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CASE REPORT

The use of lateral arthroscopy portals for the management of a fragmented lateral coronoid process in an English Bulldog

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Abstract

Objective: To report a case of unilateral lateral coronoid process fragmentation in a dog treated via lateral elbow arthroscopy portals.

Animal: A 9-month old male intact English Bulldog.

Study design: Case report.

Methods: The dog presented with a history of intermittent right thoracic limb lameness. Orthopedic examination on presentation was unremarkable. Computed tomography of the right thoracic limb was pursued and revealed a mineralized focus along the lateral margin of the lateral coronoid process as well as sclerosis of the medial coronoid process and subtrochlear region of the ulna. Elbow arthroscopy was performed via a lateral approach and revealed chondromalacia of the entire lateral coronoid process. Abrasion arthroplasty of the lateral coronoid process was performed.

Results: Complete resolution of the lameness was achieved within two weeks of surgery. At 6 weeks postoperatively, the dog remained sound and a gradual return to normal activity was recommended. At the final follow up assessment, 5 months after surgery, no abnormalities were found on orthopedic examination and the owners reported excellent limb function with no observable lameness.

Conclusion: Lateral coronoid disease can occur as a rare component of elbow dysplasia in dogs. Abrasion arthroplasty via lateral arthroscopic portals may have resulted in a successful outcome in this case and may form an effective treatment option for lateral coronoid disease in dogs.

1 | INTRODUCTION

Elbow dysplasia is a common cause of lameness in medium to large breed dogs that encompasses a group of developmental disorders including ununited anconeal process, medial coronoid disease (MCD), osteochondrosis and joint incongruity.[1–4] Of these conditions, MCD is the most prevalent and is characterized by chondromalacia, fissuring, or fragmentation of the subchondral bone and cartilage of the medial coronoid process (MCP).[1–4] Although the exact etiopathogenesis of MCD is incompletely understood, prevalent theories include a localized disturbance of endochondral ossification as well as supraphysiological loading of the MCP secondary to elbow incongruity. In either scenario, fatigue microdamage to the subchondral bone is associated with secondary degeneration of the associated articular cartilage.[5–8] The definitive diagnosis of MCD is performed through a combination of imaging modalities including radiography, computed tomography (CT), and arthroscopy.[4,9–12] Although the relative efficacy of surgical versus nonsurgical treatment modalities remains controversial, surgical treatment typically involves fragment removal and/or abrasion arthroplasty via a standard medial arthroscopic approach.[7,13–16]

Contrary to MCD, lateral coronoid disease (LCD) has rarely been reported in dogs, typically manifesting as chondromalacia of the lateral compartment secondary to diffuse elbow osteoarthritis.[18,19] To the author's knowledge, there are no clinical reports on the treatment of lateral coronoid disease (LCD) in dogs. Furthermore, the clinical application of canine elbow arthroscopy via lateral portals has only been described in a single case report[12] for the treatment of bilateral radial head OCD. As such, the objective of this case report was to describe the clinical presentation, diagnostic findings, and outcome of a dog with a fragmented lateral coronoid process treated with abrasion arthroplasty via lateral arthroscopy portals.

2 | MATERIALS AND METHODS

A 9-month-old male intact English Bulldog weighing 23.3 kg presented to the University of Georgia Veterinary Teaching Hospital with an intermittent right thoracic limb lameness of 5 months duration. The episodes of lameness would typically occur after periods of inactivity and would resolve with exercise. Radiographs of the right elbow and carpus were obtained by the primary veterinarian and revealed mild to moderate sclerosis of the ulnar trochlear notch and bipartition of the second carpal bone (Figure 1). A 3-week regimen of activity restriction and twice daily oral administration of gabapentin (8.7 mg/kg) was implemented but did not result in any discernable improvement.

Upon general physical examination, the dog was mildly overconditioned (body condition score of 6/9) and had a prolapsed urethra. Orthopedic examination was completely unremarkable with no lameness, crepitus, effusion, pain or abnormal range of motion noted in any limb or joint. Due to the ongoing right thoracic limb lameness observed at home, the owners elected to proceed with advanced imaging.

Computed tomography (Somatom Sensation 64, Siemens Healthineers, Erlangen, Germany) of both thoracic

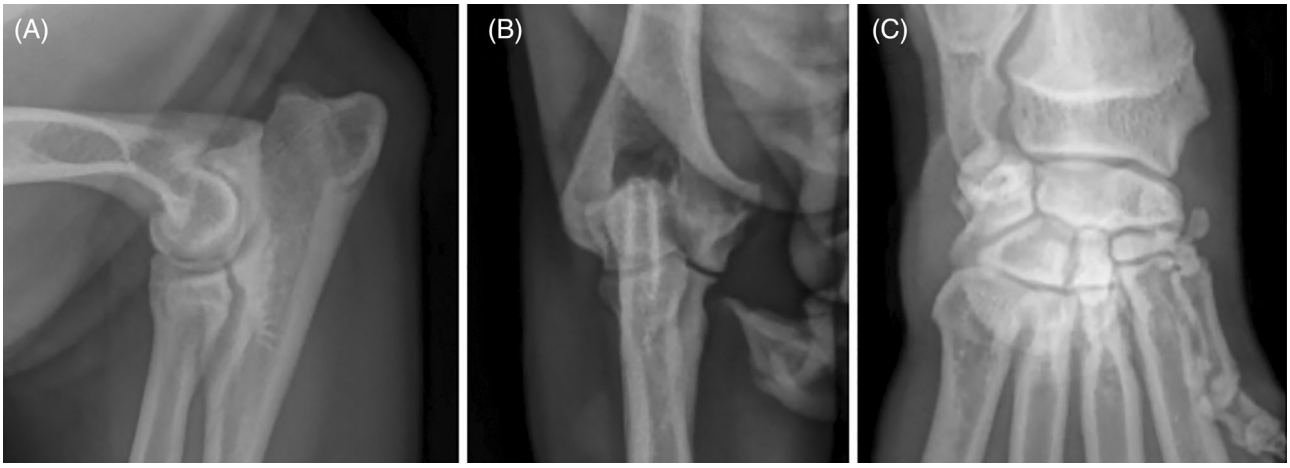

FIGURE 1 Mediolateral (A) and craniocaudal (B) radiographic projections of the right elbow. There is mild to moderate sclerosis of the ulnar trochlear notch, extending to the region of the medial and lateral coronoid processes, without evidence of fragmentation. Dorsopalmar radiographic projection of the right carpus (C) showing a bipartite second carpal bone with mild enthesophyte formation along the lateral margin of the ulnar carpal bone.

limbs was performed, which revealed a mineral attenuating focus along the lateral margin of the right lateral coronoid process. This mineral focus measured 2.2 × 1.2 × 1.3 mm and partially effaced the cortical margin of the lateral coronoid process. A corresponding small defect was also present in the adjacent lateral coronoid process, creating a blunted appearance to the lateral coronoid process (Figure 2). Moderate sclerosis of the MCP and subtrochlear region were also present without evidence of MCP fragmentation. In addition to the findings described above, CT revealed bilateral fragmentation of the second carpal bones. The right second carpal bone was bipartite while the left second carpal bone was multipartite (Figure 3).

Treatment options discussed with the owner included continued medical management with the inclusion of a non-steroidal anti-inflammatory drug or arthroscopic exploration of the lateral compartment and fragment retrieval via lateral portals. After careful consideration, the owners elected to move forward with right elbow arthroscopy, urethropexy and castration. The patient was premedicated with methadone (0.2 mg/kg IM), dexmedetomidine (3 mcg/kg IM), maropitant (1 mg/kg IV) and metoclopramide (1 mg/kg IV). General anesthesia was induced with ketamine (2 mg/kg IV) and propofol (2.1 mg/kg IV) and maintained with sevoflurane inhalation (1%–2%) and a ketamine CRI (1 mg/kg/h).

The patient was positioned in dorsal recumbency and the right thoracic limb was prepared and draped routinely using a hanging limb technique. Lateral arthroscope, instrument, and egress portals were established as previously described[12] and a 30 degree 1.9 mm arthroscope (Arthrex Inc., Naples, Florida) was used for joint exploration. Upon entry into the lateral elbow compartment, moderate synovitis was noted. An arthroscopic shaver (Formula Shaver, Stryker, Kalamazoo, Michigan) was used to debride synovium as needed to facilitate visualization. Upon inspection of the LCP, the articular cartilage surface was noticeably irregular but otherwise intact (Figure 4). During palpation of the LCP with a meniscal probe, substantial chondromalacia of the entire LCP was appreciated, providing a modified Outerbridge score (MOS) of 1. No obvious cartilage cleft or cleavage plane was identified. A curette was used to debride the diseased cartilage until healthy, bleeding, subchondral bone was seen (Figure 4). No distinct fragments were able to be obtained for histopathologic analysis. The instruments were removed, and the two portals were closed routinely.

During the immediate postoperative period, the patient was administered one dose of methadone (0.1 mg/kg IV) and subsequently started on carprofen (2.14 mg/kg orally every 12 hours for 5 days) and trazodone (6.5 mg/kg orally every 8–12 h as needed for 14 days).

The following morning, the patient had a moderate right thoracic limb lameness but was comfortable on palpation and range of motion of the right elbow. In addition to carprofen and trazodone, the patient was discharged with amoxicillin (13 mg/kg orally every 12 hours for 7 days) for a urinary tract infection. The owner was instructed to restrict the dog's activity to short leash walks until his progress examination at 6 weeks postoperatively.

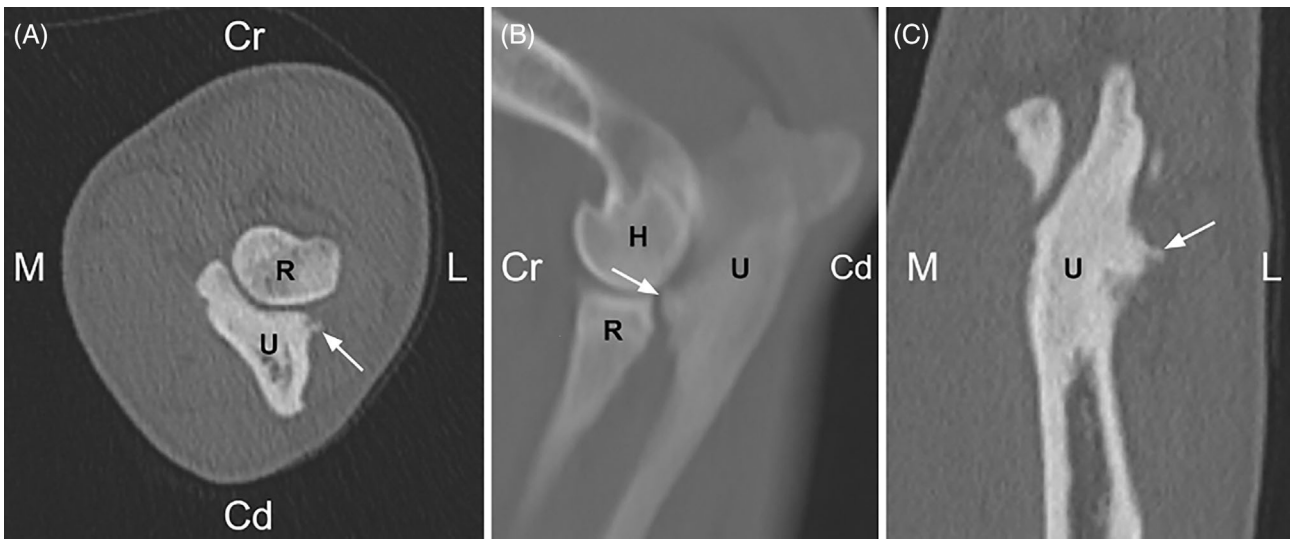

FIGURE 2 Computed tomography (CT) images of the right elbow (A–C) in an English Bulldog with incomplete fragmentation of the lateral coronoid process. Transverse (A), sagittal maximum intensity projection (B), and dorsal plane (C) CT images in a bone window showing the incomplete fragmentation of the lateral coronoid process (white arrow) and associated subchondral defect along the lateral coronoid process. Laterality markers: Cd, caudal; Cr, cranial; L, lateral; M, medial. Bone labels: H, humerus; R, radius; U, ulna.

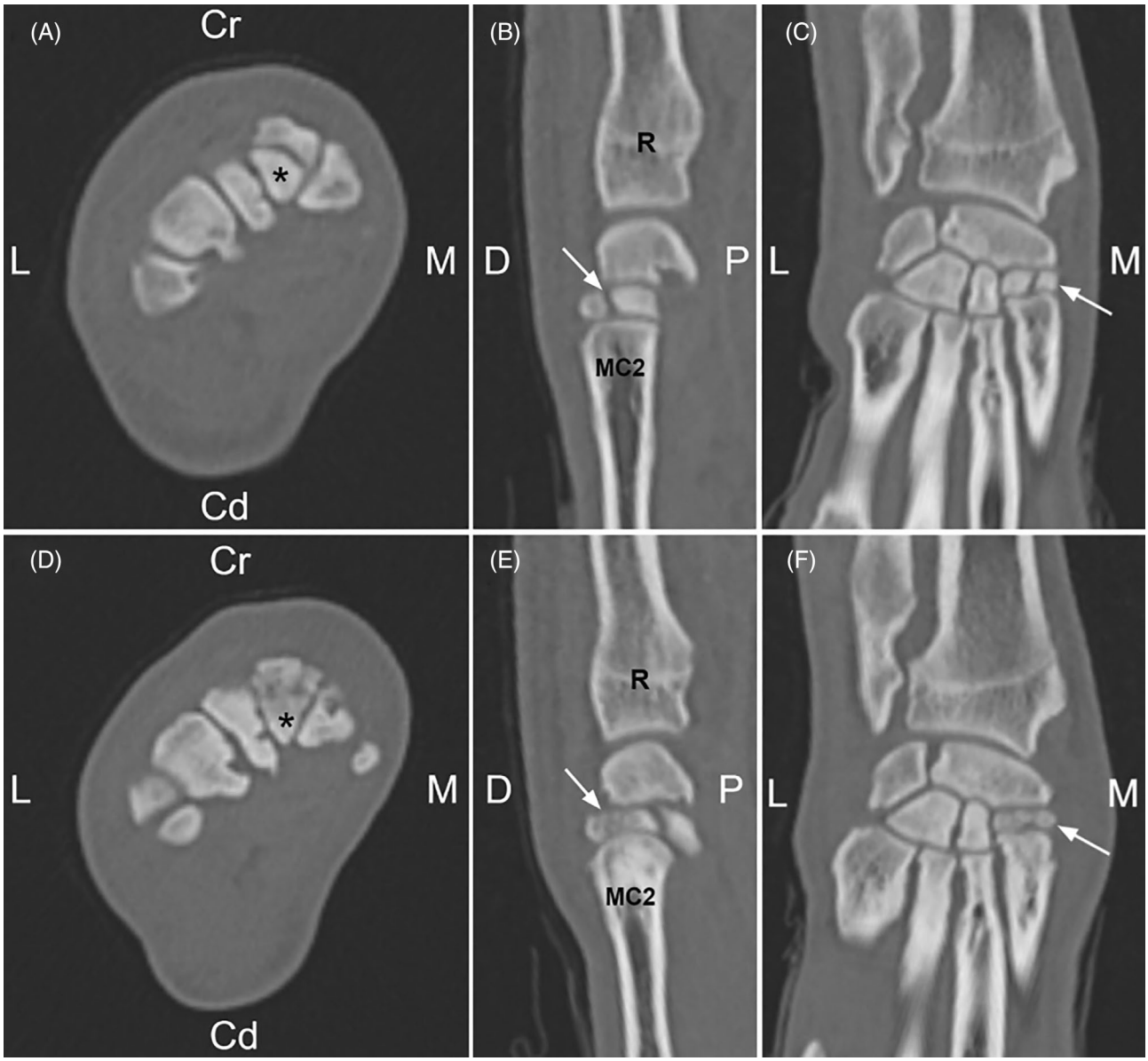

FIGURE 3 Computed tomography (CT) images of the right carpus (A–C) and left carpus (D–F) in an English Bulldog with bilateral fragmentation of the second carpal bones. Transverse (A, D), sagittal (B, E), and dorsal plane (C, F) CT images in a bone window showing fragmentation of the second carpal bone (black asterisk and white arrow). Laterality markers: D, dorsal; L, lateral; M, medial; P, palmar. Bone labels: MC2, second metacarpal bone; R, radius.

3 | RESULTS

The dog was reassessed at 2, 6, and 20 weeks postoperatively. At 2 and 6 weeks postoperatively, the owners reported excellent limb function and no abnormalities were detected on subjective gait analysis and orthopedic examination. At 6 weeks postoperatively, a gradual reintroduction to normal activity was advised. Upon final follow up at 5 months postoperatively, the owners confirmed a return to normal activity and reported continued excellent limb function with no episodes of lameness observed since surgery. Orthopedic examination remained unremarkable, with no appreciable lameness, elbow pain, or joint effusion.

4 | DISCUSSION

This case report documents the diagnosis and successful treatment of a fragmented LCP via lateral arthroscopy portals in a dog. There is a paucity of information regarding LCD in dogs. Although poorly described, LCD typically manifests as a component of diffuse elbow osteoarthritis and is most commonly referred to as a

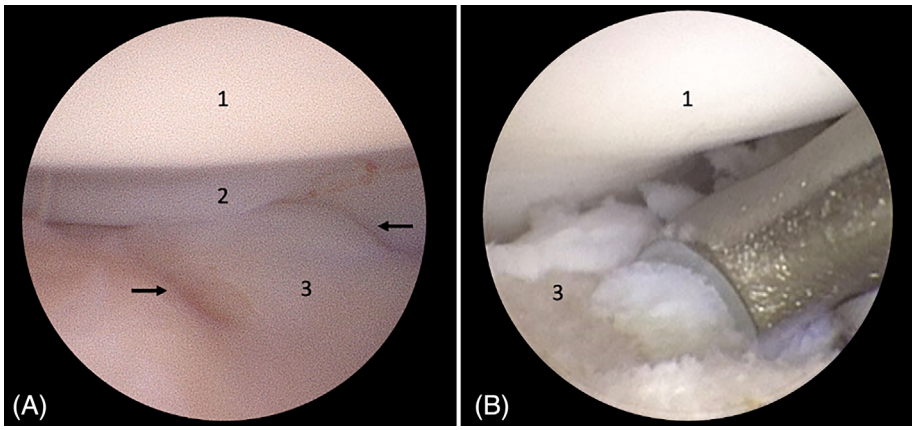

FIGURE 4 Arthroscopic views of the lateral compartment of the right elbow through a lateral arthroscope portal. (A) On initial evaluation, the articular surface of the lateral coronoid process was irregular (arrows) and soft on direct palpation (modified Outerbridge score 1). (B) Abrasion arthroplasty was performed using a small curette. The subchondral bone was soft and discolored, and was debrided until bleeding occurred. 1, lateral aspect of the humeral condyle; 2, radial head; 3, lateral coronoid process.

contraindication for certain surgical procedures addressing MCD, such as the proximal abducting ulnar osteotomy, sliding humeral osteotomy, and canine unicompartmental elbow arthroplasty procedures.[18,20,21] Interestingly, isolated fragmentation of the LCP was identified incidentally in two healthy Golden Retrievers in one descriptive anatomic study.[19] Both dogs were skeletally immature (16 and 24 weeks of age) and exhibited no lameness or evidence of elbow pathology on orthopedic examination. The fragmented LCPs described in this report were associated with a concomitant cartilage-free area at the trochlear notch near the lateral coronoid process. Although it is possible that these two findings could be correlated with each other, it is important to consider that cartilage-free areas on the ulnar trochlear notch and humeral condyle occur in absence of inflammation and are commonly identified as normal anatomic variations in healthy dogs. In addition, no cartilage-free areas were observed in the dog described in this case report.

Although the etiology of LCP fragmentation remains unclear, the authors suspect that the LCP lesion identified in this case report likely represents a rare component of elbow dysplasia. Similar to our case, clinical signs associated with elbow dysplasia are typically seen in skeletally immature, medium to large breed dogs. In addition, subchondral sclerosis of the MCP and subtrochlear region of the ulna was identified on CT, which is often considered an early indicator of MCD and elbow dysplasia.[17] Traumatic LCP fracture forms an important differential, however there was no history of an acute traumatic event. In addition, arthroscopic evaluation did not reveal a distinguishable fracture line nor the presence of healthy subchondral bone, further diminishing the probability of a traumatic etiology.[22]

It is plausible that the etiopathogenesis of LCP fragmentation in this case is similar to that of MCD, involving either a localized disturbance in endochondral ossification and/or supraphysiologic loading of the LCP secondary to elbow incongruity. Although no overt signs of elbow incongruity were observed on CT or arthroscopy, it is possible that transient or dynamic elbow incongruity may have been present and contributed to LCP fragmentation. Although previous studies have not identified the LCP as a distinct area of contact during joint loading of the normal canine elbow, the predominant areas of contact may differ depending on dog breed/conformation, elbow pathology, and activity profile.[23–25] Histopathological analysis could have provided further clarification in regards to the etiology and pathogenesis in this case. Unfortunately, this was unable to be obtained due to the absence of a distinct LCP fragment on arthroscopic evaluation.

Abrasion arthroplasty of the LCP was performed through lateral arthroscopy portals as previously described.[12] This approach was simple to perform, provided clear visualization of the lateral elbow compartment, and allowed for ready access to the LCP for treatment. An excellent outcome was achieved, with return to normal function and complete resolution of clinical signs. Nonetheless, it is important to note that clinical improvement may have been observed without surgical intervention. Although a trial of nonsurgical management was attempted prior to arthroscopy, it is possible that a longer period of activity restriction in combination with a nonsteroidal anti-inflammatory drug, as instituted postoperatively, could have contributed to clinical improvement. Similarly, the MCD identified on preoperative CT may have contributed to clinical signs

and resolved with nonsurgical management. Lastly, it must be acknowledged that the short term follow-up obtained in this report may not accurately reflect the long term outcome of this case, as progressive degeneration of the lateral compartment may lead to worsening lameness over time.

It is important to note that the dog did have evidence of concomitant MCD on CT, and that this pathology could have contributed to clinical signs. Abrasion arthroplasty of the LCP led to a successful outcome in this case, with return to normal function and complete resolution of clinical signs. Clinical signs could have been due to MCD that resolved with prolonged postoperative activity restriction and gradual return to function. No obvious pathology was visible in the medial compartment during arthroscopic exploration; however, complete visualization of the MCP was not able to be obtained via the lateral arthroscopic approach. Due to the absence of MCP fragmentation on CT, as well as the risk of iatrogenic articular cartilage injury to the medial compartment, the authors did not feel that additional exploration via medial arthroscopy portals was warranted.

In addition to the fragmented LCP, CT revealed bilateral fragmentation of the second carpal bones. Based on the bilateral distribution and smooth margination of the fragments, in combination with the absence of swelling and pain on examination, these lesions are most consistent with congenital multipartition of the second carpal bone. Interestingly, multipartition of the second carpal bone has recently been documented in another English Bulldog.[12] While the likelihood of these lesions having clinical significance is improbable, it is important to recognize that the English Bulldog breed might exhibit a predisposition to their formation. Additionally, these lesions may be encountered incidentally during diagnostic evaluation.

This case report describes the presentation, diagnosis, and treatment of a dog with a fragmented lateral coronoid process. Arthroscopic abrasion arthroplasty was performed via lateral arthroscopy portals without complications and may have led to successful resolution of the patient's clinical signs. The limitations of this study are attributed to only having a single case and the lack of histopathology to assess the cellular characteristics of the debrided lesion. In addition, since no identifiable abnormalities were found on orthopedic examination, the reliance on client-reported outcomes for lameness assessment introduces the possibility of treatment bias. Additional cases of dogs with LCD are necessary to determine its prevalence, association to MCD, clinical relevance, and the most effective treatment for alleviating related clinical signs.

AUTHOR CONTRIBUTIONS

Vernier TH, DVM: Actively involved in case management, drafted manuscript and contributed to revision and approval of the final manuscript. Verpaalen VD, DVM, MS, DACVS (Small Animal): Actively involved in case management, drafted manuscript and contributed to revision and approval of the final manuscript. Hinson WD, DVM, MS, DACVS (Small Animal): Actively involved in case management, contributed to revision and approval of the final manuscript. Belhorn SA, DVM: Provided computed tomography images and contributed to manuscript preparation. Giglio RF, DVM, MS, PhD, DACVR: Evaluated computed tomography imaging and contributed to manuscript preparation.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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REFERENCES

1. Goldhammer MA, Smith SH, Fitzpatrick N, Clements DN. A comparison of radiographic, arthroscopic and histological measures of articular pathology in the canine elbow joint. *Vet J*. 2010;186(1):96-103. doi:10.1016/j.tvjl.2009.07.025
2. Mostafa A, Nolte I, Wefstaedt P. The prevalence of medial coronoid process disease is high in lame large breed dogs and quantitative radiographic assessments contribute to the diagnosis. *Vet Radiol Ultrasound*. 2018;59(5):516-528. doi:10.1111/vru.12632
3. Gemmill TJ, Mellor DJ, Clements DN, et al. Evaluation of elbow incongruency using reconstructed CT in dogs suffering fragmented coronoid process. *J Small Anim Pract*. 2005;46(7):327-333. doi:10.1111/j.1748-5827.2005.tb00328.x
4. Hersh-Boyle RA, Chou PY, Kapatkin AS, et al. Comparison of needle arthroscopy, traditional arthroscopy, and computed tomography for the evaluation of medial coronoid disease in the canine elbow. *Vet Surg*. 2021;50(Suppl 1):O116-O127. doi:10.1111/vsu.13581
5. Samoy Y, Van Vynckt D, Gielen I, van Bree H, Duchateau L, Van Ryssen B. Arthroscopic findings in 32 joints affected by severe elbow incongruity with concomitant fragmented medial coronoid process. *Vet Surg*. 2012;41(3):355-361. doi:10.1111/j.1532-950X.2012.00949.x
6. Fitzpatrick N, Garcia TC, Daryani A, Bertran J, Watari S, Hayashi K. Micro-CT structural analysis of the canine medial coronoid disease. *Vet Surg*. 2016;45(3):336-346. doi:10.1111/vsu.12449
7. Danielson KC, Fitzpatrick N, Muir P, Manley PA. Histomorphometry of fragmented medial coronoid process in dogs: a comparison of affected and Normal coronoid processes. *Vet Surg*. 2006;35(6):501-509. doi:10.1111/j.1532-950X.2006.00183.x

8. Lau SF, Hazewinkel HAW, Grinwis GCM, et al. Delayed endochondral ossification in early medial coronoid disease (MCD): a morphological and immunohistochemical evaluation in growing Labrador retrievers. *Vet J*. 2013;197(3):731-738. doi:10.1016/j.tvjl.2013.04.021
9. Lau SF, Wolschrijn CF, Hazewinkel HAW, Siebelt M, Voorhout G. The early development of medial coronoid disease in growing Labrador retrievers: radiographic, computed tomographic, necropsy and micro-computed tomographic findings. *Vet J*. 2013;197(3):724-730. doi:10.1016/j.tvjl.2013.04.002
10. Phillips A, Burton NJ, Warren-Smith CMR, Kulendra ER, Parsons KJ. Topographic bone density of the radius and ulna in greyhounds and Labrador retrievers with and without medial coronoid process disease. *Vet Surg*. 2015;44(2):180-190. doi:10.1111/j.1532-950X.2014.12294.x
11. Shimizu N, Warren-Smith CM, Langley-Hobbs SJ, et al. Inter- and intraobserver agreement in interpretation of CT features of medial coronoid process disease. *J Small Anim Pract*. 2015;56(12):707-713. doi:10.1111/jsap.12411
12. Shetler SE, Verpaalen VD, Hinson WD, De Lombaert M, Belhorn SA, Giglio RF. The use of lateral arthroscopy portals for the management of bilateral osteochondritis dissecans of the radial head in an English bulldog. *Vet Surg*. 2022;51(8):1287-1294. doi:10.1111/vsu.13874
13. Burton NJ, Owen MR, Kirk LS, Toscano MJ, Colborne GR. Conservative versus arthroscopic Management for Medial Coronoid Process Disease in dogs: a prospective gait evaluation. *Vet Surg*. 2011;40(8):972-980. doi:10.1111/j.1532-950X.2011.00900.x
14. Fitzpatrick N, Smith TJ, Evans RB, O'riordan J, Yeadon R. Subtotal coronoid Ostectomy for treatment of medial coronoid disease in 263 dogs. *Vet Surg*. 2009;38(2):233-245. doi:10.1111/j.1532-950X.2008.00491.x
15. Meyer-Lindenberg A, Langhann A, Fehr M, Nolte I. Arthrotomy versus arthroscopy in the treatment of the fragmented medial coronoid process of the ulna (FCP) in 421 dogs. *Vet Comp Orthop Traumatol*. 2003;16(04):204-210. doi:10.1055/s-0038-1632780
16. Evans RB, Gordon-Evans WJ, Conzemius MG. Comparison of three methods for the management of fragmented medial coronoid process in the dog: a systematic review and meta-analysis. *Vet Comp Orthop Traumatol*. 2008;21(02):106-109. doi:10.3415/VCOT-07-04-0031
17. Groth AM, Benigni L, Moores AP, Lamb CR. Spectrum of computed tomographic findings in 58 canine elbows with fragmentation of the medial coronoid process. *J Small Anim Pract*. 2009;50(1):15-22. doi:10.1111/j.1748-5827.2008.00656.x
18. Coppieters E, Gielen I, Verhoeven G, Van Vynckt D, Van Ryssen B. Erosion of the medial compartment of the canine elbow: occurrence, diagnosis and currently available treatment options. *Vet Comp Orthop Traumatol*. 2015;28(1):9-18. doi:10.3415/VCOT-13-12-0147
19. Wolschrijn CF, Kik MJL, Weijs WA. Cartilage-free areas in the elbow joint of young golden retrievers. *Anat Rec A Discov Mol Cell Evol Biol*. 2003;275(1):990-996. doi:10.1002/ar.a.10114
20. Fitzpatrick N, Bertran J, Solano MA. Sliding humeral osteotomy: medium-term objective outcome measures and reduction of complications with a modified technique. *Vet Surg*. 2015;44(2):137-149. doi:10.1111/j.1532-950X.2014.12213.x
21. Bruecker KA, Benjamino K, Vezzoni A, et al. Canine elbow dysplasia: medial compartment disease and osteoarthritis. *Vet Clin North Am Small Anim Pract*. 2021;51(2):475-515. doi:10.1016/j.cvsm.2020.12.008
22. Tan DK, Canapp SO, Leasure CS, Dycus DL, O'Donnell E. Traumatic fracture of the medial coronoid process in 24 dogs. *Vet Comp Orthop Traumatol*. 2016;29(4):325-329. doi:10.3415/VCOT-15-09-0154
23. Cuddy LC, Lewis DD, Kim SE, et al. Contact mechanics and three-dimensional alignment of normal dog elbows. *Vet Surg*. 2012;41(7):818-828. doi:10.1111/j.1532-950X.2012.01036.x
24. Krotscheck U, Böttcher PB, Thompson MS, Todhunter RJ, Mohammed HO. Cubital subchondral joint space width and CT osteoabsorptiometry in dogs with and without fragmented medial coronoid process. *Vet Surg*. 2014;43(3):330-338. doi:10.1111/j.1532-950X.2014.12121.x
25. Preston CA, Schulz KS, Kass PH. In vitro determination of contact areas in the normal elbow joint of dogs. *Am J Vet Res*. 2000;61(10):1315-1321. doi:10.2460/ajvr.2000.61.1315

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