Surgical Management of Urolithiasis in Eight Dogs of Different Breeds

Abstract

Urolithiasis is one of the most frequently encountered urinary tract disorders in dogs and results in dysuria, hematuria, pollakiuria, urinary obstruction, and significant impairment of animal welfare. The present study describes the diagnosis and surgical management of urolithiasis in eight dogs comprising four Shih Tzus, two Labrador Retrievers, one Golden Retriever, and one Pug, aged between 4.5 and 7 years and weighing between 8 and 32 kg. Dogs were presented with varying degrees of lower urinary tract signs including stranguria, hematuria, frequent urination, abdominal discomfort, and urinary retention. Diagnosis was established through clinical examination, hematobiochemical analysis, urinalysis, ultrasonography, and radiographic evaluation. Surgical intervention was undertaken in all cases following confirmation of urinary calculi. Standard cystotomy was performed under general anesthesia, and cystoliths were successfully removed. Postoperative management included antimicrobial therapy, analgesics, fluid therapy, and dietary recommendations aimed at preventing recurrence. Clinical recovery was seen in all the cases, with restoration of normal urination and resolution of associated clinical signs. The findings highlight the importance of early diagnosis and timely surgical intervention in canine urolithiasis and demonstrate that cystotomy remains a reliable and effective treatment modality for dogs with bladder calculi. Long-term management through dietary modification, monitoring of urine characteristics, and periodic imaging is essential for minimizing recurrence.

Keywords: Bladder stones, canine urolithiasis, cystotomy,dogs,surgical management,urinary calculi

1. Introduction

Canine urolithiasis is a common disorder characterized by the formation of mineralized concretions within the urinary tract and represents an important cause of lower urinary tract disease in dogs (Osborne *et al.,* 1999; Lulich *et al.,* 2016). Uroliths may occur in the kidneys, ureters, urinary bladder, or urethra and can result in clinical signs ranging from mild dysuria to complete urinary obstruction (Bartges *et al.,* 2015).

The development of urolithiasis is multifactorial and involves urine supersaturation with crystalloid-forming minerals, alterations in urinary pH, urinary tract infections, genetic predisposition, dietary influences, and reduced urine volume (Osborne *et al.,* 1999; Dvorska & Saganuwan, 2015). Certain breeds including Shih Tzu, Miniature Schnauzer, Bichon Frise, Lhasa Apso, Yorkshire Terrier, and Dalmatian have been reported to be predisposed to urolith formation (Houston *et al.,* 2004; Stiller *et al.,* 2014).

The most frequently identified canine uroliths are struvite and calcium oxalate calculi, although urate, cystine, silica, and mixed mineral stones are also reported (Houston *et al.,* 2004; Lulich *et al.,* 2013). Struvite calculi are commonly associated with urinary tract infections caused by urease-producing bacteria, whereas calcium oxalate calculi are often linked to metabolic and dietary factors (Osborne *et al.,* 1999; Bartges *et al.,* 2015).

Diagnosis of canine urolithiasis relies on a combination of clinical examination, urinalysis, diagnostic imaging, and quantitative stone analysis (Lulich *et al.,* 2016). Survey radiography and ultrasonography remain the most widely utilized diagnostic modalities due to their accessibility and diagnostic accuracy (De Lima *et al.,* 2017). Surgical removal remains the preferred treatment option for large, obstructive, or non-dissolvable uroliths, with cystotomy being one of the most commonly performed procedures in small animal surgery (Kyles & Monnet, 2012; Grant *et al.,* 2010).

The present study was undertaken to evaluate the clinical presentation, diagnostic findings, surgical management, and postoperative outcome of urolithiasis in eight dogs of different breeds presented to the veterinary teaching hospital.

2. Materials and Methods

2.1 Study Animals

The study included eight client-owned dogs diagnosed with urolithiasis and presented to the veterinary clinical complex between April, 2026 and June, 2026. The animals consisted of four Shih Tzus, two Labrador Retrievers, one Golden Retriever, and one Pug. Age ranged from 4.5 to 7 years, while body weight ranged from 8 to 32 kg.

2.2 Clinical Evaluation

A detailed history was obtained from each owner regarding duration of illness, urinary abnormalities, feeding practices, water intake, and previous medical treatment. All dogs underwent complete physical and clinical examination including assessment of temperature, pulse rate, respiration rate, hydration status, abdominal palpation, and urinary bladder distension.The diagnostic protocol followed standard recommendations for canine urolithiasis evaluation described by Lulich *et al.* (2016).

2.3 Laboratory Investigations

Blood samples were collected for complete blood count and serum biochemical evaluation. Parameters including hemoglobin concentration, total erythrocyte count, total leukocyte count, blood urea nitrogen, serum creatinine, alanine aminotransferase, and electrolytes were evaluated(Bartges *et al.*, 2015).Urine samples were collected either by catheterization or cystocentesis and subjected to physical, chemical, and microscopic examination. Urinary pH, specific gravity, protein content, red blood cells, white blood cells, bacteria, and crystal morphology were recorded(Osborne et al., 1999; Lulich et al., 2016).

2.4 Diagnostic Imaging

Survey radiography of the abdomen was performed in lateral and ventrodorsal projections. Ultrasonographic examination was conducted to confirm the presence, number, and location of urinary calculi, as these imaging techniques are considered reliable methods for detecting bladder uroliths in dogs (De Lima *et al.*, 2017; Lulich *et al.*, 2016).

2.5 Surgical Procedure

Food was withheld for 12 hours prior to surgery. General anesthesia was induced according to institutional protocols. Following aseptic preparation of the ventral abdomen, a ventral midline celiotomy was performed. The urinary bladder was exteriorized and isolated using sterile laparotomy sponges.A ventral cystotomy incision was made in an avascular region of the bladder wall. Uroliths were removed using forceps and gentle flushing with sterile saline. The bladder lumen and proximal urethra were flushed thoroughly with sterile saline to minimize residual calculi, a procedure recommended to reduce recurrence and postoperative complications (Grant *et al.,* 2010). Bladder closure was performed using a two-layer inverting pattern with absorbable suture material. Routine abdominal closure was subsequently completed(Kyles & Monnet, 2012).Recovered uroliths were washed, dried, and submitted for mineral analysis when available.

2.6 Postoperative Management

Postoperative care and management consisted of intravenous fluids, antimicrobial therapy, analgesic, and dietary recommendations aimed at preventing future stone formation in accordance with current consensus guidelines (Lulich *et al.,* 2016).Dogs were monitored for urination, wound healing, appetite, and postoperative complications.

2.7 Statistical Analysis

Because of the limited number of clinical cases, data were analyzed descriptively and presented as frequencies, percentages, means, and ranges.

3. Results and Discussion

All eight dogs presented with a history of lower urinary tract dysfunction of varying duration ranging from 7 to 25 days. Dysuria and stranguria were observed in all cases (100%), followed by hematuria in seven dogs (87.5%). Pollakiuria and frequent attempts to urinate were recorded in five dogs (62.5%). Two dogs (25%) exhibited partial urinary obstruction or urinary retention at presentation. Reduced appetite, abdominal discomfort, lethargy, and restlessness were variably observed. Several dogs had received empirical antimicrobial therapy before referral; however, clinical signs persisted until definitive diagnosis and surgical intervention were undertaken.

The predominant clinical signs observed in the present study included dysuria, stranguria, hematuria, pollakiuria, and intermittent urinary obstruction. Similar clinical manifestations have been reported previously in dogs with lower urinary tract urolithiasis (Houston *et al.,* 2004; Dvorska & Saganuwan, 2015).

Breed distribution in the present study revealed a predominance of Shih Tzus (50%), which is consistent with previous reports indicating increased susceptibility of this breed to urinary stone disease, particularly calcium oxalate and struvite uroliths (Houston *et al.,* 2004;

Stiller *et al.,* 2014). The age range of affected dogs (4.5–7 years) also corresponds with earlier epidemiological studies that identified middle-aged dogs as the most commonly affected population (Houston *et al.,* 2004).

Radiographic and ultrasonographic examinations successfully identified urinary calculi in all cases. These findings support previous reports demonstrating high diagnostic utility of imaging modalities in canine urolithiasis (De Lima *et al.,* 2017; Lulich *et al.,* 2016).Urinalysis findings including hematuria, proteinuria, crystalluria, and pyuria were comparable to observations reported by Osborne *et al.* (1999) and Bartges *et al.* (2015). The presence of urinary tract infection in some cases may have contributed to the formation of infection-induced struvite calculi, as described previously by Osborne *et al.* (1999).

Cystotomy allowed complete visualization and removal of bladder calculi in all dogs. The procedure remains the most widely accepted surgical treatment for canine cystolithiasis because of its effectiveness and accessibility (Kyles & Monnet, 2012). Grant *et al.* (2010) reported that residual uroliths may occur following cystotomy if postoperative imaging is not performed, emphasizing the importance of thorough bladder and urethral flushing.

Hematological evaluation revealed a significant reduction in total leukocyte count from $24.05 \pm 1.44 \times 10^3/mm^3$ on Day 0 to $13.54 \pm 0.57 \times 10^3/mm^3$ on Day 30 ($p < 0.001$). Neutrophil percentage decreased significantly from 84.38 ± 1.03 to 70.63 ± 1.27 ($p < 0.001$), whereas lymphocyte percentage increased significantly from 13.25 ± 1.06 to 26.50 ± 0.98 ($p < 0.001$), indicating resolution of inflammatory processes following treatment. Hemoglobin concentration, PCV, RBC count, monocyte count, eosinophil count, and platelet count did not differ significantly between the two sampling periods ($p > 0.05$).

Serum biochemical analysis demonstrated highly significant reductions in ALT activity (141.88 ± 7.27 to 43.75 ± 5.78 U/L; $P < 0.001$), AST activity (95.75 ± 5.07 to 14.63 ± 0.92 U/L; $p < 0.001$), and BUN concentration (36.13 ± 2.71 to 19.75 ± 0.88 mg/dl; $p = 0.001$) by Day 30. Albumin, globulin, and A:G ratio showed no statistically significant changes ($p > 0.05$), although the A:G ratio exhibited a numerical increase from 0.98 ± 0.12 to 1.12 ± 0.10.Serum creatinine concentration decreased significantly from 2.60 ± 0.21 mg/dl on Day 0 to 1.08 ± 0.11 mg/dl on Day 30 following surgical intervention and postoperative management ($p < 0.001$). Elevated preoperative creatinine levels indicated impaired renal filtration associated with urinary obstruction and post-renal azotemia. Restoration of creatinine values to within the normal physiological range by Day 30 suggested successful relief of urinary tract obstruction and recovery of renal function.

The significant reduction in serum creatinine concentration observed in the present study corroborates the improvement in renal function following surgical removal of urinary calculi. Increased serum creatinine concentrations in dogs with urolithiasis are commonly attributed to urinary obstruction and consequent post-renal azotemia (Lulich *et al.,* 2016). Following cystotomy and restoration of urine flow, creatinine levels declined markedly, indicating normalization of glomerular filtration and resolution of obstructive pathology. Similar findings have been reported in canine patients undergoing successful treatment for lower urinary tract calculi (Osborne *et al.,* 1999; Houston *et al.,* 2004).

All dogs recovered satisfactorily following surgery and resumed normal urination within the postoperative period. Similar success rates have been reported following surgical management of lower urinary tract urolithiasis in dogs (Grant *et al.,* 2010; Arulpragasam *et al.,* 2013). Long-term management through dietary modification and regular monitoring remains critical because recurrence of urolithiasis is common, particularly in predisposed breeds (Lulich *et al.,* 2016; Bartges *et al.,* 2015).

4. Conclusion

Urolithiasis remains an important urinary tract disorder in dogs and can significantly affect animal health and welfare. In the present series of eight dogs, cystotomy proved to be a reliable and effective method for removal of urinary calculi and restoration of normal urinary function. Diagnostic imaging played a crucial role in confirming the presence of uroliths and guiding treatment decisions. Early diagnosis, appropriate surgical intervention, and comprehensive postoperative management contributed to favorable clinical outcomes. Long-term preventive measures, including dietary modification, increased water consumption, regular urinalysis, and periodic imaging, are recommended to minimize recurrence and improve patient prognosis.

Tables

Table 1. Signalment and anamnesis of dogs presented with urolithiasis

Case No.	Breed	Age (Years)	Sex	Body weight (kg)	Duration of illness	Owner reported clinical signs	Medical treatment attempted
1	Shih Tzu	4.5	M	8.0	10 days	Stranguria, frequent urination, hematuria, licking of genital region	Symptomatic treatment by local practitioner; temporary improvement
2	Shih Tzu	5.0	M	9.2	15 days	Dysuria, pollakiuria, intermittent hematuria, restlessness during urination	Oral antibiotics administered without complete resolution
3	Shih Tzu	6.0	F	8.8	12 days	Frequent attempts to urinate, passage of small urine volumes, hematuria	No previous treatment reported
4	Shih Tzu	5.5	M	10.0	20 days	Stranguria, abdominal discomfort, reduced appetite, hematuria	Previously treated for suspected urinary tract infection
5	Labrador Retriever	6.5	M	30.0	18 days	Dysuria, urinary retention, abdominal distension, lethargy	Catheterization attempted before referral
6	Labrador Retriever	7.0	M	32.0	25 days	Hematuria, pollakiuria, intermittent urinary obstruction, anorexia	Recurrent urinary tract infection treated intermittently
7	Golden Retriever	6.0	F	28.0	14 days	Stranguria, hematuria, frequent urination, reduced activity	Medical management attempted with antibiotics and urinary alkalizers
8	Pug	5.0	M	12.0	7 days	Acute dysuria, vocalization during urination, hematuria, restlessness	No prior treatment reported

Table 2: Distribution of clinical signs observed in the cases

Clinical signs	Number of cases (n=8)	Percentage (%)
Dysuria/Stranguria	8	100
Hematuria	7	87.5
Pollakiuria	5	62.5
Frequent attempts to urinate	5	62.5
Abdominal discomfort/distension	3	37.5
Reduced appetite/Anorexia	3	37.5
Urinary obstruction/Retention	2	25.0
Lethargy	2	25.0
Genital licking	1	12.5

Table 3: Haemato-biochemical alterations in dogs with cystolithiasis on 0thand 30th post-operative days

Parameter	Day 0 (Mean ± SE)	Day 30 (Mean ± SE)	P-value	Reference range
Hemoglobin (g/dl)	13.79 ± 0.57	12.65 ± 0.31	0.059	12-19
PCV (%)	41.01 ± 1.79	37.76 ± 0.93	0.090	35-57
RBC ($\times 10^6/mm^3$)	6.29 ± 0.20	6.19 ± 0.12	0.430	5.0-7.9
WBC ($\times 10^3/mm^3$)	24.05 ± 1.44	13.54 ± 0.57	<0.001 **	5.0-14.1
Neutrophils (%)	84.38 ± 1.03	70.63 ± 1.27	<0.001 **	58-85
Lymphocytes (%)	13.25 ± 1.06	26.50 ± 0.98	<0.001 **	8-21
Monocytes (%)	1.88 ± 0.30	2.38 ± 0.26	0.171	2-10
Eosinophils (%)	0.50 ± 0.27	1.00 ± 0.27	0.275	0-9
Basophils (%)	0.00 ± 0.00	0.00 ± 0.00	—	0-1
Platelets (lakh/mm^3)	3.84 ± 0.37	3.39 ± 0.41	0.336	2.11-6.21
Albumin (g/dl)	2.91 ± 0.17	2.81 ± 0.18	0.456	2.3-3.1
Globulin (g/dl)	3.14 ± 0.22	2.56 ± 0.14	0.051	2.4-4.4
A: G Ratio	0.98 ± 0.12	1.12 ± 0.10	0.209	0.6-1.3
ALT (U/L)	141.88 ± 7.27	43.75 ± 5.78	<0.001 **	10-109
AST (U/L)	95.75 ± 5.07	14.63 ± 0.92	<0.001 **	13-15
BUN (mg/dl)	36.13 ± 2.71	19.75 ± 0.88	0.001 **	8-28
Creatinine (mg/dl)	2.60 ± 0.21	1.08 ± 0.11	0.0003 **	0.5-1.7

Figures

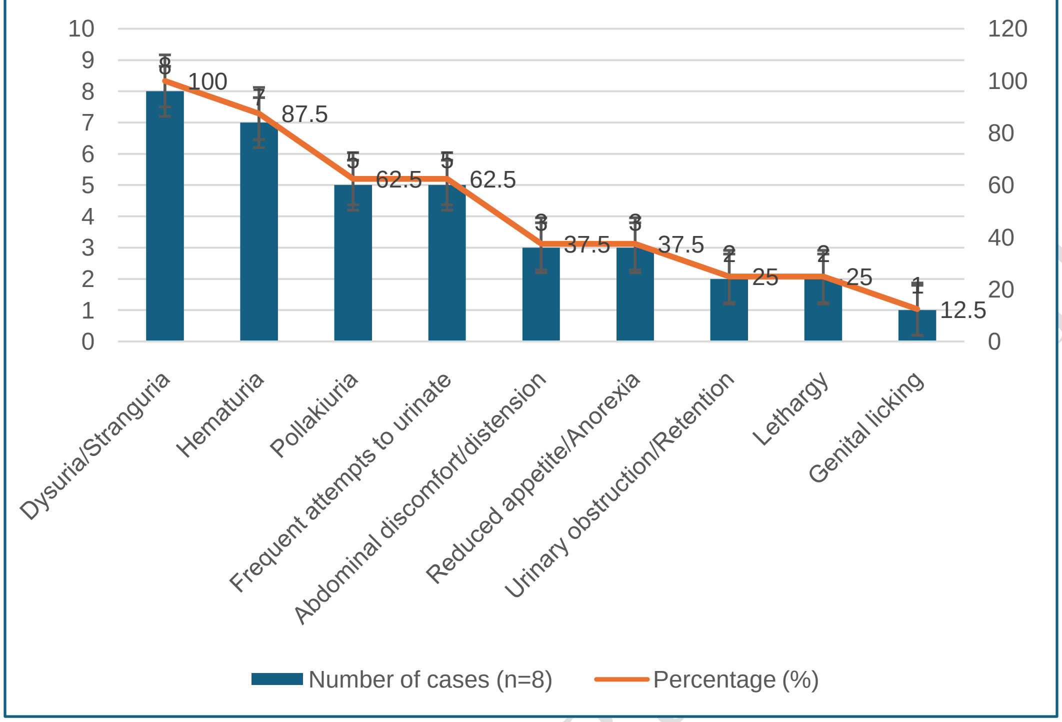

Fig. 1: Distribution of clinical signs

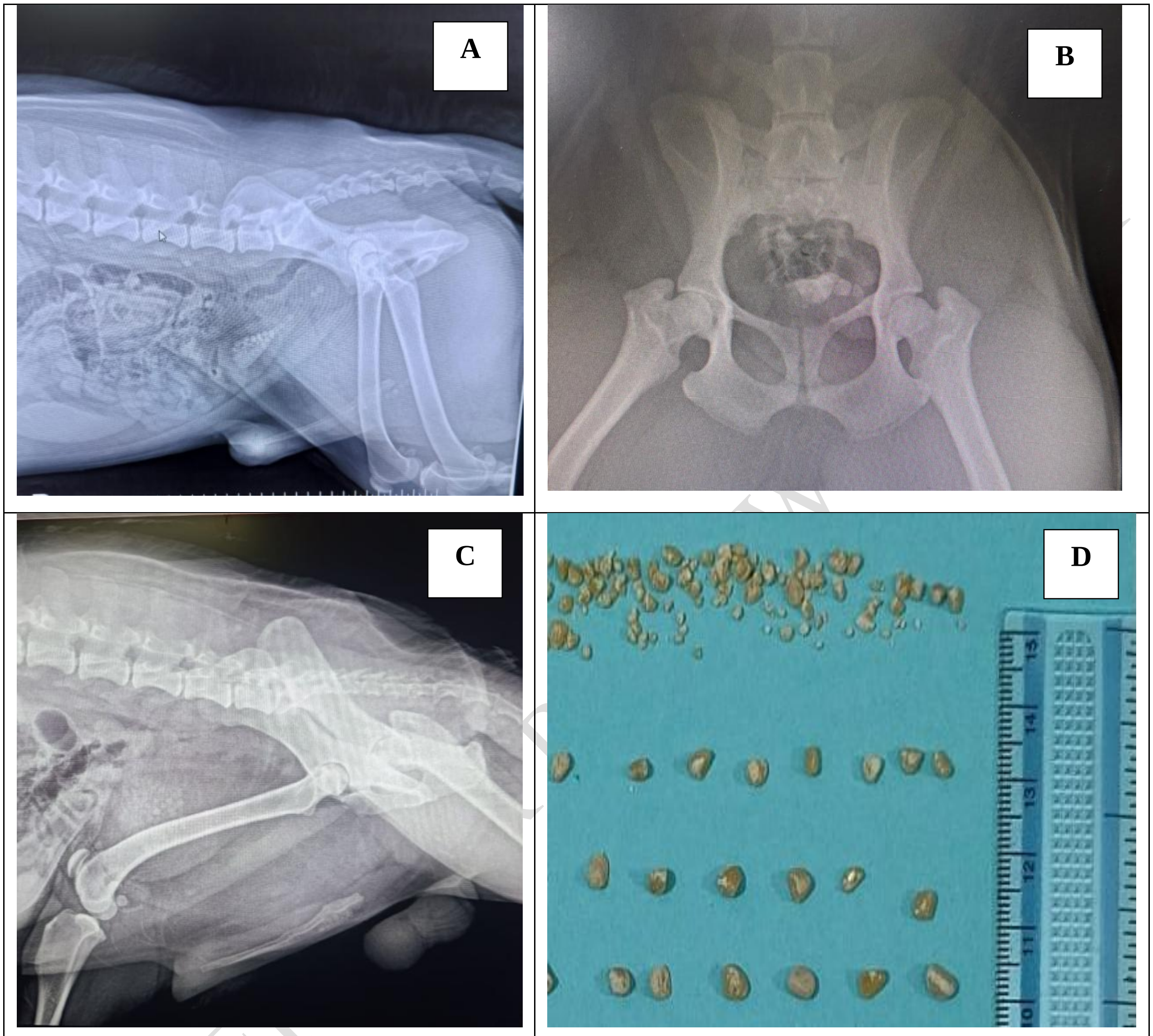

Fig. 2: Figures showing preoperative radiographic images of different cases in the present study (A to C) and retrieved urinary stones from the bladder (D)

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