

CHAPTER 3

ANATOMY OF BODY DURING PREGNANCY

- 3.1 The thorax
- 3.2 The abdomen
- 3.3 The abdominal cavity
- 3.4 The uterus
 - 3.4.1 Reproductive changes in the uterus
 - 3.4.2 Supports of the uterus
- 3.5 The menstrual cycle
 - 3.5.1 Time of ovulation in relation to menstruation
 - 3.5.2 Importance of determining the time of ovulation
- 3.6 The placenta
 - 3.6.1 Functions of Placenta
 - 3.6.2 Normal site of implantation of ovum
- 3.7 Amniotic fluid
 - 3.7.1 Function of amniotic fluid at the time of labour
- 3.8 Umbilical cord
- 3.9 Mutual relationship of amniotic cavity and uterine cavity
- 3.10 The foetus
 - 3.10.1 Growth of foetus
 - 3.10.2 Physical representation of different stages of foetus growth
 - 3.10.3 Determination of the age of embryo
- 3.11 Physiological changes during pregnancy
 - 3.11.1 Uterus
 - 3.11.2 Weight gain
 - 3.11.3 Factors influencing the weight gain
 - 3.11.4 Importance of weight checking
- 3.12 References

CHAPTER 3

ANATOMY OF BODY DURING PREGNANCY

3.1 THE THORAX :

The thorax is that part of trunk which extends from the root of the neck to the abdomen. The thorax contains the lungs which are separated from one another by a bulky, movable, median septum – the mediastinum. The main structures in the mediastinum are the heart and the great vessels which connect the heart to the body and lungs. In addition, it transmits structures from the neck to the thorax, e.g. the trachea or windpipe or to the abdomen, e.g. the oesophagus or gullet, or in the opposite direction, e.g. the thoracic duct [1].

The thoracic cavity is separated from the abdominal cavity by the musculoaponeurotic diaphragm.

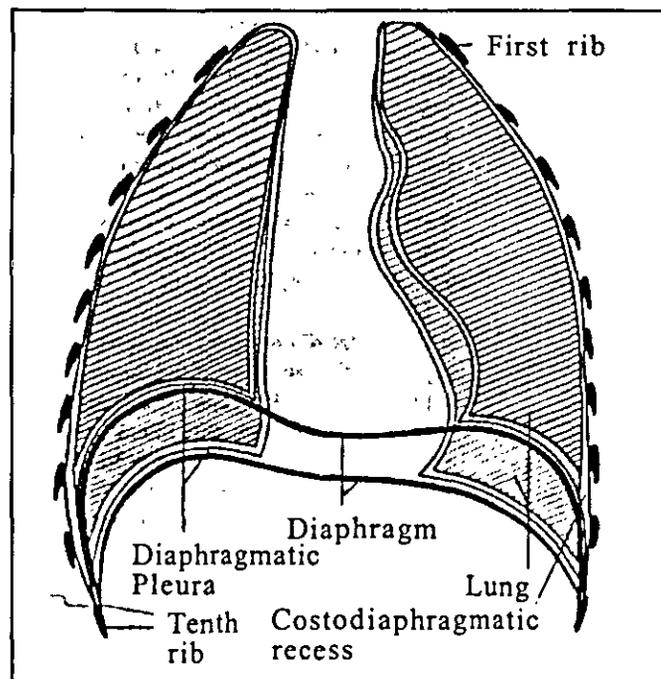


Fig. 3.1 Thoracic contents resulting from contraction of the diaphragm

This is attached to the lower margin of the thoracic cage (interior aperture of the thorax) and bulges upwards, inside it, so that the upper abdominal organs lie under cover of the lower part of the thoracic cage. The diaphragm acts like a piston. When it contracts, it descends and increases the intrathoracic volume (inspiration) (Fig.3.1). When the diaphragm relaxes, the contracting muscles of the abdominal wall force the abdominal contents, and the overlying diaphragm upwards inside the thoracic cage, thereby decreasing the intrathoracic volume (expiration) [1].

3.2 THE ABDOMEN :

The abdomen is the lower part of the trunk and lies below the diaphragm. It is divided by the plane of the pelvic inlet into a larger upper part, the abdomen proper, and a smaller lower part, the true (lesser) pelvis. The abdomen is bounded to a large extent by muscles, which can easily adjust themselves to periodic changes in the capacity of the abdominal cavity. They can thin out to accommodate distensions of the abdomen imposed by flatus (gas), fat, foetus and fluid. The abdomen contains the greater parts of the digestive and urogenital systems (Fig. 3.2) [2].

The upper abdominal contents fill the concavity of the diaphragm and so lie internal to the lower parts of the thoracic cage, pleura and lungs, but are separated from them by the diaphragm. Because the mobile diaphragm forms the upper limit of the abdominal cavity, the abdominal contents descend with it on the inspiration [3,4].

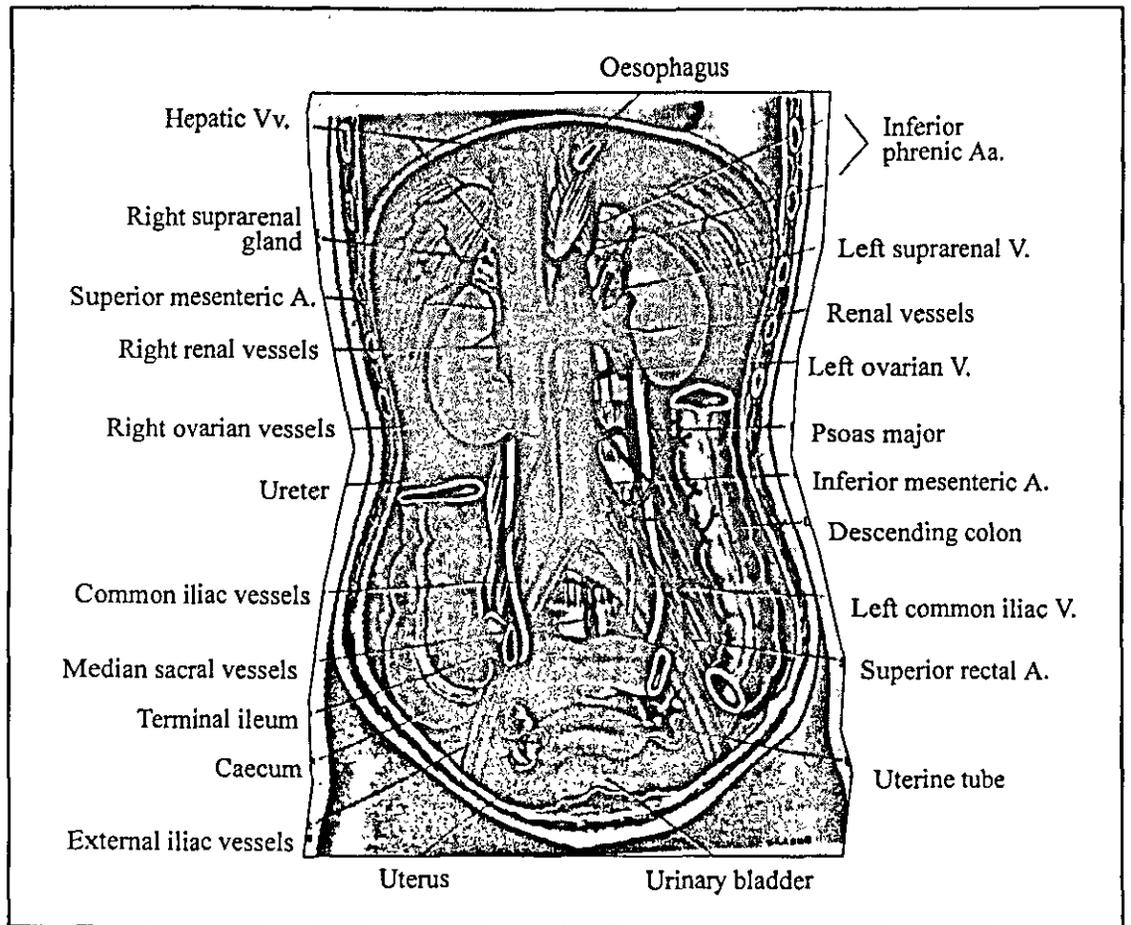


Fig. 3.2 : The inferior vena cava and the abdominal aorta

3.3 THE ABDOMINAL CAVITY :

The abdominal cavity is enclosed by the abdominal walls and is completely filled by the abdominal viscera. There are the

stomach and intestine, their associated glands (liver and pancreas with their ducts), blood and lymph vessels, the spleen, kidneys, and suprarenal glands. The kidneys, their ducts (the ureters), and the suprarenal glands lie on the posterior abdominal wall enclosed in the fascial lining of the abdominal cavity [1]. The abdominal cavity is much more extensive than what it appears to be when seen from the outside. It projects upwards deep to the costal margin to reach the diaphragm. Thus a considerable part of the abdominal cavity is overlapped by the thoracic bony cage above, and by the bony pelvis below [2,5].

3.4 THE UTERUS :

In layman's language the uterus is called the womb. It is the organ which protects and provides nutrition to a fertilized ovum, enabling it to grow into a fully formed foetus. At the time of child birth (or parturition) contractions of muscle in the wall of the organ result in expulsion of the foetus from the uterus.

The uterus is piriform in shape. It is about 9 cm long, 6.5 cm broad and 3.5 cm thick. It is divisible into an upper expanded part called the body and a lower cylindrical part called the cervix. The junction of their two parts is marked by a circular constriction. The body forms the upper two thirds of the organ, and the cervix forms the lower one third [2].

3.4.1 REPRODUCTIVE CHANGES IN THE UTERUS :

- (a) In foetal life the cervix is larger than the body which project a little above the pelvic brim.
- (b) At puberty the uterus enlarges and descends to the adult position.

- (c) During menstruation the uterus is slightly enlarged and becomes more vascular. The lips of the external 'os' are swollen.
- (d) During pregnancy, the uterus is enormously enlarged, mainly due to hypertrophy of the muscle fibres and partly to hyperplasia. As pregnancy advances the uterine wall becomes progressively thinner. After parturition the uterus gradually involutes and returns to the non pregnant size.

3.4.2 SUPPORTS OF THE UTERUS :

The uterus is a mobile organ which undergoes extensive changes in size and shape during the reproductive period of life. It is supported and prevented from sagging down by a number of factors which are chiefly muscular and fibromuscular [3,4,5]. These are namely :

- (a) Muscular or active
 - (i) Pelvic diaphragm
 - (ii) Perineal body
 - (iii) Urogenital diaphragm
- (b) Fibromuscular or mechanical
 - (i) Uterine axis
 - (ii) Pubocervical ligament
 - (iii) Transverse cervical ligament
 - (iv) Uterosocral ligament
 - (v) Round ligament of uterus.

3.5 THE MENSTRUAL CYCLE :

While the changes concerned with ovulation, and the formation of the corpus luteum, are going on in the ovary, the uterine endometrium shows striking cyclical changes. These constitute the uterine, or menstrual

cycle. The most prominent feature of this cycle is a monthly flow of blood from the uterus. This is called menstruation, or menses. A menstrual cycle is taken to begin with the onset of menstrual bleeding and ends just before the next menstruation (Fig. 3.3).

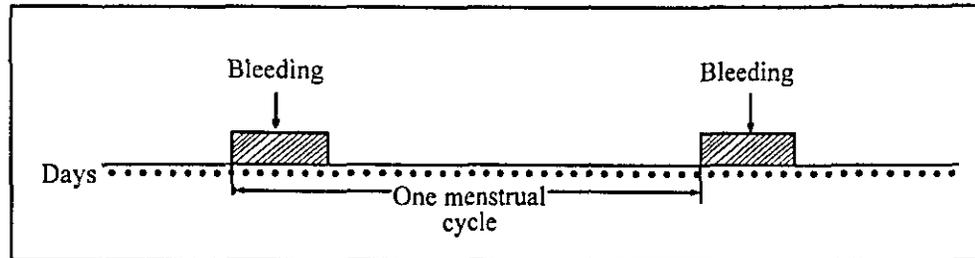


Fig. : 3.3 Diagram illustrating the definition of a menstrual cycle

3.5.1 TIME OF OVULATION IN RELATION TO MENSTRUATION :

In a 28-day cycle, ovulation takes place at about the middle of the cycle. The period between the ovulation and the next menstrual bleeding is constant at about 14 days, but the time of ovulation does not have a constant relationship with the preceding menstruation (Fig 3.4). This is so because the length of the menstrual cycle may vary from month to month in an individual [6,7].

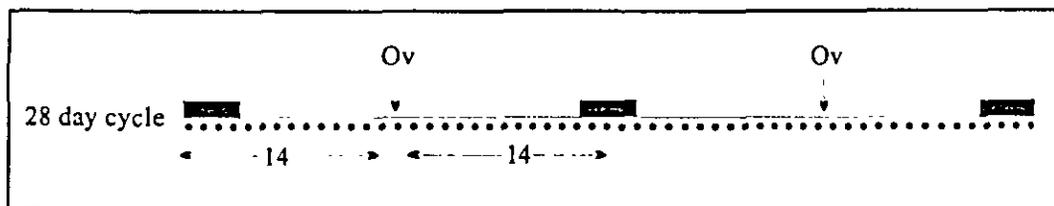


Fig. 3.4 : Relationship of ovulation to preceding, and following menstrual periods.

Normally the temperature method is used for finding the exact time of ovulation as indicated in Fig. 3.5.

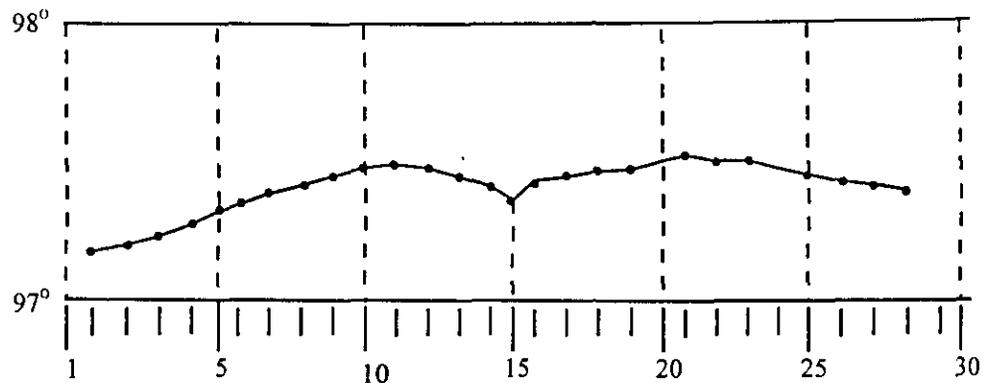


Fig. 3.5 : Graph showing the morning temperature of women, on various days of the menstrual cycle

Note, that there is a fall in temperature at about the time of ovulation, followed by a rise.

3.5.2 IMPORTANCE OF DETERMINING THE TIME OF OVULATION :

After ovulation, the ovum is viable (i.e., can be fertilized) for not more than two days. Spermatozoa, introduced into the vagina dies within four days. Therefore, fertilization can occur only if intercourse takes place during a period between four days before ovulation to two days after ovulation. The remaining days have been regarded as a 'safe period' as far as prevention of pregnancy is concerned. This forms the basis of the so-called 'rhythm-method' of family planning. The method has, however, not proved reliable because of variability in the length of the cycle. It has also been shown that various factors (e.g. emotional stress) may precipitate, or delay, ovulation [6.7]

3.6 THE PLACENTA :

After formation of ovum, the ovum enters into the uterine tube and passes into the ampulla (Fig.3.6). Fertilization of the ovum

occurs in the ampulla of the uterine tube.

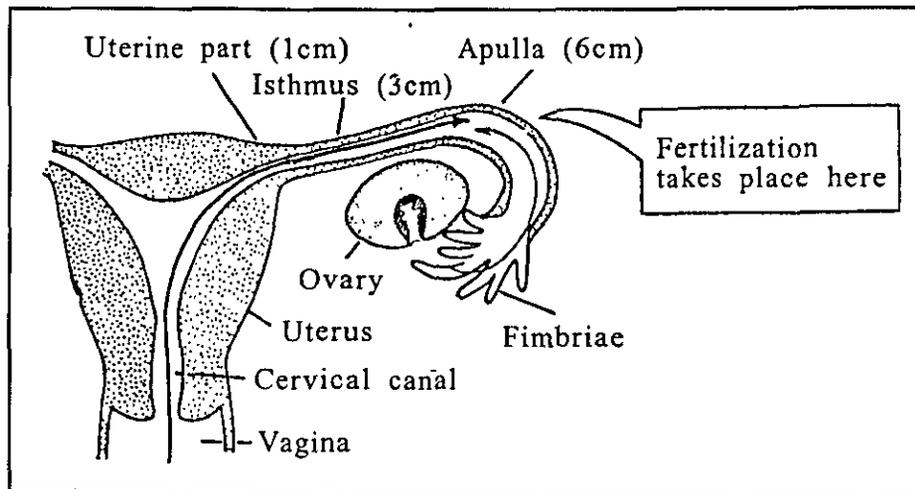


Fig. 3.6 : Path taken by sperm and ovum for fertilization.

After the ovum is shed from the ovary, it travels through the uterine tube, towards the uterus. If fertilization occurs, segmentation of the ovum begins. By the time the fertilized 'ovum' reaches the uterus, it has already become a morula. The morula is still surrounded by the zona pellucida, which prevents it from 'sticking' to the wall of the uterine tube. The cells lining the surface of the morula, constitute the trophoblast. Once the zona pellucida disappears, the cells of the trophoblast stick to the endometrium. This is called implantation (Fig.3.7).

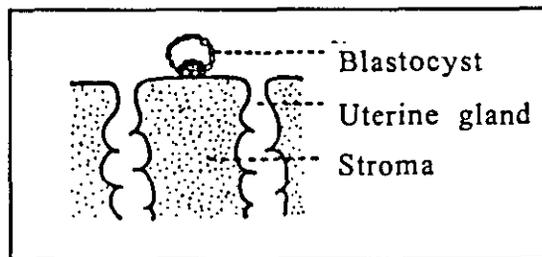


Fig. 3.7 : Relationship of blastocyst to uterine endometrium.

After the implantation of embryo, the uterine endometrium is called the decidua. The portion of decidua where the placenta is to be formed is called decidua basalis (Fig.3.8). The part of the de-

cidua that separates the embryo from the uterine lumen is called the decidua capsularis, while the part lining the rest of the uterine cavity is called the decidua parietalis [6,7].

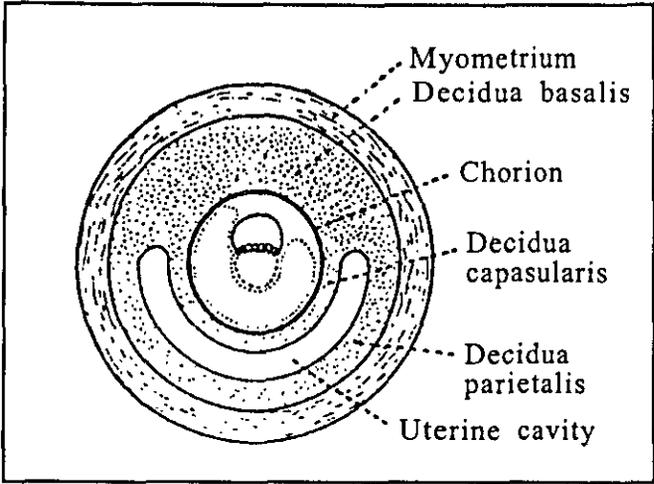


Fig. 3.8 : Subdivision of decidua

At the end of pregnancy, the decidua is shed off along with the placenta and membranes. The essential functional elements of the placenta are very small finger-like process or villi. The chorionic villi are first formed all over the trophoblast and grow into the surrounding decidua. Along with the tissues of decidua basalis these villi form a disc shaped mass which is called the placenta (Fig.3.9). The part of chorion that helps to form the placenta is called the chorion frondosum.

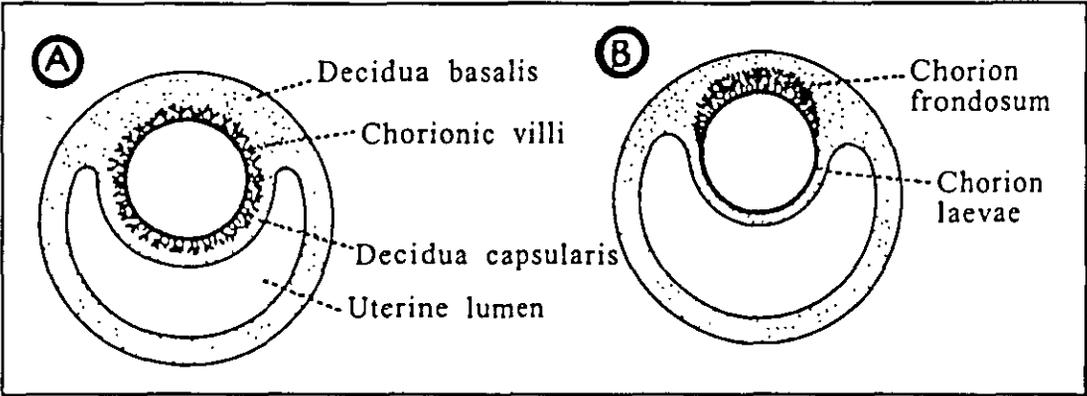


Fig. 3.9 : Two stages in the formation of chorionic villi

At full term (9 months after onset of pregnancy), the placenta is almost a circular disc with a diameter of 15–20 cm and thickness of about 2.5 cm at its centre. It thins off towards the edge. It feels spongy and weighs about 500 gm, the proportion to the weight of the baby being roughly 1:6 at term and occupies about 30% of the uterine wall. It presents two surfaces, foetal and maternal and a peripheral margin. After the birth of the child, the placenta is shed off along with the decidua. The maternal surface is rough and the foetal surface is lined by amnion.

In the placenta maternal blood circulates through the intervillous space and foetal blood circulates through blood vessels in the villi. The maternal and foetal blood do not mix with each other. They are separated by a membrane, made up of the layers of the wall of the villus. This membrane is called placental membrane or barrier. All interchanges of oxygen, nutrition and waste products take place through this membrane. In the later part of pregnancy, the efficiency of the membrane is increased, by considerable thinning of the connective tissue. This membrane which is at first 0.025 mm thick, is reduced to 0.002 mm. However, towards the end of pregnancy, a fibrinoid deposit appears on the membrane, and this reduces its efficiency [6,7].

3.6.1 FUNCTIONS OF PLACENTA :

- (a) The placenta enables the transport of oxygen, water, electrolytes and nutrition from maternal to foetal blood.
- (b) It also provides for excretion of carbon dioxide, urea and other waste produced by foetus into the maternal blood.
- (c) The placenta acts as a barrier and prevents many bacteria and other harmful substances from reaching the foetus.

However, most viruses and some bacteria can pass across it. Drugs taken by the mother may also enter into the foetal circulation.

- (d) While permitting the exchange of several substances between the maternal and foetal blood it keeps these blood streams separate thereby preventing antigenic reactions between them.

3.6.2 NORMAL SITE OF IMPLANTATION OF THE OVUM :

The uterus can be divided into an upper part, consisting of the fundus and the greater part of body and a lower part, consisting of the lower part of the body and the cervix. These are called the upper uterine segment and the lower uterine segment, respectively. It is the upper uterine segment that enlarges during pregnancy (Fig.3.10). The placenta is normally attached only to the upper uterine segment [7,8].

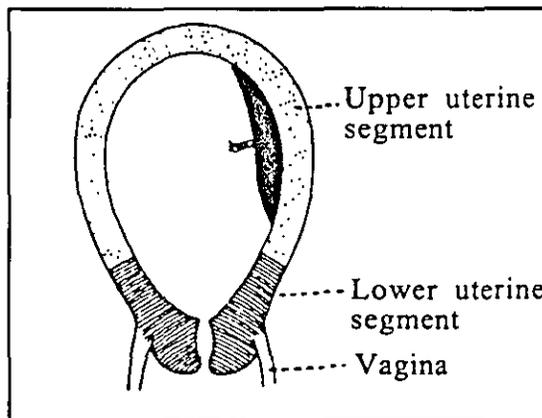


Fig. 3.10 : Upper and lower uterine segments and their relationship to the placenta.

3.7 AMNIOTIC FLUID :

It measures about 50 ml at 12 weeks, 400 ml at 20 weeks and reaches its peak of 1 litre at 36-38 weeks. Thereafter the amount diminishes, till at term, it measures about 600 to 800 ml. As

the pregnancy continues past term, further reduction occurs to the extent of about 200 ml at 43 weeks. It's main function is to provide protection to the foetus [8].

During pregnancy—

- (a) It acts as a shock absorber, protecting the foetus from possible extraneous injury.
- (b) Maintains an even temperature.
- (c) The fluid distends the amniotic sac and thereby allows for growth and free movement of the foetus and prevents adhesion between the foetal parts and amniotic sac.
- (d) Its nutritive value is negligible because of small amount of protein and salt content, however, water supply to the foetus is quite adequate [4].

3.7.1 FUNCTION OF AMNIOTIC FLUID AT THE TIME OF LABOUR :

During uterine contraction, it prevents marked interference with the placental circulation so long as the membranes remain intact. It flushes the birth canal at the end of first stage of labour and by its aseptic and bactericidal action protects the foetus and prevents ascending infection to the uterine cavity. Amniotic fluid has some clinical importance. These are

- (a) Study of amniotic fluid provides useful information about the health status and also maturity of the foetus.
- (b) Rupture of the membranes with drainage of liquor is helpful method in induction of labour [8].

3.8 THE UMBILICAL CORD :

It forms the connecting link between the foetus and the placenta through which the foetal blood, flows to and from the placenta. It extends from the foetal umbilicus to the foetal surface of the placenta. It is about

50 cm in length with an usual variation of 30-100 cm. Its diameter is average 1.5 cm with variation of 1–2.5 cm. Its thickness is not uniform. It shows a spiral twist from the left to right from as early as 12th week due to spiral turn taken by the vessels-vein around the arteries [9,10].

3.9 MUTUAL RELATIONSHIP OF AMNIOTIC CAVITY AND UTERINE CAVITY :

We have so far considered the foetal membranes (amnion and chorion), and the placenta, mainly in relation to the foetus. Let us now see their relationships to the uterine cavity. These are important as they help us to understand some aspects of the process of child birth. These are best understood by Fig. 3.11 and Fig. 3.12.

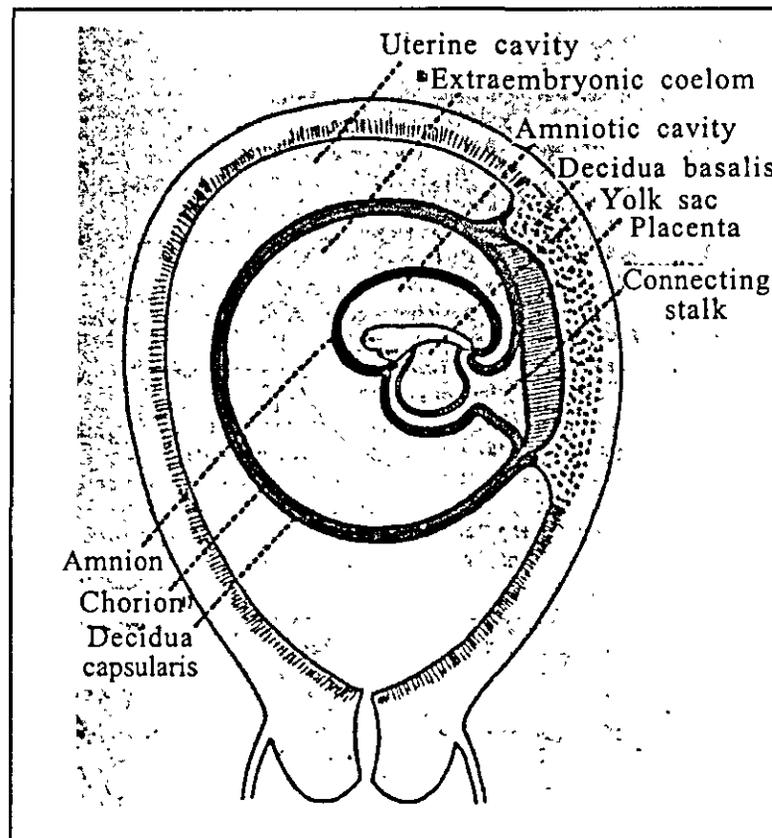


Fig. 3.11 : Relationship of amniotic cavity, extraembryonic coelom and uterine cavity

expansion of the amniotic cavity is achieved by enlargement of the uterus. Enlargement of the amniotic cavity is accompanied by an increase in the amount of amniotic fluid. This fluid provides support for the delicate tissues of the growing embryo, or foetus. It allows free movement and protects the foetus from external injury. At full term the volume of the amniotic fluid is about one liter. Too much fluid or too little may cause abnormalities in the foetus or difficulty in child birth.

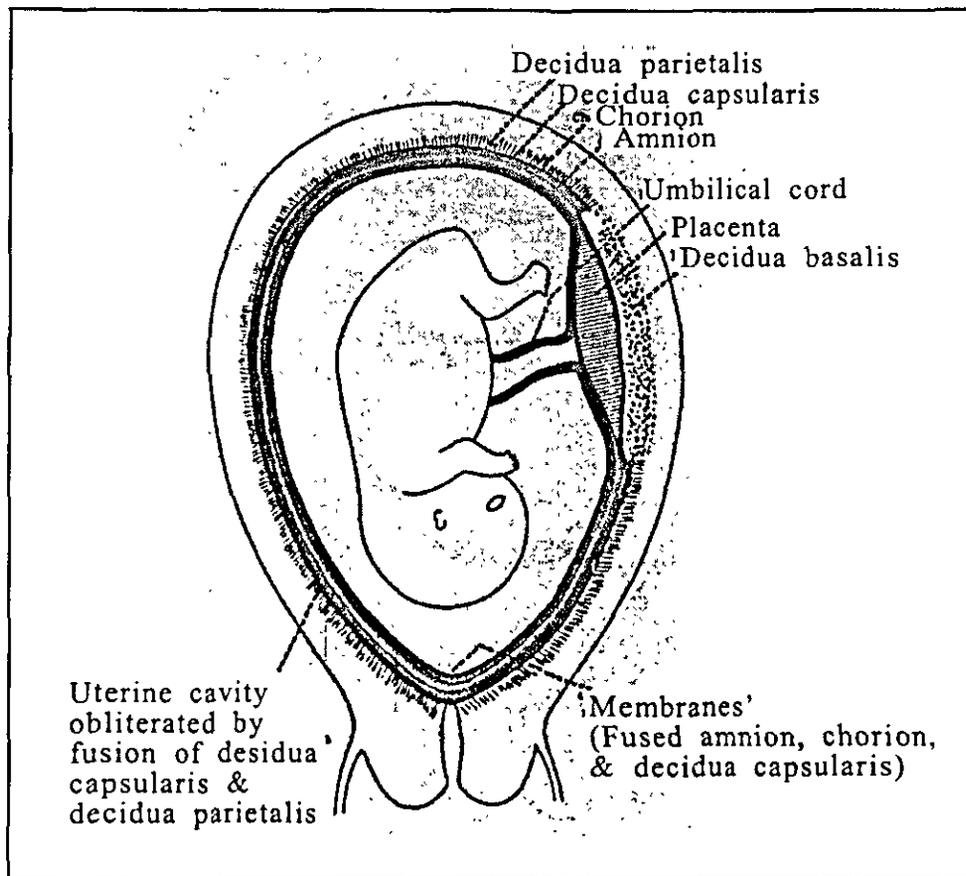


Fig. 3.13 : Amniotic cavity after obliteration of extraembryonic coelom and uterine cavity

At the time of parturition (child-birth), the fused amnion and chorion (along with the greatly thinned out decidua capsularis), constitute what are called 'membranes'. As uterine muscle contracts, increased pressure in the amniotic fluid causes these membranes to bulge into the cervical canal.

This bulging helps to dilate this canal. The bulging membranes can be felt through the vagina and are referred to as the "bag of waters". Ultimately the membranes rupture. Amniotic fluid flows out into the vagina. After the child is delivered, the placenta and the membranes along with all parts of the decidua separate from the wall of the uterus and are expelled from it [6,7,8].

3.10 THE FOETUS :

Three periods are distinguished in the prenatal development of the foetus—

- (a) Ovular period or germinal period—which lasts for 2 weeks following ovulation. In spite of the fact that the ovum is fertilized, it is still designated as ovum.
- (b) Embryonic period—begins at 3rd week following ovulation.
- (c) Foetal period—which begins at 8th week following ovulation or 10 weeks after the onset of the last menstrual period and ends in delivery. At 8th week embryo can be recognized as human one and measures about 4cm [8,9,10].

3.10.1 GROWTH OF FOETUS :

The foetal growth increases linearly with time until 37th week. There after the growth pattern is largely affected by the environmental factors. At term, the average foetal weight in India varies from 2.5 Kg to 3.5 Kg. Males are usually heavier than the females by 100 gm.

Table 3.1

Principal events of embryonic and foetal development

Days 14–21 post conception	Notocord develops. neural plate and neural folds are formed.
Days 21–28 post conception	Neural folds fuse to form neural tube. Heart is prominent.
Weeks 4–6 post conception (4–15 mm embryo)	Optic vesicles appear. Limb buds appear. Formation of face.
Weeks 6–8 post conception (15–30 mm embryo)	All major structures form. Recognisably human.
Weeks 8–12 post conception (30–60 mm embryo)	External genitalia develop.
Weeks – 20	Skin is covered with lanugo. Vernix caseosa is present.
Weeks – 28	Testes descend to the internal inguinal ring. Baby is viable.
Weeks – 36	One testicle usually descends into the scrotum. Lanugo tends to disappear.
Weeks – 40	Both the testicles descend into the scrotum. Nails project beyond the finger tips.

3.10.2 PHYSICAL REPRESENTATION OF DIFFERENT STAGES OF FOETUS GROWTH :

(a) First four weeks—

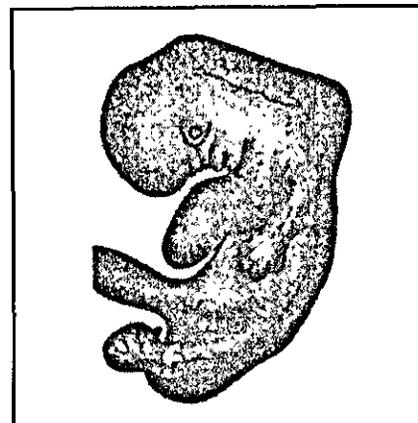
During this period the single fertilized egg multiplies and grows fast. The cells group to shape different organs. The embryo has not yet developed its human characteristic.



Fig. 3.14 : Embryo of first four weeks

(b) 5–8 weeks—

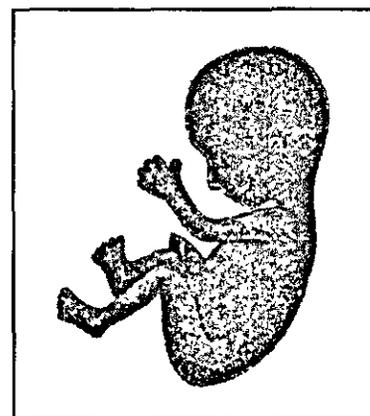
The embryo is taking a specific shape with a large head and trunk. The limb buds have appeared. The tail has shrunk and baby measures 5mm to reach over 30 mm by the end of eight weeks. There are signs of the umbilical cord and with the baby's heart beginning to beat, blood circulation starts.



**Fig. 3.15 : Embryo of
5–8 weeks**

(c) 9–12 weeks—

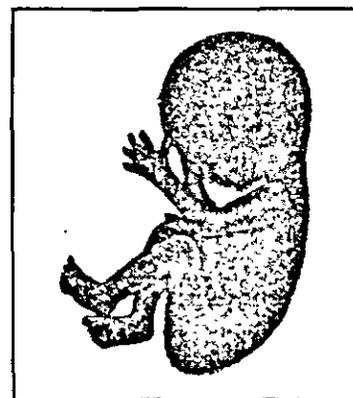
Baby is no more an embryo. It is called a foetus. Its shape is definite with forehead, nose, chin, neck, trunk and limbs. The eyes are seen though closed, the mouth opens and closes and the nails begin developing. By the end of 12 weeks there are signs of external genitalies to show whether the foetus is male or female. The placenta has matured and the circulation between mother and baby is established.



**Fig. 3.16 : Foetus of
9–12 weeks**

(d) 13–17 weeks—

The foetus shows different organs, weighs over 200 gm and measures about 14cm in length. It takes in fluid and passes urine. The head, still large is more solid. The ears stand out from the head. The neck moves. The lower limbs are well developed. Towards the later part of this period baby's heart beats can be heard by stethoscope.



**Fig. 3.17 : Foetus of
13–17 weeks**

(e) 18–22 weeks—

Hair is visible and the body is covered by soft downy hair. The skin is no more transparent. Buds for permanent teeth begin to appear. Toe nails start developing. You will start feeling the little one move inside.



Fig. 3.18 : Fetus of 18–22 weeks

(f) 23–26 weeks—

Baby grows in size and the internal organs show more maturity. The arms and legs are getting muscular. The fetus responds to sound. The heart beating can be heard if ear is placed over the mother's tummy.

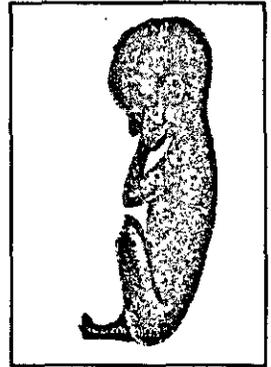


Fig. 3.19 : Baby of 23–26 weeks

(g) 27–30 weeks—

Baby's skin is still wrinkled but is getting covered with vernix, a greasy substance. Its body is filling up and weighs over one Kg. The eyes open and close, and the baby inside can hear voice and outside sounds.



Fig. 3.20 : Baby of 27–30 weeks

(h) 31–34 weeks—

Baby weighs over 2 Kg and measures 36 cm in length. Skin is smooth, less hairy. Finger nails are nicely seen. If the foetus is male the testicles descend to their lower position.

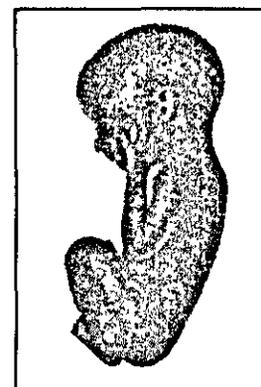


Fig. 3.21 : Baby of 31–34 weeks

(i) 35–38 weeks—

Baby weighs now nearly 3 Kg and is 50 cm tall. Fully developed, it is ready to come out in its head down position. Head shows plenty of hair but is still soft and supple. Skin is not wrinkled though covered with vernix [11].

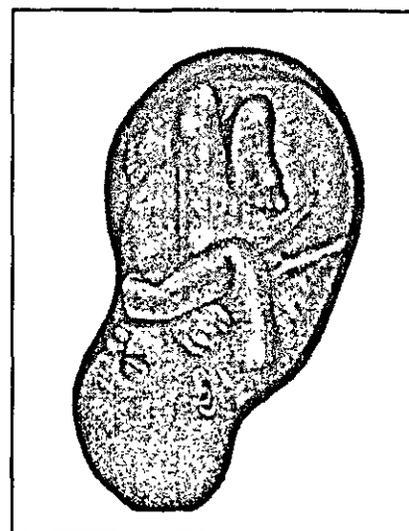


Fig. 3.22 : Baby of 35–38 weeks

3.10.3 DETERMINATION OF THE AGE OF AN EMBRYO :

The exact age of any embryo can be found out only when the date of conception is known. Usually, however, the age has to be determined indirectly. The somites begin to appear in embryos about 21 days old. Embryos younger than this are called presomite embryos and their age is reckoned in days. Once the somites appear the age is described in terms of the number of somites present e.g., one somite stage, four-somite stage etc. When the embryo is about 30 days old, it is large enough to be

measured. However, the measurement of the length of an embryo is not as simple as it sounds, as the embryo is bent on itself and can not be straightened without fear of damage to it (Fig. 3.23).

Hence, instead of measuring its full length we measure what is called the crown rump (C.R.) length. The C.R. length of one month embryo is about 5mm, where as that of a two month old embryo is about 30 mm. At full term the C.R. length is about 300 mm [6,7].

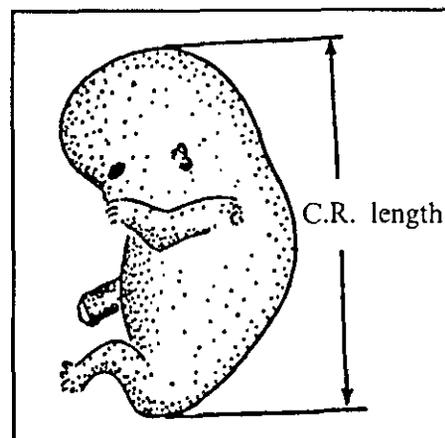


Fig. 3.23 : Measurement of C.R. length

3.11 PHYSIOLOGICAL CHANGES DURING PREGNANCY :

During pregnancy there is progressive anatomical and physiological changes not only confined to the genital organs but also to all systems of the body. This is principally a phenomenon of maternal adaptation to the increasing demands of the growing foetus.

3.11.1 UTERUS :

Non-pregnant shape is maintained in early months. It becomes globular at 12 weeks. As the uterus enlarges the shape once more becomes oval by 28 weeks and changes to spherical beyond 36 weeks. During pregnancy there is enormous growth of the uterus. The uterus which in non-pregnant state weighs about 50 gm and measures about 7.5 cm in length, at term weighs 900–1000 gm and measures 35 cm in length [12,13].

3.11.2 WEIGHT-GAIN :

In normal pregnancy variable amount of weight gain is constant phenomenon. In early weeks the patients may lose weight because of vomiting. During subsequent month the weight gain is progressive until the last one or two weeks, where the weight remains static or at time falls. The total weight gain during the course of a singleton pregnancy averages 11Kg (24lb). This has been distributed to 1Kg in first trimester and 5Kg each in second and third trimester.

The total weight gain at term is distributed approximately as follows—

- (a) Reproductive weight gain : 6Kg
foetus—3.3Kg, placenta—0.6Kg and liquor—0.8Kg,
uterus—0.9Kg and breasts—0.4Kg.
- (b) Net maternal weight gain : 6Kg
Increase in blood volume—1.3Kg, Increase in extra-cellular
fluid—1.2Kg, Accumulation of fat (mainly) and protein—
3.5Kg.

The amount of water retained during pregnancy at term is estimated to be 6.5 litres. [14,15].

3.11.3 FACTORS INFLUENCING THE WEIGHT GAIN :

The under weight or short patients or patients who are underfed during pregnancy are likely to gain less weight. This happens in most of the patients in the developing countries. All the components are affected with the result that the patient gains weight to the extent of only 6.7 Kg. Nutritional supplement and encouraging the patient to eat more during pregnancy are likely to improve the weight gain. Conversely, the obese patient are likely to gain more weight and reduction of carbohydrate and fat in the diet can help in stabilising the weight gain. Poor weight gain is too often associated with higher incidence of toxemia, prematurity, dysmaturity and

increased perinatal mortality and impairment of effective lactation [16].

3.11.4 IMPORTANCE OF WEIGHT CHECKING :

Single weight checking is of little value except to identify the over weight or under weight patient. Periodic and regular weight checking is of importance to detect abnormality.

Rapid gain in weight of more than 0.5Kg (1 lb) a week or more than 2Kg (5 lb) a month in later months of pregnancy may be the early manifestation of toxæmia of pregnancy and need for careful supervision. Stationary or falling weight is one of the suggestive feature of intrauterine growth retardation or intrauterine death of the foetus.

3.12 REFERENCES :

1. Romanes, G.J. : Cunningham's manual of practical Anatomy, Thorax and Abdomen, 15th edition, Vol. 2, ELBS Oxford University press, 1992.
2. Chauhrasia, B.D. : Human Anatomy, Regional and applied, Lower Limb and Abdomen, 2nd ed., Vol. 2, CBS Pub., New Delhi, 1998.
3. Harold, E. : Clinical Anatomy, Blackwells science, International edition, 9th ed., 1997.
4. Snell, R.S. : Clinical Anatomy, 5th ed., Little Brown, 1995.
5. Williams, P.L. : Gray's Anatomy, 30th ed., ELBS Churchill Livingstone, 1995.
6. Singh, I. : Human Embryology, 5th ed., Macmillans India Ltd., Madras, 1998.
7. Longman, M. : Embryology, 7th ed., Little Brown, 1995.
8. Dutta, S.C. : Text book of obstetrics, New Central Book Agency Pvt. Ltd., Calcutta, 1997.
9. Holland and Brews : Manual of Obstetrics, B.I. churchill Livingstone, Pvt. Ltd., New Delhi, 1998.
10. Williams, L. : Williams Obstetrics, 20th ed., Appleton and Lange, 1997.
11. Khanna, G. : The joy of parenting, A public service material, S.B. Smithkline Beecham Pharmaceuticals, 1996.
12. Howkins and Bourne : Shaw's text book of Gynaecology, 11th ed., B.I. Churchill Livingstone Pvt. Ltd., New Delhi, 1997.

13. Ratnam, S.S., etal : Obstetrics and Gynaecology, Vol. 3, B.I., Churchill Livingstone, 1997.
14. Jeffcoate, T. : Principles of Gynaecology, 5th ed., Butter Worth, Heinemann, 1996.
15. Novak and Berk : Novak's text book of Gynaecology, 12th ed., Churchill Livingstone, 1996.
16. Dawn, C.S. : Text book of obstetrics, 13th ed., Calcutta, 1995.