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CASE REPORT

Treatment of Hip Dysplasia in a Dog after a Failed Triple Pelvic Osteotomy with a Zurich Cementless Total Hip Replacement

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ABSTRACT

An Alaskan Malamute (2-year-old, castrated male, 41kg) was referred with bilateral hind limb lameness. The dog had a history of a bilateral triple pelvic osteotomy (TPO) to correct hip dysplasia one year previously, a surgery that was unsuccessful. On physical examination, pain and crepitus were noted in both hip joints. There was hip joint subluxation and mild degenerative changes bilaterally seen by radiograph. A Zurich cementless total hip replacement (ZCTHR) was planned for the right hind limb. After a craniolateral approach, an acetabular cup and a cementless femoral stem were implanted. The femoral head was placed in the femoral stem, and the prosthetic joint was then reduced. At a 9 month postoperative checkup, there was no pain on palpation or manipulation of the right pelvic limb, and the range of motion was within normal limits. On radiological examination, there was no implant loosening. The ZCTHR can thus be applied in a failed TPO patient as a revision surgery.

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INTRODUTION

Canine hip dysplasia (CHD) is a common clinical problem in veterinary medicine and is known to be caused by developmental disorder of the hip joint. The treatment of CHD includes conservative management and surgical procedures. In immature patients, juvenile pubic symphysiodesis and triple pelvic osteotomy (TPO) are two surgical procedures performed for CHD (Anderson, 2011). Although TPO shows good clinical outcomes, it has a high rate of postoperative complications and no control over osteoarthritis secondary to hip dysplasia (Koch *et al.*, 1993; Rasmussen *et al.*, 1998). Femoral head and neck osteotomy (FHO) and total hip replacement (THR) are performed as salvage procedures to treat hip dysplasia when earlier surgical attempts or conservative management fail (Anderson, 2011). To the best of our knowledge, there have not been any reports of THR after a failed TPO in veterinary medicine. The purpose of this case study is to describe the surgical technique and outcome of a Zurich cementless total hip replacement (ZCTHR) after a failed TPO in a dog.

History and clinical findings: A two-year-old, 41-kg, castrated male Alaskan Malamute was referred to the Chonbuk Animal Medical Center of Chonbuk National University with a 6-month history of bilateral hind limb lameness. The dog had been previously diagnosed with hip dysplasia of both hip joints in a local hospital. The patient was treated with a bilateral triple pelvic osteotomy surgery to correct the hip dysplasia a year prior to presentation. In spite of the TPO surgery, the patient still had hip pain, and developed progressive lameness in both hind limbs. Physical and orthopedic examinations did not find any new abnormalities besides bilateral hip joint issues that included a reduced range of motion, pain and crepitus on extension of the coxofemoral joint, and muscle atrophy. The clinical signs were more severe in the right hind limb. The complete blood count and blood serum chemistry were within normal reference ranges. Lateral and ventrodorsal radiographic views of the pelvis revealed mild degenerative change-induced hip dysplasia, with marked subluxation in both hip joints (Fig. 1). Radiographs of the hind limbs showed an angular deformity with external torsion in the tibia. The angular deformities of the right and left tibia were 18° and15°, respectively. Treatment options for mild osteoarthritis secondary to hip dysplasia were discussed with the owner. We decided to perform a ZCTHR on the right hip joint, which had been in more severe pain and had demonstrated a greater degree of lameness.

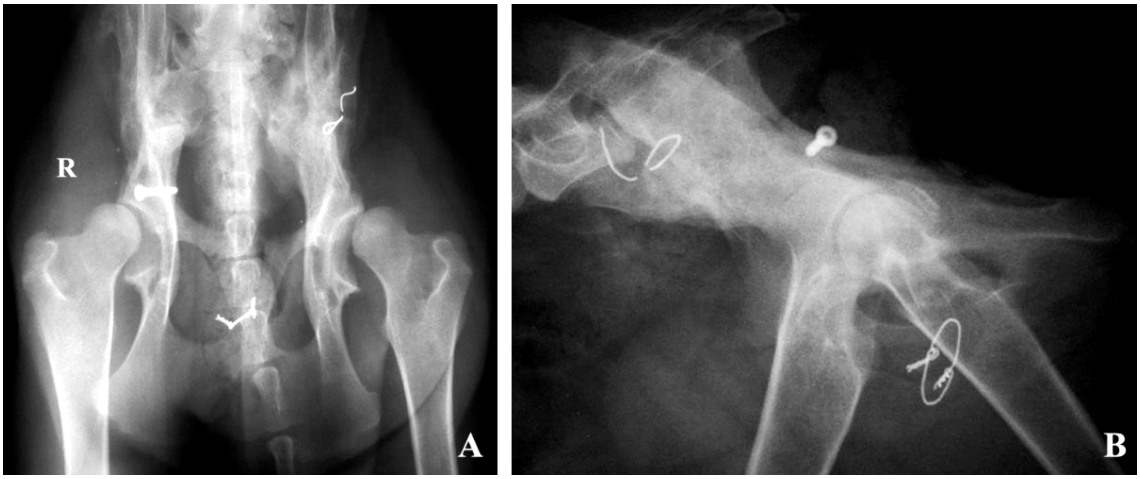

Fig. 1: Radiographic images of the pelvis. Ventrodorsal (A) and lateral (B) radiographs showing subluxation and mild degenerative change of the femoral head and muscle atrophy of both hind limbs. There is moderate bilateral periarticular remodeling of the acetabulum.

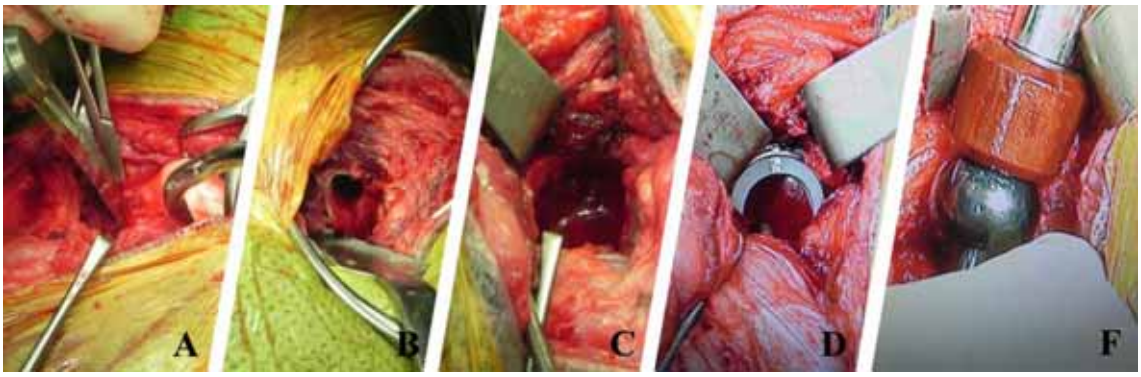

Fig. 2: Intraoperative view. The femur was removed using an oscillating saw (A), the femoral shaft created the canal for a femoral stem (B), the acetabulum was prepared with a cup reamer (C), an acetabular cup was placed within the acetabulum (D), and the femoral head was hammered onto the femoral neck (F).

Fig. 3: An immediate postoperative radiograph. The angle of lateral opening is 45°, the angle of inclination is 15°, and the angle of version is 13°.

Patient preparation and anesthesia: The patient received cephalexin preoperatively (20 mg/kg IV q one hour, Methilexin Inj®, Union Korea Pharm, Korea) for prophylaxis. The patient was premedicated with acepromazine (0.005 mg/kg SC, SEDAJECT injection®; SAMU MEDIAN, Korea) and butorphanol (0.4 mg/kg IM, Butophan Inj®; Myung Moon Pharm, Korea). Epidural anesthesia was performed with 2% lidocaine (1 ml/4.5 kg, Lidocaine Hcl Dalhan Inj®, Dai Han Pharm, Korea) and general anesthesia was induced using propofol (6 mg/kg IV, Anepol IN®; Ha Na Pharm, Korea) and maintained with isoflurane (Forane soln®, JW Pharmaceutical, Korea) with oxygen in a closed circle system.

Surgical procedure: The patient was positioned in lateral recumbency with a positioner on the surgical table. The procedure was performed with Kyon implants (Kyon Inc., Zurich, Switzerland). The hip joint to receive the ZCTHR was approached through a craniolateral approach. The joint capsule of the femoral head was incised with a T-shaped incision. The hind limb was rotated outwards 90°, retractors were placed around the surgical site, and a Hohmann retractor was placed under the femoral head to protect the soft tissue. The osteotomy of the femoral head and neck was performed with a rongeur and an oscillating saw (Fig. 2A). The osteotomy site of the femoral neck was opened with a 6 mm drill bit. The femoral canal was enlarged using an 8.2 mm stem reamer and a medium stem broach (Fig. 2B). The final femoral canal was

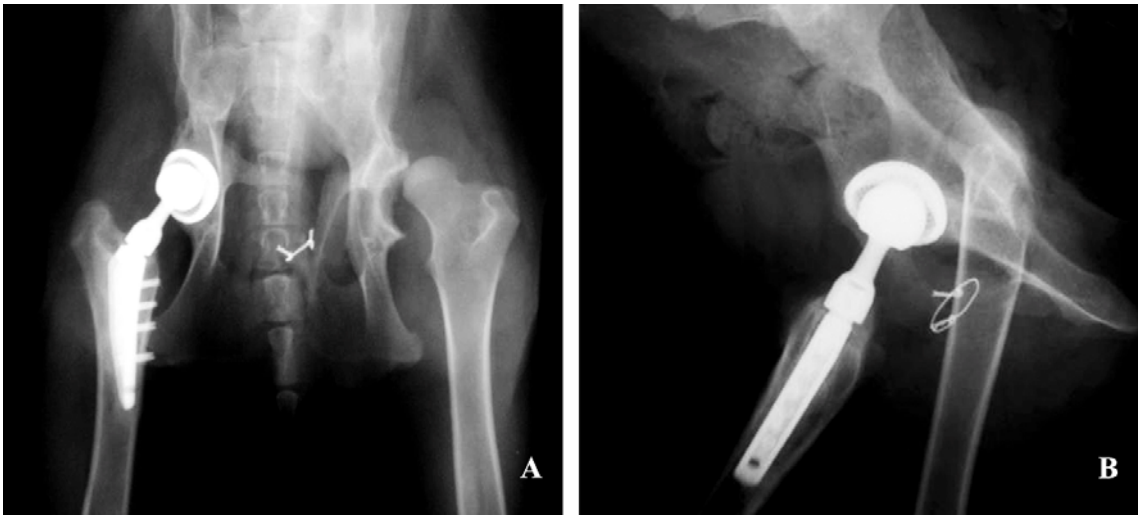

Fig. 4: Postoperative radiograph at 9 months showing good implant positioning without any changes.

checked using a medium trial stem. A 2.5 mm pilot hole was drilled into the medial site of the acetabulum to control progression of the reaming. The acetabulum was prepared with a 26 mm and 29 mm cup reamer until the cortical bottom of the fossa was reached (Fig. 2C). A 19 mm impactor was installed with orientation pins. A medium/big head cup (29.5/19 mm) was impacted with a hammer and an impactor into the prepared acetabulum (Fig. 2D). A medium-sized femoral stem was connected to a stem drill guide. The vastus lateralis muscle was retracted cranially. A 4.5 mm drill bit was drilled in the lateral cortex with a drill sleeve at the third hole of the stem. The hole was drilled into the medial cortex using a 3.0 mm drill bit and a drill sleeve. A self-tapping titanium screw was inserted and locked into the femoral stem and the medial cortex. Additional screws were then applied using the same technique. A long/big head was lightly hammered onto the conical peg of the femoral stem (Fig. 2F). The joint of the ZCTHR was reduced and evaluated for impingement and the possibility of luxation within the range of motion. The surgical site was lavaged and closed in a routine manner.

Postoperative radiographs documented appropriate implant positioning and orientation (Fig. 3). Intraoperative and postoperative cultures of the hip joint resulted in positive cultures of *Proteus penneri* and *Proteus vulgaris*. On the basis of the antibiotic sensitivity test, the patient received amikacin (15 mg/kg IV Samu Amikacin injection®, Samu Median, every 12 hours for 14 days), and the sutures were removed at 14 days. The patient was discharged from the hospital with carprofen (2.2 mg/kg PO one daily, Rimadyl®; Pfizer Animal Health, USA) and ciprofloxacin (10 mg/kg PO two times daily, CIPROXIN TAB; Newgenpharm Inc, Korea) to be taken for one month.

At the 12-week follow-up, the patient was using the right hind limb with no observed lameness. There were no complications associated with the surgery. At the 9-month follow-up examination, the patient had an improved gait and muscle mass in both limbs. There was no pain on palpation or manipulation of the right pelvic limb, which demonstrated the normal range of motion (Table 1). Radiographs confirmed no changes in implant positioning and no implant loosening (Fig 4).

Table 1: Range of motion (angles) in the hip joint

	Left (pre-OP)	Right (pre-OP)	Left (post-OP)	Right (post-OP)
Flexion*	45	45	45	45
Extension*	145	145	145	160
Excursion*	100	100	100	115

*Normal range: Flexion (50°), Extension (162°), Excursion (112°) ; OP, operative

DISCUSSION

We had satisfying results with a ZCTHR after an unsuccessful TPO in a dog. The TPO procedure for treatment of CHD includes rotating the pelvis to improve coverage of the femoral head (Koch *et al.*, 1993). Previous studies have shown good clinical outcomes after a TPO (Borostyankoi *et al.*, 2003). However, a long-term study of TPO in dogs with CHD reported that TPO is unable to prevent the development or progression of osteoarthritis secondary to hip dysplasia (Rasmussen *et al.*, 1998). The primary goals of surgical treatment for CHD are to decrease hip pain and return limbs to their normal functional state. In a patient with pain or no clinical improvement of the hip joint after TPO, it is necessary to perform salvage surgical procedures. FHO or THR are treatment options for mature or failed management of CHD (Anderson, 2011). FHO is regarded as the last option among salvage surgeries in dogs with hip joint problems (Off and Matis, 2011). However, most dogs with CHD weigh around 20 kg. A previous study on FHO reported that functional results were poor in 42% of patients and that the FHO outcome of small dogs was better than that of large dogs according to gait analysis, but that 96% of owners were satisfied with outcomes after a FHO (Off and Matis, 2011).

THR is another surgical option for returning a hip joint with CHD to normal function. In veterinary medicine, cemented and cementless THR procedures have been developed. A ZCTHR uses immediate fixation of the plasma-coated acetabular cup and the femoral stem with locking screws (Allen, 2012). In a study on ZCTHR, the

final outcome was successful in 97% of dogs. However, the complication rate was higher than with cemented THR (Guerrero and Montavon, 2009; Allen, 2012). In human medicine, few cases of THR after a failed pelvic osteotomy have been reported. It has been reported that the technical difficulty of performing THR is greater in patients who have undergone prior pelvic osteotomy (Peters *et al*., 2001). In our case, there were pelvic angle and bone changes after TPO. Nevertheless, ZCTHR identified the appropriate angle of lateral opening, inclination, and version. Furthermore, our patient achieved a nearly normal range of motion in the treated right hind limb. A five-year study of THR in dogs suggested that unilateral THR results in acceptable function in 80% of dogs with bilateral CHD (Olmstead *et al.*, 1983).

Although the left hind limb still subluxated and the bilateral tibia still had an angular deformity, our case of ZCTHR after a failed TPO in a dog with CHD showed good clinical results. A Zurich cementless total hip replacement (ZCTHR) can be applied in the case of an unsuccessful triple pelvic osteotomy patient as a revision surgery.

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