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Short Communication

A new era in the early treatment of dioctophymosis – The first laparoscopic nephrotomy without ischemia in a dog

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ABSTRACT

The parasite *Dioctophyme renale* is a nematode that infects carnivores and often causes total and irreversible destruction of renal tissue. In cases of early diagnosis, nephrotomy is an alternative for renal preservation. This report describes the first laparoscopic nephrotomy performed without ischemia in the treatment of a female dog with renal dioctophymosis, using an ultrasonic scalpel for hemorrhage control. The technique stood out for its precision in simultaneous renal parenchyma incision and coagulation, eliminating the need for temporary blood flow interruption to the organ. It allowed the removal of a 32 cm *D. renale* from inside the kidney. This approach minimized the risks associated with ischemia-reperfusion injury, proving particularly advantageous in cases with partial preservation of renal parenchyma. Postoperatively, the patient exhibited a reduction in the size of the parasitized kidney and normalization of urinary parameters in urinalysis and blood biochemistry, confirming the technique's success. The use of the ultrasonic scalpel proved safe, efficient, and promising as a tool in the minimally invasive surgical management of renal diseases. This technique represents a significant advancement in the treatment of dioctophymosis with renal preservation.

Introduction

Nephrotomy has gradually been considered a therapeutic possibility in the treatment of dioctophymosis. It is based on the removal of the parasite *Dioctophyme renale*, the causative agent of the disease, from within the kidney. It is indicated in cases where renal preservation is possible, aiming to maximize renal function through *nephron-sparing* techniques.[1–3]

Within the concept of nephron preservation, nephrotomies can be performed conventionally, via open surgery, or through minimally invasive techniques.[1–3] When not applicable, nephrectomy of the parasitized kidney is recommended, which can also be performed conventionally or via video-assisted surgery.[4–8]

Laparoscopic nephrotomies are typically performed with temporary renal ischemia to control bleeding during access to the renal pelvis.[3] However, ischemia is accompanied by time-dependent injuries resulting from the "ischemia-reperfusion" phenomenon.[9–13] Thus, this study describes the first fully laparoscopic nephrotomy without warm ischemia in the treatment of a dog with renal dioctophymosis, using an ultrasonic scalpel for hemorrhage control.

Case report

A female dog weighing 16.3 kg and estimated to be eight years old

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was referred for veterinary care. The history indicated that the patient was rescued from the street with puppies approximately three months before the consultation and had been spayed 30 days prior. The clinical complaint was intermittent hematuria and urinary incontinence, unresponsive to clinical treatment since the time of rescue. The treatment included the use of anti-inflammatory drugs and antibiotics, although the specific medications were not reported by the caregiver.

Clinical evaluation showed no alterations in physiological parameters. A scar lesion and local dermatitis were observed in the vulvar region. Laboratory analysis revealed leukocytosis (20,600/mm^3 total leukocytes) due to eosinophilia (7,000/mm^3 eosinophils); hematuria; leukocyturia; discrete bacteriuria; and the presence of *D. renale* eggs in urinary sediment. Blood urea and creatinine levels were within normal limits. The urine protein/creatinine ratio could not be determined due to excessive cellularity in the urine.

Abdominal ultrasonography suggested right renal parasitosis, with tubular structures exhibiting hyperechoic borders and hypoechoic centers in the renal pelvis and ureter (Fig. 1A). The right kidney measured 6.64 cm in length, while the space occupied by the parasite in the renal pelvis was 3.85 × 2 cm. The renal parenchyma was assessable, with a hyperechoic cortex and coarse echotexture, measuring 0.69 cm. The ureter exhibited dilation of 1.45 cm.

The patient underwent laparoscopic nephrotomy four days after admission. After anesthetic stabilization, the patient was positioned in left lateral recumbency with a tissue roll under the left flank to elevate the right kidney. The surgical site was prepared aseptically, and the first 11 mm laparoscopic port was positioned lateral to the umbilical fold between the last rib and the ilium. The abdominal cavity was inspected with a 10 mm, 30° rigid optic and insufflated with 8 mmHg of medical CO_2. Two additional 6 mm ports were placed triangulated to the first (Fig. 2A). The peritoneum exhibited a distinct red inflamed appearance that the authors have observed with previous cases of *D. renale* parasitism.The right kidney was located and stabilized using a right-angle laparoscopic Mixter forceps. A gauze sponge was inserted into the cavity for fluid absorption. For the renal incision, a straight-tip ultrasonic scalpel (Sonicision™) was employed. The instrument was used with open jaws, with the incision made solely by the ultrasonically vibrating jaw, and was aligned toward the renal pelvis (Fig. 2B). This allowed it to function as a blade, enabling simultaneous cutting and coagulation of the renal parenchyma during entry. A 10-mm longitudinal incision was performed on the convex lateral surface of the kidney and deliberately placed distant from the renal hilum to minimize the risk to hilar structures. No significant bleeding occurred during the incision. The renal pelvis was fully opened via blunt dissection with a curved Kelly forceps. A small amount of sanguineous urine was released into the abdominal cavity and immediately aspirated.

The parasite was visualized and partially exteriorized from the kidney, at which point its capsule ruptured (Fig. 2C). To prevent further leakage of worm contents, the rupture site was occluded with an intracorporeal knot made with the parasite itself (Fig. 2D). The parasite was found coiled and trapped within the renal pelvis. Upon further traction, it ruptured again, partially releasing its contents into the abdominal cavity. The parasite was removed in fragments and identified as a female, estimated at 32 cm. The kidney and abdominal cavity were lavaged with warmed Ringer's lactate solution. Complete parasite removal was confirmed via intraoperative ultrasonography (Fig. 3A) and direct endoscopic inspection of the kidney (Fig. 3B). The renal incision, estimated at 10 mm, was closed with a single intracorporeal cruciate mattress suture using 2-0 polydioxanone (Fig. 3C). After draining residual fluid and CO_2, the surgical wounds were closed in three layers, completing the 105-minute surgery.

Postoperative care included analgesics and anti-inflammatories (methadone 0.3 mg/kg IV, dipyrone 25 mg/kg IV, and meloxicam 0.1 mg/kg SC).. Antibiotics were not administered postoperatively, although intraoperative antibacterial prophylaxis (cefalotin 30 mg/kg IV every 90 minutes) was implemented. The patient was discharged six

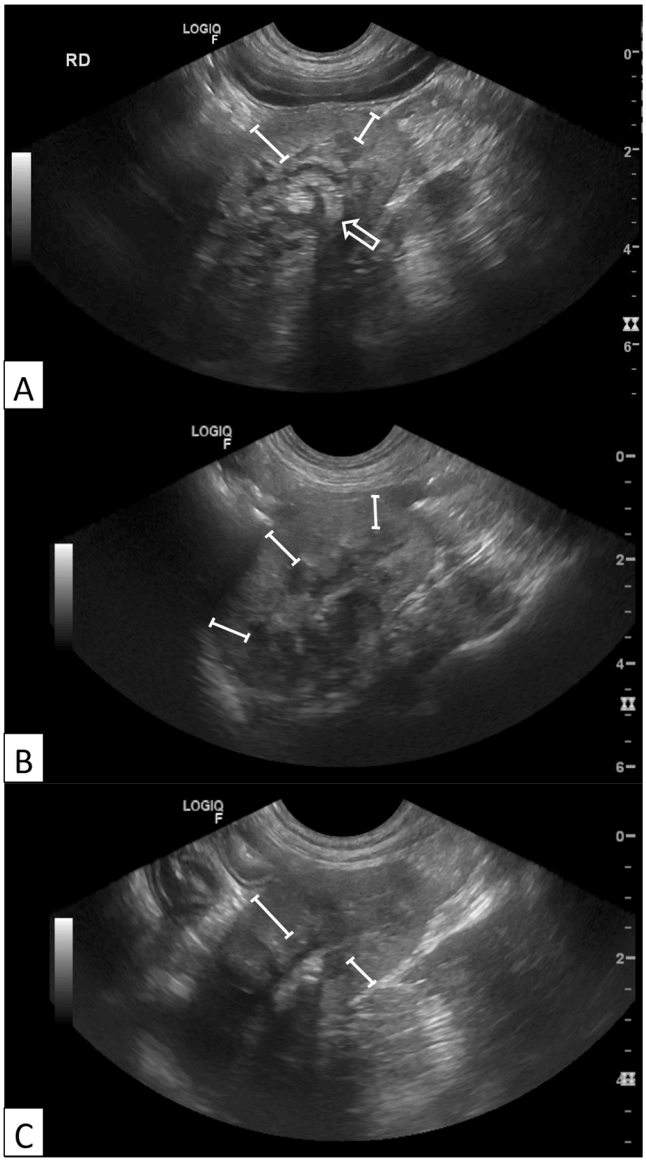

Fig. 1. Right renal ultrasonography of a dog with *Dioctophyme* treated with laparoscopic nephrotomy. A — Preoperative evaluation: kidney measuring 6.64 cm; pelvis 3.85 × 2 cm; tubular structures filling the pelvis and proximal ureter (arrow); 0.69 cm of preserved renal parenchyma. B — Evaluation three days post-nephrotomy, showing kidney reduction (5.3 cm) and mild pyelectasis and ureteritis. C — Evaluation 30 days post-nephrotomy, with further kidney (5 cm) and renal pelvis (0.4 cm) reduction. The white bars indicate the preserved renal parenchyma.

hours after the procedure with a prescription for meloxicam (0.1 mg/kg PO once daily for 2 days), tramadol (4 mg/kg PO three times daily for 3 days), and dipyrone (25 mg/kg PO three times daily for 5 days).

Ultrasonographic reevaluation three days postoperatively indicated a reduction in the right kidney size (5.3 cm), discrete pyelectasis (renal pelvis measuring 0.7 cm), and ureteritis (Fig. 1B). At 30 days postoperatively, ultrasonography showed further kidney reduction (5 cm) and renal pelvis reduction (0.4 cm), with no signs of ureteritis (Fig. 1C). Both exams indicated mild parenchymal atrophy associated with nephropathy.

At 30 days postoperatively, urinalysis and blood biochemistry showed no abnormalities. The only hematological alteration was eosinophilia (4,680/mm^3). The urine protein/creatinine ratio was 0.22 mg/dL (borderline proteinuria). The patient was active, with excellent surgical wound healing, but still exhibited urinary incontinence, which

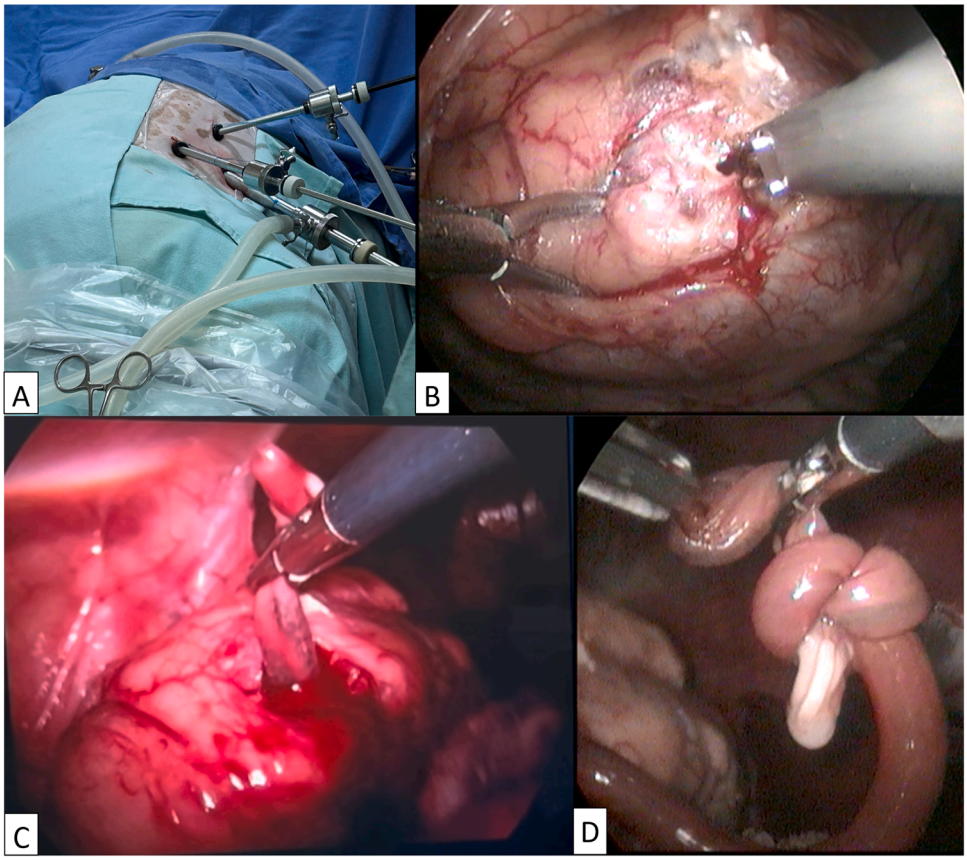

Fig. 2. Ischemia-free laparoscopic nephrotomy in a dog with *Dioctophyme renale*. A — Triangulated placement of three laparoscopic ports in the right flank. B — Renal incision with an ultrasonic scalpel. C — Removal of a *Dioctophyme renale* parasite from the renal pelvis. D — Knot tied in the parasite's body to control leakage after rupture.

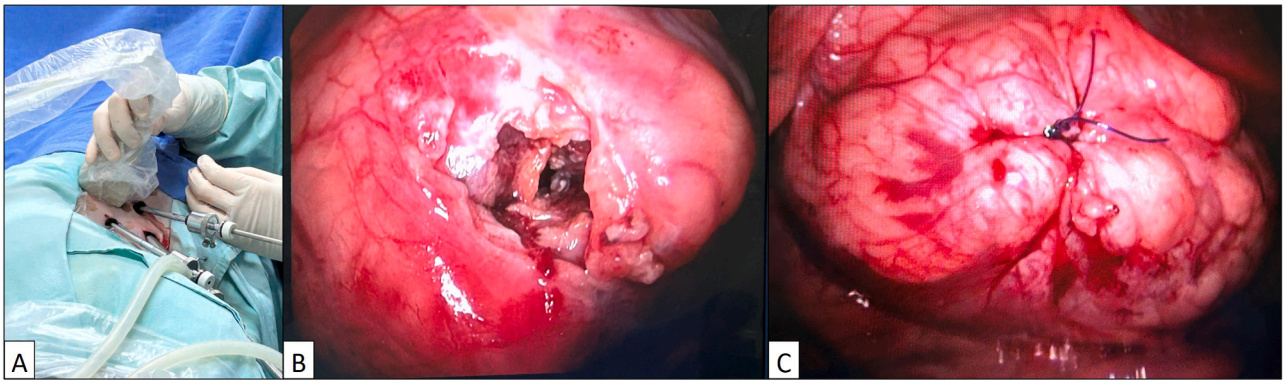

Fig. 3. Final stages of ischemia-free laparoscopic nephrotomy in a dog with *Dioctophyme renale*. A — Intraoperative ultrasonography confirming complete parasite removal. B — Direct visualization of the renal pelvis. C — Suture for renal incision closure.

was not attributed to renal parasitosis.

Discussion

The nephrotomy for *D. renale* removal, performed with an ultrasonic scalpel and without warm ischemia, yielded excellent results. Although innovative, the approach was based on three key points. First—the ultrasonic scalpel is used in human partial nephrectomies, with and without ischemia, and is associated with good hemorrhage control.[14–16] Second—in the authors' experience, kidneys parasitized by *D. renale* exhibit reduced renal artery flow and parenchymal dilation, resulting in less bleeding during incision. Third—the authors observed in previous laparoscopic nephrotomies[3] that the incision required for parasite removal is minimal (≤1 cm). Thus, the technique was successfully conceptualized.

The patient's clinical presentation was considered common, with nonspecific clinical and laboratory signs and a history of stray life.[17–20] The most unusual finding was viable renal parenchyma, allowing partial preservation of right renal function. This is uncommon, as the disease is chronic, progressive, and may evolve over years. Since it is often asymptomatic, animals are frequently diagnosed only after total renal destruction.[21; 5; 18; 22] When ultrasonography suggests renal preservation, nephrotomy is recommended.[1–3]

The development of minimally invasive techniques that reduce

ischemia-reperfusion injury is crucial. Bilateral dioctophymosis cases are reported as extremely severe and often fatal, even in humans.[23–25] However, the case described by Caye et al.[1] provided an alternative for curing a dog with bilateral dioctophymosis. The patient exhibited extremely severe acute kidney injury and underwent bilateral nephroscopy without ischemia but with Amplatz dilators. Both the technique reported by Caye et al.[1] and the one described here offer hope for managing severe dioctophymosis while optimizing renal preservation in animals and humans.

The leakage of renal and parasite contents during manipulation was not concerning, as *D. renale* has been reported to lack bacterial growth.[2] Abdominal irrigation and aspiration were performed to minimize the risk of bacterial contamination, urine absorption by the peritoneum, and parasite-associated peritonitis and adhesion formation. Parasite rupture during manipulation is common in the authors' experience. However, for the first time, they opted to tie a knot in the worm's body to control leakage. This was effective but requires intracorporeal suturing skills. Alternatively, the authors hypothesize that the worm could have been sealed with the ultrasonic scalpel, which was tested on the same specimen after removal. They confirmed that the parasite can be adequately "sealed" with the ultrasonic scalpel, adding further innovation to this report.

The patient exhibited reduced kidney length and renal pelvis measurements, similar to the dog undergoing bilateral nephroscopy described by Caye et al.[1] The authors consider these signs indicative of urinary flow restoration and renal parenchyma decompression. Parasite removal led to urinalysis normalization, with resolution of hematuria and leukocyturia.

It is important to note that the application of this surgical technique in other renal conditions, such as nephrolithiasis, may present greater limitations. Diseases characterized by preserved or increased renal blood flow and without parenchymal dilation may hinder or even preclude effective hemostasis when using an ultrasonic scalpel. The authors recommend caution and precise planning when performing nephrotomy without renal ischemia.

Conclusion

The ischemia-free nephrotomy using an ultrasonic scalpel for *D. renale* treatment in a dog was safe, feasible, and effective in curing the patient. This report marks a new era in the early laparoscopic treatment of canine dioctophymosis.

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CRediT authorship contribution statement

Pâmela Caye: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Jean Carlos Gasparotto:** Methodology, Investigation, Conceptualization. **Anna Vitória Hörbe:** Methodology, Investigation. **Brenda Viviane Götz Socolhoski:** Investigation, Data curation. **Amanda Oliveira Paraguassú:** Visualization, Investigation, Data curation. **Franciéli Mallmann Pozzobon:** Writing – original draft, Visualization, Conceptualization. **Rainer da Silva Reinstein:** Writing – original draft, Visualization, Conceptualization. **Daniel Curvello de Mendonça Müller:** Writing – original draft, Resources, Project administration, Funding acquisition. **Maurício Veloso Brun:** Writing – review & editing, Writing – original draft, Resources, Methodology, Funding acquisition, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that there are no conflicts of interest.

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