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## SURGICAL CORRECTION OF PATELLAR LUXATION IN A CHEETAH (*ACINONYX JUBATUS*)

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**Key words:** Patella, *Acinonyx jubatus*, cheetah, patellar luxation.

### INTRODUCTION

Patellar luxation is a rare disease in domestic felids; only a few dozen cases have been described.<sup>1-6</sup> Both medial and lateral patellar luxations occur, but medial displacement is most common.<sup>4</sup> The condition is bilateral in about half of the animals.<sup>1,2,4-6,8</sup> In about 20-30% of the cases, trauma is the cause of the problem.<sup>5</sup> In the other 70-80%, congenital malformations, occasionally in combination with hip dysplasia, are the cause of the luxation. There is little proof for a genetic component for the disease in cats.<sup>1</sup>

Most cats are under 1 yr of age when clinical signs first become apparent.<sup>1,2,4-6,8</sup> Signs may consist of lameness, crouched walking, inability to jump, bowed legs, or a wobbly gait.<sup>2,5</sup> Surgical correction has been a successful treatment in most patients for which follow-up information is available.<sup>4-6</sup> Bilateral, patellar luxation has, to our knowledge, not been described in the cheetah.

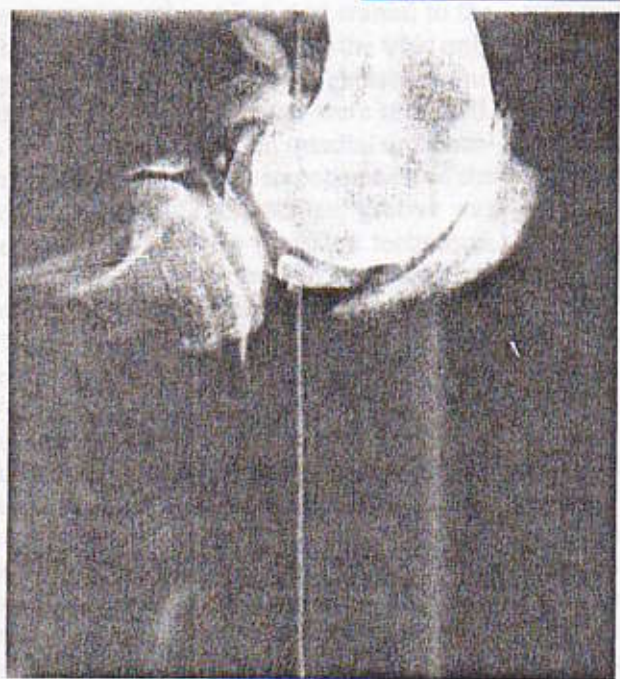
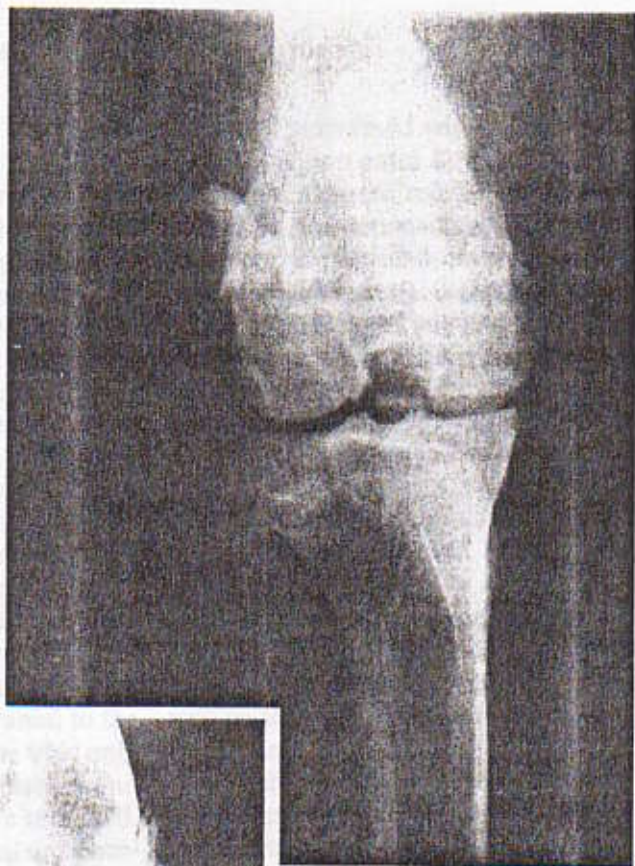
### CASE REPORT

A 7-yr-old female cheetah (*Acinonyx jubatus*) was examined because of a several

year history of difficulty in rising, reluctance to walk, and severe lameness in both hind legs. The animal was born in a zoo and had no history of trauma. When walking, the animal sagged at the knees and was occasionally reluctant to put weight on its left hind leg. Under general anesthesia, using i.m. xylazine (Rompun, Bayer, Brussels, Belgium) and ketamine (Imalgene, Mérieux, Brussels, Belgium), the animal was examined in lateral and dorsal recumbency. Both patellae were fixed on the medial side of the femur with leg extended (grade 4 medial patellar luxation). Severe crepitation was elicited by flexing and extending the knee. The flex and extension range of the knee was restricted, 90° instead of 30° and 160° instead of 180°, respectively. Mild muscle atrophy of both hind legs was present. An anterior drawer sign was mildly present on the left side (3-4 mm). Blood was drawn for clinical pathology. Tests for feline infectious peritonitis, feline immunodeficiency virus, and feline leucosis virus were negative. Apart from a mild anemia, other blood values were within laboratory reference intervals. The radiographic examination (Fig. 1) confirmed the position of both patellae medial to the femoral grooves. A severe osteoarthritis was present with an abundance of exostoses on the proximal tibia, distal femur, and the fabellae bilaterally. No varus or valgus deformities were present. Proxi-

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**Figure 1.** Radiograph of the right knee of a cheetah. **a.** Lateral projection. Severe osteoarthritic changes can be observed, such as the exostoses on the distal patella, the distal femur, and the tibial plateau. **b.** Craniocaudal projection. The patella is located medial to the femoral groove.



mal tibial internal rotation was about 20°. No hip radiographs were made.

The left side was repaired first. Presurgery, the animal was injected with long-acting amoxicillin (Duplocillin, Duphar, Brussels, Belgium) once. The animal was positioned in dorsal recumbency. Anesthesia was induced and maintained with 1–3% isoflurane (Enflurane, ICI, Brussels, Belgium) in 100% oxygen. A skin incision was made from the proximal medial tibia to the distal lateral femur. A lateral, parapatellar incision through the fascia lata and the joint capsule was performed. Joint inspection revealed a ruptured medial meniscus, with the cranial portion torn from the minor attachments to the meniscal peripheral rim. The ruptured meniscus was removed. The large exostoses lateral, medial, and cranial to the tibial plateau were attached to the tibia only by connective tissue. These exostoses and adjoining connective tissue were removed. A medial release incision (medial desmotomy) was made to allow transposition of the patella laterally. The trochlear groove was deepened by a wedge recession technique, similar to that previously described,<sup>3</sup> resulting in a recession sulcoplasty (Fig. 2). The removed piece allowed 50% of the patellar thickness to be housed in the groove. Very large erosions, covering >50% of the surface, were present at the articular face of the patella, predominantly at the lateral side. All exostoses on the medial and lateral side of the femur and on the distal part of the patella were removed. Because the patella was too broad to fit in the new femoral groove, it was narrowed at its medial and lateral border.

The tibial tuberosity was osteotomized and transposed laterally after reflection of the cranial tibialis muscle. The tuberosity was transposed to the most lateral aspect of the tibia, just medial to the medial aspect of the long digital extensor tendon. This aligned the extensor mechanism of the stifle. The tuberosity was reattached to the lateral tibial metaphysis, after constructing a cancellous bone bed at this site. The reattach-

ment was performed with a 1.25-mm cerclage wire. Two extra K-wires were placed in the tuberosity to reinforce fixation. The fascia lata and retinaculum plus joint capsule were shortened 3 cm and imbricated with polyglactine 910 (Vicryl, Ethicon, Brussels, Belgium). The subcutaneous tissue and skin were closed in a routine manner. After surgery, flexion and extension of the knee were still restricted and produced crepitation, but the patella fitted nicely in the new groove. The cheetah recovered uneventfully from the anesthesia and became weight bearing on its left leg 5 days post-surgery.

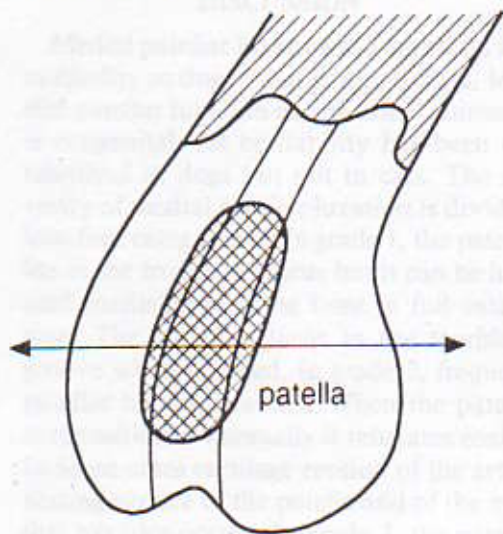
Three months later, the animal had recovered sufficiently to allow surgery on the right leg. The cheetah was bearing weight well on the left leg, better than on the right, and did not sag on this leg anymore. It also preferred use of the left leg when rising. The muscle atrophy present before surgery had diminished considerably on the left side. Clinical evaluation of the left stifle revealed a stable, nonluxated patella, crepitation on flexion and bending, and a range of motion identical to that presurgery.

Surgical joint inspection (arthrotomy) on the right side revealed that the medial femoral condyle had undergone severe atrophy. The trochlea was convex. The medial trochlea sloped 30–40° to the medial side. Deepening of the patellar groove was produced by an extreme trochleoplasty consisting of a wedge osteotomy. A medial releasing incision was made. There was a very large cartilage erosion at the articular surface of the patella, consisting of approximately 80% of the total surface area, with only a small crescent of the proximal part of the articular surface still present. The patella was narrowed laterally and medially to about half of its original width. The tibial tuberosity was transposed and reattached with a 1.25-mm cerclage wire. The fascia lata was trimmed and imbricated, and the other layers were closed routinely. Recovery was uneventful. Three months after the second operation, the animal had recovered to a

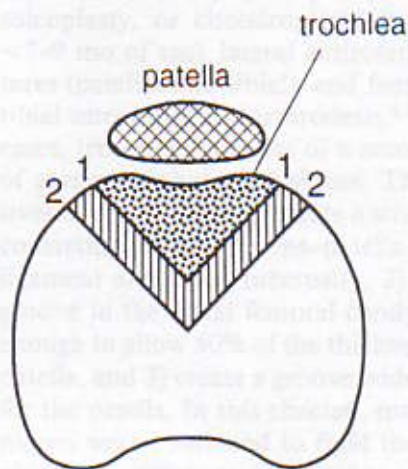


# Double wedge recession osteotomy (schematic drawing)

a. frontal (cranial) view on the distal femur and femoral condyle




b. cross section through distal femur

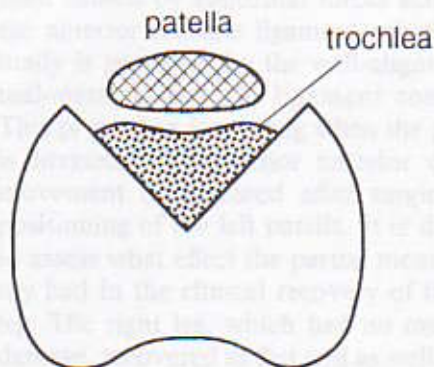


line 1 represents first cut of osteotomy

line 2 represents second cut of osteotomy

 area : bone which is removed

c. cross section through distal femur after reposition of osteotomised fragment



**Figure 2.** Double or recession wedge osteotomy in the left knee of a cheetah. This technique deepens the femoral groove to enable 50% of the patellar thickness to be housed in the groove.



normal activity level, without visible lameness or difficulty in rising. No follow-up radiographs were made.

## DISCUSSION

Medial patellar luxation is a common abnormality in dogs<sup>3,7</sup> but is rare in cats. Medial patellar luxation occurs after trauma or is congenital. Its heritability has been established in dogs but not in cats. The severity of medial patellar luxation is divided into four categories.<sup>3,7</sup> In grade 1, the patella fits in the trochlear sulcus but it can be luxated medially with the knee in full extension. The patella returns to the trochlear groove when released. In grade 2, frequent patellar luxation occurs. When the patella is repositioned manually it relaxates easily. In some cases cartilage erosion of the articulating surface of the patella and of the medial trochlea occurs. In grade 3, the patella is permanently dislocated but it can still be replaced manually in the shallow trochlear sulcus. In grade 4, the patella is permanently dislocated and cannot be replaced in the trochlear groove or sulcus, which is often flattened or even convex.

Most cases described in cats have been grade 2; very few animals had grade 4 luxations.<sup>1,2,4-6,8</sup> In dogs, grade 1 luxation causes intermittent lameness with the leg carried when the patella is luxated. Grade 2 and 3 luxations often cause severe intermittent lameness or abnormal gait, which is crouched and bowlegged when the condition is bilateral ( $\pm 25\%$  of the cases). In grade 4 luxations, the leg is carried constantly (unilateral) or the animal moves in a crouched position with the knees partially flexed. Quite often, the knee cannot be fully extended (flexure contraction). In cats, signs are not so clear. The lameness is often absent or obscure. Reluctance to jump or walking bowlegged or in a crouched position are described more often. In this cheetah, the clinical signs were not typical but included reluctance to rise, difficulty in rising, and sagging through one hind leg (the left

one before and the right one after the first surgery).

Surgical techniques for medial patellar luxation repair include lateral retinaculum and fascia lata overlap or shortening, tibial tubercle transposition, medial desmotomy, trochleoplasty (sulcoplasty, recession sulcoplasty, or chondroplasty in animals <7-9 mo of age), lateral antirotational sutures (patellar and tibial), and femoral and tibial osteotomy and arthrodesis.<sup>3,7</sup> In most cases, treatment consists of a combination of several of these techniques. The objectives of repair are to 1) create a straight line consisting of quadriceps-patella-straight ligament and tibial tuberosity, 2) create a groove in the distal femoral condyle, deep enough to allow 50% of the thickness of the patella, and 3) create a groove wide enough for the patella. In this cheetah, many techniques were combined to fulfil these three objectives, resulting in a stable and well-placed patella.

It is unknown why the cranial medial meniscus was damaged, because no cranial cruciate ligament tear was present. Also, the localization of the meniscal damage was atypical, because the medial meniscus is usually torn in its caudal part.<sup>3,7</sup> The minor laxity of the anterior cruciate ligament may have allowed the femur and tibia to produce abnormal biomechanical loads on the cranial medial meniscus. This laxity may have been caused by abnormal forces acting on the anterior cruciate ligament, which normally is protected by the well-aligned gluteal-patellar-straight ligament complex. This protection is missing when the patella is luxated.<sup>3,7</sup> The minor anterior drawer movement disappeared after surgical repositioning of the left patella. It is difficult to assess what effect the partial meniscotomy had in the clinical recovery of the left leg. The right leg, which had no meniscal damage, recovered as fast and as well as the left leg.

The condition was diagnosed at a late age probably because of exaggeration of the signs from concomitant osteoarthritis, unfamiliar

ilarity with the condition by personnel, and captive circumstances allowing only limited spontaneous activity in the animal.

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