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Replantation of a Traumatically Amputated Penis in a Dog

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Abstract : A mixed-breed hunting dog suffered penile amputation and lacerations in the femoral and inguinal areas while hunting wild boar. The penis was replanted by anastomoses of the urethra, cavernous body, and the left and right dorsal veins of the penis. The transected penis recovered anatomically and functionally. No evidence of postoperative necrosis or edema was detected at the distal portion of the penis. In addition, fistulas and stenosis were not found on urethrogram 20 days after the surgery. Aside from surgery, we performed experimental cavernosography to identify the importance of the anastomosis of the dorsal veins of the penis in three beagle dogs. The cavernosograms revealed that, the contrast medium, which was injected into the bulbus glandis, drained by the left and right dorsal veins of the penis, then converged into one vessel at the ischial arch and diverged into the left and right internal pudendal veins. Thus, reanastomosis of the left and right dorsal veins of the penis in cases of transected canine penis appears to be important for positive postoperative prognosis.

Key words **:** canine; transected penis, traumatic amputation; anastomosis; vascular surgery

Introduction

Complete penile amputation due to trauma is an uncommon injury in dogs. Traumas to the corpus cavernosum and fractures of the os penis have been documented(8,10). We could not locate any reports of replantation surgery of the traumatically transected canine penis, even there are many case reports in human medicine. The angioarchitecture and physiological properties of the canine penis have been described (3,6), but the information has not been transcribed into practical surgical application due to the rarity of penile amputation. The experimental study is considered the first replantation surgery of transected penis in dogs (12). In this animal experiment and in many human case reports, surgeries without vascular anastomosis were associated with several complications including necrosis, fistula formation and constriction. The purpose of this paper is to report a successful case of penile replantation in a dog and to elucidate the importance of the anastomosis of the left and right dorsal veins of the penis in penile replantation by cavernosography.

Case

We treated a 2-year, 3-month old mongrel hunting dog weighing 27 kg 2 hours after it was butted by a wild boar. Body temperature was 37.7°C, heart rate was 128 beats per minute, respiratory rate was 20 breaths per minute, and mental status was alert. Our physical examination revealed skin laceration of the inguinal area, laceration of the gracilis muscle, exposure of the testes from the scrotum, penis amputation in the middle portion and hemorrhage from the proximal transected cavernous bodies, muscles, and skin. Right and left dorsal veins and arteries of the penis into the bulbus glandis were transected completely (Fig 1). The distal part of the amputated penis was placed in the prepuce. It was thought that the distal branch of the external pudendal vessel from superficial vein of glandis was intact. Laboratory test results indicated mild neutrophilia, hypoproteinemia and anisocytosis which suggested anemia, while the liver enzyme level and the renal function were unremarkable.

Atropine sulfate (0.02 mg/kg, SC), metoclopramide (0.4 mg/kg, IV), cimetidine (5 mg/kg, IV), and cefazolin (22 mg/kg, IV) were administered before surgery. General anesthesia was induced with propofol (5 mg/kg, IV), followed by isoflurane (2~2.5%) in oxygen administered through an endotracheal tube. Meloxicam (Metacam®, Boehringer Ingelheim, Germany, 0.2 mg/kg) was injected intravenously to treat postoperative pain.

The operation was started about 3 hours after the trauma occurred. Under general anesthesia, the patient was positioned in dorsal recumbency. A urinary catheter was inserted from the distal amputated part into the urinary bladder through the proximal stump in order to avoid contamination and to drain urine. Both testes, which were traumatized and exposed from the scrotum, were removed at the owner's request. On the transected surface of the proximal and distal segment, all devitalized tissue was debrided meticulously. After stay suture (2-0 nylon, Ailee Co, Korea) was placed in the middle of the distal segment percutaneously, the urethra was anastomosed with polydioxanone (5-0 PDS II, Ethicon,

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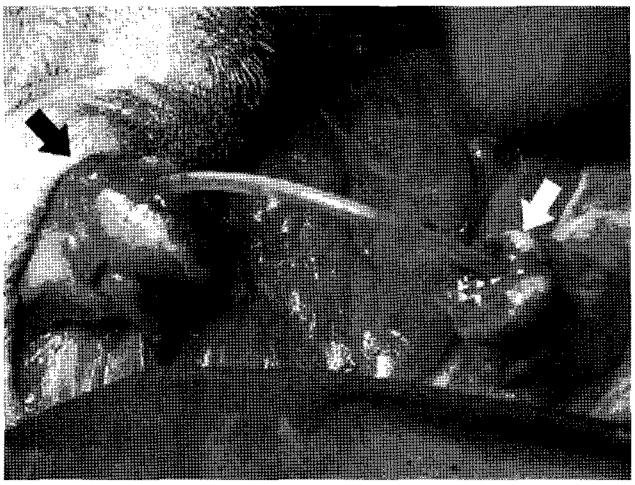

Fig 1. Intraoperative view of the distal amputated penis (black arrow) and the proximal stump (white arrow) with urinary catheter. Right and left dorsal veins and arteries of the penis into the bulbus gland are transected completely.

Inc, Scotland, UK). The tunica albuginea around the corpus spongiosum and two corpora cavernosa were sutured with polyglycolic acid (4-0 surgifit, Ailee Co, Korea) in a simple interrupted pattern. The retractor penis muscle was repaired end to end. Vascular surgery was performed to anastomose the right and left dorsal veins of the penis with polydioxanone. The patency of the anastomosed veins was confirmed by injecting sterile saline via a venous indwelling catheter (Fig 2). No other transected vascular or nerve repair was done. After restoring venous blood flow, the gracilis muscle and skin were sutured by a routine method. The abdominal catheter was indwelt 3~4 cm caudally from the umbilicus due to the contaminated peritoneal cavity.

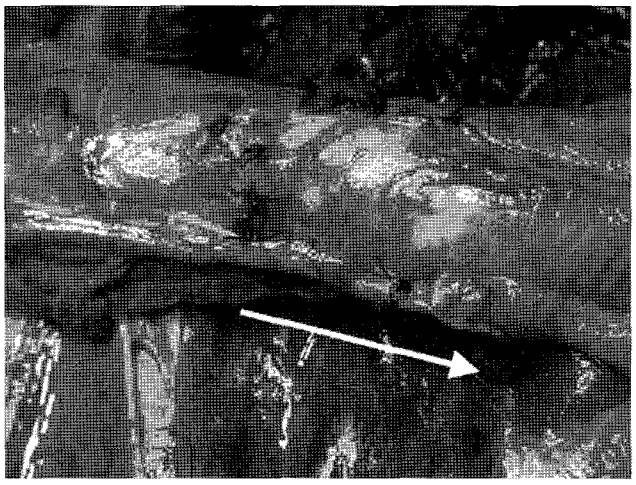

Fig 2. Intraoperative view of the anastomosed right and left dorsal veins of the penis and tunica albuginea. The blood circulation of two veins is restored by vascular anastomosis (Arrow shows the direction of blood flow).

After the operation was completed, a pressure bandage was applied and cefazolin (30 mg/kg, IV), metronidazole (15 mg/kg, IV®), cimetidine (5 mg/kg, IV®), and chymotrypsin (Chymosin®, Daesung Microbiological Labs, Korea, 1 ml, IV) were administered; the urinary catheter was maintained for 3 weeks after the operation. The patient had no clinical findings of edema, congestion, necrosis or inflammation. On the 20th postoperative day, no diverticulum or leakage from the anastomosed urethra was noted on the urethrogram. The urinary catheter was then removed (Fig 3).

Experimental cavernosography

To elucidate the importance of the anastomosis of the left and right dorsal veins of the penis in penile replantation, we performed experimental cavernosography in three beagle dogs. Dogs were used and cared for according to the approved guidelines in the handling of experimental animals by the Laboratory Animal Research Center of Chungbuk National University. After routine preanesthetic medication, the animals were anesthetized with propofol (5 mg/kg body weight) intravenously. The prepuce and penis of each dog were washed with 0.5% chlorhexidine. After bending the penile body caudally, 2 ml of ioxehol (Iobrix® inj 350, Taejoon Pharm Co Ltd, Korea) was injected into the cavernous body, and the contrast medium was monitored on fluoroscopy (SM-20HF, Listem Corp, Korea). The flow of medium injected into the corpus cavernosum stagnated, without remarkable flow to either the proximal or distal direction. But the medium injected into the bulbus glandis drained rapidly and simultaneously through the bilateral dorsal veins of the penis after the penile body was straightened. The two flows of medium united at the ischial arch, and then diverged into the right and left internal pudendal veins. The flow subsequently continued to the right and left internal iliac veins, and then diffused and diluted into the systemic venous system (Fig 4).

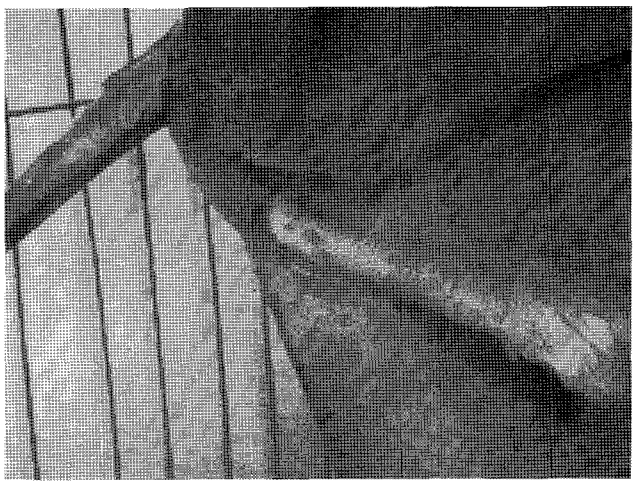

Fig 3. The penis 20 days after the replantation.

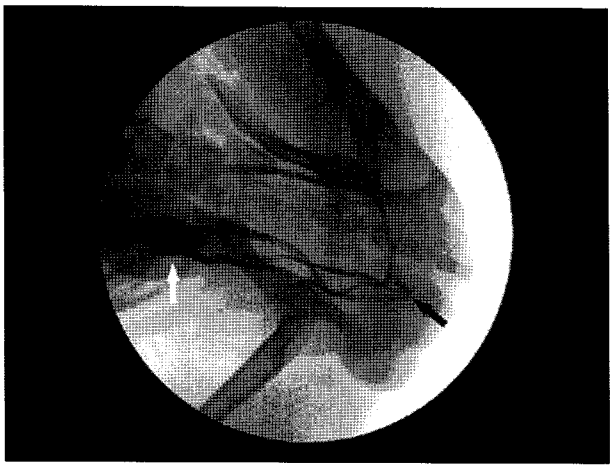

Fig 4. The experimental cavernosogram. The contrast medium injected into the bulbus glandis (white arrow) drained through bilateral dorsal veins of the penis. The two veins are united into one vessel (black arrow) which is diverged into two internal pudendal veins.

Discussion

Penile replantation has been performed in men because sexual function is important for quality of life. To our knowledge, this is the first case report of replantation of a transected canine penis. Removal of a transected penis or urethrostomy may be satisfactory treatments in many animal cases. Some cases of surgical or conservative management of fracture of the os penis have been accompanied by complications such as urethral obstruction and callus formation (8, 11,14). We presume, based on these reports, that the presence of os penis indicates fracture of the penis, rather than complete penile transection, when the penile injury occurs in the region of the os penis. In our case, complete penile amputation occurred, because there was no bony structure at the injury site.

Replantation surgeries and related studies in human medicine are very advanced compared to those in veterinary medicine. For example, microvascular surgery and neural microsurgery have been performed as part of penile replantation procedures (4,5,15). Penile reconstructions using a free flap have been used successfully (13). Anastomosed structures have included the urethra, the corpus spongiosum, two cavernosal arteries (deep artery), the tunica albuginea, the deep dorsal vein, two dorsal arteries, two dorsal nerves, Buck's fascia, and the superficial dorsal vein (2).

In our case, amputation occurred between the body and the root of the penis, caudally to the os penis. The parenchyma of the transected penis was mainly composed of urethra, spongy bodies, arteries, and veins. Spongy bodies are composed of the corpus cavernosum and the corpus spongiosum. The arteries are composed of the dorsal artery of the penis, deep artery of the penis, and artery of the bulb. Two dorsal veins of the penis are the major and small veins running through the cavernous body. Ideally, all parenchyma should be replanted in human medicine, since anatomical and functional reconstitution is the goal. Identifying the deep artery of the penis and artery of the bulb was difficult, because these vessels were centrally located in each cavernous body of the 27 kg dog. However, this kind of injury will be rare by the os penis in dog. Our objective in this castrated dog case was prevention of vascular disturbance in order to improve wound healing. Some previous reports have suggested that penile arterial circulation can be restored by the spongy tissue of the penis and corporal blood perfusion across the anastomotic site when microsurgery techniques cannot be used (1,7,9). We decided not to anastomose two dorsal arteries by these reasons as well as by no pulsatile bleeding in the proximal end of the dorsal artery in this dog. After anastomosis of the urethra, cavernous bodies, and tunica albuginea, we confirmed venous bleeding from the distal ends of the two dorsal veins of the penis, and vascular surgery was performed to repair these two veins. Both venous anastomoses prevented disturbance of venous outflow from the replanted organ.

The aim of the experimental cavernosography was to ascertain the importance of the dorsal veins of the penis for adequate outflow of blood in the replanted canine penis. In this experiment, contrast medium injected into the bulbus glandis passed through the bilateral dorsal veins of the penis immediately. Especially few blood flow was observed into distal direction. Thus, the two vessels play a significant role in draining blood from the distal part of the replanted organ. Moreover, anastomoses of these vessels are important for restoration of erectile function after surgery. These vessels are important in the venous outflow pathway in the non-erect penis, while maintenance of erection is achieved by blocking venous drainage from these veins due to constriction of the fibrous ring (6). Postoperative erection was not observed in this castrated dog.

Acknowledgement

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외상에 의해 절단된 음경의 재접합술 1례

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요 약 : 잡종의 사냥개가 멧돼지 사냥 중에 대퇴와 서혜부의 열상을 입고, 음경이 절단되었다. 음경은 요도, 해면체, 그리고 좌우측의 음경등쪽정맥을 문합함으로써 재접합되었다. 절단된 음경은 해부학적 그리고 기능적으로 회복되었다. 술 후의 음경 원위부의 부종이나 괴사는 발견되지 않았으며, 술 후 20일째 요도조영술에서 누관이나 협착 또한 발견되지 않았다. 본 수술과 별도로, 3마리의 비글견에서 음경등쪽정맥의 문합의 중요성을 확인하고자 실험적 해면체조영술을 실시하였다. 해면체조영에서 음경망울에 주입된 조영제는 좌우측의 음경등쪽정맥을 통해 배출되었고, 좌골궁 부위에서 하나의 혈관으로 수렴된 후 다시 좌우측 속음부정맥으로 분기되었다. 따라서 개의 절단된 음경의 증례에서 좌우측의 음경등쪽정맥의 재문합은 술 후 좋은 예후를 위해 중요하다고 사료된다.

주요어 : 개, 절단된 음경, 외상성 절단, 문합, 혈관수술