

When Ovaries Refuse to Ovulate: A comparative review on Follicular and Luteal Cysts in Buffalo

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Abstract

Ovarian cysts, or cystic ovarian degeneration (COD), are major causes of reproductive failure in buffaloes, primarily occurring during the early postpartum period due to endocrine, metabolic, and environmental stressors. Follicular cysts result from failed ovulation and produce estrogen, leading to irregular estrus, whereas luteal cysts fail to regress and secrete progesterone, causing prolonged anestrus. While transrectal ultrasonography and hormonal assays are required for accurate differentiation, targeted treatments involve GnRH for follicular cysts and PGF₂α for luteal cysts. Implementing proactive management through balanced nutrition and routine reproductive monitoring is essential to minimize economic losses and restore herd fertility.

Keywords: Buffalo; Follicular cyst; Luteal cyst; Fertility

Introduction

Ovarian cysts, also referred to as cystic ovarian degeneration (COD), are among the most common functional reproductive disorders causing infertility in buffaloes. They are characterized by the persistence of one or more large anovulatory follicles (generally >2.5 cm in diameter) for at least 10 days in the absence of a functional corpus luteum, resulting in abnormal ovarian function and altered estrous behavior (Youngquist and Threlfall, 2006; Vanholder et al., 2006). These cysts develop when normal follicular growth, ovulation, or corpus luteum regression is disrupted, leading to prolonged calving intervals, irregular estrous cycles, repeat breeding, and reduced herd productivity. The condition is particularly prevalent during the early postpartum period, especially within the first 45–60 days after calving, when buffaloes experience metabolic stress, negative energy balance, heat stress, nutritional deficiencies, and postpartum disorders that interfere with the hypothalamic–pituitary–ovarian axis. The incidence of COD ranges from 5–8% in dairy cattle, while surveys in India have reported that ovarian cysts account for approximately 6% of

reproductive failures in river buffaloes, with most cases occurring before 45 days postpartum (Rao and Sreemannarayanan, 1982). The two major forms are follicular cysts, which are thin-walled, estrogen-producing structures associated with prolonged or irregular estrus and anovulation, and luteal cysts, which secrete progesterone and cause prolonged anestrus and silent estrus. Because these cysts differ in their endocrine profile, clinical presentation, and treatment, accurate diagnosis is essential for selecting appropriate hormonal therapy and restoring fertility. This article provides a comparative overview of follicular and luteal cysts, focusing on their etiology, pathophysiology, clinical features, diagnosis, treatment, and preventive strategies in buffaloes.

Etiology and Risk Factors

The development of ovarian cysts in buffaloes is multifactorial, involving endocrine disturbances, environmental stressors, nutritional imbalances, postpartum disorders, and genetic predisposition. Although follicular and luteal cysts differ in their hormonal characteristics, they share several common risk factors that disrupt normal ovarian function and reproductive cyclicity.

Hormonal Imbalances

Hormonal dysfunction is the primary cause of ovarian cyst formation. Follicular cysts develop when an inadequate or delayed luteinizing hormone (LH) surge prevents ovulation, allowing the dominant follicle to persist and continue producing estrogen. In contrast, luteal cysts arise due to inadequate secretion of prostaglandin F₂α (PGF₂α), which prevents normal luteolysis, or due to excessive luteinization resulting in persistent progesterone secretion.

Environmental and Managemental Factors

Heat stress, especially in tropical and subtropical regions, adversely affects the hypothalamic–pituitary–ovarian axis, disrupting the secretion of gonadotropins (LH and FSH)

and increasing the risk of both follicular and luteal cysts. In addition, poor housing, overcrowding, improper handling, and other management-related stressors further contribute to hormonal disturbances and ovarian dysfunction.

Postpartum Disorders and Diseases

Buffaloes during the postpartum period are particularly susceptible to ovarian cysts because of metabolic stress and delayed uterine involution. Uterine infections, especially endometritis, interfere with normal endocrine regulation and ovarian activity, predisposing animals to both follicular and luteal cyst formation. Systemic illnesses may also impair reproductive function and increase the likelihood of cyst development.

Nutritional and Genetic Factors

Deficiencies of energy, protein, vitamins, and essential trace minerals such as zinc, copper, and selenium negatively affect reproductive performance and hormonal balance. High-producing buffaloes are at greater risk due to the metabolic demands of lactation. Furthermore, certain buffalo breeds may possess a genetic predisposition to ovarian cyst development because of inherited hormonal or reproductive abnormalities.

Pathophysiology

The pathophysiology of ovarian cysts involves disruption of the normal ovarian cycle, resulting in failure of ovulation or persistence of luteal tissue. The mechanisms differ between follicular and luteal cysts, although both ultimately impair fertility by preventing normal estrous cyclicity. In follicular cysts, a dominant follicle fails to ovulate because of an insufficient or absent LH surge. Instead of rupturing and releasing the oocyte, the follicle continues to enlarge and remains hormonally active, secreting estrogen. The persistent estrogen production causes abnormal estrous behavior, including prolonged or irregular estrus and, in some animals, nymphomania. The enlarged cyst also suppresses the development of new follicles, thereby preventing ovulation and conception. In luteal cysts, ovulation is followed by luteinization, but the corpus luteum fails to regress because of inadequate PGF₂ α secretion or abnormal luteal persistence. The cyst continues to produce progesterone, which suppresses the release of LH and FSH through negative feedback on the hypothalamic-pituitary axis. Consequently, follicular development and ovulation are inhibited, leading to prolonged anestrus or silent estrus and persistent infertility until the luteal tissue regresses or is treated. Thus, while follicular cysts are characterized by persistent estrogen secretion due to failed ovulation, luteal cysts are characterized by persistent progesterone secretion resulting from failure of luteal regression. This fundamental

endocrine difference explains their distinct clinical manifestations and forms the basis for different therapeutic approaches.

Clinical Signs

The clinical manifestations of ovarian cysts in buffaloes vary depending on the type of cyst and its hormonal activity.

Follicular Cysts

Buffaloes with follicular cysts commonly exhibit prolonged or irregular estrus, frequent mounting behaviour (nymphomania), and repeated signs of heat without successful ovulation. Some animals may also experience anestrus or show no obvious external signs despite remaining infertile. On rectal palpation or ultrasonographic examination, the affected ovary is enlarged due to the presence of a thin-walled fluid-filled cyst.

Luteal Cysts

Buffaloes with luteal cysts usually present with prolonged anestrus or silent estrus because persistent progesterone secretion suppresses ovarian cyclicity. Affected animals often fail to conceive despite repeated inseminations and may exhibit irregular estrous cycles. Veterinary examination typically reveals an enlarged ovary containing a thick-walled cystic structure resembling the corpus luteum.

Clinical Feature	Follicular Cyst	Luteal Cyst
Estrous behavior	Prolonged or irregular estrus	Prolonged anestrus or silent estrus
Heat signs	Frequent or persistent	Usually absent
Nymphomania	Common	Rare
Ovulation	Absent	Suppressed
Fertility	Reduced due to anovulation	Reduced due to persistent progesterone
Ovarian findings	Thin-walled enlarged cyst	Thick-walled luteal cyst

Diagnosis

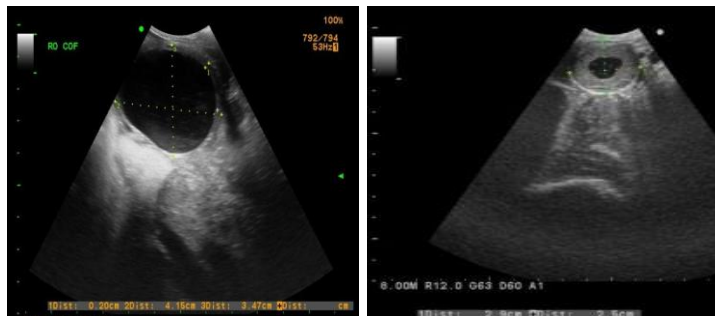
Accurate differentiation between follicular and luteal cysts is essential because treatment depends on the type of cyst.

Clinical Examination

A detailed reproductive history, including prolonged estrus, anestrus, repeat breeding, or extended calving interval, provides important diagnostic clues. Rectal palpation may reveal an enlarged ovary containing a cystic structure, although differentiation between follicular and luteal cysts is often difficult by palpation alone.

Ultrasonography

Transrectal ultrasonography is the most reliable method for diagnosing ovarian cysts. Follicular cysts appear as thin-walled, anechoic fluid-filled structures, whereas luteal cysts possess a thicker echogenic wall due to the presence of luteal tissue. Ultrasonography also enables monitoring of cyst size, ovarian activity, and response to treatment.



B-mode, Follicular Cyst

B-mode, Luteal Cyst

Hormonal Assays

Measurement of circulating reproductive hormones further aids diagnosis. Follicular cysts are characterized by high estrogen and low progesterone concentrations, reflecting persistent follicular activity. In contrast, luteal cysts show elevated progesterone levels due to the persistence of luteal tissue. Evaluation of LH and FSH concentrations may also help identify abnormalities in ovulation and ovarian function.

Diagnostic Parameter	Follicular Cyst	Luteal Cyst
Rectal palpation	Soft, fluctuant cyst	Firm, thick-walled cyst
Ultrasonography	Thin-walled, anechoic cyst (>2.5 cm)	Thick-walled cyst with luteal tissue (>2.5 cm)
Estrogen	High	Low/normal
Progesterone	Low	High
LH/FSH	Inadequate LH surge	Suppressed by progesterone
Best confirmatory test	Ultrasonography + hormone assay	Ultrasonography + progesterone assay

Treatment and Therapeutic Approaches

Successful treatment of ovarian cysts in buffaloes depends on accurate differentiation between follicular and luteal cysts, as each condition has a distinct hormonal basis and requires a specific therapeutic approach.

Follicular Cysts

Treatment of follicular cysts aims to induce ovulation and re-establish normal estrous cyclicity. Administration of gonadotropin-releasing hormone (GnRH) is the treatment of choice, as it stimulates luteinizing hormone (LH) release and promotes ovulation or luteinization of the cyst. Progestogens may also be used to regulate the estrous cycle, while estrogen therapy has been employed in selected cases to stimulate estrus. In chronic or refractory cases, manual rupture of the cyst or surgical

removal of the affected ovary (ovariectomy) may be considered. Supportive management through improved nutrition and reduction of environmental stress further enhances recovery.

Luteal Cysts

The treatment of luteal cysts focuses on inducing luteolysis and reducing progesterone secretion. Prostaglandin $F_{2\alpha}$ ($PGF_{2\alpha}$) is the treatment of choice because it causes regression of luteal tissue, allowing the buffalo to return to estrus. GnRH may be administered alone or in combination with $PGF_{2\alpha}$ to improve ovarian response in selected cases, while estrogen therapy is occasionally used to initiate estrus. Manual rupture of the cyst may be attempted by experienced veterinarians under controlled conditions. Appropriate nutritional management and stress reduction are also important components of therapy.

Treatment	Follicular Cyst	Luteal Cyst
Primary hormonal therapy	GnRH	$PGF_{2\alpha}$
Additional hormonal therapy	Progestogens, occasionally estrogen	GnRH $\pm$ $PGF_{2\alpha}$, occasionally estrogen
Manual rupture	Selected chronic cases	Selected cases
Surgical intervention	Ovariectomy in refractory cases	Rarely required
Supportive management	Improve nutrition and reduce stress	Improve nutrition and reduce stress

Prevention and Control

Prevention of ovarian cysts relies on minimizing the risk factors that disrupt normal ovarian function.

Stress and Environmental Management

Heat stress should be minimized by providing adequate shade, ventilation, cooling systems, and clean housing. Overcrowding and poor handling practices should be avoided to reduce stress-induced endocrine disturbances that predispose buffaloes to ovarian cyst formation.

Nutritional Management

Buffaloes should receive a balanced diet containing adequate energy, protein, vitamins, and essential trace minerals such as zinc, copper, and selenium to maintain normal ovarian function. Proper nutritional management during the transition and postpartum periods is particularly important for preventing reproductive disorders.

Reproductive Monitoring and Veterinary Care

Routine estrus detection, regular reproductive examinations, and transrectal ultrasonography facilitate early identification of ovarian abnormalities. Prompt diagnosis and treatment of postpartum uterine infections, particularly endometritis, together with regular veterinary check-ups, help

maintain reproductive health and reduce the occurrence of ovarian cysts.

Economic Importance

Ovarian cysts, including both follicular and luteal cysts, have a significant economic impact on buffalo production by reducing reproductive efficiency and overall herd productivity. These disorders delay the resumption of normal ovarian cyclicity, resulting in prolonged calving intervals, increased days open, repeat breeding, and reduced conception rates. Consequently, farmers incur higher costs due to repeated artificial inseminations, veterinary treatments, hormonal therapies, and extended maintenance of non-pregnant animals.

The economic losses are particularly severe in high-producing and postpartum buffaloes, where metabolic stress and reproductive disorders are more prevalent. In tropical regions, environmental challenges such as heat stress and poor nutritional management further increase the incidence of ovarian cysts, exacerbating reproductive inefficiency. Delayed conception not only reduces lifetime reproductive performance but also decreases milk production efficiency and limits genetic improvement due to reduced reproductive turnover. Therefore, early diagnosis, timely treatment, and effective preventive management of ovarian cysts are essential for improving fertility, maximizing productivity, and enhancing the profitability of buffalo farming systems.

Feature	Follicular Cyst	Luteal Cyst
Definition	Persistent unovulated follicle.	Persistent luteinized cyst or corpus luteum.
Origin	Failure of ovulation (inadequate LH surge).	Failure of luteal regression (low PGF _{2α}).
Wall Thickness	Thin (<3 mm).	Thick (>3 mm).
Contents	Clear fluid.	Fluid with luteal tissue.
Major Hormone	Estrogen	Progesterone
Hormonal Status	High estrogen, low progesterone	High progesterone
Pathophysiology	Follicle persists without ovulation.	Corpus luteum persists without regression.
Estrous Pattern	Prolonged/irregular estrus, nymphomania	Anestrus or silent estrus
Clinical Signs	Persistent heat, infertility, enlarged ovary	Anestrus, infertility, enlarged ovary
Rectal Palpation	Soft, fluctuant cyst	Firm, thick-walled cyst
Ultrasonography	Thin-walled anechoic cyst (>2.5 cm)	Thick-walled cyst with luteal tissue (>2.5 cm)
Hormonal Assay	High estrogen, low progesterone	High progesterone
Risk Factors	Heat stress, postpartum period, poor nutrition, hormonal imbalance	Heat stress, postpartum disorders, metabolic stress, hormonal imbalance
Primary Treatment	GnRH ± progestogens	PGF _{2α} ± GnRH
Additional Treatment	Manual rupture; ovariectomy (chronic cases)	Manual rupture; supportive care
Prognosis	Good with early treatment	Good after luteolysis
Prevention	Balanced nutrition, stress reduction, reproductive monitoring	Good nutrition, stress control, postpartum care, reproductive monitoring

Conclusion

Follicular and luteal cysts are among the most important ovarian disorders affecting reproductive performance in buffaloes. Although both conditions result in infertility and prolonged calving intervals, they differ markedly in their pathogenesis, hormonal profile, clinical manifestations, diagnostic characteristics, and therapeutic management. Follicular cysts are characterized by failure of ovulation and persistent estrogen secretion, whereas luteal cysts result from persistent luteal tissue producing progesterone, leading to suppression of normal ovarian cyclicity. Accurate differentiation between these cysts through clinical examination, ultrasonography, and hormonal evaluation is essential for selecting appropriate treatment and restoring fertility. Appropriate hormonal therapy, combined with good nutritional management, stress reduction, and regular reproductive monitoring, plays a pivotal role in the successful management of ovarian cysts. Preventive strategies aimed at minimizing heat stress, maintaining postpartum reproductive health, and ensuring timely veterinary intervention can substantially reduce the incidence of these disorders. A comprehensive understanding of the similarities and differences between follicular and luteal cysts enables veterinarians and buffalo farmers to implement effective reproductive management practices, thereby improving fertility, herd productivity, and the overall profitability of buffalo production systems.

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