RADIOGRAPHIC OBSERVATIONS ON ANGULAR DEFORMITIES OF CARPAL JOINT IN DOGS*

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Abstract

Six dogs, aged between 45 days to seven months irrespective of sex and breed having carpal joint affections were subjected to radiography of affected limb. Orthogonal radiographs in medio-lateral and antero-posterior views were recorded on day 0 and thereafter on the 15th, 30th, 45th and 90th day. Radiographic observations on day 0 revealed hypertrophic osteodystrophy in three dogs and carpal flexural deformity, Salter Harris type II fracture of distal radius and healing fracture of midshaft of ulna in one each. Out of the six cases studied, five cases of carpal deformities could be successfully managed by adopting both medical and surgical treatments in a period of three months.

Keywords: *Radiography, angular deformity, carpal joint in dogs*

In dogs, the angular deformities of the carpal joints could occur due to trauma to the physis, nutritional or metabolic diseases like rickets (Malik *et al.,* 1997), hypertrophic osteodystrophy (HOD), nutritional secondary hyperparathyroidism, retained cartilaginous core (Mason and Baker, 1978; Fox and Bray, 1993) and genetic causes (Fox and Bray, 1993). The complexity of the joint creates problem for the diagnosis of underlying lesions in carpal joint diseases (Jaeger and Canapp, 2010). In angular deformities of carpal joint, lameness of forelimb in both growing and adult dogs is the only apparent clinical symptom evident. Identification of underlying causes of angular deformity would help to prevent irreversible damage to the joint by adopting early corrective measures. According to O'Brien *et al.* (1971) radiography is one of the essential diagnostic tools for determining the underlying etiology of the developing deformity. The present study was undertaken to evaluate radiographic changes in the carpal joints of dogs in clinical cases.

Materials and Methods

Six dogs, aged between 45 days and seven months irrespective of sex and breed having carpal joint affections were subjected to radiography of affected limb (Table 1.). Orthogonal radiographs in medio-lateral and antero-posterior views were recorded on day 0 and thereafter on the 15th, 30th, 45th and 90th day. The radiographs were evaluated on day 0 to assess the extent of angular deformity and thereafter the post treatment changes. The radiographic evaluation was conducted to examine the epiphyseal plates and adjacent

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metaphyses of both forelimbs, width of the joint spaces, angulation of carpus and extent of the arthritic changes. Appropriate medical and surgical management were followed as per indications. Medical management comprised of modification of diet and administration of vitamins and minerals both orally and parenterally. Surgical management comprised of application of casts and splints in two dogs and segmental ulnectomy in one dog.

Results and Discussion

I: There were an increase in radiodensity of the metaphyseal region of the distal radius and ulna of both the forelimbs. A radiolucent band above the ulnar physis was observed which was not very prominent in the present case on day 0. Bennet (1976) and Montgomery (1993) reported a band of low density parallel to the growth plate called as pseudophysis which was pathognomonic for hypertrophic osteodystrophy. The pseudophyseal line and mushrooming of the metaphyseal borders of the physis of radius and ulna were observed (Fig. 1). Woodard (1982) also reported lipping of the metaphysis of long bones in hypertrophic osteodystrophy. Radiographic changes in hypertrophic osteodystrophy were limited to the ends of the long bones and lesions being bilaterally symmetrical suggested that, the disease could be metabolic in origin (Woodard, 1982).

II: The radius and ulna were having less cortical thickness. Bennet (1976) reported thinning of bone cortices in hypertrophic osteodystrophy. There was a radiolucent band above the ulnar physis. The radiodensity of metaphyseal areas of the radius and ulna was normal (Fig. 2).

III: Cortical thinning of the bones of the radius and ulna was noticed (Fig. 3). Bennet (1976) also reported thinning of bone cortices in hypertrophic osteodystrophy. The density of the bones of radius and ulna was poor indicated by least demarcation between the cortices and medullary cavity.

IV: The cortical thickness was uniform. The proximal and distal physis of radius and ulna were open and unaffected. The distal radial epiphyses were normal and rectangular in shape (Fig. 4). Radiographs in carpal flexural deformity showed no macroscopic changes with relation to growth plates, bone and cartilage (Altunatmaz, 2006).

V: An incomplete fracture in distal metaphyseal region of the radius extending into the physis (Salter Harris Type II) was observed on day 0. The fracture was involving the medial aspect of the radius alone (Fig. 5). The cortical thickness was uniform in radius and ulna. The metaphyseal areas of both radius and ulna were of normal radiodensity.

VI: Radiograph on the day of presentation showed a latero medial curvature of the radius and ulna which was similar to the findings of Ramadan and Vaughan (1978). A callus was seen in the midshaft region of the ulna indicating a healing fracture. In cases where growth at distal ulna had ceased prematurely, various changes were seen in the radius as it continues to lengthen including cranial bowing, subluxation of radial head, stress fractures, cranial radial subluxation distally and displacement of the carpal joints along with valgus deformity of the carpus (Hurov, 1983). The distal radial epiphysis appeared to be slightly rhomboidal in shape. Ramadan and Vaughan (1978) reported that the distal radial epiphyses being tilted laterally were found to be rhomboid than rectangular in shape. Lipping was observed at the distal radial metaphyseal

Table: Patient data

Case No	Breed	Sex	Age	Condition
I	German Shepherd	Male	5 months	Bilateral valgus
II	Rottweiler	Male	2 months	Bilateral valgus
III	German Shepherd	Male	4 months	Bilateral valgus
IV	Rottweiler	Male	45 days	Bilateral hyperflexion
V	Chinese Pug	Male	7 Months	Varus, left forelimb
VI	German Shepherd	Female	3 Months	Unilateral valgus, right forelimb

region laterally which was persisting till the end of the period of observation. There was a line of decreased radiodensity at the base of the ulnar growth plate (Fig. 6). The base of the ulnar metaphyseal border showed lipping in many cases according to Ramadan and Vaughan (1978). A reduction in the length of the ulna was noticed. Ramadan and Vaughan (1978) reported shortening of bones in many cases but skeletal mineralization appeared to be apparently normal. At the ulnar physis no apparent changes were seen radiographically. The metaphyseal region showed increased radiodensity. The width of the joint spaces of the elbow and carpal joints appeared to be normal. Premature closure of the radial and ulnar physeal plates was one of the causes leading to angular deformity of forelimbs. Trauma to the limb, with or without radiographically visible fractures, was a common cause of such closures (Fox *et al.,* 1995).

In hypertrophic osteodystrophy, the radiographic observations were increased radiodensity of the metaphyseal regions of the distal radius and ulna. A narrow radiolucent band above the radial or ulnar physis (pseudophyseal line) was pathognomonic for hypertrophic osteodystrophy. Mushrooming of the metaphyseal borders of the physis and cortical thinning of radius and ulna were also seen. Radiographs in carpal flexural deformity did not exhibit macroscopic changes in relation to growth plates, bone and cartilage. An incomplete fracture in distal metaphyseal region of the radius extending into the physis (Salter Harris Type II) was observed on day 0. Salter Harris fractures could cause angular deformities due to trauma to fragile germinal cells causing growth retardation. In premature closure of ulnar physis, the radiograph showed a latero medial curvature of the radius and ulna. The distal radial epiphysis appeared slightly rhomboidal in shape. A reduction in length of ulna was seen indicating growth retardation. At the ulnar physis no apparent changes were seen radiographically.

In angular deformity involving carpal joint in dogs, the radiographic evaluation on 15th, 30th, 45th and 90th day post treatment could reveal the changes in bones and their extremities and indicated the necessity for monitoring the prognosis of treatment for each deformity.

Out of the six cases studied, five cases of carpal deformities could be successfully managed by adopting both medical and surgical treatments by a period of three months.

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