



Standard Operating Procedure on iCTG, Department of Public Health, Ministry of Health 2021

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## 1 Scope

This document is aimed at providing guidance to district and community hospitals managing pregnancy and labour. It defines on the indication, interpretation of CTG, management and referral procedure to higher centers.

## 2. Objective

The objectives of this SOP are to provide Obstetricians, Medical Officers, Nurses, Midwives, and Community Health staff with essential guidance on the following aspects:

- 1.1. To specify the eligibility criteria for application of iCTG.
- 1.2. To elaborate the procedure of application of iCTG, as well as recording, transmitting and interpreting the iCTG recordings.
- 1.3. To specify the criteria and procedure for transfer of at-risk patients to designated referral center.

## 2. Responsibilities

3.1 (Write specific responsibilities of staff while writing this SOP)

Sl. No.	Official Designation	Responsibilities
1	Obstetricians: Focal person	<ol style="list-style-type: none"> <li>1. Teach, train, and guide doctors and health workers on CTG interpretation</li> <li>2. Make antenatal management plans for high risk pregnancies</li> <li>3. Guide health workers in patient referral procedure</li> <li>4. Provide feedback to hospital and programme</li> <li>5. Revise guidelines on a frequent interval</li> </ol>
2	Medical officers: Focal person in hospital	<ol style="list-style-type: none"> <li>1. Should be trained to perform iCTG and the basic interpretation</li> <li>2. Familiarize with indication and inform higher center when required</li> <li>3. Liaise with MCH units to indicate antenatal CTG</li> <li>4. Liaise with indoor ward to indicate labour CTG</li> <li>5. Consult with higher center for referral required</li> <li>6. Manage patients before referral</li> </ol>
3	Midwives in ward	<ol style="list-style-type: none"> <li>1. Should be trained to perform iCTG and the basic interpretation</li> <li>2. Familiarize with indication and inform doctors when required</li> <li>3. Maintain register and logbook of CTG device</li> </ol>

4	Health assistants in MCH	<ol style="list-style-type: none"><li>1. Should be trained to perform iCTG and the basic interpretation</li><li>2. Should be aware of the indications presented and inform doctors when required</li><li>3. Maintain register and logbook of CTG device</li></ol>
5	Biomedical engineer	<ol style="list-style-type: none"><li>1. Ensure functionality and usability of the CTG device</li><li>2. Train health worker on safety and storage</li><li>3. Monitor the proper usage of the device</li><li>4. Repair or replace the device when non-functional</li></ol>
6	Programme: Ministry focal	<ol style="list-style-type: none"><li>1. Monitor the optimal use of the device</li><li>2. Liaise with hospitals for training and guidance</li><li>3. Secure budget for the training of health workers on the usage of iCTG</li><li>4. Conduct audit and research</li></ol>

## **1. Definitions**

- 1.1. **CTG:** Cardiotocography is one of the tools to monitor fetal wellbeing. It represents the recorded fetal heart rate pattern and uterine contraction
- 1.2. **SOPs:** It refers to Standard Operating Procedures.
- 1.3. **MCH:** Mother and Child Health
- 1.4. **PROM:** Prelabour Rupture of Membrane
- 1.5. **FHR:** Fetal Heart Rate
- 1.6. **SDG:** Sustainable Development Goal
- 1.7. **FYP:** Five Year Plan

## **2. Principle**

Not Applicable

## **3. Pre-requisites**

Not Applicable

#### 4. Distribution of iCTG

A total of 55-iCTGs have been distributed to the following mentioned health facilities. Likewise, the 7 Comprehensive Emergencies Obstetric and Newborn Care Center (CEmONC) with Obstetrician will act as the referral receiving centers. Meanwhile, the Basic Emergency Obstetric and Newborn Care Center (BEmONC) will be the referring health centers.

Referral Receiving Centers	Code	Referring Health Centers	Total number of iCTG
CRRH, Sarpang (SP)	TS/DAM	Damphu Hospital	1
	SP/SAR	Sarpang Hospital	1
	ZG/YEB	Yebilaptsa Hospital	1
	ZG/PBG	Panbang Hospital	1
	PG/NLM	Nanglam Hospital	1
	SP/GAY(W) & SP/GAY (MCH)	CRRH Ward and CRRH MCH	2
	SP/CZR	Chuzurgang Hospital	1
Wangdi Hospital, Wangdi	TR/TON	Trongsa Hospital	1
	DG/DAG	Dagana Hospital	1
	GS/GSA	Gasa Hospital	1
	PK/PUN	Punakha Hospital	1
	WD/PJK	Eusa Hospital	1
	WD/WDE	Wangdue Hospital	1
	LS/LHU	Lhuntse Hospital	1

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ERRH Mongar	BT/BUM	Bumthang Hospital	1
	MG/GYL	Gyelposhing Hospital	1
	MG/MON (W)	ERRH Ward	1
	MG/MON (MCH)	ERRH MCH	1
Tashigang Hospital	SJ/DEO	Deothang Hospital	1
	SJ/SDC	Samdrupcholing Hospital	1
	PG/PGA	Pemagatshel Hospital	1
	TG/RIS	Riserboo Hospital	1
	TG/RJG	Rangjung Hospital	1
	TG/KLG	Khaling Hospital	1
	TY/TYZ	Tashiyangtse Hospital	1
	TG/KNG	Kanglung Hospital	1
	TG/BSM	Bartsham Hospital	1
	TY/KDG	Khamdang Hospital	1
	SJ/GDR	Gomdhar Hospital	1
	TG/TSP	Tshangpo Hospital	1
	TG/TGA	Tashigang Hospital	1
SJ/SZK	Samdrupjongkhar Hospital	1	
SJ/JOM	Jomotsangkha Hospital	1	
	PR/PAR	Paro Hospital	1

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JDWNRH	HA/HAA	Haa Hospital	1
	CK/TSI	Tsimalakha Hospital	1
	TP/THI (W)	JDWNRH Ward	1
	TP/THI (BC)	JDWNRH Birthing Center	1
	TP/THI (VIP)	JDWNRH VIP Out Call	1
	TP/THI (MCH)	JDWNRH VIP Out call	1
	TP/THI (MCH 1)	JDWNRH/ Mother Child Hospital	1
	TP/GID	Gidakom Hospital	1
	TP/DOL	Dechencholing Hospital	1
P/Ling Hospital	CK/GED	Gedu Hospital	1
	DG/LHZ	Lhamoizingkha Hospital	1
	CK/PHU (W)	Phuentsholing Hospital Ward	1
	CK/KTK	Khatoekha Hospital	1
	ST/SIB	Sibsoo Hospital	1
Samtse Hospital	ST/DRK	Dorokha Hospital	1
	ST/SAM (W)	Samtse Hospital Ward	1
	ST/SAM (MCH)	Samtse Hospital (MCH)	1
	<b>ST/GOM</b>	<b>Gomtu Hospital</b>	<b>1</b>

## 5. Indications

CTG is highly sensitive but less specific; which implies that a normal CTG pattern can inform a well fetus; but cannot tell whether fetus is unwell if CTG is abnormal. Therefore routine indication of CTG for low risk pregnancy is controversial; however it serves as a better monitoring method for high risk pregnancies. The common indications are pregnancies affected by medical or obstetrics conditions.

The following indications should determine the application of iCTG:

<b>Antenatal</b>	<b>Labour</b>
1. Fetal growth restriction (confirmed or suspected)	1. Induction and augmentation of labour
2. Oligohydraminos	2. Abnormal auscultation of fetal heart Sound
3. Polyhydraminos	3. Abnormal vaginal bleeding in labour
4. Prelabour rupture of membrane (PROM) & Preterm PROM (PROM)	4. Maternal pyrexia $\geq 38$ degrees
5. Prolonged rupture of membranes (>18 hours)	5. Meconium or blood-stained amniotic Fluid
6. Antepartum hemorrhage	6. Absent or decreased volume of amniotic fluid following rupture of membrane.
7. Known fetal abnormality which requires Monitoring	7. Prolonged first stage of labour
8. Hypertensive disorders in pregnancy	8. Prolonged second stage of labour
9. Diabetes (poorly controlled) or with fetal Macrosomia	9. Uterine tachysystole (more than 5 active contractions in 10 minutes without FHR abnormality on intermittent auscultation)
10. Reduced fetal movement	10. Uterine hypertonus (contraction lasting more than 2 minutes in duration or contractions occurring within 60 seconds of each other without FHR abnormality on intermittenauscultation)
11. Multiple pregnancy	11. Uterine hyperstimulation (either tachysystole or hypertonus with FHR abnormality on intermittent auscultation)
12. Post term/Prolonged pregnancy ( $\geq 42$ weeks)	
13 Elderly primigravida	



**6. Procedure of application and recording of iCTG:**

- a. The iCTG transducers shall be applied as per Chapters 3 and 4 of iCTG Operation Manual.
- b. **Duration:** The iCTG reading shall be performed for a minimum of 20-45 minutes
- c. **Speed:** 1 cm/min
- d. The frequency and continuation of iCTG recording shall be advised by the Obstetrician on-call /medical officer of receiving referral center as per clinical indication.

**7. Transmitting and consultation:**

- a. The iCTG recordings shall be first received by the Medical Officer on-call of the referring hospital on the iCTG tablet (viewer iPad).
- b. The iCTG recordings shall be transmitted electronically to the Obstetrician on-call of receiving referral center, with intimation of the same and if the obstetrician on-call is not present, it should be sent to the nearest health center

**8. Interpreting the iCTG recordings:**

- c. The Obstetrician on-call at referral center shall interpret the iCTG recordings as per *Annexure 1*.

**9. Criteria for referral:**

- e. The Obstetrician on-call at referral center shall advise referral as per the National Institute of Child Health and Human Development Three-Tiered Fetal Heart Rate Interpretation System (*Annexure 2*).

**10. Procedure for referral:**

- f. The Medical Officer on-call shall activate the referral system (ambulance, escort nurse etc.)
- g. The referring center shall inform the Emergency Unit of receiving referral center with details of the patient, time of starting journey and estimated time of arrival.
- h. The escort nurse shall update the Obstetrician on-call at receiving referral center on any events/emergencies that may occur en-route.

**11. Receiving patient at Referral Center:**

- i. The receiving facility shall prepare the required facilities (operating theater, anesthesiologist, pediatrician, blood products etc.) as per the clinical condition and iCTG recording.

- j. The Emergency Unit of referral center shall receive the patient and attended to by the medical officer on-duty.
- k. The medical officer on-duty shall notify the Obstetrician on-call about the patient's arrival and clinical condition.
- l. The Obstetrician on-call shall attend to the patient and management will be carried out accordingly.

## 12. Interpretation

CTG should be interpreted and correlated with the clinical findings and pre-existing conditions of the pregnant women. It is not a substitute for a good clinical examination and diagnosis. The fetal heart rate pattern can be viewed in four components, and must be clearly documented and interpreted. Details in annexure (1)

1. **Fetal heart rate:** The normal heart rate of the fetus ranges from 110 to 160 bpm. Above 160 bps is called tachycardia, below 110 bpm is called bradycardia. Prolonged bradycardia last more than three minutes
2. **Variability:** Due to the autonomic activity, the variability of fetal heart rate lies between 5 to 25 bpm. Below 5 bpm is considered as reduced variability and above 25 bpm is increased variability
3. **Acceleration:** Fetal heart rate acceleration consist of rise of heart rate by 15 bpm or more above baseline and last at least 15 seconds. Two to three accelerations should be seen in 20 min period tracing.
4. **Deceleration:** Fetal heart rate deceleration consist of fall of heart rate by 15 bpm or more below baseline and last at least 15 seconds
  - a. **Early deceleration:** Deceleration seen at the start of uterine contraction and completes with it ('mirror images')
  - b. **Late deceleration:** Deceleration onsets after the peak of uterine contraction completes
  - c. **Variable deceleration:** Deceleration has no relation to uterine contraction

## 13. Analysis:

- a. **Normal (Category I) CTG :** When all the four normal features present (Baseline heart rate Baseline rate variability, Presence of acceleration, absence of deceleration); heart rate within normal range, normal variability, presence of acceleration and no deceleration
- b. **Suspicious (Category II) :** When any one abnormal feature present; no acceleration, or reduced variability, or early deceleration or heart rate above or below in normal range
- c. **Pathological (Category III):** When two abnormal features present; low variability and no acceleration, low variability and deceleration present, prolonged bradycardia, repeated deceleration

**Annexure 1: FHR Parameters and their definition**

<b>Term</b>	<b>Definition</b>
Baseline Heart Rate (bpm)	It is the mean FHR maintained over at least 10 minutes in the absence of accelerations or decelerations, given in beats per minute (bpm). For immature fetuses, mean FHR in the upper range of variation. A progressive increase of FHR must be monitored carefully.
<ul style="list-style-type: none"> <li>• Normal</li> </ul>	Normal range: 110-160 bpm
<ul style="list-style-type: none"> <li>• suspicious</li> </ul>	slight bradycardia: 110-109 bpm slight tachycardia: 161-180 bpm without simultaneous accelerations
<ul style="list-style-type: none"> <li>• pathological</li> </ul>	severe bradycardia:<100 bpm Severe tachycardia:>180 bpm
<b>Heart rate variability (bpm)</b>	Fluctuations in the fetal base rate occur 3-5 times per minute. The range is the difference in bpm between the highest and the lowest fluctuation during the most part of the 30 minute reading monitor strip.
<ul style="list-style-type: none"> <li>▪ Normal</li> </ul>	> 5 bpm during the interval when no contractions occur
<ul style="list-style-type: none"> <li>▪ suspicious</li> </ul>	< 5 bpm and > 40 minutes, but < 90 minutes or > 25 bpm
<ul style="list-style-type: none"> <li>▪ pathological</li> </ul>	< 5 bpm and > 90 minutes
<b>Accelerations</b>	increase of FHR > 15 bpm or > ½ range and > 15 seconds** two accelerations in 20 minutes periodical occurrence with every contraction no accelerations > 40 minutes (significance is still unclear, assessment is therefore questionable)
<b>Decelerations</b>	drop in FHR > 15 bpm or > ½ range and > 15 seconds None
<ul style="list-style-type: none"> <li>▪ normal</li> </ul>	<b>Early:</b> uniform, periodically recurring drop in FHR is correlated with contractions, decrease in FHR begins at the start of contraction. Return to baseline at the end of the contraction. <b>Variable decelerations:</b> variations in form, duration, depth and correlation with contractions, intermittent/periodically recurring decrease in FHR with

	rapid onset and quick recovery. Can also appear as an isolated phenomenon (associated with fetal movements).
▪ suspicious	<b>Late:</b> uniform, periodically recurring FHR decrease is correlated with contractions and starts between the middle and end of the contraction. Nadir > 20 seconds after contraction has peaked. Return to baseline after contraction has ended. If the range is < 5 bpm, decelerations < 15 bpm may also be pathological.
Pathological	Atypical variable decelerations with one of the following additional characteristics: <ul style="list-style-type: none"> <li>▪ loss of primary or secondary FHR rise,</li> <li>▪ slow return to baseline after the contraction has ended,</li> <li>▪ longer increased baseline after contraction,</li> <li>▪ biphasic deceleration,</li> <li>▪ loss of oscillation during deceleration,</li> <li>▪ Resumption of baseline rate at a lower level.</li> </ul>
	<b>Prolonged decelerations:</b> must be considered pathological if they persist for more than two contractions or > 3 minutes.
	<b>Sinusoidal pattern:</b> long-term fluctuation of baseline resembling a sinus waveform. The smooth undulating pattern lasts at least 10 minutes and returns at relatively fixed intervals of 3–5 cycles per minute with an amplitude of 5–15 bpm above and below baseline. No variability of baseline can be established.

## **Annexure 2: National Institute of Child Health and Human Development Three Tiered Fetal Heart Rate Interpretation System**

**Category I:** Category I FHR tracings include all of the following:

- i. **Baseline rate:** 110–160 beats per minute
- ii. **Baseline FHR variability:** moderate
- iii. **Late or variable decelerations:** absent
- iv. **Early decelerations:** present or absent
- v. **Accelerations:** present or absent

**Category II:** Category II FHR tracings include all FHR tracings not categorized as Category I or Category III. Category II tracings may represent an appreciable fraction of those encountered in clinical care. Examples of Category II FHR tracings include any of the following:

### ***Baseline rate***

- i. Bradycardia not accompanied by absent baseline variability
- ii. Tachycardia

### ***Baseline FHR variability***

- i. Minimal baseline variability
- ii. Absent baseline variability with no recurrent decelerations
- iii. Marked baseline variability

### ***Accelerations***

- Absence of induced accelerations after fetal stimulation

### ***Periodic or episodic decelerations***

- i. Recurrent variable decelerations accompanied by minimal or moderate baseline variability
- ii. Prolonged deceleration more than 2 minutes but less than 10 minutes
- iii. Recurrent late decelerations with moderate baseline variability
- iv. Variable decelerations with other characteristics such as slow return to baseline, overshoots, or “shoulders”

**Category III: Category III FHR tracings include either:**

- Absent baseline FHR variability and any of the following:
  - i. Recurrent late decelerations
  - ii. Recurrent variable decelerations
  - iii. Bradycardia
  - iv. Sinusoidal pattern

## **References**

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