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Neoureterocystostomy for the management of extramural ectopic ureter with concurrent contralateral renal aplasia in two dogs

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SUMMARY

Two male puppies were presented: one with urinary incontinence and the other with abdominal distension and discomfort. A diagnosis of unilateral extramural ectopic ureter with associated hydronephrosis/hydroureter and contralateral renal aplasia was confirmed in both patients by a combination of abdominal imaging and exploratory coeliotomy. Both patients were also diagnosed with cryptorchidism ipsilateral to the renal aplasia. Routine investigations, including complete blood count, biochemistry and urinalysis, were otherwise unremarkable. Neoureterocystostomy with an intravesical technique and castration were performed in both patients. One month following surgery, severity of clinical signs, the degree of hydronephrosis/hydroureter and elevation of renal blood values had all improved in both patients.

BACKGROUND

Neoureterocystostomy is a well-described technique for the surgical management of ureteral ectopia in canine patients. However, successful surgical management of extramural ectopic ureters (EUs) associated with severe hydronephrosis/hydroureter and contralateral renal aplasia has not been previously reported.

The only similar report is that of a dog with unilateral extramural EU, mild hydronephrosis and contralateral renal agenesis that had been managed conservatively due to concerns of potentially fatal surgical complications.[1]

CASE PRESENTATION

Case 1

A 7-month-old male entire Border Terrier was presented with a history of urinary incontinence. Physical examination revealed a large rounded non-painful structure in the craniodorsal abdomen. The urinary bladder could not be palpated, and the left testis was absent from the scrotum.

Case 2

A 4-month-old male entire Border Collie was referred to as an emergency for investigation of acute onset of lethargy and abdominal pain noticed by the owner the same morning. Physical examination documented a left-sided cranial abdominal mass that was painful on gentle palpation and the absence of the right testis in the scrotal sac.

INVESTIGATIONS

Case 1

Haematology at presentation documented mild anaemia (red blood cell count (RBC) 5.26×10^{12} (5.5 to 8.5 26×10^{12}), hematocrit (HCT) 36.3% (37% to 55%)). Serum biochemistry was unremarkable. Symmetric dimethylarginine (SDMA) was moderately increased (20 µg/dL, range from 0 to 16 µg/dL), indicating decreased glomerular filtration rate and renal function. Urine collected by cystocentesis was moderately concentrated (urine specific gravity (USG) 1.016) and urine culture did not show abnormalities.

Survey orthogonal abdominal radiographs showed a large soft-tissue opacity in the craniodorsal aspect consistent with marked renomegaly (figure 1). Abdominal ultrasound revealed a markedly enlarged right kidney with severe hydronephrosis (sagittal orientation, renal pelvis 40 mm) and cortical parenchymal atrophy. The ureter appeared dilated (sagittal orientation, proximal portion 12 mm) and tortuous with no clear point of insertion to the bladder. Neither the left kidney nor the left ureter could be clearly identified ultrasonographically, although a small oval structure (18.35 mm in length) without corticomedullary definition in the region of the left kidney was found. The bladder appeared to be normal and was fluid filled.

A pre-contrast (Siemens Somatom Spirit) and post-contrast (Optiray) (sequences at 1, 5 and 15 min) CT scan was performed (figure 2). The nephrographic phase of the right kidney documented markedly reduced cortical parenchymal thickness at 1 min post-contrast administration. The pyelographic phase (PP) was minimal at this time. At 15 min post-contrast, the PP was adequate, although no contrast was documented in the distal right ureter. No evidence of left kidney or left ureter was documented in any phase of the CT study. Due to the lack of contrast reaching the distal right ureter, it was not possible to determine the point of insertion into bladder or urethra or confirm whether any ectopic insertion was intramural or extramural.

Based on diagnostic findings, a right-sided EU with concurrent hydroureter/hydronephrosis and left renal/ureteral aplasia, as well as left intra-abdominal cryptorchidism, were suspected.

Case 2

Haematology and serum biochemistry at presentation were unremarkable. Abdominal radiographs

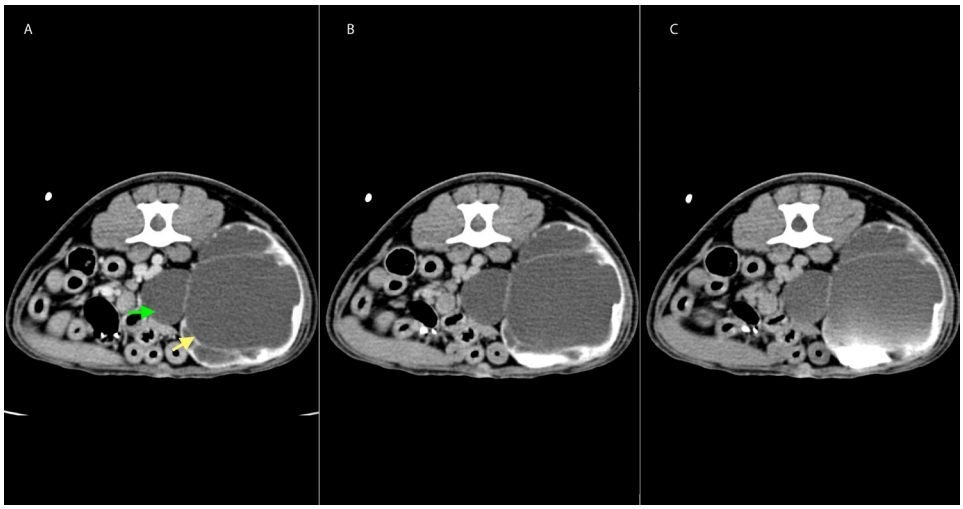

Figure 1 Transverse contrast-enhanced abdominal CT images of case 1 at the level of the hydronephrotic right kidney. Images were taken at 1 min (A), 5 min (B) and 15 min (C) post-contrast administration. Note the severe hydronephrosis (yellow arrow) and hydroureter (green arrow) with marked thinning of the renal parenchyma.

documented left-sided renomegaly and abdominal ultrasound demonstrated severe hydronephrosis (sagittal orientation, renal pelvis 70 mm) and hydroureter (sagittal orientation, ureteral diameter 12 mm) (figure 3). The dilated ureter was suspected to be extramural and was identified entering the urethra just cranial to the prostate gland. The right kidney, ureter and testis could not be identified ultrasonographically.

TREATMENT

Case 1

Following standard coeliotomy, the urogenital tract was evaluated and the presence of an extramural right EU was confirmed. It was found to enter the proximal urethra and to be stenotic on its most distal aspect, with marked luminal distension proximal to it (hydroureter). The left kidney and ureter were not identified and the retained left testis was located and excised. A right neoureterocystostomy with an intravesicular technique was performed (figures 4–5).[2] This included ligating the most distal aspect of the extramural EU and transecting it, performing a small ventral cystotomy and inserting the distal end of the transected right ureter through a small stab incision cranial to the bladder trigone to create a new stoma. The traumatised distal ureteral end was excised, and bladder mucosa was trimmed as required to allow for placement of simple interrupted sutures to appose ureteral to bladder mucosae. Once the anastomosis was performed, the urinary bladder and abdomen were closed

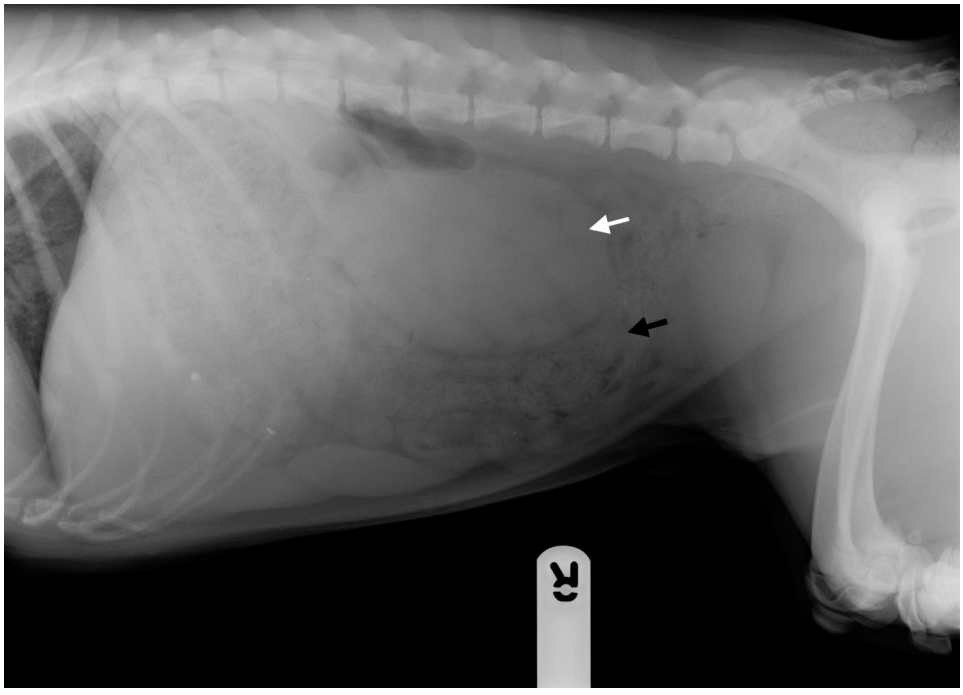

Figure 2 Right lateral abdominal radiograph of case 1. Note the marked enlargement of the retroperitoneal space due to left renomegaly (white arrow), displacing the descending colon ventrally (black arrow). The right kidney is not visible.

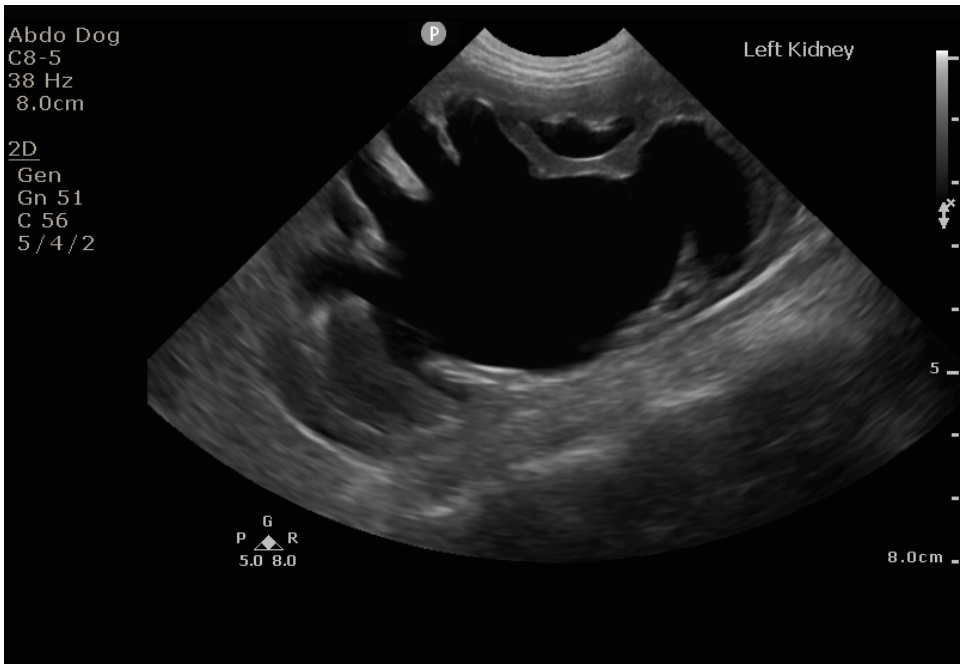

Figure 3 Sagittal ultrasonographic view of the left kidney of case 2. Note the severe hydronephrosis causing renal and pelvic enlargement and mark thinning of the renal parenchyma.

routinely. This was followed by a standard right prescrotal open orchiectomy. An indwelling urinary catheter was placed before recovery from anaesthesia. Urinary output was monitored in the immediate postoperative period and the urinary catheter was removed the day after surgery. Blood renal values and electrolytes were repeated 12 hours after surgery and were within range. Recovery from the procedure was uneventful, and the dog was monitored for 48 hours in the intensive care unit. He received methadone 10 mg/mL (Comfortan; Dechra Veterinary Products Ltd; 0.2 mg/kg intravenously) for the first 12 hours followed by buprenorphine 0.3 mg/mL (Buprecare; Animalcare; 0.02 mg/kg intravenously) every 6 to 8 hours based on regular pain score checks. Paracetamol 10 mg/mL (Perfalgan; Bristol-Myers Squibb Pharmaceuticals Ltd; 10 mg/kg) was administered every 12 hours and prescribed as an oral formulation (Pardale-V 500 mg tablet; Dechra Veterinary Products; 10 mg/kg) for further 7 days after discharge. The patient was discharged 48 hours after surgery.

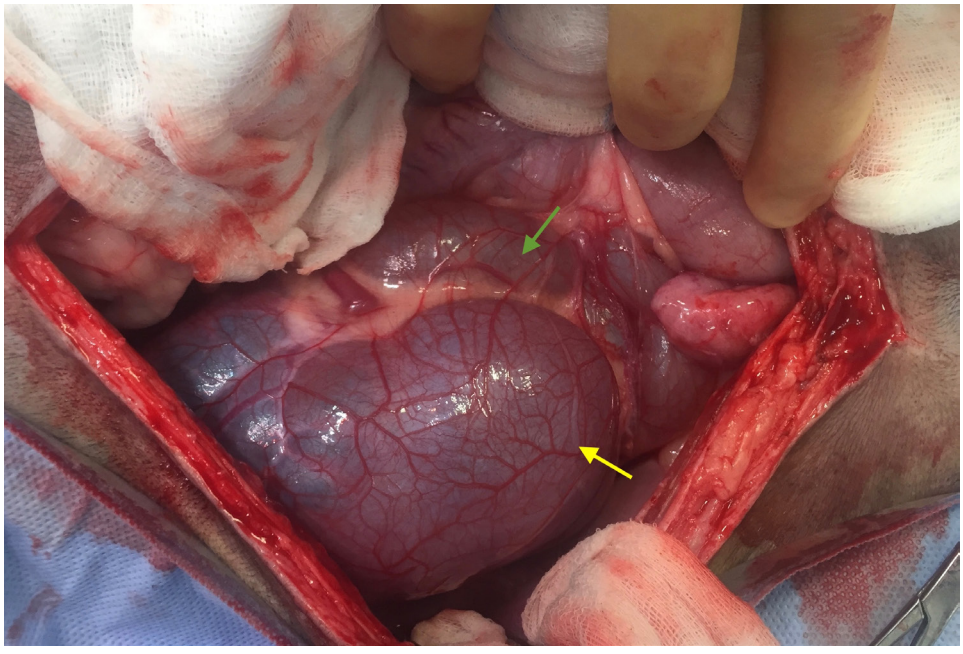

Figure 4 Intraoperative abdominal photograph of case 1. The head is to the left. Note the presence of a severely enlarged and hydronephrotic right kidney (yellow arrow) and presence of concurrent hydroureter (green arrow). Note the very thin appearance of the renal parenchyma, with urine visible through the renal capsule.

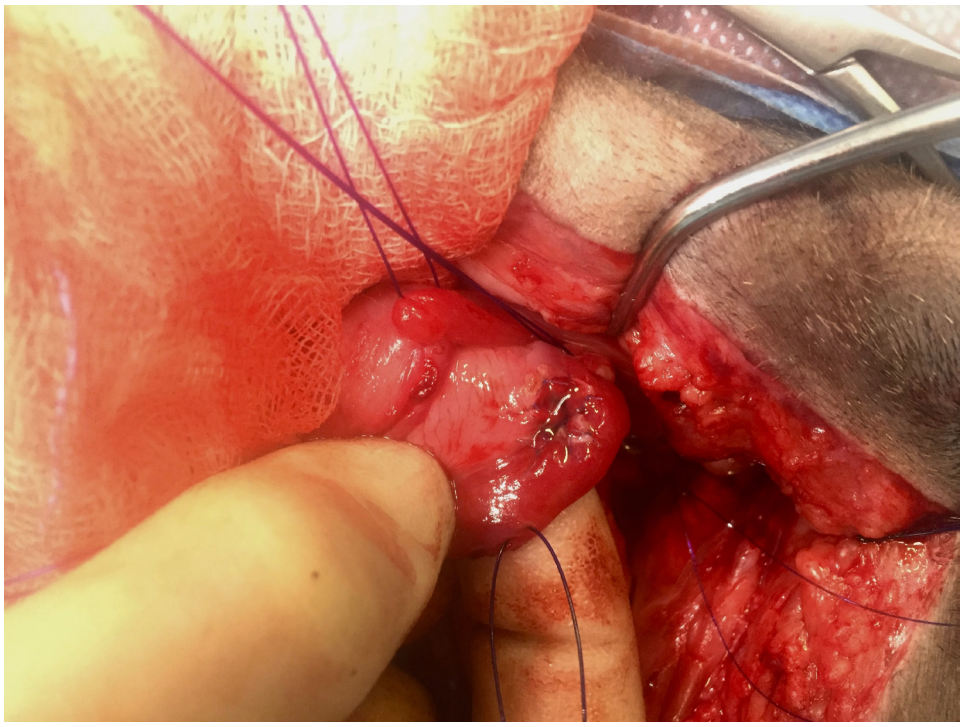

Figure 5 Intraoperative photograph of case 1 following neoureterocystostomy. Close-up view of the urinary bladder mucosa and new ureterovesical junction.

Case 2

Explorative coeliotomy confirmed the presence of a right-sided extramural EU and absence of a left kidney and ureter. The right testicle could not be found either in the abdomen or the inguinal canal. A right neoureterocystostomy with intravesicular technique was performed in a similar fashion to case 1. Standard left prescrotal open orchiectomy followed. No intraoperative complications were reported, and recovery was uneventful. During the postoperative period at the hospital, methadone 10 mg/mL (Comfortan; Dechra Veterinary Products; 0.2 mg/kg intravenously) was administered for the first 12 hours. Buprenorphine 0.3 mg/mL (Vetergesic; Ceva Animal Health Ltd; 0.02 mg/kg intravenously) every 6 to 8 hours based on pain score check. Paracetamol and codeine (Pardale-V 500 mg tablet; Dechra Veterinary Products; 10 mg/kg PO q12h) was prescribed for 7 days. The patient was discharged the day after surgery.

OUTCOME AND FOLLOW-UP

CASE 1

Two weeks after surgery, the referring veterinarian did not report any wound-associated complications. At the 4-week postoperative follow-up examination, the owner reported marked improvement of clinical signs, with only sporadic nocturnal incontinence still present. Abdominal ultrasound showed marked improvement on sagittal imaging of the hydronephrosis (sagittal orientation, 28 mm) and hydroureter (sagittal orientation, 7 mm); haematology, serum biochemistry and electrolytes were unremarkable; and SDMA had decreased to just above reference ranges (15 µg/dL).

CASE 2

The patient developed polyuria–polydipsia and urinary incontinence following surgery. At 9 days' follow-up examination, increase in urea (15.8 mmol/L (2.5–10.4 mmol/L)) and normal creatinine (104 µmol/L, range 27–106 µmol/L) were documented; biochemistry and electrolytes were unremarkable; urine was isosthenuric (USG 1.010); urine bacterial culture was negative. Treatment with phenylpropanolamine (Propalin; Vetoquinol; 0.8 mg/kg PO q12h) was initiated. By 4 weeks post-surgery, all clinical signs had resolved, blood renal values had normalised and USG had increased to 1.018. Repeat abdominal ultrasound at that time documented marked improvement, on sagittal orientation, of the hydronephrosis (30 mm) and hydroureter (5 mm). Phenylpropanolamine was discontinued.

A routine check-up was performed 1 year after neoureterocystostomy. He was reported to be completely continent without any medication. Urine culture was negative and blood serum biochemistry documented a normal creatinine (103 µmol/L). Abdominal ultrasound showed a mild reduction, on sagittal orientation, of the dilated pelvis (25 mm) with no ureteral dilation.

DISCUSSION

Ectopic ureter is a rare congenital malformation where either one or both ureters do not enter the bladder in the correct anatomical position so that the ureteral orifice is located in the bladder neck, urethra, uterus or vagina.[3] EUs are classified anatomically as tunnelling either intramurally or extramurally, with over 95% reported to be intramural in dogs.[4] This condition has been reported in both sexes, although it is more commonly described in female dogs.[5] Ectopic orifices are commonly large, although on occasions they can be small and stenotic resulting in severe hydroureter/hydronephrosis. This stenotic opening is

most commonly seen in male dogs and is often not associated with incontinence.[4] EUs are commonly associated with concurrent congenital defects of the urogenital tract such as congenital urethral mechanism incompetence, renal dysplasia/agenesis, persistent paramesonephric remnants, hydroureter, ureterocele and hypoplasia of the urinary bladder.[2 6] Approximately 5% of reported cases of renal aplasia are associated with EUs on the contralateral side.[7] Over the last few years, there has been increased recognition of the characteristics, clinical presentation and management of EUs and concurrent urogenital abnormalities in male dogs.[2 5 8] However, this is the first report of surgical management of extramural EUs associated with hydronephrosis and hydroureter secondary to a stenotic ureter-urethral junction, and concurrent contralateral renal and ureteral aplasia, in the canine patient.

Renal aplasia can remain clinically silent given the insensitivity of creatinine for detecting renal dysfunction. In the cases presented, serum biochemistry did not reveal azotaemia at presentation, indicating that the hydronephrotic kidneys were, at least in part, functional. In case 1, urinalysis at presentation documented moderately concentrated urine with increased SDMA, indicating early renal insufficiency despite the normal serum creatinine.[9] In an experimental study, reduction of USG value was associated with early-stage renal changes in patients with unilateral chronic hydronephrosis caused by partial ureter obstruction.[10] The improvement in SDMA following neoureterocystostomy, in this case, was expected despite the long-term urine flow obstruction since there is evidence that the duration of the obstruction and the severity of the preoperative imaging is not predictive of the degree of improvement of the renal function in cats with ureteral obstruction.[11]

The presenting complaints in these cases were persistent incontinence and acute abdominal discomfort, respectively. Urinary incontinence is a common feature in female dogs with EU but is rarely reported in male dogs.[3 12 13] Many male dogs with ureteral ectopia do not have urinary incontinence. Therefore, it has been hypothesised that the true prevalence of ectopic ureters in male dogs is likely underestimated. In these cases, the ectopic ureters are thought to terminate within the prostatic portion of the urethra, cranial to the external urethral sphincter, which is considered the 'continent zone of male dogs'. Termination of the EU at this level of the urethra provides continence in some dogs and may also facilitate the retrograde flow of urine into the bladder where the resistance is lower. The lower occurrence of urinary incontinence in males is also attributed to anatomical differences of the urethra between sexes, with the longer urethra of males promoting continence. The longer urethra creates greater resistance within the distal urethra, encouraging retrograde flow into the low resistance reservoir of the bladder.[14 15]

The diagnosis of EU is achievable with different diagnostic techniques, and different sensitivity is reported for different modalities.[2 3 16] In the cases reported here, ultrasonography revealed the presence of the EU and associated anomalies but was unable to identify the insertion's point in case 1. A positive-contrast CT urography study was performed unsuccessfully due to the large volume of urine filling the hydronephrotic kidney and ureter and the increased retrograde pressure, which did not allow the contrast to reach the distal ureter. Retrospectively, this test could have been avoided considering the potential nephrotoxicity of the contrast used, cost involved and potential for failure.[14 16 17] Exploratory coeliotomy confirmed the presence of the extramural EU with stenotic distal ureteral junctions in both cases.

Surgery of the ureter is associated with a high incidence of complications such as uroabdomen and stenosis of the stoma.[18] In a previous case report, these complications were considered a sufficient reason to avoid the procedure.[1] However, in the cases reported here, hydronephrosis was so advanced that non-surgical options were considered inappropriate and neoureterocystostomy was considered the safest option to relieve the obstructive process (distal ectopic ureteral stenosis) in an attempt to halt the progression of renal dysfunction. By 1 month after surgery, the clinical signs had resolved in case 2 and only occasional incontinence while asleep persisted in case 1. Biochemistry and urinalysis did not reveal relevant abnormalities. Persistence of incontinence is the major long-term complication following correction of an EU and has been reported in up to this 78% of cases. It is thought attributable to concurrent functional abnormalities of the urinary tract.[18] Repeated ultrasound confirmed a reduction in the size of the hydronephrotic kidney and ureter in both dogs.

An ultrasound scan was repeated 1 year after surgery in case 2 and showed a mild reduction of the dilation of the pelvis. Complete resolution of the renal and ureteral dilation may have occurred over a longer period, although this could be confirmed as neither of the cases presented for follow-up evaluation.

Between discharge and the 9-day re-evaluation, case 2 developed signs of polyuria and polydipsia (PU/PD). Post-obstructive diuresis could have led to increased urine production and output. The unstable function of the detrusor and sphincter muscles may also have led to alterations in voiding frequency and volume. An increase in urine production could have led to compensatory polydipsia. Alternatively, psychogenic polydipsia or iatrogenic infection could have also caused this sign. The PU/PD had resolved within 4 weeks of surgery, and therefore further investigations such as culture and sensitivity of the urine or water deprivation tests were not considered.

In conclusion, these cases reported successful surgical reimplantation of an extramural ectopic hydroureter associated with hydronephrosis and contralateral renal agenesis in two dogs.

Learning points

- Ectopic hydroureters associated with hydronephrosis and contralateral renal agenesis may not show any abnormalities on routine renal biochemistry parameters.
- Surgical reimplantation of extramural ectopic hydroureters associated with hydronephrosis and contralateral renal agenesis should be considered as a viable management option.
- Use of positive-contrast CT urography as part of the diagnostic investigation may not add information on the location of the ectopic ureteral insertion point in cases of severe hydronephrosis and hydroureter.
- Postoperative polyuria–polydipsia and/or urinary incontinence may occur and can be self-limiting.

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