

IN-UTERO MONITORING

Terms you will become familiar with in this section of the module

cardiotocograph	amniotic fluid
fetus	insulcot
uterus	resuscitaire
fundus	radiant warmer
fetal heart rate	thermostat
palpation	phototherapy
auscultation	flaccid
scalp electrode	oropharynx
ante-natal	apgars
rhesus iso-immunisation	sclera
pre-eclampsia	jaundice
oedema	serum bilirubin
intra-uterine growth retardation	
opisthotonos	hyperbilirubinaemia
doppler	hypoxia
gestation	asphyxia
feto-placental	acidosis
type I & II deceleration	hypothermia
tachycardia	hypoglycaemia
bradycardia	

Introduction

The **Cardiotocograph** [pronounced car-dee-oh-toh-koh-graf] is used to monitor the status of the unborn baby [**fetus**] by measuring its heart beat after 30 weeks of pregnancy but when it is still in the **uterus** [**in utero**].

One monitor [the **toco**] is placed on the abdominal wall at the height of the top of the uterus [**fundus**]. This measures the size [**amplitude**] of any uterine activity – tightenings [**contractions**]. A second monitor [**cardio**] is placed at the level of the baby's heart to monitor the fetal heart rate [**FHR**]. The two actual points [landmarks] are located by the obstetrician or midwife who manually presses the abdomen [**palpates**] to find the fundus and the position of the baby. Once the positions are determined, the fetal heart is **auscultated** [listened to] at the back of the baby. [During labour, a **scalp electrode** is screwed into the baby's scalp to monitor its heart rate].

The **Cardiotocograph** is used periodically during the pregnancy [**antenatally** - ante = before, natal = birth] to monitor fetal well-being and when a woman enters labour
or

there is an at-risk pregnancy – which might be indicated by evidence of:
diabetes

Rhesus iso-immunisation

chronic renal disease

pre-eclampsia [syndrome identified by mother's high blood pressure, protein in urine and swelling [**oedema**]

ante-partum haemorrhage [bleeding at any stage in pregnancy before labour begins]

IUGR [**Intra-uterine growth retardation**]

placental abnormalities

Where a cardiotocograph is unavailable or if monitoring of the fetal heart only is required, a simple **Doppler** is sufficient. The Doppler is also used when well-being of the fetus needs to be determined during transport of the mother eg to labour ward or inter-hospital transfer via ambulance

Women are monitored using the C.T.G. to monitor the state of the fetus and to identify at-risk situations that might need intervention such as – more frequent monitoring, induction of labour [making the birth happen sooner than it would] or caesarian section [surgical removal of the baby through the stomach wall] – depending on the development [**gestation**] of the fetus. If the C.T.G. readings are normal, the baby's well-being can usually be guaranteed for the next seven days [unless a 'catastrophe' happens].

The measurement [trace] is taken for approximately 20 minutes ante-natally and usually continuously during labour.

Anatomy & Physiology

A normal trace shows normal blood circulation or **feto-placental** well-being by measuring the rates of the heart beat in the mother [maternal] and the fetus.

The normal reactive trace has a variability of 75 beats per minute [bpm] and at least two accelerations of 15 bpm lasting longer than 15 seconds.

If the 20 minute trace does not include at least two accelerations, it is termed unreactive.

Beat to beat variation [variability] is normal. 5–15 bpm is expected.

Fetal Heart Acceleration

FHR should increase with fetal movement or with contraction. Accelerations indicate a reactive trace.

Fetal Heart Deceleration

FHR decreases with contractions when the cord or head is compressed. These decelerations are classified as **Type I** and are considered normal. **Type II decelerations** are signs of fetal distress and require immediate

intervention. Fetal **tachycardia** is the first sign of fetal **hypoxia** and fetal **bradycardia** indicates fetal distress. These readings need to be used together with – status of mother, stage of labour and colour of liquor [amniotic fluid] if the membranes have ruptured.

ACTIVITY

Using reference texts such as Mott, Fazekas and James, find the range of fetal heart rates for full term babies.

QUESTIONS

How is the mother's heart rate relevant to the fetal heart rate?

If the mother's heart stopped during the labour, what effect would this have on the blood supply to the fetus?

What role does the placenta take in maintaining the health of the fetus?

Using your knowledge on the effect of carbon monoxide on blood oxygen saturation levels, what impact would smoking during pregnancy have on the oxygen supply of the fetus?

Case Study

Equipment which is **emphasised, referred to** or used in this case study includes:

Monitoring

- **Cardiotocograph**
- scalp electrode
- Doppler

Haemostatic

- **insulcot ['cot]**, incubator, transporter
- **resuscitaire**
- **radiant warmer**
- thermostat

Diagnostic

- **Cardiotocograph**

Therapeutic

- **ZZ Phototherapy**

Rehabilitation

-

Carmen Alvarez is a 36 year old woman who is in labour for the birth of her third child. She has been in labour for three hours. The C.T.G. has been

continuous throughout the labour. The Fetal Heart Rate is 144 and regular and her uterine contractions are moderate. As labour progressed, the fetal heart rate slowed [decelerated]. Just before delivery decelerations occurred several times and then recovered. The last time, the FHR decelerated, it remained depressed

QUESTIONS

Find some tracings of typical fetal heart rates in a reference book [eg Beischer, Mackay & Colditz]. Identify where the FHR decelerated. What does this indicate?

At birth, baby Alvarez was floppy [**flaccid**] and had to be resuscitated on the **resuscitaire** with a bag and mask to increase oxygen levels, assist breathing and aspiration of the **oropharynx**. He had **Apgars** of 6 and 8 [See explanatory note at end of this section] . As emergency treatment began, nursing staff realised that the radiant warmer over the resuscitaire was not working.

QUESTIONS

Considering the importance of temperature regulation, what problems are created for the new-born baby by the warmer not working

ACTIVITY

What are some of the reasons why the warmer is not working? Suggest how the problem might have been avoided. Speak to the nurses who work, or have worked, in midwifery or paediatrics and find out what they would do in this situation. At what point would you expect to be called to fix the problem?

After a successful resuscitation and a quick cuddle from both mum and dad, baby Alvarez was placed in a **transporter** to be sent to the special care nursery [SCN].

The staff in the SCN had prepared an **insulcot** and the baby was nursed naked in its incubator. The temperature of the youngest Alvarez was monitored hourly and remained stable at 36.6^o.

On day 2, the skin and whites of the eyes [**sclera**] seemed to be more yellow [**jaundiced**]. Baby Alvarez's **serum bilirubin** [SBR] [pronounced billy-roo-bin] measured 450 umol/l. In a normal term infant, SBR levels over 300 umol/l are considered to indicate non-physiological [abnormal] jaundice requiring **phototherapy** for babies at an age of 24 hours and over 425 umol/l at ages greater than 48 hours. The paediatrician ordered immediate phototherapy.

At toxic levels, the infant becomes lethargic and hypertonic and develops a characteristic posture [called **opisthotonos**]. A high pitched cry and seizures may occur.

If the baby is not promptly treated, he is at risk of suffering damage to the brain tissue [kernicterus], in the renal tubule cells of the kidneys, in the pancreatic cells and in the stomach lining [intestinal mucosa]. If the baby does not die, disability such as mental retardation and cerebral palsy may develop.

QUESTIONS

Some of the causes of non-physiological jaundice include:

- prematurity and low birth weight
- conditions associated with red blood cell production
- maternal diabetes mellitus
- hypoxia, asphyxia, acidosis, hypothermia, hypoglycaemia.

Use reference books or discussion with medical or nursing staff to find the meaning of any conditions you do not recognise.

Using your knowledge of the history of baby Alvarez, what is/are the most likely causes for his **hyperbilirubinaemia**?

What maintenance strategies could be introduced into your medical centre to reduce the possibility of episodes contributing to hyperbilirubinaemia?

Who would need to be involved?

What would their roles need to be?

Who would oversee your strategies?

Phototherapy

Light in the blue wave lengths acts on bilirubin in tissues and converts it to a soluble non-toxic form which can be excreted without the need for conversion in the liver.

Infants are nursed naked to expose as much of the skin area as possible. The eyes need to be covered so that exposure to the light does not damage the retinas of their eyes. Fluid balance needs to be monitored closely to reduce the possibility of dehydration.

Phototherapy may also be delivered using a 'waistcoat' containing fibre-optic bundles which administer phototherapy to the trunk. The method does not require the infant to be nursed in an incubator and eye shields are not required.

QUESTIONS

Bilirubin is normally broken down in the liver. Why has the use of phototherapy been preferred to the natural process in this newborn infant?

Apart from the possible danger to eyes, what risks can you suggest would need to be avoided when using phototherapy with an infant?

ACTIVITY

Visit the special care nursery in your medical centre or speak to nursing staff to discover what methods are used for protecting infant's eyes. Discuss the problems nursing staff have with hyperbilirubinaemic infants and check your answers to the questions with them.

During phototherapy, incubator temperatures are measured hourly and baby Alvarez has his SBR monitored daily [or 12 hourly if it appears to be increasing]. He is progressing well. His SBR is dropping to satisfactory levels. On day 4, nursing staff notice that the incubator temperature is not reaching the temperature set on the thermostat. The midwife calls you to report the problem.

QUESTIONS

What questions will you ask the midwife over the telephone when she reports the temperature control problem?

What spare parts will you bring with you to the nursery?

What checks will you do on the incubator before you take it from the nursery?

ACTIVITY

Develop a checklist to help nursing staff troubleshoot for common problems with warming equipment so they can give you exact and relevant information to help you with rapid response to their calls.

On day 5, phototherapy was discontinued. Baby Alvarez was feeding well and maintaining his temperature. He was transferred to the post-natal ward with his mum. By day 7, baby Alvarez was quite stable and released from hospital to join his family.

NOTE: Apgar evaluation scoring was developed in 1953 by Virginia Apgar. Apgar scoring is done at one minute and five minutes following birth. There are five variables observed or measured:

1. Heart rate
2. respiratory effort [ease of breathing]
3. muscle tone [lively and moving or floppy and inactive]
4. reflex irritability [eg response to tickling feet]
5. body colour

These variables are each given a score of 0,1 or 2.

A score of 8–10 at five minutes indicates that the baby has good circulation and is in good condition

The Apgar Scoring Chart for Evaluating Status of the Newborn

Sign	0 points	1 point	2 points
Heart rate	Absent	Slow [less than 100]	Greater than 100
Respiratory effort	Absent	Slow, irregular	Good strong cry
Muscle tone	Limp	Some flexion of extremities Grimace	Extremities well flexed, motion
Reflex – irritability [response to catheter in nostril]	Absent		cough, sneeze or cry
Colour	Blue, pale	Body pink, extremities blue	Completely pink

Source: Apgar, V.A. (1966) *The newborn (Apgar) scoring system* *Pediatr Clin North Am*; 13:645

Useful References

Beischer, Mackay & Colditz (1997) **Obstetrics and the Newborn**. 2nd Edition. Sydney: W.B. Saunders

Korones, S.B. (1986) **High Risk Newborn Infants**. 4th Edition. St Louis: C.V. Mosley

Mott, S.R., Fazekas, N.F. & James, S.R. (1985) **Nursing Care of Children and Families: A Holistic Approach**. USA: Addison Wesley.

Olds, S. (1988) **Maternal Newborn Nursing**. 3rd Edition