Labour

38

Objectives

After reading this chapter, you should be able to:

- Define the onset of labour
- Describe the normal delivery of the fetus
- Understand that normal progress in labour is multifactorial
- Assess failure to progress in labour
- Describe the benefits and side effects of pharmacological methods of analgesia in labour.

Labour is divided into three stages:

- First stage: from the onset of established labour until the cervix is fully dilated.
- Second stage: from full dilatation until the fetus is born.
- Third stage: from the birth of the fetus until delivery of the placenta and membranes.

ONSET OF LABOUR

Prior to the onset of labour, painless intermittent uterine tightenings, known as Braxton Hicks contractions, become increasingly frequent. As the presenting part becomes engaged, the uterine fundus descends, reducing upper abdominal discomfort, and pressure in the pelvis increases. The signs and symptoms that define the actual onset of labour are:

- Painful regular contractions.
- A 'show' (passage of a mucoid plug from the cervix, often blood-stained).
- Rupture of the membranes.
- Cervical dilatation and effacement.

Labour is diagnosed when there are regular painful contractions in the presence of a fully effaced cervix, which is 4 cm or more dilated, with or without a show or ruptured membranes.

The exact cause of the onset of labour is not known. To some degree it is thought to be mechanical, since preterm labour is seen more commonly in circumstances in which the uterus is overstretched, such as multiple pregnancies and polyhydramnios. Inflammatory markers such as cytokines, and prostaglandins might play a role. The latter are thought to be present in the decidua and membranes in late pregnancy and are released if the cervix is digitally stretched at term to separate the membranes (a cervical sweep).

PROGRESS IN LABOUR

Once the diagnosis of labour has been made, progress is assessed by monitoring:

- Uterine contractions.
- Dilatation of the cervix.
- Descent of the presenting part.

The rate of cervical dilatation is expected to be approx 1cm/h in a nulliparous woman and 1–2 cm/hour in a multiparous woman. A partogram is commonly used to chart the observations made in labour (Fig. 38.1) and to highlight slow progress, particularly a delay in cervical dilatation or failure of the presenting part to descend (see Chapter 14).

Progress is determined by three factors:

- Passages.
- Passenger.
- Power.

Passages

Bony pelvis

The pelvis is made up of four bones:

- Two innominate bones.
- Sacrum.
- Coccyx.

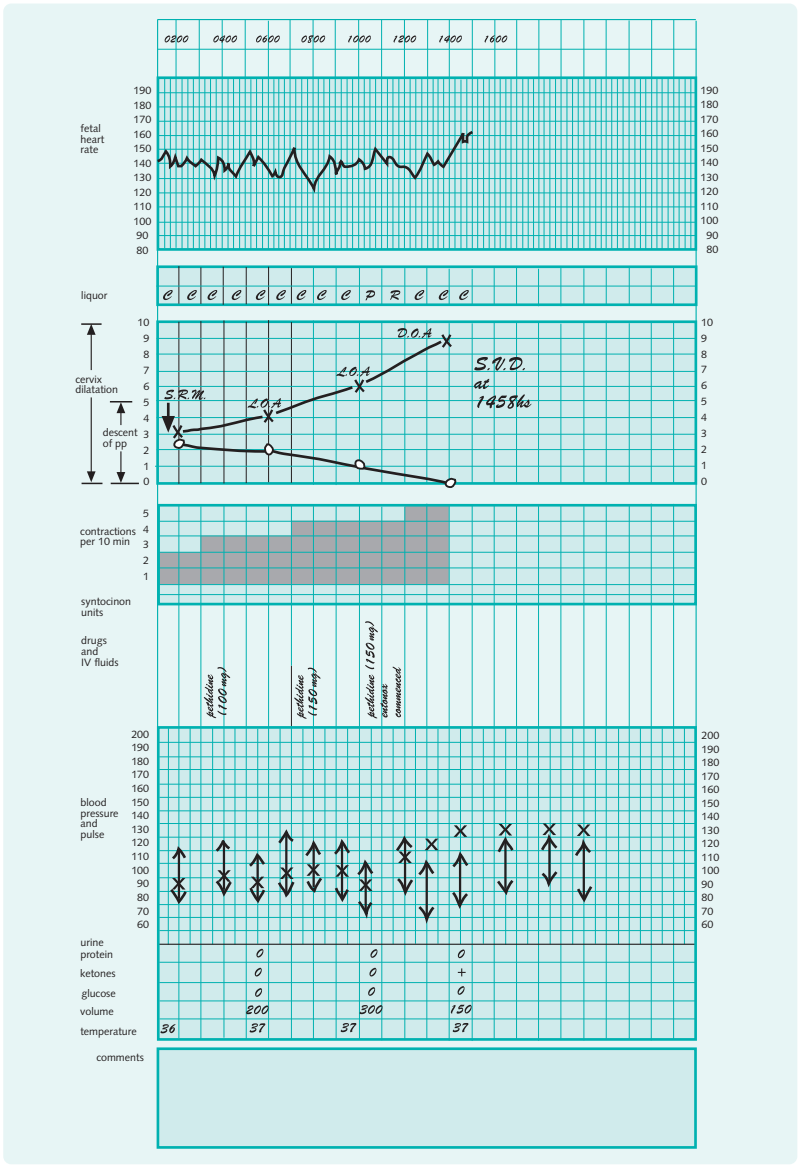

Fig. 38.1 A partogram.

The passage that these bones make can be divided into inlet, cavity and outlet (Fig. 38.2). The pelvic inlet is bounded by the pubic crest, the iliopectineal line and the sacral promontory. It is oval in shape, with its wider diameter being transverse. The cavity of the pelvis is round in shape. The pelvic outlet is bounded by the lower border of the pubic symphysis, the ischial spines and the tip of the sacrum. Again the shape is oval, but the wider diameter is anteroposterior (Fig. 38.3).

When a woman stands upright, the pelvis tilts forward. The inlet makes an angle of about 55° with the horizontal; this varies between individuals and different ethnic groups. The presenting part of the fetus must negotiate the axis of the birth canal with the change of direction occurring by rotation at the pelvic floor.

Soft tissues

The soft passages consist of:

- Uterus (upper and lower segments).
- Cervix.
- Pelvic floor.
- Vagina.
- Perineum.

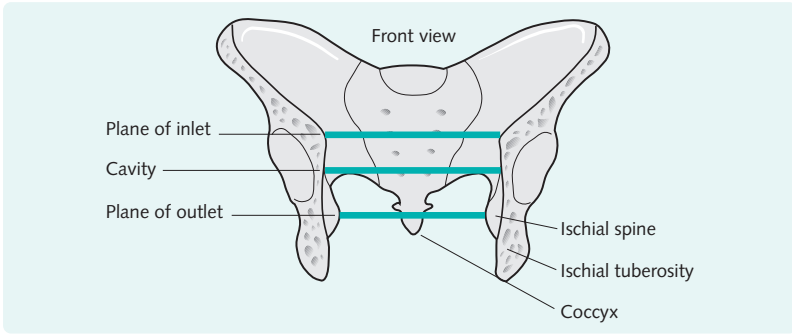

Fig. 38.2 The bony pelvis.

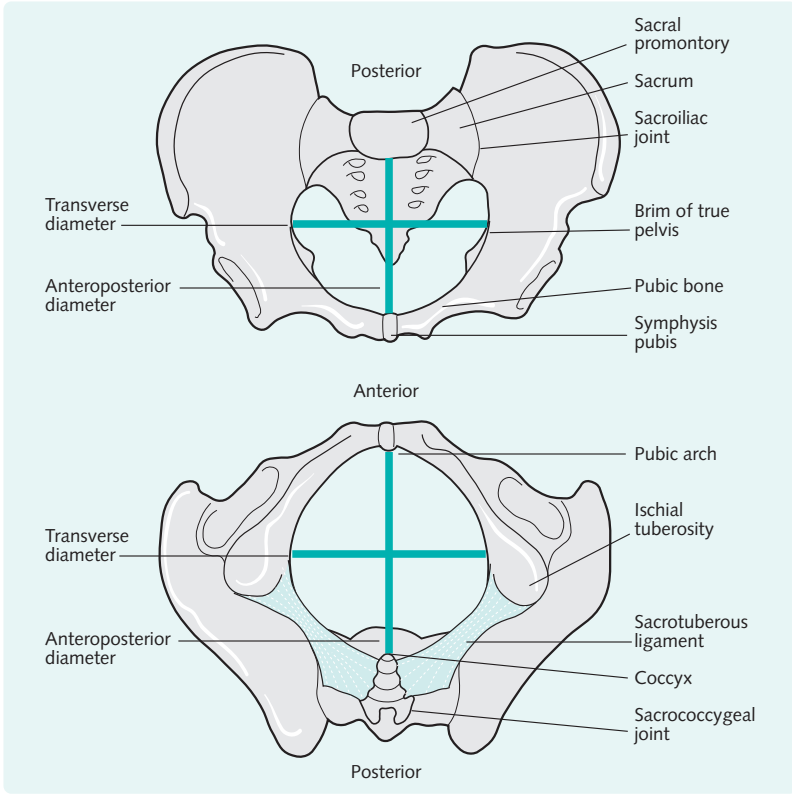

Fig. 38.3 The boundaries of the pelvic inlet and the pelvic outlet.

The upper uterine segment is responsible for the propulsive contractions that deliver the fetus. The lower segment is the part of the uterus that lies between the uterovesical fold of the peritoneum and the cervix. It develops gradually during the third trimester, and then more rapidly during labour. It incorporates the cervix as it effaces, to allow the presenting part to descend.

The pelvic floor consists of the levator ani group of muscles, including pubococcygeus and iliococcygeus arising from the bony pelvis to form a muscular diaphragm along with the internal obturator muscle and piriformis muscle (see Chapter 28). As the presenting part of the fetus is pushed out of the uterus it passes into the vagina, which has become hypertrophied during pregnancy. It reaches the pelvic floor, which acts like a gutter to direct it forwards and allow rotation. The perineum is distal to this and stretches as the head passes below the pubic arch and delivers.

Passenger

The fetal skull consists of the face and the cranium. The cranium is made up of two parietal bones, two frontal bones and the occipital bone, held together by a membrane that allows movement. Up until early childhood, these bones are not fused and so can overlap to allow the head to pass through the pelvis during labour; this overlapping of the bones is known as moulding.

Fig. 38.4 shows the anatomy of the fetal skull, including the sutures between the bones, and the fontanelles. These are important landmarks that can be felt on vaginal examination and enable the position of the fetus to be assessed (Figs 46.13 and 46.14). The position is described in terms of the occiput in a cephalic presentation, and the sacrum in a breech presentation.

The size and position of the fetal skull determine the ease with which the fetus passes through the birth canal. Fig. 38.5 shows the diameters of the fetal skull. The diameter that presents during labour depends on the degree of flexion of the head. Thus the smallest diameters for delivery are the suboccipitobregmatic diameter which represents a flexed vertex presentation, and the submentobregmatic diameter, which corresponds to a face presentation. The widest diameter is mentovertical, a brow presentation, which usually precludes vaginal delivery.

Power

The myometrial component of the uterus acts as the power to deliver the fetus. It consists of three layers:

- Thin outer longitudinal layer.
- Thin inner circular layer.
- Thick middle spiral layer.

From early pregnancy, the uterus contracts painlessly and intermittently (Braxton Hicks contractions). These contractions increase after the 36th week until the onset of labour. In labour, a contraction starts from the junction of the fallopian tube and the uterus on each side, spreading down and across the uterus with its greatest intensity in the upper uterine segment.

During labour, the contractions are monitored for:

- Intensity.
- Frequency.
- Duration.

The resting tone of the uterus is about 6–12 mmHg; to be effective in labour this increases to an intensity of 40–60 mmHg. There are usually three or four coordinated contractions every 10 minutes, each lasting approx 60 s, in order to progress in labour.

In the second stage of labour, additional power comes from voluntary contraction of the diaphragm and the abdominal muscles as the mother pushes to assist delivery.

MECHANISM OF NORMAL DELIVERY: ACTION OF THE UTERUS

The myometrium acts like all muscle, that is, it contracts and relaxes, but it also has the ability to

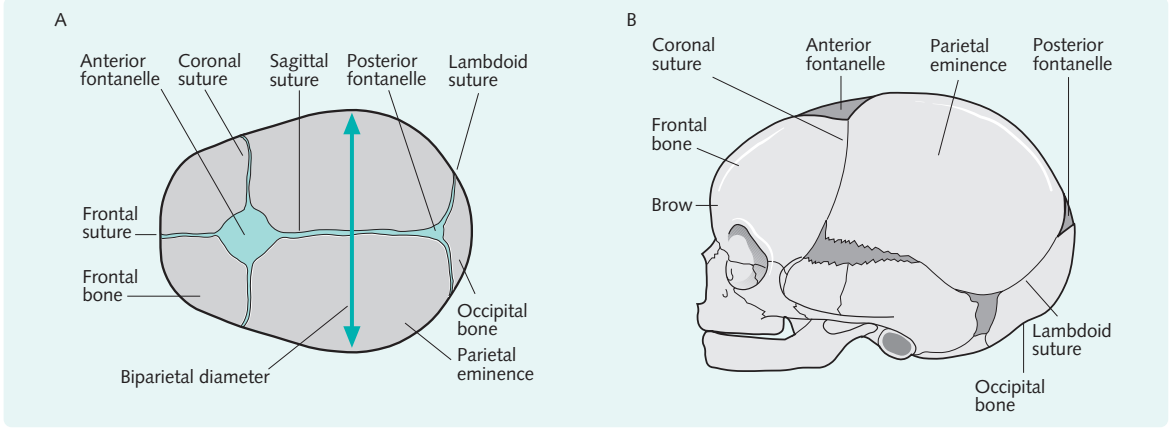

Fig. 38.4 The fetal skull from above (A) and from the side (B), showing the landmarks.

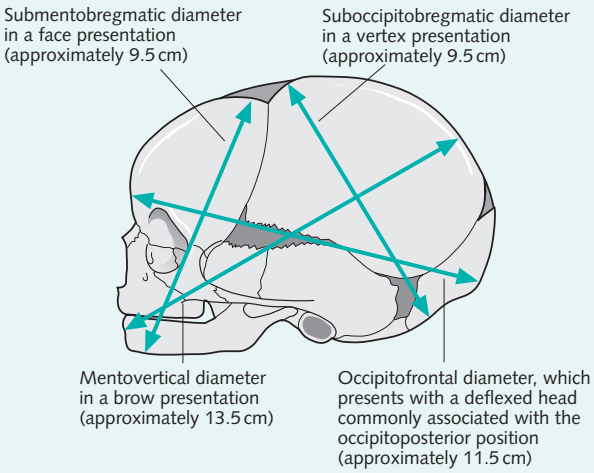

Fig. 38.5 Diameters of the fetal skull.

retract so that the fibres become progressively shorter. This effect is seen in the upper segment muscle: progressive retraction causes the lower segment to stretch and thin out, resulting in effacement and dilatation of the cervix (Fig. 38.6).

DELIVERY OF THE FETUS

Active contractions of the uterus of increasing strength, frequency and duration cause passive movement of the fetus down the birth canal. At the beginning of labour, the fetus usually engages in the occipito-transverse or occipito-anterior position. As labour progresses (Fig. 38.7), the neck becomes fully flexed so that the suboccipitobregmatic diameter is presenting (see above).

As descent occurs, internal rotation brings the occiput into the anterior position when it reaches the pelvic floor. In the second stage of labour, the occiput descends below the symphysis pubis (Fig. 38.8) and delivers by extension. Increasing extension round the pubic bone delivers the face (Fig. 38.9).

Delivery of the head brings the shoulders into the pelvic cavity in the transverse diameter, with the head oblique to the line of the shoulders. External rotation or restitution occurs: the head rotates in relation

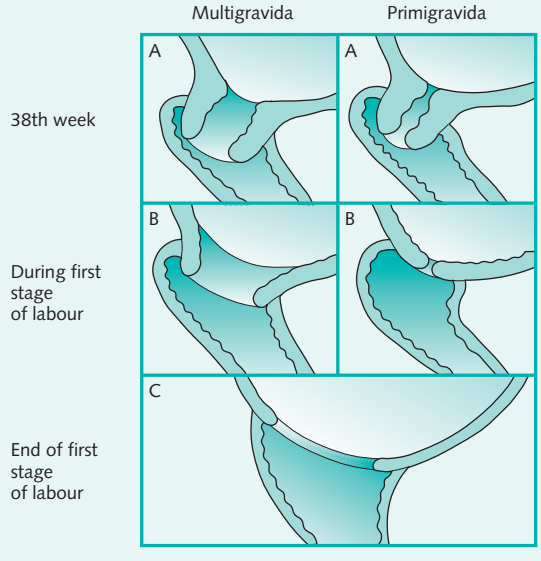

Fig. 38.6 Dilatation and effacement of the cervix in late pregnancy and labour.

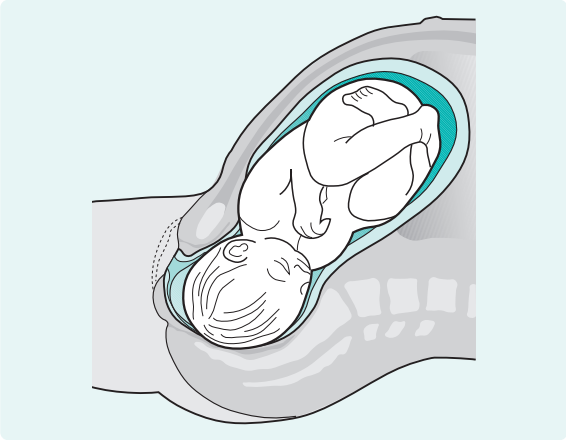

Fig. 38.7 Early labour. There has been flexion of the fetal head. The cervix is effacing and has begun to dilate.

Fig. 38.8 The second stage of labour. The head has undergone internal rotation to bring the occiput into the anterior position. The cervix is fully dilated.

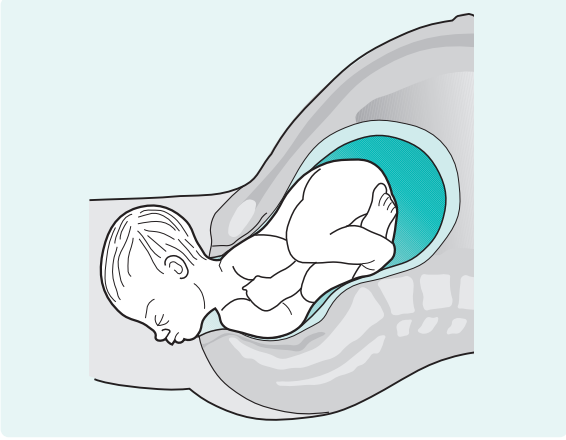

Fig. 38.9 Delivery of the head. Extension of the fetal neck occurs as the head passes under the pubic symphysis to deliver the head.

to the shoulders (Fig. 38.10). Finally, continuing descent and rotation of the shoulders brings their widest diameter (the bisacromial diameter) into the anteroposterior diameter of the pelvic outlet. This enables the anterior shoulder to pass under the pubis, usually assisted by gentle downward traction on the head. Lateral flexion of the fetus delivers the posterior shoulder and the rest of the body follows (Fig. 38.11).

Mechanism of delivery of the head:
- Flexion.
- Internal rotation.
- Extension.
- External rotation (restitution).

MANAGEMENT OF THE FIRST STAGE OF LABOUR

When a patient presents in the first stage of labour, routine assessment includes:

- Mother: pulse, blood pressure, temperature, urinalysis, analgesia requirements.
- Fetus: fetal heart rate pattern (see Chapter 15).
- Abdominal palpation: fetal size, lie, presentation, engagement.
- Contractions: frequency, duration, intensity.
- Vaginal examination: degree of cervical effacement, cervical dilatation, station of presenting part in relation to ischial spines, position of presenting part, presence of caput or moulding.
- Liquor: clear, blood-stained, presence of meconium.

Engagement and station are illustrated in Figs 46.4 and 46.11 respectively.

Maternal monitoring

The patient is encouraged to mobilize if possible and is allowed to eat, depending on her risk of needing an operative procedure. There is delayed gastric emptying during pregnancy and labour. Therefore if an emergency general anaesthetic is needed, there is an increased risk of inhalation

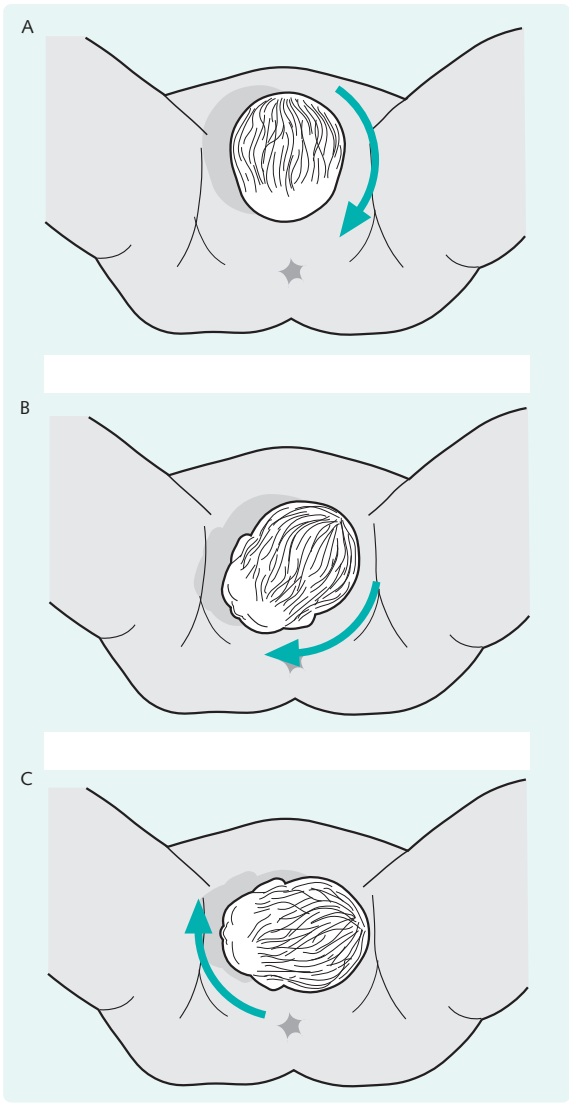

Fig. 38.10 External rotation (restitution). The head distends the perineum as it delivers in the occipitoanterior position and the external rotation occurs.

of regurgitated acid stomach contents, causing Mendelson's syndrome.

The need for analgesia during labour varies markedly between different women, different ethnic groups and depending on their antenatal preparation. Non-pharmacological techniques include the use of psychoprophylaxis, hypnosis, massage and transcutaneous electrical nerve stimulation (TENS). The pharmacological methods are summarized in Fig. 38.12.

Descent of the presenting part is assessed by abdominal palpation (amount of head felt above the pelvic brim expressed in fifths = engagement) and vaginal examination (descent in relation to level of ischial spines = station).

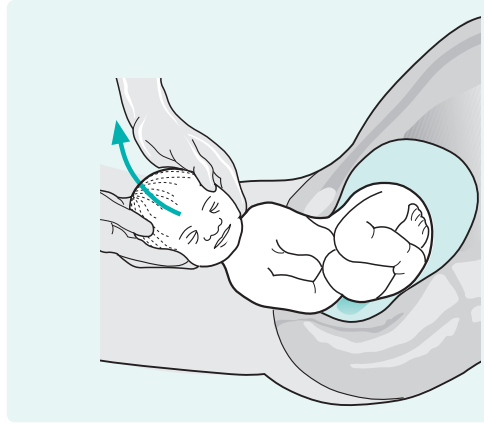

Fig. 38.11 Delivery of the shoulders. The anterior shoulder passes below the pubic symphysis, aided by downward traction of the head by the midwife or doctor. The posterior shoulder delivers as the head is gently lifted upwards.

Fetal monitoring

Different degrees of fetal monitoring are appropriate, depending on the clinical picture. For example, in a high-risk pregnancy such as the presence of IUGR or if there is meconium-stained liquor, then continuous fetal monitoring is advisable (see Chapter 15). In a low-risk pregnancy, intermittent monitoring – either electronically or with a Pinard stethoscope – might be sufficient, every 15 min during and after a contraction.

In some patients, abdominal monitoring can be difficult, for example, if the patient is obese, and so a fetal scalp electrode can be applied directly once the cervix dilates and the membranes are ruptured. If monitoring suggests that the fetal heart rate pattern is abnormal, it might be appropriate to measure the fetal pH by taking a blood sample from the fetal scalp (see Chapter 15).

Fig. 38.12 Pharmacological methods of analgesia in labour

	Technique	Indication	Effectiveness	Duration of effect	Side-effects
Oxygen/ nitrous oxide	Inhalation of 50:50 mixture with onset of contraction	First stage	< 50% Takes 20–30 s for peak effect	Time of inhalation only	Does not relieve pain
Pethidine	Intramuscular injection 100–150 mg	First stage	<50% Takes 15–20 min for peak effect	Approximately 3 h	Nausea and vomiting – give with an antiemetic Respiratory depression in the neonate (this is easily reversed with intramuscular naloxone)
Pudendal block	Infiltration of right and left pudendal nerves (S2, S3 and S4) with 0.5% lidocaine	Second stage for operative delivery	Within 5 min	45–90 min	—
Perineal infiltration	Infiltration of perineum with 0.5% lidocaine at posterior fourchette	Second stage prior to episiotomy Third stage for suturing of perineal lacerations	Within 5 min	45–90 min	—
Epidural anaesthesia	Injection of 0.25% or 0.5% bupivicaine via a catheter into the epidural space (L3–4)	First or second stage Caesarean section	Complete pain relief in approximately 95% of women	Bolus injection every 3–4 h or continuous infusion	Transient hypotension – give intravenous fluid load Dural tap Risk of haemorrhage if abnormal maternal clotting Increased length of second stage because of reduced pelvic floor tone and loss of bearing-down reflex
Spinal anaesthesia	Injection of 0.5% bupivicaine into the subarachnoid space	Any operative delivery; manual removal of the placenta	Immediate effect	Single injection lasting 3–4 h	Respiratory depression

MANAGEMENT OF THE SECOND STAGE OF LABOUR

Once the cervix is fully dilated, the patient is encouraged to use voluntary effort to push with the contractions. If she has an epidural anaesthetic in situ she might be unaware of an urge to push, and so a further hour can be allowed for the presenting part to descend with the contractions alone.

Delivery of the infant is conducted as a sterile clean procedure, usually in the left lateral or dorsal position. As the head descends, the perineum distends and the anus dilates. Then the head crowns: the biparietal diameter has passed through the pelvis and there is no recession between contractions. The attendant applies pressure on the perineum to maintain flexion of the head and, once the occiput is free, encourages extension to allow delivery. The neck is felt to exclude the presence of the cord.

After external rotation, lateral flexion of the head towards the anus dislodges the anterior shoulder with the next contraction. Lifting the head in the opposite

direction delivers the posterior shoulder. Holding the shoulders, the rest of the body is delivered either onto the bed or the mother's abdomen. Finally, the cord is divided and cut.

Shoulder dystocia is a problem of delivering the shoulders once the head is out. This occurs because the shoulders have failed to enter the pelvic inlet, rather than a problem with the outlet or the perineum. The important point is not to put excessive traction on the fetal head to facilitate delivery since this risks damage to the brachial plexus. The more common injury is Erb's palsy caused by damage to nerve roots C4,5 and 6. Manoeuvres to aid delivery include:

- McRoberts position - the hips are flexed in knee-chest position in order to widen the pelvis
- suprapubic pressure to dislodge the anterior shoulder
- internal rotation techniques to try and rotate the baby
- deliver the posterior arm.

MANAGEMENT OF THE THIRD STAGE OF LABOUR

Active management of the third stage has been shown to reduce the incidence of postpartum haemorrhage (see Chapter 42). Management involves:

- Using an oxytocic drug.
- Clamping and cutting the cord.
- Controlled cord traction.

In most units, syntocinon (5 units of oxytocin) is given intramuscularly with delivery of the anterior shoulder; it takes about 2–3 min to act. As the placenta detaches from the uterine wall, the cut cord will appear to lengthen. There is slight bleeding and the fundus becomes hard. Brandt-Andrews' method of controlled cord traction is commonly used once the placenta has separated to reduce the incidence of uterine inversion (Fig. 38.13). The placenta and membranes must be checked to ensure that they are complete.

Finally, the vagina, labia and perineum are examined for lacerations. The uterine fundus is palpated to check that it is well contracted, approximately at the level of the umbilicus. The estimated blood loss should be recorded.

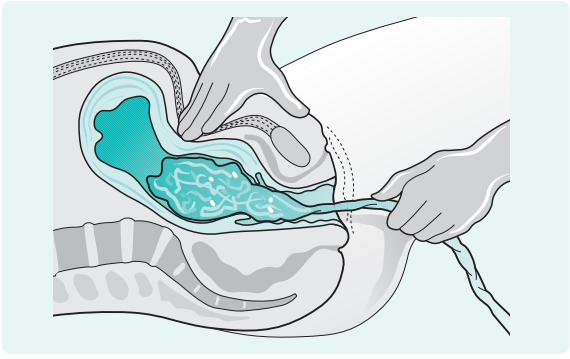

Fig. 38.13 Controlled cord traction to deliver the placenta.

INDUCTION OF LABOUR

Definition

Induction of labour is the artificial initiation of uterine contractions prior to spontaneous onset resulting in delivery of the baby.

Indications

The rate of induction varies widely between different units and even within different units. Figure 38.14 shows possible reasons for induction of labour, maternal or fetal. In the UK, the most common indication is prolonged pregnancy.

Methods

Prior to induction of labour, the favourability of the cervix should be assessed. This is usually done by using the Bishop score (Fig. 46.12); a higher score suggests a more favourable cervix.

With regard to the Bishop score to assess the cervix:

- Unfavourable cervix = hard, long, closed, not effaced (low Bishop score).
- Favourable cervix = soft, beginning to dilate and efface (high Bishop score).

Prostaglandins

Local application of a prostaglandin, usually prostaglandin E2, given as a vaginal gel, has been shown

Fig. 38.14 Indications for the induction of labour

Type of indication	Description
Maternal	Severe pre-eclampsia Pre-existing disease eg. diabetes Social
Fetal	Prolonged pregnancy Intrauterine growth restriction Rhesus disease

to ripen the cervix as part of the induction process and reduce the incidence of operative delivery when compared to use of oxytocin alone. Used locally, the gastrointestinal side-effects are minimized. NICE guidelines have been produced to advise on the dose of prostaglandin given, in order to reduce the risk of uterine hyperstimulation.

Amniotomy

Artificial rupture of the membranes (ARM) is thought to cause local release of endogenous prostaglandins. It is done using an amnihook and may be part of the induction process, or performed to accelerate slow progress in labour. It can also be done with an abnormal CTG to exclude meconium-staining of the liquor, or to apply a fetal scalp electrode.

Oxytocin

An intravenous infusion of synthetic oxytocin (syntocinon) is commonly used to induce labour, to stimulate contractions after amniotomy or spontaneous rupture of membranes. The dose must be carefully titrated according to the strength and frequency of the uterine contractions, and continuous fetal monitoring is necessary.

Complications

Fig. 38.15 lists the possible complications associated with the use of amniotomy and oxytocin.

Amniotomy and oxytocin associated complications

Treatment	Complication
Amniotomy	Cord prolapse Infection Bleeding from a vasa praevia Placental separation Failure to induce efficient contractions Amniotic fluid embolism
Oxytocin	Abnormal fetal heart rate pattern Hyperstimulation of the uterus Rupture of the uterus Fluid overload

Fig. 38.15 Complications associated with the use of amniotomy and oxytocin.

FAILURE TO PROGRESS IN LABOUR

As described in Chapter 15, progress in labour is related to the passages, the passenger (i.e. baby) and the power.

Failure to progress related to the bony pelvis

Abnormal bony shape

Antenatal X-ray pelvimetry and routine pelvic assessment by vaginal examination are no longer performed. However, certain points in a patient's history and examination can give clues to the likelihood of failure to progress in labour (Fig. 38.16).

Cephalopelvic disproportion

With cephalopelvic disproportion (CPD), the size of the pelvis is not in proportion to the fetus. It should be suspected antenatally if the head does not engage at term, particularly in a woman of short stature. Usually, a trial of labour is still appropriate but in some cases an elective caesarean section is planned.

During labour, CPD is diagnosed if the head remains unengaged on abdominal palpation. This is

Fig. 38.16 Causes of abnormalities of the bony pelvis

Type of cause	Description
Congenital	Osteogenesis imperfecta Ectopia vesicae Dislocation of the hip
Acquired	Kyphosis of the thoracic or lumbar spine Scoliosis of the spine Spondylolisthesis Pelvic fractures Rickets/osteomalacia Poliomyelitis in childhood

confirmed assessing station on vaginal examination and by the presence of caput (swelling under the fetal scalp caused by reduction in venous return) and moulding.

Failure to progress related to the soft tissues of the pelvis

Uterus

A uterine malformation, such as the presence of a midline septum, might prevent the fetus from lying longitudinally, so that a malpresentation is responsible for failure to progress. This can also be caused by uterine fibroids, which may increase in size during pregnancy and obstruct labour. The presence of a cervical fibroid might even necessitate caesarean section.

Cervix

Failure of the cervix to dilate during labour despite adequate uterine contractions is rarely secondary to cervical scarring causing stenosis. This could be the result of cervical amputation or cone biopsy.

Vagina

Congenital anomalies of the vagina rarely cause problems with respect to labour and delivery, except for patients who have had reconstructive surgery. Other types of surgery, such as a colposuspension for urinary stress incontinence or repair of a vesicovaginal fistula, generally indicates the need for an elective caesarean section at term, but more to prevent recurrent symptoms rather than because of possible slow progress in labour.

Vulva

Previous perineal tears or episiotomy should not present difficulties during delivery. More problematic is a female circumcision (FGM female genital mutilation), which usually necessitates an anterior episiotomy to prevent more severe tears and the risk of fistula formation.

Ovary

Ovarian cysts in pregnancy are usually incidental findings at routine ultrasound. They can present with abdominal pain during pregnancy, secondary to torsion or haemorrhage (see Chapter 11). They do not cause slow progress in labour because they rise up out of the pelvis as the uterus increases in size.

Failure to progress related to the passenger

Fetal size

The possibility of a large infant might be suggested by the patient's past medical history, for example, insulin-dependent diabetes or from the antenatal history, with development of gestational diabetes or hydrops fetalis, e.g. with rhesus isoimmunization or parvovirus infection (see Chapter 12).

Abdominal palpation is not particularly accurate as a method of diagnosing a large baby, although it should be suspected if the presenting part fails to engage in labour. Ultrasound is more accurate, provided that gestational age has been correctly estimated early in pregnancy. During labour, signs of cephalopelvic disproportion may indicate a large infant (see above).

Fetal abnormality

Routine ultrasound scanning is likely to diagnose abnormalities such as a congenital goitre or a lymphangioma. These extend the neck, resulting in a face presentation. Abdominal enlargement such as in the presence of ascites or an umbilical hernia may make delivery difficult.

Abnormalities of the fetal skull such as anencephaly should be suspected in labour if the head does not engage and the sutures feel widely spaced on vaginal examination.

Fetal malposition

Labour is more prolonged if the occiput is in the posterior or transverse (OP or OT) position. This can be determined abdominally by palpation of fetal parts and confirmed on vaginal examination by checking the positions of the sutures and fontanelles (see Chapter 46).

Fetal malpresentation

Malpresentation of the fetus is defined as a non-vertex presentation (see Chapter 39). This can be:

- Face.
- Brow.
- Breech.
- Shoulder.

Failure to progress related to the power

Uterine palpation monitors frequency, duration and intensity of the contractions. The cardiotocograph checks the frequency and duration but the recording of the intensity can be altered by position of the monitor on the abdomen and maternal obesity. In some centres, intrauterine pressure catheters are used to monitor contraction pressure. Inefficient uterine action can be diagnosed if labour is prolonged and the contractions are:

- Uncoordinated.
- Fewer than 3–4 in 10 min.
- Lasting less than 60 s.
- Pressure less than 40 mmHg.

CPD and a malpresentation should be excluded. Then, careful use of oxytocic drugs, most commonly intravenous syntocinon infusion, can improve the contractions. Caution must be taken to avoid too frequent contractions because this can reduce the oxygen exchange in the placental bed and lead to fetal hypoxia. Continuous electronic monitoring is advisable.

Particular care is essential in a multiparous patient because the diagnosis of inefficient uterine action is much less common than in a primiparous patient. A fetal malposition, malpresentation or increased fetal size should be considered as the causes of the slow progress; inappropriate use of oxytocic drugs is associated with uterine rupture in this group.

Further reading

Enkin MW, Keirse MJNC et al (2000) *A guide to effective care in pregnancy and childbirth* 3rd edn

NICE (2001) National evidence-based clinical guidelines *Electronic Fetal Monitoring* (NICE, London)

NICE (2001) National evidence-based clinical guidelines *Induction of Labour* (NICE, London)

NICE (2007) National evidence-based clinical guidelines *Intrapartum Care: Management and delivery of care to women in labour* (NICE, London)

RCOG Working Party Report (1999) *Childbirth: towards safer childbirth* (www.rcog.org.uk)

RCOG green-top guideline 42 *Shoulder Dystocia* (www.rcog.org.uk)