

Postpartum Uterine Involution - A Cornerstone of Reproductive Health Restoration

The Foundation of Postpartum Fertility

Dear Vets,

Postpartum period represents a critical phase during which uterus undergoes extensive anatomical, physiological and immunological modifications to restore reproductive competence. Among these postpartum events, uterine involution is of paramount importance, as its efficiency directly influences subsequent ovarian activity, conception rate, calving interval and overall reproductive performance.

Although uterine involution is a natural physiological process, several factors including retained foetal membranes, dystocia, uterine infections, metabolic disorders and poor transition management can delay uterine recovery and compromise fertility. Timely uterine evacuation, effective bacterial clearance, adequate uterine tone and optimal postpartum management are therefore essential for restoring a healthy uterine environment capable of supporting future pregnancy.

Appropriate use of ecbolics, supportive therapies and prompt management of postpartum disorders can significantly improve uterine health and reproductive outcomes. Methylergometrine, prostaglandins and supportive herbal ecbolic preparations can contribute to enhanced uterine clearance, placental expulsion and uterine involution.

This issue of Face2Vet highlights the physiology of uterine involution, factors affecting postpartum uterine recovery, disorders that delay involution and evidence based therapeutic approaches for optimizing reproductive efficiency in bovine.

We invite you to read this issue and share your valuable feedback and experiences by scanning the QR code below or by writing to us at face2vet@intaspharma.com.

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Introduction

Postpartum period or puerperium is a critical phase in bovine reproduction during which reproductive tract undergoes extensive anatomical, physiological and immunological adaptations to return from pregnant state to normal reproductive function. Successful postpartum recovery has a direct influence on subsequent ovarian activity, fertility, conception rate and calving interval.

One of the most important events during puerperium is uterine involution. It is a coordinated process through which gravid uterus progressively returns toward its non-pregnant size, position, structure and functional capacity. Uterine recovery does not occur in isolation. It is closely interconnected with postpartum ovarian rebound, immune competence, metabolic health and bacterial clearance. Neutrophils, macrophages, cytokines and other components of innate immunity participate in removal of damaged tissue and control of bacterial contamination. When this coordinated recovery is disrupted by retained foetal membranes, metabolic disorders, poor nutrition, uterine infection or dystocia, involution may be delayed, increasing risk of metritis, endometritis, delayed ovarian activity and poor reproductive performance.

Therefore, efficient uterine involution represents a fundamental determinant of postpartum reproductive health and future fertility, rather than merely a physiological event following calving.

Process of Uterine Involution

During pregnancy, uterus undergoes marked enlargement to accommodate growing foetus, placental development and increased uterine vascularity. Following parturition, genital tract progressively regresses toward the non-pregnant state through a process known as uterine involution. This process occurs in a decreasing logarithmic manner, with greatest reduction in uterine size occurring during first few days of postpartum. Although uterine contractions continue for several days after calving, they gradually decrease in frequency, amplitude, duration and regularity as involution advances.

Major components include:

- Reduction in uterine size and weight
- Restoration of uterine tone and position
- Regression of maternal caruncles
- Expulsion of lochia and postpartum debris
- Repair and regeneration of endometrium
- Elimination of bacterial contamination
- Restoration of normal uterine defence mechanisms
- Re-establishment of uterine environment to support subsequent pregnancy

Anatomical Changes during Involution

Immediately after calving, uterus is greatly enlarged, with previously gravid horn remaining markedly distended. Strong myometrial contractions during early postpartum period progressively reduce uterine volume and help to expel uterine contents.

As involution proceeds:

- Uterine volume progressively decreases
- Gravid horn becomes less distended
- Difference between gravid and non-gravid horns diminishes
- Uterus gradually returns toward its normal pelvic position
- Cervical diameter progressively decreases and cervical competence is restored.
- Uterus also undergoes a dramatic decrease in weight, approximately 8 to 10 kg at parturition to nearly 1 kg within four to five weeks postpartum (Fig. 1).

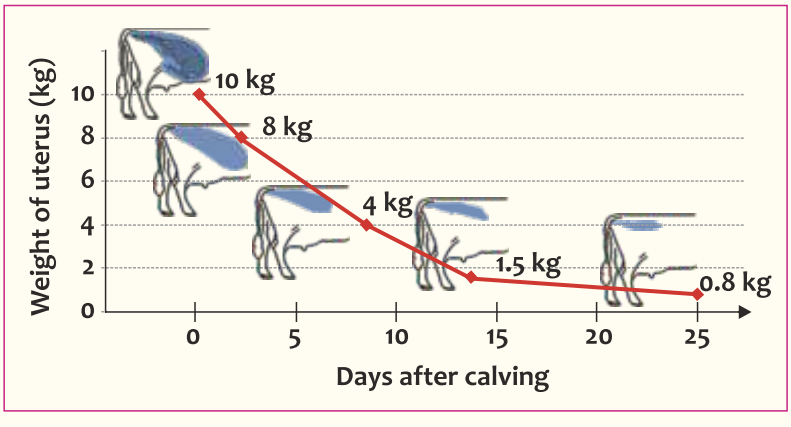


Fig. 1: Relative Change in Uterus Mass (Sheldon, 2004)

Caruncular Degeneration

Following separation and expulsion of placenta, maternal caruncles undergo extensive remodelling as part of normal involution process. Immediately after calving, caruncles remain enlarged and contain remnants of chorionic villi attached within endometrial crypts.

Within first 48 hours postpartum, ischemic and necrotic changes begin in caruncular tissue. Rapid constriction and occlusion of caruncular blood vessels reduce blood supply, resulting in progressive degeneration of superficial tissues.

By approximately 5 days postpartum, a leukocyte rich necrotic layer covers much of caruncular surface. Sloughing of this necrotic tissue contributes substantially to formation of lochia.

As involution progresses:

- Caruncular blood vessels become constricted and gradually regress.
- Necrotic tissue undergoes degeneration and liquefaction.
- Sloughed tissue is eliminated through uterine discharge.
- Small blood vessels may protrude temporarily from caruncular surface, contributing to reddish colouration of lochia.
- Most necrotic tissue is shed by approximately 10–15 days postpartum.
- Tissue remodelling, vascular repair and healing continue during subsequent weeks.
- As healing progresses, caruncles subsequently become small, healed protrusions, with substantial transformation occurring by approximately 40–60 days postpartum (Fig. 2).

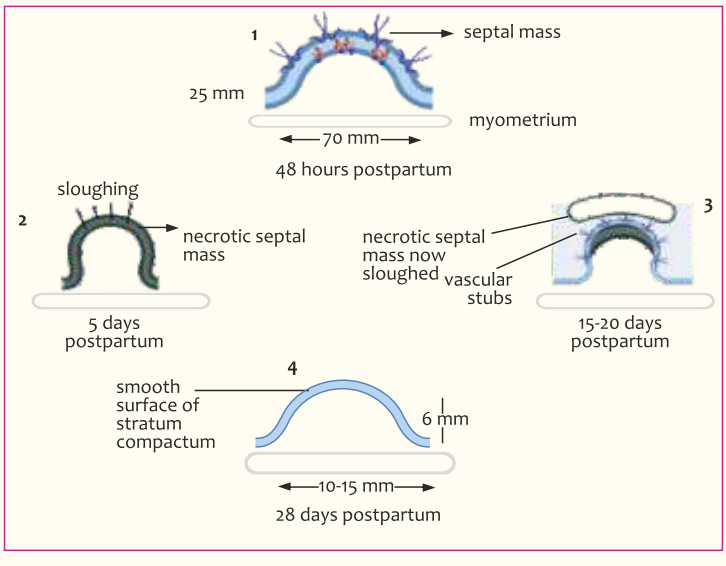


Fig. 2: Changes in Caruncles during Puerperium
(Noakes *et al.*, 2016)

Lochial Elimination

Lochia is normal postpartum uterine discharge produced during process of uterine cleansing and tissue remodelling. It contains:

- Foetal fluids
- Blood
- Remnants of foetal membranes
- Inflammatory cells
- Necrotic caruncular tissue

Lochia is typically reddish brown to yellowish brown in colour. Its volume is greatest during first 2–3 days after calving, after which it gradually decreases and usually disappears by approximately 14–18 days postpartum.

Normal lochia is typically non-offensive in odour. A fetid or foul-smelling uterine discharge, particularly when accompanied by fever, depression, reduced feed intake or other signs of systemic illness, should raise suspicion of postpartum uterine infection.

Endometrial Repair and Restoration

Endometrial regeneration is essential for restoring uterine function and preparing uterus for subsequent pregnancy. Following parturition, endometrium undergoes Inflammation, tissue remodelling, removal of damaged tissue, re-epithelialization and restoration of normal architecture.

Regeneration of endometrial epithelium begins soon after calving. Intercaruncular regions generally recover earlier, whereas caruncular areas require more extensive repair because of tissue changes associated with placental separation.

Re-epithelialization progresses from margins toward centre of caruncles. Neutrophils and lymphoid cells participate in removal of damaged tissue, control of bacterial contamination and tissue repair. In healthy animals, restoration of normal endometrial architecture and repair of caruncular areas generally occur within approximately 20–30 days postpartum, although individual variation exists.

Postpartum Uterine Clearance and Bacterial Defence

Bacterial contamination of uterus is almost inevitable during and immediately after parturition because cervical dilation and disruption of normal reproductive tract barriers allow microorganisms from environment, skin, faeces and vaginal flora to enter uterine lumen.

Postpartum uterus provides a favourable environment for bacterial growth, but effective uterine contractions and innate immune responses progressively reduce bacterial contamination as involution proceeds.

Microorganisms reported from postpartum uterus include *Escherichia coli, Streptococcus* spp., *Trueperella pyogenes*, *Fusobacterium necrophorum, Prevotella* spp. and *Bacillus* spp. Failure to control pathogenic bacterial populations can result in metritis, endometritis, delayed involution and impaired fertility.

Return of Ovarian Cyclicity (Ovarian Rebound)

Uterine recovery and resumption of ovarian activity are interconnected components of postpartum reproductive recovery. Both are influenced by metabolic, endocrine and inflammatory status.

Following parturition, removal of pregnancy associated hormonal inhibition allows gradual recovery of hypothalamic–pituitary– ovarian activity. An increase in FSH generally occurs within 7–14 days postpartum, contributing to emergence of first postpartum follicular wave. A dominant follicle may be detectable by approximately 10 days postpartum and may subsequently ovulate, undergo atresia or occasionally become cystic (Fig. 3).

- First postpartum ovulation generally occurs around 21 days in dairy cows. Buffaloes show a slower return to ovarian cyclicity, influenced by factors such as season, suckling, nutrition and management.
- Importantly, first postpartum ovulation occurs without obvious behavioural signs of estrus and is therefore often described as silent ovulation or silent heat.

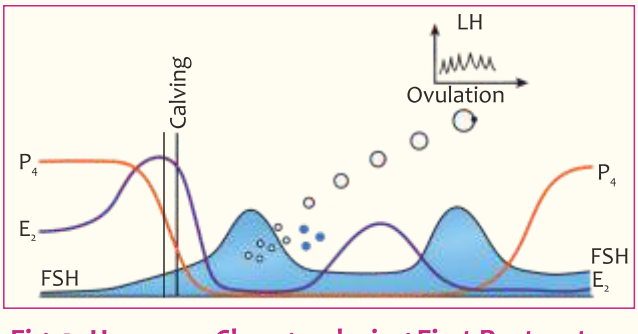


Fig. 3: Hormone Changes during First Postpartum Follicular Wave (Noakes *et al.*, 2016)

Delayed uterine involution and postpartum uterine disease can:

- Impair follicular growth
- Prolong the interval from calving to conception
- Reduce estradiol production
- Reduce reproductive efficiency
- Delay ovulation

Hormonal and Local Regulation of Uterine Involution

Uterine involution is regulated by coordinated endocrine, inflammatory and local mechanisms involving myometrial contraction, tissue remodelling, uterine repair and clearance of postpartum debris. Principal hormones involved are oxytocin, prostaglandins, steroid hormones, while immune mediators and local growth factors also contribute to uterine involution.

Oxytocin plays a crucial role immediately after parturition by stimulating rhythmic contractions of myometrium. These myometrial contractions contribute to:

- Reduction in uterine volume by inducing contractions which further facilitate expulsion of lochia
- Expulsion of postpartum contents
- Compression of uterine blood vessels, contributing to uterine shrinkage and accelerating involution
- Restoration of uterine tone

Endogenous oxytocin release is enhanced during suckling and milking, contributing to postpartum uterine recovery.

Prostaglandin $F_2\alpha$ ($PGF_2\alpha$) is another important mediator of uterine involution. It increases myometrial contractility, promotes uterine tone and aids in evacuation of uterine contents. Elevated prostaglandin production during early postpartum period is considered one of the major physiological mechanisms driving uterine regression.

Estrogen contributes indirectly to involution by increasing uterine blood flow, enhancing myometrial responsiveness to oxytocin and supporting uterine defence mechanisms. Estrogen also facilitates leukocyte migration into uterus, thereby promoting bacterial clearance and tissue repair.

Local Mediators: Cytokines, chemokines, growth factors, prostaglandins and other locally produced regulatory molecules coordinate:

- Recruitment of immune cells
- Bacterial clearance
- Tissue remodelling
- Resolution of inflammation
- Endometrial regeneration

A controlled inflammatory response is necessary for normal postpartum tissue repair, whereas prolonged or dysregulated inflammation may contribute to uterine disease and impaired reproductive performance.

Factors affecting Uterine Involution

Uterine involution is influenced by several physiological, nutritional, reproductive and management related factors. The major factors affecting postpartum uterine recovery are summarised in Table 1.

Table 1: Factors affecting Uterine Involution

Factors	Impact on Uterine Involution
Parity and age	Multiparous and older animals exhibit slower uterine recovery because of reduced uterine tone and greater tissue stretching associated with repeated pregnancies.
Nutrition and metabolic status	Adequate energy, protein, minerals and vitamins are essential for tissue repair and immune function. Negative energy balance, hypocalcaemia and deficiencies of selenium, zinc, copper or vitamin E can impair postpartum recovery.
Body condition score	Both inadequate and excessive body condition can adversely affect postpartum recovery. Poor body reserves compromise uterine repair and immune competence.
Postpartum uterine infection	Metritis, endometritis and other uterine infections interfere with normal tissue repair and prolong uterine recovery.
Calving related factors	Dystocia, prolonged labour, twin births, stillbirths, retained foetal membranes and obstetrical interventions can increase uterine trauma and bacterial contamination, thereby delaying involution.
Environmental and management factors	Poor calving hygiene, overcrowding, heat stress, inadequate housing and poor transition cow management increase risk of postpartum complications and delayed uterine recovery.
Species and seasonal influences	Buffaloes generally exhibit a longer involution period than cattle, with season, suckling, lactation status and reproductive management potentially influencing recovery.

Major Postpartum Disorders affecting Uterine Involution

Retention of Foetal Membranes

Retention of Foetal Membranes (RFM) is generally defined as failure to expel foetal membranes within 12 to 24 hours after parturition. Incidence of RFM is influenced by factors such as dystocia, twin births, premature calving, abortion, stillbirth, nutritional deficiencies, metabolic disorders and infectious diseases. It occurs more frequently in high producing dairy cows and is also an important postpartum disorder in buffaloes.

Retained foetal membranes can result in:

- Delayed uterine clearance
- Prolonged lochial discharge
- Increased bacterial contamination
- Persistent uterine enlargement
- Delayed endometrial repair
- Increased risk of metritis and endometritis
- Delayed ovarian activity
- Reduced conception rates
- Increased services per conception

Postpartum Uterine Infections

Uterine infections are important causes of delayed uterine involution and impaired fertility in bovine. When bacterial clearance is inadequate, persistent infection and inflammation can interfere with normal uterine recovery.

Consequently, postpartum uterine infections delay resumption of ovarian cyclicity, impair follicular growth and ovulation, reduce conception rates, increase services per conception and days open, prolong calving intervals and increase the risk of culling due to infertility. Major postpartum uterine infections include metritis, endometritis and subclinical endometritis.

Uterine infections delay involution through several mechanisms:

- Suppression of normal uterine contractions
- Persistence of inflammatory exudates
- Delayed elimination of lochia and debris
- Prolonged bacterial contamination
- Impaired endometrial regeneration
- Increased tissue damage and fibrosis

Monitoring Uterine Involution

Regular evaluation of reproductive tract during postpartum period enables identification of abnormalities before they have a major impact on reproductive performance. Clinical assessment of uterine involution is based primarily on changes in uterine size, symmetry, tone, cervical closure and nature of uterine discharge. Commonly used methods for monitoring postpartum uterine involution are presented in Table 2.

Table 2: Methods for Monitoring Uterine Involution

Method	Parameters Assessed	Significance
Rectal palpation	Uterine size and position, symmetry of uterine horns, uterine tone, cervical diameter and presence of abnormal uterine contents	Most widely used field method for assessing progress of postpartum uterine involution and identifying delayed recovery.
Vaginal examination	Character of vaginal discharge, presence of pus or foul odour, cervical closure and evidence of metritis or endometritis	Helps evaluate uterine health and detect postpartum uterine infections.
Ultrasonography	Uterine horn diameter, uterine wall thickness and intrauterine fluid, endometrial changes, ovarian activity	Provides an accurate and objective assessment of uterine involution and associated reproductive disorders.
Endometrial cytology and laboratory techniques	Neutrophil count, inflammatory cell infiltration, uterine pathogens and microbiological status	Useful for diagnosing subclinical endometritis and identifying uterine infections, particularly in specialized reproductive practice and research.

Therapeutic Approaches for Optimal Uterine Involution

The objective of postpartum management is not simply to make uterus contract. Successful recovery requires coordinated uterine evacuation, bacterial control, resolution of excessive inflammation, tissue repair and correction of underlying metabolic and nutritional problems.

Ecbolics

Ecbolic agents stimulate uterine contractions and facilitate expulsion of lochia, exudates and residual uterine contents.

Prostaglandin $F_2\alpha$ (Cloprostenol)

- Increases uterine tone and contractility.
- Facilitates evacuation of uterine contents.
- Promotes uterine clearance with delayed involution or fluid accumulation.
- Aids recovery by enhancing myometrial activity and uterine defence mechanisms.
- **Cloprostenol (Inj. Pragma)** or **D-Cloprostenol (Pragma-D)** is administered @ 2 ml IM in cattle and buffaloes to promote uterine evacuation, improve uterine tone and support postpartum involution.

Methylergometrine

- A semi synthetic ergot alkaloid with potent uterotonic activity.
- Produces sustained contraction of uterine smooth muscle.
- Enhances expulsion of lochia, retained secretions and inflammatory exudates.
- Improves uterine tone and accelerates reduction in uterine size during early puerperal period.
- Commonly used in bovine practice following assisted calving, retained foetal membranes, uterine atony and delayed involution.
- Particularly useful when rapid restoration of uterine tone and drainage is desired.
- Best results are achieved when administered during early postpartum period along with proper management of underlying causes.
- **Methylergometrine (Inj. Nexbolic)** is administered @ 2-5 mg/animal *via* IM/IV route as a single dose to facilitate uterine drainage, placental expulsion and restoration of uterine tone.

Herbal Preparations

- Herbal preparations are used to support postpartum uterine health, promote uterine evacuation and facilitate normal uterine involution.
- Various herbal agents such as Tankan Kshar, Ashoka, Gokharu, Lodra, Chitrak, Harmal, Manjishtha, Ajwain, Majuphal (*Quercus infectoria*), Patha (*Cissampelos pareira*), Turmeric (*Curcuma longa*) and Pudina (*Mentha piperita*) possess uterine supportive, ecbolic, restorative and cleansing properties that may aid placental expulsion, lochial drainage, uterine tone and postpartum recovery.
- These preparations are used as adjunct supportive therapy during the puerperal period, particularly in animals with delayed placental expulsion, uterine atony, retained foetal membranes or delayed uterine recovery.
- **Proshe** is administered @ 100-125 ml orally twice daily for 3-5 days in cattle and buffaloes to support uterine clearance, placental expulsion and postpartum uterine involution. In cases of retained foetal membranes, dose should be tripled and repeated every three hours until foetal membranes are expelled.
- **Ropitas** is administered @ 4 boli intrauterine to support expulsion of retained foetal membranes and facilitate postpartum uterine clearance.

Antimicrobials

Antimicrobial treatment is indicated in cases of clinical metritis, severe uterine infection or when systemic illness is evident.

Therapy aims to:

- Control pathogenic bacterial infection
- Reduce disease associated inflammation
- Prevent progression of systemic disease
- Support restoration of uterine health
- **Ceftiofur (Inj. Xyrofur)** or **Ceftiofur - Tazobactam (Inj. Xyrofur Tazo)** is administered @ 1.1-2.2 mg/kg b.wt. in cattle and 2.2-4.4 mg/kg b.wt. in buffaloes *Via* IM route with postpartum uterine infections to aid bacterial elimination and facilitate uterine recovery.
- **Lenovo-IU (Levofloxacin, Ornidazole and Alpha-tocopherol)** is administered @ 30-60 ml *via* intrauterine route for local management of endometritis, metritis, pyometra (after removal of pus) and other uterine infections, thereby supporting bacterial control, endometrial healing and restoration of uterine health.

Anti-inflammatory Agents

Inflammation associated with postpartum uterine disease may impair feed intake, milk production and reproductive performance.

Non-steroidal anti-inflammatory drugs (NSAIDs) are used to:

- Reduce fever
- Improve animal comfort
- Control excessive inflammation
- Support recovery in clinically affected animals.
- **Flunixin meglumine (Inj. Unizif)** is administered @ 1-2 ml/45 kg b.wt. *via* slow IV/IM route or **Flunixin meglumine and Serriatiopeptidase (Tab. Unizif Plus)** is administered @ 1 bolus up to 300 kg b.wt. and 2 boli orally for more than 300 kg b.wt. to control inflammation and improve clinical recovery in animals affected with postpartum uterine disorders.

Supportive and Metabolic Therapy

appropriate supportive and metabolic therapy helps to restore systemic health and facilitate normal uterine contractility, immune function and endometrial function.

Supportive therapy includes:

- Correction of hypocalcaemia
- Management of ketosis and negative energy balance
- Fluid therapy in severely affected animals
- Correction of relevant trace mineral deficiencies
- Vitamin supplementation, particularly vitamins A and E

Efficacy Studies of Inj. Methylergometrine Maleate (Inj.Nexbolic)

Study 1: Therapeutic Efficacy of Methylergometrine Maleate During the Puerperal Period in HF Crossbred Cows (Patel *et al.*, 2014).

Objective

To evaluate the effect of Methylergometrine maleate administered immediately after parturition on placental expulsion, uterine involution and postpartum reproductive performance in HF crossbred cows.

Materials and Methods

A total of 12 multiparous HF crossbred cows were divided into two groups (n=6 each). Treatment group received 5 mg Methylergometrine maleate intramuscularly immediately after calving, while control group received normal saline. Postpartum reproductive parameters including placental expulsion, uterine involution, first postpartum estrus, service period, services per conception and conception rate were recorded.

Results

Methylergometrine treatment significantly reduced time required for placental expulsion (3.47±0.23 vs. 5.36±0.19 hrs.), uterine involution (25.67±0.88 vs. 37.67±1.31 days) and first postpartum estrus (36.33±1.17 vs. 48.00±2.39 days) compared with controls. Treated cows also showed a shorter service period (79.20±8.51 vs. 100.33±6.64 days), fewer services per conception (2.0 vs. 2.6) and a higher conception rate (83.33% vs. 50.00%).

Conclusion

Administration of Methylergometrine maleate immediately after parturition accelerated placental expulsion, enhanced uterine involution, promoted earlier return to estrus and improved overall reproductive performance. These beneficial effects are attributed to its potent and sustained uterotonic action, which improves uterine drainage and postpartum recovery.

Study 2: Effect of Methylergometrine Maleate on Expulsion of Foetal Membrane in Crossbred Cows (Madhwal *et al.*, 2019).

Objective

To evaluate the effect of Methylergometrine maleate administered shortly after calving on expulsion of foetal membranes and its potential role in improving postpartum uterine recovery in crossbred dairy cows.

Materials and Methods

Study included 36 normally calved HF crossbred cows, comprising a treatment group (n=30) and a control group (n=6). Cows in treatment group received Methylergometrine maleate (10 ml IM; 0.2 mg/ml) within 30 minutes of calving, while control cows received normal saline. Time required for expulsion of foetal membranes was recorded and compared between groups.

Results

Cows treated with Methylergometrine expelled foetal membranes significantly earlier (4.42±0.08 h) than untreated control cows (8.86±0.36 h; $p<0.05$). Potent uterotonic action of Methylergometrine stimulates uterine contractions and facilitates placental separation and expulsion.

Conclusion

Administration of Methylergometrine maleate soon after parturition significantly reduced time required for expulsion of foetal membranes. Early placental expulsion helps to reduce risk of retained foetal membranes, improve uterine clearance and support faster uterine involution and postpartum reproductive recovery.

Conclusion

Uterine involution is a vital component of postpartum reproductive recovery in cattle and buffaloes. Efficient reduction in uterine size, clearance of lochia and bacteria, caruncular remodelling, and endometrial repair help restore a healthy uterine environment for subsequent breeding. Factors such as retained foetal membranes, uterine infections, metabolic disturbances, and poor postpartum management can delay this process and compromise fertility. Appropriate therapeutic interventions using ecbolics such as Cloprostenol and Methylergometrine, supportive herbal preparations, antimicrobial and anti-inflammatory drugs, along with correction of underlying metabolic disturbances, facilitate uterine clearance, improve uterine tone, and support postpartum recovery. Effective postpartum management should therefore focus on early recognition of abnormal uterine recovery, prevention and appropriate management of postpartum disorders, maintenance of metabolic and immune health, and timely Veterinary intervention when indicated. Supporting normal uterine recovery during the postpartum period can help establish the conditions required for timely ovarian rebound, successful breeding and improved reproductive efficiency.

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