

SEVERE CALCINOSIS CIRCUMSCRIPTA IN MULTIPLE FOOT PADS IN A 5-MONTH OLD POMERANIAN PUPPY SECONDARY TO RENAL DISEASE – A CASE REPORT

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SUMMARY: A 5-month old Pomeranian puppy with lameness in all four limbs, polydipsia, polyuria, vomiting, and melena observed approximately for one month was presented to the Veterinary Teaching Hospital, University of Peradeniya. The metacarpal and metatarsal foot pads of all four limbs were swollen with chalky white, mottling. The differential diagnoses for the foot pad lesions were fungal granuloma, calcosinosis circumscripita, and neoplasia. The fine needle aspirates obtained from the foot pad lesions were chalky white, gritty, and microscopically consistent with mineral deposits. Plain radiographs of the metacarpals revealed deposition of radiopaque material in metacarpal and digital foot pads with normal bones and joints. Based on the gross lesions, radiography, and fine needle aspiration cytology, a tentative diagnosis of calcosinosis circumscripita of foot pads was made. Haematology and serum chemistry revealed microcytic hypochromic anaemia and mild azotaemia. Abdominal ultrasonography revealed small right and left kidneys with increased overall echogenicity and poor corticomedullary differentiation. The historical, clinical, radiographic, and ultrasonographic findings were suggestive of calcosinosis circumscripita in multiple foot pads with concurrent renal disease. The very young age of the dog was highly suggestive of renal dysplasia as the cause of concurrent renal disease. Despite the supportive and symptomatic treatments, the puppy died five days after the presentation. This appears to be the first report of calcosinosis circumscripita of foot pads with evidence of renal disease diagnosed in a dog less than one year old.

KEYWORDS: Calcosinosis circumscripita, foot pads, renal disease, renal dysplasia, Pomeranian

INTRODUCTION

Calcosinosis circumscripita is the deposition of calcium salts in soft tissues (Declercq and Bhatti, 2005). According to the underlying pathophysiological mechanisms calcification is classified as dystrophic, metastatic, or idiopathic (Tafti *et al.*, 2005; Schaer *et al.*, 2001). Dystrophic calcification circumscripita occurs secondary to localised tissue damage caused by injury, necrosis, inflammation, or neoplasia (Tafti *et al.*, 2005). Metastatic calcification is often widespread and caused by abnormal calcium and phosphorous metabolism (Tafti *et al.*, 2005). Idiopathic calcification on the other hand occurs in the absence

of tissue injury or metabolic diseases (Craig *et al.*, 2015). Calcosinosis circumscripita is a form of tissue calcification where the pathogenesis is poorly understood. The common locations of calcosinosis circumscripita are the skin around bony prominences, tongue, and foot pads (Craig *et al.*, 2015). The location of cutaneous calcosinosis circumscripita lesions suggests chronic and recurrent exposure to pressure or trauma as a major cause (Craig *et al.*, 2015). Calcosinosis circumscripita is more common in large breed dogs than in small breed dogs (Gross *et al.*, 1997). Although calcosinosis circumscripita in dogs is not uncommon, reports of calcosinosis circumscripita with evidence of chronic renal disease are limited (Tafti *et al.*, 2005). This report describes severe calcosinosis circumscripita of

multiple foot pads in a 5-monthold Pomeranian puppy of which the serum biochemistry and ultrasonographic findings of the kidneys were highly suggestive of concurrent kidney disease.

Case presentation

A 5-month old, intact, female Pomeranian puppy weighing 9 kg was presented to the Veterinary Teaching Hospital, University of Peradeniya due to swollen foot pads with chalky white mottling (Figure 1A). In addition to foot pad lesions, the puppy was limping on all four legs, emaciated, anorexic, and had polydipsia, polyuria, vomiting, and melena approximately for one month. General clinical examination revealed 6-8% dehydration, pale mucous membranes, and bounding pulse. Other vital parameters were within the normal limits. The foot pad lesions were found on all four limbs including all metacarpal and metatarsal foot pads and some of the digital foot pads in the left front and right hind limbs. The foot pads were mildly swollen, firm, and not painful upon palpation except in one metatarsal foot pad in the left hind limb where mild ulceration was noticed. The inter digital spaces were moist, saliva stained, and malodorous, while the inter digital skin and hair were discoloured tan-brown on all four paws. The differential diagnoses for foot pad lesions were neoplasia, fungal granuloma, and calcinosis circumscripta while the discolouration of the inter digital hair and skin was suspected to be secondary to bacterial or yeast infections. The fine-needle aspiration biopsy (FNAB) obtained from one of the foot pad lesions was chalky white and had a gritty consistency. Microscopically, the aspirated material was crystalline, refractile, variably basophilic and formed variably sized aggregates suggesting mineral deposits (Figure 1B). In addition, there were rare, almost indiscernible mononuclear cells. The impression smears prepared from the inter digital skin showed numerous yeasts with a broad budding base and cocci (*Malassezia spp*). Even in the absence of a prominent inflammatory cell population in the smears, the very high density of the two organisms observed was suggestive of *Malassezia* and bacteria pododermatitis than the presence of these organisms as commensals.

Plain radiographs of the left and right metacarpal areas revealed radio dense material within the metacarpal foot pads (Figure 2A). There were no radiographic abnormalities in the bones and joints of the metacarpus and phalanges. Based on the presence of multiple lesions, localisation to the foot pads, FNAB result, and radiographic findings a tentative diagnosis of calcinosis circumscripta of foot pads was made. Subsequent blood work revealed microcytic hypochromic anaemia (Hct-24.8%, reference interval: 37%-55%, haemoglobin-8.4 g/dL, reference interval: 12-18 g/dL, MCV-59 fL, reference interval: 61-73 fL, MCHC-36.1 g/dL, reference interval: 30.0-36.9 g/dL). Serum chemistry revealed markedly elevated blood urea nitrogen (140m g/dL, reference interval 7-27 mg/dL) and a mild increase of creatinine (1.9 mg/dL, reference interval 0.5-1.8 mg/dL). Serum Calcium level was in the upper margin of the normal limit (11.9mg/dL, reference interval 7.9-12.0). Urinalysis was not performed. The clinical examination findings together with the serum chemistry supported a tentative diagnosis of renal disease. Ultrasound scanning revealed small, hyperechoic right and left kidneys (Figure 2). In the sagittal sections, the length and width of the right kidney were 30.8 mm and 21.2 mm respectively while the left kidney's length and width were 35.5 mm and 17.7 mm, respectively. In the right kidney, the cortical echogenicity was approximately evenly increased while in the left kidney, an uneven increase of cortical echogenicity was identified. In both the right and left kidneys, the corticomedullary differentiation was poor.

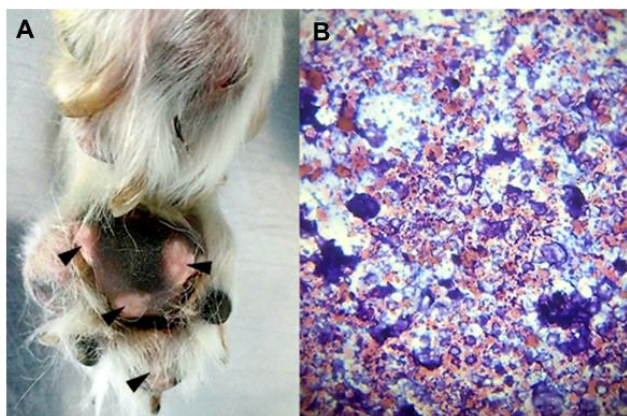


Figure 1. A: Left metacarpus revealing the ventral surface of the foot pads. Note the multifocal, chalky white mottling on the metacarpal and digital foot pads (arrowheads). **B:** Pictomicrograph of the fine needle aspirate obtained from the foot pad lesion. Note the basophilic, crystalline minerals. X 40, Diff-Quik stain

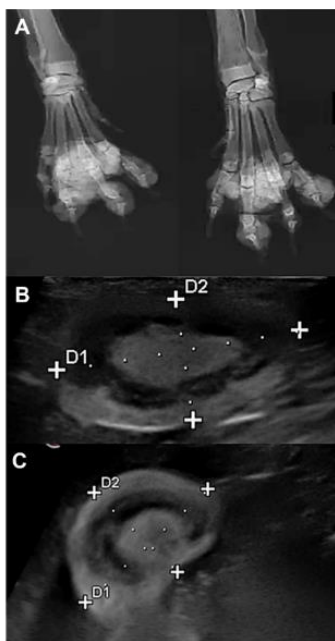


Figure 2. A: Plain radiographs of the right (Rt) and left (Lt) metacarpal areas. Note radiopaque areas within the metacarpal and digital foot pads. **B & C:** Ultrasound images of the right kidney (**B**, D1=35.7 mm and D2=17.7 mm) and left kidney (**C**, D1=30.8 mm, D2=21.2 mm). Note the increased overall echogenicity and poor corticomedullary differentiation.

Considering history, general clinical examination, and laboratory results, the puppy was diagnosed with severe calcosinosis circumscripta in multiple foot pads possibly secondary to renal disease. Surgical removal of the calcified foot pad tissues was not attempted due to the presence of multiple lesions, and the associated risk of anaesthesia. The owner was informed about the guarded prognosis and supportive and symptomatic treatments were prescribed including intravenous fluid therapy, antiemetics (ondansetron, 0.5mg/kg q12h), appetite stimulants (vitamin B12 2.5ml q12h), phosphate binders (aluminium hydroxide 100mg/kg/day) and a commercially prepared renal food. Povidone iodine ointment (5%) was prescribed for bacterial and *Malassezia* dermatitis. The puppy was referred to the regular veterinarian to continue the treatment but later the owner reported that the puppy died five days after the commencement of treatments. The body was not presented for a postmortem examination.

DISCUSSION

Only a few reports in veterinary literature describe calcosinosis circumscripta in association with renal disease in dogs (Legendre *et al.*, 1974; Scott *et al.*, 1988; Croom *et al.*, 1994; Gross *et al.*, 1997; Nicole and Nyssa., 2022; Arnaud *et al.*, 2010). To the best of our knowledge, none of the previous reports included a dog less than one year old. Therefore, the

5-month old puppy described in the present report is the youngest dog to be diagnosed with cutaneous calcosinosis circumscripta of foot pads with possible concurrent renal disease. Based on breed, none of the previous reports included a Pomeranian with calcosinosis circumscripta with concurrent renal disease.

In the present case, clinical signs and serum chemistry together were indicative of uremia. Ultrasonographic findings corroborated the serum chemistry findings and confirmed that uremia is a consequence of severe renal disease. Considering the age of the dog, renal dysplasia was the most likely differential for renal disease. A definitive diagnosis of renal dysplasia requires ultrasound-guided renal biopsy or postmortem renal histopathology (Felkai *et al.*, 1997). A previous study has suggested that small kidneys with a thin, hyperechoic cortex detected in a young dog are highly suggestive of renal dysplasia (Felkai *et al.*, 1997). In the puppy described in the present report, ultrasonography revealed small kidneys. According to previous literature, the size of the kidneys determined by ultrasound scanning was smaller than for a puppy weighing 9 kg (Miyabayashi, 2001). In addition, the overall echogenicity of both kidneys was increased and there was poor corticomedullary differentiation. These findings were mostly consistent with renal fibrosis (Perondi *et al.*, 2020). Renal fibrosis may occur consequentially to chronic inflammatory kidney disease (Perondi *et al.*, 2020). Similarly, fibrosis is a feature of end-stage kidneys in dogs with renal dysplasia (Perondi *et al.*, 2020). Therefore, in the present case, it is difficult to differentiate whether the renal lesions observed are due to renal dysplasia or chronic inflammatory kidney disease. However, the age of the puppy is highly suggestive of renal dysplasia than chronic kidney disease.

Widespread metastatic calcification is reported in dogs with chronic kidney diseases (Tafti *et al.*, 2005). In these dogs, metastatic calcification is shown to occur secondary to abnormal calcium and phosphorous metabolism. Interestingly, calcosinosis circumscripta in foot pads is reported only in a proportion of dogs with chronic kidney disease (Tafti *et al.*, 2005). It is unknown why calcosinosis circumscripta in foot pads occurs only in a proportion of dogs with chronic kidney disease. A previous report describes that calcification of soft tissues in dogs with chronic renal diseases could be partially dystrophic and locations such as foot pads that are prone to frequent tissue injury are predisposed to calcium deposition (Tafti *et al.*, 2005). Therefore, it is likely that calcosinosis circumscripta of foot pads to occur in a proportion of dogs with renal diseases of which the tissue injury in foot pads is more severe than in other dogs with renal diseases.

Generally, calcosinosis circumscripta cannot be successfully treated medically (Joffe, 1996). However, surgical excision of calcified tissues was shown to relieve the discomfort in some affected dogs (Joffe, 1996). However, all the dogs previously reported having calcosinosis circumscripta with concurrent renal disease died due to complications of renal disease (Joffe, 1996). Surgical excision of calcified tissues has not been attempted in any of these dogs and therefore it is unknown whether it is useful in dogs with concurrent renal disease. The outcome of the case described in the present report is also consistent with previous reports, confirming the grave prognosis of dogs with calcosinosis circumscripta associated with renal diseases.

The puppy described in this report had severe Malassezia and bacterial pododermatitis in addition to calcosinosis circumscripta of foot pads. Concurrent staphylococcal pododermatitis was diagnosed in a previously reported case of calcosinosis circumscripta of multiple foot pads in an 8-month-old German Shepherd dog (Legendre *et al.*, 1974). According to this report, foot pad mineralisation in this German Shepherd dog was partially regressed after treating staphylococcal pododermatitis with antibiotics. The puppy in the present case report was also treated with 5% povidone iodine ointment for bacterial and Malassezia pododermatitis although it was unable to determine whether it was useful to reduce tissue calcification as the puppy died five days after initiating treatments.

The inability to perform a complete urinalysis in the puppy described in this case report is a limitation to confirm renal pathology. Despite this limitation, the present report is relevant to veterinary clinical medicine because of the case's rarity as well as the multiple mechanisms of soft tissue calcification which are likely to have occurred simultaneously in this dog.

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