

## Infertility in cows

**Infertility** A temporary inability to produce viable young offspring within a stipulated time characteristic for each species.

**subfertility** may imply a delayed or irregular production of the annual live calf.

**Sterility** this term is used to mean an absolute inability to reproduce.

### Causes of infertility

The causes of infertility are many and can be complex. They relate to Graafian follicle development and maturation, estrus onset, successful coitus, ovulation, fertilization, implantation, and the development and delivery of the fetus and its membranes. **Anything interfering with these events, such as diseases, poor nutrition, bad herd management, hereditary and congenital factors, hormonal disturbances or environmental changes, make the animal infertile.**

Mainly both the congenital and acquired abnormalities that affect the reproductive system could lead to infertility.

### Congenital lesions of Reproductive system

**Congenital lesions of ovaries** congenital lesions of the ovaries are rare, and include

**Ovarian agenesis** in which one or both ovaries are absent or lost, accompanied by an infantile genital tract and absence of cyclical behavior.

**Ovarian hypoplasia** is a little more common. In this condition, one or both ovaries are small, functionless and composed of largely undifferentiated parenchyma. Oocytes and follicles are virtually absent. Ovarian hypoplasia is generally a sporadic condition.

### **Congenital lesions of the uterine tubes, uterus, and cervix**

#### **Segmental aplasia of the paramesonephric ducts**

Developmental defects of the paramesonephric (Müllerian) ducts lead to a wide range of anomalies of the vagina, cervix and uterus. Depending upon the site of the aplasia, the cow may be subfertile or sterile. However, the ovaries develop normally and, consequently, affected animals show normal cyclic behavior. Moreover, normal levels of steroid hormones are present, and there is a significant level of secretory activity within the tubular parts of the genital tract. Hence, when a developmental

obstruction of the tubular tract occurs, cyclical secretions distend the lumen of the isolated portion of the tract.

**Uterine unicornis** In this case, only one uterine horn has a lumen, the other appearing as a narrow, flat band. It is more common for the right horn to be absent than the left. Provided the remainder of the genital apparatus is normal, individuals may conceive to ovulations from the sound side. Animals with this deformity are often sterile.

**Duplication of the lumen of the cervix** in this case, each uterine horn connects with the vagina by a separate cervical canal. Affected animals conceive normally, but may show dystocia due to fetal limbs entering each cervical canal. A similar complication may arise in heifers with a single cervix opening into a double os uteri externum.

**Uterus didelphys** here a double cervix is present, the uterine body is divided and there may be division of at least the cranial part of the vagina. This condition represents a complete failure of fusion of the two paramesonephric ducts. Such animals may conceive, providing insemination takes place into the horn ipsilateral to the ovulation; and a number of reports exist of them carrying calves to term and giving birth normally.

**white heifer disease** This condition is considered to be due to a sex-linked recessive gene with linkage to the gene for white coat color. such gene induces arrest in the development of mullarian ducts with different degrees. Originally white heifer disease was used to describe the syndrome of straining and illness after service in animals with retention of the hymen. In all cases there is partial or complete persistence of the hymen. This may be the only abnormality, but in other animals there are abnormalities cranial to the hymen. These defects may include the absence of the cranial vaginal cervix, uterine body or horns. The ovaries are functional and in most cases there is a distension of the normal organs due to the accumulation of the products of secretion. these heifers are usually sterile.

**Freemartinism** is a heifer that born as co-twin to bull calve. It is a distinct form of intersexuality which arises as a result of a vascular anastomosis of the adjacent chorioallantoic sacs of heterozygous fetuses in multiple pregnancies. although the external genitalia of freemartin heifers appear normal, the internal genitalia are grossly abnormal. Typically, the gonads are either vestigial or have undergone masculinization. the gonads resemble testes. In extreme cases, there are well-developed epididymides, vasa deferentia and vesicular glands. Conversely, in the least affected cases, the female genital tract may be small, with a persistent hymen and

hypoplastic ovaries. More typically, the vestigial gonads of freemartins are devoid of oocytes and, hence, follicles, but have parenchyma that consists largely of degenerating sex-cords. It is generally assumed that 92% of heifers which are born as co-twins to bulls are sterile freemartins.

The newborn freemartin can sometimes be recognized by its prominent clitoris with an obvious tuft of hair at the inferior commissure of the vulva, although these signs are not always reliable.

Freemartins can be identified on the basis of the length of the vagina and the absence of the cervix. In the adult, the vagina is normally 30 cm in length, compared with 8–10 cm in the freemartin. Rectal palpation will fail to identify the cervix. In calves of 1–4 weeks of age, the vagina is normally 13–15 cm in length compared with 5–6 cm in a freemartin.

The most accurate method of diagnosis, although not absolute, is the demonstration of sex chromosome chimerism in cultured lymphocytes. Heifer calves which are born co-twins to males and which show morphological changes in their reproductive tracts invariably show sex chromosome chimerism in blood and blood-forming tissues.

**Parovarian cysts** Parovarian cysts are remnants of the mesonephric ducts that are commonly present in the mesosalpinx of cows. Tiny parovarian cysts, of a few millimetres in diameter, are very common incidental findings in slaughtered cattle. Larger cysts, of between 1 and 3 cm in diameter, may be felt during examination of the tract per rectum when they may be confused with ovaries. Parovarian cysts are of no consequence to the reproductive performance of the animal, except in the rare instances when they impinge on the uterine tube and reduce its lumen.

## **Acquired diseases or lesions of genitalia**

### **Acquired lesions of ovaries**

The most common of the acquired lesions of the ovaries, cystic ovarian disease, is considered to be a functional disturbance of ovarian function.

### **Cystic ovarian disease**

Ovaries are said to be cystic when they contain one or more fluid-filled structures larger than a mature follicle (i.e. > 2.5 cm diameter). Cysts arise as a result of anovulation of a graafian follicle. In cystic ovarian disease, the follicle increases in size and persists, for at least 10 days.

### **Predisposing factors**

- Cystic ovarian disease arises as an interaction between a hereditary predisposition, stress, milk yield, age and plane of nutrition.

The incidence of cystic ovarian disease is greatest in animals between 4 and 6 years of age

The association with age may simply reflect the fact that milk yields tend to be highest during these lactations.

- The feeding of high-protein diets appears to be a contributory factor.
- the season of the year also appears to have some effect, since the disease is more prevalent in winter than at other times of the year, this may reflect the fact that the majority of cows are calving in the autumn and thus will have reached peak yield at this time.
- Ketosis, dystocia, twin births, RFM and milk fever have also been considered risk factors for the condition. Likewise postpartum uterine infection may also predispose to the disease.

### **Etiology**

cystic ovarian disease develops as a consequence of a failure of the endocrine mechanism of ovulation. most evidence indicates that the development of ovarian cysts may be primarily due to deficiencies of LH secretion during the preovulatory surge.

An inhibition of ovulation, followed by cyst formation, has been produced experimentally with injections of adrenocorticotrophic hormone (ACTH), suggesting a direct effect of ACTH upon the ovulatory mechanism. stress, may be a significant contributor to the development of ovarian cysts.

Ovulatory failure and cyst formation are related to high prolactin secretion (i.e. as associated with high yield). prolactin may reduce the sensitivity of the ovary to normal concentrations of LH. Suggesting that effects of prolactin could be mediated either centrally or directly upon the ovary.

### **Clinical signs**

Cysts may be present in one or both ovaries. More cysts are identified in the right ovary than in the left. ovarian cysts have been classified as either follicular or luteal cysts.

Follicular cysts are thin-walled and have little or no luteal tissue in the cyst wall. It is common to find multiple follicular cysts. Luteal, or luteinized, cysts are thick walled and more usually single and have a large quantity of luteal tissue in the cyst wall.

However, the accurate classification of cysts is difficult by palpation per rectum and there are a number of other structures that can be confused with them.

Cows with follicular cysts are often nymphomaniac, i.e. displaying excessive, prolonged signs of estrus and a shortened interval between successive heats. There is edematous swelling of the vulva, frequent and copious discharge of clear mucus, sinking of the sacrosciatic ligaments and upward displacement of the coccyx. Affected cows may have a nervous disposition, with depressed milk yield and loss of bodily condition. They

will attempt to ride other cows and, as with cows in estrus, will stand to be mounted by other cows. Because of their excessive sexual activity they have a general disruptive effect upon the rest of the herd, Furthermore, owing to the relaxation of the pelvic ligaments, they are prone to pelvic and hip fractures.

The luteal or luteinized cyst usually results in a cessation of cyclical activity; the structure functions as a persistent corpus luteum. These individuals will develop a masculine conformation and will attempt to mount other cows, but unlike the nymphomaniac cow they will not stand to be mounted by other cows.

### **Treatment and consequences**

The earliest method of treating cysts was by manual rupture per rectum. it should not be done intentionally as it can cause trauma or hemorrhage, which might result in ovarobursal adhesions.

Most cysts are now treated using reproductive hormones. The choice of hormonal treatment regimen depends largely upon the type of cyst that is present; follicular cysts are usually treated with either gonadotrophic hormones (i.e. hCG) or (GnRH) whereas luteinized cysts are normally treated with luteolytic substance (PGF<sub>2</sub>α).

### **Consequences of cystic ovarian disease**

Cystic ovarian disease depresses fertility in a number of ways; it extends the calving interval, decreases lifetime milk yields and increases the involuntary culling rate.

However, one further consequence of follicular cyst is the development of mucometra in which there is distension of the uterus with mucoid fluid and thinning of the uterine wall. with ovaries which contained thin-walled, follicular cysts and no corpora lutea.

### **Ovaro-bursal adhesion**

may be due to the following conditions:

- Infectious causes e.g. extension of peritonitis due to traumatic reticulitis into the ovaro-bursal area.
- Peritoneal tuberculosis.
- Defective manipulation of ovaries like enucleation of luteal cyst leading to bleeding and adhesion.

### **Ovaritis**

is a very rare lesion of the ovary. sometimes is associated with tuberculosis.

### **Granulosa cell tumors**

are generally the most common neoplasms of the bovine ovary. These tumors have been seen in pregnant as well as non-pregnant cattle.

Granulosa cell tumors can produce any of the main ovarian steroids, although reports of estrogen or androgen. Tumors that secrete estrogen cause animals to display nymphomaniac behavior, at least in the early stages of their development. Androgen-secreting tumors are more commonly associated with anoestrus, although in long-standing cases virilism may occur. The non-affected ovary is small and inactive. Granulosa cell tumors are generally regarded as benign tumor.

## **Acquired lesions of uterus**

### **Endometritis**

Endometritis, which implies inflammation of the endometrium, is a common condition of the cow. it does not affect the general health of the cow, although it does have a profound effect upon the fertility of the animal. the most important cause of endometritis is non-specific, opportunist pathogens that contaminate the uterus during the peri-calving period.

### **Causes of endometritis**

The great majority of cows suffer from bacterial contamination of the uterus after calving, but, under normal circumstances, this flora is rapidly eliminated. In cows that develop endometritis, the bacterial flora is not eliminated from the uterus, causing the endometrium to become inflamed. the pathogenesis of disease is largely concerned with the factors that impair the cow's ability to eliminate the infection, rather than with the bacteria themselves. There are therefore many factors that are associated with the development of endometritis.

- Retained placenta. retained fetal membranes are identified as being of major importance. the incidence of endometritis was 25 times higher in cows with retained fetal membranes than in normal cows.
- Dystocia. the obstetrical interventions to correct the dystocia increase the load of pathogens within the uterus.

### **Causative agent**

it was found that endometritis is almost invariably a sequel to invasion with *A. pyogenes*; histopathological lesions of endometritis were observed in 97.4% of the uteri infected with this organism. More recently, the role of obligate anaerobes in the pathogenesis of endometritis has been demonstrated, there is synergism between *A. pyogenes* and *Fusobacterium necrophorum*, the latter organism producing a leucocidal endotoxin which interferes with the host's ability to eliminate *A. pyogenes*. Similarly, *Bacteroides* spp. also produce substances that interfere with the phagocytosis and killing of bacteria.

## **Clinical signs**

Clinical signs of endometritis are the presence of a white or whitish-yellow mucopurulent vaginal discharge. The volume of the discharge is variable, but frequently increases at the time of estrus when the cervix dilates and there is copious vaginal mucus. The cow rarely shows any signs of systemic illness, Rectal palpation frequently shows a poorly involuted uterus which has a 'doughy' feel.

## **Treatment**

A wide range of antiseptics, antimicrobial agents and hormones have been used as treatments for endometritis.

In the treatment of endometritis with antimicrobial substances, it is preferable to administer the substance by the intrauterine route. Provided an adequate dose rate is used, this will result in effective minimum inhibitory concentrations (MICs) reaching the endometrium and being established in the intraluminal secretions. The latter point is important for the effective treatment of the disease, since subtherapeutic dose rates are frequently used.

A broad-spectrum antibiotic, such as oxytetracycline, used will provide effective MIC in the lumen and uterine tissues. Intrauterine infusions of penicillin are also effective in long-standing cases in which *A. pyogenes* has become dominant. When there is a palpable mature corpus luteum on the ovary it is arguable that the best method of treating clinical endometritis is with PGF<sub>2</sub>α or its synthetic analogues. When a corpus luteum is present PGF<sub>2</sub>α causes luteolysis, thereby stimulating the return of oestrus and reducing the high progesterone concentrations.

Several intrauterine therapeutic preparations also contain estrogens, whilst the administration of estrogens by intramuscular injection at the same time as intrauterine infusion of antibiotics has also been recommended. Such hormones increase uterine blood flow and simulate the changes that occur during the follicular phase of the estrous cycle. However, high dose rates of estrogens can influence folliculogenesis, resulting in transient or irreversible changes, including ovarian cysts, and can result in long periods of infertility.

## **Consequences**

Endometritis reduces fertility by extending the calving to conception interval and increasing the number of services per pregnancy. Endometritis can cause long-term, irreversible changes to the genital tract. The consequence of this long-term effect is clearly shown by the increased culling rate. Endometritis reduces the profitability of a dairy enterprise; the cost can be calculated by relating it to the increase in the calving-conception interval.

## **Pyometra**

Pyometra is characterized by a progressive accumulation of pus in the uterus and by the persistence of functional luteal tissue in the ovary. In most cases, pyometra occurs as a sequel to chronic endometritis when, as noted above, as a result of inflammation, the uterus ceases to produce or release the endogenous  $\text{PGF}_{2\alpha}$ .

The corpus luteum of diestrus persists and, since the genital tract remains under the continuous influence of progesterone, the infection is not eliminated. Because the cervix remains fairly tightly closed and the purulent exudate accumulates within the uterine lumen.

The second main cause of pyometra is the death of the fetus, invasion of the uterus by *A. pyogenes* and retention of the corpus luteum of pregnancy. This is a relatively infrequent cause of the condition. Thus pyometra usually results from contamination of the uterus during diestrus.

## **Clinical signs**

Cows which suffer from pyometra show few or no signs of ill health; the main reason for them being examined is the absence of cyclical activity, or, perhaps, the presence of an intermittent vaginal discharge. The uterine horns are enlarged and distended.

## **Treatment**

The best treatment is the use of  $\text{PGF}_{2\alpha}$  or its analogues. They result in regression of the corpus luteum, dilatation of the cervix and expulsion of the purulent fluid, with estrus occurring 3–5 days later.

Estrogens (estradiol cypionate), It is also indicated for expelling purulent material from the uterus of cows with pyometra. It has been suggested that estradiol enhances uterine resistance to infection by increasing uterine motility as well as mucus production and flow, which collectively promote the evacuation of purulent material from the uterus.

Antiseptic agents, such as iodine, and saline, have been infused into the uterus. The irritating nature of such solutions is thought to increase uterine tone, blood flow, and defense mechanisms. The induced inflammatory response of the uterus is thought to reduce the bacteria level within the uterus and aid in evacuating abnormal uterine fluid.

The infusion of antibiotic agents into the uterus including tetracyclines, penicillins, cephalosporines have been used. With variable results.

## **FUNCTIONAL/ PHYSIOLOGICAL DISORDERS**

1. **Anoestrus:** is a condition when an animal doesn't come to heat and is the most common condition affecting fertility in cattle. Anoestrus is most commonly observed after parturition and post service when conception does not occur. There are three types of Anoestrus which are



**A. True Anoestrus:** is when ovary is non-functional and will be devoid of any palpable structures.

**Causes:**

- Inadequate or lack of pituitary hormones.
- Malnutrition. This is the most common cause of anoestrus. Inadequate level of carbohydrate, proteins, and minerals like P, Cu, Co, Fe etc., and vitamins like vitamin A. may cause anoestrus.
- Chronic debilitating diseases such as heavy endoparasitism.
- Seasonal influences. It has been observed that the incidence of anoestrus is more common during the winters. This could be correlated to malnourishment during the lean seasons and also attributed to the amount of light available in winter.

**Treatment:** Improved nutrition.

**B. Anoestrus due to Persistent Corpus Luteum(PCL)**

Corpus Luteum is responsible for maintenance of pregnancy through progesterone it secretes. It is functional and persists on the ovary only during pregnancy. If it persists in nonpregnant animals it is termed as persistent corpus luteum or Retained CL. Retained CL is often associated with other pathological conditions of the uterus, which causes the uterus to act as gravid uterus.

- Fetal Mummification
- Fetal Maceration
- Pyometra
- Early embryonic death.

**C. Anoestrus Due to Undetected Heat/ silent heat:**

Inability or ignorance of the owner to detect heat. It is more common with animals with silent or mild heat. The weak heat or silent heat may be attributed to inadequate estrogen level. This can be ascertained only by rectal palpation and detecting CL, Grafean follicle, or ovulation fossa on the ovary and changes in the reproductive tract. It can also be detected by using a teaser bull.

**Treatment:**

- estrogen Inj. at 17th days of the estrous cycle and repeated on the 20<sup>th</sup> day.
- Improved nutrition.

**Repeat breeding (repeat breeder):**

Means cow coming into repeated heat in spite of services.

**Causes:**

**1. Early Embryonic death:** In this case the retention of CL of pregnancy, which has been terminated early, This is usually occurs in the period between

fertilization and the completion of the stage of organs differentiation at approximately day 42. where the embryo is too small to be detected when aborted or it may be reabsorbed. This may be a characteristic feature in served cows coming into heat after a period longer than the normal estrous cycle.

### **Treatment**

- Improved nutrition
- Check for diseases like Trichomoniasis and Vibriosis and treat them
- Inj. Receptal 11 days after insemination is known to improve embryo survival.

**2. Anovulation:** Ovum not released from ovary. The animal has normal cycle, normal reproductive tract but fails to conceive. This is due to:

- Inadequate level or absence of L.H.
- Ovaro-bursal adhesion. It may be diagnosed by palpation of matured follicle on the ovary more than 48hrs after the end of estrus.

### **Treatment:**

- L.H preparations (hCG)- 3000 IU. I/V. when the animal is in heat.
- Receptal - 5 ml I/m.
- Improved feeding.

### **3. Delayed Ovulation:**

Ovulation takes place 48-72 hours after the onset of estrus but the spermatozoa would be dead by then.

**Cause:** Due to low level of LH.

**Treatment:** As for anovulation.