

# Avulsion fractures of the tibial tuberosity in a cat and dogs

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### Summary

The material for this study comprised 5 dogs between the ages of 5-9 months and 1 cat aged 1.5 years brought to the I.U. Veterinary Faculty Surgery Department Clinic between the years 1996-2005, with the inability to use their hindleg. The cases were presented to the clinic within a few days following the occurrence of the lesion. Case histories revealed the causes to be jumping from a height in 4 animals and unknown in 2.

A diagnosis of avulsion fracture of the tibial tuberosity was reached following clinical and radiological examination of the cases. Surgical intervention was carried out in all cases, of which fixation was achieved with a screw application in 5 cases and the tension band method using double Kirschner pins and cerclage wire in 1 case.

In the clinical and radiographical follow-up approximately 2-4 month after the operation the trouble-free recovery of the patients was established in the light of the information given by the patient owners. There was no problem with respect to the limbs bearing weight in any of the cases. Therefore, no need was seen to remove the fixation material.

In conclusion, the authors hope that it will be beneficial to veterinary practice to present the successful results achieved in the fixation of avulsion fracture of the tibial tuberosity using screws in 5 cases and the tension band method in 1 case, as well as reporting the rarely encountered lesion in cats.

**Keywords:** Tibial tuberosity, avulsion fracture, dog, cat

In dogs, the proximal tibia is formed by the union of the tibial apophysis, proximal tibial epiphysis and proximal tibial metaphysis (1). The proximal tibia has 2 ossification centres. These are, the proximal tibial epiphysis and the tibial tuberosity apophysis. The proximal tibia physis closes at approximately 10,7 months, whereas for the tibial tuberosity physis this is approximately at 8,3 months. Significant differences, however, may be observed between individuals and breeds. The tibial tuberosity apophysis and proximal tibial epiphysis fuse in the 7-8 month period before uniting with the tibial metaphysis. In skeletally immature dogs, trauma to the proximal tibia causes avulsion of the tibial tuberosity apophysis and fracture of the proximal tibial physis. Occasionally both may occur simultaneously (1, 5).

Avulsion fractures of the tibial tuberosity are rarely encountered. They are generally seen in young animals aged between 4-8 months. They occur more frequently in Greyhound and Terrier breeds (1-3, 5). The tibial tubercle forms as a separate ossification centre and functions as the point of insertion for the patellar ligament. The tuberosity is separate from the growth centre. Via the patellar ligament, the tibial tuberosity

acts as the point of insertion for the quadriceps muscle. Avulsion fractures occur due to muscle contractions observed during hyperflexion of the stifle joint. A similar mechanism may easily develop through jumping, running or falling (2-5).

Clinically, the detached tibial tuberosity can be palpated, dislocated proximally and the distal part may rotate cranially. At the same time, the patella moves towards the proximal of the femoral trochlear groove. This condition may be seen radiographically while being undetectable via palpation. In the 3<sup>rd</sup> and 4<sup>th</sup> days following the trauma, there is noticeable joint effusion, soft tissue swelling, echymosis and lameness. The degree of avulsion ranges from a detachment of a few millimetres to total separation. For definite diagnosis, a lateral radiograph is taken of the leg in flexion. If dislocation is suspected, a radiograph taken of the sound leg will help with the assessment (2-4).

Treatment methods of avulsion fractures are conservative and surgical (2-5). The most frequently encountered complication following surgery is medial luxation of the patella (5).

The aim of this study is to present to clinical practice, the successful results achieved in the treatment of

rarely encountered avulsion fractures of the tibial tuberosity using screws in 4 cases and tension band in 1 case.

### Material and methods

The material of the study consisted of a total of 5 dogs and 1 cat brought to the I.U. Veterinary Faculty Surgery Department Clinics between the years 1996-2005, with a complaint of inability to use the hindleg. The cases were presented to the clinic within a few days following occurrence of the lesion.

Following clinical examination, antero-posterior (AP) and medio-lateral (ML) radiographs of the stifle joint were taken in all cases. Radiological assessment revealed avulsion fracture of the tibial tuberosity in all cases. Surgical fixation of the fracture was carried out in each case.

Animals were premedicated using Xylazine (Rompun-Bayer/Turkey) administered at a dose of 2 mg/kg IM. Anaesthesia was induced with 5 mg/kg IV administration of Ketamine hydrochloride (Ketalar-Eczacıbaşı/Turkey). Following intubation, inhalation anaesthesia commenced. For inhalation anaesthesia, Isofluran (Forane-Abbott/England) was administered at an initial concentration of 4%, followed by 2% maintenance.

The surgical area was shaved and the patients were put into dorsal recumbency on the operating table. The affected leg was extended caudally. Following routine disinfection procedures, surgery commenced. Approach to the operation site was from the cranio-lateral. The skin incision was started at the level of the patella and lengthened towards the tibial crest. After the fracture site was reached, the organised haematoma and other tissue pieces were removed. The fracture site at the tibial crest was visualised. Using bone-grasping forceps, the proximal fragment was gently pulled distally and placed in its normal position. The stifle joint was fully extended which enabled the fracture to be fixed more easily. After the fracture was repositioned, fixation was achieved using cortical screws in 5 cases, while in 1 case the detached fragment was fixed in place with the tension band technique using 2 Kirschner pins and cerclage wire.

The operation site was closed by initially suturing the cranial tibial muscle and fascia with 2/0 Vicryl (Polyglactin 910, Johnson&Johnson, Ethicon/Belgium), followed by suturing the skin with 2/0 Propylene (Propilenumonofilament polypropylene, Döğsan/Turkey).

Postoperatively, the joint was supported with a Robert-Jones bandage for 7-12 days. Movement of the patients was restricted for 4-5 weeks until the fracture healed.

Clinical and radiological assessment of the cases was carried out at the end of the first month after the operation.

Tab. 1. Data belonging to the cases

Breed	Age (months)	Sex	Ethiology	Method used
Irish Setter	5	Female	Jumped from a height	Kirschner pin + tension band
Rottweiler	5	Male	Jumped and landed on leg	Screw (Ø: 3.5 mm)
Terrier	9	Female	Unknown	Screw (Ø: 2 mm)
Mixed breed dog	6	Female	Unknown	Screw (Ø: 2 mm)
Cocker Spaniel	6	Male	Jumped from a height	Screw (Ø: 3.5 mm)
Mixed breed cat	18	Male	Jumped from a height	Screw (Ø: 2.7 mm)

### Results and discussion

In this study, 5 dogs and 1 cat, brought to the I.U. Veterinary Faculty Surgery Department Small Animal Clinics with a complaint of inability to use the hindleg, were evaluated. Case histories revealed the causes as; jumping from a height in 4 of the cases and unknown in 2. Ages of the dogs ranged between 5-9 months. Of these, 2 were male and 3 female. The cat was 1,5-years old and male. Data belonging to the cases is shown in tab. 1.

Clinical examination revealed distinct swelling and soft tissue damage in the stifle region, proximal shifting of the patella and presence of pain in the area. Upon radiological evaluation, avulsion fracture of the tibial crest was found in all of the cases (fig. 1 and 2).

It was learned from the history of the cat that, a previous operation had been done on a comminuted supracondylar femur fracture in the same leg approximately 1 year earlier. Clinical examination revealed pain related to the avulsion fracture and partial ankylosis of the stifle joint (fig. 2).

Fixation of the fracture was achieved operatively in all the cases. Healing of surgery wounds was uncomplicated. Sutures were removed. No problems were observed in the postoperative clinical and radiographic follow-up approximately 2-4 months later. The-

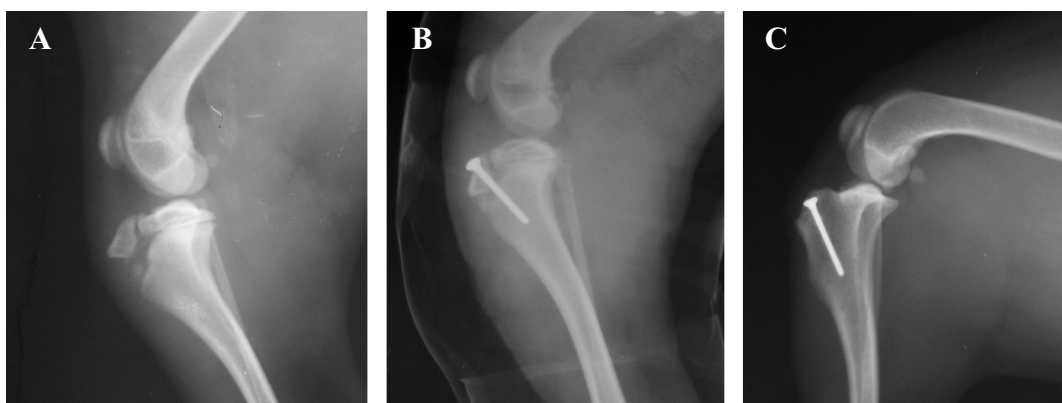


Fig. 1. Mediolateral radiographic views of mixed breed dog: A) before surgery, B) immediately after surgery, C) 4 months after surgery

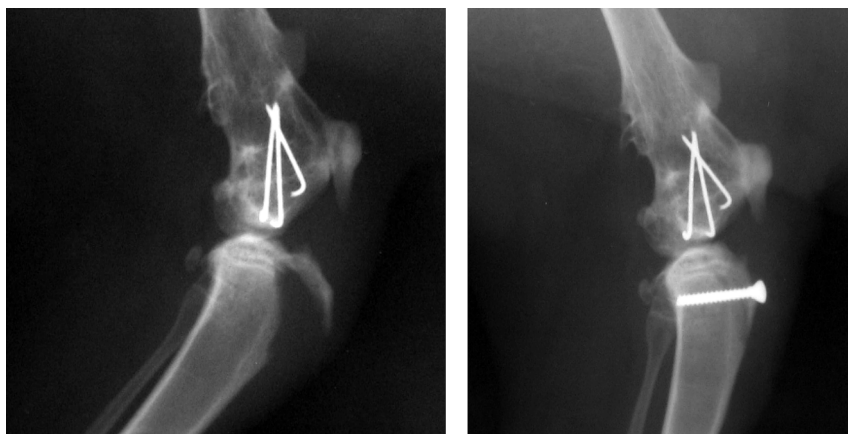


Fig. 2. Mediolateral radiographic views of avulsion fracture of the tibial tuberosity in cat. Before surgery and two weeks after surgery

refore, no need was seen to remove the materials used for fixation.

The tibial tuberosity acts as the point of insertion for the quadriceps muscle via the patellar ligament. Muscle contractions resulting in the hyperflexion of the stifle joint cause the avulsion fracture of the tibial tuberosity. A similar mechanism may easily be produced as a result of jumping, running or falling (2-5). In small animal practice, avulsion fractures of the tibial tuberosity are not frequently encountered (1-3, 5). The fact that the number of cases with avulsion fracture of the tibial tuberosity brought to the Surgery Clinics in the past 10 years was limited to 6, supports this idea.

Avulsion fractures occur more often in 4-8 month-old young animals since growth plates are weaker in comparison to bone (1-3, 5). Age distribution of the young dogs in this study was seen to be between 5-9 months.

Avulsion fractures occur mostly in relation to trauma as expressed in literature (2-5). The avulsion fractures of 4 cases examined in the study were seen to be caused by trauma as a result of jumping from a height.

In the opinion of the authors, the avulsion fracture observed in the only cat included in the study originated from the partial ankylosis in the stifle joint caused by the osteosynthesis of a previous supracondylar femur fracture. It was concluded that, the quadriceps contracture developing in relation to the ankylosis could have caused the joint to overextend during jumping from a height, resulting in the avulsion fracture of the tibia.

Clinical examination revealed that the patients were unable to use the affected leg, a distinct swelling and soft tissue damage was present in the stifle region, the patella had moved proximally and the area was very sensitive. These clinical findings are consistent with findings reported in literature (2-4). While an epiphysis fracture of the proximal tibia is usually reported to develop together with avulsion of the tibial tuberosity apophysis (1, 5), detachment of the epiphysis was not encountered in the study.

It has been expressed that, surgical intervention must be carried out as soon as possible in avulsion fractures (1, 3). The cases included in this study were operated on 3-4 days after the trauma. The operation site was approached according to literature (2, 5) and no difficulties were experienced. This situation was thought to be due to the quadriceps contracture not having begun in relation to early intervention.

In the treatment of avulsion fractures, tension band method is usually preferred. However, this method has been reported to possibly cause premature closure of the physis in the fracture site and deformity in later periods (2, 5, 6). In the light of this idea, the tension band method was employed in only 1 case in the study. In the other cases, fixation was achieved with the application of screws, as reported in literature (3-5).

While it has been expressed that following avulsion of the tibial tuberosity, a complication such as medial patellar luxation may occur (5), no complications were observed in the post-operative clinical and radiographical follow-up of the cases. Therefore no steps were taken to remove the osteosynthesis material.

In conclusion, the authors hope that it will be beneficial to veterinary practice to present the successful results achieved in the fixation of avulsion fracture of the tibial tuberosity using screws in 5 cases and the tension band method in 1 case, as well as reporting the rarely encountered lesion in cats.

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