The Journal of Veterinary Medical Science

NOTE

Surgery

Reconstruction of urethral defects using a fascia lata autograft in a dog

Da-Eun LEE[1)], Kyu-Chang KIM[1)], Soon-Wuk JEONG[1)] and Hun-Young YOON[1)]*

[1)]Department of Veterinary Surgery, College of Veterinary Medicine, Konkuk University, #120 Neungdong-ro, Gwangjin-gu, Seoul 05029, South Korea

J. Vet. Med. Sci.
81(2): 237–240, 2019
doi: 10.1292/jvms.18-0190

Received: 6 April 2018
Accepted: 8 December 2018
Published online in J-STAGE: 26 December 2018

ABSTRACT. A castrated male Shih-Tzu dog was presented for evaluation of urine leakage after urethrotomy. A fistula with urine leakage was identified in the perineal region. On retrograde urethrography, the contrast extravasated from the penile urethra into the subcutaneous tissue of the perineum. Urine leakage with urethrocutaneous fistula was diagnosed. During surgery, the disrupted urethra wall and two urethral defects were identified. A fascia lata autograft was used, rather than primary repair of the urethra. Two pieces of fascia lata were harvested and sutured to the urethral defects. The fistula was treated with debridement and drainage. No evidence of urine leakage and dysuria was noted 6 months postoperatively. Thus, this case report describes successful urethral reconstruction using a fascia lata autograft.

KEY WORDS: dog, fascia lata autograft, urethral reconstruction, urine leakage

The vast majority of urethral calculi can be flushed back into the bladder and removed via cystotomy. If the problem cannot be resolved by retrograde hydropropulsion, urethrotomy or urethrostomy can be performed on the proximal part of the obstruction site [3].

Urethral trauma or rupture can often occur via blunt or penetrating injuries, and obstructive urinary calculi. Less commonly, urethral injury results from bite wounds, gunshots, iatrogenic trauma secondary to poor catheterization techniques, or urethrotomy to remove calculi lodged in the urethra [13]. Urethral injuries result in subsequent urine leakage, which can lead to uroabdomen from the proximal urethra and prolonged urine retention within the pelvis canal or subcutaneous tissue [8, 13]. Extravasation of urine causes extensive cellulitis, tissue necrosis, and urethrocutaneous fistula [13, 15]. Conservative therapy with urine diversion such as urethral catheterization and tube cystotomy is indicated for partial lacerations. These usually heal spontaneously if urine is diverted from the traumatized area for approximately 5–14 days [5, 12]. However, leakage of urine, particularly if infected, delays wound healing and promotes periurethral fibrosis and stricture formation [13]. In such cases, extensive urethral reconstruction is required and grafts may be necessary to repair urethral strictures or defects [2, 7]. Fascia lata is the thick femoral fascia that covers the muscles on the lateral thigh [8]. Fascia lata has been used for reconstruction of anterior cruciate ligament, abdominal wall, joint surface, and oral cavity mucosa, as well as repair of perineal and diaphragmatic hernias [1, 4, 6, 9, 18].

A 5.5 kg, 6-year-old, castrated male Shih-Tzu dog was presented for evaluation of urine leakage after two consecutive urethrotomies. Ten days prior to referral, the referring veterinarian performed a urethrotomy to relieve urethral obstruction caused by urethral calculi. A second urethrotomy was performed 6 days later because the urethral calculus had proven to be incompletely removed. However, the calculus was unable to be visualized on surgery and thus not removed. Physical examination revealed that a fistula had developed in the perineal region with erythematous, painful surrounding skin. Seropurulent exudate was discharged from the fistula (Fig. 1A). Complete blood count showed leukocytosis (27.10×10^6/m*l*, reference range 6–17 $\times 10^6$/m*l*). The serum biochemistry revealed elevation in c-reactive protein (78 mg/100 m*l*, reference range 0–35 mg/100 m*l*) and decrease in blood urea nitrogen (5 mg/100 m*l*, reference range 8–31 mg/100 m*l*) and creatinine (0.4 mg/100 m*l*, reference range 0.8–1.6 mg/100 m*l*). On the lateral view of abdominal radiography, there was radiopaque material measuring 3.1 × 3.7 mm in the penile urethra, 5.6 mm proximal to the os penis. The retrograde urethrogram showed two sites in the urethra from which contrast medium had leaked (Omnipaque; GE Healthcare, Seoul, Korea). One site was identified in the ventral region of penile urethral calculus; the other was observed in the dorsal region caudal to the os penis, appearing as a diverticula-like shape (Fig. 1B). Based on these results, a diagnosis was made of urine leakage from the penile urethra with subsequent urethrocutaneous fistula secondary to urethrotomy.

Surgical intervention was performed for management of the urine leakage and the urethrocutaneous fistula. Atropine sulfate (0.04 mg/kg, SC, Atropine sulfate inj; Je Il Pharmaceutical, Daegu, Korea), cefazolin (30 mg/kg, IV, Cefozol inj; Hankook Korus Pharmaceutical, Chuncheon, Korea), butorphanol (0.1 mg/kg, IV, Butophan Inj; Myungmoon Pharmaceutical, Seoul, Korea),

*Correspondence to: Yoon, H.-Y.: yoonh@konkuk.ac.kr

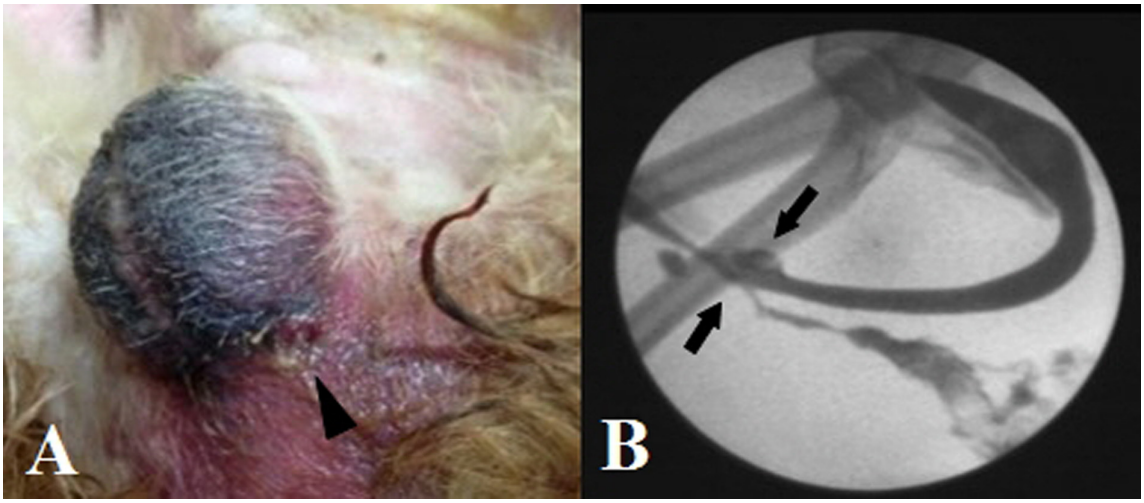

Fig. 1. Preoperative photograph (A) and retrograde urethrogram (B) of a dog with urethrocutaneous fistula in the perineal region caused by urethrotomy. (A) Urethrocutaneous fistula (arrowhead) with erythematous, painful surrounding skin is identified. Note the seropurulent exudate discharged from the fistula. (B) Extravasation of contrast into the perineum from the ventral region of penile urethra and dorsal region caudal to the os penis, appearing as a diverticula-like shape (arrows).

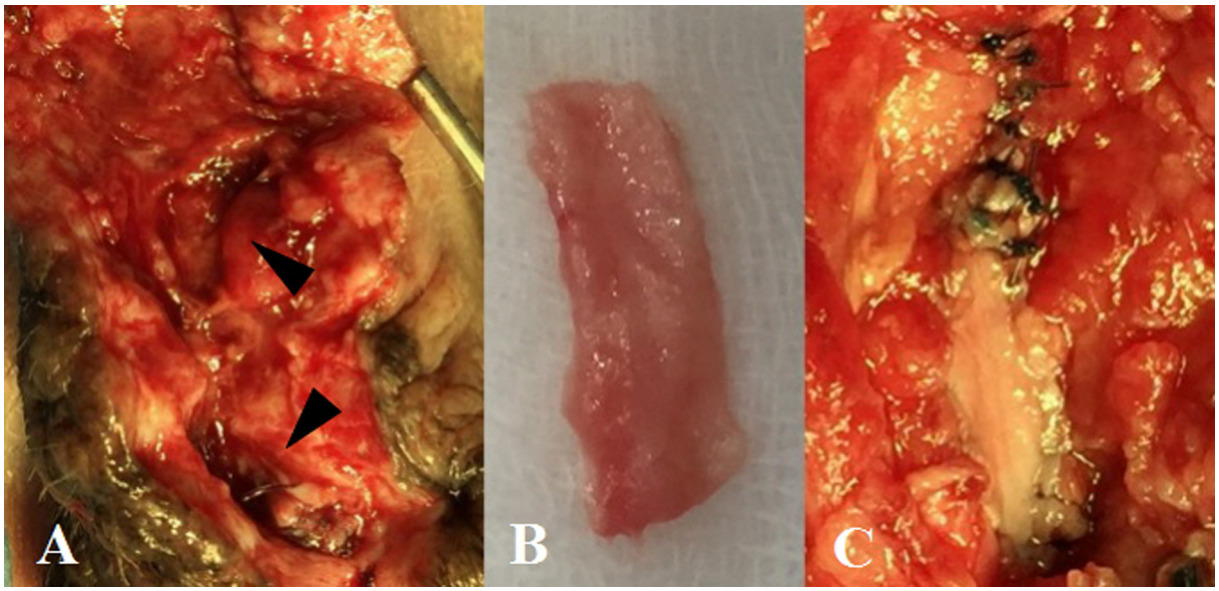

Fig. 2. Intraoperative photographs illustrating urethral defect reconstruction using a fascia lata graft. The top of each photograph is cranial and bottom caudal. (A) The leakage is confirmed at the caudal aspect of the sutured urethra and dorsal to the leakage site. The urethral wall is swollen and fibrotic (arrowheads). (B) Two pieces of fascia lata (1 × 3 cm) are harvested from the left thigh and (C) sutured to the urethral defects, respectively.

and dexamethasone (0.5 mg/kg, IV, Dexamethasone; Je Il Pharmaceutical, Daegu, Korea) were used as anesthesia premedication. Intubation was performed with propofol (4 mg/kg, IV, Provive 1%; Myungmoon Pharmaceutical, Seoul, Korea), and anesthesia was maintained with isoflurane (Isoflurane; Choongwae Pharmaceutical, Seoul, Korea) with oxygen. A ventral midline skin incision was performed between the caudal aspect of the os penis and the scrotum. Leakage at the caudal part of the sutured urethra was confirmed by flushing the urethra with sterile saline. After the suture removal, a calculus was removed from the urethra. An additional defect was found dorsal to the leakage site. Since the urethral wall was swollen and fibrotic, a fascial graft was chosen instead of primary repair of the urethra (Fig. 2A). Surgical debridement was performed on necrotic and fibrotic urethral tissue. Two pieces of fascia lata (1 × 3 cm) were harvested from the left lateral thigh (Fig. 2B). The first piece of fascia lata was trimmed to the defect size and sutured to the defect on the dorsal portion of the urethra using 5–0 monofilament absorbable sutures (Maxon; Covidien, Minneapolis, MN, U.S.A.). The second piece of fascia lata was sutured to the defect on the ventral portion of the urethra using 5–0 monofilament absorbable sutures in a combination of simple interrupted and continuous patterns (Fig. 2C).

The urethrocutaneous fistula was treated with surgical debridement and drainage using Penrose drain tube (All-Silicone Penrose Drainage Tube; Sewoon Medical, Cheonan, Korea). An 8-French urethral Foley catheter (2-Way Foley Balloon Catheter; Yushin Medical, Seoul, Korea) was installed.

Pending sensitivity test results, empirical antibiotics were administered as follows: cefazolin (30 mg/kg, IV, Cefozol inj; Hankook Korus Pharmaceutical, Chuncheon, Korea), enrofloxacin (5 mg/kg, SC, Baytril 50 inj; Bayer Korea, Seoul, Korea), and metronidazole (10 mg/kg, IV, Metronidazole inj; Daihan Pharmaceutical, Seoul, Korea). Bacterial culture from the urethrocutaneous fistula yielded a positive result for *Enterococcus hirae*. Antibiotics were maintained as described above, based on the result of bacterial culture. Surgical wound and Penrose drain tube management was performed daily. The Penrose drain was removed 5 days post-operatively as the amount of discharge decreased significantly. The urethral catheter was removed 10 days post-operatively, and the dog was closely monitored for signs of urine leakage and urethral stricture. No evidence of urine leakage and dysuria was noted 6 months postoperatively.

For complete urethral transections, surgical intervention such as anastomosis with resection of the damaged tissue or permanent urine diversion via urethrostomy proximal to lesion is required [13]. Conversely, for partial urethral defects, such as contusions, small lacerations, and perforations, conservative therapy with urine diversion such as urethral catheterization and tube cystotomy is indicated [3]. As urethral mucosa can regenerate within a period as short as 7 days, healing by primary or secondary intention is widely known to result in similar outcomes at the urethrotomy site [3, 13, 15]. However, leakage of urine from the defect, particularly if infected, delays wound healing and promotes periurethral fibrosis and stricture formation [3, 13, 15]. Normal bacterial flora inhabits the distal aspect of the urethra and prepuce, including microorganisms that are commonly responsible for infection [2]. In the present case, urethral disruption could be attributed to pressure trauma exerted by the urethral calculi and prolonged exposure of the urethra to infected urine [13]. Furthermore, urethral defects were identified in both dorsal and ventral portions of the urethra. Therefore, debridement of a wide portion of the urethra was performed, resulting in a large urethral defect of more than 50% of the urethra circumference, similar to complete urethral transection. A simple suture of the urethra was thought to cause the side effect of urethral stricture. In addition, because infection was present at the surgical site, debridement of damaged urethral wall was implemented; moreover, extensive urethral reconstruction with via engraftment was required for the recovery of the damaged urethra without the formation of a urethral stricture. Conservative therapy with a urethral catheter could not induce debridement of the damaged urethra; it could solely induce delayed wound healing due to catheter-induced irritation. In such cases, rather than using conservative therapy, surgical intervention is required with extensive urethral reconstruction.

Two critical factors affecting urethral healing are mucosal continuity and prevention of urine extravasation [3, 13, 15]. Therefore, preservation of these factors is essential in order to reconstruct the damaged urethra. In traditional methods, skin, buccal mucosa, swine intestinal submucosa, rectus abdominis muscle flap, and bladder mucosa have been used for urethral reconstruction in clinical application [7, 10, 14, 17]. Skin grafts have been attempted in urethroplasty as the grafts are easy to harvest and abundant. However, skin grafts have been associated with various complications, such as stricture or fistula formation, hair growth, shrinkage, and diverticula formation, because they are differ from the native uroepithelium [7, 16]. One experimental study established that skin grafts were associated with severe fibroblastic infiltrates and inflammation. Moreover, skin graft epithelium revealed irregular thickness with areas of atrophy [7]. Bladder mucosa grafts may be compatible with urine contact as bladder mucosa resembles native urethral tissue. However, urethral tract stenosis and prolapse, as well as a granulomatous reaction, have previously been reported. In addition, bladder mucosa is fragile, prone to rupture or shrinkage, and difficult to harvest [2, 7]. Buccal mucosa has been used for urethral reconstruction in human medicine as it is easy to harvest, not prone to rupture, and has been associated with successful outcomes [7, 10]. However, buccal mucosa grafts are insufficient for reconstruction of extensive or pan-urethral defects [10].

Fascia lata is firm, elastic, and tensile; notably, it has been used for the reconstruction of anterior cruciate ligaments, abdominal walls, joint surfaces, and oral cavity mucosa, as well as repair of perineal and diaphragmatic hernias [1, 2, 4, 6, 9, 18]. Fascia lata has a high epithelialization capacity, which can restore continuity of the transitional uroepithelium as this layer prevents stricture formation and infection [16]. Further, fascia lata graft is non-hair bearing, abundant, readily available in almost all patients, and easy to harvest [2, 11]. Use of fascia lata within the urinary tract has been reported experimentally in mixed-breed dogs [2]. In this study, half the urethral circumference was excised, and fascia lata harvested from the lateral thigh was sutured to the urethral defect. On postoperative day 60, all dogs recovered successfully without ulceration, stricture, diverticula, or fistula formation. Histologic examination of the penile urethra revealed that the conduit was intact and covered with transitional epithelium. Further, the corpus spongiosum with cavernous spaces surrounded the lumen with blood-filled vessels. Donor sites also healed without complications such as infection or degenerative reaction [2]. Sade *et al.* investigated the feasibility of the fascia lata graft in a rabbit model for reconstruction of urethral defects [16]. In the histological study, urethral epithelium was moved towards the graft and formed a single layer of epithelium on postoperative day 10 [16]. On postoperative day 21, the epithelium became multilayered [16]. After postoperative day 30, transitional epithelium completely covered the urethra [16]. Therefore, according to the results of this study, it is possible to restore the complete urethra within 30 days postoperatively; importantly, this is covered with a complete urethral transitional epithelium, such that it can function as permanent urethral mucosa [16]. In addition, a single layer of epithelium was observed on postoperative day 10; thus, the transitional epithelium may function as a urethral mucosa beginning at approximately 10 days after operation [16]. As the above experiments support, the fascia lata graft seems to be a suitable substitute in urethral reconstruction because of its rapid epithelization capacity and low complication rate in animals. Fascia lata grafts for closure of secondary urethral fistulas have already been clinically attempted in humans [11]. In this study, no recurrence of urethral fistula was observed after surgery and patients were completely satisfied with the result [11]. In the present case, because the urethral wall was swollen and fibrotic, urethral reconstruction via the application of fascia lata was selected rather than primary

repair of the urethra. The fascia lata autograft itself does not carry blood supply. Therefore, graft viability was initially maintained by diffusion of nutrients [16]. The fascia lata can be used as a substitute for regeneration of urethral tissue, rather than fully replacing the urethra; this provides an environment in which the urethral epithelium can be completely regenerated [2, 16]. After 2 weeks of graft placement, the ingrowth of vascular tissue is noted [16]. During this period, temporary diversion of urine should be provided by transurethral catheterization. The catheter can prevent delayed wound healing and periurethral fibrosis; therefore, it is assistive for urethral healing [3, 5]. Two pieces of fascia lata were harvested from the left lateral thigh and sutured to the defect on the dorsal and ventral portion of the urethra each with a combination of interrupted and continuous suture patterns. In general, continuous and interrupted patterns are both available during urethral surgery; each exhibits advantages and disadvantages. The simple continuous pattern has the advantage of intensive leakage sealing; however, it has the disadvantage of narrowing the lumen of the urethra and causing stricture [3]. Conversely, the interrupted pattern does not enable intensive sealing, as provided by the continuous pattern; however, it has little effect on the diameter of the lumen and is less likely to induce stricture [3]. In the present case, the risk of urethral stricture formation was reduced because of the large diameter of the reconstructed urethra after use of the fascia lata graft. In addition, in the present case, prevention of urine leakage through reliable sealing was the most important aspect. Therefore, a combination of simple interrupted and continuous patterns was used.

In the present case report, a fascia lata autograft served as an adequate substitute with no anatomic insufficiency or urethral obstruction; moreover, it was associated with low morbidity, a lower complication rate, and favorable results. This technique seems to be an encouraging alternative for large urethral defects accompanied by urethrocutaneous fistula.

REFERENCES

1. Argün, M., Baktir, A., Türk, C. Y., Ustdal, M., Okten, T., Karakas, E. S. and Akbeyaz, O. 1993. The chondrogenic potential of free autogenous periosteal and fascial grafts for biological resurfacing of major full-thickness defects in joint surfaces (an experimental investigation in the rabbit). *Tokai J. Exp. Clin. Med.* **18**: 107–116. [Medline]
2. Atalan, G., Cihan, M., Sozmen, M. and Ozaydin, I. 2005. Repair of urethral defects using fascia lata autografts in dogs. *Vet. Surg.* **34**: 514–518. [Medline] [CrossRef]
3. Bjorling, D. E. 2003. The urethra. pp. 1638–1650. *In*: Textbook of Small Animal Surgery, 3rd ed., Saunders, Philadelphia.
4. Bongartz, A., Carofiglio, F., Balligand, M., Heimann, M. and Hamaide, A. 2005. Use of autogenous fascia lata graft for perineal herniorrhaphy in dogs. *Vet. Surg.* **34**: 405–413. [Medline] [CrossRef]
5. Boothe, H. W. 2000. Managing traumatic urethral injuries. *Clin. Tech. Small Anim. Pract.* **15**: 35–39. [Medline] [CrossRef]
6. Disa, J. J., Klein, M. H. and Goldberg, N. H. 1996. Advantages of autologous fascia versus synthetic patch abdominal reconstruction in experimental animal defects. *Plast. Reconstr. Surg.* **97**: 801–806. [Medline] [CrossRef]
7. El-Sherbiny, M. T., Abol-Enein, H., Dawaba, M. S. and Ghoneim, M. A. 2002. Treatment of urethral defects: skin, buccal or bladder mucosa, tube or patch? An experimental study in dogs. *J. Urol.* **167**: 2225–2228. [Medline] [CrossRef]
8. Evans, H. E. and Lahunta, A. 2013. The urogenital system. pp. 361–405. *In*: Miller's Anatomy of the Dog, 4th ed., Elsevier Saunders, St. Louis.
9. Hinton, R., Jinnah, R. H., Johnson, C., Warden, K. and Clarke, H. J. 1992. A biomechanical analysis of solvent-dehydrated and freeze-dried human fascia lata allografts. A preliminary report. *Am. J. Sports Med.* **20**: 607–612. [Medline] [CrossRef]
10. Hu, X., Xu, Y., Song, L. and Zhang, H. 2011. Combined buccal and lingual mucosa grafts for urethroplasty: an experimental study in dogs. *J. Surg. Res.* **169**: 162–167. [Medline] [CrossRef]
11. Kargi, E., Yeşilli, C., Akduman, B., Babucçu, O., Hoşnuter, M. and Mungan, A. 2003. Fascia lata grafts for closure of secondary urethral fistulas. *Urology* **62**: 928–931, discussion 931. [Medline] [CrossRef]
12. McLoughlin, M. A. 2011. Complications of lower urinary tract surgery in small animals. *Vet. Clin. North Am. Small Anim. Pract.* **41**: 889–913, v. [Medline] [CrossRef]
13. Pechman, R. D. Jr. 1982. Urinary trauma in dogs and cats: a review. *J. Am. Anim. Hosp. Assoc.* **18**: 33–40.
14. Powers, M. Y., Campbell, B. G. and Weisse, C. 2010. Porcine small intestinal submucosa augmentation urethroplasty and balloon dilatation of a urethral stricture secondary to inadvertent prostatectomy in a dog. *J. Am. Anim. Hosp. Assoc.* **46**: 358–365. [Medline] [CrossRef]
15. Rawlings, C. A. and Wingfield, W. E. 1976. Urethral reconstruction in dogs and cats. *J. Am. Anim. Hosp. Assoc.* **12**: 850–860.
16. Sade, C., Ugurlu, K., Ozcelik, D., Huthut, I., Ozer, K., Ustundag, N., Saglam, I. and Bas, L. 2007. Reconstruction of the urethral defects with autologous fascial tube graft in a rabbit model. *Asian J. Androl.* **9**: 835–842. [Medline] [CrossRef]
17. Suzuki, K., Takahashi, T., Itou, Y., Asai, K., Shimota, H. and Kazui, T. 2002. Reconstruction of diaphragm using autologous fascia lata: an experimental study in dogs. *Ann. Thorac. Surg.* **74**: 209–212. [Medline] [CrossRef]
18. Uğurlu, K., Hüthüt, I., Ozçelik, D., Ozer, K., Sakiz, D., Yildiz, K. and Baş, L. 2004. Epithelialization process of free fascial flaps used in reconstruction of oral cavity mucosa defects in dogs. *Plast. Reconstr. Surg.* **113**: 915–923, discussion 924–926. [Medline] [CrossRef]