**Parturition**

It is essential for the veterinarian to be perfectly familiar with the normal course of parturition in domestic species in order to be able to differentiate between physiological and pathological birth. Parturition is the process of delivery of the fully grown fetus on the completion of the normal pregnancy period.

**Initiation of parturition**

Parturition is one of the most fascinating of biological Processes .The uterine musculature is the key component of labour , and the **essential physiological change between gestation and birth is a liberation of the contractile potential of the myometrium;** the factors involved in this transformation are neural, humoral and mechanical.

The humoral factors are most important is the reversal of those mechanisms which are necessary for the maintenance of pregnancy, in particular the removal of the progesterone block, which ensures that, during this phase of the animal‟s reproductive life, the myometrium is largely quiescent.

Parturition occurs as result of activation of the fetal hypothalamus–pituitary–adrenal (HPA)axis.

There is still uncertainty about the mechanisms responsible for the activation of the fetal hypothalamus.

A number of theories have been proposed. These are:

 ● maturation of the fetal hypothalamus which might result in the development of critical synapses in the para ventricular nucleus, allowing an increase in fetal neuroendocrine function.

● ability of the hypothalamus to respond to the effects of placental hormones.

● fetal stressors such as hypoxia, hyper-capnia, changes in blood pressure and blood glucose

During the last 20–25days of gestation, there is a dramatic rise in fetal cortisol concentrations, which reach a peak 2–3days before birth, thereafter declining 7–10 days postpartum. The source of the increase in fetal cortisol is the fetal adrenal, which is due to both an increase in the size of the organ in relation to total body weight, and an increase in its sensitivity to adrenocorticotrophic hormone (ACTH) ,maternal cortisol concentrations only rise around the time of parturition.

The reis an increase in corticotrophin-releasing hormone (CRH) in the fetal hypothalamus during the last10 days of gestation.

The rise in fetal cortisol stimulates the conversion of placental-derived progesterone to oestrogen by activating the placental enzyme 17α hydroxylase; this hydroxylates progesterone via androstenedione to oestrogen .

The consequences of the rise in oestrogens in the peripheral circulation are three fold :

Firstly: oestrogens have a direct effect upon the myometrium, increasing its responsiveness to oxytocin.

Secondly: they produce softening of the cervix by altering the structure of collagen fibers.

Thirdly : they act upon the cotyledon–caruncle complex to stimulate the production and release of prostaglandin F2α(PGF2α). The latter change is induced by the activation of the enzyme phospholipaseA2 stimulated by the decline in progesterone and rise in oestrogen. This enzyme stimulates the release of arachidonic acid from phospholipids, so that under the influence of the enzyme prostaglandin synthetase, PGF2α is formed. Prostaglandins play a key role in initiating parturition; because of their molecular structure they are soluble in fat and water so that they readily pass from cell to cell via cell membranes or between cells in the extracellular fluid.

Prostaglandins have a wide range of actions which are :

1- they cause smooth muscle contraction.

2- Luteolysis (regression of CL in ovary).

3- softening of cervical collagen .

4- Stimulating smooth muscle cells to develop special areas of contact called gap junctions, thereby allowing the passage of electrical pulses and ensuring coordinated contractions.

PGF2is considered to be the intrinsic stimulating factor of smooth muscle cells, and thus its release is important in initiating myometrial contractions.

The effect of these contractions is to force the fetal lamb towards the cervix and vagina where it will stimulate sensory receptors and initiate Ferguson‟s reflex, with the release of large amounts of oxytocin from the posterior pituitary. Oxytocin will stimulate further myometrial contractions and the release of PGF2 from the myometrium. Hence both these hormones, together with uterine contraction, seem to work as a positive feedback system of increasing magnitude, thus stimulating further uterine contractions and consequent expulsion of the fetus. Other important changes which are brought about by the endocrine events of parturition have been observed. For instance, maturation of the fetal lamb‟s lungs, especially the production of alveolar surfactant, is stimulated by cortisol, as are many other changes in fetal function and structure that enable the lamb to survive after birth.

**Signs of approaching parturition**

Some externally visible changes do occur in animals when parturition is approaching. The most important external changes of approaching parturition are seen in the **udder, vulva and pelvic ligaments** and to some extent in the behavior. The symptoms are inconsistent between individual animals, and between consecutive parturitions. The symptoms therefore, do not permit an accurate prediction as to the exact time of parturition in a certain animal but are only useful indications as to the approximate time parturition can be expected.

Clinicians must therefore refrain from too positive statements concerning the exact time of parturition.

- Animals like sow, dog and cat attempt to segregate themselves from the other animals to make a suitable nest or bed. Cats often hide in some isolated places when kept as a pet, and so do bitches attempt to hide.

- In the cow, buffalo, sheep and goat the pelvic ligaments, especially the sacro-sciatic ligaments become progressively relaxed as parturition approaches, causing a sinking of the croup ligaments and muscles and raising of the tail head . These changes occur because of the changing hormonal milieu including estrogen and relaxin. The changes are most marked in the cow and presence of very relaxed ligaments indicates that parturition will probably occur in 24-48 hours.

 -The vulva becomes progressively edematous, flaccid and enlarged (2 to 5 times normal size) as parturition approaches in most domestic animals.

-The udder becomes enlarged and edematous. In heifers, udder enlargement may be initiated at 4months of pregnancy but this may not be noticeable in pleuriparous cows 2 to 4 weeks before parturition.

-Edema in the udder may sometimes be extensive(towards abdominal floor even up to the xiphoid region)and may create difficulty in walking. Caudally this may extend up to the vulva.

- Just prior to parturition the udder secretion changes from a honey like dry secretion to a yellow, turbid, opaque cellular secretion called colostrum which may sometimes dribble down. In mares, the udder becomes distended with colostrums 2 days before foaling and oozing of colostrum from teats, called

waxing is usually observed in most mares 6 to 48 hours before foaling .The udder development is less marked in the ewe and doe. In bitches, cats and sows mammary enlargement may be evident a few days before, parturition and milk let down may occur in sows 24 hrs before farrowing.

- Because of the liquefaction of the cervical seal in the cow tenacious vaginal mucus discharge may be seen. Similar discharges may be seen in the sheep, goat, buffalo, sow, female camel and bitch. Some vaginal discharge is seen in the cow from the seventh month of pregnancy but this is scanty, however near parturition the discharge may be profuse (24 hours before calving).

- In the cow a drop in body temperature may occur before parturition, but this is most marked in the bitchin which there is drop of 1°C body temperature 24hours before whelping.

- As animals approach the first stage of labor the symptoms of restlessness, abdominal discomfort and anorexia become prominent and mares may roll down. Dogs may show little vomiting.

**Stages of parturition**

Although, the events resulting into the delivery of fetus are a continuous process, however, for the sake of understanding the process of parturition, it has been divided into three stages referred as the stages of labor.

The stages of labor defined previously are :

1) The first stage of labor (Dilation of cervix)

2) The second stage of labor (Expulsion of fetus)

3) The third stage of labor (Expulsion of fetal membranes)

To describe the position of the fetus in the birth canal during its delivery some terms are used to understand its position which are**:**

**Presentation**: The relation of the spinal axis of the fetus to that of the dam is known of presentation. Thus, presentation of the fetus in the birth canal can be longitudinal, transverse or vertical.

Longitudinal presentations are of two types: **anterior longitudinal**; when the fore limbs and head enter the birth canal first, and **posterior longitudinal** when the hind limbs and tail enter the birth canal first. **Transverse presentations** are either dorsal or ventral, depending upon which portion of the fetus is towards the birth canal. True **Vertical presentations** are not possible. A type of presentation which is considered partially vertical is the dog sitting posture.

**Position :** The relation of the dorsum of fetus in longitudinal presentation, or the head in transverse presentation, to the quadrants of the maternal pelvis is known as position. The quadrants are the sacrum, the right ilium, the left ilium, and the pubis. Thus positions can be **dorso sacral**, right or left **dorso ilial**, **dorso pubic** and right or left cephalo-ilial.

**Posture :** The posture signifies the relation of the fetal 0extremities, or the head, neck and limbs to its own body. The extremities or head may be flexed or extended or retained on the left or right side, or above the fetus.

The normal birth presentation in uniparous animals is the anterior longitudinal presentation, dorso-sacral position with the head resting on the metacarpal bones and knees of the extended forelegs. Birth can occur without assistance if the fetus is in posterior longitudinal presentation dorso-sacral position and both hind limbs are extended. Unless, the fetus is small most other presentation, position and postures result in dystocia. The transverse presentation can occur in the mare, in which the fetus develops in both uterine horns, rather than in the body of uterus and one uterine horn.

 Transverse presentations are rare in ruminants, and the small animals.

In the multipara, posterior longitudinal presentations are considered normal and in fact around 40 percent of fetuses are delivered in the posterior presentations. Since the limbs of multiparous animals are small, short and flexible hence their posture is of little significance. Similarly, because of the short neck of swine fetuses the head and neck are seldom deviated.

**First stage of parturition**

The first stage of parturition comprises the initiation of contractions and the dilation of the cervix. The first stage of labor is presumed to have culminated with the delivery of the first water bag the allantois-chorion. This is usually grayish white in cattle and reddish in the mare.

The initial stages of the first stage of labor are characterized by active contractions that occur in both the longitudinal and circular muscles of the uterine wall, dilation of the cervix and assumption of the birth posture by the fetus.

When both the oss externus and oss internus are fully dilated the cervix becomes continuous with the vagina and is palpable only as a small frill like structure.

Uterine muscle contractions are greatly increased the last 1 to 2 hours before birth basically because of the high levels of estrogens in some species. The oxytocin is seldom released from the maternal hypophysis before the second stage of labor in many species. In the cow the contractions occur about every 10 to 15minutes and last 15 to 30 seconds. They progressively become intense, more frequent and of greater duration such that they occur about every 3 to 5 minutes in the late stage of labor.

By the end of first stage of labor the cervix is fully dilated and contractions occur rapidly. The allantochorion of the fetus enters the cervix and is ruptured here or when it protrudes out of the vulvar lips forcing the fluids of the allantois to be released.

After the rupture of the first water bag the fetus wrapped in the amnion enters the birth canal and as the fetal legs enter the pelvis, there is reflex stimuli and release of high amounts of oxytocin from the pituitary. This is known as **“Ferguson’s reflex”**. There are increased uterine and abdominal contractions. The first stage of labor is considered to be over by the rupture of first water bag, and the entry of fetus wrapped in amnion in the vagina or outside the vulvar lips indicates the start of the second stage of labor.

The externally visible signs of the first stage of labor in the cow, buffalo, ewe and goat include symptoms of mild abdominal pain, frequent getting up and lying down which are marked in the primiparous animals. Animals evidence anorexia, stand with an arched back and raised tail, strain occasionally and ruminate irregularly. In the mare, symptoms of restlessness, anorexia, colicky pains, slight sweating behind the elbows and around the flanks, lying down and getting up are observed. The elevation of the tail, repeated stretching as if to urinate, frequent bowel evacuations, and looking at the flank are characteristic of abdominal discomfort in the mare.

**The second stage of labor:**

This stage of labor is characterized by the entrance of the fetus/fetuses into the dilated birth canal, rupture of the amnion, abdominal contractions and the expulsion of the fetus through the vulva. In the cow, following the rupture of the allantochorion the fetus wrapped in the amnion is pushed through the cervix and may appear at the vulva as a grayish blue translucent distended membrane. Intermittent straining occurs, and the amnion usually ruptures as the feet passes through.

Abdominal contractions are stimulated and they become intense as the head, shoulders or hips of the fetus pass through the pelvis. The head creates greatest difficulty in passing through in the uniparous animals. Often, after the fetal head passes the vulva, the dam will rest for a few minutes before straining again as the chest passes through the birth canal and vulva. The hips then follow.

The fetus is delivered in an arc fashion. Almost all animals lie down as soon as straining commences. Although foaling is very rapid in the mare however, it is accompanied by great expulsive efforts and the mare is usually exhausted and will lie down on her side for15 to 30 minutes before rising. Since the umbilical cord in the mare is long it will remain attached to the fetus for an average 8 to 20 minutes until the mare or foal moves, when it breaks at a point 2 inches from the foals body.

Occasionally in the mare, bitch and cat and only rarely in other domestic animals, the fetus may be born with the amnion or portion of it wrapped around its head. This may cause suffocation and therefore should be promptly removed. The intra-abdominal pressure, caused by the contraction of the abdominal muscles and diaphragm and closure of the glottis is equal in all directions.

**The third stage of labor:**

The third stage of labor is characterized by the expulsion of placenta. After expulsion of the fetus the uterus continues to contract strongly for 48 hours and less vigorously, but more frequently thereafter.

The changes necessary for the expulsion of the placenta in cow, ewe, goat and buffaloes start a few days before, parturition and are completed post-partum. A weakening of the a cellular layer of adhesive protein the so called “glue line” between the cotyledons and the caruncular epithelium need to be lysed or weakened for placental separation . The fetal villi shrink, owing mainly to the sudden loss of turgidity related to the loss of blood from the fetal side of the placenta when the umbilical cord ruptures. This is aided by the uterine contractions.

When a large portion of afterbirth becomes detached it forms a mass within the uterus which stimulates reflex contractions of the uterine and abdominal muscles and this straining completes the expulsion of the allanto-chorionic sac, which is seen to have its smooth, shining allantoic surface outermost .

The placental separation however, is rapid in the mare compared to ruminants. With the exception of the mare domestic animals may sometimes eat their after birth.

In polytocous animals(bitch ,cat and pig ) there are no third stage because the fetal membrane are expelled readily with each fetus .

Within an hour of birth it is normal for the young of all species to start suckling milk. This suckling stimulus initiates the release of oxytocin which potentiates the myometrial contractions and help in the expulsion of placenta.