Review Article:

UROVAGINA IN DAIRY CATTLE: A CLINICAL OVERVIEW

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ABSTRACT

Urovagina is the pathological condition in which the urine accumulates into the floor of cranial vagina. Its prevalence in dairy cows and impact on fertility has been sparsely investigated in comparison to that in mare. The cases of urovagina in dairy cows have been increasing and this condition appears to be one of the important causes of infertility through conception failure, repeat breeding and embryonic loss. The prevalence of clinically relevant urovagina in Holstein cows across various countries ranged from 3.1% to 15.4%. Major risk factors of urovagina involve multiple parturition, low body condition score, horizontal vulva, cranio-ventral pelvic displacement and postpartum endometritis. Mild cases can be managed by improving body condition and vaginal douching, whereas moderate to severe cases often require surgical correction, such as urethral extension, flap-based techniques, or vestibulovaginal cerclage. Early diagnosis and targeted intervention are critical to restore normal urine flow, prevent uterine damage, and improve conception rates, thereby enhancing overall reproductive efficiency in affected cows. This article highlights the etiology, risk factors, prevalence, diagnosis and impact of urovagina and its treatment approach in dairy cattle and its management.

Keywords: Cranio-ventral pelvic displacement, horizontal vulva, infertility, urine pooling

INTRODUCTION

Urovagina refers to the accumulation of urine into the cranial floor of the vagina; it is also called as urine pooling or vesicovaginal reflux (González-Martín et al, 2026; Guanga et al., 2025; Ishiyama et al., 2025). It is one of the most common reproductive disorders causing infertility in breeding mares (Hooper & Taylor, 1995; McKinnon & Belden, 1988; Sellnow, 1996). This condition has been sparsely documented in dairy cows, although there are a few reports describing the surgical correction of urovagina (Gilbert et al., 1987; Gonzalez-Martin et al., 2008; Prado et al., 2007; St. Jean et al., 1988). An increasing number of cows are being diagnosed with urovagina (Gilbert et al., 2017; González-Martín et al, 2026; Hopper, 2021), and there seems to be a greater prevalence in certain breeds, particularly Charolais and Holstein (Noakes et al., 2009). Although no published data are currently available on the prevalence of urovagina in Nepalese cattle, field observations by the author indicate several occurrences of this condition, particularly in low body condition scored Holstein cows with the history of conception failure and repeat breeding. These observations suggest that urovagina may be under-recognized by the veterinary practitioners as a contributing factor to the conception failure and repeat breeding. Therefore, there is a clear need to enhance the understanding of urovagina in dairy cattle among the veterinary practitioners. The purpose of this systematic review is, therefore, to comprehensively synthesize current knowledge on urovagina in dairy cattle, including its predisposing factors, epidemiology, diagnostic approaches, therapeutic interventions and management strategies.

ETIOLOGY AND RISK FACTORS OF UROVAGINA

Urine pooling results from poor vestibular muscle tone or cranioventral tipping of the pelvis, which causes the external urethral orifice during urination to be higher than the adjacent vaginal floor. This results in urine gravitating into the vaginal fornix (Brown et al., 1978; Sellnow, 1996; St. Jean et al., 1988). The weight of urine in this area may then cause cranioventral displacement of the vagina toward the brim of the pelvis, further complicating the problem (St. Jean et al., 1988). A feature shared by all cows with urovagina is the incompetence of, or damage to, the constrictor vestibule muscle (Gonzalez-Martin et al., 2008).

Higher parities, dystocia, low body condition score (BCS), endometritis, cranio-ventral slopping of pelvic girdle and horizontal vulva have been described as the major risk factors for urovagina in dairy cows (Gautam & Nakao, 2009; Noakes et al., 2009; St. Jean et al., 1988; Wolfe & Baird, 1993). Repeated pregnancies are thought to weaken and elongate the supporting structures of the reproductive tract, which may promote the accumulation of urine in the cranial portion of the vagina (Fubini & Ducharme, 2004; Noakes et al., 2009; St. Jean et al., 1988). In addition, severe dystocia specially in cows with feto-pelvic disproportion can injure the constrictor vestibuli muscle (Fubini & Ducharme, 2004; Hooper & Taylor, 1995; St. Jean et al., 1988), potentially allowing urine to reflux and collect in the cranial vagina (Gonzalez-Martin et al., 2008). Cows with low BCS exhibited a greater predisposition to urovagina than animals with good BCS. Reduced perivaginal fat in thin cows may diminish vaginal wall support, encouraging ventral vaginal displacement and positioning the urethral opening above the cranial vaginal floor, thereby favoring urine accumulation within the vaginal fornix (Gautam & Nakao, 2009).

The occurrence of postpartum endometritis within 60 days after calving was also associated with an increased likelihood of urovagina. Uterine enlargement secondary to inflammatory edema, fluid retention, or delayed involution may promote cranioventral shifting of the reproductive tract, facilitating cranial urine flow and retention in the vagina (Gautam & Nakao, 2009).

Vulvar conformation showed a strong relationship with the occurrence of urovagina: cows displaying a horizontal vulvar orientation were more likely to develop urovagina than those with a vertical vulva (Gautam & Nakao, 2009; St. Jean et al., 1988). Greater vulvar angulation corresponded with more pronounced clinical findings. Higher parity animals tended to exhibit this conformation, likely reflecting age-related increases in abdominal mass and weakening of supportive musculature, which contribute to forward and ventral displacement of the cranial vagina, cervix, and uterus (Pouret, 1982). The weight of retained urine may further exacerbate this displacement (Gonzalez-Martin et al., 2008; St. Jean et al., 1988), suggesting that a horizontal vulva may serve as a possible indicator of urovagina.

Pelvic orientation was likewise another risk factor: cows with cranioventral pelvic inclination demonstrated a higher prevalence of urovagina than those with caudoventral orientation (Gautam and Nakao, 2009). Such pelvic alignment positions the urethral orifice at higher position relative to the cranial vagina, predisposing to urine retention within the vaginal fornix (Prado et al., 2007).

DIAGNOSIS OF UROVAGINA AND ITS CLASSIFICATION

Vaginoscopic examination is recommended as a practical tool to diagnose urovagina and to determine whether surgical correction is needed (Guanga et al., 2025). During vaginoscopic examination, the vaginal content can be aspirated using an artificial insemination (AI) gun sheath fitted to a 20 or 50 ml syringe, and the presence of urine or urine mixed mucus can be confirmed by observing the yellowish color, watery consistency, urine smell and measuring the

pH of the content (pH>7.4). Based on vaginoscopic examination, the urovagina in cattle can be classified into- a mild, moderate, or severe depending on the extent of covering of external cervical os by the urine or urine mixed content (Gautam & Nakao, 2009) (Fig. 1). The case having the presence of urine or urine mixed content (<100 ml) only on the floor of the vagina but not covering the external os of the cervix can be considered as mild form; it has no risk of entering the content into the uterus. Similarly, the case having approximately 100 to 500 mL of urine into the cranial vagina and covering up to the half portion of the external cervical os can be considered a moderate form; it has a risk of urine reaching into the uterus during estrus. Furthermore, the case having large volume of urine (>500 mL) covering almost all portion of external cervical os is considered as severe degree; it has a high risk of urine reaching into the uterus. Based on the impact on subsequent fertility, only the moderate and severe degrees were defined as the clinically relevant urovagina (Gautam & Nakao, 2009).

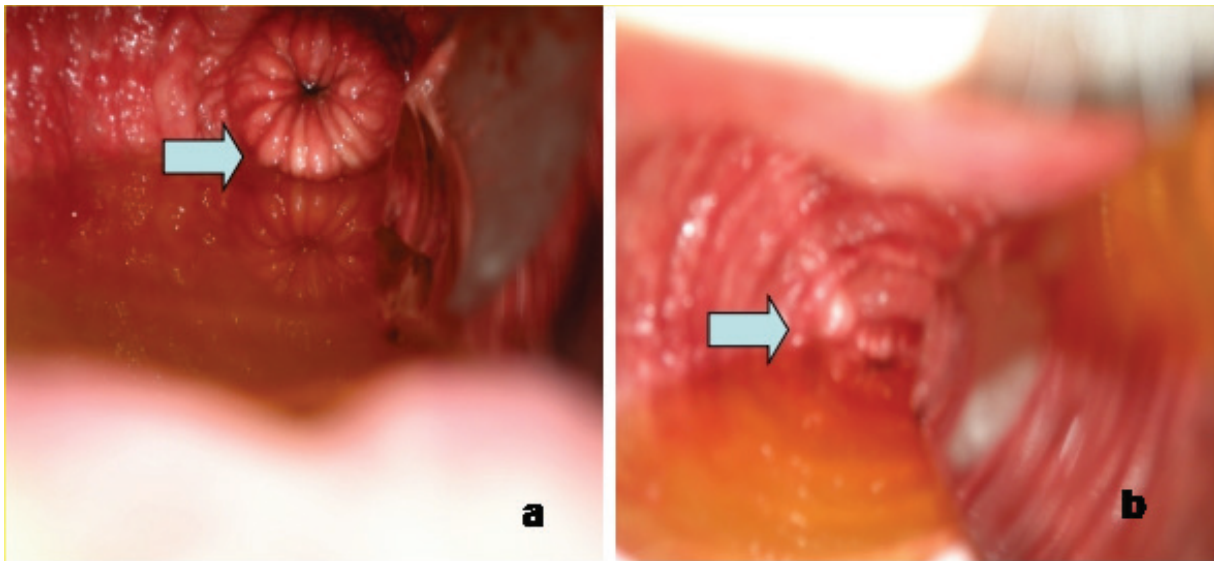

Fig. 1. Assessment of degree of urovagina based on the extent of covering of external cervical os (shown by arrow) by the urine or urine mixed mucus: a. moderate urovagina, covering up to the half portion of the external cervical os; b. severe urovagina, covering almost all portion of external cervical os (Source: Photograph taken by the Author during vaginoscopic examination)

A gloved-hand or Metricheck device can be also used to diagnose the cases of urovagina in field cases (Ishiyama et al., 2025), however classifying its degree may not be possible with these methods (Guanga et al., 2025). Recently, Ishiyama et al. (2025) compared the various vaginal examination methods to diagnose the urovagina and demonstrated that the gloved-hand method was equally effective in detecting the cases of urovagina that could predict fertility.

Although transrectal palpation of the reproductive tract may also identify severe cases of urovagina, the mild and moderate cases may not be detected solely on the basis of transrectal palpation (Author's clinical observation).

PREVALENCE OF UROVAGINA

There are limited studies regarding the prevalence of urovagina in dairy cattle (Farhoodi et al., 2000; Gautam & Nakao, 2009; Ishiyama et al., 2025). Recently, several authors confirmed an increase in the prevalence of urovagina over time (Gilbert et al., 2017; Hopper, 2021). In a previous study comprising 344 lactations of Holstein cows in Japan, the overall lactational prevalence of urovagina was 26.7%, including 11.3% mild, 11.0% moderate, and 4.4% severe

cases. Clinically relevant urovagina was identified in 53 lactations (15.4%), with herd-level prevalence ranging from 4.8% to 20.6% (Gautam & Nakao, 2009). In a recent study in Japan comprising 277 Holstein cows, the overall incidence of a urovagina was 10.7% using the gloved-hand method and 6% using the speculum method; the incidence of a urovagina diagnosis tended to be higher in gloved-hand method (12.6%) compared to the speculum method (6.6%) in the cows within 200 days postpartum, whereas the incidence was comparable between the two methods in the cows beyond 200 days postpartum (Ishiyama et al., 2025). In Turkey, out of total of 1167 Holstein and Brown Swiss cows examined, the prevalence of pneumovagina and urovagina were 19.2% and 3.1%, respectively (Goncagul et al., 2012). However, the prevalence of urovagina in Holstein cows in Iran was only 1.5%, where the authors did not mention the method of diagnosis (Farhoodi et al., 2000).

Among the urovagina affected cows examined during two subsequent parities, there was recurrence of urovagina in subsequent lactation in 54.3% of affected cows whereas 45.7% of cows had urovagina only in one parity. Likewise, initial diagnosis of urovagina occurred within 60 days postpartum in 48.9% of cases while 51.1% were first detected after this period. Of the early postpartum cases, 26.7% resolved and were not observed to recur later in lactation indicating that approximately one quarter of cases resolved spontaneously during later stage of lactation (Gautam & Nakao, 2009).

IMPACT OF UROVAGINA ON FERTILITY

Mild degree of urovagina was not associated with impaired reproductive performance. However, the moderate and severe degrees of urovagina significantly impaired the fertility of the affected cows. Therefore, these two grades were classified as clinically relevant urovagina. Clinically relevant urovagina was consistently associated with marked reductions in reproductive indices, including a 65% decrease in pregnancy rate, a 48% decrease in AI submission rate, and a 53% decrease in pregnancy per insemination relative to the unaffected cows. As a result, the affected cows were 6.6-fold likely to remain non-pregnant by 210 days postpartum and 9.5-fold likely to be culled for reproductive failure (Gautam & Nakao, 2009).

Urovagina in dairy cows has been associated with greater inseminations per conception leading to conception failure or repeat-breeding (Gautam & Nakao, 2009; González-Martín et al., 2008; Sood & Vatsayan, 2017). Accumulation of urine into the vagina may facilitate uterine exposure to urine, potentially impairing fertility through the spermicidal properties of urine and the development of chronic endometritis (Easley, 1988; Gilbert et al., 1989; González-Martín et al., 2026; Hudson, 1986; Wolfe & Baird, 1993; Youngquist, 1997). Exposure of spermatozoa to urine has been shown to impair its motility and functional integrity, likely due to its alkaline condition and the presence of toxic compounds such as urea and ammonia (Chen et al., 1995; Griggers et al., 2001; Kim & Kim, 1998).

Even if the fertilization may take place, the chronic exposure of the endometrium to the urine and associated inflammation can disrupt uterine receptivity and early embryonic development, ultimately leading to pregnancy loss and repeat breeding (Easley, 1988; Gilbert et al., 1989; González-Martín et al., 2026; Youngquist, 1997). In a study, the incidence of endometritis was significantly greater in cows with clinically relevant urovagina than in cows without urovagina. Furthermore, there was severe congestion of the external cervical os and cranial vagina in the cows affected with clinically relevant urovagina (Gautam & Nakao, 2009). Accumulation of urine and vaginal debris can induce vaginitis and cervicitis and, particularly during estrus, the inflammation may ascend into the uterus, contributing to superficial or necrotizing endometritis (Monin, 1972; Gilbert et al., 1989). Persistent vesicovaginal reflux may further promote

periglandular fibrosis secondary to prolonged inflammation (Easley, 1988). Endometrial irritation or inflammation can stimulate premature prostaglandin $F_2\alpha$ release, resulting in early regression of corpus luteum, reduced progesterone secretion, and subsequent embryonic loss (Thatcher et al., 2001; Mann & Lamming, 2001; Sheldon et al., 2006).

TREATMENT OF UROVAGINA

As the criteria used for classification of clinically relevant urovagina had a predictive value of subsequent fertility, the decision for surgical correction can be made based on the extent of covering of the external cervical os by the accumulated urine. The cases with urine or urine-mixed mucus only on the floor of the vagina may not require surgical correction, as these had no negative impact on fertility of dairy cows (Gautam & Nakao, 2009) whereas severe degree of urovagina require surgical correction (Gilbert et al., 1989; Gonzalez-Martin et al., 2008). Some cases of urovagina associated with low BCS are spontaneously recovered once the animal achieves the good BCS. There appeared to be improvement in the orientation of vulva once the BCS was improved (Gautam & Nakao, 2009). The degree of sloping of the bony pelvis is a fixed anatomical trait, with some cows having a more horizontal pelvic floor while others have a steep, cranio-ventral slope (Nogalski & Mordas, 2012).

In cows diagnosed with mild to moderate urovagina, vaginal douching using 1–2 liters of 3% alum solution, normal saline with or without penicillin-streptomycine, or 1–2% povidone-iodine has been recommended as a conservative therapeutic approach (Absy, 2015; Gautam & Nakao, 2009; Mido et al., 2016; Radostits et al., 2007; Yoshida et al., 2020). Such flushing may reduce local inflammation and promote vaginal tissue contraction, thereby improving genital tract conformation and limiting urine retention (Youngquist & Threlfall, 2007; Noakes et al., 2009). Recent evidence indicates that ozone-based therapy may serve as an effective non-surgical management strategy for urovagina in dairy cattle. Vaginal lavage with ozonated solution, when combined with intra-cornual insemination, has been associated with improved uterine conditions and enhanced conception outcomes, resulting in successful pregnancies in affected cows (Zobel et al., 2012). In cows with urovagina, manual evacuation of pooled urine by applying ventral and caudal pressure through the rectum before insemination may help improve the reproductive tract environment, and insemination using a double-sheath technique is often recommended to minimize semen contamination. Some practitioners also recommend repeat evacuation approximately 24 h post-breeding followed by intrauterine antibiotic infusion to reduce ascending infection and support conception (Noakes et al., 2009; Zobel et al., 2012).

Surgical correction is recommended in cows with persistent or severe urovagina when conservative therapy fails to resolve urine pooling and associated infertility, or when the vaginal content of urine exceeds 100 mL (St. Jean et al., 1988). Various surgical techniques have been described, each aiming to prevent cranial urine flow and restore normal genital tract function (Gilbert et al., 1989; Gonzalez-Martin et al., 2008; Hudson, 1986; Prado et al., 2007; St. Jean et al., 1988).

1. Urethral Extension (Urethroplasty)

This technique involves extending the urethral mucosa toward the vulvar lips to redirect urine flow (Gilbert et al., 1989; St. Jean et al., 1988). In a study involving 14 cows with urovagina, the technique corrected urine pooling in 64% of cases and restored fertility in 79% of treated cows. Complications, particularly fistula formation at the cranial portion of the extension, were frequently observed (St. Jean et al., 1988).

2. Modified McKinnon and Brown Flap Techniques

Originally developed for correction of urovagina in mare, these approaches have been adapted for bovines. The modified McKinnon technique creates a U-shaped mucosal flap to form a lined urethral tunnel, while the Brown method employs alternative flap designs. Despite their utility, both techniques had high rates of fistula formation, prompting evaluation of tissue grafts to improve outcomes (Prado et al., 2007).

3. Vestibulo-vaginal Cerclage

Another technique reinforces the vestibulo-vaginal junction to prevent retrograde urine flow (Raayat et al., 2021). Placement of an encircling suture at the junction has achieved resolution of urovagina in 89.5% of cows and markedly improved pregnancy rates in treated cows compared with untreated animals (GonzálezMartín et al., 2008).

CONCLUSION

Urovagina in dairy cattle reduces the fertility through conception failure, repeat breeding and embryonic loss. Major risk factors of urovagina involve high parity, low body condition score, horizontal vulvar conformation, cranio-ventral pelvic orientation and postpartum endometritis. Mild cases may respond to conservative management such as improving body condition score and vaginal douching, whereas moderate to severe cases often require surgical correction, such as urethral extension, flap-based techniques, or vestibulo-vaginal cerclage. Early diagnosis and targeted intervention are critical to restore normal urine flow, prevent uterine damage, and improve conception rates, thereby enhancing overall reproductive efficiency in affected cows.

CONFLICT OF INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

ETHICAL APPROVAL AND PERMITS

Not applicable.

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