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What Is Your Diagnosis?

In collaboration with the American College of Veterinary Radiology

History

A 6-year-old castrated male Belgian Sheepdog was presented following a 20-foot fall from a ledge onto grass. On presentation, the dog was toe-touching lame on the left forelimb, with evident swelling of the left carpus. Remaining findings on physical examination and point-of-care bloodwork were within reference limits. Two-view radiographic images of the left carpus were obtained **(Figure 1)**.

Formulate differential diagnoses, then continue reading.

Radiographic Findings and Interpretation

The accessory carpal bone was rotated, with the palmar aspect of the bone proximally displaced, indicating disruption of the accessory metacarpal ligaments **(Figure 2)**. The palmar aspect of the carpometacarpal joint space was widened, and the carpometacarpal joints were hyperextended, indicating disruption of the palmar fibrocartilage. A small amount of ill-defined, mineral material was evident immediately dorsal to the distal row of carpal bones; this may have represented small bone fragments or cutaneous debris. On the dorsopalmar view, there was mild widening of the medial aspect of the middle carpal joint and the articulation between the second carpal and metacarpal bones, suggestive of injury to the medial collateral ligament of the carpus. Moderate soft tissue swelling was evident surrounding the carpus and palmar to the metacarpal bones. These findings were consistent with carpal hyperextension injury.

Treatment and Outcome

The next day, radiographic images of the affected joint with stress applied (stress radiographs) were obtained: a mediolateral view of the left carpus positioned in hyperextension and dorsopalmar views of the left carpus positioned with medial stress (abduction of the manus with the antebrachium fixed in place) and then with lateral stress (adduction of the manus with the antebrachium fixed in place). On the hyperextended view, the carpometacarpal joints were subluxated, with marked palmar rotation of the proximal aspects of the metacarpal bones relative to the distal row of carpal bones **(Figure 3)**. On the medial stress view, the medial aspects of the middle carpal and carpometacarpal joints were widened, confirming injury to the medial collateral ligament of the carpus. There was also mild subluxation of the radiocarpal joint evident on this view, with medial displacement of the intermedioradial carpal bone relative to the distal aspect of the radius. There were no meaningful findings on the lateral stress view (not shown).

The carpal hyperextension injury was treated surgically with a pancarpal arthrodesis. The limb was splinted for 8 weeks, with weekly bandage changes. Follow-up monthly radiographic examinations from

Figure 1—Mediolateral (A) and dorsopalmar (B) radiographic images of the left carpus of a 6-year-old castrated male Belgian Sheepdog with toe-touching left forelimb lameness and carpal soft tissue swelling following a 20-foot fall from a ledge.

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Figure 2—Same images as in Figure 1. A—The accessory carpal bone (black arrow) is rotated, with proximal displacement of its palmar aspect. The palmar aspect of the carpometacarpal joint space is widened (black arrowhead). The carpometacarpal joints are hyperextended (dashed line). There is ill-defined mineral material immediately dorsal to the distal row of carpal bones (white arrow). B—There is mild widening of the medial aspect of the middle carpal joint and the articulation between the second carpal and metacarpal bones (black arrowheads). There is also moderate soft tissue swelling palmar to the metacarpal bones and surrounding the carpus on both views (white arrowheads).

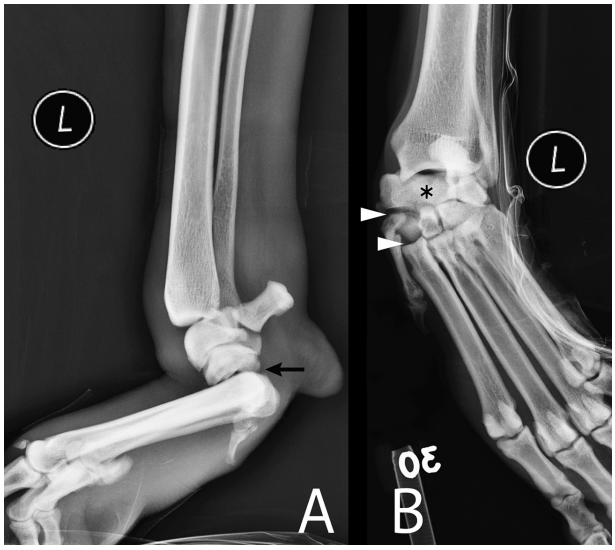

Figure 3—Mediolateral and dorsopalmar radiographic images of the left carpus of the dog described in Figure 1, with the carpus positioned in hyperextension (A) or medial stress applied (abduction of the manus with the antebrachium fixed in place; B). A—The carpometacarpal joints are subluxated (black arrow). B—The medial aspects of the middle carpal and carpometacarpal joints are widened (white arrowheads), and there is mild subluxation of the radiocarpal joint, with medial displacement of the intermedioradial carpal bone (asterisk) relative to the distal aspect of the radius.

2 to 6 months after surgery showed stable surgical implants and progressively decreased visibility of the middle carpal and carpometacarpal joint spaces, consistent with arthrodesis. The dog had intermittent lameness during the recovery period, which had resolved by 6 months after surgery.

Comments

Traumatic hyperextension is a common injury of the carpus in dogs,[1] occurring secondary to excessive limb loading and often associated with falling from a height.[2,3] Acquired carpal hyperextension is also (though infrequently) found with immune-mediated joint disease,[2] which can be differentiated with clinical history and ruled out with arthrocentesis. Pancarpal arthrodesis is the established procedure for treatment of carpal hyperextension injuries in small animals; conservative treatment with casts or splints usually fails to resolve carpal instability.[2] Studies show that 97% (33/34) of dogs improved and 74% (25/34) returned to normal function following pancarpal arthrodesis,[2] whereas only 50% (6/12) returned to normal function following partial carpal arthrodesis.[3]

Hyperextension injury disrupts the palmar carpal ligaments and fibrocartilage that support the normal angulation of the carpal joints during weight-bearing.[4] The carpometacarpal and radiocarpal joints are most commonly involved.[2,3] The carpometacarpal joint is primarily stabilized by the palmar carpal fibrocartilage, which attaches the distal row of carpal bones to the proximal aspects of metacarpal bones II through IV.[2] During weight-bearing, the carpus is also stabilized by the flexor carpi ulnaris muscle and the accessory metacarpal ligaments, which originate on the distal aspect of the accessory carpal bone and insert on the proximopalmar aspects of metacarpal bones IV and V.[2,4] Carpal hyperextension injury often involves rupture of the accessory metacarpal ligaments, leading to rotation of the accessory carpal bone with proximal displacement of its palmar aspect in 28% (10/36) of cases.[2] This rotation can be appreciated on lateral radiographic images obtained without stress applied[2] and should prompt the use of stress radiography to investigate the presence and severity of injury to the palmar carpal fibrocartilage and collateral ligaments of the carpus.

Stress radiography uses controlled force applied to a joint to demonstrate abnormal spatial relationships between joint components.[5] It is helpful to investigate for the presence of ligamentous injuries, particularly when bony components appear normal on conventional radiographic images.[4,5] Heavy sedation or general anesthesia is required, given the potential for patient discomfort. Specialized equipment is not necessary; Farrow[5] describes stress radiography techniques using a wooden mixing spoon and a toilet plunger. At the authors' institution, stress radi-

ography is performed with the use of padded metal blocks, tape, and foam wedges stabilized with sandbags. To our knowledge, the use of stress radiography in the diagnosis of carpal ligamentous injuries for surgical planning was originally described by Slocum and Devine.[4] A lateral view of the carpus when weight-bearing or positioned in hyperextension (to assess the palmar ligaments and fibrocartilage) and dorsopalmar views of the carpus with medial and lateral stresses (to assess the collateral ligaments) should be acquired.[4]

For the dog of the present report, radiographic findings, particularly on the stress views, were useful in the evaluation and subsequent surgical repair of the dog's carpal hyperextension injury. Although the dog's hyperextension injury was evident as rotation of the accessory carpal bone and widening of the palmar aspect of the carpometacarpal joint space on the initial radiographic images, the severity of the instability was not fully appreciated until a hyperextended view was acquired. Furthermore, medial collateral ligamentous injury was confirmed by the widening of the medial aspect of the middle carpal and carpometacarpal joints and radiocarpal joint subluxation on the medial stress dorsopalmar view. For cases in which carpal hyperextension injury is suspected (acute non–weight-bearing forelimb lameness with carpal soft tissue swelling and no evidence of fractures), stress radiography is useful to fully evaluate the severity of instability.

References

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