

PERINATAL EDUCATION PROGRAMME

PAIN RELIEF IN LABOUR

UNIT 10

OBJECTIVES

When you have completed this unit you should be able to:

1. Explain the differences between analgesia, anaesthesia and sedation.
2. List the causes of pain in labour.
3. List which drugs can be given during labour for analgesia.
4. Ensure that a patient has adequate pain relief during labour.
5. List the dangers of the drugs which can be used for pain relief.
6. Prepare a patient for general anaesthesia.

COPYRIGHT

All rights reserved. No part of this Perinatal Education Programme may be altered in any way, nor may copies of the complete Programme be made, without the written permission of the editorial board of the Perinatal Education Trust. To facilitate the improvement of perinatal care in Southern Africa, however, parts of the Programme may be reproduced for teaching purposes provided due acknowledgement is given and the material is not sold for financial profit. While the advice and information in the Programme are believed to be accurate, the editorial board cannot accept responsibility or liability for any errors or omissions that may have been made.

ISBN 0 7992 1362 4

10-1 WHAT IS ANALGESIA?

Analgesia means the relief of pain. Drugs used to relieve pain are called analgesics. Analgesics must not be confused with sedatives which do not relieve pain but only make the patient drowsy.

10-2 WHAT IS ANAESTHESIA?

Anaesthesia means the loss of all sensation, including pain. Local anaesthesia causes the loss of all sensation in that region of the body. With general anaesthesia the patient loses consciousness.

10-3 WHAT CAUSES PAIN DURING LABOUR?

Pain in labour is caused by:

1. **CONTRACTIONS:** They progressively increase in duration and frequency during the first stage of labour and, therefore, become more painful. Contractions are most painful when the cervix is fully dilated and the patient has an urge to bear down. At first the pain is felt over the abdomen but later, when the cervix is nearly fully dilated, pain is felt in the lower back.
2. **CERVICAL DILATATION:** This is due to uterine contractions and pressure of the presenting part on the cervix.
3. **VAGINAL EXAMINATIONS AND PROCEDURES:** Any vaginal examination is uncomfortable and for many patients is also painful. This is particularly so when a forceps delivery, a vacuum extraction or an episiotomy is performed.

The amount of pain experienced by patients in labour is very variable. Some patients have little pain, while others have severe pain, even during early labour.

10-4 WHAT WILL MAKE THE PAIN WORSE?

Anxiety, fear and uncertainty lower the pain threshold. This is particularly noticeable in primigravid patients, especially if they are very young. Pain increases the patient's anxiety, which in turn reduces her ability to tolerate pain.

10-5 WHY DO YOU NEED TO GIVE A PATIENT ANALGESIA DURING LABOUR?

1. As health workers, one of our primary responsibilities is to relieve pain and suffering. All too often pain during labour is regarded as part of a normal process. Therefore, during labour patients should frequently be asked whether they need pain relief. If required, the most appropriate and effective form of analgesia available must be given.
2. The relief of pain often allows labour to progress more rapidly by reducing the anxiety which is caused by pain. It is well known that anxiety may cause poor progress during labour.

THE RELIEF OF PAIN IS VERY IMPORTANT AND MUST RECEIVE CAREFUL ATTENTION WHEN A PATIENT IS CARED FOR DURING LABOUR

10-6 SHOULD ALL PATIENTS RECEIVE ANALGESIA?

No. Some patients have little pain in labour and, therefore, may not need an analgesic. Other patients feel that they are able to tolerate the pain of uterine contractions, e.g. by concentrating on their breathing, and choose not to have analgesia. It is important to consider the patient's wishes when deciding whether or not to give analgesia. However, most patients do need analgesia during labour.

10-7 WHEN DO YOU GIVE ANALGESIA TO A PATIENT IN LABOUR?

1. IN THE FIRST STAGE OF LABOUR:

- (i) When patients ask for pain relief.
- (ii) When patients experience painful uterine contractions during a normal labour.
- (iii) When patients have painful contractions and in addition require oxytocin stimulation of labour.
- (iv) When patients have painful contractions with slow progress during the active phase of the first stage of labour, e.g. with an occipito-posterior position.

2. IN THE SECOND STAGE OF LABOUR:

- (i) When an episiotomy is done.
- (ii) When an instrumental delivery is done.

3. IN THE THIRD STAGE OF LABOUR:

- (i) When an episiotomy or perineal tear is repaired.

10-8 WHAT METHODS OF PROVIDING ANALGESIA CAN YOU USE?

1. GENERAL MEASURES: A pleasant environment and the support and encouragement of those who are attending to the patient help to reduce anxiety and fear. The help and support of a family member, partner or friend is of great value. The patient, therefore, will be more relaxed and pain is more easily tolerated.

2. SPECIFIC METHODS:

- (i) Opiates, e.g. pethidine.
- (ii) Inhalational analgesia, i.e. nitrous oxide with oxygen.
- (iii) Local anaesthesia.
- (iv) Epidural anaesthesia.
- (v) General anaesthesia.

10-9 WHY ARE THE ENVIRONMENT AND EMOTIONAL SUPPORT IMPORTANT TO A PATIENT IN LABOUR?

A patient should be prepared for her labour during the antenatal period. Primigravidas must be told in simple terms what is going to happen during labour. Relaxation exercises and breathing methods can help patients prepare for labour, and should be taught as part of antenatal care.

During labour, particularly during the latent phase and early in the active phase of the first stage, patients may be encouraged to walk around and not spend all the time in bed in the labour ward. A calm, considerate and caring attitude from those who are attending the patient in labour is important. Thorough but gentle clinical examinations, rubbing the patient's back and talking to her all do much to relieve the stress of labour and to some extent the pain.

Most patients find it helpful to have someone with them during labour. A lay person can fulfill this role perfectly well. A patient should be encouraged to have her husband, a family member or someone else that she knows well to stay with her during labour.

ANTENATAL PREPARATION AND EMOTIONAL SUPPORT ARE IMPORTANT IN REDUCING ANXIETY AND PAIN DURING LABOUR

10-10 WHY IS IT IMPORTANT THAT LABOUR SHOULD BE A POSITIVE EXPERIENCE?

- 1. The chances of breastfeeding successfully are increased.
- 2. Patients will manage their infants with greater confidence and master the art of motherhood quicker.

10-11 WHY DOES A PATIENT GET PAIN RELIEF IN LABOUR IF HER LOWER BACK IS RUBBED?

The nerve impulses that come from the lower back travel to the same spinal segments as those from the uterus and cervix. Pain impulses from the uterus and cervix are, therefore, experienced as less painful by the patient if they are partially blocked by touch impulses from the lower back. Therefore, it is important to remember that a patient's lower back should be rubbed during labour.

10-12 WHICH ANALGESIC DRUG IS COMMONLY USED IN THE FIRST STAGE OF LABOUR?

Pethidine. This drug is a powerful analgesic but commonly causes nausea and vomiting as a side effect. Pethidine also produces some sedation.

10-13 WHAT DRUG IS OFTEN GIVEN TOGETHER WITH PETHIDINE?

Hydroxyzine (Aterax) or promethazine (Phenegan). They combine well with pethidine for 3 reasons:

1. They have a tranquillizing effect which makes the patient feel more relaxed.
2. They have an anti-emetic effect, reducing the nausea and vomiting due to pethidine.
3. They increase the analgesic effect of pethidine.

The dose of hydroxyzine is 100 mg and promethazine is 25 mg, irrespective of the amount of pethidine given.

10-14 WHAT ARE THE ACTIONS OF PETHIDINE?

It is a powerful analgesic but causes depression of the central nervous system. Large doses can, therefore, cause respiratory depression. A drop in blood pressure may also occur. Pethidine crosses the placenta and can cause respiratory depression in the newborn infant who may, therefore, need resuscitation at birth.

Morphine, which is less commonly used, has similar actions and side effects to pethidine.

**** Pethidine and morphine may temporarily affect the cardiotocogram with the fetal heart rate tracing showing loss of beat-to-beat variation.*

AN OVERDOSE OF PETHIDINE MAY CAUSE RESPIRATORY DEPRESSION IN BOTH THE MOTHER AND HER INFANT
10-15 HOW IS PETHIDINE USUALLY GIVEN AND HOW LONG IS ITS DURATION OF ACTION?

1. The INTRAMUSCULAR route:
 - (i) This is the commonest method of giving pethidine, especially with a cervical dilatation of less than 7 cm.
 - (ii) Pain relief will be experienced about 30 minutes after administration and the duration of action will be about 4 hours, although this varies from patient to patient.
2. The INTRAVENOUS route:
 - (i) This method may be used if the patient requires analgesia urgently and the cervix is already 7 cm or more dilated.
 - (ii) Pain relief is experienced within 5 minutes and the duration of action will be about 2 hours.

10-16 WHAT DOSE OF PETHIDINE SHOULD BE GIVEN?

1. The INTRAMUSCULAR route: Two mg per kg body weight. Therefore, 100 to 150 mg is usually given. Patients weighing less than 50 kg must receive 75 mg.
2. The INTRAVENOUS route: One mg per kg body weight. Therefore, 50 to 75 mg is usually given. Obese patients weighing more than 75 kg must not receive more than 75 mg. An intravenous infusion must first be started before the drug is given.

10-17 HOW CLOSE TO FULL DILATATION MAY PETHIDINE BE GIVEN?

There is no limit to how late in labour pethidine can be given. If the patient needs analgesia she should be given the appropriate dose. However, if she receives pethidine within 6 hours of delivery, the infant may have respiratory depression at birth.

PETHIDINE MAY BE GIVEN LATE IN LABOUR IF NEEDED
10-18 HOW OFTEN MAY PETHIDINE BE GIVEN IN LABOUR.

If an adequate dose of intramuscular pethidine is given, it is usually not necessary to repeat the drug within 4 hours. (In South Africa registered nurses are allowed by law to give 100 mg pethidine by intramuscular injection during labour, without a doctor's prescription, and to repeat the injection after an interval of 4 hours or more).

10-19 HOW SHOULD YOU TREAT RESPIRATORY DEPRESSION DUE TO PETHIDINE IN A NEWBORN INFANT?

Naloxone (Narcan) is a specific antidote to pethidine (and morphine) and will reverse the effects of the drug.

If a patient was given pethidine during labour, and delivers an infant who does not breathe well after birth, the infant should be given naloxone (Narcan). The correct dose of Narcan is 0,1 mg/kg (i.e. 0,25ml/kg). A 1 ml ampoule contains 0,4 mg naloxone. Therefore, an average sized infant requires 0,75 ml while a large infant up to 1 ml naloxone. Do not give naloxone to asphyxiated infants whose mothers have not received pethidine (or morphine). Naloxone will not reverse the respiratory depression caused by barbiturates (e.g. phenobarbitone), benzodiazepines (e.g. Valium) or a general anaesthetic.

Research has shown that the previously recommended dose (0,01 mg/kg) of Neonatal Narcan is ten fold too low. The use of Neonatal Narcan must, therefore, be stopped and replaced with adult Narcan.

INFANTS WHO DO NOT BREATHE WELL AFTER DELIVERY SHOULD ONLY RECEIVE NALOXONE IF THEIR MOTHERS WERE GIVEN PETHIDINE OR MORPHINE DURING LABOUR
10-20 HOW SHOULD NALOXONE BE GIVEN?

Usually naloxone is given to a newborn infant by intramuscular injection into the anterolateral aspect of the thigh. The drug will reverse the effects of pethidine. Meanwhile, it is important to continue ventilating the infant. Naloxone can also be given intravenously. The drug acts more rapidly when given intravenously, e.g. into the umbilical vein.

10-21 IS A SINGLE DOSE OF NALOXONE ADEQUATE?

Yes. A single dose of naloxone is almost always adequate to reverse the respiratory depression caused by pethidine. The action lasts about 30 minutes. Some infants may become lethargic after 30 minutes and may then require a second dose of naloxone.

10-22 ARE SEDATIVES USEFUL IN LABOUR?

In practice there are very few indications for the use of sedatives in labour. If a patient is restless or distressed, it is almost always because of pain and she, therefore, needs analgesia. The tranquillising effect of hydroxyzine (Aterax) or promethazine (Phenegan) together with pethidine will provide sufficient sedation for a restless patient. The dose is 100 mg hydroxyzine (Aterax) and 25 mg promethazine (Phenegan).

There is no role for sedation with diazepam (Valium) and barbiturates. Sedatives may also cross the placenta and sedate the infant. Diazepam (Valium) can cause severe respiratory depression in the infant and this effect is not reversed by naloxone.

10-23 WHAT INHALATIONAL ANALGESIA IS AVAILABLE?

The most commonly used inhalational analgesic is Entonox. This is a mixture of 50% nitrous oxide and 50% oxygen. It is usually supplied in cylinders and is breathed in by the patient through a mask when she needs pain relief.

The advantages of Entonox are:

1. It is safe for mother and fetus.
2. It is short acting.
3. It acts quickly.

The disadvantages of Entonox are:

1. It is expensive.
2. It requires special apparatus for administration.
3. It is not always effective because the patient needs to start inhaling the gas as soon as the contraction starts for the analgesic effect to be present during the peak of the contraction. Many patients start the inhalation too late.
4. Patients often hyperventilate and get "pins and needles" in their face and hands.

10-24 WHICH PATIENTS SHOULD PREFERABLY USE ENTONOX?

A patient requiring analgesia for the first time in advanced labour, where the delivery is expected within an hour.

10-25 DOES ENTONOX HAVE ANY SERIOUS SIDE EFFECTS?

No. Entonox is completely safe and cannot be used in excessive doses.

ENTONOX IS A COMPLETELY SAFE ANALGESIC**10-26 WHAT IS A LOCAL ANAESTHETIC?**

Local anaesthetics are drugs which are injected into the tissues and which result in a loss of all sensation in the injected area. Local anaesthetics often give a burning sensation which lasts 1 to 2 minutes while they are being injected. The patient should be warned about this before starting the injection.

Lignocaine (Xylocaine) is the local anaesthetic used most commonly. Although available in different concentrations it is best to use the 1% solution. The possibility of giving an overdose will then be reduced.

10-27 WHEN SHOULD YOU USE A LOCAL ANAESTHETIC?

There are 23 main indications for local anaesthesia in labour:

1. When performing an episiotomy, or when repairing an episiotomy or perineal tear.
2. When performing a pudendal block. The local anaesthetic acts on the pudendal nerves, and is usually given before an instrumental delivery.

10-28 WHAT ARE THE RISKS OF LOCAL ANAESTHESIA?

1. Too much local anaesthetic is dangerous and may cause convulsions. The maximum dose of a 1% solution of lignocaine (Xylocaine) for a patient of average size is 20 ml.
2. A local anaesthetic can cause convulsions if it is injected into a vein in error.

*** *The maximum safe dose of lignocaine is 3 mg/kg body weight. One ml of a 1% lignocaine solution contains 10 mg lignocaine.*

AN OVERDOSE, OR INTRAVENOUS INJECTION, OF A LOCAL ANAESTHETIC MAY CAUSE CONVULSIONS

10-29 WHAT IS THE DURATION OF ACTION OF LIGNOCAINE?

Lignocaine results in loss of sensation in the infiltrated area for 45 minutes. If the maximum dose has already been given but more local anaesthetic is required, a further 10 ml of 1% lignocaine may be given after 30 minutes.

10-30 WHAT ARE THE INDICATIONS FOR EPIDURAL ANAESTHESIA?

1. When there is poor progress during the active phase of the first stage of labour, e.g. due to an occipito-posterior position.
2. When ineffective uterine contractions are present, prior to starting oxytocin.
3. When it is important to prevent bearing down before a patient's cervix is fully dilated, e.g. with a preterm infant or a breech presentation.
4. Caesarean sections may also be done under epidural anaesthesia.

This is the ideal form of local anaesthesia as it offers the patient complete pain relief. Unfortunately special training and equipment are necessary for giving epidural anaesthesia and, therefore, it is only available in most level 2 and 3 hospitals.

10-31 WHAT SPECIAL NURSING CARE IS REQUIRED FOLLOWING AN EPIDURAL ANAESTHETIC?

1. There is a danger of hypotension following the administration of the first and each further dose of the local anaesthetic. The blood pressure must be taken every 5 minutes for 30 minutes following each dose of the local anaesthetic.
2. Depending on the amount of anaesthesia achieved, patients often cannot pass urine. A Foley's catheter is, therefore, often required until the effect of the anaesthesia wears off.

10-32 WHAT ARE THE DANGERS FOR A PREGNANT OR POSTPARTUM PATIENT WHEN RECEIVING A GENERAL ANAESTHETIC?

Any pregnant or postpartum patient who receives a general anaesthetic has a very high risk of vomiting and aspirating stomach contents because:

1. Stomach emptying is delayed.
2. The tone of the sphincter in the lower oesophagus is reduced.
3. The intra-abdominal pressure is increased.

Patients who have been starved must be managed in the same way as patients who have recently eaten. During a general anaesthetic, the risk of the patient vomiting is particularly high during intubation and extubation.

10-33 WHAT PRECAUTIONS MUST BE TAKEN PREOPERATIVELY THAT WILL REDUCE THE DANGERS OF VOMITING?

1. A patient who may require a general anaesthetic should be kept nil per mouth (i.e. she should be starved).
2. Metoclopramide (Maxalon) 20 mg (2 ampoules) should be given intravenously 15 minutes before the induction of general anaesthesia. Metoclopramide is an anti-emetic (prevents vomiting), it speeds up emptying of the stomach and it increases the tone of the lower oesophagus. The drug acts for about 2 hours.
3. The gastric acid must be neutralized by an antacid before the induction of general anaesthesia. Usually 30 ml of a 0,3 molar solution of sodium citrate is given. If induction of anaesthesia is not started within 30 minutes of the sodium citrate being given, the 30 ml dose should be repeated.

*** *Sodium citrate is cheap and can be made up by any pharmacist. It is an electrolyte solution and, therefore, preferable to other antacids which contain particles that can cause a chemical pneumonitis if the drug is aspirated.*

CASE PROBLEMS

CASE 1

A patient and her husband present at the maternity hospital. She is 26 years old, gravida 2 para 1 and at term. Her antenatal course has been normal and her routine observations on admission are also normal. The fetal presentation is cephalic with 2/5 of the fetal head palpable above the pelvic brim. The membranes rupture spontaneously and her cervix is found to be 5 cm dilated on vaginal examination. The patient is relaxed and does not find her contractions painful. She is admitted to the labour ward and given 100 mg pethidine and 100 mg hydroxyzine (Aterax) by intramuscular injection as she is already in the active phase of the first stage of labour. Her husband is asked to wait outside the labour ward. It is suggested that he go home for a while as the infant is unlikely to be born during the next 5 or 6 hours.

1. Has the patient been correctly managed?

No. She did not require analgesia. Not all patients need analgesia during labour. Some patients experience little pain during labour while others handle the pain of contractions with no difficulty.

2. What would have been the correct management of this patient?

The patient should have been reassured that her labour was progressing normally. She should have been encouraged to walk about and not spend all the time in bed. Analgesia need not be given routinely to all patients in active labour.

3. Do you agree with the handling of the patient's husband?

No. Most patients prefer to have someone they know well remain with them during labour. Her husband should have been encouraged to stay with her if that was what the patient wanted.

4. What should the husband do if he stays with his wife during labour?

Simply being there is reassuring to the patient. He can help to keep her relaxed and comfortable. Furthermore, he can be shown how to rub her back during contractions.

5. Is it of any value to rub a patient's back during contractions, or is it only an "old wife's tale" that has no place in modern midwifery?

Rubbing a patient's lower back is of great help as the nerve impulses that come from the skin over the lower back travel to the same spinal segments as the nerve impulses from the cervix and uterus. The nerve impulses from the lower back, therefore, partially block those from the uterus and cervix. As a result, the pain of contractions is experienced as less painful by the patient if the lower back is rubbed.

CASE 2

A 16 year old patient presents in labour at term after a normal pregnancy. She is very anxious, does not cooperate with the labour ward staff and complains of unbearable pain during contractions. She bears down with every contraction even though the cervix is only 4 cm dilated. The patient is told to behave herself. She is informed that the worst part of labour is still to come and is scolded for becoming pregnant. As she is a primigravida, she is promised analgesia when her cervix reaches 6 cm dilatation.

1. Why is the patient frightened?

Because she is unprepared for labour and does not know what to expect. In addition, she is in a strange environment and the staff are unfriendly and aggressive. Being anxious results in her experiencing her contractions as very painful while the pain in turn makes her even more anxious.

2. What should have been done during the antenatal period to avoid the present situation?

Receiving good information about the process of labour at antenatal visits, attending antenatal exercise classes and visiting the labour ward during the last weeks of pregnancy would have resulted in a far more relaxed patient in labour.

3. What should have been done in the labour ward to reduce her anxiety?

She should have experienced a pleasant atmosphere in the labour ward with understanding and encouragement from the staff. They should have reassured her that everything was under control and that there was no reason for her to be frightened. The staff themselves should appear confident, relaxed and caring. It is important that a family member or friend of the patient's remain with her.

4. Should the doctor be informed about the unmanageable patient and be asked to prescribe 10 mg of intravenous diazepam (Valium)?

No. Sedatives, especially diazepam, should be used very rarely because they may result in severe respiratory depression in the infant at birth. This complication is not reversed by the commonly available drugs at delivery.

5. What would have been the correct management of labour for this patient, beside reassurance?

She should have been encouraged to concentrate on her breathing during contractions. In addition she should have been given adequate analgesia as soon as possible.

6. What form of analgesia should have been given to this patient?

The ideal form of analgesia for this patient would have been an epidural anaesthetic as it provides complete pain relief. Alternatively she should have been given pethidine and hydroxyzine (Aterax) or promethazine (Phenegan) by intramuscular injection. The tranquillizing effect of hydroxyzine or promethazine would have helped to lessen her anxiety.

CASE 3

Cervical dilatation in a multigravid patient in labour at term progresses from 3 cm to 8 cm in 4 hours. Now for the first time she complains that her contractions are very painful. The midwife informs her that she is progressing fast and that her cervix will soon be fully dilated. She adds that the patient must just continue without analgesia for the last 2 hours as the delivery will soon be over.

1. Do you agree with the patient's management?

No. The patient needs analgesia and the most appropriate form of analgesia should be offered to her.

2. What would be the best form of analgesia to offer this patient?

Entonox (nitrous oxide with oxygen) as it works rapidly and is completely safe. She also only needs analgesia for a short time as her cervix will soon be fully dilated.

3. If Entonox is not available or if the patient is unable to use Entonox correctly, what other form of analgesia should be considered?

Pethidine and hydroxyzine (Aterax) or promethazine (Phenegan).

4. What would be the best route of administering the pethidine to this patient?

The pethidine should preferably be given intravenously. Pain relief will then be obtained in 5 minutes and the effect of the drug should last 2 hours.

5. **The infant is delivered 45 minutes after the pethidine is given. What complication of the drug may be present in the infant at delivery?**

The infant may have respiratory depression and as a result may not breathe adequately at birth.

6. **How should the infant be managed if the breathing is inadequate (i.e. the infant has asphyxia)?**

The infant must be resuscitated with oxygen and artificial respiration provided via a face mask or endotracheal tube. Naloxone (Narcan) must be given to the infant to reverse the effect of the pethidine. Naloxone is usually given by intramuscular injection. However, it acts more rapidly if it is given into the umbilical vein.

CASE 4

A multigravid patient, who has had 2 previous caesarean sections, is booked for an elective caesarean section under general anaesthesia at 39 weeks gestation. The patient is admitted to hospital at 07:00, having had nothing to eat since 24:00 the previous night. She is prepared for surgery at 08:00. As the patient has been kept "nil by mouth" no drug to prevent vomiting during intubation and extubation is given. Only an intravenous infusion is started and a Foley's catheter passed before she is moved to theatre.

1. **Do you agree that a drug to prevent vomiting is not needed as the patient has had nothing to eat or drink for 8 hours?**

No. All pregnant patients are at risk of vomiting during general anaesthesia even if they have taken nothing by mouth during the past few hours.

2. **Why should a pregnant patient who has not eaten overnight still be at risk of vomiting during a general anaesthetic?**

Because her stomach has a delayed emptying time, the lower oesophageal tone is reduced and she has a raised intra-abdominal pressure.

3. **What preventative measures should have been carried out during the pre-operative preparation of the patient for theatre?**

Metoclopramide (Maxalon) 20 mg (2 ampoules) must be given intravenously 15 minutes before the induction of anaesthesia. It is an anti-emetic, it increases the stomach emptying time and raises the sphincter tone of the lower oesophagus. These effects will reduce the danger of vomiting. An antacid should also be given before the general anaesthetic. The drug of choice is 30 ml of a 0,3 molar solution of sodium citrate.

4. **Both these drugs are given at 07:45. However, due to a delay, the patient is only taken to theatre at 08:30. Is it necessary to repeat either of these drugs?**

The metoclopramide (Maxalon) acts for 2 hours so need not be repeated. However, the sodium citrate acts for only 30 minutes and, therefore, must be repeated before the start of the anaesthetic.