The stages and physiology of labour

4th stage
The onset of labour:

The onset of labour can be defined as regular painful contractions bringing about progressive cervical change (in form of dilatation and effacement).

Loss of a 'show' (a blood stained plug of mucus passed from the cervix) or spontaneous rupture of the membranes (SROM) does not define the onset of labour, although they may occur at the same time.
The uterine segments:  

During labour the uterus may be divided into two functional segments:

1. *The upper segment (upper part of the uterus)*

This contracts strongly, and with each successive contraction the smooth muscle fibers become shorter and thicker (retraction) which is a major feature of uterine contractility during labour, after the cells contract they relax but they do not return to their original length.

This powerful segment draws the weaker, thinner and more passive lower part of the uterus up over its contents and so will pull up and then dilate the cervix.
2. The lower uterine segment:

This consists of the lower part of the body of the uterus and the cervix (extends from the reflection of peritoneum of uterovesical pouch to the internal cervical os), it contracts but is relatively passive compared with the upper segment.
Symptoms and signs of labour:

1. Painful uterine contractions.

   Throughout pregnancy there are painless irregular uterine contractions called **Braxton Hick's contractions**.

   The contractions of labour occur at regular interval, increase gradually in frequency, intensity and duration and cause cervical change.

   The contractions last for 30-60 seconds, at intervals of 2-4 minutes and the intensity of the intrauterine pressure generated with each contraction averages between 30 and 60 mmHg.

   The pain of labour results from ischaemia of the uterine muscles from compression of the blood vessels in the wall of the uterus.

   Uterine contraction is involuntary in nature with minimal extrauterine neuronal control.
2. The show.

With the onset of labour, as the cervix is pulled up the mucous plug which fills the cervix will be expelled mixed with blood as mucous show or bloody show.
3. *Rupture of the membranes.*

The membranes may rupture at any time during labour, although this usually occurs towards the end of the first stage or in the second stage.
. Shortening (effacement) and dilatation of the cervix.

When labour begins the contraction and retraction of the upper uterine segment stretches the lower uterine segment, as the internal os is pulled (opened), the cervix will dilate from above downwards, becoming shorter until no projection into the vagina. So the whole cervix is taken up and its cavity is made one with that of the body of the uterus.
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<th>38th week</th>
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<td><strong>Multiparous</strong></td>
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Labour can be divided into three stages:

**First stage:**

This describes the time from the diagnosis of labour to full dilatation of the cervix (10 cm).

The first stage of labour can be divided into two phases. The *latent phase* is the time between the onset of labour and 3-4 cm dilatation. During this time the cervix becomes fully effaced.

The duration of the latent phase is variable; it usually lasts between 3 and 8 hours, being shorter in multiparous women.
The second phase of the first stage of labour is called the active phase and describes the time between the end of the latent phase (3-4 cm) and full dilatation (10 cm). It is also variable in length, usually lasting between 2 and 6 hours. Cervical dilatation during the active phase in a primigravida usually occurs at 1.2 cm/hour or more in a normal labour. Again it is usually shorter in multiparous women about 1.5 cm/hr. Friedman subdivided the active phase into the acceleration phase, the phase of maximum slope, and the deceleration phase
Friedman's curve showing phase of maximum slope
Second stage:

This describes the time from full dilatation of the cervix to delivery of the fetus.

The second stage of labour may be divided into two phases:
The passive phase is where there is no maternal urge to push and the fetal head is still relatively high in the pelvis. The active phase where there is maternal urge to push because the fetal head is low, causing a reflex need to bear down.

A normal second stage should last no longer than 2 hours in a primiparous woman and 1 hour in multipara. The use of epidural anaesthesia may prolong the second stage of labour.
Third stage:

This is the time from delivery of the fetus until delivery of the placenta. The placenta is usually delivered within a few minutes of the birth of the baby. A third stage lasting more than 30 minutes should be considered abnormal.
The duration of labour:

It is difficult to define prolonged labour, but it would be reasonable to suggest that labour lasting longer than 12 hours in nulliparous women and 8 hours in multiparous women should be regarded as prolonged.
The physiology of labour:

The mechanism responsible for initiating human parturition is still unknown. There are however, certain processes that seem to be of particular importance. The onset of labour occurs when those factors which inhibit contractions and maintain a closed cervix diminish and are succeeded by the actions of factors which do the opposite. Both mother and the fetus contribute to this.
1. **Hormonal factors:**

Progesterone maintains uterine quiescence by:

A. suppressing prostaglandin production

B. inhibiting communication between myometrial cells

C. preventing prostaglandin release

Oestrogen opposes the action of progesterone.

Prior to labour, there is a reduction in progesterone receptors and an increase in oestrogen concentration relative to progesterone.
Oxytocin release from the pituitary and prostaglandin synthesis by the chorion and the decidua increase, leading to an increase in calcium influx into the myometrial cells and increase gap junction formation between individual myometrial cells, creating a functional syncytium, which is necessary for co-ordinated uterine activity.

Maternal corticotrophin-releasing hormone (CRH) increases in concentration towards term and potentiates the action of prostaglandin and oxytocin on myometrial contractility. As labour becomes established, the output of oxytocin increases through the Fergusson reflex (pressure from the fetal presenting part against the cervix is relayed via a reflex arc involving the spinal cord and results in increased oxytocin release from the posterior pituitary)
2. The myometrium:

Myometrial cells contain filaments of actin and myosin which interact and bring about contraction, while their separation brings about relaxation.

An increase in intracellular free calcium ions results in the formation of the contractile entity of actin-phosphorylated myosin.

Prostaglandins and oxytocin increase intracellular free calcium ions.

Individual myometrial cells are communicated by means of gap junctions which facilitate the passage of various products of metabolism and electrical current between cells, these gap junctions are absent for most of the pregnancy but appear in significant numbers at term. Prostaglandins stimulate their formation.
3. The cervix:

The cervix contains muscle cells and fibroblasts separated by a ground substance. Interaction between collagen, fibronectin and dermatan sulphate (a proteoglycan) during the earlier stages of pregnancy keep the cervix rigid and closed. Contractions at this point do not bring about effacement or dilatation. Under the influence of prostaglandins and other mediators there is an increase in proteolytic activity and collagen turnover. Dermatan sulphate is replaced by the more hydrophilic hyaluronic acid, which results in an increase in water content of the cervix. This causes cervical softening and ripening, so that contractions can bring about effacement and dilatation.
. History:
The followings are important points in the admission history:

* Patient age
* The frequency, duration and strength of contractions and when they began
* Membranes ruptured or not, colour and amount of amniotic fluid
* The presence of abnormal vaginal discharge or bleeding
* Fetal activity: Kick count
* Past obstetric history: details of each previous birth and size of the baby, previous caesarean section.
* Any risk factor or medical problem like hypertension or diabetes.
2. Examination:

*General examination:*

- General look for pallor, jaundice, BMI.
- Vital signs for fever, tachycardia and hypertension.
Abdominal examination:

1 - Inspection: abdominal distension, presence of scars, dilated veins, striae gravidarum

2 - Fundal height by the ulnar border of the left hand measure the symphysis fundal height with tape measure (each 1 cm equal 1 week above the umbilicus)
3 - The obstetric maneuvers (Leopold's maneuvers):
   A. fundal grip to identify which part of the fetus occupying the uterine fundus.
   B. lateral grip to identify the lie of the baby, and the site of the back (for fetal heart auscultation)
   c. First pelvic grip to identify which part of the fetus occupying the lower uterine segment.
   d. Second pelvic grip (Pawlick's grip) to identify how much of the fetal head has entered the pelvis (engagement). In clinical practice this is assessed by the 5/5th rule
   4 - Auscultation of the fetal heart: by sonicaid or ultrasound.
   5 - Estimation of the fetal size and assessment of uterine contractions
Descent of the fetal head

- It should be assessed by abdominal examination immediately before doing a vaginal examination, using the rule of fifth to assess engagement.
- The rule of fifth means the palpable fifth of the fetal head are felt by abdominal examination to be above the level of symphysis pubis.
- When \( \frac{2}{5} \) or less of fetal head is felt above the level of symphysis pubis, this means that the head is engage, and by vaginal examination, the lowest part of vertex has passed or is at the level of ischial spines.
Vaginal examination:

1 - A full explanation of the purpose and technique, consent is obtained from the patient.

2 - Cervical dilatation is estimated digitally in centimeters, when no cervix can be felt, this means the cervix is fully dilated (10 cm).

3 - The length of the cervix, the cervix at 36 weeks is about 3 cm long. It gradually shortens by the process of effacement.

4 - Cervical position which is usually graded as posterior, central and anterior. Anterior shift of the cervix occurs with progress of labour.

5 - Cervical consistency. The cervix changes from firm to soft with progress of labour.

6 - Presenting part of the fetus, as cephalic or breach.

7 - Position which is the relation between an arbitrary point in the presenting part (denominator) to the maternal pelvis. It is the occiput in cephalic presentation (right or left, anterior or posterior) and the sacrum in breech presentation.
8 - station which is the distance between the lowermost point of the presenting part from an imaginary line between the two ischial spines. It is usually graded as – above the spines and + below the spines.

9 - Amniotic membrane whether intact or ruptured. If ruptured, the colour (meconium or bloody) and amount (scanty or copious) of fluid should be noted.

10- Clinical pelvimetry for pelvic adequacy
Fetal assessment in labour:

A. Colour and amount of the amniotic fluid: fresh meconium staining and heavy bleeding are markers of fetal compromise, and also reduced volume.

B. Intermittent auscultation of the fetal heart using a pinard stethoscope or Doppler ultrasound.

C. Continuous external fetal monitoring (EFM) using cardiotocography (CTG), normal fetal heart pattern: baseline rate 110-160 bpm, baseline variability 10-25 bpm, two accelerations in 20 minutes (at least 15 bpm), and no deceleration.

D. Fetal blood sampling to measure fetal pH in case of abnormal CTG.
4. The partograph: it is a graphic record of labour.
Components of the partograph

- **Part 1**: fetal condition: fetal heart rate, membranes and liquor, moulding (overlapping of fetal skull bones, and caput (scalp oedema) (at top)
- **Part 11**: progress of labour: cervical dilatation, descent of fetal head, fetal position, uterine contractions (at middle)
- **Part 111**: maternal condition: drugs, intravenous fluid, vital signs, urine analysis (at bottom)
- Outcome: 

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ANNEX 2: Partograph
Management of the first stage of labour:
The first stage of labour is timed from the diagnosis of onset of labour to full dilatation of the cervix.

1. Women who are in the latent phase should be encouraged to mobilize; they can go home and return when contractions are stronger or more frequent. The posture of the woman is a matter of choice, although standing upright encourages progress.

2. Emotional support to the mother.

3. There is no reason to restrict eating and drinking, although light food and clear fluid may be better tolerated.

4. Observation of progress of labour. Vaginal examinations are usually performed every 4 hours to determine cervical dilatation and descent of the presenting part.
5. The membranes may be intact or ruptured; if they are intact it is not necessary to rupture them artificially if the progress of labour is satisfactory. Artificial rupture of the membranes (ARM) enhances the progress of labour and monitoring of amount and colour of amniotic fluid.

6. Analgesia in labour: narcotic analgesia as pethidine may be used although it crosses the placenta and causes respiratory depression of the newborn. Epidural anaesthesia provides pain relief although it prolongs the labour.
7. Adequate hydration to prevent ketosis, frequent bladder emptying and urinalysis for proteins, ketones and infection.

8. Monitoring of fetal well-being. In low risk pregnancies, fetal heart should be listened to every 15 minutes during and after contractions. If there are risk factors or abnormal heart rate, continuous electronic fetal monitoring is indicated.

9. Efficient uterine contractions are those contractions with frequency every 2-4 minutes, lasting 30-60 seconds. Inefficient uterine contractions could be treated with oxytocin infusion.
Management of the second stage of labour:
The second stage is timed from full dilatation of the cervix to the delivery of the fetus.
Cardinal movements in the mechanism of labor and delivery, left occiput anterior position.

1. Head floating, before engagement
2. Engagement; descent, flexion
3. Further descent, internal rotation
4. Complete rotation, beginning extension
5. Complete extension
6. Restitution (external rotation)
7. Delivery of anterior shoulder
Management of the second stage involves the followings:

1. Patient position: lithotomy position with the head upright and her hands behind her knees so will be in comfortable position to push effectively. Alternatively, left lateral position.

2. Encourage the patient to push down with contractions while instruct her to breath deeply in between.

3. The progress of descent of the head can be judged by watching the perineum, the anus will begin to open, and soon after the baby's head will be seen at the vulva.

4. Pudendal nerve block with xylocaine may be done to alleviate pain in the vulva.
5. Episiotomy (surgical incision to enlarge the introitus) may be done.
6. Once the stage of crowning is reached with extension of the fetal head, the woman should be discouraged from bearing down by telling her to take rapid shallow breaths. Support of the maternal perineum to prevent perineal tears and damage.

7. The head may now be delivered carefully by pressure on the forehead and control the rate of escape with the other hand.
Crowning and Episiotomy
8. After delivery of the head, loops of the cord around the neck may be clamped and divided before delivery of the rest of the body.

9. In case of meconium, suction of the fetal mouth and nose may be done before complete delivery of the fetal head.

10. To aid delivery of the shoulders, the head should be pulled gently downward and forward until the anterior shoulder appears beneath the pubis.

11. The head is then lifted gradually until the posterior shoulder appears over the perineum.

12. The body and the limbs usually delivered spontaneously.

13. After the delivery of the fetus, clamping and cutting of the umbilical cord is done to complete the second stage of labour.
Immediate care of the neonate:

There is no need for immediate clamping of the cord, as about 80 ml of the blood will be transferred to the baby, suction of the oropharynx if there are secretions. 1-minute Apgar score assessed and then placed on the mother's abdomen for suckling. Vitamin K should be given and general examination for any abnormalities.
Management of the third stage of labour:

This is timed from delivery of the baby to the expulsion of the placenta and membranes. This normally takes between 5 and 10 minutes, if longer than 30 minutes, it should be regarded as prolonged.

Separation of the placenta occurs because of the reduction of volume of the uterus due to uterine contraction and retraction (shortening).
signs of separation are:
1. Lengthening of the cord protruding from the vulva.
2. a small gush of blood from the placental bed, which normally stops quickly due to retraction of the myometrial fibres.
3. Rising of the uterine fundus to above the umbilicus.
4. The fundus becomes hard and globular compared to the broad, softer fundus prior to separation.

Active management of the third stage involve a procedure called controlled cord traction CCT.
This technique is as follows:

- synthetic oxytocin 10 iu or syntometrine (5 iu oxytocin, 0.5 mg ergometrine) is given by intramuscular injection following delivery of the anterior shoulder. Ergometrine causes sustained contraction of the uterus, but should not be given in hypertension.

- After delivery of the baby, the attendant should place the left hand on the uterus to identify when a contraction has occurred.
When a contraction is felt, the left hand should be moved suprapubically and the fundus elevated with the palm facing towards the mother. At the same time, the right hand should grasp the cord and exert steady traction so that the placenta separates and is delivered gently, the membranes also delivered with a twisting motion.

If the placenta not delivered, repeat CCT after 10 minutes. If not delivered, the placenta is retained and will require manual removal under general or regional anaesthesia.

The placenta should be inspected for missing cotyledons, and the vulva for any tears or laceration.
The key features of normal labour:
1. Spontaneous onset.
2. Single cephalic presentation.
3. 37 – 42 week's gestation.
4. No artificial interventions.
5. Unassisted spontaneous vaginal delivery.
6. Duration of less than 12 hours in primigravida, and 8 hours in multiparous women.
7. A retrospective diagnosis.
A labour deviates from above features considered abnormal.
Thank you