ANEURYSMAL BONE CYST IN THE PELVIS OF A CAT

Aneurysmale beencyste in de pelvis van een kat

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ABSTRACT

An aneurysmal bone cyst was diagnosed in the pelvis of a 3 1/2-year-old domestic short-hair cat. Clinically, the cat was suffering from tenesmus and dysuria. Radiographs showed an expansive lytic lesion appearing as a subperiosteal 'blow-out' of the ventral aspects of the pubic and ischial bones. Definitive diagnosis was provided by histopathology. The veterinary literature on aneurysmal bone cysts is reviewed.

SAMENVATTING

Een aneurysmale beencyste werd gediagnosticeerd in het bekken van een drieeënenhalf jaar oude Felis vulgaris. De kat leed aan tenesmus en dysurie. De radiografieën toonden een uitgebreide uitpuilende subperiosteale lytische zone van het ventraal aspect van het os pubis en van de os ischii. Een definitieve diagnose werd gesteld aan de hand van histopathologie. De literatuur over aneurysmale beencysten bij huisdieren wordt besproken.

CASE HISTORY

A 3 1/2-year-old male domestic short-hair cat had been suffering from tenesmus for six weeks and from dysuria for two weeks. A symptomatic treatment with mineral oil (10 ml/day) and an osmotic laxative (Microlax®, Sanofi-Winthrop Ind., Colomiers, France) had been given by the referring veterinarian with poor results. A second examination was performed 2 weeks later by the same practitioner and on rectal examination a mass of approximately 3 cm in diameter was palpated at the cranial aspect of the pubic bone. The patient was referred for further evaluation and potential curettage of the lesion.

At presentation, the general condition of the cat was normal. The patient was normally hydrated, the rectal temperature was 39.1°C, the mucous membranes were pink and capillary refill time was within normal limits. Thoracic auscultation revealed no abnormality. A distended bladder was palpated. On rectal digital examination, an irregular, ovoid, hard mass of approximately 5 cm in diameter was detected extending to the left side of the pelvis. Results of complete blood count, biochemical tests and urinalysis were normal.

A radiographic examination, including right-left lateral and ventro-dorsal projections of the caudal abdomen and pelvis, was performed. The lateral projection revealed an expansile thin-walled septated lytic lesion originating from the ventral floor of the pelvis (Fig. 1). The colon was filled with feces and the bladder was distended. On the ventro-dorsal projection, there was evidence of complete osteolysis of the rami and symphysis pubis on both sides and of the corpus pubis on the left side (Fig. 2). Due to the severity of bone involvement, the location of the lesion, urinary tract dysfunction and complicated defecation, a poor prognosis was given. Consequently, the owner requested euthanasia.

At necropsy, a dark mass, 5 cm in diameter and limited at its cranial aspect by a fibrous capsule, was found to have replaced the floor of the pelvis. All internal organs were within normal limits. Except for the pelvis, the skeletal system appeared normal. Sagittal sections of the pubic bone were performed and confirmed a rather well delineated bloody cystic mass

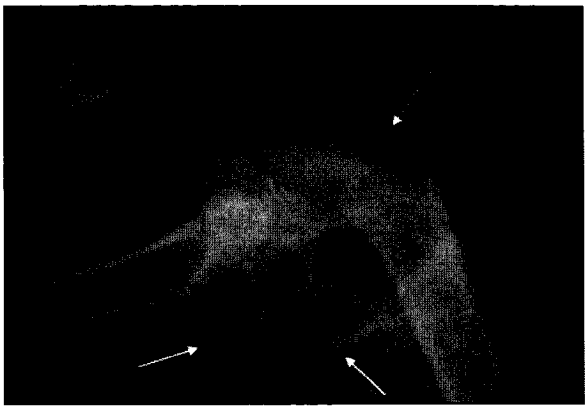

Figure 1. Lateral radiograph of the pelvis revealing an expansile, osteolytic lesion affecting pubis and symphysis pelvis. (arrows)

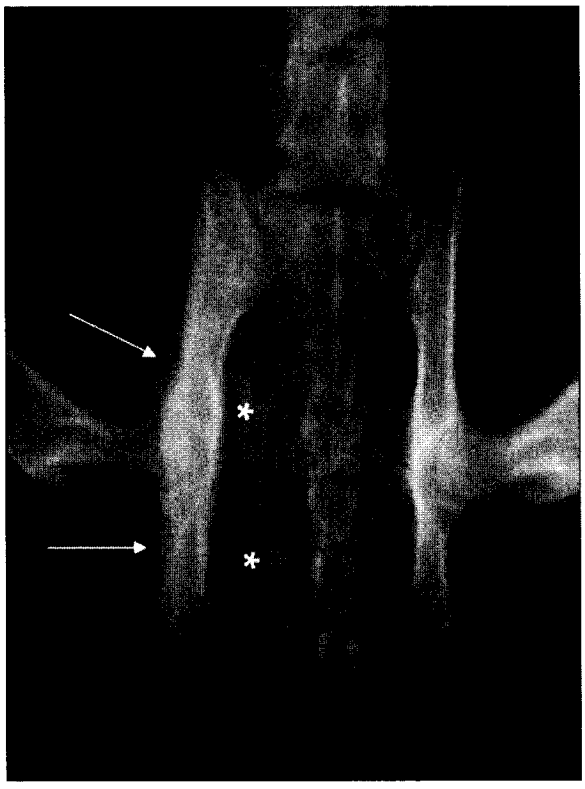

Figure 2. Ventro-dorsal radiograph of the pelvis revealing osteolysis of the pubis (asterisks) osteolysis is more extensive on the right side and new bone formation at the lateral aspect of the pelvis (arrows).

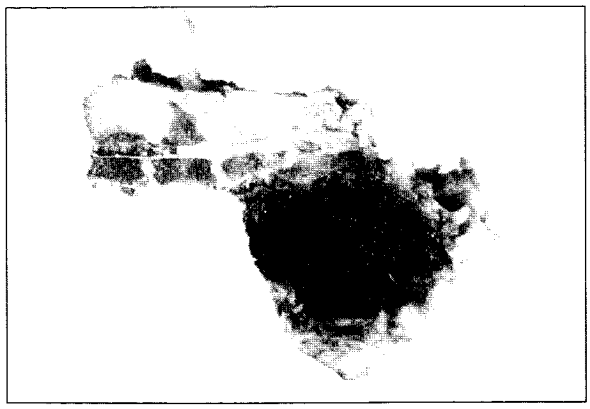

Figure 3. Sagittal section of the pelvis. A dark mass measuring 5 cm in diameter is located ventral to the sacrum. The normal vertebral bodies of L6, L7 and S1 are visible.

Figure 4. High-power photomicrograph of the aneurysmal bone cyst: the septae contain one multinucleated giant cell, histiocytes, plasma cells and lymphocytes.

(Fig. 3). Upon closer examination, the cyst was found to be multiloculated, the blood lakes being separated by thin soft tissue strands giving a spongy honeycomb appearance. The bone sections were fixed in 10% neutral buffered formalin for fixation. Then they were decalcified in a 50/50 solution of sodium citrate and formolic acid. Numerous sections were obtained in order to identify the etiology of the lesion. These sections were processed following the routine histotechnique, embedded in paraffin, sectioned at 6 μ, and stained with hematoxyllin and eosin. Immunoperoxidase staining for factor VIII was performed on some sections. On histological examination, most of the initial bone was found to have been replaced by variably sized blood lakes. These lakes were delimited by loose collagen strands that served as support to benign fibroblasts, osteoclasts, a few benign endothelial cells, some hemosiderin-laden macrophages, and a few lymphocytes and plasma cells. Occasionally, bone trabecules were still present (Fig. 4). The atrophied and disorganized primary bone was often the seat of a subperiosteal woven bone formation. The le-

sion was separated from the surrounding soft tissue only by a fibrous capsule similar to reminding fibrous periosteum along the cranial surface of the pubis. There was no blood clot formation, and only rarely an accumulation of fibrin in some spaces. A perivascular non-specific mixed inflammation, muscle atrophy and fibrosis was present in the surrounding soft tissues. A few cells randomly distributed on the surface of the septae stained positively for factor VIII and were considered to be endothelial cells. These findings were consistent with a diagnosis of aneurysmal bone cyst (ABC).

DISCUSSION

Cystic bone lesions are a group of entities that share a common feature, namely the "de novo" formation of unilocular or multilocular cavities. On the basis of histology, three major types of bone cysts are described in small animals: the solitary bone cyst, the subchondral bone cyst and the ABC (Jubb *et al.*, 1985). The solitary bone cyst most frequently affects young dogs of larger breeds (Schrader *et al.*, 1983). It is located in the metaphyses and the adjacent portion of the diaphyses of the long bones, generally leaving growth plates and epiphyses unaffected (Schrader *et al.*, 1983). One (monostotic) or several bones (polyostotic) may be involved (Carrig *et al.*, 1975). The subchondral bone cyst is located in the subchondral bone between the articular cartilage and the growth plate. A communicating channel is usually present between the cyst and the articular surface (Bascher *et al.*, 1988). This type of cyst is usually a manifestation of osteochondrosis, which is more common in horses and pigs (Jubb *et al.*, 1985). Its clinical significance is unclear.

The term "aneurysmal" relates to a blow-out distention of the contour of the affected bone, and the term "cyst" relates to the fact that it represents mainly a blood-filled cavity. The name refers to the gross and radiological appearance of the lesion, which in fact is not a true cyst and is not caused by an aneurysm (Marcove, 1984; Gebhart & Mankin, 1990). The ABC is a non-neoplastic vascular lesion that leads to the formation of a cystic cavity filled with blood and is surrounded by a discontinuous endothelial lining.

ABC in animals have been reported in dogs (Renegar *et al.*, 1979; Groulade *et al.*, 1981, Bowles & Freeman, 1986; Pernell *et al.*, 1992; Riedesel, 1993; Shiroma *et al.*, 1993; Duval *et al.*, 1995; Shimada *et al.*, 1996; Nomura & Sato 1997), cats (Liu *et al.*, 1974; Walker *et al.*, 1975; Biller *et al.*, 1987), horses (Steiner & Rendano 1982; Purdy 1985; Lamb & Schelling 1989; Thomas *et al.*, 1997), a llama (Anderson *et al.*, 1997) and a bull (Belknap *et al.*, 1992). The lesions involved the leg (Walker *et al.*, 1975;Renegar *et al.*,1979; Groulade *et al.*,1981; Steiner & Rendano 1982; Pernell *et al.*,1992; Riedesel 1993; Duval *et al.*,1995; Shimada *et al.*,1996; Anderson *et al.*,1997; Thomas *et al.*,1997), mandible (Purdy 1985; Lamb & Schelling 1989; Belknap *et al.*,1992), vertebra (Liu *et al.*,1974; Shiroma *et al.*,1993), pelvis (Liu *et al.*,1974; Bowles & Freeman 1986; Nomura & Sato 1997) and rib (Biller *et al.*,1992). Age and sex predilection have not been established in domestic animals.

An ABC may be either primary or secondary. In primary ABC, no underlying condition can be identified radiographically or microscopically. A secondary ABC is a vascular malformation that is caused by increased intravenous pressure or a dilated arteriovenous shunt. It can also represent intraosseous dynamic changes in an antecedent lesion or an unusual reparative response to an intramedullary hemorrhage (Johnson & Watson 2000). In human beings, ABCs have been found to develop secondarily to a preexisting condition such as a bone tumor, a solitary bone cyst, fibrous dysplasia or a giant cell granuloma. In the present case, no underlying lesion was found.

The history and clinical signs associated with ABC vary with the location and the stage of the disease. In this case, the location of the cyst was responsible for the compression of the pelvic viscera, which resulted in tenesmus and urinary retention. The involvement of the vertebrae and pelvis may lead to complex disturbances, including damage to the nervous system (Bowles & Freeman 1987; Shiroma *et al.*, 1993).

In human medicine, four radiological stages have been described in ABC. In the initial phase, a well-defined area of osteolysis with discrete elevation of the periosteum is observed. This is followed by the active growth phase, involving rapid destruction of bone and the development of the characteristic "blow-out" appearance. The third phase is called "stabilization" and corresponds with the development of the characteristic "soap-bubble" appearance as a result of the bony shell. Finally, healing results in progressive calcification and ossification, which gives rise to a dense, bony mass. The most commonly encountered radiographic feature in veterinary medicine is an eccentric lytic lesion with an expanded, remodeled "blow-out" or "soap-bubble" appearance (Marcove 1984; Bowles & Freeman 1986; Halliwell 1993). This

appearance is usually distinct enough to diagnose ABC, as in our case. Nevertheless, in some less typical cases, a differential diagnosis must be considered between ABC and atypical osteosarcoma, giant cell tumor, cystic degeneration of fibrous dysplasia and polyostotic bone cyst. In these cases, the most sophisticated imaging techniques such as computed tomography, magnetic resonance imaging or, even better, histological examination may be required.

The histopathological picture observed in our case is similar to the previously described ABC in domestic animals. Biopsies for histological examination should be taken in the areas where the mass shows the worrisome radiographic features. The possible histological differential diagnosis includes a bone cyst (solitary or aneurysmal) or a tumoral process such as a giant cell tumor, a telangiectasic osteosarcoma, a hemangioma or a hemangiosarcoma. The solitary bone cyst is typically a unilocular cystic lesion that does not have a lining and is filled with serous fluid. The presence of numerous spaces dividing the mass and the absence of bone spicules extending from the wall into the mass, as is often seen in simple bone cysts, led us to give a final diagnosis of ABC. ABC refers to a lesion characterized by the presence of spongy or multilocular cystic tissue filled with blood. Clotting is absent in this lesion. ABC is a multiloculated cyst. There were no cytological or architectural criteria of malignancy that warranted a diagnosis of hemangiosarcoma, giant cell tumor or telangiectasic osteosarcoma. Despite the taking of numerous sections, the present case did not reveal an underlying condition, so it is considered a primary form of ABC. Telangiectasic osteosarcoma is the major differential diagnosis for ABC. In most of the cases described, the cellularity and organization rarely present any difficulties in terms of establishing the final diagnosis. Cytology or small biopsy fragments may complicate the diagnosis as they may contain numerous giant cells. Furthermore, areas of hemorrhage within a malignant tumor may mistakenly suggest that it is benign. The definitive diagnosis should be based on a combination of radiographic and histologic features. In the event of discrepancy, new biospsies should be taken.

Natural healing of ABC has been observed in humans, and it has been suggested that when this tumor has been diagnosed in a situation that does not threaten mechanical or functional failure, it may be sufficient merely to observe progress in the hope of natural healing (McQueen *et al.*, 1985). In human medicine, the classical treatment consists of curettage, but this technique has resulted in a high recurrence rate and it may in some cases lead to an undesirable loss of bone and joint tissue (Marcove 1984; Gebhart & Mankin 1990). The addition of a cancellous graft decreases the risk of recurrence (Koskinen *et al.*, 1976). Radiation therapy has proven superior to surgery and it reduces the recurrence rate. Osteoradionecrosis, due to the large amount of radiation frequently needed to control these lesions, and malignant transformation are possible complications of radiation therapy (Nobler *et al.*, 1968; Marks *et al.*, 1976). A successful treatment of ABC has been described using transcatheter embolization therapy. The advantages of transcatheter embolization over surgery and radiotherapy include the possibility of placing emboli more selectively, decreased risk of malignant transformation and decreased morbidity (Murphy *et al.*, 1982). Surgical intervention may even be aided by previous embolization therapy, since hemostasis may be less difficult on a devascularized tumor. Cryosurgery, combined with bone cementing, has also been shown to be effective and shows a low recurrence rate and rapid healing of the lesion (Marcove 1984; Malawer & Dunham 1991).

In veterinary medicine, there are only a few reports of surgical treatment in dogs and cats. Satisfactory treatment was achieved by amputation in two dogs with a humeral cyst and in one cat with a scapular cyst (Walker *et al.*, 1975; Pernell *et al.*, 1992; Shimada *et al.*, 1996). Clinical cure was obtained after surgical resection in one dog with a diaphyseal ulnar cyst and in one cat with a rib lesion (Biller *et al.*, 1987; Riedesel 1993). Clinical cure was also obtained after surgical currettage with bone grafting in one dog with a distal tibial lesion (Duval *et al.*, 1995) and in another dog with a pelvic cyst (Nomura & Sato 1997).

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