Use of a TTA Plate for Correction of Severe Patella Baja in a Chihuahua

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ABSTRACT

A 7 yr old spayed female Chihuahua presented for right hind limb lameness and reduced stifle range of motion. Radiographs showed a marked patella baja of the right stifle and evidence of a previous surgery to correct a medial patellar luxation. A tibial tuberosity osteotomy was performed to allow proximal translation of the tibial tuberosity, which was stabilized with a tibial tuberosity advancement plate. Four weeks postoperatively, lameness and articular range of motion were improved, and the use of anti-inflammatory and analgesic medications was discontinued. The dog was still ambulating well and had no lameness 12 mo postsurgically. (J Am Anim Hosp Assoc 2012; 48:——–). DOI 10.5326/JAAHA-MS-5686)

Introduction

Patella baja, also known as patella infera, is well documented orthopedic condition in human medical literature that may develop secondary to stifle disease, injury, or surgery. The condition causes lameness, secondary osteoarthritis, and decreased joint range of motion with subsequent pain due to pathologic shortening of the patellar tendon. Patella baja is much less common in dogs and has rarely been documented in veterinary literature. The purpose of this case report is to described surgical correction of patella baja in a dog by proximal translation of the tibial tuberosity and stabilization using a TTA plate.

Case Report

A 7 yr old spayed female Chihuahua was referred to the Animal Hospital Specialty Center with a right hind limb lameness of approximately 6 wk duration. The dog had received multiple anti-inflammatory and analgesic medications prior to referral. Three years prior to referral, the dog underwent surgery to correct a medial luxating patella of her right hind limb.

On initial examination, the dog had a weight-bearing lameness (grade 3/4) of the right hind limb. A bilateral, mild, hind limb paresis that was worse on the right side was also observed. A full orthopedic examination revealed moderate discomfort and decreased range of motion upon manipulation of the right stifle. An approximate 20° loss of flexion and 10° loss of extension were observed based upon the range of motion present in the contralateral limb. Moderate discomfort was observed with firm palpation of the lumbar spine. A small (2 cm × 2 cm) soft, movable, subcutaneous mass was documented on the left lateral thorax. The remainder of the examination was unremarkable.

Radiographs of the right stifle, thoracolumbar spine, and hips were obtained. Radiographic findings of the stifle included a severe patella baja, moderate joint effusion, and mild osteophytosis present on the distal patella and fabella (Figure 1). Two Kirschner wires were present engaging the tibial tuberosity in a cranial to caudal orientation, indicating the previous medial patellar luxation surgery involved a lateral tibial tuberosity transposition. Spinal radiographs revealed moderate narrowing of the fourth to fifth lumbar intervertebral disc space and mild narrowing of the intervertebral disc spaces between the third and fourth lumbar vertebrae and the fifth and sixth lumbar vertebrae. Ventrodorsal radiographs of the pelvis revealed adequate acetabular femoral

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head coverage bilaterally and radiographically healthy coxofemoral joints. Fine-needle aspirates of the lateral thoracic mass were diagnostic for lipoma. A complete blood cell count and serum biochemical analyses were unremarkable.

Initially, medical therapy was started consisting of exercise restriction and a nonsteroidal anti-inflammatory medication, meloxicam¹ (0.1 mg/kg per os [PO]). This treatment plan had a good response initially. During a recheck examination 2 wk after the initial consultation, the previously observed paresis was markedly improved. The right hind limb lameness was mildly improved (grade 2/4), but was still present.³ Moderate discomfort and decreased range of motion of the right stifle were also still present. The dog was examined again 4 wk after the initial consultation. No further improvement or regression of lameness was observed even with continued conservative therapy of exercise restriction and meloxicam. At this examination, the decision was made to pursue surgical correction of the dog’s right patella baja; however, due to financial constraints, the surgery was postponed to a later date.

Approximately 5 mo after the initial consultation, the dog returned for surgery. Preoperative examination showed a consistent, weight-bearing, right hind limb lameness (grade 2/4), moderate discomfort upon manipulation, and decreased range of motion of the right stifle.³ Preoperative blood analyses were unremarkable. The dog was premedicated with hydromorphone⁵ (0.1 mg/kg subcutaneously) and midazolam⁶ (0.2 mg/kg subcutaneously) 30 min prior to surgery. Anesthesia was induced with propofol⁷ (4 mg/kg IV) and was maintained with isoflurane⁸ in oxygen. The dog received cefazolin⁹ (22 mg/kg IV) at the time of anesthetic induction and every 2 hr during surgery.

The right leg and left thorax were clipped and aseptically prepared for surgery. A standard medial approach to the right stifle was made. Following a medial parapatellar arthrotomy, the patella was grossly observed to be in a severe baja position. The proximal most cranial aspect of the tibial tuberosity appeared to mildly displace the straight patellar tendon cranially. Therefore, an ostectomy of the proximal cranial aspect of the tibial crest was performed using a reciprocating saw⁹. This portion of the tibial tuberosity was removed due to the likelihood of it causing significant impingement on the anterior joint compartment after a proximal tibial tuberosity transposition. The ostectomy also exposed and isolated more of the tendon distally, effectively adding additional length to the straight patellar tendon. A partial longitudinal osteotomy was performed using a reciprocating saw that transected the distal tibial tuberosity as with a routine tibial tuberosity advancement (TTA).⁴,⁵ The transected tibial tuberosity was then moved proximally ~1 cm until a grossly normal anatomic position of the patella was achieved. The TTA plate was secured distally to the tibia using two 2.4 mm bone screws¹. The stifle was then manipulated through a full range of motion as the patella was visualized. The patella remained within the patellar groove through full flexion to full extension. The area was lavaged with warmed sterile saline. The joint, subcutaneous tissue, and skin were closed routinely. Of note, the fascia was closed distally, but not proximally, effectively creating a medial retinacular release. The previously identified lipoma was then removed from the left lateral thorax in a routine fashion.

Postoperative radiographs were performed of the right stifle to ensure adequate implant placement, and a soft padded bandage was applied. The dog recovered without complication. Pain management was maintained with a morphine constant rate infusion (0.06 mg/kg IV) for the first 18 hr. Meloxicam (0.1 mg/kg PO q 12 hr) was prescribed for 14 days and tramadol (12.5 mg PO q 8 hr pro re nata) was prescribed and first administered 18 hr postoperatively.

![Mediolateral radiograph of the right stifle showing severe patella baja, moderate joint effusion, and mild osteophytosis present on the distal and cranial patella, proximal tibial tuberosity, fabella, and proximal trochlear ridges. Note two IM pins from previous stifle surgery along with mild cranial displacement of the patellar tendon proximal to its attachment (arrow).](image)
The dog was discharged from the hospital 1 day postoperatively with a soft padded bandage in place. A recheck examination was performed 7 days after discharge from the hospital. Following removal of the bandage, a physical examination revealed a healing incision with no incisional swelling and minimal stifle effusion. An orthopedic examination revealed a moderate weight-bearing lameness (grade 2/4) of the right hind limb and decreased stifle range of motion. The patella was located in a normal anatomic position within the trochlear groove. The owner was instructed to perform gentle passive range of motion exercises two to three times per day. The authors discussed a rehabilitation consultation at that time; however, the owner elected not to pursue physical therapy consultation.

Subsequent recheck examinations were performed at 4 wk, 8 wk, 12 wk, 16 wk, and 52 wk postoperatively. At 4 wk, a mild weight bearing lameness (grade 1/4) of the right rear limb was observed. An ~20° loss of flexion and 10° loss of extension were still present compared with the left stifle. The owner had given 3–4 doses of meloxicam for observed lameness since the last recheck examination. At 8 wk, no significant lameness was observed, and a full range of motion was appreciated in the right stifle. All medications had been discontinued by the owner after the 4 wk examination. Radiographs were performed that showed complete healing of the osteotomy and an anatomically normal patella (Figure 2). An exercise regimen was recommended consisting of gradually lengthening leash walks over a 4 wk period. At 12 wk and 16 wk, the dog again showed no lameness and had full range of motion in the right stifle. No further medications had been given, and no further restrictions were recommended. At 52 wk, the dog had experienced no further lameness, even with heavy activity. The right stifle had full range of motion with no discomfort. The patella was palpated within the trochlear groove and could not be luxated medially or laterally. Radiographs were obtained that showed an anatomically normal proximodistal patella position. Radiographic measurements confirming normal vertical patella position were also performed during this visit. The patellar length (measured using the mediolateral radiograph) was 0.9 cm. The distance from the proximal patella to the femoral transcondylar axis (measured using the craniocaudal radiograph) was 1.8 cm (Figure 3). Therefore, a calculated ratio of 2 was present, indicating a normal anatomic position of the patella.

**Discussion**

Patella baja, also known as patella infera, is a low-riding patella that may develop secondary to stifle disease, injury, or surgery. In humans, pathologic shortening of the patellar tendon results in a decreased range of motion and the subsequent development of pain, lameness, and osteoarthritis. Following knee surgery, joint immobility and hypotonia of the quadriceps mechanism together with arthofibrosis of periarticular structures has been documented to lead to the condition called patella infera syndrome by Noyes et al. (1991) and infrapatellar contracture syndrome by Paulos et al. (1994). In humans, this most commonly occurs following intra-articular stabilization of anterior cruciate ligament deficient knee using patellar ligament graft. Other documented causes of patella baja in humans include extra-articular anterior cruciate ligament reconstruction, multiple knee ligament repairs, meniscal repair, posterior cruciate ligament reconstruction, lateral retinacular release, femoral fracture fixation, patellar fractures, arthroscopy, anterior knee contusions, proximal tibial osteotomy prior to total knee arthroplasty, and quadriceps tendon rupture. In dogs, patella baja is associated with lateral patellar...
luxation and increased proximal tibial length compared with controls. The most likely cause of the patient’s patella baja described in this report is a poorly performed lateral tibial tuberosity transposition to correct a medial patellar luxation.

Multiple surgical procedures for patella baja have been reported in humans. The most commonly reported procedure involves tibial tuberosity osteotomy, proximal translation of the tibial tuberosity, and fixation using either lag screws or a bone plate and screws. The technique performed on the patient in this report involved the principle of proximal tibial tuberosity translation. Patellar tendon lengthening techniques have also been described. The most recent technique involves placement of a ring style (Ilizarov) external skeletal fixator engaging the tibia and patella that is distracted gradually until normal patellar tendon length is restored. The small size of the patient described herein precluded any tendon lengthening procedures from being performed.

One concern with the procedure involved stability of the proximal tibial tuberosity. With routine TTA, the proximal tibial tuberosity is stabilized with the advancement cage and bone screws along with the TTA plate. Placement of a cranial to caudal Kirschner wire through the proximal tibial tuberosity was discussed, but was not performed due to the size of the patient and the previous surgery involving the tibial tuberosity. The tibial tuberosity osteotomy healed in the patient in this report without complication. Another concern involved the placement of the TTA plate. On postoperative radiographs, it was discovered that the distal fork might not have fully engaged bone. However, the two proximal forks firmly engaged bone; thus, further action was not pursued. Use of the newer and smaller two-fork TTA plate would be more ideal for this patient due to size, but was not available at the time of surgery.

Notably, the patella was palpated within the trochlear groove during all recheck examinations in this patient. In the normal stifle, patellofemoral contact facilitates extensor function of the stifle joint and provides a smooth gliding mechanism for the quadriceps apparatus while greatly increasing mechanical efficiency. A functioning patellofemoral joint also provides caudal compression and contributes to the overall stability of the stifle. An abnormal patellofemoral joint due to patella baja may have been the source of this patient’s preoperative lameness. Therefore, a patella located consistently within the trochlear groove would suggest a functioning patellofemoral joint capable of supplying normal compressive force and stability to the stifle. As with the patient described in this report, a normal postoperative patellofemoral joint may be a significant factor in the long-term resolution of lameness after correcting patella baja.

Radiographic measurements to diagnose patella baja and patella alta have been reported in medium- to giant-breed dogs. With this technique, a measurement of the distance from the proximal patella to the femoral transcondylar axis was taken from a craniocaudal or caudocranial view and a measurement of the patellar length was taken from the mediolateral view. The distance from the proximal patella to the femoral transcondylar axis was then divided by the patellar length and was expressed as a ratio. As reported, a calculated ratio of <1.92 is suggested to represent a patella baja condition. Conversely, patella alta is suggested with a value of >2.03 and is associated with medial patellar luxation. That report suggested that intentional positioning of the tibial tuberosity distally during surgical correction of medial patellar luxation may be needed to correct for associated patella alta. It is not known whether the tibial tuberosity was moved distally during this patient’s initial surgery to correct a medial patellar luxation, but excessive distal translation during
the initial surgery may have manifested as patella baja in this patient.

Twelve months after surgery, the patient described in this report returned for a follow-up examination and radiographic evaluation. The measured patellar length and distance from the proximal patella to the femoral transcondylar axis produced a calculated ratio of 1:94, indicating a normal anatomic position of the patella. However, the size of this patient must be taken into consideration when evaluating this value. In the previously referenced study by Mostafa et al. (2008), the reported values were identified in medium- to giant-breed dogs >11 kg. It is not currently known whether these values can be extrapolated to small-breed dogs accurately.

While writing this case report, numerous radiographs were either unavailable or were taken with poor radiographic technique or positioning. Absent and poorly obtained radiographs should be considered a limitation of this case report. The current preoperative mediolateral radiograph of the stifle shows a low-riding patella consistent with patella baja; however, a cranio-caudal or caudocranial radiographic view is necessary to perform radiographic measurements to confirm a diagnosis of patella baja, but the preoperative cranio-caudal radiographic view is unavailable. Furthermore, immediate postoperative radiographs were obtained using poor radiographic positioning. Measurements confirming normal patella position could not be performed accurately until the 12 mo recheck visit.

Another limitation of this report involves the varied degree of flexion present in the preoperative and postoperative mediolateral radiographic views. With this case, all mediolateral postoperative radiographs were obtained with the stifle positioned at a standing angle compared with the mediolateral preoperative radiograph, which was obtained with increased stifle flexion. Although the degree of flexion is different, the authors feel that the radiographs effectively show a severely low-riding patella consistent with patella baja preoperatively, proximal translation of the tibial tuberosity, and an anatomically normal patellar position postoperatively. In this case of patella baja, long-term follow-up has revealed a relative return to normal limb function after proximal translation of the tibial tuberosity using a TTA plate.

Conclusion

Twelve months postoperatively, the dog had returned to normal activity without medications. A TTA plate may therefore provide acceptable stabilization following proximal translation of the tibial tuberosity to surgically correct severe patella baja in a Chihuahua.

FOOTNOTES

REFERENCES