Surgical correction of lateral patellar luxation in a pileated gibbon (*Hylobates pileatus*)

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**SUMMARY**

A twenty-six-year-old pileated gibbon (*Hylobates pileatus*), weighing 8.3kg, was presented with change in the locomotion mode and ischial pressure sores. On examination and radiographs, a grade-3 lateral patellar luxation of the right hind limb was diagnosed. Surgical correction involving a medial tibial tuberosity transposition and a medial retinacular imbrication was planned. An additional trochleoplasty was decided intraoperatively because arthroscopy revealed a flat femoral trochlear groove: the trochlea was surgically deepened, and the removed wedge of cartilage was replaced in the groove. The gibbon recovered its hind limb use one month after surgery, but pressure sores persisted. It finally died of contagious digestive infection 43 days after surgery. Patellar luxation is a common disorder of the stifle in dogs and cats, but very little is known about this disorder in non-human primates. Only one elbow luxation and one radial luxation have been reported. To the authors' knowledge, this is the first description of a patellar luxation and its management in a gibbon.

**Keywords**: *Hylobates pileatus*, patellar luxation, tibial tuberosity transposition, retinacular imbrication, trochleoplasty

**CASE PRESENTATION**

A 26-year-old, 8.3kg male pileated gibbon (*Hylobates pileatus*) from the Parc Zoologique et Botanique de Mulhouse, was presented for change in locomotion type in July 2016. An increase in arboreal moves was observed at the expense of biped ones on the floor, in association with mild right hindlimb lameness. The individual appeared apathetic and moved less in the exhibit. Before any clinical examination, the animal was treated with meloxicam (Melosus' 0.2 mg/kg p.o., s.i.d. for 3 days). However, no improvement was observed.

**INVESTIGATIONS**

The animal was anesthetized for a complete examination a week after the first symptoms were recorded. The right leg presented major muscle atrophy and lateral patellar luxation was palpated. An ischial pressure sore was observed on the opposite side. An antero-posterior radiographic projection of coxofemoral joints showed displacement of the right patella.
lateral to the trochlear groove (Figure 1). Other joints and femurs did not show any abnormalities, and no degenerative signs were observed. Manual reduction was possible, but the patella reluxated when the manual pressure of the reduction was removed. It was therefore graded III-IV according to the clinical findings [18]. In the absence of any other significant abnormalities, the animal’s symptoms were considered to be due to the lateral right patellar luxation.

**Treatment and outcome**

Considering the significant atrophy of the leg, the luxation was estimated chronic with an onset several weeks prior to the degradation of the gibbon’s health. As the apparent pain relief had failed to improve with conservative management, surgical therapy was planned two weeks later. A combination of medial tibial tuberosity transposition and medial retinacular imbrication was planned. An additional trochleoplasty would be decided intraoperatively depending on the trochlear groove aspect.

The morning of the surgery, the animal received a dose of amoxicillin and clavulanic acid (Augmentin®, 12.5mg/kg, PO). Anesthesia was induced with isoflurane 5% for 20 min in a box, and maintained with isoflurane 3% via tracheal probe (6 mm). Clinical examination revealed bilateral ischial pressure sores and flexion of the right stifle was limited compared to the left limb. After anesthetic induction, robenacoxib (Onsior®, 2 mg/kg, SC) and morphine (Morpheine Cooper®, 0.2 mg/kg, SC) were administered. The gibbon was positioned in dorsal recumbency and the right stifle was clipped, aseptically prepared and draped. A cranialateral approach to the stifle was performed. A 6 cm cranialateral incision of the skin and subcutaneous tissues was made with a diathermy knife, beginning proximal to the patella and ending distal to the tibial tuberosity. An arthrotomy was performed: the deep fascia was incised with a scalpel, and the incision was extended with Metzenbaum scissors. The joint was sprinkled with sterile Lactated Ringer’s solution. The incision was extended with Metzenbaum scissors. The joint was sprinkled with sterile Lactated Ringer’s solution. The arthrotomy revealed a flat femoral trochlear groove, requiring trochleoplasty. Thus, an elliptical wedge of cartilage and subchondral bone was removed with an oscillating saw from the trochlear groove. The trochlea was then deepened with a rongeur, and the wedge was replaced in the newly deepened groove. Medial tibial tuberosity transposition was then performed: the tibia was replaced in the newly deepened groove. Trochleoplasty and medial retinacular imbrication were also performed. Note the patella in place in the trochlear groove.

The gibbon was then isolated in the inside enclosure for a single day to avoid generating too much stress linked to group separation. Comfortable areas were set up in the inside enclosure. For one month, it was given anti-inflammatory medication (robenacoxib, Onsior®, 2 mg/kg p.o., s.i.d.). In the absence of any other significant abnormalities, the animal’s symptoms were considered to be due to the lateral right patellar luxation.

![Figure 1: Antero-posterior lower limbs radiograph of a 26-yr-old male pileated gibbon. Note the right lateral patellar luxation (arrow, grade 3 on physical examination), and major right hind limb muscle atrophy.](image1)

![Figure 2: Lateral (A) and antero-posterior (B) radiographs of a 26-yr-old male pileated gibbon right stifle showing surgical repair of a lateral patellar luxation with two 1.2 mm pins and a cerclage for the medial tibial tuberosity transposition. Trochleoplasty and medial retinacular imbrication were also performed. Note the patella in place in the trochlear groove.](image2)
the beginning, no support was observed on the right leg, and swelling of the stifle was observed for some days. After 15 days, the gibbon showed partial weight bearing on its right limb, and flexion of the stifle increased. 36 days postoperatively, lameness had disappeared. However a degradation of the ischial pressure sores was noticed. Honey application was performed, and a hydrocolloid bandage was applied on the ischial pressure sores. Bandage was changed twice a week under general anesthesia. Thirty-eight days after the surgery, the group presented an episode of acute diarrhea. Two individuals of the group, including the operated gibbon, died from digestive infection 43 days after the surgery. Digestive PCR failed to indentify a precise pathogen.

Discussion

Different structures of the knee help sustain the patella in the trochlear groove: the groove itself, the lateral and medial patellofemoral ligaments (also called lateral and medial retinaculum), the Vastus Medialis Obliquus Muscle and the patellar ligament [10]. Thus, the dysfunction, dysplasia or weakening of one of these structures can lead to patellar instability, and potential lateral patellar luxation, as observed in the present case. The factors of this instability can be separated in osseous and soft tissue abnormalities. Osseous abnormalities include trochlear dysplasia (flat or convex trochlear groove), femoral valgus, patella alta and lateralization of the tibial tuberosity [1]. Soft tissue abnormalities include distension of the medial patellofemoral ligament (MPFL) and/or patellar ligament, weakness of the Vastus Medialis Obliquus Muscle, and increased distance between the tibial tuberosity and the center of the trochlear groove as well as other, less frequent conditions [16].

Surgery may address either bony or soft-tissue components, in a proximal or distal procedure. The gold standard of surgical treatment is yet to be clearly defined in the literature, as over one hundred surgical techniques have been described [20]. Osseous and soft tissue procedures have been developed to restore patellar stability in case of lateral patellar luxation. Osseous procedures include femoral recession trochleoplasty or chondroplasty [2], medial or inferior tibial tuberosity transposition, bony realignment procedures and patellar osteotomy [20, 21]. On the other hand, soft tissue procedures include lateral retinacular release and/or medial retinacular imbrication [8], and MPFL repair [5]. Combination of several procedures has shown good clinical outcomes. In human medicine, patellar tendon tenodesis in association with tibial tuberosity inferior transposition allowed treating episodic patellar luxation with patella alta [15]; the association of lateral retinacular release, medial transposition of the tibial tuberosity and medial retinacular imbrication allowed treating recurrent patellar luxation in humans [7]; MPFL repair combined with lateral soft tissue release appeared as a promising treatment for habitual patellar luxation in humans [14]. In the present case, a combination of two osseous procedures (trochleoplasty and medial tibial tuberosity transposition) and one soft tissue procedure (medial retinacular imbrication) was elected. A recent study in 47 humans showed that trochleoplasty as a solitary treatment results in good clinical outcome if severe torsional and axial misalignment is excluded [4]. Here, trochleoplasty was non-remedial, as the patella remained slightly unstable. Another study evaluated the outcomes of patellar luxation surgery in 91 dogs, with a combination of lateral retinacular imbrication and tibial tuberosity transposition procedures without trochleoplasty. Results were comparable to studies on groove deepening procedures, showing trochleoplasty is not always necessary [13]. Thus, the use of this technique remains controversial. MPFL repair has proven to be valuable for correcting patellar instability in many studies [25], but was not used in the present case, because patellar stability was good enough at the end of the surgery.

The diagnosis of patellar luxation and the decision to do surgery or not must be made as early as possible to avoid complications that can be difficult to manage. In the present case, the gibbon presented left and then bilateral ischial pressure sores. They were probably due to excessive weight report resulting from pain or dysfunction of the opposite side, which directed our examination to the right leg. The diagnosis of patellar luxation allowed to explain these lesions.

Complications after corrective surgery of patellar luxation include: patellar relaxation [13, 22], arthritis [28], tibial tuberosity transposition implant removal, seroma, infection, patellar tendon laceration, tibial tuberosity osteopenia [24], and fracture of one of the trochlear ridges [6]. A retrospective study on 109 dogs [3] showed tibial tuberosity transposition and femoral trochleoplasty minimize the risk of postoperative patellar relaxation and major complications, while retinacular release resulted in higher frequency of major complications. Based on these results, the procedures chosen for the gibbon’s surgery seem appropriate. However, post-operative management was not optimal as in humans or dogs; immobilization, useful to recovery [19], was not feasible in the present case. The gibbon would have probably removed a splint or external fixators, a plaster would have been too heavy and a resin would have favoured infection. On the other hand, the recovery was estimated of good prognosis because of gibbons’ particular locomotion mode: they mainly use brachiation, and to a lesser extent bipedalism [26]. Thus, the risk of an excessive use or trauma on the operated knee was very limited.

Acknowledgements

The authors would like to thank all the staff from Mulhouse Zoo for their help with this case. We also thank Marc Bridou, English teacher at Ecole Nationale Vétérinaire de Nantes, for his proofreading.
LATERAL PATELLAR LUXATION IN A PILEATED GIBBON

References


