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Outcomes of 25 female dogs treated for ectopic ureters by open surgery or cystoscopic-guided laser ablation

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Abstract

Objective: To report outcomes after the correction of ectopic ureter (EU) by open surgery or cystoscopic-guided laser ablation (CLA) in female dogs.

Study design: Retrospective study from 2011 to 2018.

Animals: Twenty-five female dogs.

Methods: Data collected included signalment, clinicopathologic data, procedural data, complications, and short-term and long-term outcomes. Complications were graded as minor or major if a surgical revision was required. Continence status was scored subjectively (1 = completely incontinent to 10 = fully continent).

Results: Fifteen dogs had bilateral EU and 24 had intramural EU (iEU). Open surgical correction included 13 neoureterostomies, 2 neocystoureterostomies, and a combination of these in 2 dogs. Eight dogs underwent CLA. Eighteen dogs experienced minor complications (72%), and 2 experienced major complications (8%). One-month postoperative continence was achieved in 20/25 (80%) dogs (median score of 10). Incontinence recurred at a median time of 24.9 months in 5 dogs but responded to medical treatment. Overall, dogs remained continent for 66 months (median) and 22/25 (88%) dogs achieved continence with adjunction of medical/surgical treatment in incontinent ones. Fewer minor complications and postoperative recurrences of incontinence were documented after CLA than neoureterostomy ($P < .01$ and $P < .05$).

Conclusion: Ectopic ureter correction by open surgery or CLA resulted in a subjectively good prognosis, most dogs reaching continence within a month of surgery, although incontinence occasionally recurred in the long term. CLA was associated with fewer complications and incontinence recurrences than neoureterostomy.

Preliminary results of this study were presented at the ECVS congress in Budapest, Hungary, on July 6, 2019.

Clinical significance: Cystoscopic-guided laser ablation should be preferred to correct iEU to prevent short-term complications and the recurrence of incontinence. Further studies should investigate the cause of postoperative recurrence of urinary incontinence.

1 | INTRODUCTION

Ectopic ureter (EU) is rare in dogs but it is the most common cause of juvenile urinary incontinence in this species.[1–4] It is a congenital anomaly of the urinary system in which one or both ureteral orifices are inappropriately positioned caudal to the bladder trigone.[1,5,6] Embryologically, improper differentiation and migration of the mesonephric and metanephric duct systems results in 2 possible terminal paths; in 95% of cases, the ureter terminates within the bladder wall and is defined as intramural ectopic ureter (iEU). By contrast, extramural ectopic ureters (eEU) are separated from the bladder.[4,7–9] Affected dogs typically present with intermittent or continuous urine dribbling from birth or adoption. Concurrent congenital conformational or functional abnormalities have been described in more than 80% of cases; renal dysgenesis or agenesis, hydroureter, ureterocele, pelvic bladder, congenital urethral sphincter mechanism incompetence (USMI), vestibulovaginal septal remnants (VVSR), and recessed vulva have all been reported in dogs with EU.[1,2,7,8,10–15]

Traditional open approaches for EU correction include neoureterostomy with either ligation of the distal ureteric tunnel or reconstruction of the urethral-trigonal region and neocystoureterostomy (ureteral reimplantation).[3,12,16,17] Extramural ectopic ureter is treated using neocystoureterostomy whereas iEU is typically treated using neoureterostomy or, less commonly, neocystoureterostomy. These procedures, which require an open laparotomy, are associated with significant postoperative morbidity, with surgical revision needed in up to 21% of the reported cases.[4,8,18] Recently, cystoscopic-guided laser ablation (CLA) has been described as an alternative to open surgery for treating iEU in dogs.[10,11,14,19,20] In addition to the minimally invasive approach, which is thought to reduce morbidity, few complications have been reported in association with this technique.[20] To date, however, no study has compared the complications associated with either open surgery or CLA. The outcome after EU correction seems inconsistent, irrespective of the technique used, with a reported postoperative continence rate ranging from 36% to 72%. In addition, no prognostic factor has been identified to explain incontinence persistence after surgery or to understand incontinence recurrence in continent dogs after surgery, a phenomenon sparsely described in some studies.[2,7,8,11,12,14,20] In particular, despite the increasing description of CLA, no study compared the influence of the technique of correction of EU on continence outcome.[10,19]

The objectives of this study were (i) to report complications and short-term and long-term outcomes after EU correction by open surgery or CLA in female dogs; (ii) to compare neoureterostomy and CLA in terms of complications and both short-term and long-term outcomes in female dogs with iEU.

2 | MATERIALS AND METHODS

2.1 | Case selection

Medical records of incontinent female dogs diagnosed with EU and subsequently treated at the teaching hospital of the National Veterinary School of Alfort between September 2011 and October 2018 were reviewed. Cases were included in the study if affected dogs were treated by neocystoureterostomy, neoureterostomy, or CLA. Dogs with incomplete medical records, follow up less than 1 month after surgery, dogs treated using ureteronephrectomy alone, and dogs that received a concomitant additional procedure aiming to increase urethral sphincter tone (such as colposuspension or urethropexy) were excluded.

2.2 | Medical record review

Data collected included signalment (breed, age, body weight, neutering status); laboratory biochemical findings; imaging and functional testing (urethral pressure profilometry (UPP), Solar Blue, Medical Measurement System, Enschede, Netherlands; anesthesia with Xylazine, ROMPUN, Elanco, Cuxhaven, Germany 1.1 mg/kg IM); EU features (unilateral or bilateral EU, iEU or eEU, localization of terminal ureteral opening) determined by cystoscopic (Mini Multi-Purpose Rigid Telescope 30°, 9.5 Fr, 14 cm, Karl Storz Endoskope, Tuttlingen, Germany or URF-P5 Flexible ureteroscope, Olympus Medical Systems, Rungis, France) or intraoperative findings; associated conformational abnormalities; type of treatment; additional

procedure; complications; duration of hospitalization stay; preoperative and postoperative urine culture on urine collected through cystocentesis (considered positive when bacterial growth was equal to or above 3 log); and preoperative and postoperative continence status. Breeds were categorized as small (<15 kg) or medium to large (>15 kg), depending on the adult body weight. Conformational abnormalities were assessed by either clinical examination (recessed vulva), diagnostic imaging (hydronephrosis, hydroureter, renal dysgenesis, ureterocele with ultrasound; pelvic bladder with contrast studies), or cystoscopy (VVSR). The site of the terminal ureteral opening of the EU was classified as proximal (terminal ureteral opening in the bladder neck or the abdominal portion of the urethra) or distal (terminal opening in the mid to distal portion of the urethra, vagina, or vestibule). Complications were classified as major (surgical revision required such as uroabdomen, ureteral obstruction, or stenosis) or minor (no surgical revision required such as lower urinary tract symptoms).

2.3 | Procedures

Dogs preoperatively diagnosed with positive urine culture received, before surgery, 7-10 days of antibiotic therapy based on microbial susceptibility testing. The same primary surgeon performed all procedures. Surgical procedures were performed as previously described.[11,12,17] More specifically, neoureterostomy was performed by urethral-trigonal reconstruction (ligation and transection of the prepubic urethral portion of EU); in the eventuality of ectopic ureterocele, ureterocelectomy was performed in addition to neoureterostomy. Cystoscopic-guided laser ablation was performed without fluoroscopy under endoscopic guidance alone (Telescope 30°, 9.5Fr, 14 cm, Karl Storz Endoskope) with a holmium: yttrium aluminum garnet laser and a 230 μm laser fiber (10 Hz, 1.2 J, Calculase II CMB; Fiber Calculase II 230 μm, Karl Storz Endoskope). No urinary catheter was placed after open surgery or the CLA procedure. Analgesia was provided with a combination of opioids and nonsteroidal anti-inflammatory drugs. Ultrasonographic examination and urinalysis were systematically performed before discharge. Antibiotics were administered according to microbial susceptibility testing in dogs with positive urine cultures.

2.4 | Continence assessment and follow up

Continence status was established using an owner's subjective 10-point scale score, from 1 = completely incontinent to 10 = fully continent.[21] Dogs were considered to be continent if the score was a 9 or 10. The preoperative continence status was recorded according to the in-clinic consultation before surgery. The postoperative continence status was assessed at both 1-month and >1-month follow up by in-clinic patient evaluation and a phone interview with the owners, respectively. Incontinent dogs were classified with either incontinence persistence if postoperative continence scores were between 1 and 8 at 1 month evaluation, or incontinence recurrence if continence scores were above 9 at 1 month evaluation but decreased below that threshold during the follow up. For incontinent dogs, urine culture was performed and additional ultrasonographic, cystoscopic examination, and UPP and medical or further surgical treatment were proposed to the owners.

2.5 | Data analysis

Categorical variables are expressed as frequency and percentage and numerical variables are presented as the median and interquartile range (IQR). At 1 month follow up, the association between categorical data was assessed by Fisher's exact test. Quantitative data were assessed by the Mann-Whitney *U*-test. At follow up >1 month, only in dogs that achieved continence after surgery, the proportions of incontinence recurrence after CLA and neoureterostomy were analyzed using an exact test comparing the difference between 2 binomial proportions. The duration of continence (median) was estimated using Kaplan-Meier survival analyses with patients censored at the time of the last follow up if no incontinence occurred. The statistical analyses were performed using commercially available software (GraphPad Software Inc., La Jolla, California), and $P < .05$ was considered significant.

3 | RESULTS

3.1 | Preoperative findings

Twenty-five dogs were included in the study. At the initial presentation, the median age and body weight were 5.9 (3.8-10.4) months and 13.3 (9.0-19.4) kg. The dog breeds included 9 retrievers (8 golden; 1 Labrador); 4 terriers (Jack Russel, fox, Staffordshire terriers); 2 Beaucerons; 1 each of Shetland sheepdog, briard, Australian shepherd, French bulldog, English bulldog, dalmatian, and border collie; and 3 cross breeds. In total, 18/25 (72%) dogs were medium to large, and only 3 dogs (12%) were spayed at presentation (Table 1). All dogs were presented for continuous dribbling of urine since birth or weaning. The median continence score was 1 (1-3)

TABLE 1 Epidemiologic, preoperative, peroperative, and postoperative findings in 25 incontinent female dogs undergoing surgical treatment of EU

Parameters	Female dogs
Median age at surgery (months)	7.8 (6.1-11.4)
Median weight at surgery (kg)	19.0 (15.5-23.0)
Breed	
Small breed (<15 kg)	28% (7/25)
Medium to large breed (>15 kg)	72% (18/25)
Neutered before EU surgery	12% (3/25)
Serum creatinine concentration at presentation (mg/dL)	0.80 (0.60-0.90)
Diagnostic imaging	
Ultrasonography	100% (25/25)
Cystoscopy	84% (21/25)
Computed tomography scan	16% (4/25)
Retrograde vaginourethrography	8% (2/25)
Intravenous urography	4% (1/25)
Conformational abnormalities	76% (19/25)
Urinary related	76% (19/25)
Renal dysgenesis	24% (6/25)
Hydronephrosis	48% (12/25)
Hydroureter	48% (12/25)
Pelvic bladder	12% (3/25)
Ureterocele	16% (4/25)
Genital	52% (13/25)
Recessed vulva	40% (10/25)
VVSR	28% (7/25)
EU features	
Bilateral EU	60% (15/25)
iEU	96% (24/25)
Surgery	
Neoureterostomy	52% (13/25)
CLA	32% (8/25)
Neocystoureterostomy	8% (2/25)
Combined EU procedures	8% (2/25)
Median continence score	
At presentation	1 (1-3)
At 1 month	10 (9-10)
1 month continence status	
Continent dogs	80% (20/25)
Minor complications	72% (18/25)
Hematuria	60% (15/25)
Pollakiuria	20% (5/25)
Dysuria	12% (3/25)
Stranguria	8% (2/25)
Minor complications	
Neoureterostomy	
Rate	100% (13/13)
Duration (days)	9 (5-10)
CLA	
Rate	13% (1/8)
Duration (days)	0 (0-0)
Neocystoureterostomy/combined procedures	
Rate	100% (4/4)
Duration (days)	13 (8-16)
Major urinary-related complications	4% (1/25)
Other major complications	4% (1/25)

Abbreviations: CLA, cystoscopic-guided laser ablation; EU, ectopic ureter; iEU, intramural EU; VVSR, vestibulovaginal septal remnants.

(Table 1). Prior to surgery, the median serum creatinine concentration was 0.80 (0.60-0.90) mg/dL (reference range 0.50-1.60) (Table 1); urine cultures were positive in 15/23 (70%) tested dogs and 2 (9%) had more than 2 urinary tract infections (UTIs) diagnosed.

Diagnostic imaging modalities used to investigate the presence of EU and conformational abnormalities included ultrasonography (25/25, 100%), cystoscopy (21/25, 84%), computed tomography (4/25, 16%), retrograde vaginourethrography (2/25, 8%), and intravenous urography (1/25, 4%) (Table 1). Conformational abnormalities associated with congenital EU were diagnosed in 19/25 (76%) dogs (Table 1), with 16/25 (64%) of them having more than 1 abnormality. Nineteen of 25 (76%) dogs had urinary-related abnormalities and 13 (52%) genital malformations. One animal had preoperative UPP. The maximal urethral closure pressure (MUCP) was 23 cmH_2O. This value was considered a normal MUCP value based on the values previously published in healthy female dogs with the same anesthetic protocol (17-29 cmH_2O) and was thus not suggestive of USMI.[22]

3.2 | Peroperative findings

3.2.1 | Population and EU features

The median age and body weight at the time of surgery were 7.8 (6.1-11.4) months and 19.0 (15.5-23.0) kg. Among the 25 dogs, 40 EUs were diagnosed; 15 dogs (60%) had bilateral EU and 10 (40%) had unilateral EU (6

right sided; 4 left sided). Intramural EU was diagnosed in 24/25 (96%) and eEU in 1 (4%) of them (Table 1). The site of the terminal ureteral opening was recorded in 24 dogs: 6 (25%) dogs had proximal, 9 (38%) had distal, and 9 (38%) had both proximal and distal terminal ureteral openings.

3.2.2 | Procedures

Neoureterostomy, CLA, and neocystoureterostomy were performed in 13 (52%), 8 (32%), and 2 (8%) of cases; combined EU procedures (neocystoureterostomy and neoureterostomy, $n = 1$; neoureterostomy and ureteronephrectomy for end-stage hydronephrosis, $n = 1$) were performed in 2 cases (Table 1). Neocystoureterostomy was performed for 1 dog with eEU and 2 dogs with iEU (because the ectopic path of the ureter was subjectively considered very close to the bladder serosa). Neoureterostomies and CLA were performed only in cases of iEU. Of the 24 dogs for which the information was recorded, 10 (42%) had a persistent ureteral remnant (in the pubic urethra, distal to the ligation site) after surgery (all after neoureterostomy). Additional procedures were performed in 2/25 (8%) dogs and included spaying ($n = 1$), and pubic symphysiodesis ($n = 1$).

3.3 | Postoperative findings

All dogs survived to discharge with a median hospitalization stay of 3 (2, 3) days.

3.3.1 | Complications

Minor complications occurred after surgery in 18/25 (72%) cases and comprised only lower urinary tract symptoms that lasted a median of 5 (0-10) days (Table 1). Depending on the technique, the minor complication rate and duration were 100% (13/13) lasting 9 (5-10) days after neoureterostomy, and 13% (1/8) lasting 0 (0-0) day after CLA (Table 1). Lower urinary tract symptoms were more frequent after neoureterostomy compared to CLA ($P < .0001$), and their duration was longer after neoureterostomy compared to CLA ($P < .01$). Urinary-related major complications following EU correction occurred in 1/25 (4%) cases diagnosed with a uroabdomen after neocystoureterostomy. Intestinal intussusception after neoureterostomy also occurred in 1 dog (Table 1). Major complications were reported in 2/25 (8%) cases, and all had a successful surgical revision.

3.3.2 | Outcome

Short-term outcome

At 1 month follow up, 20/25 (80%) dogs were continent without any medical treatment. The median continence score was 10 (9-10) (Table 1). All 5 dogs (20%) with incontinence persistence after surgery had improved continence scores compared to the preoperative period. Twelve out of the 13 dogs, 7 out of the 8 dogs, and 1 out of the 4 dogs that received neoureterostomy, CLA, or neocystoureterostomy/combined procedures for EU correction were continent at 1 month. When comparing neoureterostomy and CLA to treat EU (iEU), no significant difference regarding incontinence persistence was observed ($P = 1.00$).

For the 5 persistently incontinent dogs after EU correction, urine cultures were negative at 1 month follow up. Creatinine was within the reference range. Ultrasound examination, cystoscopic examination, and UPP were performed in 5, 3, and 2 dogs. Both ultrasound and endoscopic examinations revealed proper localization of the ureteral orifice in all the investigated cases without any other abnormality observed. The UPP results (MUCP value of 15 and 16 cmH_20) were suggestive of USMI in 2 dogs, considering the values previously published in healthy female dogs with the same anesthetic protocol (17-29, cmH_20).[22] Phenylpropanolamine (PPA; Propalin, Vetoquinol, Paris, France) was prescribed in these 5 persistently incontinent dogs, and 1 of them achieved continence. In the 2 dogs diagnosed with USMI, a urethral hydraulic occluder was placed; 1 of them achieved continence.

Long-term outcome

The median duration of follow-up time was 38.9 (23.2-49.6) months. Incontinence recurred in 5/ 20 (25%) dogs at a median of 24.9 (18.8-35.2) months after surgery, all after neoureterostomy. Five dogs were spayed during follow up; 3 of them experienced incontinence recurrence at 18.8, 35.2, and 65.8 months after EU correction (12 and 29.9 months after spaying and 11 months before spaying, respectively). At follow up, the estimated proportions of continent dogs ($n = 20$) were 95%, 88%, and 71% at 1, 2, and 3 years from 1 month following surgery. The median duration of continence was 66 months (Figure 1). When comparing the use of CLA and neoureterostomy to treat EU (iEU) in dogs, the proportion of recurrence after CLA (0/7) was significantly less than after neoureterostomy (5/12) ($P < .05$). All 5 dogs that experienced incontinence recurrence during follow up recovered continence with medical treatment: PPA alone in 4 dogs and PPA and estriol (Incurin, MSD, Beaucouzé, France) in 1 dog. One dog died 27 months

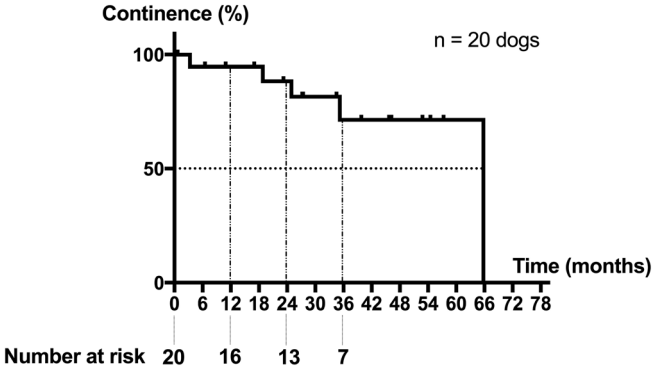

FIGURE 1 Follow up of continent dogs after correction of EU alone ($n = 20$). Incontinence recurrence was documented in 5 dogs. The proportions of continent dogs, as estimated by the Kaplan-Meier curve, were 95%, 88%, and 71% at 1, 2, and 3 years from 1 month following surgery. The median duration of continence was 66 months. Vertical lines are recurrences and short vertical bars are censored dogs

after surgery from acute renal failure based on the information provided by the referring veterinarian. At last follow up, continence was achieved in 15 (60%) dogs with EU correction alone, in 6 (24%) dogs with EU correction and adjunction of medical treatment, and 1 (4%) dog with EU correction and subsequent placement of urethral occluder. In total, continence was achieved in 22/25 (88%) of dogs either by surgery alone or by the addition of medical/surgical treatment.

3.3.3 | Postoperative urine culture

Of the 19 dogs with urine culture performed before discharge, 6 (32%) had positive results. After 1 month and during the entire follow up, 7 dogs were diagnosed with at least 1 positive urine culture. Four dogs had more than 3 positive urine cultures, and one of them had experienced a major complication after surgery.

4 | DISCUSSION

In the present study, 22/25 (88%) dogs achieved continence after correction of EU ± additional medical/surgical treatment with an associated urinary-related major complication rate of 4%. Continence lasted for 66 months during follow up and all dogs with recurrence of incontinence responded to medical treatment alone. Cystoscopic-guided laser ablation was associated with fewer minor complications and with a lower proportion of incontinence recurrence after iEU correction than neoureterostomy.

In total, 40 ectopic ureters were treated in 25 dogs over 7 years. Epidemiological data were similar to previous studies as medium to large breed dogs (72%) were overrepresented.[1,4,7,8,12] Incontinence persisted in 5/25 dogs 1 month after surgery, although correct postoperative ureteral positioning was confirmed and UTI was excluded. The persistence of incontinence may be due to decreased bladder capacity, disturbance of the urethral sphincter either secondary to the surgical approach or to the persistence of distal EU remnant, or associated USMI.[1,6,8,11,15,20] Few data are available in the literature concerning the use of UPP in dogs with EU but considering MUCP values previously published, USMI was diagnosed in 2 of our incontinent dogs.[15,22] The median duration of follow up was 38.9 months. Dogs that were continent after surgery remained so for a median of 66 months, with recurrence of incontinence in 5/20 dogs. Recurrence of incontinence has been reported after EU correction and justifies long-term follow up.[7] The reason for recurrence remains undetermined and probably multifactorial.[6] Urethral sphincter mechanism incompetence is well described in dogs after spaying[23] but no association between incontinence recurrence following EU correction and spaying was identified in some previous studies.[7,20] At the last follow up in our cohort, 4 of the 5 dogs that experienced incontinence recurrence were spayed (1 before surgery and 3 during follow up). This low number of cases precludes further conclusions, but other studies with larger cohorts are needed to assess the effect that spaying and USMI may have on incontinence recurrence of dogs after EU correction. Other hypotheses to explain incontinence recurrence include urinary tract infections, long-term scarring of the urethral sphincter following surgery or persistence of a ureteral remnant that could disturb the urethral sphincter mechanism. This latter hypothesis seems supported by fact that all dogs treated by CLA (no ureteral remnant) remained continent while, among the 5 dogs that experienced incontinence recurrence after neoureterostomy, 3 had a persistent ureteral remnant. All 10 incontinent dogs were medically treated. Interestingly, medical treatment was successful in all dogs with incontinence recurrence, but was effective in only 1/5 cases who never regained continence after surgery. These data prompt us to suggest that (i) dogs that are continent after surgery have a good long-term prognosis even if medical treatment may be needed, and (ii) dogs that fail to respond to EU correction are less prone to respond to medical treatment and have a worse long-term continence prognosis as described in previous studies.[8,11,20] Factors to explain this finding may include more complex congenital or functional abnormalities in dogs with incontinence persistence compared than those who experienced incontinence recurrence.

Minor complications occurred in 72% (18/25) of dogs and consisted of lower urinary tract symptoms that lasted for a median duration of 5 days. Minor complications occurred in all cases that underwent open surgery and were reported in a higher proportion than previous studies dealing with cystotomy alone (37%-50% minor complications).[24] These findings may reflect the invasive nature of correction of EU and associated urinary trauma. Major urinary-related complication occurred in one neocystoureterostomy, which was successfully revised. Preoperative UTI was diagnosed in more than half of the dogs tested, justifying a systematic urine culture and appropriate antimicrobial treatment if needed, as previously published.[1,11] Postoperative urine culture was positive in 32% of cases. The lack of systematic control of the cure of preoperatively diagnosed UTI in our study and the presence of asymptomatic bacteriuria (previously reported in up to 10% of dogs) could be possible explanations for the high rate of positive postoperative urine culture observed in the current study.[25,26] After 1 month and over the entire follow-up period, 7 UTIs were documented, and 4 dogs had more than 3 positive urine cultures. Dogs undergoing EU correction may be predisposed to postoperative UTI. During follow up, 1 dog died in acute renal failure, as recently reported after EU correction.[20] The cause of death was not fully investigated, precluding conclusion regarding the cause of acute renal failure. However, this continent dog had a history of positive preoperative and postoperative urine cultures; monitoring for UTI during follow up may be valuable in dogs after EU correction, regardless of the surgical technique or functional outcome.

Cystoscopic-guided laser ablation has only been available since 2016 in our hospital, explaining the low number of cases treated with CLA in our study. Several studies have previously reported the use of CLA for iEU correction in both female and male dogs.[10,11,14,19,20] Proposed advantages of CLA include its minimally invasive nature, the ability to diagnose and treat the EU simultaneously and resect the entire length of some distally opening iEU. Nearly 90% (8/9) of dogs treated by CLA were continent at short-term evaluation in our study although no difference in incontinence persistence after iEU correction was detected when compared to dogs treated with neoureterostomy. This result may be due to our small sample size, suggesting a larger cohort of dogs is needed to confirm this result. Nevertheless, incontinence did not recur in any dog treated with CLA, a complication documented in 42% (5/12) of dogs treated with neoureterostomy; in addition, CLA was associated with a lower risk of incontinence recurrence and fewer minor complications than neoureterostomy for iEU correction. These encouraging results may be due to the minimally invasive nature of CLA, likely minimizing trauma to the urethra. Cystoscopic-guided laser ablation also allows removal of the intramural ureteral path. No major complication occurred in our case series, despite the risk of urethral tear during the procedure and subsequent uroabdomen.[20] These findings prompt us to recommend CLA to treat iEU in female dogs. In contrast to previous studies, fluoroscopy was not used in the present study.[10,11,14,19] This imaging modality may be used to confirm the anatomical position of the ureter and confirm the correct position of the newly formed ureterovesical junction within the bladder, potentially reducing the risk of urethral tear during CLA.[20]

The limitations of this study pertained to its retrospective nature, the small number of cases (which precluded multivariate analysis), the absence of systematic cystoscopic control, and the absence of UPP in all incontinent dogs that would have confirmed the cause of incontinence. In addition, the >1 month continence status was assessed by phone interview rather than physical examination. Eventually, the differences in size and duration of follow up of the groups open surgery and CLA are also a limitation that could prevent further conclusion.

In conclusion, most dogs in our case series regained urinary continence by 1 month after surgical correction of EU, although incontinence recurred in some dogs about 2 years after surgery. Overall, dogs for which EU correction alone was successful remained continent for a median of 66 months. In the long term, continence was achieved in 22/25 of dogs, with adjunct medical/surgical treatment. Cystoscopic-guided laser ablation was associated with fewer minor complications and incontinence recurrences than neoureterostomy, prompting us to recommend CLA to treat female dogs with iEU.

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CONFLICT OF INTEREST

The authors declare no conflict of interest related to this report.

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