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Clinical and epidemiological assessment of obstructive urolithiasis in buffalo calves

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Abstract

The objective of this study was to evaluate the epidemiological characteristics, clinical presentation, risk factors, site of obstruction, and treatment outcome of obstructive urolithiasis in buffalo calves presented to a Referral Veterinary Polyclinic during a six-month period. Hospital records from November, 2025 to May, 2026 were reviewed retrospectively. Data regarding age, season, feeding pattern, clinical signs, site of urethral obstruction, treatment modality, and outcome were extracted and analyzed using descriptive statistics and Chi-square test. A total of 138 male buffalo calves were diagnosed with obstructive urolithiasis. The highest incidence occurred in calves aged 3–6 months (34.78%), followed by 6–9 months (30.43%). Winter accounted for 52.17% of cases. Concentrate-rich feeding consisting primarily of wheat bran, calf starter, and cereal grains was recorded in 71.01% of affected calves. Stranguria was observed in 100% of cases, while tenesmus (88.41%), tail switching (79.71%), restlessness (74.64%), abdominal distension (63.04%), and complete urine retention (53.62%) were also common. The distal sigmoid flexure was the predominant site of obstruction (46.38%). Tube cystostomy was performed in 82 calves and achieved the highest recovery rate (87.80%). Overall survival was 84.06% (116/138). Concentrate-rich feeding showed a highly significant association with obstructive urolithiasis ($\chi^2 = 16.84$, $p = 0.00004$). Obstructive urolithiasis in buffalo calves was predominantly a winter-season disease affecting rapidly growing male calves fed high-phosphorus concentrate diets. Early diagnosis and tube cystostomy resulted in favorable clinical outcomes.

Keywords: Buffalo calf, obstructive urolithiasis, tube cystostomy, sigmoid flexur, retrospective study.

1. Introduction

Obstructive urolithiasis is an important urinary tract disorder of male buffalo calves and is characterized by the formation of urinary calculi that interfere with normal urine outflow, resulting in partial or complete obstruction of the urinary tract (Van Metre *et al.*, 1996; Constable *et al.*, 2016) [6, 2]. The condition is frequently encountered in intensively reared buffalo calves and is associated with considerable economic losses owing to treatment costs, mortality, and reduced growth performance (Ewoldt, *et al.*, 2006) [4]. In buffaloes, a hospital incidence of 12.66% has been documented (Singh *et al.*, 2008) [9]. Urolithiasis is a significant urinary tract disorder with an overall incidence of approximately 5.04% in India. Among different animal species, the highest occurrence has been reported in goats (49.83%), followed by cattle (32.87%), dogs (14.53%), horses (1.38%), and sheep (1.04%), (Amarpal *et al.*, 2004) [1].

Young buffalo calves between 3 and 12 months of age are particularly susceptible because they are commonly maintained under intensive feeding systems that utilize concentrate-rich rations containing cereal grains, wheat bran, and oilseed cakes (Singh *et al.*, 2010; Makhdoomi *et al.*, 2013) [9, 5]. These feeds are characterized by high phosphorus concentrations and often result in an inverted calcium-to-phosphorus ratio, thereby predisposing animals to phosphatic urolith formation (Van Metre *et al.*, 1996) [6]. Male calves are affected more frequently than females because of the greater length, narrower diameter, and anatomical curvature of the male urethra. The distal sigmoid flexure and penile urethra represent the most common sites of obstruction due to their relatively narrow lumen (Rakestraw *et al.*, 1995; Constable *et al.*,

2016)^[8, 2].

Seasonal variation has also been reported, with a higher prevalence during winter months. Reduced water intake during cold weather may increase urine concentration and facilitate precipitation of urinary minerals (Van Metre *et al.*, 1996)^[6]. Phosphate-containing calculi, particularly struvite (magnesium ammonium phosphate) and calcium phosphate calculi, are commonly reported in concentrate-fed ruminants maintained under intensive production systems (Makhdoomi and Ghazi, 2013)^[5]. Despite advances in diagnosis and surgical management, obstructive urolithiasis continues to be a major cause of morbidity in buffalo calves. Therefore, the present retrospective study was undertaken to evaluate the epidemiological characteristics, clinical findings, risk factors, and treatment outcomes of buffalo calves presented with urolithiasis during a six-month period.

Materials and Methods

Study design and case selection

A retrospective study was conducted using medical records of buffalo calves presented to the Referral Veterinary Polyclinic between November, 2025 and May, 2026. Cases diagnosed with obstructive urolithiasis based on history, clinical examination, ultrasonography, catheterization findings, and surgical confirmation were included in the study.

Data collection

Information regarding age, sex, breed, feeding practices, season of occurrence, duration of illness, clinical signs, ultrasonographic findings, treatment methods, and outcomes was extracted from hospital records. Animals were categorized according to age: Less than 3 months, 3–9 months, 9–12 months, more than 12 months. Seasonal occurrence was categorized into winter, spring, and summer.

Statistical analysis

Data were analyzed using SPSS version 25.0. Descriptive statistics were used to calculate frequencies and percentages. Chi-square (χ^2) analysis was employed to evaluate associations between feeding practices and occurrence of obstructive urolithiasis. Significance was considered at $p < 0.05$.

Result and Discussion

Overall occurrence and age distribution

A total of 138 buffalo calves were diagnosed with obstructive urolithiasis during the six-month study period. All affected animals were males. Age-wise analysis (Table 1) revealed that calves between 3 and 6 months constituted the largest group with 48 cases (34.78%), followed by 6–9 months (42 cases; 30.43%). Together, calves between 3 and 9 months represented 65.21% (90/138) of all cases, indicating that rapidly growing calves receiving supplemental concentrate feeding were the most susceptible group. Only 12 calves (8.70%) were younger than 3 months, whereas 10 calves (7.25%) were older than 12 months. The predominance of young calves is consistent with earlier reports in buffalo calves, where intensive feeding during the post-weaning growth phase was considered an important predisposing factor. Similar age-related susceptibility has been reported by Singh *et al.* (2010)^[9] and Makhdoomi *et al.* (2013)^[5], who observed that rapidly growing buffalo calves receiving concentrate-rich diets were more frequently affected than older animals.

Seasonal prevalence

Seasonal distribution (Table 2) showed a marked winter predominance. Seventy-two cases (52.17%) occurred during winter (November–February), compared with 38 cases (27.54%) in spring and 28 cases (20.29%) in summer. Thus, more than half of all cases were presented during the colder months. Reduced voluntary water intake during winter likely resulted in increased urine concentration and enhanced precipitation of urinary minerals, thereby favoring calculus formation. Similar seasonal trends have been described in bovine urolithiasis under intensive management systems (Van Metre *et al.*, 1996)^[6]. Seasonal variation in disease occurrence has also been observed, with a higher prevalence during winter months. This increased incidence may be associated with reduced water consumption and vitamin A deficiency resulting from limited availability of green fodder during this period (Radostits *et al.*, 2000)^[7]. Vitamin A plays a crucial role in maintaining the integrity of the urinary tract epithelium and regulating vitamin D metabolism. Conversely, increased exposure to sunlight and elevated vitamin D activity during summer may contribute to the development of urinary calculi by influencing mineral metabolism and urinary crystal formation.

Feeding practices and risk factors

Feeding history (Table 3) indicated that 98 of 138 calves (71.01%) were maintained on concentrate-rich rations containing wheat bran, calf starter, crushed cereal grains, and oilseed cakes. Mixed feeding was recorded in 30 calves (21.74%), whereas only 10 calves (7.25%) received predominantly roughage-based diets. Wheat bran is characteristically rich in phosphorus and, when fed excessively, may reduce the dietary calcium-to-phosphorus ratio below the recommended level for growing ruminants. Such an imbalance promotes phosphaturia and favors formation of phosphate-containing calculi, particularly struvite and calcium phosphate uroliths (Van Metre *et al.*, 1996)^[6]. Chi-square analysis (Table 7) demonstrated a highly significant association between concentrate-rich feeding and obstructive urolithiasis ($\chi^2 = 16.84$, $p = 0.00004$), confirming the major role of nutritional management in disease occurrence. The significant association observed between concentrate feeding and occurrence of obstructive urolithiasis in the present study further supports the importance of nutritional factors in disease pathogenesis.

Clinical findings

Clinical manifestations are summarized in Table 4. Stranguria was present in all 138 calves (100%), making it the most consistent diagnostic sign. Tenesmus was observed in 122 calves (88.41%), tail switching in 110 calves (79.71%), restlessness in 103 calves (74.64%), and abdominal distension in 87 calves (63.04%). Complete urine retention occurred in 74 calves (53.62%), while 59 calves (42.75%) showed varying degrees of depression and anorexia. These findings indicate progressive urethral obstruction leading initially to painful urination and later to bladder distension and systemic illness. Comparable clinical signs have been reported in buffalo calves with obstructive urolithiasis (Singh *et al.*, 2010; Makhdoomi *et al.*, 2013)^[9, 5].

Site of urethral obstruction

As shown in Table 5, the distal sigmoid flexure was the most common site of obstruction, accounting for 64 cases

(46.38%). Obstruction of the penile urethra was identified in 39 calves (28.26%), while 25 calves (18.12%) had calculi lodged near the ischial arch. Multiple obstruction sites were recorded in 10 calves (7.24%). The predominance of the distal sigmoid flexure reflects the anatomical narrowing and sharp curvature of this segment, which favors lodgment of even small calculi. Similar observations have been reported in bovine and buffalo urolithiasis (Rakestraw *et al.*, 1995; Constable *et al.*, 2016) [8, 2].

Treatment outcome

Treatment outcomes are presented in Table 6. Twenty-eight calves responded to medical management, of which 22 recovered (78.57%). Tube cystostomy was performed in 82 calves and achieved the highest success rate, with 72 recoveries (87.80%). Combined tube cystostomy and urethrotomy was required in 28 advanced cases, resulting in 22 recoveries (78.57%). Overall, 116 of 138 calves recovered, giving an overall survival rate of 84.06%. The superior outcome of tube cystostomy likely reflects restoration of urine flow while allowing time for urethral inflammation to resolve. Similar outcomes have been reported in previous studies where tube cystostomy effectively restored urine flow and facilitated urethral healing (Ewoldt *et al.*, 2006; Makhdoomi *et al.*, 2013 and Tamilmahan *et al.*, 2014) [4, 5, 10]. Before surgical procedure, it is must to stabilise the animal as metabolic derangements like hyperkalemia, hyponatremia and hypocalcemia exists (Makhdoomi and Ghazi, 2013) [5]. This is generally been done by giving fluid therapy. Maintaining an appropriate calcium-to-phosphorus ratio, ensuring unrestricted access to water, and limiting excessive wheat bran supplementation may reduce disease incidence (Van Metre *et al.*, 1996) [6].

Table 1: Age-wise distribution of buffalo calves affected with urolithiasis

Age group	Number of cases	Percentage (%)
<3 months	12	8.70
3–6 months	48	34.78
6–9 months	42	30.43
9–12 months	26	18.84
>12 months	10	7.25
Total	138	100.00

Table 2: Seasonal occurrence of urolithiasis

Season	No. of Cases	Percentage (%)
Winter (Nov–Feb)	72	52.17
Spring (Mar–Apr)	38	27.54
Summer (May–Jun)	28	20.29
Total	138	100.00

Table 3: Feeding history of affected buffalo calves

Feeding practice	Cases	Percentage (%)
Concentrate-rich feeding + calf starter)	98	71.01
Mixed feeding	30	21.74
Roughage-dominant feeding	10	7.25
Total	138	100.00

Table 4: Clinical signs observed

Clinical sign	Cases	Percentage (%)
Stranguria	138	100.00
Tenesmus	122	88.41
Tail switching	110	79.71
Restlessness	103	74.64
Abdominal distension	87	63.04
Complete urine retention	74	53.62
Depression	59	42.75

Table 5: Site of urethral obstruction

Site	Cases	Percentage (%)
Distal sigmoid flexure	64	46.38
Penile urethra	39	28.26
Ischial arch	25	18.12
Multiple sites	10	7.24
Total	138	100.00

Table 6: Treatment outcome

Treatment modality	Cases	Recovered	Recovery (%)
Medical management	28	22	78.57
Tube cystostomy	82	72	87.80
Tube cystostomy + urethrotomy	28	22	78.57
Total	138	116	84.06

Table 7: Association between feeding pattern and obstructive urolithiasis

Feeding type	Obstructive cases	Non-obstructive cases	Total
Concentrate-rich diet	98	16	114
Other feeding systems	40	31	71
Total	138	47	185

* The analysis demonstrated a highly significant association ($p < 0.001$) between concentrate-rich Feeding and occurrence of obstructive urolithiasis ($\chi^2 = 16.84$, $p = 0.00004$).

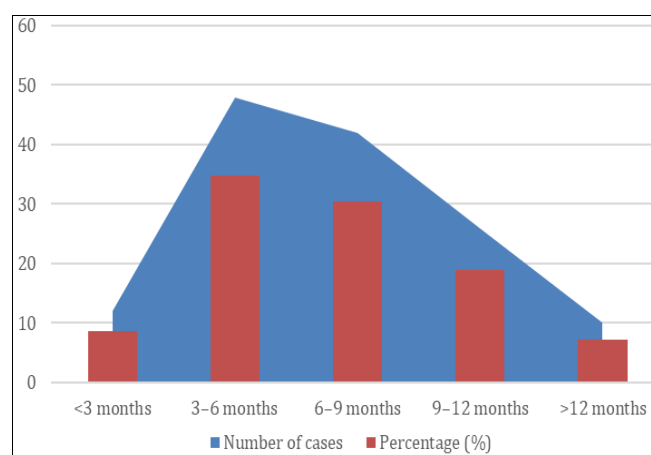


Fig 1: Age-wise distribution of buffalo calves

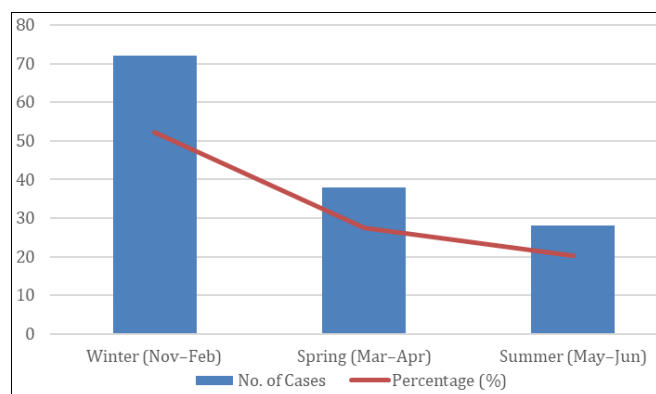


Fig 2: Seasonal occurrence of urolithiasis

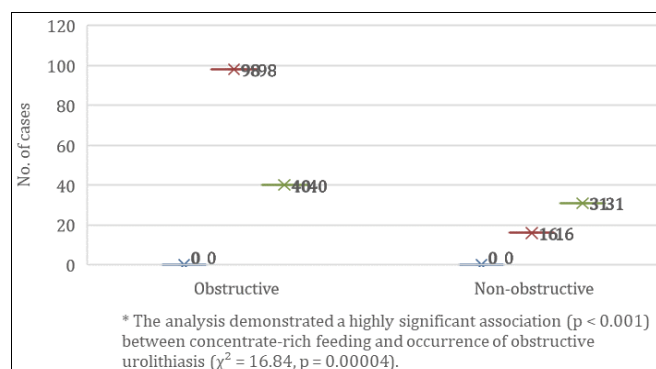


Fig 3: Association between feeding pattern and obstructive urolithiasis

Conclusion

The present retrospective study demonstrated that obstructive urolithiasis is predominantly a disease of male buffalo calves between 3 and 9 months of age. Winter season, concentrate-rich feeding, and excessive use of wheat bran were important risk factors. The distal sigmoid flexure was the most common site of obstruction. Early diagnosis and prompt surgical intervention, particularly tube cystostomy, resulted in favorable treatment outcomes. Adoption of balanced mineral nutrition, adequate roughage supplementation, unrestricted access to clean water, and urinary acidification strategies may help reduce disease incidence.

Conflict of Interest

Not available

Financial Support

Not available

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