



Ultrasonographic and Radiographic Diagnosis of Ectopic Ureter in a Dog

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ABSTRACT

Background: Ureteral ectopia (or ectopic ureter) is a congenital anomaly of the urinary system in which the ureter inserts anywhere other than the vesical trigone. This anatomical change may have unilateral or bilateral involvement. The most evident clinical sign, occurring mostly in females, is urinary incontinence, however in some cases the condition may progress to nephritis and dilation of the renal pelvis. The diagnosis is established through imaging, and definitive treatment requires surgical approach. The present study reports a case of ureteral ectopia in a dog which was diagnosed by ultrasound and contrast radiography (excretory urography) and successfully treated by neoureterostomy.

Case: A 10-month-old female American Pit Bull Terrier was attended at the Veterinary Hospital of the Federal Rural University of the Semi-Arid (UFERSA), in Mossoro, RN. Her owner reported incontinence of dark, malodorous urine since birth as the chief complaint. After clinical examination, cystitis was suspected, and a complete blood count, urinalysis, and abdominal ultrasound was requested. The blood count and creatinine were within the reference values. The presence of struvite crystals were found on urinalysis. Ultrasound examination revealed a tortuous, dilated right ureter from the renal pelvis to the urinary bladder; no uroliths were identified as a cause of potential obstruction, but the ipsilateral kidney showed increased cortical echogenicity, loss of corticomedullary definition, and moderate pelvic dilation. These findings supported a presumptive diagnosis of ectopic ureter. For the purpose of confirming this suspicion, excretory urography was performed, revealing unilateral ureteral dilation and radiopaque contrast uptake following the path of the urethra. Once the diagnosis was confirmed, surgery was performed to correct the ureteral ectopia using the standard neoureterocystostomy technique. Considering the unilateral involvement, location of the insertion, and preserved renal function, the decision was made to perform a neoureterostomy. During the surgery it was possible to identify that the ectopic ureter was found to be intramural. At 2-month follow-up, urinary incontinence had resolved and control ultrasound showed significant improvement in the inflammatory appearance of the right renal parenchyma, with no signs of dilation of the renal pelvis or ureter.

Discussion: Different from what happens in male dogs, females with an ectopic ureter will often present with urinary incontinence as the main (and, often, only) symptom, usually in the first months of life. As pollakiuria suggests a wide range of diseases of the urinary tract, ultrasound was considered the first-line imaging modality of choice, indispensable for ruling out other differential diagnoses such as a severe urinary tract infection, urolithiasis, or even malignancy. Despite the literature reporting that urinary incontinence persists in 44 to 67% of cases of ureteral ectopia, even after surgery in this case there was complete recovery of the patient after two months. Accessible techniques like ultrasonography and contrast radiography (excretory urography) supplemented one another in the elucidation of this case, with both demonstrating an excellent contribution to the diagnosis of ectopic ureter as well as served as support for surgical planning, enabling effective repair and consequent recovery of the patient.

Keywords: diagnostic imaging, dog, hereditary anomaly, urinary system.

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INTRODUCTION

Ureteral ectopia is a congenital disorder that occurs when one or both ureters open into any area other than the vesical trigone [5]. Anomalous insertions in the bladder neck, uterus, vagina, and prostatic urethra have been reported [4]. The ectopic ureter can be classified as intramural, when it is attached to the bladder mucosa, or extramural, when it passes externally and independently of the bladder [1].

The most common clinical sign is urinary incontinence. In females, this occurs even at younger ages. Conversely, it is rare in males due to the replacement of the action of the bladder sphincter by the ureteral muscle; incontinence may appear only in old age [2,5]. Other reported signs are perivulvar or preputial dermatitis, recurrent cystitis, and secondary pyelonephritis [9].

The diagnosis is made by a combination of history, clinical signs, laboratory tests, and imaging. Ultrasonography and excretory urography are the most common imaging modalities; cystoscopy and computed tomography may be performed if necessary [5,8]. Definitive treatment is surgical. The choice of technique depends on the type of ureteral ectopia, the insertion site, renal function, and concomitant anomalies, if any [3]. Approximately 65% of cases achieve a satisfactory outcome after surgery [5].

CASE

A 10-month-old unspayed female American Pit Bull Terrier, weighing 24.4 kg, was attended at the Veterinary Hospital of the Federal Rural University of the Semi-Arid (UFERSA), Mossoró, Rio Grande do Norte, Brazil, with a chief complaint of incontinence of dark, malodorous urine since birth. On physical examination, normal active behavior was observed; the abdomen was nontender to palpation, mucous membranes pink and moist, and the heart and respiratory rate normal. The owner reported normal bowel movements and eating and drinking habits, as well as up-to-date vaccinations. The nervous and locomotor systems were within normal limits. Cystitis was suspected, and a complete blood count, urinalysis, and abdominal ultrasound were performed.

Blood counts and creatinine were within normal range; the urinalysis report noted the presence of struvite crystals. Ultrasound examination was performed with the animal in dorsal recumbency after wide shaving of the abdomen. A linear transducer

with 5-10 MHz frequency (Infinit 7V, Ultramedic®)¹, and water-based gel were used. During examination, the left kidney was normal in size and parenchymal architecture, while the right kidney showed signs of nephritis and moderate pyelectasis (Figure 1). The right ureter was visualized throughout its length. It was tortuous, intensely mobile, and dilated to approximately 1 cm from the takeoff at the renal pelvis to the dorsocaudal region of the urinary bladder (Figure 2). The latter was moderately filled with urine and a small amount of sediment; the bladder wall was thickened. As no structures that could cause ureteral obstruction and consequent pyelectasis were observed, a diagnostic hypothesis of unilateral ureteral ectopia was proposed. The other abdominal organs evaluated were normal at the time of ultrasound examination.

To confirm the diagnostic suspicion of ectopic ureter, excretory urography was performed under sedation. For bowel preparation, the diet was restricted to wet food only 72 h before the procedure and subsequently to liquids only, plus mineral oil and simeticona [75 mg/kg - Luftal®²] agents every 8 h, in the 24 h immediately before the procedure. As a contrast medium, ioversol (Optiray® 320 solution for injection 68%)³ was used intravenously, at a dose of 600 mg/kg. First, a set of plain radiographs was obtained, followed by additional films immediately after administration of the contrast medium and 5, 20, and 40 min thereafter. All were obtained in ventrodorsal and right lateral projections.

There was no evidence of changes in the urinary or gastrointestinal tracts on the plain radiographs obtained (Figure 3A & 3B). However, during the nephrogram phase, immediately after administration of the contrast medium, a slight homogeneous increase in radiopacity was seen in the renal cortices, showing regular contours and normal size bilaterally; the ureters were not visualized (Figure 3C & 3D). During the pyelogram phase, most evident 20 to 40 min. after the administration of the contrast medium, contrast uptake was observed in the renal pelvis, ureters, and bladder (Figure 3E & 3F). In addition to mild pyelectasis in the right kidney, we found that the ipsilateral ureter was dilated and tortuous for most of its course, extending to the vicinity of the bladder. Moreover, the final continuity of this ureter was visible, following the adjacent urethra, changes which are also suggestive of ureteral ectopia with insertion into the urethra or even communicating with the outside medium.

Once the diagnosis of unilateral ureteral ectopia was confirmed, surgical correction was performed. Intraoperatively, an ectopic ureter of the intramural type was found, in close relationship with the submucosa of the bladder and urethra and emptying into the vagina, communicating directly with the external environment. A new orifice communicating the ureter with the urinary bladder was made, a unilateral neoureterostomy was performed, and the ectopic orifice was closed. Ovariohysterectomy was also performed. The animal was discharged on the same day. At 15-day follow-up, her owner reported an uneventful recovery and no further episodes of urinary incontinence.

Two months after surgery, a follow-up ultrasound examination revealed evident improvement of the right kidney, which exhibited an almost normoechoic parenchyma, slightly more evident corticomedullary definition, absence of pyelectasis, and no visible dilation of the ipsilateral ureter. In addition, the bladder presented normal ultrasound characteristics (Figure 4).

DISCUSSION

In this case, the normal complete blood count and finding of struvite crystals on urinalysis corroborates the hypothesis of a bacterial urinary infection,

since ectopic ureter is known to predispose animals to cystitis [9]. The creatinine values were still within reference range for the species, indicating absence of renal function impairment.

The main clinical sign in cases of ectopic ureter, especially in females, is urinary incontinence [1]. In the case presented herein, this was the only outward sign of any issue according to the dog's owner; thus, ultrasound was considered the first-line imaging modality of choice, aiming to address clinical suspicion and rule out the other differentials of urinary incontinence, such as severe urinary infection, urolithiasis, or even malignancy [12].

Although ultrasound showed clear signs that corroborated the suspicion of ureteral ectopia, excretory urography was still necessary for diagnostic confirmation and demonstration of impairment in the urinary tract. In this case, contrast radiography was able to detect those changes visible on ultrasound examination, such as pyelectasis and unilateral ureteral dilation. Other authors report excretory urography as sufficient to elucidate the diagnosis of ectopic ureter [7]; however, ultrasound is well established as a less expensive, simpler, and noninvasive alternative. It may be particularly useful in the initial workup of cases in

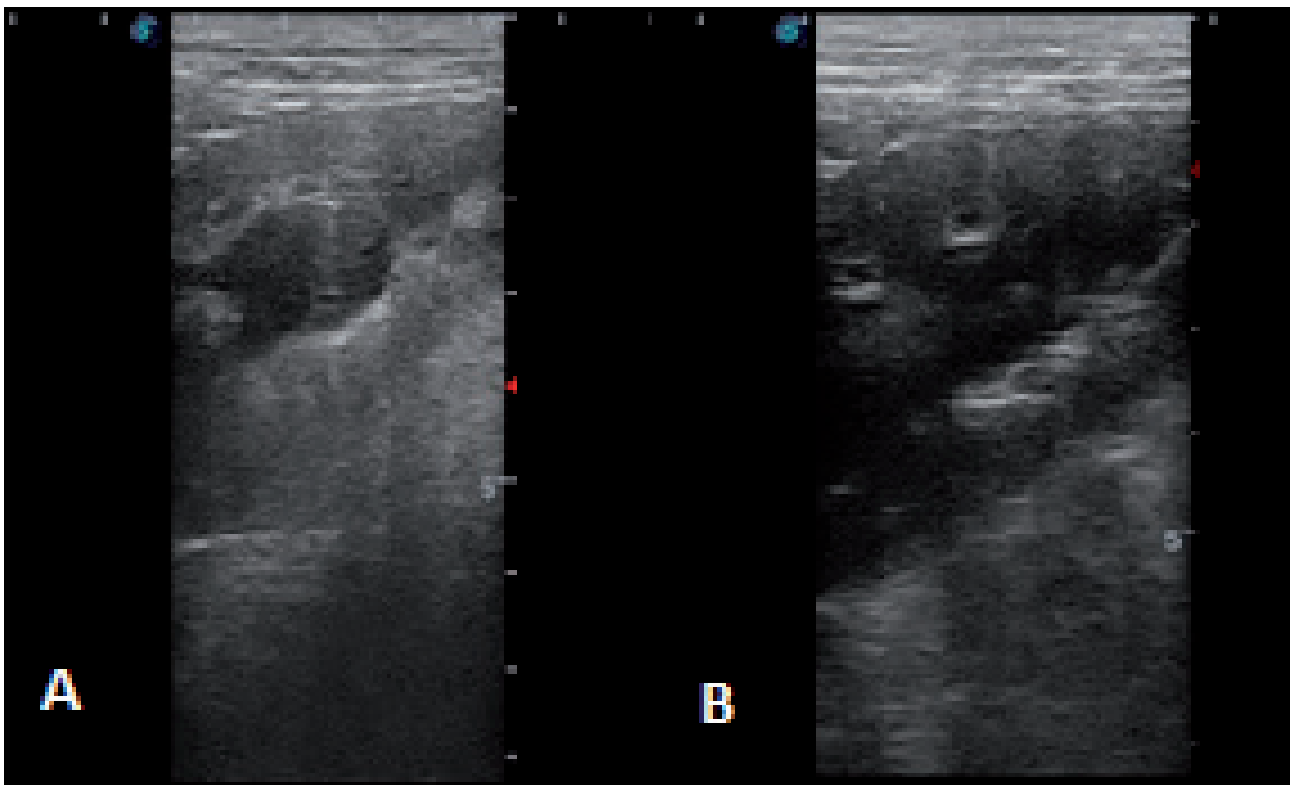


Figure 1. Ultrasonographic images of the kidneys. A- Right kidney: Increased cortical echogenicity, loss of corticomedullary definition, and dilation of the renal pelvis (pyelectasis). B- Left kidney, showing normal ultrasound characteristics. [Source: HOVET-UFERSA, 2018].

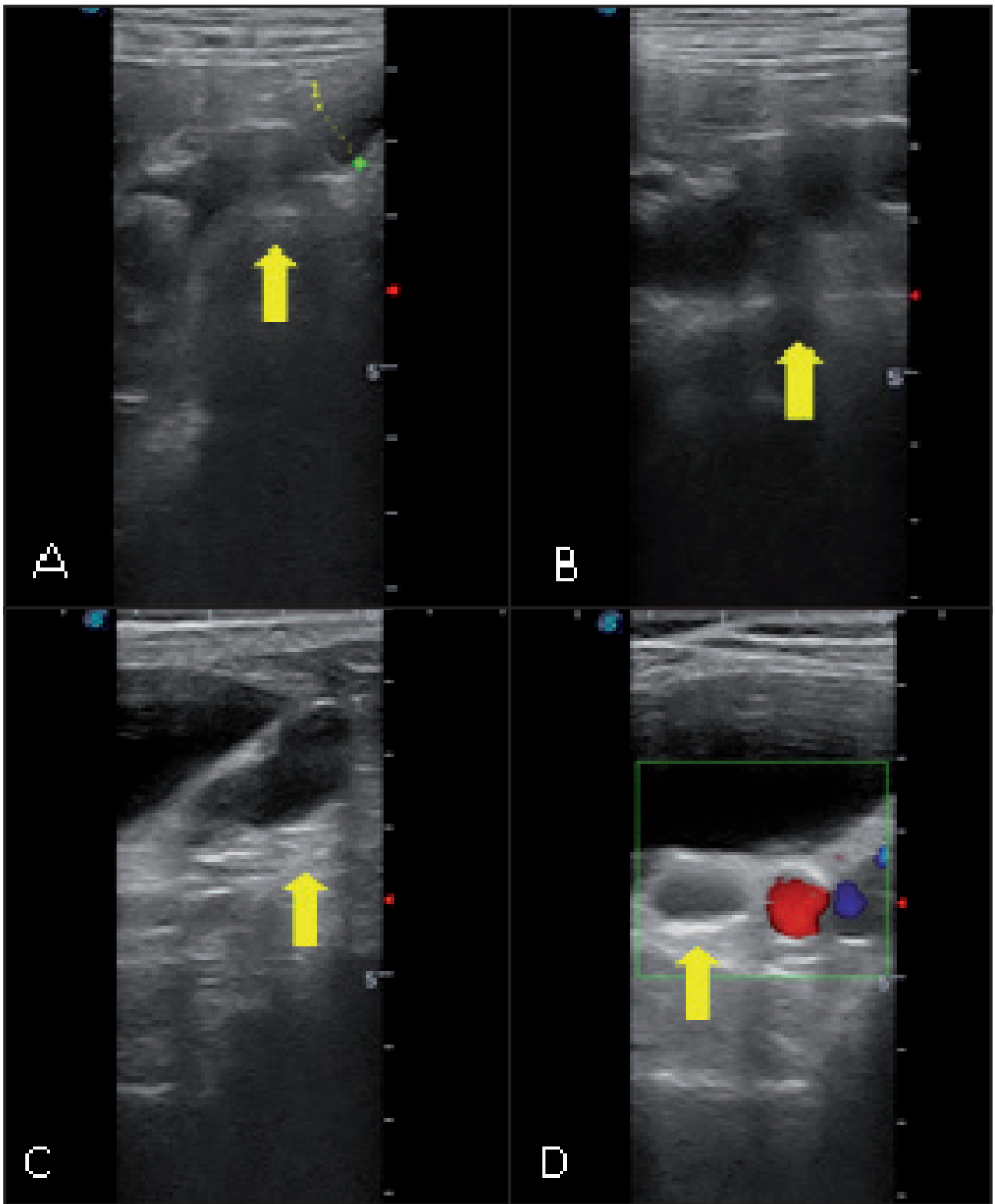


Figure 2. Ultrasonographic images of the right kidney, in cross-section. A- Dilated pelvis and ureter (arrow). B & C- Trajectory of the ureter to the bladder. D- Differentiation of the ureter (arrow) and blood vessels (red and blue) can be seen through Doppler ultrasonography. [Source: HOVET-UFERSA, 2018].

which no hypotheses have yet been ruled out from the differential diagnosis, as the clinical signs of ectopic ureter are somewhat nonspecific.

Cystoscopy has recently been reported as the most efficient method to diagnose ectopic ureter

[11]. However, this technique still has limited utility in veterinary medicine due to the attendant costs and need for specialized services. Computed tomography is a noninvasive technique but still costly alternative, limiting its routine use and making radiography and/or

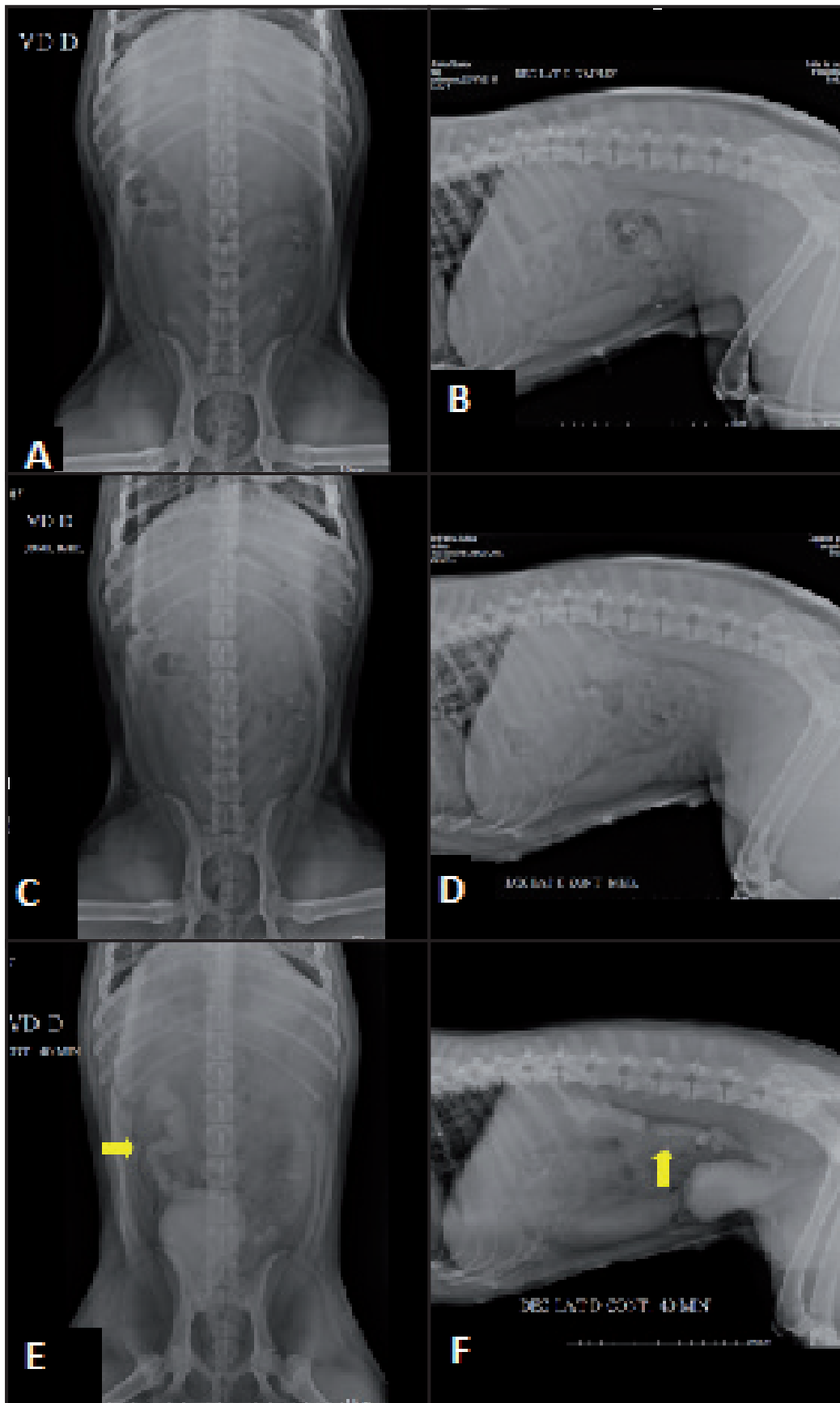


Figure 3. A & B- Plain abdominal radiographs of the patient before injection of the contrast medium. C & D- In the nephrogram phase, immediately after injection of the contrast medium. E & F- In the pyelogram phase, 40 min after injection of the contrast medium, showing the dilation and tortuosity of the right ureter (arrow). All radiographs obtained in ventrodorsal and right lateral projections. [Source: HOVET-UFERSA, 2018].

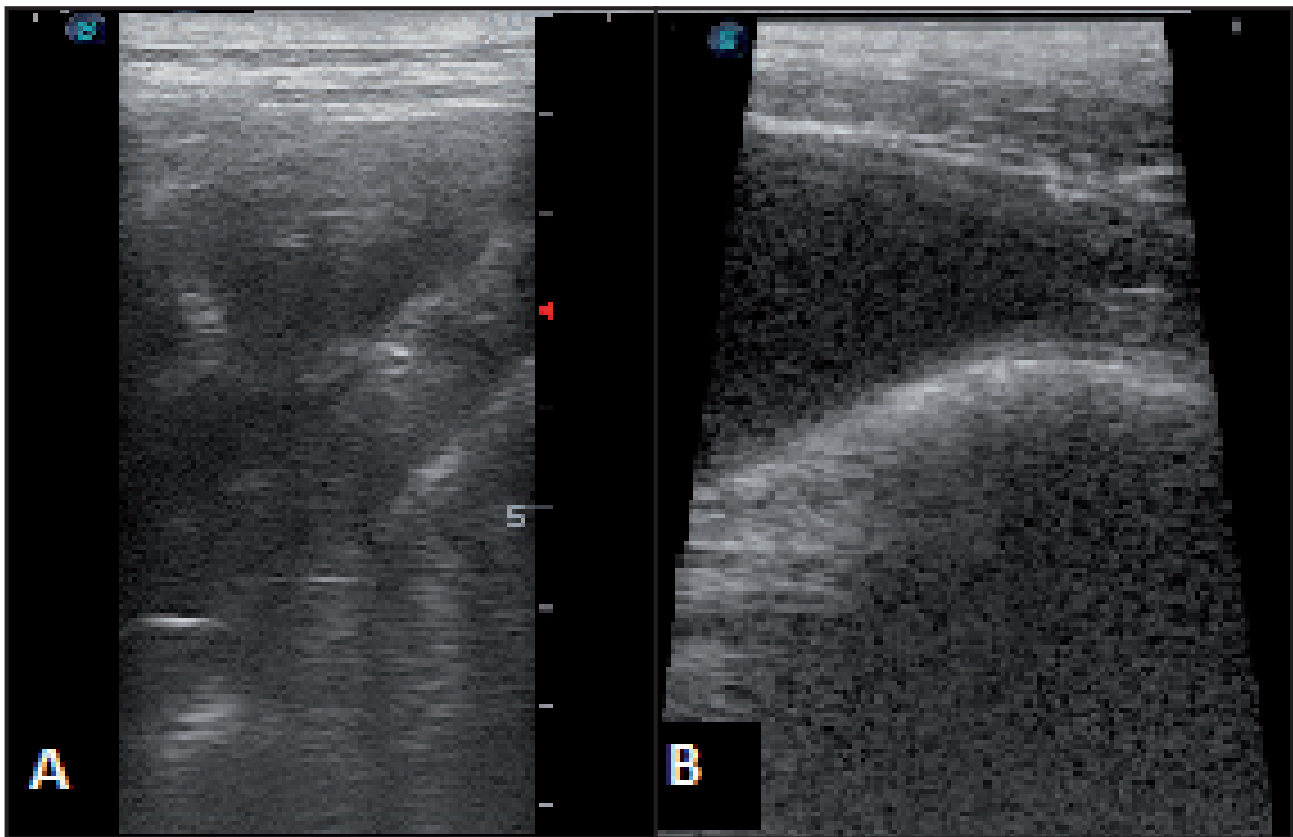


Figure 4. Ultrasound images of the patient 2 months after surgery. A- Improvement of the right renal parenchyma. B- Normal bladder, with no changes in the operated area. [Source: HOVET-UFERSA, 2018].

ultrasonography the imaging modalities of choice for diagnosis and treatment planning in ureteral ectopia.

Treatment of an ectopic ureter is eminently surgical. The specific approach will depend on the course and particular features of each case. In the present case, the ectopic ureter was intramural, which is the most common form reported in the literature [1]. Excision of the affected kidney and ureter was not necessary; indeed, this procedure is only justifiable in extreme cases [2]. Ovariohysterectomy was performed to prevent the possibility of heritable transmission of any anomalies.

Urinary incontinence persists in 44 to 67% of cases of ureteral ectopia even after surgery [10]. In the case reported herein, the incontinence resolved in less than 2 weeks after neoureterostomy. This successful outcome may be explained at least partly by studies

that report a higher incidence of therapeutic failure in cases of bilateral ureteral ectopia [6].

This report demonstrates that readily accessible techniques as ultrasonography and contrast radiography (excretory urography) are both essential and sufficient for the diagnosis of ectopic ureter. Both modalities allow visualization of changes highly specific for this condition, as well as suggest the possible location of mal-insertion of the ureter.

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Declaration of interest. The authors report no conflicts of interest. The authors alone are responsible for the contents and writing of the paper.

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