital (TAH) by Beyene over a 9 yr period (1979–1982 E.C.) with 37,732 deliveries, the C/S rate has increased from 7.67% to 13.67%, the main reason for the rise being fetal distress. The contribution of fetal distress has tripled from 11% to 34.5% of all cesarean deliveries while the C/S rate for NRFHR increased 5 times from 0.85 to 4.71% (25).
- A prospective study done in TAH over 6 months (1996 E.C.) by Abraham with a total of 2031 deliveries showed a C/S rate of 20.1%. Fetal distress was the leading indication accounting for 33% of all cesarean deliveries and the calculated C/S rate for fetal distress was 6.84% (26).
- The annual (September 2001 – August 2002) perinatal report of TAH, showed C/S, forceps and vacuum delivery rates of 26.2%, 11.1% and 5.8% respectively. Fetal distress was the major indication for the interventions, being an indication in 24.3%, 46.6 & 43.0% of C/S, forceps & vacuum deliveries respectively. The calculated c/s rate for fetal distress was 6.3 (27).

There is a common perception that the infant who is depressed at birth represents a failure of intrapartum assessment and is at high risk for abnormal neurologic development. In fact this is infrequently true (10), because: -

- 1- Studies of still births, early neonatal deaths and ante partum cordocentesis have shown that fetal asphyxia may occur in the ante partum period.(9,31,32,and 33).
- 2- Ideally, fetal intra partum surveillance should begin with onset of labour. With the exception of induced labour, this timing is rarely achieved and intrapartum fetal asphyxial exposure may occur before fetal assessment is initiated (9).
- 3- In practical terms, the initial neonatal assessment formalized in the APGAR score is used to identify the infant who may need resuscitation and who may have sustained intrapartum compromise (34). Although it is reasonable to presume that a new born with an APGAR score of ≥ 7 at 5 minutes has not sustained intrpartum hypoxic insult sufficient to result in long-term neurologic impairment, the same can't be said of a low APGAR predicting abnormal outcome (10). This limitation was shown convincingly by several studies and by an analysis from the collaborative perinatal project (33,34). An

association between low APGAR scores and the incidence of cerebral palsy among survivors was observed, but the APGAR strongly predicted abnormal outcome only among infants with profound depression (APGAR of 0 to 3 for ≥ 20 mins) (29).

The evidence to date indicates that intrapartum FHR monitoring has been associated with a reduction in the number of IUFDs (9). However intrapartum fetal deaths continue to occur. A national study of still births in England and Wales between 1993 & 1995 reported that 10% still births occurred in the intrapartum period and most were attributed to asphyxia (35).

Rationale:

As mentioned before, hypoxia is the commonest cause of fetal injury and /or death in labour. In an attempt to minimize the magnitude of this problem several intrapartum fetal monitoring methods were developed to intervene before fetal injury and/ or death occurs. However obstetricians have overreacted to the situation and intervention rate, specifically C/S rate, has increased progressively and markedly both locally and globally. On the other hand in resource limited areas like ours it is impossible to fulfill 1-to-1 intrapartum fetal monitoring and intrapartum fetal death rates are still high.

Both the cost and maternal morbidity associated with operative delivery is significantly higher as compared to normal delivery. In addition there is currently a 20-25 per 100000 risk of cesarean associated maternal mortality (1). Finding a mechanism that decreases unnecessary operative interventions (especially C/S) while at the same time improving the perinatal outcome, therefore, would be the interest of every concerned body. Improving the quality of intrapartum fetal monitoring is one of the methods for such an objective.

The purpose of this study was to describe the prevalence of NRFHR, associated operative intervention rates, the perinatal outcome and factors related to poor perinatal outcomes and provide base line information to:-

- 1- evaluate the quality of our intrapartum fetal monitoring,
- 2- improve the quality of the intrapartum fetal monitoring,
- 3- improve compliance with the recommended DDI interval, and
- 4- ultimately improve perinatal outcome.

The results of this study could benefit women in labor hence at risk of developing NRFHR and operative delivery; and physicians involved in the management of these women.

SUBJECTS AND METHODS:

This is a cross-sectional study done June – September 2005. The study was conducted in 3 teaching hospitals in Addis Ababa, namely Tikur Anbesa Hospital (TAH), St Paul's Hospital (SPH) and, Gandhi Memorial Hospitals (GMH). These hospitals' labor wards are run by Gynecology and obstetrics department of Addis Ababa University, and use a common management protocol. All laboring women admitted to the labor wards with alive fetus,

developed abnormal FHR while on follow-up with intermittent auscultation with fetoscope, and then deliver in the hospitals were included in the study. Considering similar socio-economic status and intrapartum fetal monitoring method, the Harare's study prevalence of abnormal FHR in labor, which was 15 %, was taken to calculate the sample size (216).

Data was collected using a structured, pre- tested questionnaire prepared in English. Data was collected by interviewing each of the study subjects, revising the mother's & neonates charts, and the hospital's labor ward & neonatal unit registration books. Questionnaires were completed by the principal investigator and physicians attending in the delivery rooms. Data was entered and analyzed using EPI –INFO version 6 statistical software. Simple descriptive statistics and contingency tables were used to describe selected exposure and outcome variables. The exposure variables were age, address, mode of referral in labor, parity, ANC follow up & medical illness history, labor onset & duration, duration of rupture of membrane, type of FHR abnormality, time of delivery, status of liquor, type of operative intervention, and DDI. Outcome variables were IUFD, APGAR score, need for intubation, neonatal ICU admission and ENND. Comparison of 5th minute low apgar score rates were done for selected exposure variables to describe possible associations.

Ethical Consideration:- Ethical clearance was obtained from the Department of obstetrics & Gynecology, AAU. Verbal informed consent was obtained from each of the study subject.

Operational definitions:-

- *Normal FHR pattern:-* Base line FHR of 120- 160 beats/ min.
- *Abnormal FHR pattern:-* Base line FHR <120 or >160.
- *Bradycardia:-* Base line FHR <120.
- *Tachycardia:-* Base line FHR >160.
- *NRFHR:-* Those with abnormal FHR recorded more than twice during follow-up.
- *Low apgar score:-* Score 0 – 6.
- *Labour:-* Painful contractions with show or rupture of the membranes or cervical dilatation after 28th wk of gestation.
- *Very low apgar score:-* Score 0 – 3.

Limitation of the study: Being conducted in teaching hospitals, many of the study subjects were selected groups (i.e. referred & high risk pregnancies) and may not reflect the true picture of the general population.

RESULT

During the study period there were a total of 1379 deliveries; 557 (40.4%) from GMH, 421 (30.5%) from SPH and 401 (29.1%) from TAH. Questionnaires were filled for 257 laboring mothers (which is 119% of the sample size) who were found to have abnormal FHR recorded more than twice (table- 1).

Table-1:- Distribution of deliveries & FHR abnormalities by hospital.

Hospital	% of deliveries n=1379	No of NRFHR	% of NRFHR n=257
1. Gandhi Memorial	40.4	102	39.7
2. Saint Paul's	30.5	83	32.3
3. Tikur Anbassa	29.1	72	28.0
Total	100	257	100

The socio-demographic characteristics of the 257 mothers are shown in table II. The ages of the mothers ranged from 16 yrs to 40 yrs, the mean age being 26.4 yrs. 85.2 % were in the age range of 20 – 34 yrs. 84.4 % were from Addis Ababa while the rest were from outside the city. Parity ranged from 0- to – XI. Majority, 86.8 % (223 / 257), were either nulliparous or primiparous; each contributing 65.8% (169 / 257) & 21.0 % (54 / 257) respectively. 84.8 % (218 / 257) were married and 4.7 % (12 / 257) single.

Table II: - Socio-demographic characteristics of the 257 laboring women with NRFHR.

Variable	Frequency (No)	Percentage (%)
1. Age		
15-19	15	06.2
20-24	75	29.2
25-29	95	37.0
30-34	49	19.0
35 +	22	08.6
3. Address		
Addis Ababa	217	84.4
Out of Addis Ababa	40	15.6
4. Parity		
0	169	65.8
I - IV	81	31.4
V +	7	2.8
5. Marital status		
Married	218	84.8
Single	12	4.7
Divorced	2	0.8
Widowed	1	0.4
Others	24	9.3

Table III demonstrates the antepartum characteristics of the study subjects. Gestational age ranged from 29 to 46 weeks. 47.4 % (122 / 257) were at term (gestational age of 37–41 weeks)

while gestational age was unknown in 27.6 % (71 / 257). Majority, 61.1 % (157 / 257), had antenatal care (ANC) follow-up in health centers; where as 9.3 % (24 / 257) had no ANC follow-up. Although majority had ANC follow-up in health centers, only 43.6 % (112 / 257) came to the study hospitals referred directly from the health centers. Only 5.4 % (14 / 257) had known medical disorders like pre-gestational diabetes & chronic hypertension. 11.7 % (14 / 257) were admitted with premature rupture of membrane (PROM) in some of which labor started spontaneously while induced in others.

Table III: - Antepartum obstetric & medical characteristics of the study subjects.

Variable	Frequency (№)	Percentage (%)
1. Gestational age (wks.) (n = 257)		
- 28 - 36	13	5.1
- 37 - 41	122	47.4
- 42 +	51	19.9
- Unknown	71	27.6
2. Antenatal care (n = 257)		
- None	24	9.3
- At health center	157	61.1
- In hospital	76	29.6
3. Mode of referral in labor (n = 257)		
- Self referral	103	40.1
- From health center	112	43.6
- From hospitals	42	16.3
4. Medical & obstetric problems identified		
- Known medical dis.	14	5.4
- PROM	30	11.7
- Previous C/S	16	6.2
- Other obstetric problems	27	10.5

The intrapartum obstetric conditions are summarized in table IV. Onset of labor was spontaneous and not augmented in 86.4 % (222 / 257). The duration of labor at admission ranged from 0 to 96 hrs the mean, median and mode durations being 12.43, 10.0 & 6.0 hrs respectively. Similarly; the duration of leakage of liquor at admission ranged from 0 to 144 hrs, the mean and median durations being 6.31 & 1.0 hrs respectively. 47.6 % were admitted with either intact membrane or duration of leakage of liquor of < 30 minutes. Labor was induced in 13.6% (35 / 257) and augmented in 11.3% (29 / 257). Mal-position and malpresentation were identified in 8.9 % (23 / 257) and 4.7 % (12 / 257) deliveries respectively. Liquor was thickly meconium stained at the time of detection of FHR abnormality in 16.3 % (42 / 257); while it was clear in 26.1 % (67 / 257). Liquor status was not known in 30 % (77 / 257) due to either membrane was intact, or status not documented.

Table IV: - Intrapartum obstetric characteristics.

Variable	Frequency (№)	Percentage (%)
1. Labor onset & progress		
- Spontaneous	222	86.4
- Augmented	29	11.3
- Induced	35	13.6
2. Status of liquor		
- Clear	67	26.1
- Grade I	24	9.3
- Grade II	47	18.3
- Grade III	42	16.3
- Intact membrane / not documented	77	30.0
3. Obstetric problems identified		
- Malpresentation	12	4.7
- Malposition	23	8.9

The prevalence and types of FHR abnormalities is summarized in table V. The overall prevalence of NRFHR was 18.64% (257 / 1379). Bradycardia was the commonest FHR abnormality, 65.0% (167 / 257), with prevalence in labor of 12.14 % (167 / 1379). The rest were tachycardia and mixed pattern, in 25.3% (65 / 257) & 9.7% (25 / 257) respectively. The duration between admission, start of induction or onset of labor after admission; and detection of the initial abnormal FHR ranged 0 hrs to 18.24 hrs, the mean, median and mode durations being 3:58, 1:40 and 0:00 hrs respectively. 31.9 % (82 / 257) had abnormal FHR at admission making the prevalence at admission 5.9 % (82 / 1379). Similarly the duration between detection of the initial abnormal FHR and delivery ranged from 0 hrs to 12.02 hrs, the mean, median and mode durations being 1:56, 0:57 and 0:20 hrs respectively. FHR abnormality responded to conservative management only in 12.5% (33 / 257) of the mothers.

Table V:- Prevalence and types of FHR abnormalities.

Type of FHR abnormality	Frequency (№)	Percentage (%) n = 257	Prevalence (%) n = 1379
1. Fetal tachycardia	65	25.3	4.71
2. Fetal bradycardia	167	65.0	12.14
3. Mixed pattern	25	9.7	1.81
Total	257	100	18.64

As demonstrated in table VI, the 24 hours of a day was divided in to 3 equal groups of 8 hours to see the distribution in relation to the time of the day. 47.1 % (121 / 257) were admitted, 39.4 % (102 / 257) FHR abnormalities detected and 33.9 % (87 / 257) delivered during the working hours time group i.e. from 8:01 am to 4:00 pm.

Table VI: - The distribution of the prevalence of NRFHR in relation to the time of the day (n = 257).

Variable	Frequency (No)	Percentage (%)
1. Time of admission		
- 12:01 AM – 8:00 AM	50	19.5
- 8:01 AM – 4:00 PM	121	47.1
- 4:01 PM – 12:00 MN	86	33.5
2. Time at detection of initial FHR abnormality		
- 12:01 AM – 8:00 AM	55	21.4
- 8:01 AM – 4:00 PM	102	39.4
- 4:01 PM – 12:00 MN	100	38.9
3. Time at delivery		
- 12:01 AM – 8:00 AM	61	23.7
- 8:01 AM – 4:00 PM	87	33.9
- 4:01 PM – 12:00 MN	109	42.4

The distribution of the prevalence in relation to the stage of labor is demonstrated in table VII. Majority (62.3%) were admitted in early labor i.e. cervical dilatation ≤ 5 cm. Only 18.3% (47 / 257) were admitted in second stage of labor; of which 40.9% (105 / 257) of mothers with NRFHR were detected and 59.5 % (153 / 257) delivered in this stage of labor.

Table VII: - The distribution of the prevalence of NRFHR in relation to the stage of labor (cervical dilatation) {n = 257}.

Variable	Frequency (No)	Percentage (%)
1. Cervical dilatation at admission		
- ≤ 5 cm	160	62.3
- 6 – 9 cm	50	19.5
- 10 cm	47	18.3
2. Cervical dilatation at detection of initial FHR abnormality		
- ≤ 5 cm	92	35.8
- 6 – 9 cm	60	23.3
- 10 cm	105	40.9

3. Cervical dilatation at delivery

- ≤ 5 cm	72	28.0
- 6 – 9 cm	32	12.5
- 10 cm	153	59.5

Among the neonates born 153 (59.5%) were males and the rest (40.5) were females. Birth weight of the neonates ranges from 1300 to 4750 grams; the mean, median and mode birth weights being 3106, 3080 & 3000 grams respectively. 226 (87.9%) neonates had normal birth weight (2500gms – 4000gms) while 8.6% (22 / 257) were <2500gms. As presented in table VIII, the commonest mode of delivery was caesarean section i.e. 112 (43%), of which 103 (40.1%) were primarily for NRFHR. Therefore the caesarean section rate for NRFHR was 7.47% (103 / 1379). Decision delivery intervals for cesarean delivery ranged from 15 to 170 minutes; the mean, interval being 48.45 minutes. Only 23.2% (26 / 112) fulfilled the recommended interval of ≤ 30 minutes. Forceps and vacuum delivery rates for NRFHR were 3.05% (42 / 1379) and 4.86% (67 / 1379) respectively. Overall operative delivery rate for NRFHR was 15.38 %.

Table VIII: - Modes of delivery and operative intervention rates.

Mode of delivery	Frequency (№)	Percentage (%) n = 257	Operative intervention rate for NRFHR (%) n = 1379
1. Spontaneous	31	12.1	-----
2. Assisted breech	04	1.6	-----
3. Craniotomy	01	0.4	-----
4. Cesarean section			
- For other indications	09	3.5	-----
- Primarily for NRFHR	103	40.1	7.47
5. Forceps	42	16.3	3.05
6. Vacuum	67	26.1	4.86
Total	257	100	15.38

Summary of the perinatal outcome of the 257 deliveries is presented in table IX. 100 neonates were born with low 1st minute APGAR score (< 7), and 34 with low 5th minute APGAR score (<7). Only 07 (2.8 %) neonates were intubated for intensive resuscitation. The intra partum fetal death rate was 4.4 ‰ (6 / 1379). The early neonatal ICU admission rate in those with NRFHR was 23.7 % (61 / 257). There were 10 / 257 (3.89 %) early neonatal deaths; and 9 of the deaths had apgar score < 7 at 5th minute (LAS). This shows that, neonates born with LAS at 5th minute had increased risk of death in the early neonatal period. The NRFHR related perinatal mortality rate, therefore, was 11.6‰ (16 / 1379).

Table IX: - A summary of the perinatal outcomes of the study subjects. (n = 257).

Variable	Frequency (No)	Percentage (%)
1. Intra-uterine fetal death	06	2.3
2. APGAR score		
- 1 st minute		
- 0 - 3	19	7.4
- 4 - 6	81	31.5
- 7 - 10	157	61.1
- 5 th minute		
- 0 - 3	09	3.5
- 4 - 6	25	9.7
- 7 - 10	223	86.8
3. Intubations	07	2.8
4. Neonatal ICU	61	24.3
5. Early neonatal death	10	4.0

As demonstrated in table X; there was no identifiable cause for NRFHR in 87.9% (226 / 257) deliveries. 10 (3.9%), 8 (3.1) & 13 (5.1%) NRFHR were attributed to tight cord around the neck, chorioamnionitis and miscellaneous causes respectively.

Table X: - Distribution of identified possible causes of NRFHR.

Identified cause of NRFHR	Frequency (No)	Percentage (%)
1. None	226	87.9
2. Placental abruption	6	2.3
3. Tight cord around the neck	10	3.9
4. Chorio-amnionitis	8	3.1
5. Uterine hyperstimulation	1	0.4
6. Cord prolapse	3	1.2
7. Others	3	1.2

Table XI summarizes positive predictive values (PPV) of NRFHR during intra partum fetal monitoring with intermittent auscultation in our set-up i.e. in the study. The PPV for low 1st & 5th minute APGAR score were 38.91 % (100 / 257) and 13.23 % (34 / 257) respectively. PPV for 5th minute VLAS was 3.5 %. Tachycardia and bradycardia had comparable positive predictive value for 1st minute LAS (38.5 % Vs 38.9 %) while tachycardia had a better PPV for 5th minute LAS (16.9 % Vs 11.4 %)

Table- XI: - Positive predictive values of FHR abnormalities for LAS & VLAS.

FHR abnormality				VLAS (0-3)				LAS (0-6)			
				1 ST minute		5 TH minute		1 ST minute		5 TH minute	
				N _o	PPV	N _o	PPV	N _o	PPV	N _o	PPV
1	Tachycardia	65	25.3	6	9.2	3	4.6	25	38.5	11	16.9
2	Bradycardia	167	65.0	12	7.2	6	3.6	65	38.9	19	11.4
3	Mixed	25	9.7	1	4.0	-	-	10	40.0	4	16.0
Total		257	100	19	7.4	9	3.5	100	38.9	34	13.2

Table XII shows selected variables (risk factors) which were found to be associated with higher 5th minute LAS rate among the fetuses that developed NRFHR in labor. These factors are mentioned below:-

1. Women who came in labor from outside Addis Ababa were associated with 2.6 times higher rate of delivery with low APGAR score (27.5% Vs 10.6%).
2. Those who had no antenatal care follow-up had 4.2 times higher rate of LAS (37.5% Vs 8.9%) compared to those who had ANC follow-up.
3. Women who came referred in labor from hospitals were associated with 2.7 times higher rate of LAS compared to those who came directly from health centers (23.8% Vs 8.9%).
4. Those deliveries with thickly meconium stained liquor (grade III) were associated with 12.7 times higher rate of compared to those with clear liquor (38.1% Vs 3.0%).
5. DDI of >30 minutes in C/S deliveries was associated with 18.6% (16 out of 86) low 5th minute APGAR score rate as compared to DDI of ≤ 30 minutes with 3.8% (1 out of 26). This shows a 4.9 times increased rate of LAS when the recommended DDI is not respected.

Table- XII: - Factors (variables) found to be associated with statistically significant risk of low APGAR score among those who develop

Exposure variable	Frequency (No)	LAS rate	
		1 st min.	5 th min.
1. Address			
- out of Addis Ababa	40	52.5	27.5
- Addis Ababa	217	36.4	10.6
2. ANC follow-up			
- no	24	54.2	37.5
- yes	157	38.2	8.9
3. Referral in labor from			
- health center	112	42.0	8.9
- other hospital	42	54.8	23.8

4. Liquor status			
- thickly meconium sta.	42	73.8	38.1
- clear	67	23.9	3.0
5. Decision-delivery interval			
- $\leq$ 30 minutes	26	42.3	3.8
- $>$ 30 minutes	86	50.0	18.6

In addition; fetal sex (male Vs female), time of delivery (4:00 pm - 12:00 MN and 12:00 MN - 8:00 am Vs 8:00 AM - 4:00 pm), type of NRFHR (bradycardia Vs tachycardia) and mode of delivery (vacuum Vs forceps) were compared for possible association with low APGAR score but the differences were not significant.

DISCUSSION AND CONCLUSION

This study has attempted to see the clinical profile and perinatal outcomes of 257 deliveries, out of 1379 deliveries which qualify the eligibility criteria, in which fetal heart rate (FHR) abnormality were detected. The three hospitals, in which the study was conducted, are central referral hospitals: and the deliveries conducted are likely to be high risk groups. This is evidenced by the finding that 59.9 % of the deliveries in which non-reassuring fetal heart rate (NRFHR) developed came in labor referred either from health centers or other hospitals. Therefore some of the findings of this study are unlikely to reflect the true picture of any other hospital in the country despite the use of the same intrapartum fetal monitoring technique i.e. intermittent auscultation with fetal stethoscope. The goal of FHR monitoring should be to carefully & thoroughly monitor all women in labor; avoid unnecessary interventions for benign FHR patterns; correct NRFHR patterns with non invasive etiology specific therapies when possible; use appropriate means such as scalp PH to rule out acidosis; and finally, if acidosis can not be ruled out operatively intervene in an expeditious manner appropriate for the entire clinical situation.

The prevalence of NRFHR in labor was found to be 18.6 %. This prevalence is higher than the prevalence found in other studies in other countries including that of the Harare (15 %) study (15). There was no similar study done in our country to compare. To evaluate the perinatal outcome APGAR score, intra partal death, ENND, intubation & neonatal ICU admission rates were used. This, however, could be misleading because of a variety of confounding factors such as infection, birth trauma, anesthesia & analgesia, prematurity, e.t.c.. Because of the inherent problems of use of APGAR score in judging neonatal condition, several investigators have suggested umbilical cord PH as a better measure of fetal condition at birth. Based on these suggestions most studies worldwide are conducted by determining cord PH at birth. This has made comparison of our finding with that of others difficult.

The operative intervention rates in the study were also higher than rates recommended by most authors. The cesarean section rate for NRFHR (7.47 %) is 2 times higher than the commonly recommended rate of 3 - 4 % (2,18). It is also higher than the previous studies done in TAH by Beyene (4.7 %, 15 years back) and by Abraham (6.8 %) (25,26). The increase in the rate can be explained by the change in the referral system. The forceps delivery rate for NRFHR (3.05 %) is

also higher than previous studies in other countries. It is, for example, 2.5 times higher than the Dublin randomized controlled trial rate of 1.2 %. More interesting is the high vacuum delivery rate for NRFHR (4.9 %) which is not mentioned in other studies; and not a recommended mode of delivery in NRFHR because of the time it takes as compared to forceps delivery. The high vacuum delivery rate could be due to its safety and easier technique for the less experienced trainees in the study hospitals. However, fortunately, there was no statistically significant difference in low APGAR score (< 7) rate between the two modes of deliveries.

The recommended DDI in cesarean delivery is not respected in the majority (84.4 %) and this has resulted in 4.9 times (18.6 % Vs 3.85 %) higher rate of low 5th minute APGAR score. This implies that improving the DDI has significant effect on the perinatal outcome and needs due attention.

The positive predictive value of intrapartum fetal monitoring with intermittent auscultation for 1st and 5th minute low APGAR score, 38.9 % & 13.2 %, were low as compared to values mentioned in literature (50 %). This results in high operative intervention rates with associated rise in maternal morbidity and cost of care. On the other hand there were 6 intra partal deaths, 13 deliveries with very low APGAR scores (< 4) and 10 early neonatal deaths among the 257 deliveries in which FHR abnormalities were detected. And this partly is because there are NRFHR tracings that are quite indicative of hypoxia and acidosis that are not likely to be detected with the intermittent auscultation monitoring.

Among those who develop NRFHR certain factors were found to be associated with a statistically significant higher risk of low APGAR score. Most of the factors have already been identified by several studies worldwide. One of the risk factors was having no antenatal care (ANC) follow up, OR = 4.99 (95 % CI = 1.80 - 13.76), which can be minimized by maximizing the ANC coverage. Those referred in labor from health centers & hospitals were also found to be at higher risk. This could be due to delay in diagnosis & referral and/or delay in transporting the mothers to the managing hospitals. FHR abnormalities associated with thickly meconium stained liquor are at a higher risk, OR = 6.74 (95% CI = 2.86 - 15.14), of low 5th minute APGAR score. This calls for early intervention and expeditious delivery in those with combination of the two factors.

RECOMMENDATIONS

1. To improve the quality of intrapartum care we need either to improve the quality of the intermittent auscultation or supplement it with other tests & monitoring method. One such approach can be selective use of electronic fetal monitoring or base line tracing for all laboring mothers at admission.
2. As most of the mothers who develop NRFHR came referred in labor from health centers and hospitals; and as they are found to be at higher risk for low APGAR score, health administrators should give due attention on improving the quality of intrapartum follow up in health centers and facilitate transportation of the referred laboring mothers to the managing hospitals. In addition, health centers should be able to make sure that the woman is going to be accepted by the hospital to which she is referred.

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