

# Fracture of the lateral humeral condyle after a bone cyst treated with a self-compressing pin



An 8-month old Maltese dog was referred because of a pathological fracture of the lateral portion of the right humeral condyle. A diagnosis of unicameral bone cyst was made based on radiographs, cytology/histology and long-term follow-up. Reduction and fixation, performed with a self-compressing pin, were preferred to amputation or arthrodesis. The dog did not experience any complications associated with the procedure. Functional recovery of the limb at the 1-year follow-up was considered excellent.

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## INTRODUCTION

Bone cysts in the dog are classified as simple (unicameral or multicameral), aneurysmal or subchondral and are rare causes of lameness.

Simple bone cysts are cavities containing fluid encapsulated by epithelial tissue in which osteoblast-like or osteoclast-like cells can be found. These cysts may be mono-stotic or polyostotic depending on whether they involve one or more bone segments. The cause and pathogenesis are unknown, as for all bone cysts. It is thought that the lesion may be the result of trauma to the growth plate, which may interfere with proper endochondral ossification. Another hypothesis, given the rapid deposition and resorption of bone at the metaphysis of growing animals, is that cysts may develop when reabsorption is so rapid that it causes the formation of fibrous tissue that obstructs the sinusoids such that the interstitial fluid itself forms the cyst. A further theory is that, during foetal development, some functional synovial tissue is incorporated into adjacent bone tissue and produces synovial fluid that forms cysts.

Aneurysmal cysts are osteolytic, expansive, multilocular benign lesions containing blood and probably originate

from an arteriovenous malformation, while subchondral lesions are located at synovial surfaces and may open into the joint space.

Bone cysts have been described in a large variety of breeds and sizes of dogs, at ages ranging from 6 months to 14 years<sup>1-6</sup>.

They are found most frequently in the metaphysis, but also the diaphysis and epiphysis, of long bones, especially the tibia, and have also been described in the pelvis<sup>7</sup> and, more recently, in the patella<sup>8</sup>. These cysts are often asymptomatic. In some cases, however, they can cause lameness associated with soft tissue oedema, especially when the lesion is very extensive, when it is localised distally in the limbs, or when it is the cause of a pathological fracture.

The therapeutic options that have been reported in the case of fracture are arthrodesis<sup>9</sup> or amputation<sup>3</sup> of the limb.

Here we report the case of a pathological fracture caused by a bone cyst which was treated with the insertion of a self-compressing pin and transplantation of autologous cancellous bone with the addition of synthetic osteoconductive material.



**Figure 1** - Antero-posterior and medio-lateral radiographs of the right elbow of an 8-month Maltese dog with a bone cyst and pathological fracture of the lateral humeral condyle.

### CASE REPORT

An 8-month old, male Maltese dog weighing 2.5 kg was referred to our clinic because of a pathological fracture of the right humeral condyle.

The patient had previously been evaluated by the owner's veterinarian because of the sudden onset of fourth-degree lameness of the right anterior limb which had occurred in the absence of a history of trauma. Orthopaedic evaluation of the elbow revealed swelling, crepitus, and pain on manipulation. The animal was administered carprofen (4 mg/kg orally every 24 hours) and the limb was bandaged.

Radiographic studies were performed in our clinic, using standard elbow projections (Fig. 1); these studies led to the diagnosis of a pathological fracture of the lateral humeral condyle with evidence of a radiolucent lesion in the distal epiphysis of the humerus, clearly visible in both projections. There was no periosteal reaction. Radiographic examination of all the other appendicular bone segments did not reveal any further alterations.

The initial differential diagnosis included a benign, monostotic, unicameral bone cyst, aneurysmal bone cyst, osteomyelitis, and, less likely, a neoplastic process.

After sedating the dog deeply (0.2 mg/kg of methadone and 2 mcg/kg dexmedetomidine) a fine-needle (25 G diameter) biopsy was performed.

The cytological examination showed groups of reactive spindle cells, giant osteoclast-like cells, and occasional macrophages containing partially degenerated red blood cells on a richly blood-stained background. This finding, associated with the radiographic picture, suggested a diagnosis of a bone cyst.

The next day, following induction of general anaesthesia and administration of an antibiotic (cefazoline 22 mg/kg intravenously in a single dose), surgery was carried out using a lateral approach to the humeral condyle<sup>10</sup>. In accordance with the guidelines for the management of bone cysts, a delicate, precise surgical curettage was performed<sup>1</sup>.

In order to reduce the fracture in compression, a “fragment fixation system” (FFS, Orthofix, Verona, Italy)

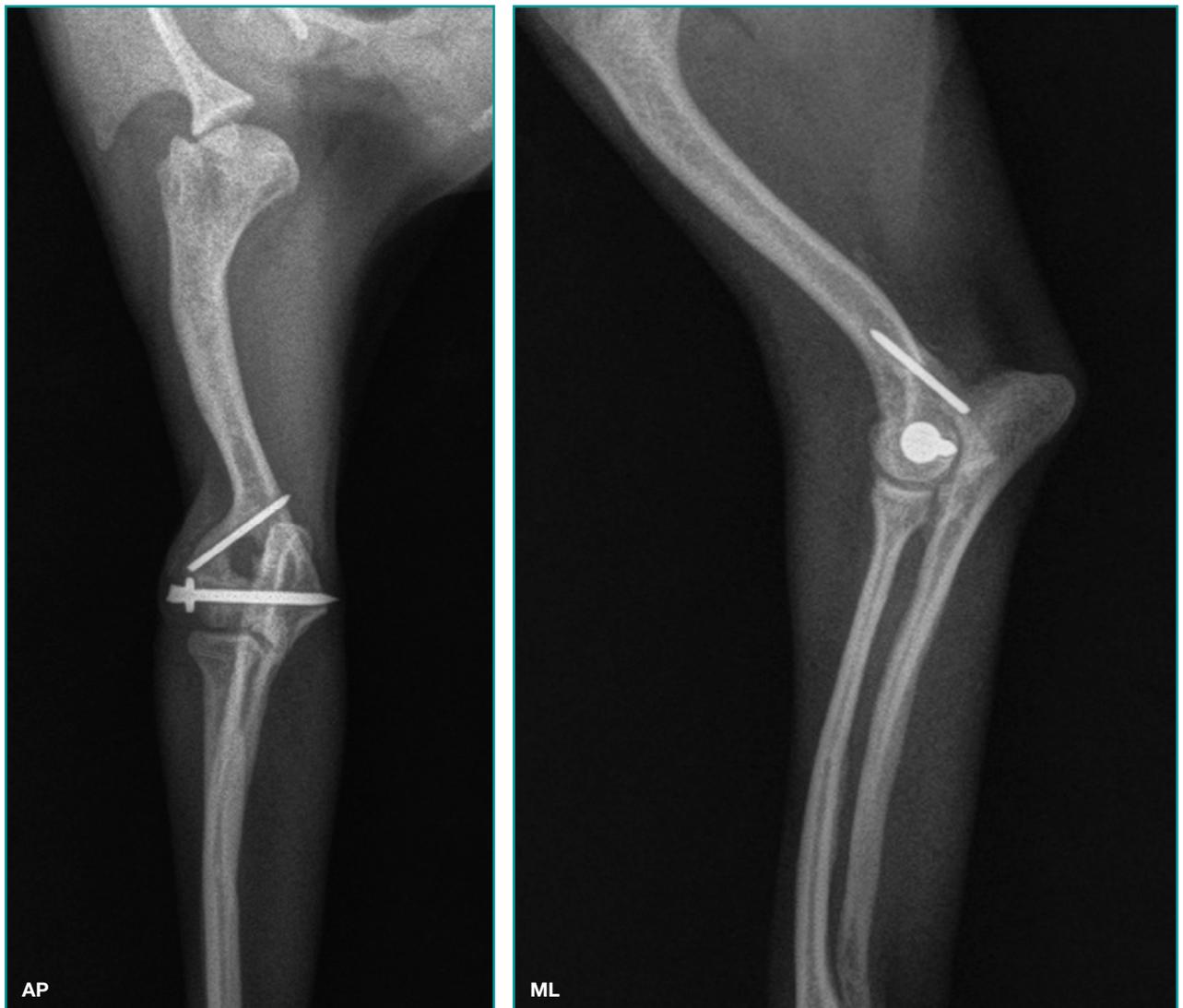
pin was introduced, using the lateral tuberosity of the condyle as the landmark (threaded part diameter 2.2, support 3.0, length 25 mm with washer), and kept as closely parallel as possible to the joint surface. In addition, a 1 mm Kirschner wire with an anti-rotation effect was inserted in a disto-proximal and latero-medial direction from the lateral cortex to the medial one.

**This is the clinical case of an 8-month old Maltese dog with a pathological joint fracture of the lateral humeral condyle, resulting from a bone cyst.**

The cystic cavity was filled with autologous cancellous bone (taken from the proximal epiphysis of the humerus itself) mixed with bioactive, synthetic osteoconductive material (Vetros putty, Biomedtrix, Boonton, NJ, USA).



**Figure 2** - Post-operative X-rays in antero-posterior and medio-lateral projections of the right elbow of the dog in Fig. 1. The fracture was repaired using a self-compressing pin.



**Figure 3** - Antero-posterior and medio-lateral X-rays of the same dog 24 weeks after surgery showing complete healing.

Finally, the surgical access was closed, as per routine. Post-operative X-rays (Fig. 2) confirmed the correct position of the implants and satisfactory anatomical reduction. A modified Robert Jones bandage was applied for the next 7 days.

The patient recovered from the anaesthesia without complications. Analgesic therapy in the first 24 hours after surgery consisted of methadone 0.2 mg/kg administered every 6 hours intramuscularly. Antibiotic therapy was amoxicillin and clavulanic acid (22 mg/kg orally every 12 hours). Tramadol (4 mg/kg orally every 12 hours) and meloxicam (0.1 mg/kg orally every 24 hours) were administered for 7 days.

The patient was discharged from the clinic on the fourth day. The bandage was removed after 1 week and it was recommended that the animal be confined in a restricted environment for the first month, given its extreme vivacity.

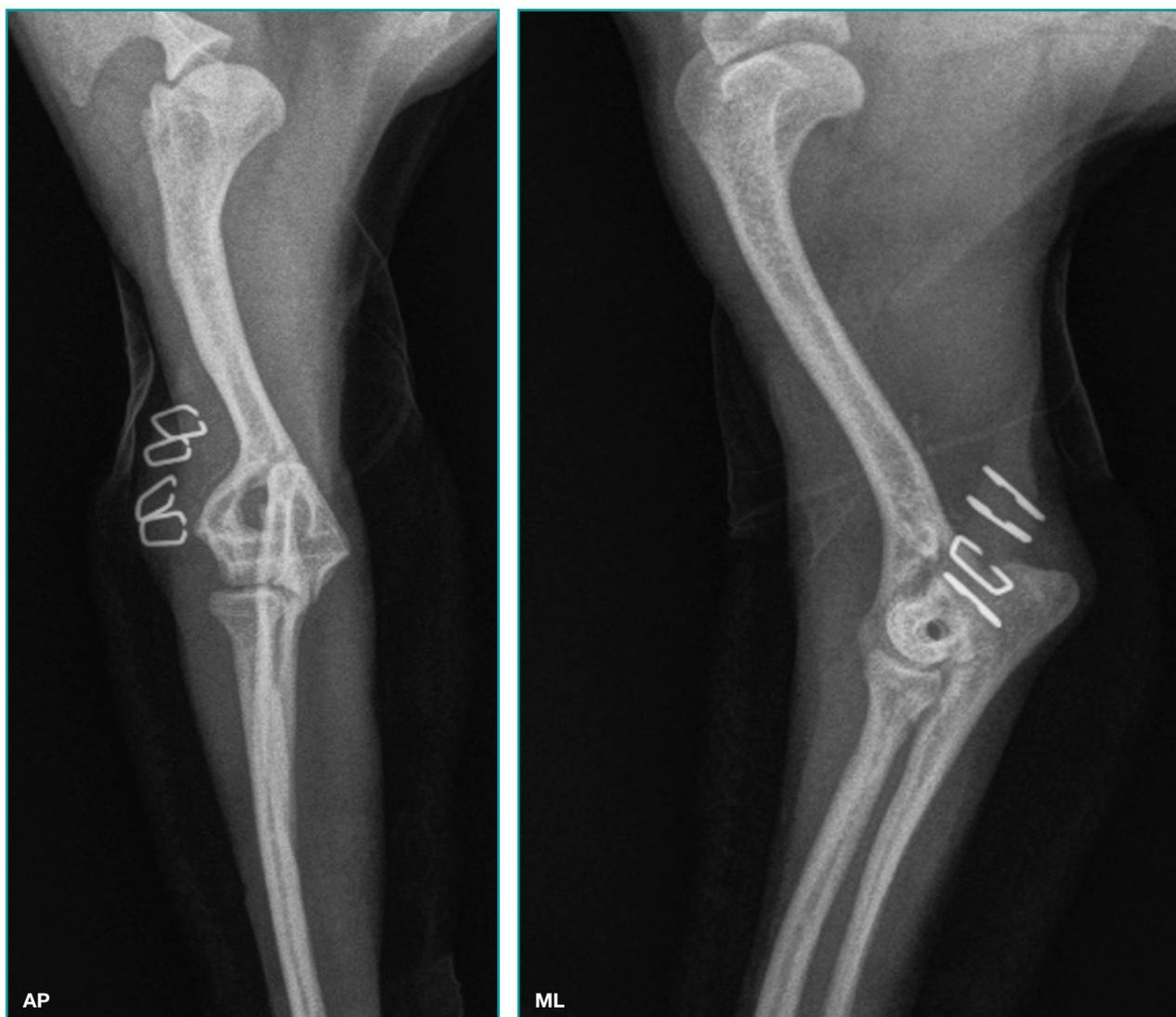
Four weeks after surgery, the radiographic control revealed satisfactory progression of the bone healing process. The owners were, therefore, advised that the animal could gradually return to its normal activities.

Radiographic follow-up after another 2 months showed consolidation of the fracture and, from a clinical point of view, the animal was no longer lame. At 6 months, the implants were removed (Figs. 3 and 4).

One year after surgery, the dog uses the limb at full load both during normal walking and when running.

## DISCUSSION

The use of fine needle biopsy for an initial evaluation of primary bone tumours, although controversial in human medicine, aims to minimise destruction of the tumour bed and limit the spread of carcinogenic cells, especially if the intended treatment is limb salvage<sup>11</sup>. Fine needle biopsy is considered to be minimally invasive compared to a full



**Figure 4** - Antero-posterior and medio-lateral X-rays of the elbow after removal of the fixation device.

bone biopsy, with a low percentage of complications but high diagnostic specificity. The diagnostic accuracy for bone lesions in the dog ranges from 69% to 92%<sup>12</sup>.

**There are no descriptions in the literature of this type of fracture being repaired without amputating the limb or performing an arthrodesis; in our case we used a fixation device.**

Based on the cytological findings, the initial differential diagnosis in our case was between an aneurysmal cyst and a simple, unicameral bone cyst. The definitive diagnosis in humans and animals is only achieved after histopathological examination<sup>13</sup>. Unfortunately, in our case, the laboratory results on the material sent after curettage were not definitive, probably because of the scarcity and irregularity of the sample, although elements

indicative of neoplasia were not found. It should be noted that full healing of the lesion at 1 year is more suggestive of a simple, unicameral bone cyst, because aneurysmal cysts can recur and, had the lesion been an undiagnosed juvenile sarcoma, there would have been rapid progression of the tumour following the surgical intervention.

The surgical procedures that have been reported for the treatment of bone cysts in the absence of fractures are curettage of the lesion and filling the cavity with transplanted bone, which is usually autologous<sup>1,13,14</sup>.

The use of demineralised bone matrix, bone marrow mononuclear cells and xenografts of deproteinised bovine spongy bone, in addition to the autologous graft, has also been proposed<sup>16-18</sup>.

In our case, in addition to transplantation of cancellous bone, it was decided to use a synthetic osteoconductive

material to promote the process of engraftment and filling of the cyst itself.

When there is no evidence of osteolysis and/or damage to the surrounding tissues, bone cysts can also be filled with cement and the prognosis is reported to be favourable<sup>15</sup>.

**The suspicion, following cytology, that the cyst was aneurysmal and not a simple, unicameral cyst, was not supported by histopathology or by the fact that the fracture healed completely, without recurrence.**

Recently, a unicameral cyst was successfully treated using a custom-made titanium implant, after curettage, to prevent pathological fractures<sup>19</sup>.

Amputation of the limb<sup>3</sup> or arthrodesis (in the case of bilateral elbow cysts with fracture of a single limb)<sup>9</sup> are the options proposed in the case of concomitant fracture. The young age of the animal was the first consideration in choosing the treatment in this case, so the decision was made to maintain the integrity of the joint and the functionality of the limb, with full approval of the owner. The fracture required immediate treatment in view of the pain and joint involvement.

Publications regarding the use of FFS in veterinary medicine are scarce. Self-compressing pins are, however, easy to apply and their mechanical properties are not significantly different from those of cortical screws. These implants can be considered, especially for repairing traumatic fractures of the humeral condyles. Both this implant and a compression screw can provide sufficient stability and strength to support the expected physiological loads<sup>20-22</sup>. In the case described here, it was preferred to use this method of fixation instead of a traditional screw because of its practical convenience given that, precisely because of the method of insertion, the bone fragility resulting from the cyst would have made it very risky to introduce a compression screw.

Finally, it should be pointed out that there is a report in the literature of a bone cyst, aneurysmal in that case, which showed malignant changes after 33 months<sup>23</sup>; for this reason the owner of the case described here has been advised to carry out periodic radiographic controls of the dog's limb and chest (every 6-12 months).

In conclusion, the use of FFS with curettage and transplantation of autologous cancellous bone, combined with a synthetic osteoconductive material, enabled good stabilisation of the pathological fracture caused by a cyst in the humeral condyle, with full recovery of the function of the affected limb at 1 year after surgery.

#### KEY POINTS

- A pathological fracture resulting from a bone cyst in the lateral humeral condyle was managed by reduction and internal fixation rather than by amputating the limb or performing an arthrodesis, as has been done up to now.
- The method of osteosynthesis used was a self-compressing pin in addition to an autologous cancellous bone graft and introduction of osteoconductive material.
- The fracture healed completely with regeneration of bone tissue within the cavity of the cyst.

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