

## Patellar fracture and patellar tendon rupture in a dog\*

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Received: 03.06.2011 • Accepted: 20.03.2012 • Published Online: 22.01.2013 • Printed: 22.02.2013

**Abstract:** The case of a patellar fracture in a 2-year-old male Chow Chow dog was reported. Clinical examination showed a few superficial wounds, erythema, a slight edema on the lateral aspect of the knee joint, and mild to moderate limping in the right hind leg. The patella was palpated more proximally than expected, while an acute ridge was felt at its distal pole. X-ray examination indicated that it had been fractured into 3 fragments. Following routine surgical preparation and inhalation anesthesia, the right knee joint was accessed through a lateral parapatellar incision. Spongy bone tissue was visible in the articular space due to erosion and loss of both femoral condylar cartilages. Small pieces, which made up the distal fragment, were excised, being considered inadequate for reconstruction. A transverse hole was drilled in the tibial crest, cerclage wire was looped over the proximal patella and led through the mentioned hole and stretched adequately to allow tension-free suturing of the ruptured ends of the patellar tendon, and the wire ends were then secured by a knot. Another thicker cerclage wire was led successively through the quadriceps tendon, the patellar ligament, and the already mentioned hole in the tibial crest and fixed. In conclusion, the removal of smaller fragments from a patellar fracture does not seem to impair articular movement. A patellar tendon rupture can be successfully repaired by the method described here.

**Key words:** Dog, patellar fracture, patellar tendon rupture

### 1. Introduction

Patellar fractures and rupture of the patellar ligament are uncommon in dogs (1–3). Forced or extreme flexion, due to a strong or extreme contraction of the quadriceps under conditions such as the impact of hard objects due to a fall or a collision, as in a traffic accident or while running (1,2,4–11), may result in patellar fracture and/or patellar ligament rupture (1,2,10,11).

Patellar fractures can be simple (transversal in the middle of the patella), multipartite, or in the form of an avulsion fracture of the distal pole (1,2,10,11). The main symptoms of patellar ligament ruptures and patellar fractures are severe limping due to a breakdown of quadriceps function, local swelling and pain, laxity of the patellar ligament, and proximal dislocation of the patella (4,10,11).

Final diagnosis is usually made by X-ray examination, because patellar fractures or patellar ligament ruptures can be confused with avulsion fractures of the tibial tuberosity at the insertion of the patellar ligament (10). A patellar position proximal to the femoral trochlea on the X-ray in the anteroposterior (AP) and mediolateral (ML) projections is also reported as useful for the diagnosis (6,10).

The size of the patient's body and that of the bone fragments are both significant for treatment outcome. Considering the importance of the patella in providing osculation during the extension of the knee joint, bone fragments should only be excluded from reconstruction if they are very small. It has been suggested that reconstruction becomes particularly difficult when 50% or more of the patellar joint surface is lost in the form of multiple fragments (1,2,10,11). As a principle, the use of tension bands should be preferred for treatment since the patella is placed between opposite pulling forces (11). Therefore, a screw fixation method should be avoided, even though its use has been reported (10,12).

The following procedure is proposed for patellar tendon restoration: a cerclage wire starting at the proximal end is driven circularly around the patella and led through a hole drilled in the tibial tubercle, following which the ruptured ends of the patellar tendon are tensioned adequately to be touching each other and then sutured with 2/0 or 0 nonabsorbable material (2). In the postoperative period, a bandage may be applied to the leg for 1–3 weeks (1,2) and the patient should be walked on a short leash for 6–8 weeks (2).

\* Part of this research was presented as a poster at the 14th National Congress of Veterinary surgery.

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## 2. Case Report

A patellar fracture was diagnosed in a 2-year-old Chow Chow dog, which was presented with injury of the right hind knee; the animal was limping as a result of the reluctance of the animal to use that limb.

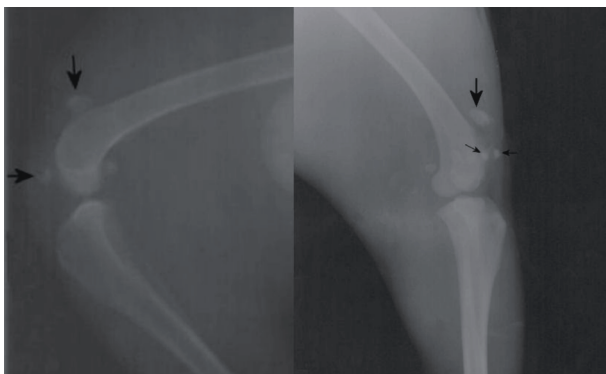
Clinical examination showed mild to moderate weakness of the right hind leg, several small soft tissue lesions on the lateral aspect of the right knee joint, and slightly edematous skin. The patellar ligament was lax, the main body of the patella was dislocated proximally, and a sharp ridge was palpated at its distal pole.

X-rays in the oblique and ML projections (Figure 1) showed the presence of a large piece of the patella proximally and 2 more much smaller fragments more distally. Of note, the proximal fragment was located in the proximal part of the sulcus patellae, while the small fragments were 2.5 cm distal to it.

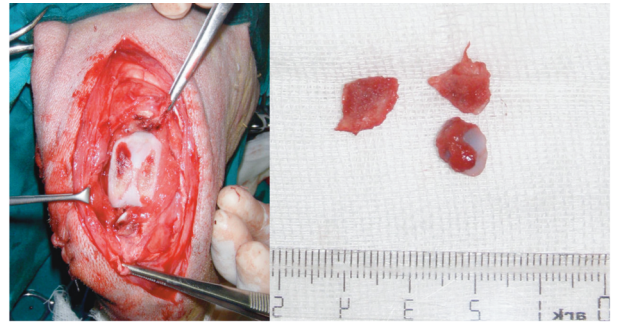
Anesthesia was induced by 1 mL/kg xylazine HCl (Alfazine® Egevet) and 2 mg/kg ketamine HCl (Alfamine® Egevet) intramuscularly, and maintained with 2% isoflurane (Isoflurane® Adeka).

A lateral parapatellar approach was used to enter the knee joint. Cartilage on both of the femoral condyles had eroded away, exposing the underlying spongy bone (Figure 2). In addition to the large proximal piece and the 2 distal fragments seen on the X-ray (Figure 1), an additional splinter was found in the distal group during the operation (Figure 2).

The small pieces into which the distal part of the patella had been splintered were considered inadequate for surgical reassembly. While the proximal, main patellar remnant remained in situ, the other pieces were excised. A 2-mm hole was drilled perpendicular to the tibial crest. A 0.8-mm cerclage wire was led through this hole, then around the patella's proximal fragment along its intact edge (i.e. laterally, dorsally, and medially), and secured by a circular suture. The ends of the cerclage wire were finally knotted after having adjusted the tension appropriately to



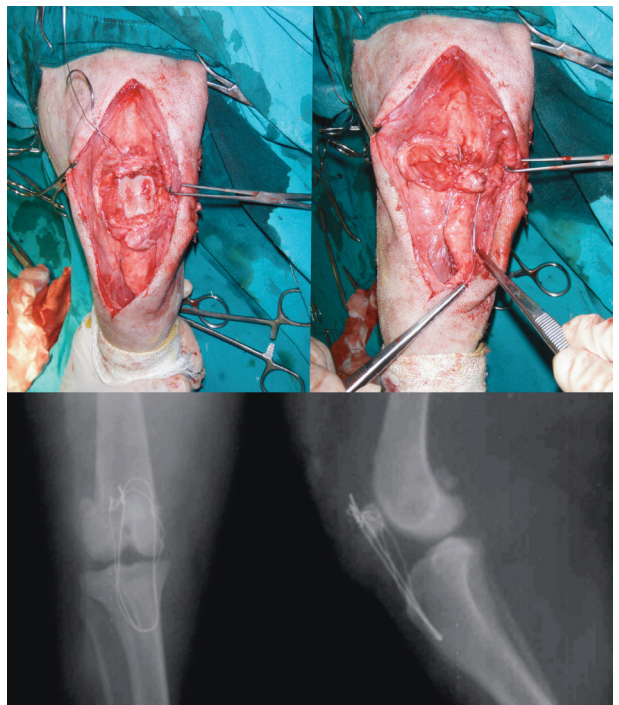
**Figure 1.** Preoperative X-rays of the patient (arrows: fragments).



**Figure 2.** Intraoperative view and excised distal fragments.

achieve contact between the ruptured ends of the patellar ligament. To support the first cerclage application, a 1-mm cerclage wire was threaded through the drill hole in the tibial crest, sutured to the quadriceps tendon in the proximity of the patella, and its extremities were secured (Figure 3).

The wire keeping in contact the ruptured ends of the patellar tendon allowed tension-free suturing, performed with usp 0 multifilament suture material (Supramid®, Kruuse). The soft tissues were closed with usp 2/0 polyglactin 910 (Vicryl®, Ethicon), and the skin was closed with a 2/0 silk suture (Silk®, Kruuse). Penicillin-streptomycin (Iemycine®, I.E. Veteriner) was administered intramuscularly for a week.



**Figure 3.** Intraoperative and postoperative X-rays of the cerclage wires.

### 3. Results and discussion

The patient was not brought back for a postoperative follow-up owing to the busy schedule of its owner, who informed us that the patient was in excellent shape and had been followed-up by a private veterinarian. According to information obtained from both the owner and the private veterinarian at 2 months after surgery, the patient was able to use its leg without visible stress or limping.

Patellar fracture and patellar ligament rupture are rare in dogs (1–3). Even though these are listed in textbooks, actual cases are seldom reported (1–3,5–8,10–16). We therefore thought that sharing our experience may be useful.

Extreme distractive forces inflicted by the quadriceps mechanism lead to patellar fractures. These forces occur as the animal falls and lands with its stifle flexed. Quadriceps contraction occurs as the animal attempts to extend its stifle as its hind feet hit the ground (16). More often than dogs, cats fall from height; maybe for this reason, patellar fractures in cats could be encountered more often than in dogs. A total of 56 patellar fractures in 34 cats were described (17) and it was reported that for 6 of those a partial patellectomy was performed.

Different types of patellar fractures may be seen, including the simple (transversal across the middle), the multifragmented, and the avulsion fracture of the distal pole (1,2,10–16). The principal clinical signs of patellar ligament rupture and patellar fracture include acute limping due to quadriceps dysfunction, local swelling and pain, laxity of the patellar ligament, and palpable proximal dislocation of the patella. It is also reported that leg function can become very restricted or impossible (4,10–16).

While clinical signs in this case were consistent with those published in reports, it was interesting to note that the patient had retained some limb function.

In a case involving a patellar fracture with fragmentation and an avulsion of the patellar ligament, Darnell (15) reported a loss of cartilage in the medial femoral trochlea; the animal in that case could use its leg fully following a 6-month postoperative healing period. Fascial grafting was performed to prevent a medial luxation of the patella. In our case, several lesions, including full erosion of the cartilage exposing the spongy bone, were found on both sides of the femoral head, suggesting that the dog had been using its knee. The medial patellar luxation was checked by the operative procedure and the achieved stability did not seem to necessitate additional treatment.

It has been suggested that finding the patella located closer than normal to the femoral trochlea on AP and ML

X-rays is a favorable factor for outcome (6,10). The patellar remains seen in the ML projection in our case consisted of 1 large piece above the trochlea femoris and 2 distal small fragments; the larger fragment was located more proximally than the normal patellar position, while the distal fragments were displaced distally.

A consequence of the fact that the patella is normally subjected to opposing tensions is the use of tension wire principles for treatment, as well as the significant role played by the size of both the animal and the patellar fragments (9–11); discarding splinters should be possible (2,10). Yücel (5) reported in the case of a 2-year-old male Dalmatian that the animal had returned to normal 2 months after an intervention in which small fragments were excised, with the ligament secured to the patella by means of a thick synthetic suture and the leg supported with a bandage. Partial patellectomy was reported (17) in 6 of 56 patellar fractures in 34 cats. In our case, a proximal fragment making up two-thirds of the patella was retained, while other smaller fragments were removed. We were informed that the patient could use its leg well 2 months later.

Yanık (8) suggested that tension wires used in the patellar fractures in dogs should be at least 0.8 mm thick for a body weight of 5–15 kg and 1 mm for 15–30 kg. Vasseur (2) recommended the use of 18–20 gauge (1.03–1.26 mm) monofilament sutures for the patellar ligament. In our case, both the patella and the patellar ligament were fixed to the tibial tuberosity with, respectively, 1 mm and 0.8 mm monofilament cerclage wires. Even though there was no direct postoperative follow-up, the information received indicated an absence of complications.

According to Vasseur (2), the following protocol may be implemented for the patellar ligament: the wire, originating at the proximal end and led along the outer edge of the patella, is threaded through a hole drilled in the tibial tuberosity and tensioned appropriately to allow contact among the ruptured ends of the patellar ligament, and the ligament ends should be sutured with number 2/0 or 0 nonabsorbable material. It has also been recommended to bandage the leg for 1–3 weeks (1,2) and walk the dog on a short leash for 6–8 weeks (2). In our case, the bandage was not applied, in order to prevent possible atrophy, but a 3-week pen rest was recommended to the owner. No complications were reported.

In conclusion, it can be said that leg function may recover if patellar fragments unsuitable for reconstruction are discarded, provided that their total surface area is smaller than 50% of the whole patella, and the patellar ligament is fixed with a carefully sutured wire support.

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