ECRONICON OPEN ACCESS

EC VETERINARY SCIENCE
Research Article

Incidence of Elbow Dysplasia of Dogs in Egypt

Mohamed M Shokry[1]*, HM Farghali A[1] and MF Metwally[2]

[1]*Department of Surgery, Anesthesiology and Radiology, Faculty of Veterinary Medicine, Cairo University, Egypt*

[2]*Veterinary Military Hospital, Cairo, Egypt*

***Corresponding Author**: Mohamed M Shokry, Department of Surgery, Anesthesiology and Radiology, Faculty of Veterinary Medicine, Cairo University, Egypt.

Received: September 14, 2018; **Published:** December 01, 2018

Abstract

The present study focused on the status of elbow dysplasia in pet clinics in Egypt. Seventy-two dogs out of 888 presented with thoracic limb disorders had elbow dysplasia (ED) which represented 8% of the examined animals. The affected dogs were of different breeds and aged (45 cases, 6 - 12 months) and (27 cases, < 12 months). The majority of the recorded dysplastic dogs were of males (53 dogs) (73.6%) and females (19) accounted for (26.4%). The most common presented breeds were German shepherd (37) (12.1%). Elbow joint screening radiography revealed that ED were found bilateral in 15 dogs (21%) while in 57 of dogs (79%) were unilateral. Thirty-one- (43%) elbows had single primary lesions, thirty elbows- (41.6%) had two combined lesions, nine elbows (12.5%) had three combined lesions, and two elbows (2.7%) had four combined lesions. Since the present study is concerned with the study of the current status of elbow dysplasia in front legs of dogs, the problem that is often overreached or ignored by veterinary practitioners during their examination especially when diagnosing cases of intermittent or imperceptible lameness in the front legs of young dogs of some breeds. Early diagnosis of such elbow problems is of great importance to proper treatment in appropriate time and also to take precaution when breeding is concerned as a genetic problem.

Keywords: *Canine Elbow; Elbow Dysplasia; Fragmented Coronoid Process; Ununited Anconeal Process; Osteochondrosis; Joint Incongruity*

Introduction

Elbow pathology is a frequent cause of lameness and osteoarthritis in young, rapidly growing, large and giant breed dogs [1-3]. The term elbow dysplasia ED refers to ununited anconeal process (UAP), fragmented coronoid process (FCP), osteochondritis dissecans (OCD) and elbow incongruency (EI) [4].

All conditions are polygenetic and multifactorial diseases that often occur in young, popular breeds [5-8]. Dogs with elbow dysplasia should be eliminated from breeding [9,10]. The clinical signs usually start at the age of 8 months and include muscle atrophy, joint pain, joint effusion and a decreased range of motion [6]. Additional imaging techniques such as radiography, CT, MRI or arthroscopy can be performed to diagnose elbow dysplasia [1,11,12]. This study was designed to give an overview of the status of elbow dysplasia among different breeds and ages of dogs in some private and governmental clinics.

Materials and Methods

A total of 888 dogs were assembled over 3 years period (2015 - 2017) with a history of thoracic limb lameness, and presented at the Military Veterinary Hospital, the surgery clinics of the Faculty of Veterinary medicine, Cairo university, and some private clinics.

The actual population of dogs suffered from elbow dysplasia after exclusion of all other leg problems were 72 dogs of different species and ages.

History and vital signs

The data collected included breed, age, gender, weight, function, complaint, the duration of the problem and previous trials for treatment. The physiological health parameters including the respiratory rate, rectal temperature, heart rate, and the mucous membrane status were also recorded.

Physical examination

The thoracic limbs were inspected for any sign of lameness at rest and movement or altered posture.

Orthopedic examination

Attention was also given to the presence of any musculoskeletal disorders including signs of inflammation, effusions, tenderness on palpation, crepitation, range of motion of the elbow joint, and muscle atrophy.

Radiographic examination

All radiographs were done under deep intravenous sedation induced by combination of 2.0 mg/kg xylazine (Xylaject[R], Adwia), 5.0 mg/kg ketamine (Ketavet[R], Parke Davis) and 1.0 ml/kg Propofol (Propofol[R], Abbott). Three radiographic projections (mediolateral extended projection, mediolateral maximally flexed projection, and craniocaudal projection) of both elbows were performed, collimating to the elbow joint while centering the primary beam on the medial epicondyle of the humerus. Radiographical examination was performed using digital radiography apparatus (Siemens, Germany) with resolution of 1170 x 2370 pixels. Radiographic diagnosis of elbow dysplasia was based on the detection of primary ED lesions (EI, UAP, FCP and OCD) or the detection of secondary osteoarthritic changes which were subjected to the IEWG elbow screening protocol (International Elbow Working Group) [13] for osteophyte evaluation: (0) normal, (1) mild (mild joint incongruity, sclerosis of ulnar trochlear notch or, step =/< 2 mm between radius and ulna or, osteophyte formation less than 2 mm high), (2) moderate (clear incongruity, osteophyte formation 2 to 5 mm high), or (3) sever (osteophyte formation over 5 mm high as illustrated in table 1.

Elbow Dysplasia Scoring		Radiographic finding
0	Normal elbow joint	Normal elbow joint, No evidence of incongruency or sclerosis or arthrosis
1	Mild arthrosis	Presence of osteophytes < 2 mm high, sclerosis of the base of the coronoid processes trabecular pattern still visible
2	Moderate arthrosis or, suspect primary lesion	Presence of osteophytes of 2 - 5 mm high Obvious sclerosis (No trabecular pattern) of the base of the coronoid processes Step of 3 - 5 mm between radius and ulna Indirect signs for a primary lesion (UAP, FCP/Coronoid disease, OCD)
3	Severe arthrosis or evidence of primary lesion	Presence of osteophytes of > 5 mm high Step of > 5 mm between radius and ulna Obvious presence of a primary lesion (UAP, FCP, OCD)

Table 1: *Evaluation of elbow joint arthrosis according to IEWG.*

Results

From this study,72 dogs (8%) exhibited ED from a total of 888 dogs presented with thoracic leg lameness. The recorded ages of the affected dogs were (45 cases, 6 - 12 months) and (27 cases, < 12 months). Also the majority of dysplastic dogs were of males (53 dogs) (73.6%) and females (19) (26.4%) The most common presented breeds were German shepherd (37) (12.1%), Rottweiler (16) (6.4%), and Golden Retriever (7) (5.2%). The other breeds represented as individual cases (Pitbull -3, Great Dane -2, Saint Bernard -1, Caucasian Shepherd -1, Kangal -1, Labrador -1, Bengal -1, Mastiff -1, and Native (Figure 1a, 1b, 1c and Table 2).

The recorded clinical signs allowed for inclusion in this sample of thoracic limb lameness consisted of abducted elbow, stiffness, abnormal posture of the affected limb, hopping, reduced range of motion, and signs of local inflammation, gait changes, slightly tilting of the limb after rest, induced pain after exercise, on flexion or/extension of the elbow. It was also noted that some of the examined cases (10 dogs) (13.9%) did not exhibit any clinical signs upon examination. Radiographic screening examination using the 3 radiographic projections (mediolateral extended, mediolateral flexed, and craniocaudal) confirmed the dysplastic conditions of the elbows even in young cases without clinical signs. ED radiography revealed that ED were bilateral in 15 dogs (21%) while in 57 of dogs (79%) were only unilateral (Figure 1c).

Breed		Thoracic Limb Cases	Elbow dysplasia	Gender		Age		
				Male	Female	0 - 6m	6 - 12m	> 12m
Giant breeds	Saint Bernard	24	1	1	-	-	-	1
	Greate Dane	34	2	2	-	-	2	-
	Cocassion	19	1	-	1	-	1	-
	Kingale	13	1	1	-	-	1	
Total Subgroups		90	5	4	1	-	4	1
Large and medium Size breeds	German Shepherd	306	37	26	11	5	21	11
	Rottweiler	249	16	12	4	-	7	9
	Golden Retriever	136	7	6	1	2	4	1
	Labrador	47	1	1	-	-	-	1
	Bengale	3	1	1	-	-	1	-
	Mastiff	11	1	1	-	-	-	1
	Pitbull	27	3	1	2	1	2	-
	Native breed	19	1	1	-	1	-	-
Total Subgroups		798	67	49	18	9	35	23
Total		888	72 (8%)	53	19	9	39	24

Table 2: *Details of the presented cases.*

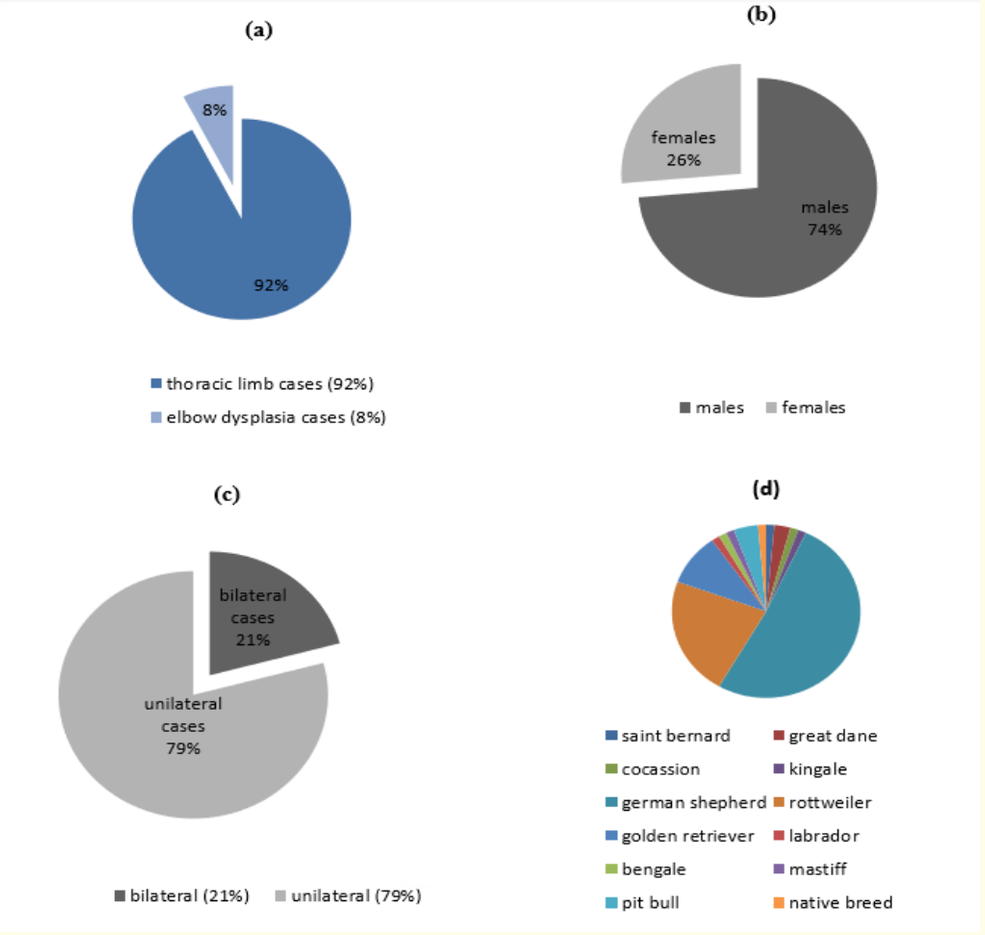


Figure 1: *Illustrated charts of the presented cases.*

A total of 87 elbow joints of 72 dogs was affected with different varieties of ED and scored as dysplastic. The distribution of elbow joint lesions in the dysplastic elbows was illustrated in tables 3-7. Thirty-one (43%) elbows had single primary lesions; thirty elbows (41.6%) had two combined lesions. Nine elbows (12.5%) had three combined lesions, and two elbows (2.7%) had four combined lesions (Table 8). Most of the recorded lesions had elbow incongruency and osteoarthrosis. The most common lesion combinations were JI and UAP, which were noted in 14 dogs and representatives (19.4%) (Figure 8 and 9) while 7 dogs had 3 combined lesions (JI+UAP+OA) and representatives (9.7%) (Figure 6). Also, there were two cases had 4 combined lesions (Figure 7). Arthrosis grading according to IEWG as grade-2 (19 dogs) (medium arthrosis) (Presence of osteophytes of 2-5 mm high, Obvious sclerosis of the base of the coronoid processes, Step of 3 - 5 mm between radius and ulna (IN) (Figure 10 and 11) and grade-3 (53 dogs) (severe arthrosis) (Presence of osteophytes of > 5 mm high, step of > 5 mm between radius and ulna (obvious IN), the obvious presence of a primary lesion UAP, FCP, OCD)

Breed	Total	Sex		Age	
		Male	Female	< 12 month	> 12 month
Kangal	1	1	-	1	-
Saint Bernard	1	1	-	-	1
German Shepherd	15	11	4	8	7
Rottweiler	9	5	4	4	5
Bengal	1	1	-	1	-
Total	27	19 (70%)	8 (30%)	14 (52%)	13 (48%)

Table 3: *Distribution of UAP lesion among different breeds.*

Breed	Total	Sex		Age	
		Male	Female	< 12 month	> 12 month
Great Dane	2	2	-	1	1
German Shepherd	14	8	6	11	3
Rottweiler	3	3	-	2	1
Golden retriever	6	5	1	4	2
Labrador	1	1	-	-	1
Native breed	1	1	-	1	-
Pitbull	3	1	2	3	-
Total	30	21 (70%)	9 (30%)	22 (73%)	8 (27%)

Table 4: *Distribution of JI lesion among different breeds.*

Breed	Total	Sex		Age	
		Male	Female	< 12 month	> 12 month
Caucasian Shepherd	1	-	1	1	-
German Shepherd	5	5	-	4	1
Total	6	5 (83%)	1 (17%)	5 (83%)	1 (17%)

Table 5: *Distribution of FCP among different breeds.*

Breed	Total	Sex		Age
		Male	Female	> 12 month
Rottweiler	1	1	-	1
German Shepherd	2	2	-	2
Total	3	3 (100%)	-	3 (100%)

Table 6: *Distribution of OCD among different breeds.*

Breed	Total	Sex		Age
		Male	Female	> 12 month
German Shepherd	1	-	1	1
Rottweiler	3	3	-	3
Golden Retriever	1	1	-	1
Mastiff	1	1	-	1
Total	6	5 (83%)	1 (17%)	6 (100%)

Table 7: *Distribution of OA among different breeds.*

Elbow joint lesions	Lesion combination in EJ	Number of cases
Primary lesions (Figure 3, 4, 5, 6 and 7)	JI	19
	FMCP	-
	UAP	7
	OCD	1
	OA	4
Total Subgroups		31 (43.2%)
Two combined lesions (Figure 8)	JI+UAP	14
	JI+FMCP	6
	JI+OCD	3
	JI+OA	4
	FMCP+OCD	1
	UAP+OA	2
Total Subgroups		30 (41.6%)
Three combined lesions (Figure 9)	JI+OA+UAP	7
	JI+OA+FMCP	1
	UAP+OCD+OA	1
Total Subgroups		9 (12.5%)
Four combined lesions (Figure 10)	JI+UAP+OCD+OA	1
	JI+FCP+OCD+OA	1
Total Subgroups		2 (2.7%)
Total		72

Table 8: *Distribution of lesion combinations diagnosed in the sample of ED dogs.*

JI: Joint Incongruency; UAP: Ununited Anconeal Process; FMCP: Fragmented Medial Coronoid Process; OCD: Osteochondrosis; OA: Osteoarthrosis.

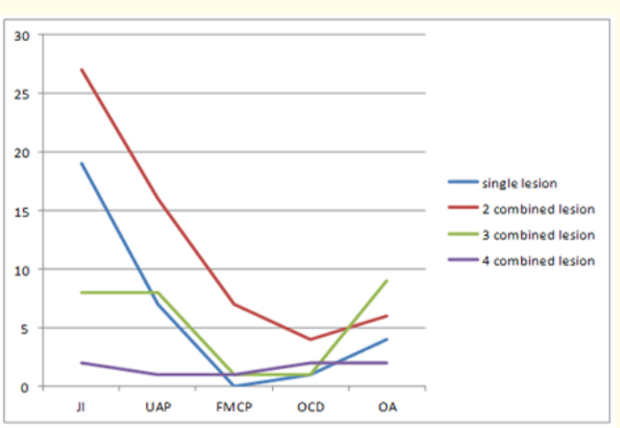


Figure 2: *The distribution of lesion combinations through ED cases.*

(a) *(b)*

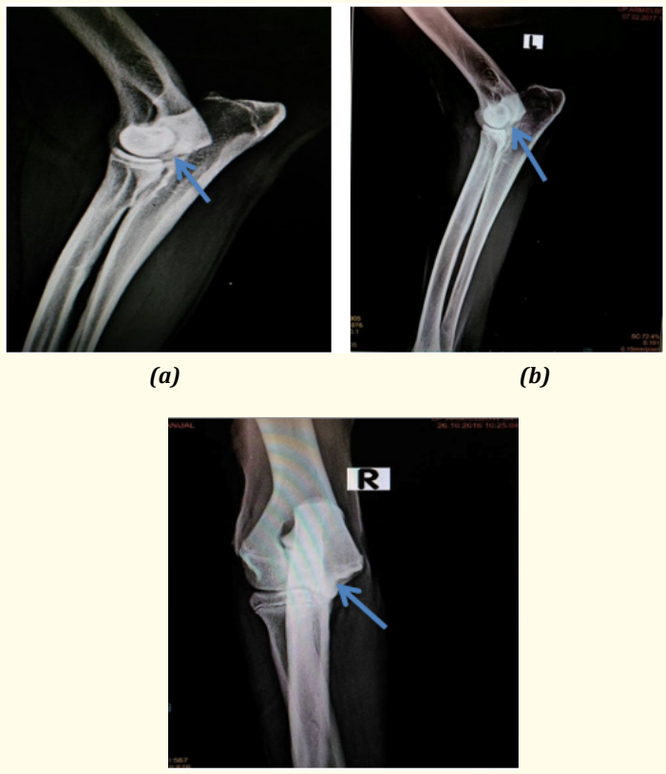
(c) *(d)*

Figure 3: *Mediolateral radiographic projection showing UAP fragment (the blue arrow or the circle) in: a) a 7-month, male German Shepherd, b) an 8-month, male Kingale, c) an 18 month, male Rottweiler, and d) a 7 -month, male Rottweile.*

(a) *(b)*

(c) *(d)*

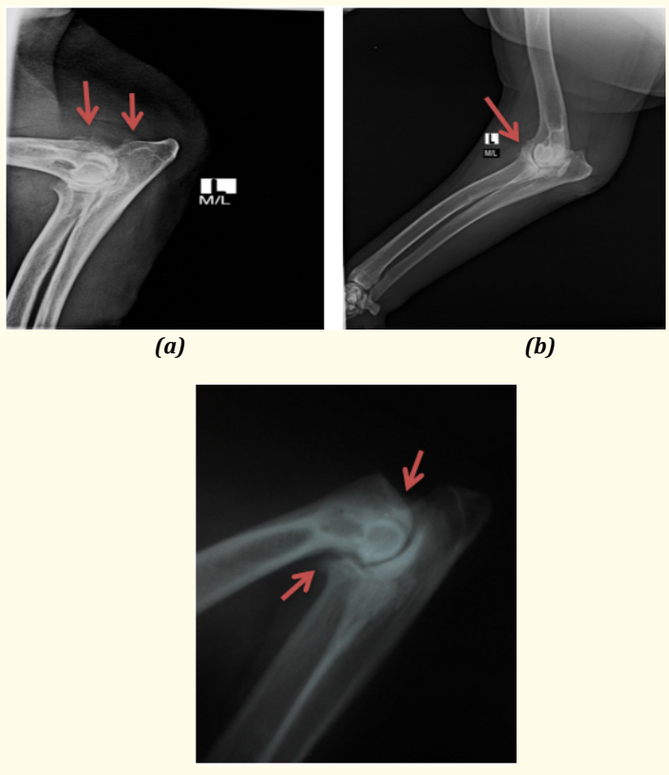
Figure 4: *Fully extended mediolateral projection showing of EJ incongruency with increased joint spaces (red lines), the radioulnar step (blue arrow),the cranial displacement of humeral condyle (green arrow), and the malformed elliptic shape of ulnar trochlear notch (black arrow) in: a) a 1-year, male Golden Retriever, b) a 1-year, male German Shepherd, c) a 6-month, male Pitbull, and d) a 6-month, male German Shepherd.*



(a) *(b)*

(c)

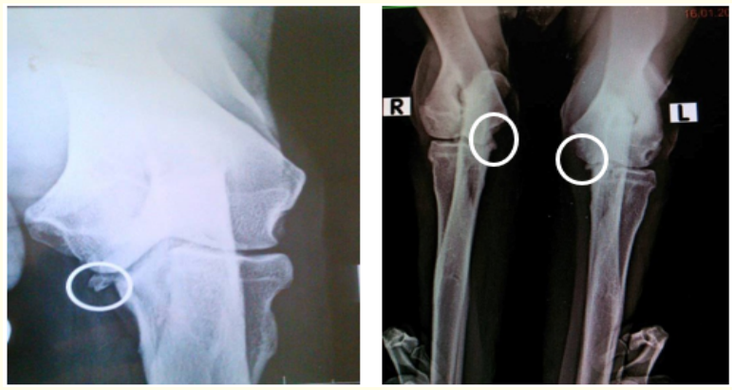
Figure 5: *Extended mediolateral radiographic projection showing the subchondral bone defect from osteochondrosis (blue arrow) in: a) a 10-month, male German Shepherd, b) a 6-year, male German Shepherd, and c) a 7-month, male Rottweiler.*



(a) *(b)*

(c)

Figure 6: *Flexed mediolateral radiographic projection showing osteophyte development (red arrows) in: a) a 3-year, male Rottweiler, b) a 2.5-year, male Golden Retriever, c) a 2-years, female German Shepherd.*



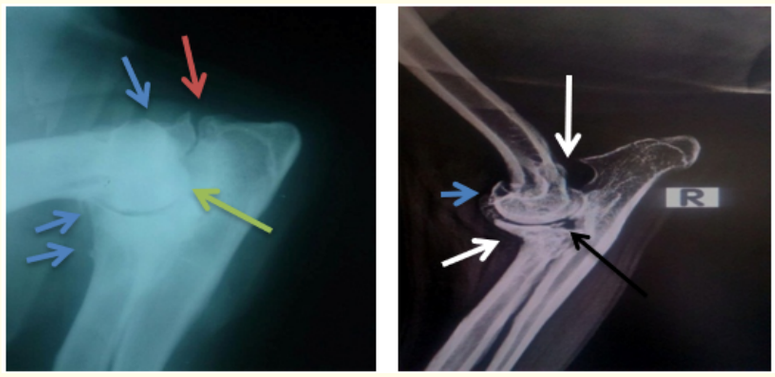
(a) *(b)*

Figure 7: *Oblique craniocaudal radiographic projections showing FCP fragment (white circle) , in : a) an 8-month, male German Shepherd and b) a 9-month, female Cocassion.*

(a) *(b)*

(c) *(d)*

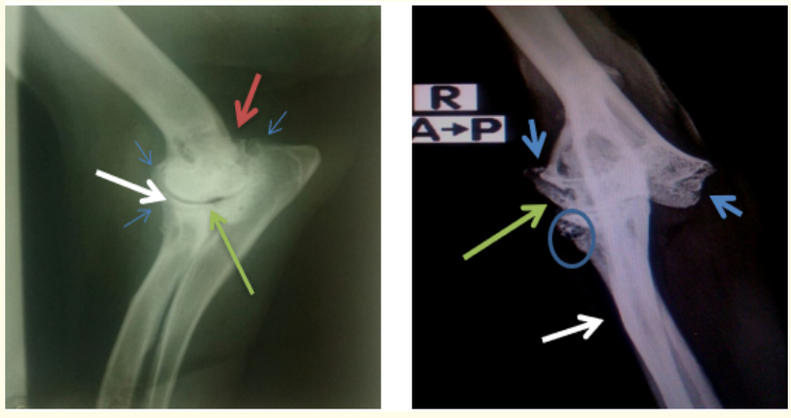
Figure 8: *Mediolateral radiographic projections of EJ showing fragmented UAP (red arrow) and the radioulnar incongruity (blue arrow) in a 5-month, male German Shepherd. b) Mediolateral radiographic projections of FCP and INC., showing the missed medial coronoid process (green arrow) and the increased humeroulnar joint space (red line) in a 10- month, male german shepherd. c) Mediolateral radiographic projection of UAP and OA in elbow joint, showing the osteophyte development (white arrows) and the fragment (red arrows) in a 7-year, male Masstif. d) Oblique craniocaudal radiographic projection of a dysplastic elbow in a 10-month, male German Shepherd showing the FCP and OCD as (white circle) encloses the kissing lesion.*



(a) *(b)*

(c)

Figure 9: *Mediolateral radiographic views of a UAP in different dogs showing the dislocated fragments (red arrow), the radioulnar step (white arrows), the osteophyte development (blue arrows), the subchondral bone defect due to osteochondrosis in medial humeral condyle (green arrow), and the FMCP (Black arrow) in a) a 5-year, male Saint Bernard, b) 3.5 years, male Rottweiler, and c) a 16-month, female German Shepherd.*



(a) *(b)*

Figure 10: *a) Mediolateral radiographic view of ED of a 2.5- year, female German Shepherd showing unfused anconeal process with the ulna (red arrow), the radioulnar incongruity (white arrow), the osteophytosis (blue arrows) , and the subchondral bone defect after osteochondrosis (green arrow). b) Oblique craniocaudal radiographic projection of an incongruent dysplastic elbow joint of a 3.5-year, male Rottweiler with fragmentation and fissuring in the medial coronoid process of ulna(the blue circle), osteochondrosis of the medial humeral condyle (green arrow), long ulna bone (white arrow), and osteophyte development (blue arrows).*

Discussion

The present study confirmed that ED occupied an important position among the disorders of the thoracic leg of dogs. Many pathological conditions of the elbow had been recognized and represented 8% of the presented animals with forelimb lameness. The majority of the presented dogs with ED were males (73.6%). This sex predisposition is supported in other studies [5,14,15]. The age between 6 and 12 months was usually presented, almost the age range was mentioned by Fitzpatrick., *et al* [16]. Although ED was diagnosed in various giant breeds of dogs, German shepherd dogs showed high prevalence (51.3%). Similar higher incidence (30%) of ED has been recorded in German Shepherd by Corely., *et al* [17]. In German Shepherd dogs, published prevalences were between 15and 20% in Sweden [18] and between 30,47% in Germany [19]. The prevalence recorded in this study indicates that the German shepherd dog breed is at high risk of ED. Some researchers demonstrated that ED is independently inherited disease in giant breed dogs and show a polygenic mode of inheritance [20,21]. Most studies of heritability of the ED have used radiographic scoring for phenotype determination [22-24]. The more or less high presentation of German shepherd breed may be explained by the existence of broad chondral junction in association with an accelerated pattern of skeletal maturation [25]. The presented clinical signs were variable. Some of the affected dogs showed no obvious forelimb clinical manifestations of the disorder. Others were clinically lame, or had abnormal gait. Some dogs exhibited bilateral forelimb lameness. Affected limbs were usually rotated inward while the elbows rotated outward. The most common recorded signs were intermittent lameness, marked lameness with exercise, pain on flexion and extension or rotation of the elbow; crepitation was also recorded on flexion or extension of the involved joint. Almost similar clinical signs were consistent with published reports of Bennett., *et al*. [26], Berzon and Quick [27], Denny and Gibbs [28] and Dietz., *et al* [29]. Crepitation was noted by Carlson and Sevrin [30] with flexion and extension of the affected joint. Also, the lameness could be unilateral or bilateral according to Lang., *et al* [31]. In the present study, radiographic diagnosis of ED was based on the detection of primary lesions or secondary osteoarthritic changes. Hence, radiographic diagnosis is prerequisite for achieving definitive diagnosis as mentioned by Olsson [32], Berzon and Quick [27], Robins [33], Bennett., *et al.* [26], Wind [34] and Fluckiger [35]. In this study, adopting radiographic screening using the standard radiographic projections (mediolateral flexed and extended, craniocaudal, and the craniolateral caudomedial oblique), primary and combined lesions were clearly observed. Similar screening views have been used by many authors providing a clear view of the anconeal process and good recognition of FCP and OCD [27,36]. Additional antero-posterior medial oblique projection to detect many varieties of ED is mentioned by Robins [37]. According to Wind [38], the extended lateral projection makes evaluation of overall congruity of the joint and allows a clear outline of the medial coronoid process. As a consequence, radiographic diagnosis was based on at least two projections (The mediolateral and craniocaudal projections) for diagnosis of OCD and FCP [39]. Moreover Morgan, Wind and Davidson [40] stated that older dogs suspected of having ED, the diagnosis is much easier than in young dogs, because of the presence of advancing osteoarthritis and the signs of incongruency may be not clear. In this study, the flexed mediolateral projection was valuable to confirm ununited anconeal process. Although incongruity is not always easy to detect on radiography [41,42], the mediolateral projection was found suitable for evaluating joint incongruency. Moreover, craniocaudal projection could facilitate the differentiation between OCD and arthrosis of the medial coronoid process of the ulna. In the present study, the most common lesion combinations recorded were JI and UAP which represented (19.4%) of the presented cases. While 3 combined lesions (JI and UAP and OA) were recorded in 9.7% of cases. Also 4 combined lesions were also recorded in 2 cases. The overall prevalence of primary lesions (JI) (26.3%) would be the majority in the studied sample. Here, it should be emphasized that JI was the initial main lesion always present when more than one lesion was reported [43].

Conclusion

Most veterinary clinics that care for pet animals are located in Cairo, and certainly reflect the prevalence of common diseases and surgical problems in pets in Egypt. Since the present study is concerned with the study of the current status of elbow dysplasia in front legs of dogs, the problem that is often overreached or ignored by veterinary practitioners during their examination especially when diagnosing cases of intermittent or imperceptible lameness in the front legs of young dogs of some breeds. Early diagnosis of such elbow problems is of great importance to proper treatment in appropriate time and also to take precaution when breeding is concerned as a genetic problem.

Bibliography

1. Van Ryssen B and Van Bree H. "Arthroscopic findings in 100 dogs with elbow lameness". *Veterinary Record* 140.14 (1997): 360-362.

2. Morgan JB., *et al*. "Bone dysplasias in the Labrador retriever: a radiographic study". *Journal of American Animal Hospital Association* 35.4 (1999): 332-340.

3. Gemmill TJ and Clements DN. "Fragmented coronoid process: Is there a role for incongruency?" *Journal of Small Animal Practice* 48.7 (2007): 361-368.

4. Samoy Y., *et al*. "Arthroscopic Findings in 32 Joints Affected by Severe Elbow Incongruity with Concomitant Fragmented Medial Coronoid Process". *Veterinary Surgery* 41.3 (2012): 355-361.

5. Grondalen J and Lingaas F. "Arthrosis in the elbow joint of young rapidly growing dogs-a genetic investigation". *Journal of Small Animal Practice* 32.9 (1991): 460-464.

6. Kirberger RM and Fourie SL. "Elbow dysplasia in the dog: pathophysiology, diagnosis and control: review article". *Journal of the South African Veterinary Association* 69.2 (1998): 43-54.

7. Kirberger RM and Stander N. "Incidence of canine elbow dysplasia in South Africa". *Journal of the South African Veterinary Association* 78.2 (2007): 59-62.

8. Janutta V., *et al*. "Genetic analysis of three different classification protocols for the evaluation of elbow dysplasia in German shepherd dogs". *Journal of Small Animal Practice* 47.2 (2006): 75-82.

9. Fossum TW. "Small Animal Surgery". Mosby Publication, 2nd Edition (1997): 137-138.

10. Slatter D. "Textbook of small animal surgery, 3rd edition". Philadelphia, PA: Saunders (2003): 1927-1952.

11. Snaps FR., *et al*. "Comparison of radiography, magnetic resonance imaging, and surgical findings in dogs with elbow dysplasia". *American Journal of Veterinary Research* 58.12 (1997): 1367-1370.

12. De Rycke LM., *et al*. "Computed tomography of the elbow joint in clinically normal dogs". *American Journal of Veterinary Research* 63.10 (2002): 1400-1407.

13. Hazewinkel H. "Elbow Dysplasia; introduction, clinical investigation and force plate evaluation". 29th annual meeting IEWG (2015).

14. Sinibaldi KR and Arnoczky SP. "Surgical removal of the ununited anconeal process in the dog". *Journal of the American Animal Hospital Association* 11 (1975): 192-198.

15. Read RA., *et al*. "Fragmentation of the medial coronoid process of the ulna in dogs: a study of 109 cases". *Journal of Small Animal Practice* 31.7 (1990): 330-334.

16. Fitzpatrick N. "Biceps ulnar release procedure for treatment of medial coronoid disease in 49 elbows". In: Proceedings of 36th Annual Conference, Veterinary Orthopaedic Society, Steamboat Springs, Colorado, USA (2009): 44.

17. Corley EA., *et al*. "Genetic aspects of canine elbow dysplasia". *Journal of the American Veterinary Medical Association* 153.5 (1968): 543-547.

18. Grondalen J. "Occurrence and genetic aspects of elbow dysplasia". *Veterinary and Comparative Orthopaedics and Traumatology* 9 (1996): 60-61.

19. Tellhelm B., *et al*. "Prevalence and inheritance of canine elbow dysplasia in German Rottweiler". *Journal of Animal Breeding and Genetics* 117.6 (2000): 375-383.

20. Padgett GA., *et al*. "The inheritance of osteochondritis dissecans and fragmented coronoid process of the elbow joint in labrador retrievers". *Journal of the American Animal Hospital Association* 31.4 (1995): 327-330.

21. Ubbink GJ., *et al*. "Familial clustering and risk analysis for fragmented coronoid process and elbow joint incongruity in Bernese Mountain Dogs in The Netherlands". *American Journal of Veterinary Research* 60.9 (1999): 1082-1087.

22. Guthrie S. "Use of a radiographic scoring technique for the assessment of dogs with elbow osteochondrosis". *Journal of Small Animal Practice* 30.11 (1989): 639-644.

23. Guthrie S and Pidduck HG. "Heritability of elbow osteochondrosis within a closed population of dogs". *Journal of Small Animal Practice* 31.2 (1990): 93-96.

24. Janutta V., *et al*. "Genetic evaluation of elbow angles as predictors of elbow dysplasia in German shepherd dogs". *Journal of Veterinary Medicine* 52.5 (2005): 254-261.

25. Gustaffson PO. "Skeletal development of Greyhounds, German Shepherd Dogs and their crossbreed offspring. An investigation with special reference to hip dysplasia". *Acta Radiologica Supplementum* 334 (1975): 81-108.

26. Bennett D., *et al*. "Osteochondritis dissecans and fragmentation of the coronoid process in the elbow joint of the dog". *The Veterinary Record* 109.15 (1981): 329-336.

27. Berzon JL and Quick CB. "Fragmented coronoid process: anatomical, clinical, and radiographic considerations with case analyses [dogs]". *Journal-American Animal Hospital* 16.2 (1980): 241-251.

28. Denny HR and Gibbs C. "The surgical treatment of osteochondritis dissecans and ununited coronoid process in the canine elbow joint". *Small Animal Practice Journal* 21.6 (1980): 317-331.

29. Dietz O., *et al*. "Zur Klinik der Ellenbogengelenkdysplasie (isolierter Processus anconeus) des Hundes". *Monatshefte für Veterinärmedizin* 27.19 (1972): 734-738.

30. Carlson WD and Severim GA. "Elbow dysplasia in the dog". *Journal of the American Veterinary Medical Association* 138 (1961): 295.

31. Lang J., *et al*. "Comparison of two classification protocols in the evaluation of elbow dysplasia in the dog". *Journal of Small Animal Practice* 39.4 (1998): 169-174.

32. Olsson SE. "[New type of elbow joint dysplasia in the dog; preliminary report]". *Svensk Veterinartidning* 26 (1974): 152.

33. Robins GM. "Some aspects of the radiographic examination of the canine elbow joint". *Journal of Small Animal Practice* 21.8 (1980): 417-428.

34. Wind AP. "Elbow inconguity and developmental elbow diseases in the dog: part I". *Journal of the American Animal Hospital Association* 22 (1986): 711-724.

35. Flückiger M. "Radiographic diagnosis of elbow dysplasia (ED) in the dog-Requirements for the internationally standardized screening procedure for ED". Proceeding of International Elbow Working Group (Estoril, Portugal) (2003).

36. Mason TA., *et al*. "Osteochondrosis of the elbow joint in young dogs". *Journal of Small Animal Practice* 21.12 (1980): 641.

37. Robins GM. "Osteochondritis dissecans in the dog". *Australian Veterinary Journal* 54.6 (1978): 272-279.

38. Wind AP. "Radiographic screening for elbow dysplasia of dogs one year and older". International lbow Working Group Proceedings. Orlando, USA (1999): 33-34.

39. Wind AP and Packard ME. "Elbow inconguity and developmental elbow diseases in the dog: part II". *Journal of the American Animal Hospital Association* 22 (1986): 725-730.

40. Morgan JP., *et al*. "Hereditary bone and joint diseases in the dog, schlütersche". IEWG proceeding 2002, Granada, Spain (2000).

41. Blond L., *et al*. "Sensitivity and specificity of radiographic detection of canine elbow incongruence in an in vitro model". *Veterinary Radiology and Ultrasound* 46.3 (2005): 210-216.

42. Mason DR., *et al*. "Measurement Of Humeroradial And Humeroulnar Transarticular Joint Forces in the Canine Elbow Joint After Humeral Wedge and Humeral Slide Osteotomies". *Veterinary Surgery* 37.1 (2008): 63-70.

43. Remy D., *et al*. "Canine elbow dysplasia and primary lesions in German shepherd dogs in France". *Journal of Small Animal Practice* 45.5 (2004): 244-248.

Volume 3 Issue 3 December 2018