



An application of sublingual mucosa to establish a new urination passage in male cats with complications after urethrostomy

Wanchart YIPPADITR¹⁾ and Atthaporn ROONGSITTHICHAI^{2,3)*}

¹⁾Kasetsart University Veterinary Teaching Hospital Hua Hin, Faculty of Veterinary Medicine, Kasetsart University, Prachuap Khiri Khan 77110, Thailand

²⁾Veterinary Clinic Research Unit, Faculty of Veterinary Sciences, Mahasarakham University, Maha Sarakham 44000, Thailand

³⁾Office of Academic Affairs, Faculty of Veterinary Sciences, Mahasarakham University, Maha Sarakham 44000, Thailand

ABSTRACT. This is the first study of using sublingual mucosae to establish a new urination passage in male cats suffering from complications from prior urethrostomy. In total, five domestic male cats afflicted with various complications, such as urethra stricture, scalding dermatitis, and urinary tract infection, after urethrostomy were included in the study. Sublingual mucosa was harvested to graft with abdominal muscles and further made into a tube connecting with the remaining urethra of the bladder at the cranial end and with the prepuce at the caudal end, serving as a new passage for urination. Postoperatively, all cats were alive and well recovered with no complications both in the oral cavity and at the surgical site. Radiography with contrast medium at two weeks and six months after surgery showed no leakage, stricture, or abnormality of the new urination passage. Moreover, all cats were able to urinate from the prepuce without any difficulties or signs of discomfort.

KEY WORDS: cat, complications, sublingual mucosa, urethrostomy

J. Vet. Med. Sci.

81(5): 771–775, 2019

doi: 10.1292/jvms.18-0571

Received: 24 September 2018

Accepted: 15 March 2019

Published online in J-STAGE:
26 March 2019

At present, feline urinary tract disorders are commonly found in a number of animal hospitals. Those disorders include idiopathic lower urinary tract diseases, urethral plugs, urolithiasis, neoplasms, and laceration or rupture of the urethra from accident or iatrogenic trauma [14]. Focusing on the urethra, major injuries are obstruction, laceration, and rupture. Besides, various clinical signs can be observed from urethral problems, depending on site, severity, and duration of the lesions [5]. In case of minor injuries, such as contusion or small laceration, urethral healing occurs spontaneously [3]. On the other hand, surgical managements are required in case of severe injuries, such as urethra rupture [9] since urine might leak into the peritoneal cavity, resulting in an azothemic status [5]. Primary surgical treatment for urethral rupture is an end-to-end anastomosis between two sides of the tattered urethrae [4]. However, a previous study, in dogs, reported that the anastomotic sites might have high tension, entailing the stricture and/ or rupture again which then requires further surgical corrections [12]. As a result, urethrostomy is one of the outstanding alternatives to repair these urethral damages [1]. Nonetheless, urethrostomy contributes to a great number of complications, including urine infiltration to the subcutaneous tissues, urinary incontinence, stricture of the urethral stoma, bleeding from the urethral mucosa, recurrence of lower urinary tract infection, chronic urine scalding dermatitis, and kinking of the urethra [6, 7, 13]. These complications considerably decrease the quality of the cat's life. Various supportive treatments are applied to the animals, aiming to relieve these complications; for instance, antibiotic treatment in case of urinary tract and skin infections, petroleum oil application around the surgical site in those with dermatitis, permanent urethral catheterization in the cat with urethral stenosis and urine scalding dermatitis, and so on. Furthermore, a previous study revealed that a number of male cats suffered excruciatingly from complications after urethrostomy; some were eventually euthanized [1].

At present, several studies have been conducted in order to correct the complications from urethrostomy and improve quality of life of the affected male cats. Moreover, the number of studies using tissue graft, especially sublingual mucosal graft, as a correction tool for complications after urethrostomy in male cats has been very scant. Consequently, the present study investigated the procedure of using sublingual mucosae for ameliorating complications after urethrostomy in male cats.

*Correspondence to: Roongsitthichai, A.: Atthaporn.r@msu.ac.th

©2019 The Japanese Society of Veterinary Science



This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial No Derivatives (by-nc-nd) License. (CC-BY-NC-ND 4.0: <https://creativecommons.org/licenses/by-nc-nd/4.0/>)

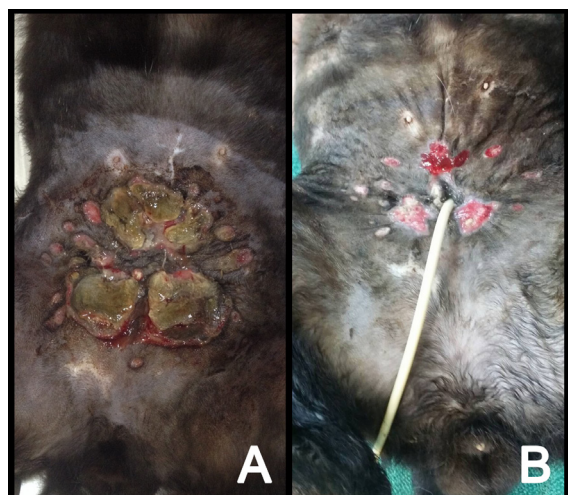


Fig. 1. Complications clinically seen after urethrostomy in the cat: chronic urethral stricture and chronic urine scalding dermatitis (A). After foley catheterization into the urethra for two weeks, the cat skin is stabilized and ready for surgery (B).

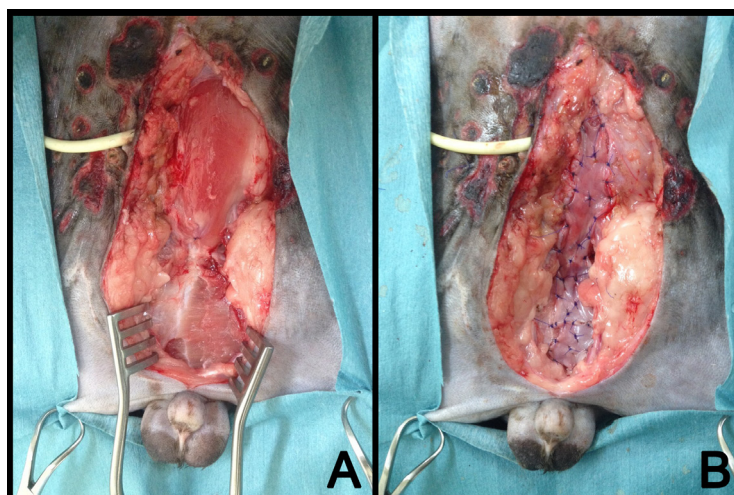


Fig. 2. The rectus abdominis muscles without muscle sheath are prepared for a graft bed (A). The sublingual mucosa is placed on and sutured with the graft bed (B).

MATERIALS AND METHODS

Animals

In total, five male domestic cats visited the Veterinary Teaching Hospital with the chief complaint of severe complications after urethrostomy, such as urethra stricture, dysuria, hematuria, chronic urine scalding dermatitis, and so on. All cats were examined by the same veterinarian; a surgical correction was required. Prior to surgery, blood samples were individually collected to examine complete blood count, serum creatinine, and alanine aminotransferase. In addition, a consent form was individually signed by all cat owners before commencing the study. Initially, the cats were stabilized by foley catheterization at the area of urethrostomy for approximately two weeks (Fig. 1), in order to prevent a skin irritation caused by urine, until those lesions were so ameliorative that surgery could be performed. Animal interventions were approved from the Institutional Animal Care and Use Committee, Maharakham University (IACUC-MSU) with the approval number 21/2018.

Surgical procedure

Surgery was performed twice with each cat. The first surgery was to harvest graft from the tongue and adhere to the abdominal muscles. The second surgery was to tubularize the graft and connect the tubular graft with the urethra near the urinary bladder and with the prepuce. Prior to both surgeries, the cats were administered with alfaxan® (2 mg/kg) for anesthetic induction, morphine (0.2 mg/kg) for pain management, and cephalexin (22 mg/kg) for antibiotic prophylaxis. Thereupon, they were positioned in dorsal recumbency. Finally, isoflurane was applied through the gas system in order to maintain the anesthesia.

The first surgery

The skin incision was performed at the ventral midline from the urethrostomy area to the base of the penis in order to prepare the graft bed at the rectus abdominis muscles. In addition, the distance between the urethrostomy area and base of the penis was measured to prepare the graft length from the tongue. Afterwards, fasciae of the rectus abdominis muscles were removed approximately 1.0 cm wide for the graft application (Fig. 2A).

In the oral cavity, sublingual mucosae were harvested from the ventral surface of the tongue (Fig. 3) according to the methods described by Barbagli *et al* [2]. Initially, the tongue apex was stitched with 5-0 polydioxanon (PDS) for manipulating tongue during the operation. Afterwards, the sublingual mucosae were harvested; a fat portion was thereafter removed. At the donor site, suturing was not performed; tongue bleeding was handled with gauze compression and natural wound healing was allowed.

At the abdominal wall, the sublingual mucosae were placed on the bed and sutured using 5-0 PDS with a simple interrupt pattern (Fig. 2B). Thereafter, the subcutaneous layer was closed using 4-0 PDS with a simple continuous pattern; 4-0 polyamide (Dafilon®) was used to close the skin layer with a cross mattress suture pattern. Afterwards, urine collection bag was connected to the foley catheter end in order to investigate the urination of the cat. Finally, the cat was individually kept in a cage, and appointed to the second surgery two weeks later.

The second surgery

The skin was incised at the same position as that of the first surgery. The adhesion between graft and its bed was grossly



Fig. 3. The harvest of sublingual mucosa from ventral surface of the cat's tongue.

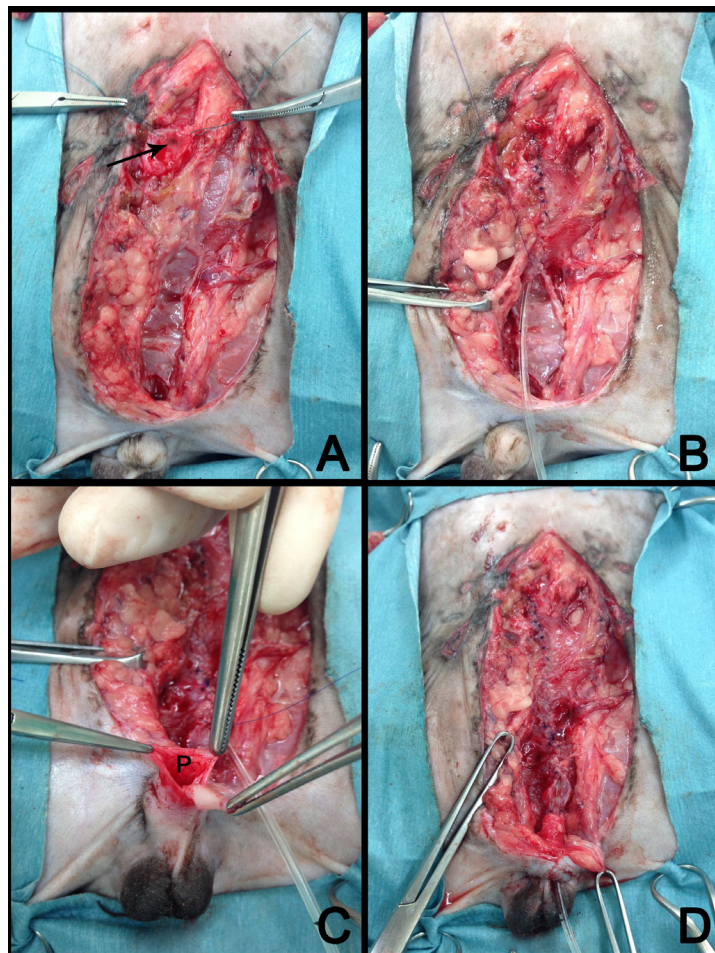


Fig. 4. The adhesion between graft and bed (A); an arrow indicates the remaining urethra connecting with the urinary bladder. The graft is tubularized from both longitudinal edges; the cranial end of the feeding tube is inserted into the urinary bladder instead of foley catheter. The cranial end of the graft tube is sutured with the remaining urethra connecting with the urinary bladder (B). The penis is identified and removed (C), leaving only the prepuce (P). The caudal end of the feeding tube is put through the prepuce in order to connect with a urine collection bag (D).

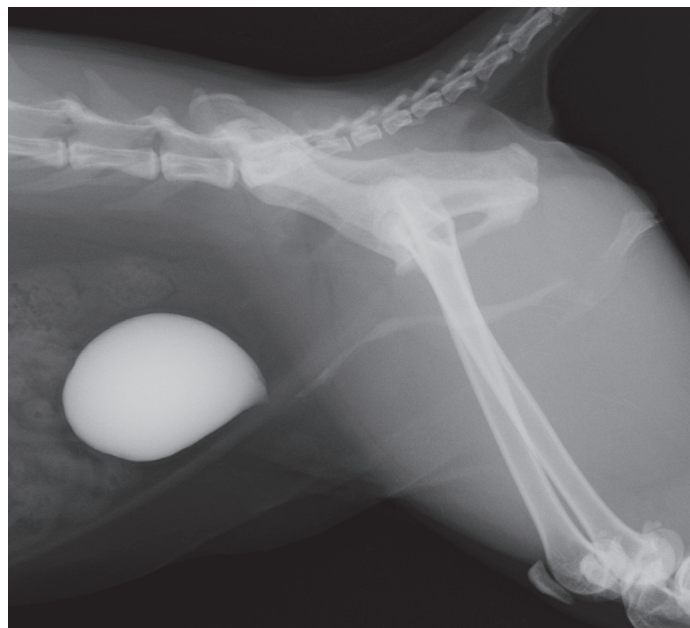


Fig. 5. Radiographic findings of a cat at six months after the second surgery show no leakage of the contrast medium from the bladder to the prepuce.

examined on the criterion of a solid union between graft and bed, including a pale pink color with an apparent vascularization on the graft [16] (Fig. 4A). Once the good adhesion was confirmed, a scalpel was used to carefully undermine along both longitudinal sides of the graft edges. After that, a feeding tube was placed onto the graft; the graft tubularization was then created by connecting both undermined edges longitudinally with 5–0 PDS using a simple interrupt pattern. Thereupon, the remaining urethra connecting with the bladder was identified, inserted with the cranial end of the feeding tube instead of foley catheter, and sutured with the cranial end of the graft tube with 5–0 PDS using a simple interrupt pattern (Fig. 4B). Later, the penis was identified and removed, leaving only the prepuce (Fig. 4C). The caudal end of the feeding tube was put through and stitched with the prepuce, leaving the remaining part outside the cat's body (Fig. 4D) in order to connect with the urine collection bag for investigating the urination after surgery. Finally, the caudal end of the graft tube was connected with the prepuce using 5–0 PDS with a simple interrupt pattern. The subcutaneous layer was sutured with 4–0 PDS using a simple continuous pattern; the skin was closed with 4–0 polyamide (dafilon®) using a cross mattress pattern.

Postoperative managements

After the first surgery, the cats were accommodated in individual cages and required to wear an Elizabethan collar in order to prevent self-mutilation of the surgical site until the second surgery. Besides, the urination was monitored from the urine collection bag on a daily basis until the second surgery. Medications were oral amoxy-clavulanic acid (15 mg/kg) for two weeks and subcutaneous injection of morphine every 4–6 hr for three consecutive days. Wound dressing was performed on a daily basis until the second surgery. Skin sutures were removed 10 days after surgery.

After the second surgery, an Elizabethan collar was also used to protect the surgical site from self-mutilation until skin sutures were removed. Medication protocol was the same as that of the first postoperation. Wound dressing was conducted for ten days successively and skin sutures were removed. The urination was daily monitored from the urine collection bag for two weeks; the feeding tube was then removed. Each cat was radiographed using iohexal as a contrast medium, on the day of feeding tube removal, in order to examine abnormalities along the tube. Six months later, the follow-up was performed by a radiography with iohexal, as well as an interview with the cat owners.

RESULTS

After the second surgery, every cat recovered well. At the surgical site, three out of five cats had good healing without wound dehiscence and complications. However, the rest had premature suture loosening at some stitches and minor dehiscent skins; sterile isotonic saline solution was daily applied at their surgical sites until they completely healed. Postoperative radiographs after the second surgery showed no leakage throughout the graft tube. As a result, the feeding tube, that was functioning as a urethral catheter, was removed. At the hospital, all cats were able to urinate with no difficulty or signs of discomfort. Furthermore, dysuria, stranguria, and other complications were not clinically observed.

Six months after the second surgery, every cat visited the hospital again to follow up the surgery. According to an interview with the owners, complications in the oral cavity were not observed. Moreover, all the cats were able to urinate smoothly and had meals

without any difficulties in daily life. In addition, urine scalding dermatitis was not observed from any of the cats. Furthermore, radiography with contrast medium showed no abnormalities, especially leakage and stricture, along the tube from the urinary bladder to the prepuce (Fig. 5).

DISCUSSION

The present study reported the first success of using sublingual mucosa to manage complications after urethrostomy in male cats by initiating a new passage of urination. Previous studies have indicated that urethrostomy is one of the surgical alternatives to correct urethral rupture. Nonetheless, it contributed to a number of complications, such as urine scalding dermatitis, urethral stricture, and urinary incontinence in the cats [6, 7, 13]. In addition, the urethrostomy might be performed again, especially in the case of repeated urethra rupture, resulting in much more difficulty operating than during the first urethrostomy since the remaining urethra was shorter. As a result, a high tension within that urethra contributed to the stricture of the opening [1]. Nonetheless, the present study demonstrated that sublingual mucosa could be applied to reconstruct the urination passage and correct the complications arising from prior urethrostomy as vividly seen that those complications were not clinically examined in any of the cats in this study after the surgery.

Several preceding studies, in humans, recommended the use of buccal mucosa for tissue replacement, especially in the complicated cases of urethral construction, since it provided satisfactory outcomes [8, 10]. However, the oral cavity of the cat was so small and the oral mucosae were not long enough to connect between urinary bladder and preputial ends. As a result, the present study selected sublingual mucosae to create the graft. A former study reported that the success of urethroplasty, in humans, using lingual mucosa could be comparable with that using buccal mucosa (76.1 vs 78.2%) [11]. Furthermore, a preceding study revealed that mucosae from the ventrolateral aspect of the tongue provided excellent results in human urethroplasty [15]. Correspondingly, the current study demonstrated that sublingual mucosae were apparently effective for reconstructing the damaged urethra in male cats. Moreover, sublingual mucosae provided adequate length and area to establish the graft tube connecting between bladder and preputial ends of the male cats.

Considering the graft bed, abdominal muscles were selected since their strength and capacious areas could be responsible for a strong adhesion with the graft from sublingual mucosa. However, muscle sheaths of the graft bed area were required to be entirely removed in order to enhance the adhesion efficiency between the graft and its bed. Moreover, this study demonstrated that two weeks were considered a suitable time for strong adhesion between the graft and its bed. After the tubularization and the connection of the graft tube with the remaining urethra connecting with the urinary bladder and with the prepuce, the cats urinated without any difficulties and discomfort characteristics. Moreover, radiography with contrast medium confirmed that no abnormality was observed along the new urination passage.

In summary, sublingual mucosae could be one of the useful materials for correcting damaged urethra in male cats suffering from complications after urethrostomy. The urethral reconstruction using sublingual mucosal graft could establish a new passage of urination for the cats by connecting the tube between the remaining urethra of the bladder and the preputial mucosae. This technique did not only correct the urethral problems, but also apparently improved quality of life of the cats since they could urinate similarly to their normal ways of life and had no clinical complications after the surgery.

REFERENCES

1. Baines, S. J., Rennie, S. and White, R. S. 2001. Prepubic urethrostomy: A long-term study in 16 cats. *Vet. Surg.* **30**: 107–113. [Medline] [CrossRef]
2. Barbagli, G., De Angelis, M., Romano, G., Ciabatti, P. G. and Lazzeri, M. 2008. The use of lingual mucosal graft in adult anterior urethroplasty: surgical steps and short-term outcome. *Eur. Urol.* **54**: 671–676. [Medline] [CrossRef]
3. Bellah, J. R. 1989. Wound healing in the urinary tract. *Semin. Vet. Med. Surg. (Small Anim.)* **4**: 294–303. [Medline]
4. Bjorling, D. E. 1984. Traumatic injuries of the urogenital system. *Vet. Clin. North Am. Small Anim. Pract.* **14**: 61–76. [Medline] [CrossRef]
5. Boothe, H. W. 2000. Managing traumatic urethral injuries. *Clin. Tech. Small Anim. Pract.* **15**: 35–39. [Medline] [CrossRef]
6. Bradley, R. L. 1989. Prepubic urethrostomy. An acceptable urinary diversion technique. *Probl. Vet. Med.* **1**: 120–127. [Medline]
7. Carbone, M. G. 1971. Urethral surgery in the cat. *Vet. Clin. North Am.* **1**: 281–298. [Medline] [CrossRef]
8. Dubey, D., Kumar, A., Mandhani, A., Srivastava, A., Kapoor, R. and Bhandari, M. 2005. Buccal mucosal urethroplasty: a versatile technique for all urethral segments. *BJU Int.* **95**: 625–629. [Medline] [CrossRef]
9. Knecht, C. and Slusher, R. 1970. Extrapelvic anastomosis of the bladder and penile urethra in a dog. *J. Am. Anim. Hosp. Assoc.* **6**: 247–251.
10. Kolar, I. 2004. [Congenital penile curvature (chordee without hypospadias): surgical treatment for correction of penile curvature and/or buccal mucosal graft urethroplasty]. *Lijec. Vjesn.* **126**: 71–75. [Medline]
11. Maarouf, A. M., Elsayed, E. R., Ragab, A., Salem, E., Sakr, A. M., Omran, M., Abdelmonem, I. I., Khalil, S. A., Abdalsamad, K., Abouhashem, S., Shahin, A. M. and Eladl, M. 2013. Buccal versus lingual mucosal graft urethroplasty for complex hypospadias repair. *J. Pediatr. Urol.* **9** 6 Pt A: 754–758. [Medline] [CrossRef]
12. McRoberts, J. W. and Ragde, H. 1970. The severed canine posterior urethra: a study of two distinct methods of repair. *J. Urol.* **104**: 724–729. [Medline] [CrossRef]
13. Mendham, J. H. 1970. A description and evaluation of antepubic urethrostomy in the male cat. *J. Small Anim. Pract.* **11**: 709–721. [Medline] [CrossRef]
14. Osborne, C. A., Kruger, J. M. and Lulich, J. P. 1996. Feline lower urinary tract disorders. Definition of terms and concepts. *Vet. Clin. North Am. Small Anim. Pract.* **26**: 169–179. [Medline] [CrossRef]
15. Simonato, A., Gregori, A., Lissiani, A., Galli, S., Ottaviani, F., Rossi, R., Zappone, A. and Carmignani, G. 2006. The tongue as an alternative donor site for graft urethroplasty: a pilot study. *J. Urol.* **175**: 589–592. [Medline] [CrossRef]
16. Swaim, S. F. 1990. Skin grafts. *Vet. Clin. North Am. Small Anim. Pract.* **20**: 147–175. [Medline] [CrossRef]