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Fetal Monitoring Devices

External and Internal Heart Rate Monitoring of the Fetus

Objectives of Fetal Monitoring System

- It can **detect** whether the baby is doing well or in distress.
- It offers help in Factor of **Uterine Contraction**; Factor of **Cord Accident**; Factor of **Head Compression**.
- It offers **measurement of stress**, as Labor is a physiologic stress to the fetus.
- It allows us to treat the fetus as a **separate patient** & to evaluate fetal response to labor
- It improves the potential to improve neonatal **survival and reduce morbidity**.
- It ensures that the baby is getting **sufficient amount of oxygen** during these contraction changes in strength and duration.
- It offers **assessment of fetal physiology** in labor/ oxygenation; if there is compression on Umbilical Cord or problems with the placenta and flow of blood.
- It offers **HR measurement** as the baby's heart rate can be affected by several factors including the mother's contractions and the baby's movement and position.

3 Types of Fetal Monitoring

MEDLINE TECHNOLOGIES (PVT.) LTD.

Intermittent Auscultation

Fetal auscultation is done with a small, hand-sized device called a transducer. Wires connect the transducer to a fetal heart rate monitor. Transducer placed on abdomen and the device will pick up baby's heartbeat.

- Transducer to monitor your baby's heartbeat.
- Routine for low-risk pregnancies.

Electronic Fetal Monitoring

EFM to monitor how baby's heart rate responds to Mother's contractions.
To do this, doctor will wrap two belts around the abdomen. One of these belts will record the baby's heart rate. The other belt measures the length of each contraction and the time between them.
The doctor will most likely only use the EFM device for the first half hour of the labor.

Internal Fetal Monitoring

This method is used if doctor is unable to get a good reading from EFM, or if your doctor wants to closely monitor baby.

The doctor will attach an electrode to the part of the baby's body that is closest to the Cervical opening. This is usually the baby's scalp. Insert a pressure catheter into the uterus to monitor contractions.

Methods Available for Fetal Monitoring in Labor

1. Pinard Horn (Fetoscope).
2. Doppler Fetal Monitor.
3. Vibro-acoustic stimulation.
4. CTG Fetal electrocardiography.
5. Scalp stimulation.
6. Fetal scalp sampling.
7. PH determination.
8. Fetal pulse oximetry

Intermittent Auscultation

Pinard Horn (Fetoscope)

Doppler Fetal Monitor

Vibro-acoustic stimulation

Pinard Horn (Fetoscope)

A Pinard horn is a type of stethoscope used to listen to the heart rate of a fetus during pregnancy. It is a hollow horn, often made of wood or metal, about 8 inches (200 mm) long. It functions similarly to an ear trumpet by amplifying sound. The user holds the wide end of the horn against the pregnant woman's abdomen, and listens through the other end.

It provides and stethoscope designed as an alternative to the more expensive Doppler Fetal Monitor to monitor fetuses auscultating .

A Pinard horn may be used to determine the position of the fetus. It is more precise than a Doppler device for this purpose and detects heart tone farther away from the location of origin.

Doppler Fetal Monitor (Ultrasound Transducer)

A Doppler fetal monitor is a **hand-held ultrasound transducer used to detect the fetal heartbeat for prenatal care**. It uses the Doppler effect to provide an audible simulation of the heart beat. Some models also display the heart rate in beats per minute (BPM). Use of this monitor is sometimes known as **Doppler auscultation.**

The Doppler fetal monitor is commonly referred to simply as a *Doppler* or *fetal Doppler*. It may be classified as a form of Doppler ultrasonography.

Hand held Dopplers are pocket-sized, battery-operated devices that send out high-frequency ultrasound waves. There's usually a handset, a built-in speaker, and a transducer that's placed against your bump. The ultrasound waves pass through your skin and tissue, and then bounce back.

Vibro-acoustic stimulation

Vibroacoustic stimulation (VAS), sometimes referred to as fetal vibroacoustic stimulation or fetal acoustic stimulation test (FAST), is the application of a vibratory sound stimulus to the abdomen of a pregnant woman to induce FHR (fetal heart rate) accelerations.

The presence of FHR accelerations reliably predicts the absence of fetal metabolic acidemia. Vibroacoustic stimulation is typically used during a non-stress test (NST) and done by using Acoustic Stimulator.

Fetal vibroacoustic stimulation uses a hand-held electronic device placed just above the pregnant woman's abdomen. Brief sounds are sent through the mother's abdomen to her baby. The vibroacoustic stimulation gives the opportunity to assess how the baby responds. Exposure of the baby to the vibroacoustic stimulation is generally considered safe but it can cause vigorous fetal movements and fetal distress.

ELECTRONIC FETAL MONITORING

CTG Fetal Electrocardiography

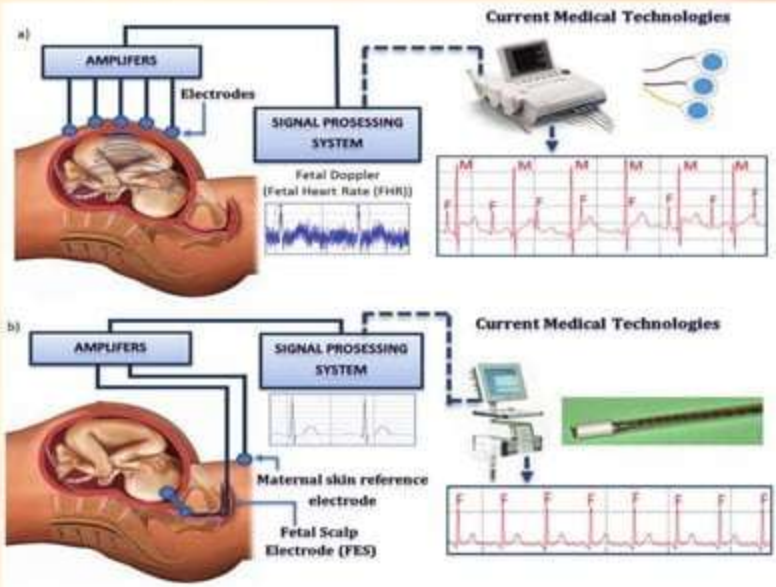
Portable Mini Telemetry

CTG Fetal Electrocardiography

Cardiotocography (CTG) is a technique used to monitor the fetal heartbeat and the uterine contractions during pregnancy and labour. The machine used to perform the monitoring is called a cardiotocograph. It is a paper record of the continuous FHR blotted simultaneously with a record of uterine activity by Ultrasound (cardio) transducer & Tocotransducer.

The Fetal ECG Monitoring
a) External (Ultrasound (cardio) transducer & Tocotransducer).

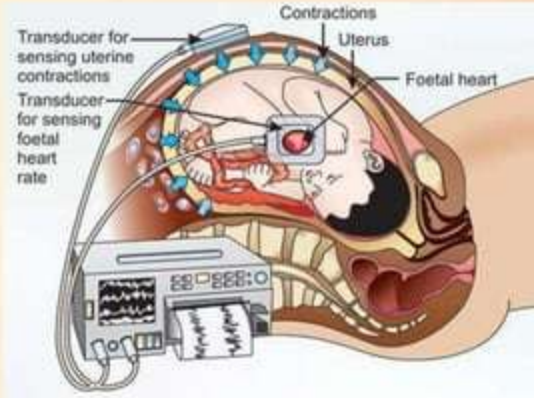
b) Internal (Fetal Scalp Electrode & Intrauterine Pressure Catheter).



External (Ultrasound Transducer & Toco-transducer)

Electronic fetal monitoring (EFM) provides graphic and numeric information on fetal heart rate (FHR) and maternal uterine activity (UA) to help clinicians assess fetal well-being before and during labor. FHR often exhibits decelerations and accelerations in response to uterine contractions or fetal movements; certain patterns are indicative of hypoxia.

Fetal monitors detect FHR externally by using an **Ultrasound Transducer** to transmit and receive ultrasonic waves; the frequency (or Doppler) shift of the reflected signal is proportional to the velocity of the reflecting structure—in this case, the fetal heart. A transducer contains one or more **Piezoelectric Elements** that convert an electrical signal into ultrasonic energy that can be transmitted into tissues. into ultrasonic energy that can be transmitted into tissues. When this ultrasonic energy is reflected back from the tissues, the transducer reconverts it to an electrical signal that can be used to create a waveform for display and recording and an audible FHR (sound created by the frequency shift of the ultrasonic signal).



Working Principle

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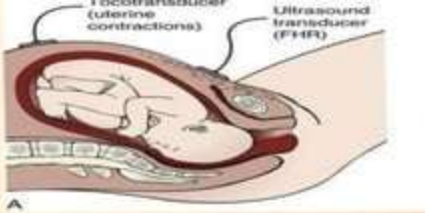


A TOCO transducer is a cardiotocography monitoring tool that determines the length and frequency of uterine contractions during labor.

The Toco-transducer is a tocotonometer which operates on the strain gauge principle to measure displacement. The central section of the TOCO transducer is depressed by the forward displacement of the abdominal muscles during a contraction. It is used for assessing **frequency** and **duration** of uterine contractions.

The external uterine monitor (tocotransducer) is placed near the fundus of the uterus. The monitors may be held in place with the belts or with a band. Another form of fetal surveillance is via a wireless monitor, which can perceive the fetal ECG , maternal ECG and uterine activity.

Portable Mini Telemetry

Electronic fetal heart monitoring is done during pregnancy, labor, and delivery. It keeps track of the heart rate of your baby (fetus). It also checks the duration of the contractions of your uterus. Your baby's heart rate is a good way to tell if your baby is doing well or may have some problems.

Two types of monitoring can be done: **External and Internal.**

Sometimes external monitoring is done remotely. This is called telemetry. It allows you to be checked without being hooked up to a machine. At some hospitals, the sensors can send the details about your baby's heart rate and your contractions to a remote monitor. This monitor is usually at a nurse's station.

Telemetry is offered to any woman who needs continuous monitoring of the fetal heart in labour.

INTERNAL FETAL MONITORING

Portable Mini Telemetry

Fetal Scalp stimulation Test

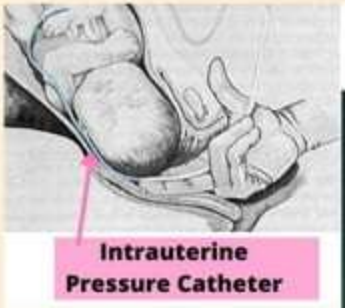
Intrauterine pressure catheter (IUPC)

Fetal Scalp Sampling (Fetal pH Determination)

Fetal Scalp stimulation Test

Fetal scalp stimulation test is a diagnostic test used to detect fetal metabolic academia. It can be used as a non-invasive alternative to fetal scalp blood testing.
External monitoring is used for a non-stress test. This **test records your baby's heart rate while your baby is moving and not moving**. A non-stress test may be done with a fetal ultrasound to check the amount of amniotic fluid. External monitoring is also done for a contraction stress test.

It is non-invasive method, utilizes an ultrasonic transducer to monitor the fetal heart and it utilizes tocodynamometer to monitor uterine contraction pattern. FHR = well oxygenated fetus and normal acid base balance. It includes easy application, it can be difficult to keep baby monitored especially with obesity, polyhydramnios, etc.



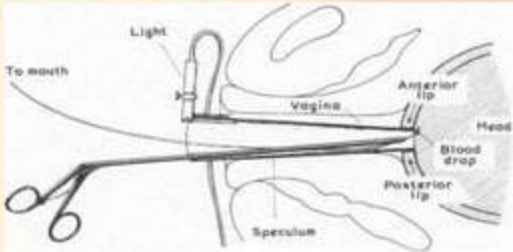
Fetal Scalp Sampling (Fetal pH Determination)

Fetal scalp pH testing is a procedure performed when a woman is in active labor to determine if the baby is getting enough oxygen. The scalp of the fetus is cleansed and a small blood sample is taken for examination. The blood is collected in a thin tube. The tube is either sent to the hospital laboratory or analyzed by a machine in the **labor** and delivery department. In either case, results are available in just a few minutes.

This procedure is performed using continuous ultrasound guidance to place a needle through the maternal abdomen into a tiny fetal blood vessel.
A sample of fetal blood can then be sent for testing.

Only performed in the intrapartum period when the membranes are ruptured and the cervix is dilated 2-3 cm. Used to determine true acidosis (less than 7.20) when FHR is non-reassuring.

Normal pH: 7.25 to 7.35
Borderline pH: 7.20 to 7.25



Endoscopic view

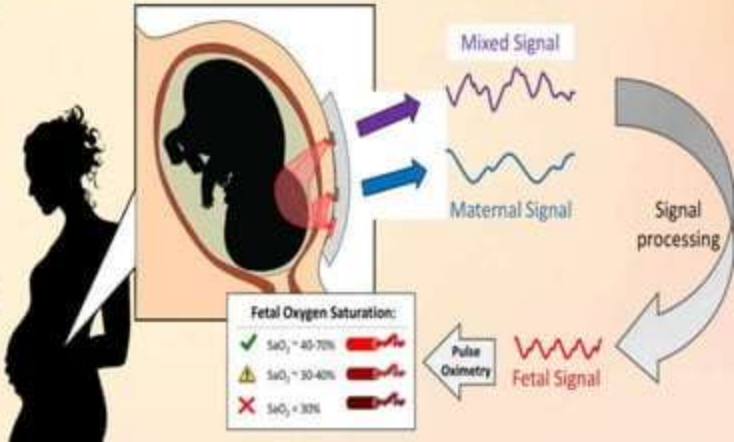
Fetal Pulse Oximetry

Fetal pulse oximetry is a new method for directly assessing the fetus' oxygen status during labor and delivery.

How do you check oxygen levels in a fetus?
In fetal oxygen saturation monitoring, a **sensor** is inserted by hand through the cervix after the membranes have ruptured and placed against the baby's face. The sensor, connected to a monitor by a cable, provides a continuous reading of the baby's oxygen level.

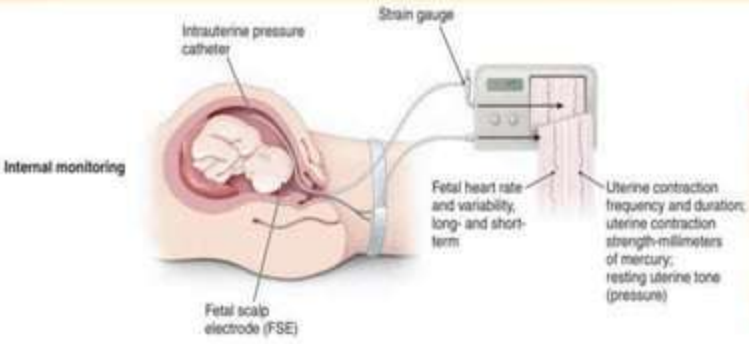
The adaptation of pulse oximetry for use in the unborn fetus could **potentially contribute to improved evaluation during labour** and therefore lead to a reduction in caesarean sections for non-reassuring fetal status, without any change in neonatal outcomes.

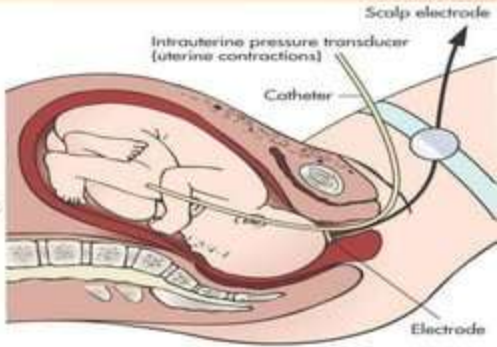
Pulse oximetry can help in monitoring oxygen saturation over time. Alert to dangerously low oxygen levels, particularly in newborns. Offer peace of mind to people with chronic respiratory or cardiovascular conditions.



Intrauterine pressure catheter (IUPC)

Intrauterine pressure catheter (IUPC) preferred by thousands of clinicians for its unrivaled accuracy, safety and reliability. The sensitive, single-use pressure transducer of is located at the tip of the catheter that is placed inside the uterus. Placement of the transducer inside the uterus ensures that clinical decisions are based on the most accurate contraction frequency, duration, resting tone and peak pressure data.





Thank you!

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