WHAT IS YOUR DIAGNOSIS?

A 1 year old female entire Bulldog Cross was referred to the R(D)SVS Internal Medicine Service for investigation of urinary incontinence. She had been dribbling urine unconsciously during the day as well as during the night since puppyhood. She also urinated normally during the day approximately 4 to 5 times. She postured normally to urinate, with no signs of discomfort, straining or haematuria observed. No changes in drinking pattern have been identified over her lifetime. Her owner reported that during the past few weeks she has small amount of green mucoid discharge from her vulva.

On presentation she was bright, alert and responsive. Her mucous membranes were pink and moist with capillary refill time of 2 seconds. Her body condition score was 6/9. Her body temperature was 39.7 degrees Celsius. Urine staining was present on her perineum and hind limbs due to incontinence. Other elements of physical examination were within normal limits.

1. **What is your problem list for this patient?**

2. **What are your differential diagnoses for this patient?**

3. **How would you investigate this case further?**
1) **Problem list:**
- Urinary incontinence
- Pyrexia
- Vulval discharge

2) **Differential diagnoses:**
- Ectopic ureter
- Urinary sphincter mechanism incompetence
- Urinary tract infection
- Neurologic disease
- Pyometra
- Urinary stones

3) **Investigations:**
- **Comprehensive haematology and serum biochemistry profile** was performed to assess kidney function and potential inflammatory responses. Haematology did not reveal any significant abnormalities. Serum biochemistry panel revealed increased creatinine (146 umol/l, ref. 40-132 umol/l), globulins (44.1 g/l, ref. 18-37 g/l) as well as decreased sodium (134 mmol/l, ref 139-154 mmol/l) and triglycerides (0.46 mmol/l, ref 0.57-1.14 mmol/l)

**What is the cause of increased creatinine in this case?**
There are three major types of azotaemia: prerenal, renal and postrenal. Based on the history and clinical signs, which type of azotemia would you consider? Which diagnostic test would you run next?

Urine analysis with culture was performed as well as abdominal ultrasound.
- **Urine analysis and urine culture:** should be performed to assess the kidney function as well as for any signs urinary tract infection. Incontinent dogs are at high risk for urinary tract infections. Ruling out infections is important as these needs to be addressed prior to interventions. In this case cystocentesis was performed and urine analysis revealed USG of 1.010, as well as presence of blood, proteins and leucocytes (all three +++ on dipstick). Urine sediment revealed high presence of neutrophils and chains of cocci. Culture was
consistent with *Streptococcus canis* infection, that was susceptible to all antibiotics tested.

- **Ultrasound of the urinary and reproductive tract:** can help in identifying of many abnormalities including renal changes, stones, pyometra or frequently also can help in identification of ectopic ureters. In this case, the left kidney was markedly abnormal due to hydrenephrosis. This kidney consisted of only a thin portion of parenchyma, which had moderate vascularity (Figure 1). Leading from the kidney was the massively distended ureter, up to 8cm (normally not visible at all) which had sediment within it (Figure 2). The bladder was partially intra-pelvic and also contained moderate amounts of sediment. The uretero-vesicular junction was difficult to identify, but ureter were suspected to be entering the urinary bladder at an abnormally cranial position. The right kidney and ureter were normal.

![Figure 1. Distended left kidney, that was almost completely lacking normal structure.](image-url)
Figure 2. Distended left ureter, which is larger in diameter then aorta or caudal vena cava, although normally should be difficult to identify.

Based on these results one could categorize the azotaemia as potentially being both renal (urinary tract infection, potential for pyonephritis) as well as postrenal (due to abnormal flow of urine - hydronephrosis, distended ureter). Based on culture results the dog was prescribed a four week course of amoxicillin, which cleared the infection.

What is the most probable cause of this animal’s clinical signs and would be your next diagnostic/therapeutic measure?

The initial investigations were suggestive of a left ectopic ureter with consequent hydronephrosis and hydroureter, as well as urinary tract infection, which both most probably contribute to the clinical signs. In order to further investigate the location of the disease as well as to treat it, a CT scan and cystoscopy were performed. Contrast enhanced CT scan together with cystoscopy is considered the best
diagnostic modalities for identification of ectopic ureters. Laser ablation of ectopic ureters is a minimally invasive method for treatment of this congenital anomaly and is currently the standard of care in our hospital if the ureters are intramural in location (majority of cases).

- **CT scan:** This imaging modality revealed severe hydroureteronephrosis and markedly distended left ureter. The ureter entered the bladder wall at the trigone and followed up to the level of bladder neck, at which it entered a cystic structure compressing the bladder neck (ureterocele). The right kidney was within normal limits, with right ureter being mildly compressed by the left ureter, but entering the kidney at the bladder trigone.

Figure 3. Extreme hydronephrosis in this case. Note distension of the left kidney and ureter as well as normal structure of the right kidney.
• **Cystoscopy and laser ablation of the ectopic ureter:** Cystoscopy is the gold standard for investigation and identification of many lower urinary tract disease including ectopic ureters. In this case, we have previously identified that the dog has a suspected ectopic ureter, and her owner was given an option to minimally invasively treat the ectopic ureter using laser ablation. During the cystoscopy, a small vestibular paramesonephric remnant was also identified in the vagina at the urethral opening, which is frequently encountered in dogs with ectopic ureters and can contribute to incontinence as well as increase risk of urinary tract infections. The left ureteral opening was abnormally located, about half way along the urethra (Figure 4). The right ureteral opening was correctly located at the bladder trigon. When scope was introduced into the left ureter a large ureterocele was identified with marked mucosal granularity. Laser ablation was successfully performed (Figure 5).

![Urethra and Ectopic Ureter](image)

*Figure 4. Abnormally placed ectopic ureter within the urethra.*
Outcome

Urinary incontinence resolved immediately following laser ablation of the ectopic ureter. Six weeks after treatment, the patient was re-examined at R(D)SVS. Urinary incontinence was still resolved and the urinary staining of the hind legs was clearing. Clinical serum chemistry revealed normalization of creatinine levels (128 umol/l, ref 40-132 umol/l). Abdominal ultrasound revealed marked decrease in distension of the renal pelvis (3 cm, while 6 cm previously, Figure 6). Mid and distal ureters were of normal shape and peristalsis, while the proximal ureter was still distended, but to lesser extent compared to previously (2 cm compared to 8 cm). Urine analysis revealed that neutrophils were still present, but urine culture was negative.
Figure 6. Left kidney one and a half month after the procedure. Note presence of more normal appearance of the kidney, although the renal pelvis is still dilated (red arrow).

Discussion
Ectopic ureters are frequent cause of urinary incontinence, especially in young dogs. It can occur in both male and female dogs. Several breed predispositions have been identified including Poodles, Golden Retrievers, Labrador Retrievers, Skye Terriers, West Highland white terriers, Fox terriers and English bulldogs. Ectopic ureters can be extra or intramural, with the latter are the far most common ones seen in dogs. Different approaches to treatment of ectopic ureters have been described. These traditionally included various surgical approaches. More recently a minimally invasive technique, called cystoscopic guided laser ablation, has been implemented. In a prospective study of 30 female dogs, this technique alone allowed for resolution of incontinence in 47% of patients (14/30), while with addition of other treatment modalities a total of 77% of patients (23/30) became continent. In the case described urinary continence was fully gained. The main reason for failure of this technique as well as surgical technique is concurrent existence of other abnormalities within the urinary tract such as urinary sphincter mechanism incontinence. One of the discussions prior to management of this case was if we should remove the kidney. There are no clear guidelines on how to
proceed. Historically, it was considered that severe hydrenephrosis, as present in this case, is an indication for removal of the affected kidney whilst other specialists suggest a renal sparing approach, as was performed in this case. In this case the treatment of both underlying urinary tract infection as well as treatment of the congenital anomalies of the lower urinary tract, lead to normalization of creatinine levels and changes in the kidney architecture, that resembled normal kidney, as well as increase in urine specific gravity, suggestive of better functionality. Some dilation of the renal pelvis as well as proximal ureter are still present and may continue to improve with time.