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Refereed Peer Review

Canine Elbow Dysplasia: Incidence, Diagnosis, Treatment, and Prognosis*

KEY FACTS

- Canine elbow dysplasia is most commonly diagnosed in rapidly growing, large- to giant-breed dogs.
- Advanced radiographic imaging remains the best tool for diagnosing elbow dysplasia.
- Treatment and prognosis vary depending on the specific cause of the elbow dysplasia, but progression of osteoarthritis is common.

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ABSTRACT: Canine elbow dysplasia is a common cause of pain and forelimb lameness in large-breed dogs and is being diagnosed more frequently because of the better understanding and awareness of its components by veterinarians. Diagnosis is based on findings obtained from physical examination, radiography, and advanced imaging techniques. Both medical and surgical treatments are advocated. The prognosis for normal joint function in dogs with canine elbow dysplasia varies.

Canine elbow dysplasia (CED) is common in large-breed dogs and typically causes signs of pain and lameness before 1 year of age. Patients with CED typically have similar signalments, histories, and clinical signs. Survey radiographs may aid in the diagnosis, but advanced techniques (e.g., computed tomography [CT], magnetic resonance imaging [MRI], nuclear scintigraphy, arthroscopy) are often required for confirmation. Treatment of CED may include medical management and surgery, the specific treatment depending on the cause of the disease and the degree of osteoarthritis. The prognosis varies, and progression of osteoarthritis is common. This article discusses the incidence, diagnosis, treatment, and prognosis of CED.

INCIDENCE

Most patients with CED are large to giant, rapidly growing breeds of dogs, although CED occurs in some medium-size and chondrodystrophic breeds as well.[1–5] No sex predilection has been observed in dogs with ununited anconeal process (UAP) and osteochondrosis (OC). Fragmented medial coronoid process (FMCP) occurs more commonly in males than in females.[6] Bilateral joint involvement is common, with the right and left limbs equally represented. OC and FMCP frequently coexist in the same joint (i.e., 30%,[7] 37%,[8] 40%[9]).

UAP occurs less frequently (0.2%[7]) with the other lesions in the same elbow joint, except perhaps in breeds in which puppies sometimes develop a separate ossification center for the anconeal process (e.g., German shepherds). In one

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Figure 1—Typical appearance of a dog with CED. This 6-month-old Labrador retriever presented with a 4-week history of left forelimb lameness. Note the weight shifting to the right forelimb, adduction of the elbow, and carpal abduction.

author's experience (R. R. P.), most German shepherd puppies examined at necropsy did not have secondary centers of ossification for the anconeal processes. UAP also occurs in some chondrodystrophic breeds (e.g., basset hounds). Achondroplastic dwarf puppies may have all three disorders affecting both elbows.

Clients commonly report that signs of lameness have been present for several months or even years. The age of the patient at the onset of clinical signs ranges from 4 to 12 months; however, dogs as young as 2 to 3 months of age and as old as 6 to 8 years of age have been diagnosed with CED. Concurrent developmental orthopedic diseases (e.g., canine hip dysplasia, panosteitis, OC lesions elsewhere in the body) are frequently identified, but a direct relation to CED has not been established.[1]

DIAGNOSIS

Physical Examination

A thorough physical and orthopedic examination should be performed on all potentially affected dogs. Potential lameness is evaluated with the dog walking, trotting, and circling in a figure-eight pattern to identify forelimb abnormalities. Dogs normally place 60% of their body weight on the forelimbs, but dogs with elbow pain caused by CED typically place only 40% to 50% of their body weight on the forelimbs. Clinical signs of CED include short strides, difficulty in rising or lying down, abducting the affected elbow when lying down, and gradual and progressive lameness that is heightened after exercise. Most dogs with elbow dysplasia sit or stand with the elbow adducted and the carpus abducted (Figure 1). Palpation of the elbows may reveal soft tissue swelling (indicative of joint capsule thickening or effusion), muscle atrophy, pain, and crepitus. Pain is often elicited when the elbow is flexed and the antebrachium is pronated and/or supinated. A reduced range of motion of the elbow joint may be observed in some dogs with the disorder.

Radiography and Special Imaging

Confirmation of CED is often accomplished with radiography. A tabletop technique using detail screens and collimation is preferred.[10] Both elbows are radiographed to identify bilateral disease and to allow comparison between joints. Proper positioning is essential. Recommended radiographic views include craniocaudal, standard mediolateral, mediolateral, and craniocaudal medial to lateral oblique with the elbow maximally extended and supinated 15°[10] (Figure 2). The lateral view permits visualization of the anconeal process and periarticular osteophytosis.[1] The oblique views enhance visualization of the medial humeral condyle and the medial coronoid process of the ulna. A mediodistal to lateroproximal 30° oblique view also helps in some cases.[10] Murphy et al[11] reported that elbow congruity was best assessed via a flexed 90° mediolateral radiographic view. However, when Mason et al[12] evaluated dogs for radioulnar incongruence, they observed that a standard radiographic evaluation was associated with relatively poor sensitivity and specificity. They stated that a more reliable diagnostic method should be available before use of invasive surgical procedures and screening programs.

For suspected OC, positive-contrast arthrography may be used to determine the size of subchondral defects, the presence of a radiolucent flap, and the presence of unmineralized free joint bodies.[13] CT and MRI are extremely helpful in diagnosing elbow diseases, although these tools are not available in all practices (Figure 3). Nuclear scintigraphy and arthroscopy may also help confirm the presence of CED.

Figure 2A—FMCP

Figure 2B—FMCP and a "kissing lesion"

Figure 2C—OC lesion

Figure 2—Mediolateral radiographic view (**A**) and craniocaudal medial to lateral oblique radiographic view (**B**) of the left forelimb of a 7-month-old Labrador retriever. FMCP *(arrows* in **A***)* can be seen. The medial humeral condyle shows a "kissing lesion" *(arrowheads* in **B***)*. (**C**) Craniocaudal radiographic view of an 8-month-old Labrador retriever with an OC lesion *(arrowheads)* of the medial aspect of the humeral condyle.

TREATMENT AND PROGNOSIS

Ununited Anconeal Process

Surgery is recommended for treating UAP. Surgical options include removal of the UAP, reattachment of the anconeal process to the ulna, and osteotomy or ostectomy of the ulna with or without surgical fixation of the anconeal process[1,9,14–24] (Table 1). In many cases, medical therapy after surgery includes weight management, controlled exercise, and appropriate medications, such as NSAIDs and agents that modify osteoarthritis. Medical management alone is usually less successful than surgery, which results in rapid progression of osteoarthritis.[25] Although spontaneous fusion of the UAP is rarely observed, it has been reported.[26,27] Breeding of affected dogs is generally not recommended.[2,9,27–29]

Surgical Removal of the UAP

Surgical removal of the UAP is performed by means of caudomedial or caudolateral arthrotomy.[30] Arthroscopic removal was also described.[31] Excision of the UAP resulted in good to excellent long-term function in a retrospective study of 23 dogs.[18] Long-term evalua-

Table 1. Published Data on Treatment of Ununited Anconeal Process

Study	*Treatment*	*No. of Dogs*	*Age*	*No. of Joints*	*Follow-up Period (mean)*	*Fusion Occurred*	*Lameness (Joints)*
Sinabaldi and Arnoczky (1975)[16]	Excision	16	<1 y: 3 1–2 y: 4 >2 y: 9	19	2–40 mo (19.5)	N/A	1 excellent 14 good 4 poor
Roy et al (1994)[18]	Excision	6	6–12 mo (mean = 8.5)	7	35–118 mo (65)	N/A	6 good to excellent 1 fair
Fox et al (1996)[20]	Lag screw fixation	8	5–24 mo (mean = 8.7)	10	6–48 mo (20.2)	5	Not reported
Krotscheck et al (2000)[22]	Lag screw and proximal ulnar osteotomy	4	6–8.5 mo (mean = 7.8)	4	23–40 mo (30.5)	4	4 excellent
Sjostrom et al (1995)[9]	Proximal ulnar osteotomy	20	5–13 mo (mean = 6.6)	22	4–51 mo (21)	21 (see Results/ Comments)	12 excellent 5 good 2 fair 1 poor
Turner et al (1998)[23]	Proximal ulnar osteotomy	17	5–22 mo (mean = 7.7)	23	12–55 wk (21.6)	5	21 improved 2 worsened
Meyer-Lindenberg et al (2001)[24]	Proximal ostectomy (UAP tightly in place)	9	17–29 wk (mean = 21.7)	9	Short: 9–18 wk (13) Late: 27–51 wk (41)	9	8 good 1 satisfactory
	Lag screw and ostectomy (UAP loose)	33	19–46 wk (mean = 23.3)	35	Short: 7–20 wk (13) Late: 31–233 wk (81)	34	28 good 5 satisfactory 2 unsatisfactory

AP = anconeal process; *OA* = osteoarthritis; *ROM* = range of motion.

Results and Comments

After surgery, 15 of 16 dogs remained unchanged on the basis of clinical and radiographic evaluation; 4 of 16 showed progression of OA. Average time to full use of operated limb was 2 wk. Sixty-nine percent of cases were in German shepherds.

All surgeries were performed before 1 y of age. OA progressed universally. ROM decreased in all joints on extension and three of seven joints on flexion. Excision of the AP eliminated pain but resulted in progression of OA.

Time of gap closure in six dogs was reported as 2–6 mo. Postoperative remarks were reported for four dogs and were favorable for three of the four. OA was described as minimal in one dog, mild in two, and moderate in five. No long-term follow-up radiographs were performed.

Minimal to no progression of OA. K-wires were used along with the lag screw. Preoperative pain on elbow manipulation was noted in three of four joints, postoperative pain in none of four, with normal ROM.

Ninety-one percent of cases were in German shepherds. Fifteen of 21 fused, and six of 21 showed a narrowing of the physeal gap (considered healed by authors because of clinical improvement and no signs of OA). OA was not reported preoperatively. Authors reported that six of 20 dogs had no OA postoperatively but only 2 of 6 had *no* radiographic signs. Additional fixation of the ulna was not necessary.

Sixteen of 23 joints were nonfused and nondisplaced. The two dogs that worsened clinically required additional surgery to remove the AP. Average healing time for 16 cases was 21 wk (range: 12–27 wk). Additional fixation of the ulna was not necessary.

Implants loosened in one dog 8 wk after surgery and required excision. Of 30 of 44 joints evaluated for OA at the late follow up, 20% had no sign of progression, 60% had mild signs, 16.7% had moderate signs, and 3.3% had severe signs. The ulna was stabilized in the nine ostectomy cases. Ostectomy in the middle third of the ulna was effective in preventing development of a "step." Proximal ulnar ostectomy produced more postoperative discomfort and callus formation than what was observed with middle or distal ostectomy.

Figure 3—Transverse cross-sectional CT image of the forelimb of a 1.5-year-old rottweiler illustrates the radius *(r)*, ulna *(u)*, and FMCP *(arrow)*. (Courtesy of Dr. S. A. Martinez, Washington State University)

tions found that dogs treated with excision of the UAP have a favorable prognosis.[16,18]

Surgical Reattachment of the UAP

Surgical reattachment of the UAP is performed by using lag screw fixation. The lag screw is inserted from the ulna into the anconeal process. Inserting the lag screw from the anconeal process into the ulna has also been described, although this method places the implant within the joint. Reattachment is usually attempted before the dog is 24 weeks of age. After 24 weeks, removal of the UAP is usually recommended. A study of lag screw fixation techniques used in 10 elbows found encouraging results, although additional long-term studies are warranted.[20]

Osteotomy of the Ulna

Osteotomy of the ulna is performed to reduce abnormal forces applied to the anconeal process and to allow attachment. However, treatment using ulnar osteotomy alone has produced mixed results. Meyer-Lindenberg et al[24] performed proximal ostectomy of the ulna on 35 joints in which the anconeal process appeared stable at the time of surgery. Long-term follow-up evaluations (average of 20 months) found that most of the dogs were not lame and had good function. Only 30% of the joints examined radiographically showed a minor increase in osteoarthritis.[24] Turner et al[23] reported good clinical results for 17 dogs after ulnar ostectomy, but anconeal fusion was not achieved consistently. Sjostrom et al[9] also reported favorable results after ulnar osteotomy compared with excision in 22 elbows. Osteotomy or partial ostectomy of the ulna alone is performed in cases in which the

Table 2. Published Data on Treatment of Fragmented Medial Coronoid Process

Study	*Treatment*	*No. of Dogs*	*Age*	*Follow-up Period*
Grondalen (1979)[40]	Surgical removal: 68 (58 followed up) No surgery: 20	88 (114 joints)	<12 mo: 31 >12 mo: 9 All <12 mo	6 mo to 4 y (all from questionnaire) 52% clinical follow-up of surgical group 40% clinical follow-up of nonsurgical group
Read et al (1990)[41]	Surgical removal: 68 Medical therapy: 62	109 (130 joints; 81% were rottweilers)	13.2 mo	Surgical group: 50% responded (mean = 16.2) Nonsurgical group: 47% responded (mean = 13.2)
Huibregtse et al (1994)[38]	Surgical removal: 13 Medical therapy: 9	22	6 mo to 5 y 63% <12 mo	Not reported
Tobias et al (1994)[39]	All surgical removal	35	<13 mo: 16 >13 mo: 19	3–159 mo
Bouck et al (1995)[37]	Surgical removal: 10 Medical therapy: 9	19	7–28 mo (mean = 12.5) 8–20 mo (mean = 13)	9 mo 9 mo
Meij et al (1996)[42]	Surgical removal: 63 Medical therapy: 24	87 (all retrievers)	Not reported	32 mo 6 mo to 8 y
Brunnberg and Allgoewer (1996)[43]	All surgical removal	60 (all Bernese mountain dogs)	4–36 mo	6–12 mo
Ness (1998)[44]	All surgical removal and proximal ulnar osteotomy	10	7.5–10 mo (mean = 8.6)	12–20 mo
Theyse et al (2000)[36]	All surgical removal	7	7–66 mo (mean = 20.5)	6 wk and 6 mo

MCL = medial collateral ligament; *OCD* = osteochondritis dissecans; *OA* = osteoarthritis.

anconeal process is stable at the time of surgery. However, surgical fixation of the UAP along with ulnar ostectomy is preferred when the UAP is grossly unstable. In short-legged and chondrodystrophic dogs (e.g., basset hound, dachshund), distal ulnar osteotomy is performed to avoid creation of a painful nonunion that may occur after proximal or midshaft ulnar transection. Proximal osteotomy is preferred for long-legged and nonchondrodystrophic breeds.[32] Removal of the UAP may be necessary if fusion is not observed 12 to 18 weeks after ulnar ostectomy and clinical signs remain.

Osteotomy of the Ulna with Lag Screw Fixation

Osteotomy of the ulna with lag screw fixation of the anconeal process has also been reported for treating UAP. Krotscheck et al[22] used lag screw fixation and ulnar osteotomy for four dogs. Follow-up evaluations at

Results	*Comments*
Surgical group: 48% normal, 35% lame, 15% euthanized Nonsurgical group: 40% lame, 15% euthanized	No difference between the two groups. All dogs developed OA. The nonsurgical group took longer to recover.
Surgical group: 65% lame Nonsurgical group: 59% lame	No difference between the two groups. Surgically treated dogs were more active. A tenotomy of the pronator teres origin with an incision through the MCL and joint capsule was performed.
Surgical group: 76% improved Nonsurgical group: 77% improved	No difference between the two groups on the basis of force plate analysis. All elbows developed radiographic evidence of OA. No long-term follow-up reported.
All dogs had questionnaire returned: 69% improved 20 of 35 dogs were clinically reevaluated: 53% normal with no lameness	No difference in outcome according to surgical approach. Age at surgery had no effect on outcome. Complications requiring surgery were more common when osteotomy was performed.
Surgical group: 5 FMCP unilateral, 3 FMCP bilateral, and 2 OCD bilateral	No difference between surgical and nonsurgical groups on the basis of force plate and gait analysis. A partial desmotomy was used along with the muscle separation technique.
Surgical group: 27% lame Nonsurgical group: 67% lame	Abstract only; limited information
Good function: 60% Satisfactory function: 35% Unsatisfactory function: 5%	Abstract only: 75% good outcome if surgery performed before 6 mo of age; 42% good outcome if surgery done after 6 mo of age; 64% of the dogs had a "step" lesion at the first examination.
54% excellent outcome 31% good outcome 15% fair outcome	Assessment of clinical outcome depended on subjective estimations by clinician and owner. Time to best improvement = 6–12 wk. Arthrotomy is recommended, although some FMCP may consolidate when only osteotomy is used.
At 6 wk: visual 43% lame, force plate 57% abnormal At 6 mo: visual 29% lame, force plate 29% abnormal	Surgical treatment of unilateral FMCP had a favorable result on the basis of force plate analysis. Severity of a kissing lesion and OA did not predict surgical outcome. Previous studies[29,37,38] used partial or total tenotomy of the MCL, which is now known to affect joint stability and surgical outcome.

23 to 40 months revealed excellent clinical outcomes with no evidence of pain, crepitus, or joint effusion and with minimal progression of osteoarthritis. Meyer-Lindenberg et al[24] treated eight joints in which the anconeal process was loose at the time of surgery by stabilizing the UAP with a lag screw and pin and performing an ulnar ostectomy. Follow-up evaluations (at an average of 20 months) revealed that the majority of dogs had good function and were not lame after exercise. Only minor increases in osteoarthritis in 30% of the joints were found by radiography.[24]

Osteochondritis Dissecans

Treatments for elbow osteochondritis dissecans (OCD) include medical management and surgery. Medical therapy is used primarily for small lesions and consists of rest, weight control, and medications, including NSAIDs and drugs to treat osteoarthritis.

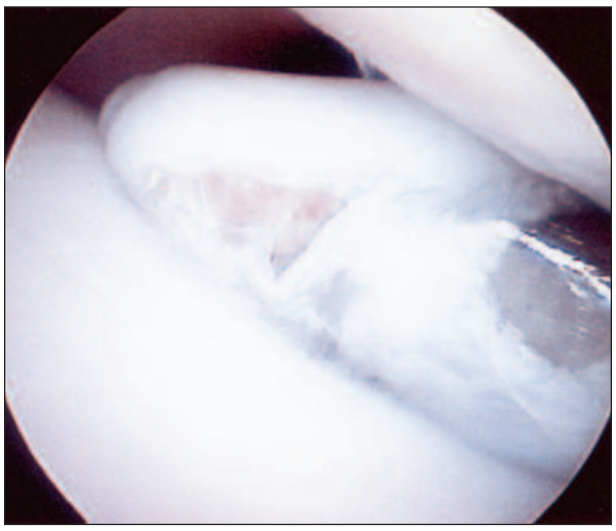

Figure 4—Arthroscopic view of the elbow joint of an 8-month-old Labrador retriever. The FMCP has been dislodged and is being manipulated by a probe. (Courtesy of Dr. J. L. Cook, University of Missouri–Columbia)

Surgery is typically performed via a medial arthrotomy to remove the cartilaginous flap. Most surgeons recommend mild curettage or forage of the defect bed. Arthroscopic techniques are increasingly popular and allow exploration of the entire joint, removal of the cartilage flap, and forage or curettage of the defect.[31,33] Arthroscopy provides a less invasive alternative to arthrotomy and is the preferred method. The prognosis after medical or surgical treatment of elbow OCD is guarded. Progression of secondary degenerative joint disease is common. Early surgical treatment of the OCD lesion often reduces lameness but may not prevent progression of OA.

Fragmented Medial Coronoid Process

Treatments for FMCP include medical management and surgery[29,32,34–39,41–44] (Table 2). Medical therapy includes weight control, activity restrictions, and medication for pain and osteoarthritis. The goals of surgery include removal of loose or free-floating cartilage or bone fragments and correction of articular incongruence.[13,34] Typical surgical procedures include medial arthrotomy and arthroscopy[30,33] (Figure 4). In most cases, surgery is recommended for dogs younger than 12 months of age that have clinical or radiographic signs of FMCP. Surgery is also recommend for dogs up to 24 months of age with large lesions evident radiographically and with significant clinical signs.[35] Dogs with severe radiographic signs of OA are typically poor surgical candidates and are better managed with conservative therapy. Removal of the FMCP or large osteophytes may give temporary relief of clinical lameness, but long-term medical management is still necessary. Surgical treatment often has a favorable outcome despite progression of osteoarthritis as evidenced by follow-up radiographs.[36] However, a comparison of surgical and medical treatment of 19 dogs determined that medical management resulted in a more rapid return to normal weight bearing than did surgical treatment.[36] Medical management consisted of initial weekly subcutaneous injections of a chondroprotective agent (i.e., pentosan polysulfate [Cartrophen Vet]) for a total of four doses followed by additional injections as needed, determined on the basis of follow-up examinations. At a 9-month follow-up, no differences were detected between the medically and surgically treated dogs.[37] In another study of 22 dogs, little difference in the outcome was observed between dogs treated medically or surgically.[38] Eleven of the dogs that returned for evaluation had progression of osteoarthritis according to radiographic evidence. Most surgeons find that dogs have improved clinical function after surgical removal of the fragmented coronoid process, although lameness and pain often recur as osteoarthritis progresses.

The prognosis for dogs with FMCP varies and depends primarily on the severity of clinical signs, progression of osteoarthritis, and treatment used. Early diagnosis and treatment with surgery can allow a positive clinical outcome. However, surgery is not curative, and secondary osteoarthritis will continue. Medical therapy to control clinical signs is also recommended. Factors that do not appear to affect long-term prognosis have included the age at the time of surgery and the surgical approach used.[39]

Elbow Incongruity

Treatment of elbow incongruity is problematic and depends on the cause and severity of the incongruity. Elbow incongruity caused by asynchronous growth of the radius and ulna is treated surgically. Radioulnar bowing and rotation that clinically affect the elbow or carpal joint should be addressed early to avoid dysfunction and the potential for severe osteoarthritis.[29] Restoring the congruity and alignment of the elbow joint early in the disease process is critical.[29] Addressing the disease with corrective ulnar or radial ostectomy or osteotomy can provide more synchronous growth and less stress on the elbow joint (Figure 5). Later in the disease, after bony malformation of the trochlear notch of the ulna or humeral condyle, surgical treatment may be ineffective. In cases of severe malformation of the trochlear notch and advanced, painful osteoarthritis, treatment options may include medical therapy, arthrodesis, elbow replacement, and amputation. The

Figure 5A—Results of an ulnar osteotomy

Figure 5B—Results of an ulnar ostectomy

Figure 5—(**A**) Mediolateral radiographic view of a 7-month-old rottweiler immediately after an ulnar osteotomy was performed for treatment of CED (i.e., FMCP, OC). An arthrotomy was also performed for removal of the fragmented coronoid process and curettage of the OC lesion. (**B**) Mediolateral radiographic view of a 2-year-old basset hound immediately after an ulnar ostectomy for treatment of CED (elbow incongruity).

prognosis of dogs with elbow incongruity varies and depends on the age of the patient, clinical signs, magnitude of the incongruity, and development of osteoarthritis. Early surgical intervention is important to prevent or reduce clinical angular limb deformities and secondary osteoarthritis.

CONCLUSION

CED is a common cause of lameness in fast-growing, large-breed dogs. Survey radiography, CT, and MRI allow early diagnosis of the condition. Treatment for CED includes arthroscopy or arthrotomy and medical management to slow the development of osteoarthritis and reduce joint pain. Lameness and progressive osteoarthritis may continue in some dogs even after appropriate therapy.

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43. Brunnberg L, Allgoewer I: Age-related results of the treatment of elbow dysplasia (FCP) in the Bernese mountain dog [abstract]. *Vet Comp Orthop Traumatol* 9:65–66, 1996.
44. Ness MG: Treatment of fragmented coronoid process in young dogs by proximal ulnar osteotomy. *J Small Anim Pract* 39:15–19, 1998.

ARTICLE #4 CE TEST

The article you have read qualifies for 1.5 contact hours of Continuing Education Credit from the Auburn University College of Veterinary Medicine. *Choose the best answer* to each of the following questions; then mark your answers on the postage-paid envelope inserted in *Compendium*.

1. Which statement regarding the incidence of elbow dysplasia is true?
   a. Bilateral involvement is not very common.
   b. Females are typically more affected than males.
   c. Most affected dogs are miniature or toy breeds.
   d. Concurrent developmental diseases can also be observed.
   e. Initial onset of signs is usually observed in dogs older than 1 year of age.

2. Which characteristics best describe the lameness typically associated with CED?
   a. acute, non–weight-bearing lameness
   b. acute, weight-bearing lameness that improves with exercise
   c. gradual and progressive, weight-bearing lameness that is heightened by exercise
   d. mild, weight-bearing lameness with dragging of the paw
   e. none of the above

3. Physical examination of a patient with CED may reveal all of the following except
   a. a reduced range of motion on flexion and extension of the elbow.
   b. short strides with the affected limb, as seen on gait analysis.
   c. a sitting or standing position with the elbow adducted and the carpus abducted.
   d. soft tissue swelling, muscle atrophy, and crepitus observed by palpation.
   e. no pain on palpation (typically).

4. Which radiographic view is best for assessing elbow incongruity?
   a. craniocaudal view
   b. flexed 90° mediolateral view
   c. craniocaudal medial to lateral oblique view
   d. mediodistal to lateroproximal 30° oblique view
   e. skyline view

5. Additional diagnostic tools that can assist in diagnosing CED include
   a. CT.
   b. MRI.
   c. arthroscopy.
   d. nuclear scintigraphy.
   e. all of the above

6. Which statement about radiography is true?
   a. Both elbows should be radiographed to identify bilateral disease and to allow comparison.
   b. Several radiographic views are necessary to adequately assess the elbow joint.
   c. A tabletop technique with detailed screened film and collimation is preferred.
   d. a and b only
   e. a, b, and c

7. Which statement about the treatment of UAP is false?
   a. Spontaneous fusion has been reported.
   b. Surgical options include proximal ulnar osteotomy, excision, and lag screw attachment.
   c. Reattachment techniques should be performed before the patient is 24 weeks of age.
   d. Excision of the anconeal process is typically performed by using a caudal approach to the proximal ulna.
   e. Arthroscopy has been used to examine the elbow joint and remove the anconeal process.

8. Which of the following treatments is not part of the medical management regimen for CED?
   a. dietary management
   b. NSAIDs
   c. osteoarthritis-modifying agents
   d. strenuous activity
   e. none of the above

9. An advantage of arthroscopy for treating CED is that it
   a. allows exploration of the entire joint.
   b. provides removal of free bone fragments or flaps.
   c. permits forage or curettage of osteochondral defects.
   d. is minimally invasive.
   e. all of the above

10. Which statement concerning the prognosis of patients with CED is true?
    a. For each disease process, the prognosis is very favorable.
    b. Duration of clinical signs and progression of osteoarthritis are important factors for prognosis.
    c. With FMCP, early diagnosis and treatment with surgery result in a poorer outcome.
    d. Progression of secondary osteoarthritis is not common after medical management in cases of OCD.
    e. none of the above