Radical Cystectomy and Cutaneous Ureterostomy in 4 Dogs with Trigonal Transitional Cell Carcinoma: Description of Technique and Case Series

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Abstract

Objective: To describe radical cystectomy followed by cutaneous ureterostomy as a treatment of invasive bladder neoplasia in dogs.

Study Design: Retrospective study.

Animals: Client-owned dogs with transitional cell carcinoma of the bladder trigone (n=4).

Methods: Perioperative complications and long-term outcomes of dogs that underwent cutaneous ureterostomy following radical cystectomy and lymphadenectomy for transitional cell carcinoma of the urinary bladder trigone were reviewed. Both ureters were transected and anastomosed to the ventral abdominal skin. Polyvinyl chloride catheters were placed in the ureteral stomas and maintained for 5 days. After catheter removal, dogs were managed with an absorbent diaper over the stomas. Long-term outcome and survival were documented by follow-up visits or phone contact.

Results: Median age at the time of surgery was 10.3 years (range, 8–12). Average procedural time was ~4.7 hours (range, 3.8–6.1). Minor complications occurred in all dogs, including bleeding and edema of the ureterostomy site during the first 2–3 days after surgery. One dog developed urine scald that resolved with improved stoma care and hygiene. Median survival time after surgery was 278.6 days (range, 47–498). Distant metastases were documented in 2 dogs at 47 days (bone) and 369 days (lung) after surgery.

Conclusion: Radical cystectomy with cutaneous ureterostomy is a viable salvage procedure for urinary diversion after cystectomy in dogs with invasive bladder neoplasia. Postoperative management and quality of life were considered acceptable by most owners. Future studies are warranted to evaluate survival time in a larger number of animals.

1 INTRODUCTION

Several therapeutic techniques have been introduced in recent years to improve the management of bladder cancer in people.1 Radical cystectomy with bilateral pelvic lymph node dissection is considered the gold standard for surgical management of muscle-invasive bladder cancer.2,3 Urine drainage is re-established through 1 of 3 techniques: (1) incontinent diversion using an ileal conduit to abdominal skin; (2) continent cutaneous diversion using an intestinal...
**TABLE 1** Summary of 4 dogs undergoing radical cystectomy and cutaneous ureterostomy

<table>
<thead>
<tr>
<th>Case</th>
<th>Presenting signs</th>
<th>Hydronephrosis</th>
<th>TNM stage*</th>
<th>Procedures†</th>
<th>Perioperative complications</th>
<th>Surgery time (hours)</th>
<th>Outcome owner satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hyporexia, dysuria, hematuria, episodic vomiting</td>
<td>Bilateral</td>
<td>T2N0M0</td>
<td>Prostatectomy</td>
<td>Mild edema, hemorrhage (2 days)</td>
<td>4.8</td>
<td>Hit by car and died (498 days); very satisfied</td>
</tr>
<tr>
<td>2</td>
<td>Dysuria, hematuria</td>
<td>Bilateral</td>
<td>T2N0M0</td>
<td>Prostatectomy</td>
<td>Edema left hind leg, hemorrhage from ureteral stomas (3 days). Urine scald (30 days)</td>
<td>6.1</td>
<td>Euthanasia due to aggression toward owner (193 days); very satisfied</td>
</tr>
<tr>
<td>3</td>
<td>Dysuria, hematuria (left &gt; right)</td>
<td>Bilateral</td>
<td>T1N1M0</td>
<td>None</td>
<td>Peristomal edema, hemorrhage (2 days)</td>
<td>4.0</td>
<td>Euthanasia. Probable lung metastasis (369 days); very satisfied</td>
</tr>
<tr>
<td>4</td>
<td>Dysuria, hematuria, abdominal pain</td>
<td>Bilateral</td>
<td>T2N1M0</td>
<td>None</td>
<td>Peristomal edema (3 days)</td>
<td>4.7</td>
<td>Euthanasia. Bone metastasis (47 days); very satisfied</td>
</tr>
</tbody>
</table>

aTNM stage\(^{20,21}\) = tumor (T), lymph node (N), metastasis (M).
T0: no evidence of a primary tumor; T1: superficial papillary tumor; T2: tumor invading the bladder wall, with induration; T3: tumor invading neighboring organs (prostate, uterus, vagina, and pelvic canal).
N0: no regional lymph node involvement; N1: regional lymph node involved; N2: regional lymph node and juxtaregional lymph node involved.
M0: no evidence of metastasis; M1: distant metastasis present.
bIn addition to cystectomy and cutaneous ureterostomy.
pouch; or (3) creation of an orthotopic bladder that is anastomosed to the remaining urethra. In general, continent diversion techniques with formation of a neobladder are used in stable patients, while simpler ileal conduits are favored in elderly or compromised patients that are considered unfit for more extensive procedures. Cutaneous ureterostomy has been reported as an alternative to ileal conduit in debilitated persons, reducing surgical trauma and risk of complications. Cutaneous ureterostomy avoids surgical and metabolic complications such as small bowel obstruction, paralytic ileum, delirium, and delayed ambulation that can be seen after ureteroenteric anastomoses.

In veterinary medicine, historical use of ureterocolonic anastomosis for urinary diversion has been largely abandoned due to severe hyperammonemia, metabolic alkalosis, diarrhea, vomiting, and neurologic complications resulting from absorption of uremic toxins across the colonic mucosa. Intestinal or gastric pouch reservoirs have also been attempted for bladder replacement in dogs, but led to similar complications of hypochloremic metabolic alkalosis and frequent pyelonephritis from ascending infections. More recent case reports described reimplantation of the ureters in the cranial aspect of the vagina and prepuce. Although this procedure avoided the previously described metabolic complications associated with intestinal pouch reservoirs, its use must be restricted to cases in which the uninvolved ureter is long enough to be reimplanted and would be contraindicated in animals with neoplastic extension into the distal urethra or vagina. The purpose of this report was to describe the use of complete cystectomy and cutaneous ureterostomy as an alternative method for urinary diversion in male and female dogs with invasive transitional cell carcinoma of the urinary bladder.

2 | CLINICAL REPORT

Medical records of client-owned dogs diagnosed with transitional cell carcinoma of the bladder trigone presented to the Veterinary Teaching Hospital at UNESP, Brazil (3 dogs) and the Ribeirão Preto Hospital, Brazil (1 dog) between 2012 and 2014 were reviewed. Initial diagnosis of a trigonal mass of the urinary bladder was made by ultrasound (cases 1, 3, and 4) or by positive contrast retrograde urethrocystogram (case 2), and carcinoma was diagnosed by histopathology in all cases by open bladder biopsy 7-10 days before definitive surgery was performed. Staging included abdominal ultrasound examination and 3-view thoracic radiographs to evaluate for metastasis (Table 1). Complete blood cell count, biochemistry panel, and urinalysis were obtained in all dogs. Because all dogs were referred with a recent history of antibiotic use, no cultures were performed. Piroxicam (0.5 mg/kg orally every 24 hours) was administered for 30 days in all dogs in an attempt to reduce tumor volume. All 4 dogs showed progressive disease during this period, with the development of progressive bilateral hydroureter and hydronephrosis. One dog (case 4) had moderate azotemia (creatinine 2.5 mg/dL and blood urea nitrogen 75 mg/dL). In each case, indications for radical cystectomy included the detection of an invasive tumor in the bladder trigone, causing ureteral obstruction without evidence of distant metastasis. Descriptive statistics for age, survival, and surgical time.
were calculated using a statistical software program (GraphPad Software Inc, San Diego, CA).

2.1 | Surgical technique

Protocols for general anesthesia were determined by the supervising clinician and varied between cases. Each dog received an epidural prior to surgery (2% lidocaine 0.22 mg/kg). Exploratory laparotomy was performed by ventral midline approach and the urinary bladder and ureters were identified (Fig 1). The ureters were dissected distally using tweezers to the level of the bladder, but were transected 5 cm from the trigone to allow a wide margin around the trigonal mass at both ureteral margins and to remove redundant ureteral length before performing cutaneous ureterostomy. The abdominal wall was incised lateral to the rectus abdominal muscle using a scalpel, creating a short (3–4 cm) and oblique tunnel parallel to the linea alba (Fig 1). The ureter was

FIGURE 2  Postsurgical evaluation of dogs following radical cystectomy and cutaneous ureterostomy. (A) Immediately after surgery showing catheterized ureters prior to securing to them to the skin. (B) Surgical wound and stoma 2 days after surgery; note the attachment of the temporary catheter to the skin and zinc oxide-lanolin cream applied around the stoma to prevent dermatitis. (C) At the time of suture removal 14 days after surgery. (D) Appearance of wounds 90 days after surgery. Note the presence of urine coming out of the ureter after removing the diaper (arrow)
spatulated by making a 2–3 mm longitudinal incision in the cut end and the ureter was anastomosed to the ventrolateral abdominal skin using a simple interrupted pattern (Fig 1). Full thickness suture bites were placed between the ureter and skin, 1–2 mm from the incision edges and 2 mm apart with 5-0 polyglaicapron 25 (cases 1, 2, 3) or 5-0 nylon (case 4).

After urinary diversion was completed, definitive resection of the transitional cell carcinoma was performed. The urinary bladder was decompressed using a urinary catheter and radical cystectomy was performed,13 including resection of the distal 5 cm of the ureters bilaterally. The proximal urethra was similarly resected to include a margin of at least 3 cm from the bladder trigone and was ligated using polyglaicapron 25 in the pelvic portion of the urethra before transection. In male dogs (cases 1 and 2), complete prostatectomy was performed in coordination with cystectomy.14 Bilateral sublumbar lymph node resection was performed in all dogs and the sublumbar lymph nodes and surgical margin at both ureters and at the urethra were examined for neoplastic invasion using histopathology. The abdominal cavity was lavaged with saline solution and the linea alba was closed using polyglaicapron 25 in a simple interrupted pattern. The subcutaneous tissue was closed in a simple continuous pattern and the skin was closed with simple interrupted sutures using nylon. Sutures were removed from the cutaneous ureterostomy sites and skin incision 14 days after surgery. Median procedure time was 4.7 hours (range, 3.8–6.1). An 8 (cases 1, 3, and 4) or 12 Fr (case 2) polyvinyl chloride catheter (Embramed Ind. E Com. LTDA, São Paulo, Brazil) was placed into each ureteral stoma and sutured in place using 2 simple interrupted sutures placed through adhesive tape affixed to the catheter (Fig 2). Ureteral catheters were connected to a closed aseptic collecting system (P. Simon, S.A, São Paulo, Brazil) and maintained for 5 days after surgery (Fig 2).

2.2 | Postoperative care and follow-up

An Elizabethan collar was maintained for 15 days after surgery. All ureters were patent after catheter removal (Fig 2C). Disposable absorbent diapers were applied to cover the cutaneous ureterostomy sites and were replaced every 8–12 hours. Before replacing the diaper, saline solution was used to clean the stoma and zinc oxide-lanolin cream (Hipoglos® cream, Procter & Gamble, São Paulo, Brazil) was applied around the stoma to prevent dermatitis (Fig 2B). Diaper changes and hygiene protocol were continued in this manner for the entire life of the dogs following surgery. Due to the perceived risk of introducing bacteria into the ureter by catheterization of the cutaneous ureterostomy stoma, urinalyses or urine cultures were not obtained in any of the dogs after surgery. Instead, dogs were monitored using complete blood counts, serum biochemistry panels and ultrasonographic examination of the urinary tract. Due to the retrospective nature of the study, follow-up appointments after suture removal were performed at varying frequency as documented in the following case reports. However, all dogs were followed until death. Owners were contacted at the time of writing this report and were asked to estimate quality of life of their dog after surgery (poor, fair, good, excellent), their satisfaction with the procedure (unsatisfied, somewhat satisfied, very satisfied), and whether they would do the surgery again in another pet (yes or no).

2.3 | Case 1

An 8-year-old 3.2 kg male mixed breed dog was presented to the Veterinary Teaching Hospital at UNESP, Brazil, with a history of hyporexia, dysuria, hematuria, and episodic vomiting. Complete blood count and biochemical profile were within reference intervals (creatinine 1.1 mg/dL [reference, 0.5–1.4] and urea 50 mg/dL [reference, 15–65]). Urinalysis was performed and cytology was suggestive of transitional cell carcinoma, with atypical cells and a high nuclear/cytoplasmic ratio. Ultrasound imaging revealed a trigonal mass (4.65 × 3.87 cm), bilateral hydronephrosis, and mild hydronephrosis. Thoracic radiographs showed no evidence of lung metastasis. Open bladder biopsy through a caudal midline laparotomy confirmed a diagnosis of transitional cell carcinoma.

Thirty days after piroxicam therapy was initiated, additional tumor growth was noted, but the size of the renal pelvis and ureter were unchanged. No evidence of prostatic or lymph node invasion were detected. Cutaneous ureterostomy, radical cystectomy, and concurrent prostatectomy were performed. The prostatic artery was ligated near its origin from the internal pudendal artery and the prostatic veins were ligated at their insertion into the common iliac vessels. The urethra was ligated and divided 2 cm caudal to the prostate. The vas deferens was ligated and divided bilaterally. Then, the bladder, membranous urethra, and prostate were resected en bloc, along with surrounding peritoneal and retroperitoneal fat. Ureteral and urethral margins were free of neoplastic tissue, confirming complete resection of the transitional cell carcinoma. No evidence of metastasis was found in the sublumbar lymph nodes.

During the immediate postoperative period, analgesia was provided with morphine (0.3 mg/kg IM, as needed). Cephalexin (30 mg/kg orally every 12 hours) and metronidazole (10 mg/kg orally every 12 hours) were prescribed for 15 days. Anti-inflammatory and analgesic therapy was prescribed for 4 days after discharge (meloxicam 0.1 mg/kg orally every 24 hours and tramadol 2 mg/kg orally every 12 hours). Mild edema and hemorrhage were noted from the catheterized ureterostomy sites for 2 days after surgery.
These resolved with local wound care consisting of frequent diaper changes (every 6–8 hours), saline cleansing, and application of zinc oxide-lanolin cream.

Postoperative chemotherapy was declined by the client and the dog was re-evaluated at 3 and 6 months after surgery. Complete blood count and biochemical profile were within reference ranges at both re-evaluations. Abdominal ultrasound showed no evidence of hydronephrosis. One year and 4 months (498 days) after surgery the dog was hit by a car and died. No necropsy was performed. On phone follow-up, the owner was very satisfied with the surgery and would perform the same surgery in another pet, if necessary. The quality of life for the dog was considered excellent.

2.4 | Case 2

An 11-year-old 59 kg intact male Fila Brasileiro dog was presented to the Veterinary Teaching Hospital at UNESP, Brazil, with a history of dysuria and hematuria. Complete blood count and biochemical profile were within reference intervals. A mass was noted in the bladder trigone (7.3 × 4.0 cm) on ultrasound examination. There was no evidence of prostatic or lymph node invasion. Mild bilateral hydroureter and hydronephrosis were present, but creatinine (1.1 mg/dL) and urea (50 mg/dL) were within the reference ranges. Thoracic radiographs showed no evidence of lung metastasis. Exploratory laparotomy and open bladder biopsy confirmed a diagnosis of transitional cell carcinoma. Urinalysis showed mildly increased cellularity and no bacterial growth was obtained on urine culture from a cystocentesis sample obtained during the surgical procedure.

Cutaneous ureterostomy and radical cystectomy with prostatectomy and lymphadenectomy were performed as described. During the immediate perioperative period, analgesia was provided with morphine (0.3 mg/kg IM, as needed). Amoxicillin-clavulanate (25 mg/kg orally every 12 hours for 14 days) and tramadol (4 mg/kg orally every 12 hours for 5 days) were prescribed. Firocoxib (2.2 mg/kg orally once daily) was administered daily during the first month, then every 48 hours for 3 months. Ureteral and urethral margins were free of neoplastic tissue, confirming complete resection of the transitional cell carcinoma. No evidence of metastasis was found in the sublumbar lymph nodes.

After surgery, pitting edema was observed in left hind limb, which was resolved in 3 days after treatment with massage and warm compresses. Hemorrhage from the ureteral stomas and catheter site were reported during the first 3 days after surgery. Urine scald (redness, swelling, and inflammation) occurred on the ventral abdominal skin 5 days after surgery. Further questioning revealed that the client was experiencing difficulty in changing the diapers as recommended, due to the aggressive temperament of the dog. After re-instituting diaper changes every 8–12 hours, the dermatitis resolved within 5 days. Complete blood count and biochemical parameters were within reference ranges at 1 month after surgery. Adjuvant chemotherapy was declined by the owner after surgery and follow-up was limited to phone contact after this time. Euthanasia was performed 6 months (193 days) after surgery due to aggression towards the owner and inability to perform nursing care. No necropsy was performed. On phone follow-up the owner was very satisfied with the surgical procedure and the lack of complications and said that quality of life was difficult to assess for this dog due to a larger behavioral problem. The owner noted that nursing care was difficult because the dog was very aggressive. Despite the difficulties described, this owner expressed that they would perform the same surgery in another pet, if necessary.

2.5 | Case 3

A 10-year-old 4 kg spayed female Maltese dog was presented to the Veterinary Teaching Hospital at UNESP, Brazil, with a history of dysuria and hematuria. Complete blood count and biochemical profile were within reference intervals (creatinine 1.3 mg/dL and urea 65 mg/dL; 15–65 mg/dL were in the upper end of the reference ranges). On ultrasound examination, bilateral hydronephrosis (left > right) and mild increase in echogenicity were noted. Both ureters were dilated. Tumor size was 0.6 × 0.5 cm (trigonal area) at initial examination and increased despite 30 days of piroxicam therapy. No lymphadenopathy was detected. Thoracic radiographs were normal. Radical cystectomy, lymphadenectomy, and cutaneous ureterostomy were performed without intraoperative complications. During the postoperative period analgesia was provided with morphine (0.3 mg/kg IM as needed). Cephalexin (30 mg/kg orally every 12 hours for 14 days) and tramadol (3 mg/kg orally every 12 hours for 5 days) were prescribed. Histopathology showed that ureteral and urethral margins were clean, but metastasis to the resected sublumbar lymph nodes was identified, despite normal appearance on previous ultrasound examination.

Peristomal edema and mild hemorrhage occurred during the first 2 days after surgery, but resolved with standard stoma care and hygiene. Firocoxib (2.2 mg/kg orally once daily) was used continuously during the first month after surgery and every 48 hours for the next 3 months. Adjuvant chemotherapy was begun at the time of suture removal using doxorubicin (30 mg/m²) and carboplatin (250 mg/m²) every 21 days for a total of 4 cycles. After the end of the fourth chemotherapy cycle the dog was noted to have a normal appetite and activity level. Euthanasia was performed 1 year (369 days) after surgery due to development of respiratory signs and detection of lung metastasis on thoracic radiographs. No necropsy was permitted. On follow-up phone
call, the owner was very satisfied, rated the dog’s quality of life to be good, and stated that he would perform the same surgery in another pet, if necessary.

2.6 | Case 4

A 12-year-old 6 kg spayed female Maltese dog was presented to the Ribeirão Preto Hospital, Brazil, with a history of dysuria, hematuria, and abdominal pain. A trigonal mass (4.1 × 2.6 cm) affected more than 50% of bladder and failed to respond to piroxicam therapy. No lymph node enlargement was detected on preoperative ultrasound exams. Hydroureter and mild hydronephrosis was noted, along with moderate azotemia (creatinine 2.5 mg/dL and urea 75 mg/dL). Thoracic radiographs showed no evidence of lung metastasis. Urinary bladder biopsy was performed at an initial surgery and incidental cystoliths were removed at that time. Ten days after the initial surgery, radical cystectomy, cutaneous ureterostomy, and lymphadenectomy were performed. Biopsy results confirmed the presence of transitional cell carcinoma.

Definitive resection and ureterocutaneous anastomoses were performed as previously described. Histopathology of the terminal ureters and proximal urethra showed no evidence of neoplasia at the surgical margin. After surgery, enrofloxacin (5 mg/kg orally every 12 hours) and tramadol (2 mg/kg orally every 8 hours) were prescribed for 10 days. Anti-inflammatory drugs were prescribed for 4 days (meloxicam 0.1 mg/kg orally every 24 hours). Histopathology of the submitted tissues showed that clean margins were obtained for both ureters and the urethral resection. Metastatic transitional cell carcinoma was identified in the resected sublumbar lymph nodes. Although metastasis was diagnosed, adjuvant chemotherapy was declined by the owner after surgery.

Peristomal edema was reported for 3 days after surgery, but resolved with wound management (cleaning with saline solution and more frequent diaper changes). Abdominal pain and incoordination of the hind limbs were noted 47 days after surgery. Complete blood count and biochemistry panel revealed anemia (hematocrit 35.5%, reference 37–55), thrombocytosis (878,000/μL, reference, 180,00–480,00), and mildly increased alkaline phosphatase (190 U/L, reference, 20–150). Radiographs of the lumbar spine showed periosseous new bone formation at lumbar vertebrae 5–7 and S1 suggestive of bone metastasis. Euthanasia was recommended and necropsy confirmed the presence of metastatic carcinoma in the lumbar spine. No lung metastasis was detected. Mild hydrourerter and hydronephrosis were noted bilaterally, though there was no evidence of pyelonephritis. On a follow-up phone call, the owner classified the dog’s quality of life as fair during the postoperative period. While the owner stated that they knew that the disease had metastasized to the local lymph nodes and that survival time would likely be shorter, they remained very satisfied with the procedure and said that they would perform the same surgery in another pet, if necessary.

3 | DISCUSSION

This small retrospective case series supports that cutaneous ureterostomy is a viable technique for urinary diversion after complete cystectomy in dogs. Aside from 1 dog that showed aggressiveness towards the owner, maintenance of dogs after surgery was surprisingly simple and clients perceived their dog’s quality of life to be good. While radical cystectomy and lymphadenectomy may be expected to increase survival times, the small number of cases in this report, the retrospective design, and the lack of consistent use of adjunctive chemotherapy prevents us from making any strong conclusions regarding the potential survival benefits for this procedure when compared to other methods of treatment.

Although indications for radical cystectomy have been proposed for transitional cell carcinoma in people, there is no consensus on how to determine which patients are candidates for cystectomy. Some authors propose that muscle invasion on histopathology is an indication of aggressive biological behavior and therefore to pursue radical resection in people with transitional cell carcinoma; however, 10–30% of initially non-muscle invasive cancer will progress to muscle-invasive disease. Factors currently used to determine the suitability of human patients for surgery are age, functional status, nutritional status, cognitive status, and medical comorbidities. In our canine study, the decision to pursue radical cystectomy was based on tumor location (trigonal) and progressive dysuria and hydronephrosis despite medical management with piroxicam. It should be noted that radiation therapy and interventional procedures such as ureteral stenting are not widely available in Brazil and there were no other practical options for pursuing care of these dogs aside from urinary bypass surgery. Dogs with the most difficult to manage tumors were selected for this study. However, the fact that we selected dogs with documented hydroureter may have actually decreased the technical difficulty associated with the procedure, because the dilated ureteral lumen was easier to suture and may have been less likely to obstruct.

In people, a similar method of cutaneous ureterostomy and radical cystectomy has been described. In that study, a double-J ureteral stent was placed in all patients, with planned replacement every 6 months. Antibiotic prophylaxis was maintained for life. In our series of dogs, ureteral patency was maintained without the need to maintain a permanent ureteral stent, significantly simplifying postoperative care and avoiding the need for follow-up procedures. It is important to note that incontinence is an expected outcome
of cutaneous ureterostomy and this must be explained to the pet owner prior to surgery. In addition, owners should be counseled that this procedure may be contraindicated in dogs intolerant to direct owner handling to maintain hygiene as described in the postoperative care section. Use of disposable diapers and diaper rash ointment allowed a low cost and simple method to maintain hygiene after discharge from the hospital, and probably helped avoid self-injury. Interestingly, no clinical or biochemical signs of urinary tract infection were detected in these dogs after surgery, although standard assessment of urinalyses or culture were not considered practical due to the potential risk of percutaneous catheterization of the ureteral stomas. Instead, dogs were monitored by noninvasive ultrasound of the urinary tract, complete blood count, and serum biochemistry panels at each follow-up visit. While it is recognized that this is not an ideal method to detect subclinical urinary tract infection, the clinicians involved in the care of these animals felt that the risks of ureteral stoma catheterization outweighed the benefits when dogs were not showing clinical or biochemical evidence of pyelonephritis.

Radical cystectomy in people is associated with recurrence-free survival rates of 68 and 66% at 5 and 10 years, respectively.\(^2\) While ureterocolic anastomosis and intestinal reservoir surgeries in dogs led to important adverse effects such as severe vomiting and neurologic signs, more clinically acceptable outcome was described after total cystectomy and ureteral transplantation to the prepuce\(^13\) or vagina.\(^12,13\) The majority of protocols used in veterinary patients focus on palliation using standard chemotherapy and piroxicam,\(^16\) intravesical chemotherapy,\(^17\) metronomic therapy,\(^18\) or radiation therapy,\(^5,19\) although no studies have documented improved outcomes compared to piroxicam and chemotherapy alone.\(^19\)

Median survival time in our case series (276.8 days) was similar to chemotherapy with vinblastine (299 days),\(^16\) or to piroxicam and mitoxantrone therapy (326 days)\(^19\); however, it is important to explain that all dogs in our study failed to respond to piroxicam treatment and only 1 dog received postoperative chemotherapy. In another case series, 10 dogs undergoing radical cystectomy with urinary diversion to the vagina or prepuce experienced prolonged survival (385 days median survival time) and only 3 of these dogs received chemotherapy.\(^13\) Several dogs in that study experienced major postoperative complications including pyelonephritis (3 dogs), dehiscence of the ureterostomy and peritonitis (2), oliguria (2), azotemia (1), and ureteral obstruction (1).\(^13\) Thus, while no randomized controlled studies have evaluated radical cystectomy and urinary bypass in comparison to other approaches,\(^5,6\) prolonged survival in individual dogs in our report and in those of others\(^13\) suggests that radical cystectomy and urinary bypass technique may result in prolonged survival in some dogs, even without adjunctive therapy.

Completeness of local resection and presence of lymph node metastasis are major prognostic indicators in transitional cell carcinoma.\(^3,15\) While we were fortunate to obtain clean margins in all dogs in this series using ultrasound findings and surgical palpation, uroendoscopy would be a preferred method to plan the areas of surgical resection. Ideally, a systematic endoscopic survey of the urethra and bladder should be performed in all dogs with transitional cell carcinoma.\(^20\) Localized or diffuse erythematous areas should raise a suspicion of carcinoma\(^15\) and may affect planned margins of surgical excision.

In conclusion, based on our limited case series, radical cystectomy and cutaneous ureterostomy can be successfully performed in dogs with naturally occurring transitional cell carcinoma in the bladder trigone. Postoperative management and quality of life were considered acceptable by most owners, but docility and easy handling should be potential criteria for pursuing this surgery due to the need for life-long hygiene control using diapers and creams applied to the stomas. Long-term effects of radical cystectomy and cutaneous ureterostomy on survival and local recurrence will need to be evaluated in a larger prospective study.

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DISCLOSURE
The authors declare no conflicts of interest related to this report.

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