



What Is Your Diagnosis?

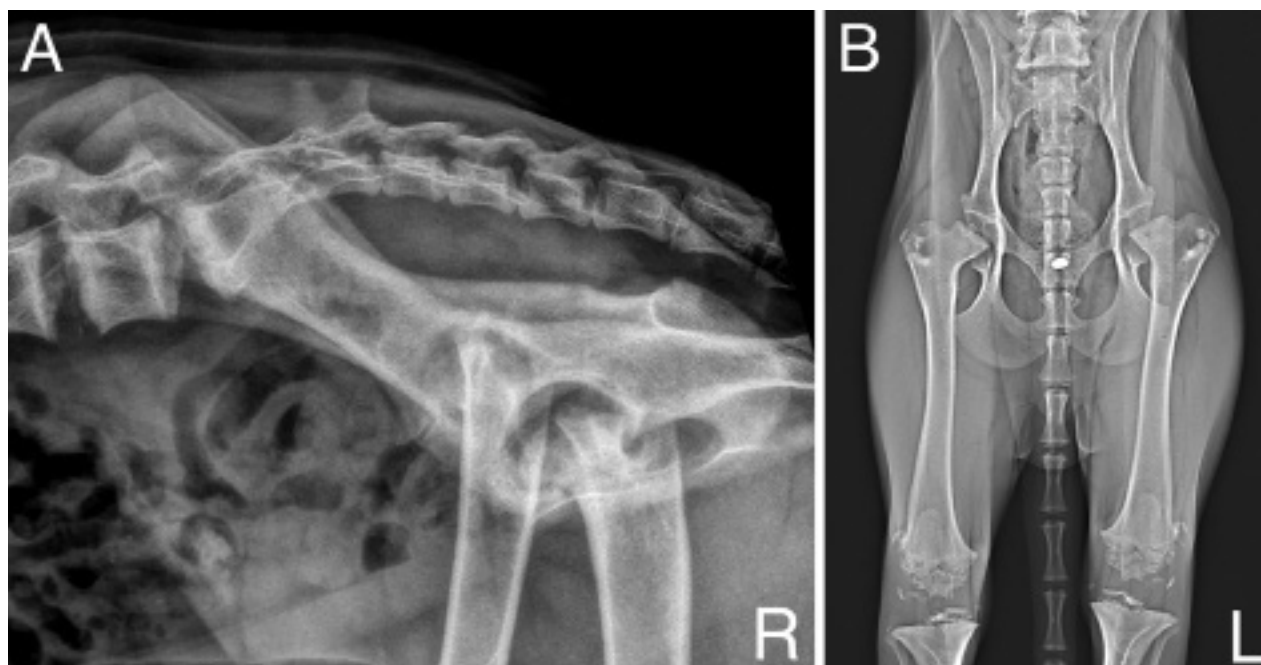


Figure 1—Right lateral (A) and ventrodorsal (B) radiographic images of the pelvis and hip joints of a 7-month-old 13-kg (28.6-lb) sexually intact male Hungarian Vizsla evaluated because of a history of exercise intolerance, stiff gait, and reluctance to play.

History

A 7-month-old 13-kg (28.6-lb) sexually intact male Hungarian Vizsla was examined because of exercise intolerance, stiff gait, and reluctance to play. The owners did not report related trauma. On physical examination, the dog was bright and responsive but had a narrow stance, bunny hopped with short strides in the hind limbs, and had a stilted gait in the forelimbs. The dog frequently sat and showed signs of difficulty in rising. On orthopedic examination, the dog had bilateral moderate hypotrophy of its gluteal muscles and limited range of motion in its hip joints, with signs of pain elicited on hip joint extension. The remaining findings on physical, orthopedic, and neurologic examinations were within reference limits. The dog was sedated with butorphanol (0.2 mg/kg [0.09 mg/lb], IM) and dexmedetomidine (4 µg/kg [1.8 µg/lb], IM), and orthogonal radiographic images of the pelvis and hip joints were obtained (**Figure 1**).

Formulate differential diagnoses and treatment strategies from the history, clinical findings, and Figure 1—then turn the page →

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Radiographic Findings and Interpretation

Radiography revealed bilateral agenesis of the femoral head epiphyses, shortened and widened femoral necks, and underdeveloped apophyses of the greater trochanters, distal epiphyses of the femurs, and proximal epiphyses of the tibiae (**Figure 2**). Because of these findings, radiographic examination of the vertebral column and the stifle, elbow, and shoulder joints was performed. Additional radiographic findings for the hind limbs included bilaterally underdeveloped tibial tuberosities, mildly delayed ossification of the patellae and fabellae, and almost complete absence of articular surfaces within the stifle joints with only the central portions of the distal femoral and medial portions of the proximal tibial epiphyses remaining (**Figure 3**). The tarsi were also mildly affected. Bilaterally, the forelimbs had marked underdevelopment of the proximal and distal humeral epiphyses, mildly affected carpi, and severely underdeveloped proximal radial heads that resulted in widened humeral-radial spaces and humeral-radial and humeral-ulnar step defects in the elbow joints. Radiographic examination of the vertebral column revealed diffusely irregular vertebral body profiles, an absence of vertebral endplates, and widened intervertebral spaces (**Figure 4**). These findings were highly suggestive of multiple epiphyseal dysplasia (MED) disease; other differential diagnoses included dietary disorders (eg, sulfate metabolic disorder) or hormonal deficiencies (eg, congenital hypothyroidism).

Treatment and Outcome

Initially, conservative treatment during the phase of musculoskeletal development of this young dog was proposed to the owners. The owners were instructed to keep the dog rested indoors, provide 3 to 4 short leash walks daily, and avoid prolonged recreational activities with other dogs. Robenacoxib (1 mg/kg [0.45 mg/lb], PO, q 24 h for 7 days) was prescribed. Genetic analysis to thoroughly investigate for MED was declined.

Four months later, the dog was returned for a recheck examination because of worsening clinical signs and decreased activity. On physical examination, palpation of the hip joints elicited signs of pain, and the gluteal, supraspinatus, and infraspinatus muscles had atrophied since the previous examination. Signs of discomfort in the shoulder joints were elicited during passive range-of-motion evaluation of each forelimb; signs were more severe for the left shoulder joint and occurred mainly during shoulder joint flexion.

Because of the dog's young age and the mismatch between moderate clinical versus severe radiographic signs, staged surgical treatment of the most severely affected joints was planned. A standard left femoral neck ostectomy was performed first, then total hip joint arthroplasty was performed on the right hind limb 4 months later (**Supplementary Figure S1**, available at: avmajournals.avma.org/doi/suppl/10.2460/javma.259.1.33). After each surgery, the dog was treated with cefazolin (25 mg/kg [11.4 mg/lb], PO, q 24 h for 10 days), carprofen (4 mg/kg, PO, q 24 h for 7 days followed by 2 mg/kg [0.9 mg/lb], PO, q 24 h for 7 days), and tramadol (3 mg/kg [1.4

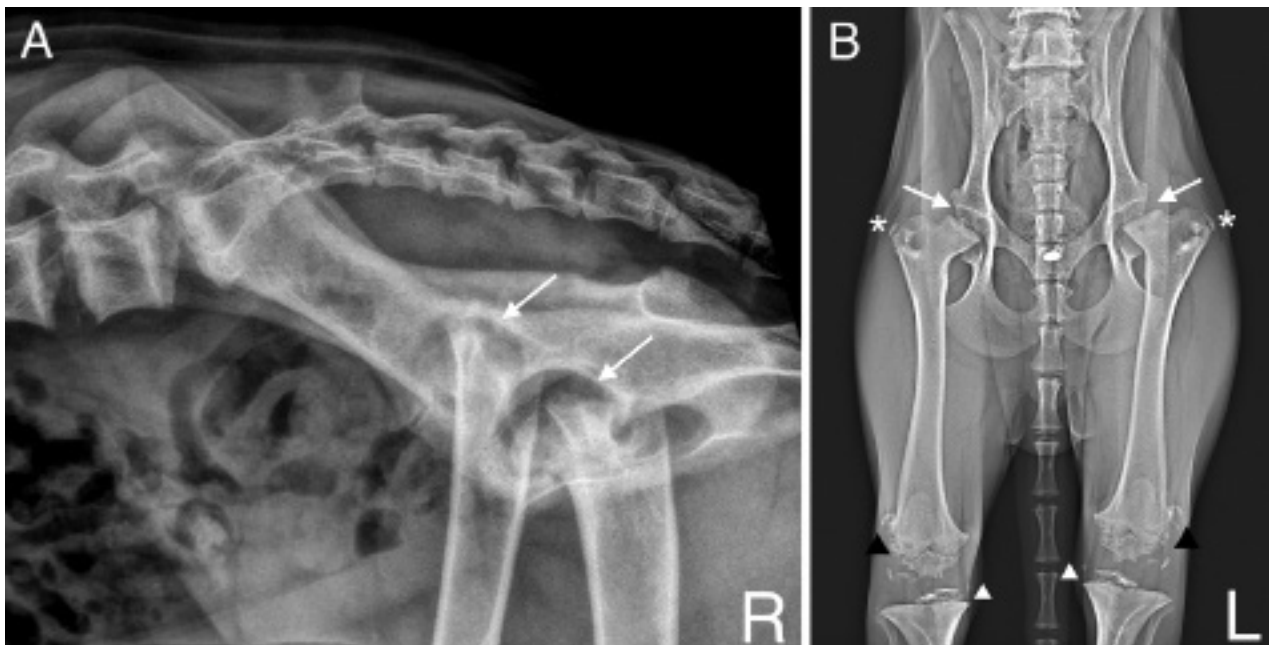


Figure 2—Same radiographic images as in Figure 1. The dog has bilateral agenesis of the femoral head epiphyses and flattening of the corresponding acetabula (white arrows), shortened and widened femoral necks, and underdeveloped greater trochanter apophyses (asterisks), distal femoral epiphyses (black arrowheads), and proximal tibial epiphyses (white arrowheads). The oval mineral radiopacity, visible at the level of the pubic symphysis in the ventrodorsal image, is an external artifact.

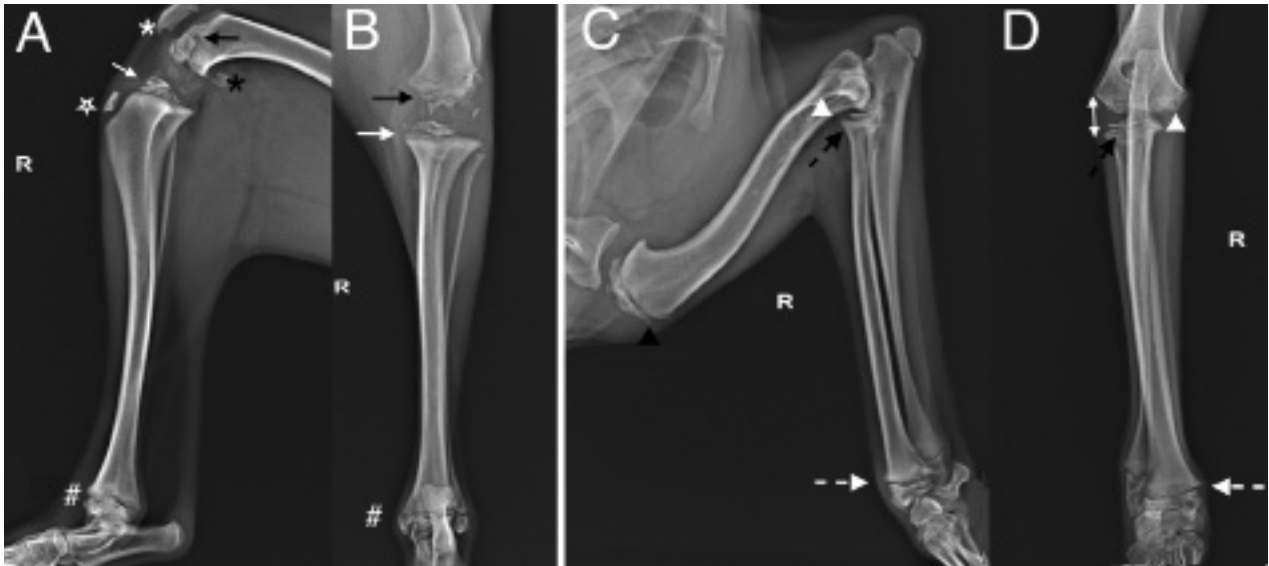


Figure 3—Right hind limb mediolateral (A) and craniocaudal (B) and right forelimb mediolateral (C) and craniocaudal (D) radiographic images of the dog described in Figure 1. A and B—There is severe underdevelopment and delayed ossification of the distal femoral epiphysis (black arrow) and proximal tibial epiphysis (white arrow), mild delayed ossification of the patella (white asterisk) and fabella (black asterisk), moderate underdevelopment of the tibial tuberosity (white star), and mild delayed ossification of the distal tibial epiphysis (pound sign), which is more accentuated in the cranial aspect of the cortex. C and D—The humeral epiphyses (proximal [black arrowhead] and distal [white arrowhead]) are underdeveloped. Severe underdevelopment of the proximal epiphysis of the radius (black dotted arrow) results in a widened humeral-radial space (double-headed arrow) in the elbow joint. The distal radial epiphysis (white dotted arrow) is mildly underdeveloped, and there is mild soft tissue swelling cranial and medial to the radiocarpal joint space.



Figure 4—Left lateral (A) and ventrodorsal (B) radiographic images of the lumbar portion of the vertebral column of the dog described in Figure 1. The vertebral body profiles are irregular (arrows) and lack endplates. All of the intervertebral spaces visible are abnormally wide.

mg/lb], PO, q 8 h for 4 days). Results of histologic examination of the excised femoral epiphyses indicated a dystrophic degenerative process of the femoral articular cartilages with articular cartilage that was microscopically fenestrated, was partially detached from the subchondral bone, and had erosive-ulcerative lesions, consistent with MED. Additionally, multiple areas of subchondral bone eburnation and aseptic necrosis were found.

The dog recovered well after these surgeries and gradually increased its physical activity; however, 7 months after hip joint arthroplasty, the dog

developed progressive bilateral forelimb lameness. Radiographic examination revealed a fracture in the left humeral head (not shown), and a left scapular-humeral osteotomy was performed (Supplementary Figure S1). Histologic features of samples of the humerus were similar to those identified previously in the excised femoral tissues.

After surgery, the dog's signs of lameness and comfort improved, and the owner reported that the dog was able to slowly climb the stairs. The dog had a shortened gait, inward rotation of the left shoulder

joint, and elbow joint abduction; however, palpation of the left shoulder joint did not elicit signs of pain. The dog routinely underwent physical and radiographic examination for long-term follow-up monitoring. Two years after the dog's first hip joint surgery, the dog could walk, trot, run for short durations, and play without restriction; however, the dog continued to have a stilted gait owing to reduced range of motion in the affected, nontreated joints.

Comments

Multiple epiphyseal dysplasia disease is a genetic and clinical heterogeneous skeletal disease that causes mild to moderate skeletal underdevelopment and results in abnormal joint function, decreased range of motion, and early-onset osteoarthritis.¹ To our knowledge, MED was first described in human medicine in 1947,² and in human medicine, genetic studies³⁻⁵ show 6 gene mutations potentially responsible. They can be inherited in either dominant or recessive autosomal forms.^{4,6} In veterinary medicine, MED is a rarely reported disease that to our knowledge has been described in only 6 reports⁷⁻¹² during the last 6 decades. Therefore, limited knowledge relative to clinical and pathological abnormalities associated with MED in dogs is available. Furthermore, there is a lack of data related to prognosis, treatment, and follow-up for affected dogs. A retrospective study¹² of 19 dogs with MED shows that lameness usually develops between 5 and 8 months of age, inadequate ossification of epiphyses was the most frequent radiographic finding, and severity of signs varied among litters but was consistent in dogs of the same litter.

Before surgery, the dog of the present report could walk, sit down, and stand up but was physically limited in its movements and would not run or play. Radiographically, the dog had widespread underdevelopment of femoral, tibial, humeral, radial, and vertebral epiphyses and apophyses, and these abnormalities likely caused the dog's stiff gait and other abnormal clinical signs. Our finding

of these radiographic abnormalities in the main weight-bearing joints was sufficient for presumptive diagnosis of MED, and histologic findings further supported the diagnosis. We are aware that surgical treatment of dogs with MED is rare and cannot be recommended as a standard treatment. Nonetheless, our findings for the dog of the present report could help veterinarians identify MED in affected dogs and contribute to the knowledge base for potential surgical treatment as an option in select cases.

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