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Ureteral Papilla Implantation as a Technique for Neoureterocystostomy in Cats Undergoing Renal Transplantation: 30 Cases

Brian J. Sutherland, Jonathan F. McAnulty, and Robert J. Hardie

Department of Surgical Sciences, School of Veterinary Medicine, University of Wisconsin-Madison, Madison, Wisconsin

Corresponding Author
Robert J. Hardie
Department of Surgical Sciences, School of Veterinary Medicine, University of Wisconsin-Madison
2015 Linden Drive
Madison, WI 53706
robert.hardie@wisc.edu

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Objective: To describe the clinical outcome of donor and recipient cats undergoing ureteral papilla harvest and implantation as a technique for neoureterocystostomy in clinical kidney transplant.

Study Design: Retrospective case series.

Animals: Donor (n=31) and recipient (n=30) cats that underwent kidney harvest and transplantation using ureteral papilla implantation technique for neoureterocystostomy.

Methods: Medical records for donor and recipient cats presented to the University of Wisconsin Veterinary Teaching Hospital from January 2003 to December 2014 were reviewed. Data recorded included complete blood count, serum chemistry panel, surgical technique, diagnostic imaging results, short- and long-term complications, and anesthetic survival.

Results: All 30 recipients recovered from anesthesia. Four died within 24 hours and 26 survived to hospital discharge. Serum creatinine was within the reference interval by 72 hours in 22/26 cats (85%). Complications related to the ureteral papilla implantation technique were seen in only 1 cat (3%). Uroabdomen diagnosed on day 3 ultimately resolved over the following 24 hours without surgical intervention. All 31 donor cats survived to discharge. Four donors (13%) experienced mild, transiently increased serum creatinine.

Conclusion: Ureteral papilla implantation is a viable technique for neoureterocystostomy in cats undergoing kidney transplantation. Proposed benefits for the recipient include a less technically challenging anastomosis, decreased risk of ureteral obstruction at the anastomosis site, and reduced risk of leakage compared to previous reports. Benefits for recipients should be weighed against risks to donors, including a more complex ureteral harvest, increased surgical time, and potential injury or obstruction of the contralateral ureteral papilla.

Chronic kidney disease is a common diagnosis in domestic cats, with a reported incidence ranging from 4.5% to upward of 50%.1,2 Kidney transplantation is a well-accepted treatment for end-stage kidney disease with about 70% of cats surviving 1 year after surgery.3–14 Historically, neoureterocystostomy techniques have included the drop-in technique, and intravesicular and extravesicular mucosal apposition techniques.4,5,7,11,14 Although many advances have been made, complications associated with the neoureterocystostomy site are relatively common, including stricture, obstruction by granulation tissue, leakage, and dehiscence.5,7,10–12 The extremely small size of the normal feline ureter (≈0.4 mm luminal diameter) makes neoureterocystostomy using the transected end of the distal ureter technically very challenging and prone to postoperative complications. In an effort to minimize complications with the neoureterocystostomy, a new technique was previously described in which the entire ureteral papilla, including a 2–3 mm cuff of the bladder wall, was harvested from the donor and implanted in the recipient.13 The goal of this technique is to minimize neoureterocystostomy complications by providing a 2-layer appositional closure that does not require placement of sutures directly in the ureteral lumen, thereby reducing the risk of obstruction because of granulation tissue formation, stricture, leakage, or dehiscence.

The purpose of this study was to describe the clinical outcome of donor and recipient cats undergoing ureteral papilla harvest and implantation as a technique for neoureterocystostomy in clinical kidney transplant.

METHODS

All donor and recipient cats presented to the University of Wisconsin Veterinary Teaching Hospital from January 2003 to December 2014 were included in this study. Medical records of recipients were reviewed and data recorded included signalment, complete blood count and serum biochemistry values, diagnostic imaging (including thoracic
Surgical Technique

The left kidney was harvested in all cats using a previously described technique. Briefly, the kidney and ureter were dissected from the peritoneal and retroperitoneal attachments. Using an operating microscope, the ureter was dissected to the level of the bladder and the peritoneal tissue surrounding the ureteral papilla was removed. For cats in which the bladder was not moderately distended with urine, the bladder was distended with sterile saline to increase the separation between the two ureteral papillae before starting the resection. A circumferential incision was then made around the ureteral papilla including a 2–3 mm cuff of bladder wall (Fig 1). The circumferential incision was typically performed in 2 stages. The first stage involved making an incision through the seromuscular layer using a #11 scalpel blade followed by an incision through the mucosa using microdissecting scissors. Incising the seromuscular layers first allowed the mucosa to bulge slightly from the bladder, making it easier to complete the circumferential incision and maintain a consistent 2–3 mm cuff of bladder wall. The mucosal incision was started lateral to the ureteral stoma and completed once both ureteral stomata were identified in order to avoid accidentally cutting too close to either the ipsilateral or contralateral ureteral stoma. In most cats, the ureteral stoma were cannulated with a small length of 4-0 polypropylene suture to help identify the stoma and maintain orientation of the papilla during resection. After removing the ureteral papilla, the bladder was closed in 2 layers using 6-0 polyglactin 910. The mucosa was closed using a simple continuous pattern and the seromuscular layer was closed using either a simple continuous or simple interrupted pattern.

After the bladder was closed, the renal artery and vein were dissected to the level of the aorta and vena cava, respectively. The vessels were clamped and the kidney was removed. The kidney was immediately flushed with cold (10°C), sucrose phosphate preservation solution (1,000 IU/L heparin, 53.6 mmol/L Na₂HPO₄, 15.5 mmol/L NaH₂PO₄, 140 mmol/L sucrose in distilled water, pH 7.2) by cannulation of the renal artery with an 18 gauge Teflon IV catheter (Covidien, Minneapolis, MN). The kidney was flushed until the outflow from the renal vein was clear and the kidney was slightly turgid and uniformly pink in color, indicating that it had been adequately perfused (~20 mL). The kidney was then placed in a sterile bowl and submerged in the same cold preservation solution surrounded by an ice bath. The renal artery and vein were then double ligated using 4-0 silk and the vascular clamps removed.

Kidney Implantation

The kidney was implanted by an end-to-side anastomosis of the renal vein and artery to the caudal vena cava and aorta, respectively, and using an operating microscope. The respective areas of aorta and vena cava caudal to the native left kidney were dissected free from the peritoneum and any overlying adventitia removed with microdissecting scissors. The vena cava was partially occluded using a vascular aneurysm clamp and a circular venotomy made with microdissecting scissors. The venous anastomosis was completed with 2 simple continuous suture lines (dorsal and ventral) using 10-0 polyester. After the venous anastomosis, the aorta was partially occluded using a Satinsky clamp and a circular arteriotomy made with an arteriotomy clamp and #11 scalpel blade. The arterial anastomosis was completed with 2 simple continuous suture lines (dorsal and ventral) using 8-0 nylon. After completing the anastomoses, the clamps were released and the sites evaluated for hemorrhage. If any leaks were identified, additional simple interrupted sutures were placed to reinforce the anastomosis. For cats that developed spasm of the renal artery, chlorpromazine (0.02–0.05 mL of 25 mg/mL) was topically applied to the renal artery to minimize spasm of the vessel and promote blood flow.

Figure 1 Illustration of ureteral papilla harvest and implantation technique. (A) The proposed incision line encircling the ureteral papilla including a 2–3 mm cuff of bladder wall. (B) Closed cystotomy incision. (C) Start of the mucosal apposition. (D) Final result after implantation. (From Hardie, R. J., Schmiedt, C., Phillips, L. and McAnulty, J. (2005), Ureteral Papilla Implantation as a Technique for Neoureterocystostomy in Cats. Veterinary Surgery, 34: 393-398. doi: 10.1111/j.1532-0292.2005.00060.x, reprinted with permission.)
Neoureterocystostomy

The ureteral papilla was implanted into a circular defect created in the bladder using a 4 mm skin biopsy punch. The papilla was sutured to the bladder in 2 layers (mucosa to mucosa and seromuscularis to seromuscularis) using simple continuous patterns of 8-0 polyglactin 910 (Fig 2). After completing the anastomosis, the site was tested for leaks by distending the bladder with sterile saline. In the first 8 cats, the ureteral papilla was implanted on the apex of the bladder and the redundant length of the ureter was laid along the left dorsolateral body wall, avoiding any kinks or excessive tension on the anastomosis (Fig 3A). In the subsequent cats, the ureter was passed dorsal to the bladder through a fenestration made in the lateral ligament of the bladder between the contralateral ureter and urethra and implanted on the ventral surface of the bladder. This approach was selected in an attempt to straighten the redundant length of ureter and minimize any potential for kinks as it was placed along the dorsolateral body wall (Fig 3B).

Postoperative Care

After surgery, recipients were monitored in the critical care unit and supportive care was provided based on the individual cat’s status. Typical monitoring included vital signs, PCV and total solids (every 6–24 hours), renal function (electrolytes, BUN, and creatinine every 12-48 hours), indirect blood pressure (hourly), voided urine output, and blood cyclosporine levels (every 24 hours). Typical supportive care included IV fluids (balanced electrolyte solution 50 mL/kg/day), systemic analgesia (buprenorphine HCl, [0.01–0.03 mg/kg IV or sublingual], butorphanol tartrate [0.2–0.4 mg/kg IV], or oxymorphone HCl [0.025–0.05 mg/kg IV] every 4–6 hours, or fentanyl [constant rate infusion, 2–4 μg/kg/hr]), and IV antibiot- 

Figure 2  Intraoperative image of the ureteral papilla implanted on the apex of the bladder.

ics (cefazolin [22 mg/kg every 8 hours], enrofloxacin [5 mg/kg every 24 hours], or doxycycline [3–5 mg/kg every 12 hours]).

The immunosuppressive protocol included cyclosporine (1–5 mg/kg orally every 12 hours) and prednisolone (0.25 mg/kg orally every 12 hours) with a target trough cyclosporine level of 400–600 ng/mL. Once cyclosporine levels stabilized in the target range, ketoconazole (8 mg/kg orally every 24 hours) was added to the protocol and cyclosporine was switched to once daily administration (with the same target trough level). Approximately 6–12 months after surgery, the target trough cyclosporine level was reduced to 250–300 ng/mL.

Renal function (BUN, creatinine, and electrolytes) was monitored daily for 5–7 days (unless otherwise clinically indicated), then approximately every second or third day for the remainder of hospitalization. Whole blood cyclosporine levels were monitored by high-performance liquid chromatography daily for 5–7 days and then approximately every second or third day until stable within the target range.

Ultrasound evaluation of the transplanted kidney was performed within the first 3 days after surgery to assess for kidney perfusion, urine production by observation of ureteral jet with color flow Doppler, or evidence of ureteral obstruction (Fig 4). Values recorded included kidney size and the dimensions of the renal pelvis and ureter if hydronephrosis or hydroureter were present. Intravenous or direct pyelography was performed in cats with persistently or acutely elevated serum creatinine and evidence of hydronephrosis and hydroureter to determine if ureteral obstruction was present.

Donor cats were monitored in the critical care unit for 24–72 hours after surgery and vital signs and urine output recorded at least every 8 hours. Cats received maintenance crystalloid fluid therapy (60–80 mL/kg/day IV) while in the critical care unit and were treated with opioids

Figure 3  Illustration depicting the modification of the technique. (A) The ureter was initially implanted directly at the apex. (B) To straighten the redundant length, the ureter was passed dorsal to the bladder and through the contralateral lateral ligament and implanted on the ventral aspect of the bladder.
(buprenorphine HCl [IV or sublingual] or oxymorphone HCl [IV or IM] every 4–6 hours, fentanyl 2–5 µg/kg/hr constant rate infusion, or butorphanol tartrate [0.05–1 mg/kg IM every 4–6 hours]) as needed for postoperative analgesia.

Recipient cats were discharged with instructions to have blood work (cyclosporine, serum creatinine, PCV and total solids, ± serum chemistry panel and electrolytes) rechecked weekly for 1–4 weeks, then every 1–4 months to evaluate kidney function and ensure that cyclosporine levels were maintained in the target range. Donor cats were discharged with instructions to continue routine wellness examinations and evaluate kidney function every 6–12 months.

RESULTS

Recipient Cats

Thirty cats underwent kidney transplantation using the ureteral papilla implantation technique for neoureterocystostomy during the study period. Recipients included 16 castrated males and 14 spayed females, with 24 domestic shorthair and 1 each of Siamese, Persian, Bombay, Scottish Shorthair, Burmese, and Abyssinian breeds. Median age was 8.5 years (range 3–18). Median preoperative serum creatinine was 4.65 mg/dL (range 2.5–10.9). Comorbidities identified included compensated cardiac disease in the form of hypertrophic cardiomyopathy (5 cats), mitral valve regurgitation (4), tricuspid valve regurgitation (1), mitral and tricuspid valve regurgitation (1), sick sinus syndrome (1), and unspecified heart disease (4 cats), hypertension (3), pemphigus (1), and diabetes mellitus (1). One cat had undergone kidney donation (using the ureteral papilla harvest) 4 years before kidney transplantation.

All 30 recipients recovered from anesthesia. Four died within 24 hours of surgery. Causes of death included hemorrhage from the vascular anastomosis site and from an undetermined site (2 cats), heart failure and subsequent cardiac arrest (1), and undetermined reason (1; necropsy declined by owner). All 26 other cats were discharged from the hospital. Median duration of hospitalization was 29 days (range 14–53).

Median time to creatinine normalization was 25.5 hours (range 16–714). Thirteen cats (50%) normalized on the first postoperative day (~16 hours after surgery), an additional 5 cats (for a total of 69%) normalized on the second postoperative day. An additional 4 cats normalized by the third postoperative day, making a total of 22/26 cats (85%) normalized within 72 hours of surgery. The 4 remaining cats experienced creatinine normalization on days 7, 9, 21, and 23 post-transplant.

Ultrasound examination of the transplanted kidney and bladder was performed between days 1 and 3 after surgery in 21 cats. The ureteral papilla was identified as a button-like projection within the bladder in all cats. A urine jet arising from the implanted ureter was identified in 11 cats using color flow Doppler. Kidney perfusion using Doppler measurements was subjectively assessed as excellent, good, or adequate in 8 cats.

Short-Term Complications. Short-term complications were reported in 8 cats (30%) and included heart failure secondary to fluid overload (2 cats), transient hind limb neuropathy (bilateral plantigrade stance [1] and paresis and absent proprioception [1]), unilateral hind limb edema and pain (1), bacterial pneumonia (1), renal vascular thrombosis (1), and uroabdomen (1). For the 1 cat with renal vascular thrombosis, the diagnosis was made using Doppler ultrasound and IV pyelography (IVP) on postoperative day 10. No blood flow was noted on Doppler ultrasound of the transplanted kidney and no contrast reached the kidney on IVP. The cat subsequently underwent a second transplant 1 month later with normalization of serum creatinine on the first postoperative day (creatinine 2.7 mg/dL preoperatively and 1.6 mg/dL day 1 postoperatively).

For the 1 cat with uroabdomen, the diagnosis was made on postoperative day 3. After an initial decrease in creatinine (3.1 mg/dL) on day 2 postoperatively, the creatinine subsequently increased (5.1 mg/dL) on day 3. Ultrasonic examination of the transplanted kidney and bladder was performed that revealed a mass effect in the region of the ureteral papilla along with dilation of the proximal ureter (3.3 mm) and the presence of free abdominal fluid. The diagnosis of uroabdomen was made based on comparison of creatinine and potassium concentrations of abdominal fluid with that of the blood (abdominal fluid creatinine 8.8 mg/dL and potassium 13.4 mmol/L vs. blood creatinine 5.1 mg/dL and potassium 5.1 mmol/L). The following day (day 4), creatinine normalized (1.9 mg/dL) without intervention and the cat was discharged 24 days later with normal kidney function (creatinine 0.6 mg/dL).
Long-Term Complications. Long-term complications occurred in 8 cats (30%). Five cats (19%) were diagnosed with retroperitoneal fibrosis and secondary ureteral obstruction 2–7 months after transplantation. All 5 cats with retroperitoneal fibrosis were reoperated for ureteral obstruction. Two of the 5 cats died in the immediate postoperative period and 3 survived to discharge. Two of the 3 surviving cats developed recurrent episodes of ureteral obstruction and ultimately died 395 and 2,100 days after revision surgery, and 1 cat was lost to follow-up. Other long-term complications included graft rejection and infection. Two of 8 cats died on days 90 and 95 because of graft rejection because they were unresponsive to anti-rejection treatment (IV cyclosporine and prednisolone sodium succinate). One of 8 cats died because of graft pyelonephritis and secondary sepsis 1,095 days after transplantation.

For the 26/30 (86.7%) recipient cats that survived to discharge, 4 were still alive at the time of manuscript preparation (range 467–3,754 days post-transplantation). Six cats died because of renal-related disease, including progressive renal failure (2 cats) on days 120 and 730, graft rejection (2 cats) on days 90 and 95, graft pyelonephritis and sepsis (1 cat) on day 1,095, and ureteral obstruction secondary to ureterolith formation (1 cat) on day 1,000. Eleven cats died of causes not directly related to kidney disease. The causes of death included heart failure (2 cats), lymphoma (2), and a single case of each of the following: pneumonia, colonic carcinoma, diabetes mellitus, liver failure, and liver neoplasia. As described above, 2 of the cats that underwent a revision surgery for retroperitoneal fibrosis experienced cardiac arrest and died within 24 hours of surgery. Five cats were lost to follow-up and died of unknown causes. Overall median survival time for the 26 cats that were discharged was 605 days (range 25–3,301).

Donor Cats

Thirty-one donor cats (1 cat required 2 donors because of second transplant) underwent the ureteral papilla harvest technique during the study period. Median age was 12.5 months (range 6–61). There were 24 males (77%) and 7 females (23%). Breeds included 30 domestic short hair cats and a single Scottish Shorthair cat. Before kidney donation, all cats were considered to be free of comorbidities and have normal kidney function based on serum creatinine, urine specific gravity, and radiographic assessment of kidney size and shape. Median preoperative creatinine was 1.4 mg/dL (range 1.0–1.7; reference interval, 0.9–2.1). All donor cats survived to hospital discharge. Complications specifically related to the ureteral papilla harvest technique occurred in 4 cats (13%). All 4 cats experienced mild elevation in serum creatinine in the immediate postoperative period. Maximum creatinine values were 2.2 mg/dL (cats 1 and 2), 2.3 mg/dL (cat 3), and 3.0 mg/dL (cat 4). For cats 1 and 3, creatinine was normalized on postoperative days 3 and 15, respectively. For cat 4, creatinine progressively increased from 1.7 mg/dL preoperatively to 3.0 mg/dL on day 8 postoperatively. Ultrasound of the kidney and ureter on day 10 revealed normal renal pelvis and ureter dimensions and no other indication of ureteral obstruction. Follow-up creatinine on days 14, 1,218, and 1,610 were 2.7, 1.6, and 2.2 mg/dL, respectively. For cat 2, follow-up creatinine was not recorded. The recipient that previously underwent unilateral nephrectomy as a donor was not one of these 4 cats that experienced postoperative elevation in creatinine.

DISCUSSION

The results of our study indicate that ureteral papilla implantation is a viable technique for neoureterocystostomy in cats undergoing kidney transplantation. With this technique, the majority (85%) of recipients experienced rapid normalization of serum creatinine and only 1 cat experienced complications directly related to the ureteral papilla implantation technique (uroabdomen). However, a mild, transient increase in serum creatinine was noted postoperatively in 4 donor cats (13%). This highlights the potential for complications like swelling and inflammation at the harvest site obstructing urine flow in the donor that must be considered when using this technique.

Ureteral papilla implantation was developed to reduce the challenge of anastomosing the transected end of the distal ureter by including the ureteral papilla and a 2–3 mm cuff of bladder wall. The technique was previously described in an experimental study involving 5 cats and has several reported advantages including a less technically challenging ureteral anastomosis, the elimination of sutures placed directly in the lumen of the ureter, and the reduced risk of leakage or dehiscence provided by the 2-layer appositional closure.13

Sutting the ureteral papilla is less technically challenging than the transected end of the distal ureter because of its larger size and the ability to place sutures in the cuff of bladder wall several millimeters away from the stoma. Although not specifically recorded in these cats, it was our impression that the surgical time for ureteral papilla implantation was substantially less than that required for the intravesicular mucosal apposition technique that was used in our previous transplant cases. Ureteral papilla implantation allows for a 2-layer closure with direct apposition of the mucosa and seromuscularis of the papilla to the mucosa and seromuscularis of the bladder. This anastomosis of anatomically similar tissue layers provides a robust closure that helps to minimize risk for leakage or dehiscence. Ureteral papilla implantation also eliminates sutures placed directly in the lumen of the ureter, thereby minimizing the risk for obstruction from swelling or granulation tissue formation at the anastomosis site.

In a series of 29 renal transplant cases in which the intravesicular mucosal apposition technique was used for neoureterocystostomy, 4 cats (13.7%) developed postoperative complications because of leakage and uroabdomen.10 Similarly, in 2 other studies involving an extravesicular neoureterocystostomy technique and the intravesicular mucosal apposition technique, 2 of 5 and 1 of 14 cats, respectively, developed uroabdomen because of leakage or dehiscence of the anastomosis site.5,11 In our study, uroabdomen because of suspected leakage from the anastomosis site was documented in only 1 cat. Analysis of the abdominal fluid was consistent with urine. Although cesarean delivery was associated with uterine dehiscence in some cases, the technique proved successful in others. It is important to note that the technique described in this study was used with caution due to concerns about leakage or dehiscence. The results of our study indicate that ureteral papilla implantation is a viable technique for neoureterocystostomy in cats undergoing kidney transplantation.
pyelography was not performed to confirm a specific site of leakage. The definitive cause for uroabdomen in this cat was never confirmed; however, the ultrasound findings were suspicious for some degree of partial ureteral obstruction and possible swelling of the implantation site that may have led to transient urine leakage.

The majority (85%) of cats in our study experienced normalization of creatinine within 3 days of surgery. Rapid normalization of creatinine supports the idea that ureteral papilla implantation minimizes disruption to normal urine flow immediately after surgery and does not result in significant inflammation or swelling that would contribute to postrenal azotemia. Similar results were seen in the experimental study investigating ureteral papilla implantation in which only a mild transient elevation in creatinine was seen in 3 cats on the first postoperative day, lasting less than 24 hours, and remaining normal for the duration of the study. In contrast, a study investigating 3 different neoureterocystostomy techniques utilizing the transected end of the distal ureter in 15 normal cats (without autotransplant) found that all cats developed elevated creatinine levels (4.9–10.4 mg/dL for the 3 different techniques) peaking day 3 after surgery and remaining elevated for 5–50 days. Since only a neoureterocystostomy was performed in these cats, the elevated creatinine levels were considered to be the result of obstruction or other complications associated with the ureteral anastomosis technique.

The rapid normalization of creatinine seen in our cats was also likely aided by perfusion of the kidney with cold sucrose phosphate preservation solution immediately after harvest. Cold preservation limits nephron loss because of ischemic injury and its use has been shown to contribute to early graft function in cats undergoing kidney transplantation. The benefits of cold preservation are highlighted in a study that specifically evaluated the effects of warm ischemia (without cold preservation) on kidney function using an autotransplant model (without transection and re-implantation of the ureter) in 6 normal cats. In this study, mean graft warm ischemia time was 52 minutes and all cats developed increased levels of creatinine (mean 3.2 mg/dL) peaking 24–48 hours after surgery and remaining elevated for 5 days. The elevated creatinine levels were a direct reflection of the degree of nephron injury that occurred from warm ischemia during autotransplantation.

In our study, 5 cats (19%) developed ureteral obstruction secondary to clinically significant retroperitoneal fibrosis. Initially, it was thought that the redundant length of ureter lying along the dorsolateral body wall predisposed the ureter to obstruction. After the first 2 cases of retroperitoneal fibrosis were diagnosed, a minor change in technique was made such that the ureter was passed dorsal to the bladder and through a fenestration made in the lateral ligament of the bladder between the contralateral ureter and urethra in an attempt to straighten the ureter. Subsequent to that modification, 3 more cases of retroperitoneal fibrosis with secondary ureteral obstruction were diagnosed suggesting that straightening the ureter does not necessarily prevent obstruction from retroperitoneal fibrosis should it occur. In a recent study of 138 feline kidney transplant cases, 29 (21%) developed clinically significant retroperitoneal fibrosis and subsequent ureteral obstruction. This similar rate of occurrence suggests that the development of retroperitoneal fibrosis is not likely related to the ureteral implantation technique.

When evaluating techniques for kidney harvest, resecting the ureteral papilla is technically more challenging than simple ligation and transection of the distal ureter and requires an operating microscope to adequately visualize both ureteral stoma during the procedure. Concerns with the technique include the additional surgical time required for the procedure and the potential for accidental injury or swelling of the contralateral ureteral stoma when either removing the papilla or closing the bladder leading to partial or complete obstruction of the ureter. For the 4 donor cats that experienced mild elevation in creatinine in the immediate postoperative period, all appeared to be urinating normally and so complete obstruction of the ureter secondary to swelling was definitively ruled out. However, since urine output was not precisely quantified, and since additional diagnostic imaging (IVP or Doppler ultrasound) was not performed in all of the cats, partial obstruction of the remaining ureter could not be definitely excluded and therefore may have been the most likely reason for the transient elevation in creatinine. For the single cat that underwent ultrasound examination on postoperative day 10, the absence of dilation of the renal pelvis or ureter would suggest that the elevation in creatinine was not because of obstruction of the ureteral stoma; however, it is still possible that at that point after surgery, ultrasonographically detectable dilatation had not yet occurred.

Limitations of our study include the lack of a contemporaneous control group utilizing the mucosal apposition technique for neoureterocystostomy for direct comparison. However, outcomes of the mucosal apposition technique are well described in the literature and, in our opinion, represent an established historical control. Ultrasound was not consistently performed in all cats as it is possible that some subclinical ureteral complications may have been missed. Also, the cause of death was not known for 5 of the cats, which may have had some effect on assessment of the overall outcome in this series of cats.

Our study demonstrates that ureteral papilla implantation is a viable technique for neoureterocystostomy in cats undergoing kidney transplantation. Ureteral papilla implantation is less technically challenging for the recipient and fewer postoperative complications directly related to neoureterocystostomy were encountered with this technique compared to those reported with other traditional implantation techniques. However, the benefits of this technique for the recipient must be weighed against the increase in surgical time and potential morbidity for the donor. Further research in the form of a direct comparison between the most commonly performed mucosal apposition technique could be performed to further elucidate the benefits of the ureteral papilla implantation technique.

REFERENCES


