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Urethrocystoscopic-guided scissor correction of vestibular vaginal changes as minimally invasive treatment option to endoscopic scissors in female dogs: 13 cases (2022–2024)

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Objective
To evaluate the incidence and effectiveness of urethrocystoscopy-guided scissor correction for vestibulovaginal anomalies in female dogs.

Methods
The study included 13 female dogs treated between September 2022 and September 2024 at the Veterinary Nephrology and Urology Center. Diagnosed anomalies were persistent paramesonephric septal remnants (10 cases), vaginal septa (2 cases), and double vagina (1 case). Inclusion criteria were clinical signs of urinary tract infections and anomalies confirmed via endoscopy. Urethrocystoscopy-guided scissor correction was performed. Preoperative assessments included bloodwork, urinalysis, urine culture, sensitivity testing, and ultrasonography. Outcomes were monitored for 1 year postprocedure.

Results
Persistent paramesonephric septal remnants were the most common (10 cases). Associated conditions included ectopic ureters (4 cases), bladder wall thickening (4 cases), and urolithiasis (7 cases). Mean correction time ranged from 30 to 93 minutes, depending on the anomaly. Clinical signs such as dysuria, pollakiuria, hematuria, and urinary incontinence resolved in most cases. Minor complications included transient intraoperative bleeding that did not require discontinuation.

Conclusions
Urethrocystoscopy-guided scissor correction proved effective and minimally invasive for treating vestibulovaginal anomalies, with high success rates and minimal morbidity. Clinical signs resolved in most cases, supporting its use as an alternative to traditional surgery or laser ablation.

Clinical Relevance
This technique offers a safe, cost-effective option for treating vestibulovaginal anomalies in dogs, improving clinical outcomes, and reducing complications. Further studies with larger sample sizes are recommended to validate these findings.

Keywords: congenital, urogenital, malformations, cystoscopy, surgery

In female dogs, the uterus and vagina form through the fusion of the paramesonephric (Müllerian) ducts during the development of the urogenital sinus, which gives rise to the vaginal vestibule, urethra, and urinary bladder. The vaginal opening derives from the caudal face of the fused ducts, projecting into the urogenital sinus and forming a thin membrane that separates the vagina from the vestibule, resulting in the hymen.[1]

Urogenital tract anomalies can occur if embryological development is irregular, leading to conditions such as imperforate hymen, vestibulovaginal stenosis, segmental vaginal hypoplasia or aplasia, and persistent paramesonephric septal remnants (PPSRs).[2]

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When the paramesonephric ducts develop abnormally, a band of tissue or a partial vaginal septum may form, extending between the vestibule and the cervix at the vestibulovaginal junction. The term vestibulovaginal septal remnants (VVSRs) is commonly used to describe such conditions.[2,3]

Vestibulovaginal malformations are not yet precisely defined in the literature. However, several forms can be distinguished.[3] Currently, they are divided into 4 main conditions: PPSRs, imperforate hymens, vaginal septa, and double vaginas.[2,4] A PPSR is a membrane projecting cranially from the vestibulovaginal junction, measuring < 1 cm, and excluding lesions perforable manually, such as an imperforate hymen. A vaginal septum is a membrane extending cranially for more than 1 cm but stopping short of the cervix. A double vagina features a membrane extending from the vestibulovaginal junction to the cervix, dividing the vagina into 2 compartments.[2,4]

Congenital anomalies of the female reproductive tract are rare in veterinary practice, with occurrences reported in 0.02% to 0.05% of the canine population.[5] Although infrequent, these anomalies often occur alongside other congenital malformations, identified in 93% of female dogs with ectopic ureters.[1] The presence of multiple malformations in a single patient complicates understanding the clinical implications of VVSR defects.[6]

Anatomical anomalies may be discovered incidentally in some female dogs, while others may present clinical signs resulting from the anomaly, such as difficulty in natural reproduction, urinary incontinence, urine pooling in the vagina, chronic infections, dysuria, recurrent vaginitis, and ambiguous external genitalia.[7,8]

Although the clinical consequences of these malformations remain uncertain, various treatments have been described, ranging from traditional surgical methods to laser or endoscopic scissor procedures.[2,4]

Urethrocystoscopy is a minimally invasive technique used to access the lower urogenital tract, including the urethra, bladder, ureteral orifices, and vagina.[9] The endoscopic scissor transection (EST) technique uses scissors passed through the working channel of the cystoscope, offering a minimally invasive, safe method with fewer complications and lower costs than surgical lasers.[2,8]

The study's objective was to describe a diagnostic and therapeutic minimally invasive option for various vaginal malformations (PPSRs, vaginal septa, and double vaginas) using EST of the VVSR (EST-VVSR) and to retrospectively review clinical signs and short- and medium-term outcomes. The hypothesis was that this technique would be effective, have low complication rates, and provide a minimally invasive alternative when laser ablation is unavailable, offering a better option than traditional surgeries.

Methods

Case selection

The present study included female dogs evaluated via urethrocystoscopy for diagnostic purposes conducted between September 2022 and September 2024 at the Veterinary Nephrology and Urology Center. In cases where a VVSR was identified, correction of the malformation was performed during the procedure. The inclusion criteria for endoscopic evaluation in this study required dogs to present at least one of the following conditions: recurrent infections (at least 3 episodes of infection within a 1-year period) with no prior cause, vulvar fold,[10] double-J catheter removal, non-neurological urinary incontinence, or urolith removal via percutaneous cystolithotomy. Animals were excluded from the study if their corrective procedures did not involve the use of endoscopic scissors for anomalous tissue transection or if no vestibulovaginal abnormalities were detected.

Historical and laboratory data

Medical records were obtained through the online platform SimplesVet by the team responsible for the cases. Data collected included animal identification, body weight, breed, sex, age, clinical history, presence of vulvar abnormalities, preoperative laboratory results (CBC, serum biochemistry, urinalysis, urine culture, sensitivity testing, and abdominal ultrasonography), prior treatments, procedures performed, postoperative complications, cystoscopy findings, identification of concomitant urogenital abnormalities, postprocedure cultures, diagnosis, and treatment response. All dogs underwent CBC, serum biochemistry, urinalysis, bacterial culture of urine, and antimicrobial susceptibility testing before the procedure.

Procedure

All animals in the study had owner consent for the EST technique. Individualized anesthetic protocols based on the preoperative evaluation were used for the procedures. The anesthetized female dogs were positioned in right lateral recumbency for urethrocystoscopy and prepared aseptically with perivaginal hair clipping, followed by cleansing with 2% chlorhexidine scrub, 0.5% alcohol-based chlorhexidine, and 70% alcohol. In animals with uroliths, percutaneous cystolithotomy was performed alongside urethrocystoscopy. This procedure involved ventral bladder access using the endoscope in dorsal recumbency, followed by urolith extraction with endoscopic forceps. The lower urinary tract was examined using a 0° optical mini-nephroscope, 2.25 mm in diameter, with a working channel (5.4F), 2 ports angled at 45°, and a length of 220 mm, with continuous saline irrigation (0.9% NaCl).

Urethrocystoscopy allowed a thorough evaluation of the urethra, urinary bladder, and ureteral orifices, with the correction of any abnormalities performed under endoscopic guidance using the EST technique.

For treating PPSRs, the endoscope was inserted into the vaginal vestibule, and upon identifying the anatomical alteration, a flexible endoscopic scissor (5F, 34 cm long) was inserted through the working channel to transect the remnant septum. Under endoscopic visualization, the scissor jaws were opened and advanced until the distal portion of the tissue was positioned between the jaws, which were

then closed. The scissors allowed a single action cut for PPSRs; however, for cases involving double vagina and vaginal septa, the cutting process was repeated multiple times. Once any induced hemorrhage subsided, the process was repeated, progressively advancing toward the cervix, as recommended by Jacobson et al.[8] The procedure ceased upon complete transection of the septum. For an imperforate hymen case, multiple ureteral dilators (8F to 16F; MSB Medical System) were used to rupture the ligament. After hydrocolpos drainage, the remnant tissue was transected with endoscopic scissors until vaginal opening allowed access to the cervix.

Endoscopic scissor transection of the VVSR

Procedures were performed by a qualified veterinary surgeon. Following anesthesia and positioning, asepsis was ensured in the region accessed for urethrocystoscopy. The cystoscope was retrogradely inserted via the vulva to reach the vestibulovaginal region, initially assessing the bladder and then the vaginal canal for abnormalities. Perioperative and postoperative analgesia was administered based on procedural pain assessments.

Postprocedure antibiotic therapy included amoxicillin-clavulanate (15 mg/kg, twice daily) for 5 to 7 days in patients without clinical signs or preoperative culture results. In patients with prior urinalysis and culture, antibiotics were selected based on sensitivity results. Repeat urinalysis, culture, and sensitivity testing were performed during follow-up in some cases to evaluate treatment response.

Postoperative monitoring

The success of EST-VVSR was determined through in-person and telephone interviews with pet owners, as well as patient reassessment at 2 and 4 weeks postdischarge. All owners were contacted, and a standardized questionnaire **(Supplementary Material S1)**, based on the study published by Jacobsson et al,[8] was used to assess continence status, recurrence of urinary tract infections (UTIs), quality of life, and any concurrent medical concerns regarding their pet.

Urinary incontinence was defined as any involuntary leakage of urine, either persistent or intermittent. Continence was scored on a scale from 1 to 10, where 1 indicated continuous leakage (minimally continent), 5 represented occasional leakage while lying down or when the bladder was full but with partial urine retention (moderately continent), and 10 indicated complete absence of leakage (perfectly continent). Owners were asked about the progression of incontinence at 3 time points: 72 hours, 15 days, and 30 days after the procedure.

Abdominal ultrasonography was performed on all patients during postoperative follow-up, and in some cases, CT was used as a complementary diagnostic tool. In patients with urolithiasis, the removed uroliths were returned to the owners with a recommendation for mineralogical/crystallographic analysis upon hospital discharge. The first reassessment took place between 12 and 14 days postprocedure during suture removal. Additionally, all patients underwent abdominal ultrasonography or focused assessment with sonography in trauma ultrasound of the urinary tract at approximately 15 and 30 days postprocedure. Based on the stone analysis, dietary and urolith prevention protocols were established, with regular clinical follow-ups, including urinalysis and ultrasonography at 3 months, 6 months, and subsequently every 12 months.

Urine bacterial culture was performed between 2 and 4 weeks postprocedure and was recommended at 3 months, 6 months, and subsequently every 12 months, especially in patients with a history of recurrent UTIs. All patients were monitored for a minimum of 6 months after the procedure to evaluate the expected clinical resolution. In cases where urinary incontinence or UTIs persisted despite ectopic ureter correction via open surgery, removal of the double-J stent, and prior diagnosis of untreated vestibulovaginal anomalies, reevaluation by urethrocystoscopy was indicated, with correction of the VVSR when necessary.

Statistical analysis

Overall results were reported as range, and the numbers and percentages were reported for animals affected with variables of interest. Available software (Excel, version 2304; Microsoft Corp) was used for all calculations.

Results

Selected cases

Thirteen female dogs with vestibulovaginal malformations, including PPSRs (10 cases), vaginal septa (2 cases), and double vagina (1 case), were included in the study. Five of these animals exhibited a vaginal fold, 4 of which were associated with PPSRs. Additionally, 3 cases also presented ectopic ureters, and 1 case of vaginal fold was associated with a vaginal septum. All anomalies were identified through endoscopic evaluation following the presentation of characteristic clinical signs of unresolved UTIs. Among the concomitant abnormalities, 5 female dogs (38%) had ectopic ureters, while 8 (62%) presented VVSRs as the only morphological alteration of the urogenital tract.

The mean age at the time of the procedure was 7 years (range, 8 months to 10 years). Breeds included 2 Lhasa Apsos, 2 mixed-breed dogs, 3 Yorkshire Terriers, 1 English Bulldog, 1 French Bulldog, 1 Shih Tzu, 1 Golden Retriever, 1 German Shepherd Dog, and 1 Rottweiler. The mean body weight at the time of cystoscopy was 15.5 kg (range, 2.5 to 56 kg). Only 1 female dog was intact, which was the case diagnosed with a double vagina associated with an ectopic ureter; all other female dogs were spayed.

Clinical and pathological findings

Clinical signs observed in animals with VVSR as the sole malformation (8 cases), included pollakiuria (6 cases [75%]), dysuria (4 cases [50%]), urinary incontinence (1 case [12.5%]), hematuria (4 cases [50%]), and polyuria (1 case [12.5%]).

Preoperative serum biochemical analysis results were available for all dogs, along with CBCs and abdominal ultrasonography. Mild abnormalities were noted in some cases but were not deemed clinically significant to contraindicate the procedure.

Preoperative bacterial cultures and antibiotic sensitivity tests were performed for all patients, with bacterial growth detected in 10 cases: *Proteus mirabilis* (4 cases), *Escherichia coli* (1 case), and *Staphylococcus* sp (5 cases, including 1 mixed with *Proteus* sp). Animals with bacterial infections underwent antibiotic therapy for 7 days, based on bacterial sensitivity testing, before undergoing cystoscopy. The 4 cases of urinary incontinence analyzed in this study exhibited varying degrees of response to treatment, with 2 cases achieving complete resolution and the other 2 showing partial improvement after additional interventions.

In the first case, urinary incontinence was associated with persistent paramesonephric ligament, with an initial continence score of 8, improving to 10 after endoscopic correction. In the second case, incontinence was related to persistent paramesonephric ligament accompanied by a UTI and struvite urolithiasis, also with an initial score of 8, reaching 10 after endoscopic treatment.

In the cases with partial improvement of urinary incontinence, 1 patient had bilateral intramural ectopic ureters associated with recurrent UTIs, with an initial incontinence score of 1, improving to 5 after ureteroneocystostomy via open surgery. During urethrocystoscopy for removal of the double-J stent, additional congenital malformations were identified, including a short and wide urethra and a double vagina. Three months after the initial correction, a second urethrocystoscopy was performed for correction of the double vagina, resulting in an improvement in the incontinence score from 5 to 8 and a reduction in recurrent UTIs.

The last case involved a patient with a unilateral intramural ectopic ureter associated with a vaginal septum, short and wide urethra, and recurrent UTIs. This patient initially had a score of 1, which improved to 3 after endoscopic correction of the vaginal septum and ectopic ureter. However, as incontinence persisted, further intervention with the implantation of an artificial urethral sphincter (AUS) was required. After this procedure, the score improved to 10, with significant enhancement in urinary control and a reduction in recurrent UTIs over a 1-year postoperative period.

A noteworthy finding in this study was the association between ectopic ureters and VVSRs in 5 patients. Among these, 3 did not exhibit clinical signs of urinary incontinence reported by their owners and were evaluated during routine consultation.

Among these cases, 1 patient had bilateral intramural ectopic ureters associated with a paramesonephric ligament, while the other 2 had unilateral intramural ectopic ureters, also associated with a paramesonephric ligament, with 1 of them also presenting urolithiasis.

All 3 patients had a history of recurrent UTIs, with 2 cases associated with previously treated pyelonephritis. Urethrocystoscopy revealed that the ectopic openings were located in the proximal urethra, with no evidence of external urethral sphincter involvement in any of the cases.

Conversely, the most severe cases of urinary incontinence were observed in patients with unilateral or bilateral ectopic ureters opening into the distal urethra, often associated with a double vagina and/or a short and wide urethra.

Regarding the development of new UTIs, 10 cases showed negative urine cultures 10 days after completing antibiotic therapy. Among these, 2 patients had no history of recurrent UTIs or active infection at the time of the procedure. These patients showed no abnormalities on ultrasound, urinalysis, or follow-up urine cultures and did not develop new clinical signs of lower urinary tract disease (LUTD) until the last follow-up.

Among the cases with new UTIs, 1 patient with bilateral ectopic ureters associated with a paramesonephric ligament remained culture negative for 1 year after endoscopic correction. However, the patient later developed a UTI caused by a multidrug-resistant bacterium. After antibiotic treatment, the patient has maintained a state of untreated subclinical bacteriuria for 6 months.

Another case, followed for 2 years and 8 months, involved a patient diagnosed with a short and wide urethra following the correction of a double vagina and bilateral ectopic ureters. This patient exhibited subclinical bacteriuria due to multidrug-resistant microorganisms, in addition to experiencing at least 2 symptomatic UTIs per year.

A third case, followed for 1 year and 8 months, involved a patient with a short and wide urethra after correction of a vaginal septum and a unilateral ectopic ureter, who had undergone implantation of an AUS.

In this study, 5 female dogs presented with recessed vulvas, all of which were associated with UTIs. Two of these dogs were indicated for vulvoplasty and underwent urethrocystoscopy before the procedure. In 1 of them, a paramesonephric ligament was diagnosed and corrected endoscopically before vulvoplasty was performed. In the other, concomitant malformations were identified, including a paramesonephric ligament and an ectopic ureter, both of which were corrected using endoscopic scissors. However, due to the prolonged surgical duration, vulvoplasty was not performed. Both dogs remained free of UTIs for over a year following the procedures.

A third female dog, who underwent urolith removal and vaginal septum correction, also showed no recurrence of a UTI. Similarly, another female dog who underwent urolith removal and correction of a paramesonephric ligament, but did not have the unilateral ectopic ureter corrected (whose opening was located at the transition between the bladder neck and the proximal urethra), remained free of a UTI.

The last female dog in the group had a single episode of a UTI 1 year after correction of the ectopic ureter and paramesonephric ligament, suggesting that despite the correction of malformations, other factors may contribute to the long-term predisposition to UTIs.

Endoscopic and imaging findings

Endoscopic evaluations confirmed vestibulovaginal malformations in all 13 dogs. Persistent paramesonephric septal remnants were identified in 10 cases (77%), presenting as a tissue band less than 1 cm in size. One case was diagnosed and corrected for a ureterocele with the presence of a ureteral calculus at the time of diagnosis, along with the correction of the paramesonephric ligament via urethrocystoscopy **(Figure 1; Supplementary Videos S1 and S2)**. Vaginal septa were observed in 2 cases (15%), with tissue bands greater than 1 cm, and were successfully corrected during urethrocystoscopy **(Figure 2; Supplementary Video S3)**. Endoscopic images demonstrated the successful treatment of congenital vaginal atresia with secondary hydrocolpos in 1 case **(Figure 3; Supplementary Video S4)**. One dog (8%) was diagnosed with a double vagina, where a tissue band extended from the vestibule to the cervix, dividing the vagina into 2 compartments **(Figure 4; Supplementary Video S5)**.

Nine cases of PPSRs were associated with other anomalies, including unilateral intramural ectopic ureters (3 cases), bilateral ectopic ureters (1 case), urolithiasis (7 cases), and pyelonephritis (2 cases). Cases of pyelonephritis were diagnosed through ultrasound and urine culture. A 14-day antibiotic treatment was administered based on bacterial sensitivity testing before the animals underwent cystoscopy. Ultrasonographic findings in 1 case indicated a fistula between the left ureter and vagina, confirmed endoscopically as a vaginal septum. No morphological correlation was observed between vestibulovaginal anomalies and bladder wall thickening. Wall irregularities were noted in 4 cases and urolithiasis in 7 cases. Paramesonephric ligaments with lymphoid follicles were observed in a case suggestive of vaginitis **(Figure 5; Supplementary Video S6)**; this alteration is directly associated with chronic inflammatory conditions.

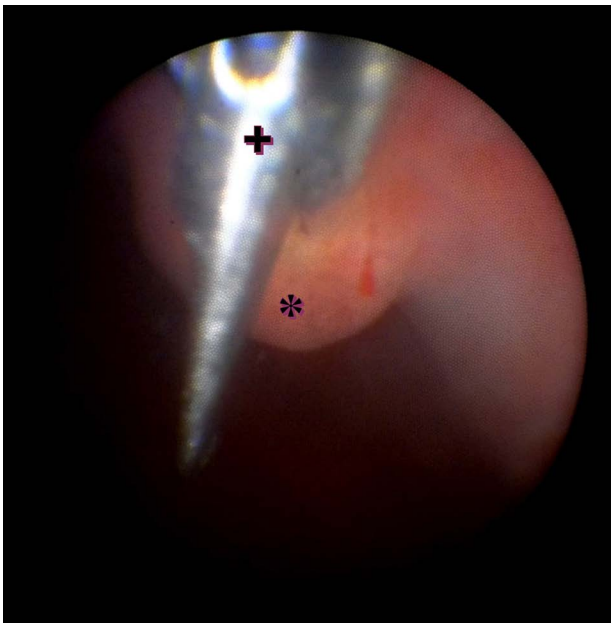

Figure 1—Correction of a ureterocele (asterisk) using endoscopic scissors (plus sign) and removal of a ureteral calculus in the distal ureter of a spayed female Yorkshire Terrier with recurrent urinary tract infections. Urethrocystoscopy facilitated the diagnosis and correction of a paramesonephric ligament during the same procedure.

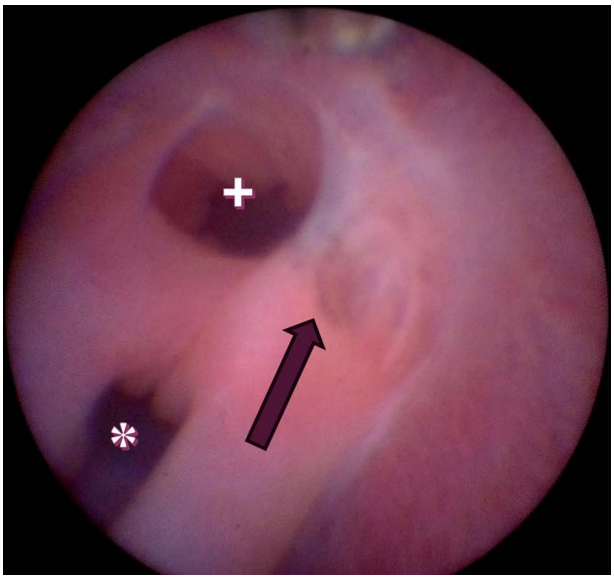

Figure 2—A 9-year-old spayed female Shih Tzu with a history of recurrent urinary tract infections and struvite calculi underwent percutaneous cystoscopy for calculus removal. At the end of the procedure, urethrocystoscopy was performed, allowing for the diagnosis of a vaginal septum and correction of the ligament using endoscopic scissors. The vaginal vestibule including the urethra (asterisk), vagina (plus sign), and vaginal septum (arrow) is shown.

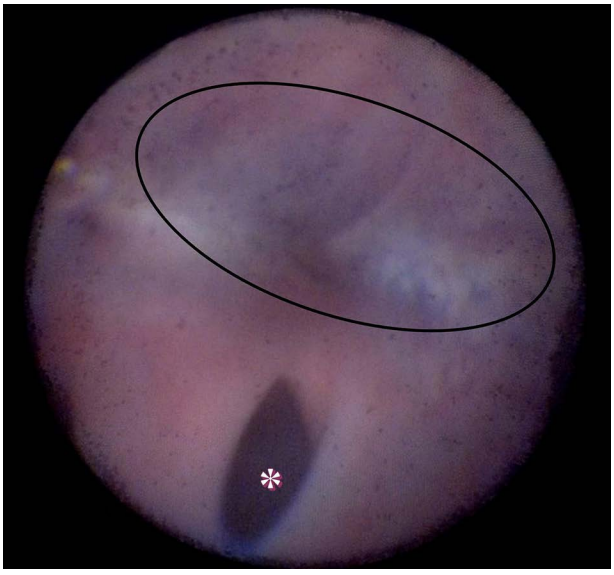

Figure 3—Endoscopic images during the treatment of congenital vaginal atresia and secondary hydrocolpos in a 10-year-old spayed mixed-breed female dog. The appearance of the atretic vaginal opening before treatment during endoscopy including the urethra (asterisk) and atretic vagina (circle) is shown.

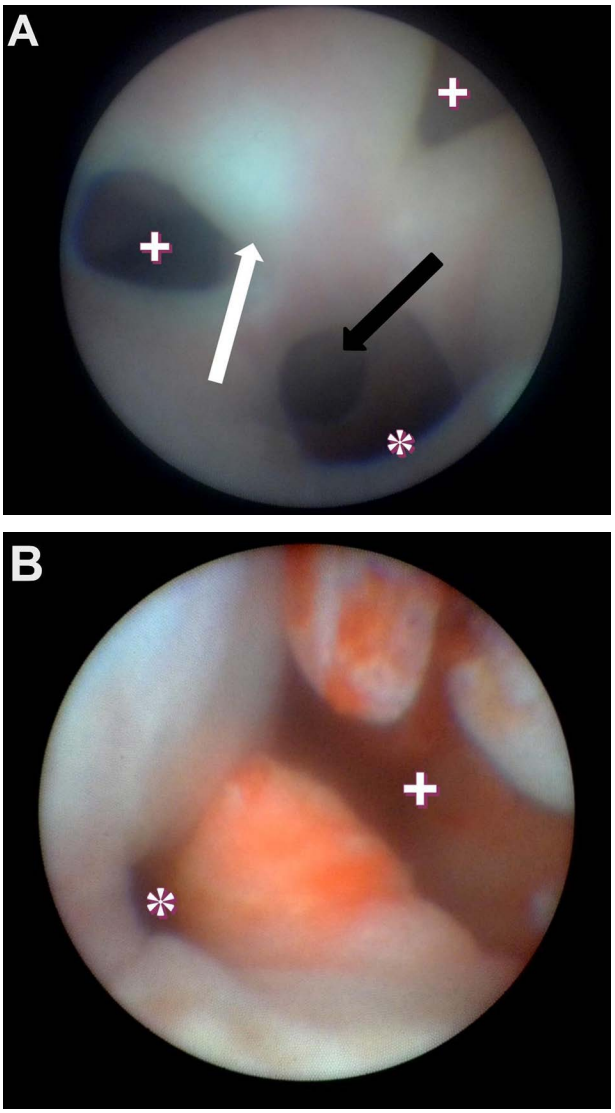

Figure 4—An 8-month-old German Shepherd Dog with severe incontinence. A—Vaginal vestibule with a duplicated vagina (white arrow), showing broad bands of tissue extending through the vaginal canal to the cervix. Urethrocystoscopy diagnosed additional malformations, including bilateral intramural ectopic ureters and a short and wide urethra. The opening to an ectopic ureter (black arrow) is visible dorsally to the urethra, just within the external urethral orifice. B—Vaginal vestibule after correction of the duplicated vagina using endoscopic scissors. The urethra (asterisk) and vagina (plus sign) are indicated.

The mean procedure time for correcting PPSRs was 30 minutes (range, 20 to 40 minutes); for double vaginas, it was 93 minutes; and for vaginal septa, it was 30 minutes (range, 20 to 40 minutes). Procedure times excluded additional concurrent interventions, such as ectopic ureter corrections or cystolithoscopy.

Complications

A mild hemorrhage was identified as a postoperative complication in only 1 patient, and minor bleeding occurred during the procedures for correcting a double vagina and ectopic ureter. The intraoperative hemorrhage was not sufficient to interrupt the procedure, and although it slightly prolonged the surgical time, the patients were discharged without clinical signs. No signs of dysuria or bacterial growth were reported in postoperative urinalysis and urine culture following urethrocystoscopy of all animals.

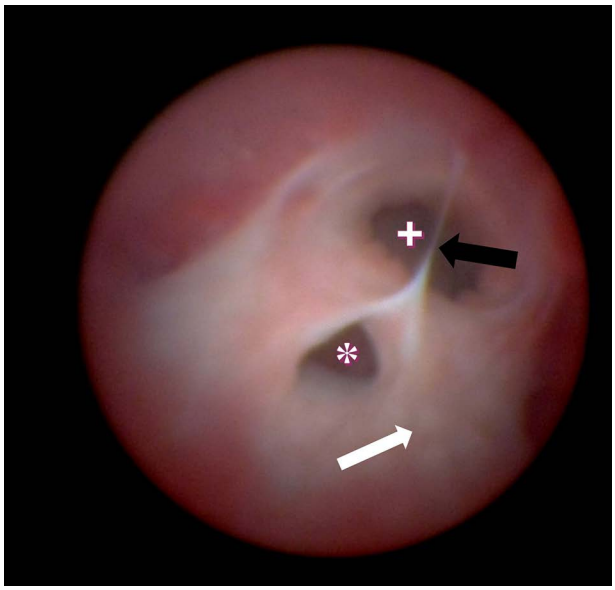

Figure 5—A paramesonephric ligament (black arrow) observed as a thin band of tissue extending dorsoventrally across the vestibulovaginal junction, with the presence of lymphoid follicles (white arrow) suggestive of vaginitis. This was noted in a 7-year-old spayed French Bulldog undergoing preoperative urethrocystoscopy for vulvoplasty to address chronic cystitis. The urethra (asterisk) and vagina (plus sign) are indicated.

No patients experienced long-term complications resulting from urethrocystoscopic correction of VVSR malformations. However, 1 case involving the correction of a unilateral ectopic ureter associated with a vaginal septum did not show significant improvement in urinary incontinence following the procedure. Subsequently, an AUS device was implanted. The persistence of incontinence was attributed not to a complication of the procedure but to the presence of a short and wide urethra, leading to external urethral sphincter incompetence.

Discussion

The results of this study indicate that the EST-VVSR provided an effective, safe, and minimally invasive treatment option for various vestibulovaginal anomalies, avoiding the need for more invasive surgeries and offering an alternative to laser ablation. In this study, endoscopy was used both as a diagnostic and therapeutic tool for VVSRs, successfully identifying vestibulovaginal malformations in all cases and facilitating simultaneous treatment.

The most common malformation observed was PPSRs (10 cases), followed by vaginal septa (2 cases) and double vaginas (1 case). The procedure was deemed safe and effective in removing the septal remnants, with satisfactory postoperative outcomes. Complications were minimal and self-limiting, and most patients showed significant

improvement in UTIs and urinary incontinence. However, 3 out of 13 cases remained incontinent and/or developed new episodes of UTIs. These findings align with those of Burdick et al,[2] who also reported successful outcomes with endoscopically guided laser ablation of VVSRs, identifying similar distributions of malformations.

The definitions of vestibulovaginal anomalies remain inconsistent in the literature, complicating the comparison of diagnostic criteria, treatment options, and outcomes. In this study, VVSRs encompassed PPSRs, vaginal septa, and double vaginas. None of the patients presented with vestibulovaginal stenosis, characterized by a narrowing at the vestibulovaginal junction. Imperforate hymens, defined as thin membranes at the paramesonephric-septal junction, were also excluded as these cases can typically be resolved through manual perforation.[2,4]

Unlike prior studies by Burdick et al[2] and Nicoli et al,[4] where most affected animals were large-breed, young dogs, this study predominantly included older (mean age, 7 years) and medium-sized dogs (mean weight, 15.5 kg). Epidemiological studies on this topic remain sparse, and published research often involves limited patient numbers, potentially accounting for discrepancies between studies.

Common clinical signs in this study included pollakiuria, dysuria, urinary incontinence, and hematuria, often associated with lower UTIs. These symptoms were consistent with findings by Morgan and Forman.[9] The role of vaginal malformations in urinary incontinence, vaginitis, and recurrent infections remains unclear, as these anomalies may be incidental findings in some patients but causative or contributory in others.[11] It has been hypothesized that VVSRs may allow urine pooling in the vagina, contributing to urethral meatus opening, vaginal inflammation, and recurrent UTIs.[12]

Bacterial cystitis was a significant clinical finding, most commonly associated with *P mirabilis* and *Staphylococcus* sp.[13] Of the 13 patients evaluated, 10 presented with recurrent UTIs before the procedure. After treatment, 7 of these cases were completely resolved, with no recurrence of UTIs observed during a 1-year follow-up period. In the 3 cases where symptoms persisted, all were associated with the presence of ectopic ureters. Additionally, 2 of these patients also exhibited a short and wide urethra, a condition that contributes to external urethral sphincter incompetence. This finding reinforces the hypothesis that concomitant abnormalities play a significant role in the recurrence of UTIs, potentially predisposing patients to chronic infections throughout their lives. This observation is consistent with the findings of Burdick et al,[2] who reported a 64% postoperative UTIs rate in patients undergoing similar procedures.

Throughout this study, concomitant malformations were identified and corrected whenever possible, with intramural ectopic ureters being the most frequently associated anomaly, present in 4 of the 13 patients (30.7%). Additionally, 2 patients (15.3%) exhibited a short and wide urethra, while 1 patient (7.6%) was diagnosed with a ureterocele.

The literature[2,8,14] describes a high association between ectopic ureters and VVSRs, ranging from 83% to 93% of cases. However, the data from this study indicate a lower frequency of this association. This discrepancy may be related to incidental findings, case selection methodology, or specific clinical implications of vaginal remnants in the analyzed LUTD cases.

Among the evaluated patients, 7 presented with urolithiasis. Of these, 4 were diagnosed during percutaneous cystolithotomy associated with urethrocystoscopy, 2 were diagnosed during double-J stent removal following ureterolithotomy, and 1 case was associated with concurrent correction of a ureterocele.

Most patients had a history of recurrent UTIs and/or recurrent urolithiasis. However, none of these cases exhibited new episodes of LUTD up to the time of the last evaluation, suggesting a possible correlation between endoscopic correction and clinical control of these conditions.

Despite these promising results, the actual influence of vaginal remnants in LUTD remains unclear.[15] It is not yet established whether these structures are merely incidental findings, contribute as cofactors in other congenital abnormalities, play a multifactorial role in the persistence of urinary incontinence and/or UTIs, or represent a primary cause of these conditions.[2] Future studies are necessary to delve deeper into this issue and establish a more precise correlation between these abnormalities and their clinical relevance.

The frequent coexistence of multiple congenital malformations, such as ectopic ureters and vestibulovaginal abnormalities, suggests that the observed improvement in incontinence may be associated with the simultaneous correction of the ectopic ureter rather than solely the EST-VVSR.[2,8]

A relevant example involved a dog that underwent bilateral ureteroneocystostomy, where a double vagina, ureter openings at the trigone, and a short and wide urethra were diagnosed during urethrocystoscopy at the time of double-J stent removal. Initially, the patient presented with an incontinence score of 1 (maximum severity), which improved to 5 after surgery. Subsequently, another urethrocystoscopy was performed to correct the double vagina, resulting in a substantial improvement in the incontinence score to 8.

Another notable case involved a dog with a paramesonephric ligament as the sole finding, which demonstrated an improvement in incontinence from a score of 8 to 10 after endoscopic correction, suggesting a possible correlation between the anatomical alteration and incontinence.

Given these findings, it is relevant to hypothesize that EST-VVSR may have significant clinical implications depending on the physiology and the alterations promoted by the VVSR, such as urethral traction, thickening, and the length and width of the anomalous tissue band.[2,9,14] The primary aim of this study was to describe the EST-VVSR technique, emphasizing its applicability as a minimally invasive approach for correcting

vestibulovaginal malformations. Looking ahead, the objective is to characterize and describe with greater precision the clinical benefits of isolated VVSR correction, seeking to determine whether this anomaly alone can influence the pathophysiology of LUTD. Additional studies could evaluate the direct impact of this correction on improving clinical signs, reducing urinary incontinence, and preventing recurrent infections.[1,2,8,16,17]

A proposed factor that may contribute to the failure of dogs to regain urinary continence is the presence of concomitant urethral sphincter mechanism incompetence. Urethral sphincter mechanism incompetence can be either congenital or acquired in dogs and is considered the most common cause of acquired urinary incontinence, particularly in animals weighing over 15 kg.[16] Two dogs in this study exhibited congenital urethral sphincter mechanism incompetence associated with VVSR, supporting the notion proposed by other authors that this condition worsens the chances of complete incontinence remission.[17] The use of the EST technique yields favorable outcomes, as demonstrated in this study. However, challenges remain, including costs, training, and equipment requirements.[18] Despite observed advantages, the technique still necessitates improvements for increased safety and efficacy, such as enhanced cauterization during scissor transection. Limitations of this study include its retrospective nature, small sample size, and simultaneous correction of multiple anomalies in some cases.

In conclusion, EST-VVSR is a safe alternative for treating many vestibulovaginal defects in dogs, offering a long-term effective solution. Diagnosis and treatment can occur concurrently with this technique, eliminating the need for separate anesthetic episodes. The EST-VVSR is a more economical option compared to laser ablation, potentially resulting in lower morbidity than surgical alternatives.

Further research involving larger sample sizes and prospective studies is warranted to evaluate the broader application and efficacy of this minimally invasive technique. Nonetheless, the findings of this study underscore its potential as a valuable tool in veterinary practice.

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Supplementary Materials

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