Avulsion of the tibial tuberosity +/- proximal tibial epiphysis

What is tibial tuberosity avulsion?

The tibial tuberosity is the bony prominence at the top of the tibia or shin-bone. It is important because the tendon of the knee cap (patellar tendon) attaches to it. In the growing dog, the tibial tuberosity is separated from the rest of the tibia by a zone of cartilage called an ossification centre. Its strongest attachment is to the very top of the tibia (the epiphysis), which is separated from the rest of the tibia by a similar zone of cartilage called a physis or growth plate.

Physes or growth plates are thin bands of cartilage located near the ends of long bones in growing animals. Longitudinal bone growth i.e. lengthening occurs from the physes. The zones of cartilage cells in physes and ossification centres are weaker than the surrounding bone so in young animals it is more common for the physes to separate (fracture) than for the surrounding bone to fracture.

Physeal fracture may sometimes cause significant damage to the delicate cells of the physis responsible for bone growth such that the injured physis is no longer capable of growth, and the physis shuts down (physeal closure).

The tibial tuberosity may break away from the rest of the tibia or it may pull the tibial epiphysis off with it, such that the entire top of the tibia detaches from the main tibial bone segment. These fractures occur most commonly when young dogs (typically three to six months old) jump awkwardly or are dropped. As the dog lands the stifles are forcibly flexed resulting in a rapid increase in the tensile force of the quadriceps mechanism. The cartilage plates are the weakest point in the mechanism and are typically the first point of failure i.e. the tuberosity pulls away from the tibia.

Surgical repair

Avulsion fractures of the tibial tuberosity are typically repaired with very small pins (Kirschner-wires) +/- a figure of eight tension-band wire to resist the pull of the quadriceps muscles. When the proximal tibial epiphysis is also involved additional epiphyseal Kirchner wires may be required. The implants are often removed after two to four weeks.

Outcome and potential risks of surgery

Despite the fact that damage to the cartilage cells in the of ossification centre +/- physis may cause it to cease growing, most dogs recover well after fracture repair with little if any change to the shape of the tibia, and the majority of dogs are able to return to normal levels of activity without consequence.

In some cases a distalised tuberosity or a shortened tibia may develop, but often compensatory growth can occur from the bottom of the tibia and even the femur, such that overall limb length is not unduly reduced. Angular deformity (bent leg) is a relatively uncommon but serious complication of asynchronous (uneven) growth of the damaged physis.

Overall success rates with physeal fracture repairs are typically very good, however, as with any surgery complications may arise and are detailed below:

- The bone is quite fragile in young animals and may occasionally suffer additional fractures during attempted repair.

- Infection is uncommon if the fracture site was uncontaminated before surgery, as strict sterile technique is used during the surgery and antibiotics are administered during and after the procedure. Statistically, approximately 1 in 50 animals undergoing orthopaedic surgery are likely to develop a post surgical infection (this will be higher for risk factors such as soft tissue injuries, contaminated wounds or pre-existing disease in the patient). Contamination of the wound in the early post-operative period may increase this risk e.g. your dog licking the wound in the first few days after surgery may significantly increase the risk of infection. Should infection occur, early detection and treatment generally results in rapid resolution, although very occasionally removal of the implants may be required once the bone has healed. More serious problems may occur if infection progresses

untreated or if your dog suffers infection with a multiple resistance bacteria e.g. MRSA. If you suspect an infection contact your VET immediately.

- Excessive early activity will reduce the likelihood of the bone healing and will increase the risk of implant failure or loosening; very young animals have much softer bone than adults thus implant loosening occurs more readily.

- The growth plate may have suffered significant damage at the time of fracture; this may result in complete arrest of physeal activity i.e. the growth plate "shuts down" and the bone stops growing. Fortunately the phenomenon of "compensatory growth" often occurs, in which growth occurs elsewhere in the limb to make up for lost growth from the inactive physis. e.g. the other end of the tibia can provide some extra growth, as can the femur. Sometimes the early closure of the affected growth plate may result in more significant shortening of the limb as a whole and/or deformity of the proximal tibia. Occasionally, damage results in uneven growth from one side of the growth plate to the other, causing the limb to bend as it grows. Consequences may include lameness and the potential for development of osteoarthritis due to abnormal joint loading.

- Even after the physis has healed it is still important to have a controlled, gradual increase in activity, similar to human patients undergoing rehabilitation following surgery. If activity is increased too quickly after surgery straining of joint structures may occur. Rest and anti-inflammatory medications typically resolve these problems.

Postoperative care

A pad may be covering the wound at the time of discharge from the hospital. This can be removed after several days, or immediately if soiled. Medications e.g., Pain killers will be dispensed. Ice packs may also be helpful in the days following surgery to reduce swelling and improve comfort.

Your dog should be kept confined to eliminate running and jumping for the first 4 weeks: a single room with non-slip flooring and no furniture may be sufficient, however a cage is advisable initially. Short leash walks in the garden (a few minutes four to six times daily) are recommended to allow toileting.

X-rays should be performed approximately three to four weeks following surgery to assess implant position and healing.

Early implant removal may be recommended to increase the likelihood of continued physeal function. Implant removal may be also advised if causing irritation to soft tissues.

Declaration:

I have read the information contained herein and am satisfied I have a sufficient understanding of tibial tuberosity avulsion, including potential complications that may occur and requirements for aftercare following surgery. I hereby consent for my dog to undergo fracture repair.

Owner's name: Dog's Name:

Owner's signature: Date: