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Fetal Distress, Interventions, and Newborn Outcomes at a National Referral Hospital in Kampala, Uganda: A Retrospective Study

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ABSTRACT

Background:

Fetal distress, also known as non-reassuring fetal status, is a major contributor to poor newborn outcomes before and after birth. This study examined the clinical diagnosis of fetal distress and the newborn outcomes in a three-month cohort of women.

Methods:

This was a retrospective cohort study where 5404 maternity case records of women who gave birth at Kawempe National Referral Hospital during June to August 2019 were reviewed. Data were collected by trained nurse/midwives from the records using a checklist designed in Kobo Collect software. The data were exported to Stata 14 for cleaning and analysis. The prevalence of fetal distress was calculated as a percentage of those with a diagnosis out of the total number of records. All other data were summarized descriptively, and chi-square tests were computed to assess the association between fetal distress and newborn outcomes.

Results:

The prevalence of fetal distress was 257/4799 (5.4%), and of these, 51.3% had an abnormal fetal heart rate < 120b/min or > 160b/min. Meconium-stained amniotic fluid was present in 65% of all women diagnosed with fetal distress. Interventions for fetal distress during labour were mainly: administration of intravenous fluids (28.8%), monitoring of the fetal heart rate (10.5%), and lateral positioning (4.3%). An emergency cesarean section was the most common mode of birth planned for women with fetal distress (90.7%), although eventually, only 76.7% delivered by cesarean section. Women with fetal distress were more likely (12.5%, p<0.001) to have newborns with low Apgar scores <7 at 5 minutes.

Conclusion:

Fetal distress occurred in 5.4% of case records reviewed, with the majority undergoing a cesarean section birth. Despite the interventions such as intravenous fluid infusion, FHR monitoring, and lateral positioning, poor outcomes were observed more in those with fetal distress than in those without.

Key words: Apgar score, fetal hypoxia, newborn, fetal heart rate, Uganda
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Introduction

Globally, fetal distress, also known as non-reassuring fetal status, is a term used to describe the presence of category III tracing on the cardiotocogram. The fetal heart rate (FHR) tracing shows a sinusoidal pattern or absent variability and either recurrent late decelerations or recurrent variable decelerations or bradycardia (FHR <110 bpm) ("ACOG Committee Opinion #326:

Inappropriate Use of the Terms Fetal Distress and Birth Asphyxia," 2005). In the absence of a cardiotocogram, which is the case in many low-income settings, fetal distress is diagnosed when the fetal heart rate is abnormal (<120 or >160 beats/min or when there is the presence of meconium staining in the amniotic fluid or the presence of other signs of fetal compromise (Ministry of Health, 2022). Fetal distress occurs due to deprivation of oxygen that leads to fetal hypoxia and progressive brain damage, which manifests as asphyxia or hypoxic ischemic encephalopathy (HIE) at birth (Parer & Livingston, 1990). In the long term, the infants tend to suffer severe developmental delays and neurological complications (Golubnitschaja, Yeghiazaryan, Cebioglu, Morelli, & Herrera-Marschitz, 2011).

Worldwide, birth asphyxia that occurs primarily due to fetal distress or fetal hypoxia is one of the leading causes of neonatal mortality. It accounts for 12% of under-5 mortality, and in Uganda, it contributes to nearly half of all neonatal deaths (Ministry of Health, 2021). While efforts to manage newborns with birth asphyxia are emphasized, the outcomes have not been good in many low and middle-income countries due to inadequate resources and facilities to manage very sick newborns (Adhikari & Rao, 2017; Ogunkunle, Odiachi, Chuma, Bello, & Imam, 2020). Sometimes, the hypoxia during labour causes severe irreversible damage that negates any resuscitative efforts at birth. Studies have shown worse outcomes for newborns who were diagnosed with fetal distress intrauterine, compared to those who were not diagnosed. In Bangladesh, low Apgar scores were found in 11.3% of newborns diagnosed with fetal distress compared to 5.7% in those without this diagnosis (Akhter et al., 2021). Another study showed a five times higher risk of fetal academia and overall perinatal morbidity among newborns who had non-reassuring fetal status before birth (Rimsza et al., 2021). Therefore, prevention of hypoxia during labour is important to reduce the risk of birth asphyxia, hypoxic ischemic encephalopathy, and neonatal death. Some of the preventive measures, such as monitoring of labour using a partograph and immediate interventions by intrauterine fetal resuscitation, and performing cesarean births, have been suggested. Cesarean section is done as the definitive management of fetal distress, and this could improve outcomes if the decisions are made promptly (Gangwar & Chaudhary, 2016). However, these efforts follow an accurate diagnosis of fetal distress or non-reassuring fetal status. In Uganda (Ministry of Health, 2022), the definition for fetal distress involves the presence of any of these four parameters: fetal heart rate of less than 120 or more than 160 beats per minute, presence of late decelerations, presence of meconium-stained amniotic fluid of 2+ or 3+, and irregular fetal heart rate patterns.

Since the diagnosis of fetal distress has many parameters, we set out to examine how fetal distress was diagnosed by health workers, how it was managed, and the newborn outcomes among the women with fetal distress. We also determined the prevalence of fetal distress at the study site using the health workers' diagnosis.

This study described the interventions used at the study site and outcomes of newborns following fetal distress diagnosis.

Materials and Methods

Study design and setting

A retrospective record review study was conducted for women attending intrapartum care at Kawempe National Referral Hospital (KNRH) from June to August 2019. KNRH is the largest referral hospital in the capital city of Uganda, offering comprehensive maternity services including antenatal care, intrapartum care, and postnatal care. In the 2019/2020 financial year, the hospital had around 22,000 births. In addition, the hospital provides basic and specialized care for newborns with a neonatal intensive care unit.

Study population and inclusion

The study population included maternity case records of women who had given birth at the study site during the period selected for review. All records that were available at the department falling within the time period were screened for eligibility. Among those who were eligible, further screening was done to ensure that they fit into the inclusion criteria.

Exclusion criteria

Files of women who gave birth before arrival at the facility, came for a postnatal reason like postpartum hemorrhage, had no time of admission or time of discharge, or those who had no diagnosis at admission were excluded.

Sample size estimation

Sample size for the document review was estimated at 5,000 files, considering 3 months of data collection and an average of 20,000 births per year. This sample size was thought to be sufficient to answer the question of prevalence, interventions, and outcomes. In total, 5,404 files were entered of fetal distress.

Study procedures

Working hand in hand with the data team at the hospital, files of women who were admitted to the hospital from June to August 2019 were retrieved. All the files retrieved were consecutively screened for eligibility, and for those eligible, data extraction commenced using a checklist in the Kobo Collect software. The checklist included 8 sections: demographic characteristics of the mother, labour information, diagnosis of fetal distress, possible causes of fetal distress, interventions in labour,

response to interventions in labour, cesarean section for management of complications, and maternal and newborn outcomes. Four data entry clerks were recruited, trained, and supervised by the Principal investigator while entering the data. All entries were sent to the server immediately after entry.

Variables

The key independent variable was fetal distress, defined as a diagnosis of fetal distress made by the attending health care worker. An abnormal fetal heart rate, which is one of the indicators of fetal distress, was defined by a rate less than 120 or more than 160 beats per minute. Other independent variables included the demographic characteristics of the mother and intrauterine resuscitation interventions. In addition, intrauterine resuscitation interventions such as maternal lateral positioning, intravenous fluid infusion, oxygen administration, amnioinfusion, and tocolysis were recorded. The main outcome variable was birth asphyxia, defined as an Apgar score of less than 7 at 5 minutes. Other outcomes included newborn Apgar score at 1 minute, admission to special care unit, and the status of the baby at birth. We documented the mode of birth of the baby and the gestational age of newborns.

Data collection and management

After obtaining ethical approval to conduct the study, administrative clearance was sought from the study site to access records of women who gave birth at the facility from June to August 2019. A member of the hospital records department was assigned by the hospital management to support the retrieval of the maternity records. These maternity records entailed individual files of women used for documentation during labour, birth, and the postpartum period. In case there was a need to look at the maternity birth register to clarify some information, these were available to the team. Research assistants checked each record for eligibility before starting the data entry. In order to ensure anonymity, each record was assigned a study number. Each of the maternity records was used to fill in the questionnaire in the Kobo toolbox software ("Kobo Toolbox") until all the available records were completed.

Quality control

Research assistants who were all nurse/midwives were trained in the data collection procedures. The data entry checklist was developed by the researchers, pretested on 5 maternity records to ensure that all information would be properly captured. The pretesting was done on similar maternity records at the study site, which were outside the designated study period. The questionnaire was designed in Kobo Toolbox, and all data was sent to a password-protected server only accessible by the research team. Data was checked for completeness by reviewing the maternity record before sending the entry to the server.

Data analysis

Data was downloaded as an Excel file and exported to Stata 15 software for cleaning and analysis. Descriptive statistics were computed to determine the prevalence of fetal distress during the study period and intrauterine resuscitation interventions provided to women. The prevalence of fetal distress was obtained by the number of maternity records with a diagnosis out of the total number of maternity records. The relationship between fetal distress diagnosis and newborn outcomes was determined by cross-tabulations using chi-square statistics, and a p-value of 0.05 was considered to be statistically significant.

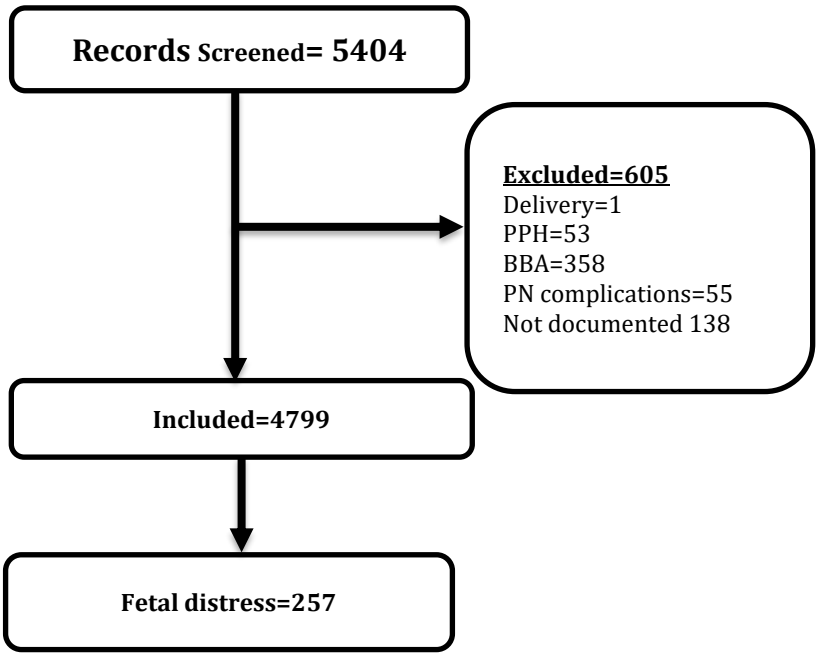
Ethical considerations

Ethical approval was sought from the higher degrees' research and ethics committee (HDREC) at the School of Health Sciences, Makerere University (SHSREC 2016-051) and the National Council of Science and Technology (HS-2572). Administrative clearance was obtained from the study site before the commencement of data collection. In addition, a records officer at the site supported the team with the retrieval of the records and stored them when the data extraction was completed.

Results

We entered 5404 case files of mothers who were admitted to Kawempe National Referral Hospital from June to August 2019. We excluded 605 due to various reasons and remained with 4799 cases for analysis as per figure 1:

Figure 1: Screening and recruitment flow chart for maternity records of women attending at KNRH from June to August 2019



***PPH**: Postpartum Hemorrhage; **BBA**: Born Before Arrival; **PN complications**: Postnatal complications*

Demographic characteristics

The median maternal age was 25 years (IQR: 21-29), and half (50.0%) of mothers were gravida two. The majority (69.1%) of mothers were not referred and were admitted during the day (51.6%) in established labour with cervical dilation of 4-10cm (58.6%)

Table 1: Characteristics of women who gave birth at KNRH from June to August 2019

Characteristic	Median (IQR)	Frequency N=4799	Percentage (%)
Age (yrs)	25(21-29)		
Less than 20 years		576	12.0
20 -35 years		3,946	82.2
35 years and above		268	5.6
Not known		9	0.2
Gravidity (n=4583)			
Primigravida		1,549	32.3
Multigravida		2,401	50.0
Grand multigravida		633	13.2
Not known		216	4.5
Cervical dilatation at admission			
Os closed		460	9.6
1-3cm		1,007	21.0
4-10cm		2,815	58.6
Not known		517	10.8
Diagnosis at admission			
Active labour		2,241	46.7
Latent labour		1,025	21.4
Not in labour		481	10.0
For Elective C/S		125	2.6
Second stage of labour		638	13.3
Not documented		289	6.0
Time of admission			
Day (6-18 hours)		2,476	51.6
Night (19-5 hours)		2,110	44.0
Not know		213	4.4
Referral status of the mother			
Referred		1,212	25.3
Not referred		3,317	69.1
Not known		270	5.6

Recording of the fetal heart rate at admission to the labour ward

Of the 4799 records included, only 3270(68.1%) had the fetal heart recorded in terms of a rate. In some files, the fetal heart had been auscultated, but the rate was not counted, and it was documented as fetal heart heard 11.6% and regular. In 20.3% of files, it is not clear whether the fetal heart was listened to or not. Among those whose fetal heart rate was recorded at admission, the majority, 3045/3270 (93.1%), had a normal heart rate, while 148/3270 (4.5%) had an abnormal heart rate of less than 120 or more than 160 beats per minute.

Table 2: Fetal heart rate recording at admission of women who gave birth at KNRH from June to August 2019

Parameter	Frequency	Percentage
FHR recording at admission (n=4799)		
FHR recorded	3270	68.1
Fetal Heart Heard without a recorded rate*	555	11.6
Not documented	974	20.3
FHR findings at admission(n=3270)		
Intrauterine fetal death (IUFD)	77	2.4
Abnormal FHR(<120 or >160b/min)	148	4.5
Normal FHR	3045	93.1

**In these records, the fetal heart had been recorded as: "fetal heart heard and regular."*

Prevalence, diagnosis, and signs of fetal distress were documented during labour

The prevalence of fetal distress as diagnosed by the attending health workers was 257/4799 (5.4%). Among these, only 51.3% of mothers had an abnormal fetal heart rate. Of the women diagnosed with fetal distress, nearly half (49.4%) were already admitted at the study site, while 45.1% were diagnosed at admission during the initial assessment. Other signs of fetal distress that were recorded included: meconium-stained liquor (65.0%), caput (27.6%), and molding (13.6%). These signs were sometimes used to make the diagnosis of fetal distress in the absence of an abnormal fetal heart.

Table 3: Prevalence, diagnosis, and signs of fetal distress for women who gave birth at KNRH

Parameter	Frequency	Percentage
Fetal distress diagnosed by health worker (n=4799)		
Yes	257	5.4
No	4542	94.6
Timing of fetal distress diagnosis(n=257)		
Before admission	14	5.5
At admission	116	45.1
After admission	127	49.1
Fetal heart rate at diagnosis of fetal distress (n=257)		
Normal (120-160bpm)	110	42.8
Abnormal (< 120 bpm or > 160 bpm)	116	45.1
FHR not known	31	12.1
Other signs of fetal distress documented (multiple responses, n=257)		
Meconium-stained amniotic fluid	167	65.0
Caput	71	27.6
Molding	35	13.6
Irregular fetal heart rate	49	19.1

Interventions provided to women with fetal distress

The main plan of action for women diagnosed with fetal distress was to perform an emergency caesarean section 90.7%. Other interventions included intravenous fluids (28.8%), close monitoring of the fetal heart rate (10.5%), and lateral positioning at 4.3%. Other plans of action included vacuum extraction (planned for only two women), oxygen administration, augmentation of labour, provision of tocolytics, and stopping oxytocin. The fetal heart rate was seen to normalize in 16.3% of women with fetal distress following intrauterine resuscitation interventions. Details are shown in Table 4

Table 4: Interventions for management of women with fetal distress

Planned actions for Fetal Distress as per records	Frequency (n=257)	Percentage (%)
C/Section	233	90.7
IV Fluids	74	28.8
Monitoring of Fetal heart rate	27	10.5
Lateral positioning	11	4.3
Vacuum extraction	2	0.8
Oxygen administration	3	1.2
Augmentation	3	1.2
Tocolytics	1	0.4
Stopping oxytocin	1	0.4

Outcomes of fetal distress

Women diagnosed with fetal distress were more likely to have a cesarean section birth compared to those without fetal distress (76.7% versus 31.6%, X2=219.8, p<0.001). At 5 minutes, 12.9% of women with fetal distress had low Apgar scores compared to 5.6% without (X2=23.7, p<0.001). The status of the newborn

at birth was not associated with having fetal distress during labour. More details are in Table 5.

Table 5: Association of fetal distress and newborn outcomes among records of women who attended birth at KNRH from June to August 2019

	Fetal Distress Yes n(%)	No. (%)	X^2	P-Value
Gestational age at birth			17.7	<0.001
Term	247 (96.1)	3963(87.2)		
Preterm	8 (3.1)	481 (10.6)		
Not documented	1 (0.8)	98 (2.2		
Mode of birth			219.8	<0.001
Spontaneous vaginal birth	60(23.3)	3406(68.4)		
Cesarean section birth	197(76.7)	1436(31.6)		
APGAR score at 1 minute			45.9	<0.001
0	3 (1.2)	112 (2.5)		
1-6	74 (28.9)	613 (13.7)		
7-10	179 (69.9)	3,748 (83.8)		
APGAR score at 5 minutes			23.7	<0.001
0	4 (1.6)	119 (2.7)		
1-6	33(12.9)	250 (5.6)		
7-10	219 (85.5)	4,101 (91.7)		
Newborn resuscitation			46.4	<0.001
Yes	31 (21.1)	217 (4.8)		
No	11 (43.2)	2,783 (61.3)		
Not known	115 (44.7)	1,542 (33.9)		
Status of the baby at birth			4.1	0.129
Alive	255 (99.2)	4,411 (97.1)		
Dead	2 (0.8)	112 (2.5)		
Not documented	0 (0)	19 (0.4)		

Discussion

In this retrospective cohort study, we found the prevalence of fetal distress to be 5.4% based on clinicians' diagnosis. Slightly more than half (51.3%) of these had an abnormal fetal heart rate (<120 or >160beats per minute). Meconium-stained amniotic fluid was present in 65% of all women diagnosed with fetal distress, and it was the most common sign of distress recorded. Interventions for fetal distress included cesarean section in 90.7%, administration of intravenous fluids (28.8%), monitoring of the fetal heart rate (10.5%), and lateral positioning (4.3%). Despite the plan for caesarean section in 90.7% of women, only 76.7% delivered by cesarean section. Apgar scores less than 7 at both 1 and 5 minutes were higher in the fetal distress group compared to those without it.

This study is one of the few highlighting the prevalence of fetal distress at a referral hospital. A similar study in Durban, South Africa, found a slightly lower incidence of fetal distress, 3.7% in a primary health care facility (Hoque, 2011). This lower prevalence could be because most women who give birth at primary care facilities are more likely to have fewer predisposing factors compared to the referral facility, where our study was conducted. Conversely, studies in Ethiopia have found a higher magnitude of fetal distress (non-reassuring fetal heart rate patterns) at 15.1% and 21.2% (Belete, Bazezew, Desta, Misganaw, & Tefera, 2022; Kassahun et al., 2020). In this study, nearly half of the participants were diagnosed with fetal distress based on clinical signs such as molding and meconium-stained liquor. Meconium-stained liquor grade II or more is accepted as a criterion for fetal distress diagnosis in the Ugandan clinical guidelines (Ministry of Health, 2022). It is, however, not known whether these clinical signs on their own would be enough to diagnose non-reassuring fetal status. Although the mechanism of passage of meconium is not understood, it has been associated with poor newborn outcomes and, therefore, may be an important additional sign to monitor when fetal

compromise is suspected (Unsworth & Vause, 2010). An earlier study looking at outcomes of newborns with fetal distress found that lower Apgar scores were more common in situations of abnormal fetal heart rate than with meconium-stained liquor alone (De Souza, John, Richards, & Milner, 1975). On the contrary, a recent study found no differences in fetal heart rate patterns or Apgar scores in women with or without meconium (Parween et al., 2022). This suggests a possibility of coupling the two signs to better diagnose fetal distress and predict poor newborn outcome, but not meconium-stained liquor alone.

In this study, a higher number of women with fetal distress were diagnosed while already admitted in labour, which is an indicator of the quality of intrapartum care, including monitoring and intervention. Several studies have shown sub-optimal fetal heart rate monitoring in similar settings (Ayebare et al., 2020; Litorp, Gurung, Målqvist, & KC, 2020; Namwaya et al., 2017). Efforts to reduce the number of women developing fetal distress at health facilities are crucial to reduce of poor newborn outcomes in these low-resource settings. Fetal distress has been shown as one of the key indications for caesarean section in many settings, and rightly so, this study showed that the majority of women gave birth by caesarean section. There is increasing concern for caesarean sections done inappropriately, even in low-income countries such as Uganda (Litorp et al., 2020). However, the majority of the cesarean sections done in low-resource settings are necessary; in fact, there is more unmet need for cesarean sections (Betran, Ye, Moller, Souza, & Zhang, 2021; Khumalo, Leonard, Scribante, & Perrie, 2022). This unmet need could be due to delayed caesarean section or poor access for women with fetal distress that leads to adverse outcomes at birth. One study has shown cesarean section to be a protective factor in women with fetal distress in a low-resource setting (Khanum & Chowdhury, 2020). A study in Uruguay comparing immediate delivery versus intrauterine resuscitation first before delivery found that newborn outcomes were better when intrauterine resuscitation was done first before birth. These findings, however, must be taken with caution since this was a developed country where immediate delivery happened within 16 minutes, and the intervention group was delivered within 34 minutes (Briozzo et al., 2007). In low-income settings like Uganda, where the decision to deliver intervals was found to be five hours, the outcomes may not be similar (Hughes et al., 2020).

Intrauterine resuscitation interventions mainly used included administration of intravenous fluids and changing of the maternal position. These interventions have been used in other settings in Africa and high-income countries (Garite & Simpson, 2011; Mgaya, Litorp, Kidanto, Nyström, & Essén, 2016; Ministry of Health, 2022; Simpson, 2007). In our study, we found that tocolysis and the use of oxygen were rarely performed. In addition, close monitoring of the fetal heart rate was done for around a third of women diagnosed with fetal distress. Poor fetal heart rate monitoring practices have been observed in several studies in low-income countries (Ayebare et al., 2020), and this affects decision-making and timely interventions (Litorp et al., 2020). There was fetal heart normalisation for 16% of women in the records. This is an indication that intrauterine resuscitation actually improved the fetal status. Although robust evidence on the actual effect of intrauterine fetal resuscitate interventions is lacking, available studies show improvement of both fetal and newborn outcomes following intrauterine resuscitation (Lauren M Bullens, van Runnard Heimel, van der Hout-van, & Oei, 2015; Reddy et al., 2021). A higher rate of birth asphyxia was documented among women with fetal distress compared to those with normal fetal status. Similar findings were reported in Thailand, where 35% of newborns compared to 15% developed birth asphyxia following fetal distress (Rattanaprom, Ratinthorn, Sindhu, & Viwatwongkasem, 2023). Another study also showed high birth asphyxia rates at 5 minutes of 15% among women who had abnormal fetal heart tracings (Roy et al., 2008). These findings further highlight the importance of managing fetal distress as a strategy to prevent birth asphyxia.

Conclusion

The prevalence of fetal distress was found to be low at the study setting, with the majority of the diagnoses made based on clinical signs such as meconium. The commonly implemented interventions for intrauterine resuscitation were intravenous fluid administration, close monitoring, and lateral positioning of the mother. There was a higher proportion of birth asphyxia among women with fetal distress compared to those without. There is a need for further research on the outcomes of women with fetal distress after implementing certain interventions. For example, do the women who give birth by Caesarean section have better outcomes than those who give birth vaginally? The role of intrauterine resuscitative measures on outcomes also requires further investigation.

Strengths and limitations of the study

This is one of the few studies that document the prevalence of fetal distress, its diagnosis, and interventions used during labour in the Ugandan setting. In addition, we describe the newborn outcomes of women diagnosed with fetal distress. The study was not without limitations: since this study was conducted by a retrospective review of maternity records, we faced a challenge of missing data. However, we ensured that the basic data required for this study were present in the records reviewed and excluded those that lacked some

key information, such as time of admission and demographic characteristics.

Implications for clinical practice

Fetal distress remains a key contributor to poor newborn outcomes, especially low Apgar scores and the need for resuscitation. This paper highlights three important practice points: 1) Health workers in the maternity units are not documenting fetal heart rate appropriately, and not all women diagnosed with fetal distress have an abnormal fetal heart rate; 2) Interventions for fetal distress were not applied similarly for all women; 3) Women with fetal distress are more likely to have poor newborn outcomes compared to those without. The criteria for diagnosis of fetal distress require more clarification to ensure that health care professionals employ the most prompt and effective preventive measures. Implementation of intrauterine resuscitation interventions needs to be encouraged for all women with fetal distress. Women with fetal distress are prone to poor newborn outcomes, and therefore, prevention and active management should be provided by all maternity care providers.

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