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PREVALENCE OF ELBOW DYSPLASIA AMONG COMMON DOG BREEDS IN EGYPT

By

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ABSTRACT

Developmental anomalies of the elbow joint (elbow dysplasia) in dogs are a relatively common presentation for some young growing breeds of dogs. 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%), 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 -1, Kangal -1, Labrador -1, Bengal -1, Mastiff -1, and Native breed 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. From the obtained data it could be concluded that, 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.

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 **(Van Ryssen and Van Bree, 1997; Morgan, Wind and Davidson, 1999; Gemmill and Clements, 2007).**The term elbow dysplasia refers to ununited anconeal process (UAP), fragmented coronoid process (FCP), osteochondritis dissecans (OCD) and elbow incongruency **(EI) (Samoy, Van Vynckt, Gielen, Van Bree, Duchateau and Van Ryssen, 2012).** All conditions are polygenetic and multifactorial diseases that often occur in young, popular breeds **(Grondalen and Lingaas, 1991; Kirberger and Fourie, 1998; Janutta, Hamann, Klein, Tellhelm and Distl, 2006).** Dogs with elbow dysplasia should be eliminated from breeding **(Fossum, 1997; Slatter, 2003).** 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. **(Kirberger and Fourie, 1998).** Additional imaging techniques such as radiography, CT, MRI or arthroscopy can be performed to diagnose elbow dysplasia. **(Snaps, Ballig and, Saunders, Park and Dolinger, 1997; De Rycke, Gielen, Van Bree, and Simoens, 2002; Van Ryssen and Van Bree, 1997).**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.

MARTIAL 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 theFacultyofVeterinary medicine,Cairo university,and someprivate clinics.

The population of dogs under examination studied were 72 animals suffered from ED which included 36 German shepherds, 16 Rottweiler, 7 Golden retrievers, 1 Kangal, 2 Great Dane, 1 Saint Bernard, 1 Caucasian Shepherd, 1 Mastiff, 1 Labrador, 1 Bengal, 3 Pitbull, and 1 native breed. Only dogs presented with complaint of thoracic limb lameness were ruled in this study.

History and vital signs

By the aid of the previously designed flow chart, 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 inspected and recorded.

Physical examination

The animal's thoracic limbs were inspected for any sign of lameness at rest or movement, altered posture of the affected limb and intermittent lameness.

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 xylazine (2.0 mg/kg. Xylaject, Adwia), ketamine (5.0 mg/kg. Keta vet, Parke Davis) and Propofol (1.0 ml/kg,Propofol, 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 IEWGelbow screening protocol**(Hazewinkel,2015)** for osteophyte evaluation. In to: (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).

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

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)**

RESULTS

Seventy-two dogs out of 888 presented with thoracic limb disorders had elbow dysplasia ED which represented 8% of the animals. The affected dogs were of different breeds and ages (45 cases, 6-12 months) and (27 cases, <12 months). It was recorded that the majority of dysplastic dogs were of males (53 dogs) (73.6%) and females (19) accounted for (26.4%) as shown in (Table 2). 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 breed 1 as illustrated in (Table2). 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. 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, 4, 5, 6 and 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%) Fig. (8,9) while 7 dogs had 3 combined lesions (JI+UAP+OA) and representatives (9.7%). Fig. (6). Also, there were two cases had 4 combined lesions Fig. (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) Fig.(10 ,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) Fig. (2, 3, 6, 7, 8, 9, 10 and 11).

Table (2): Details of the presented cases.

Breed		Thoracic Limb cases	Elbow dysplasia	Gender		Age		
				Male	Female	0-6 m	6-12 m	>12 m
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

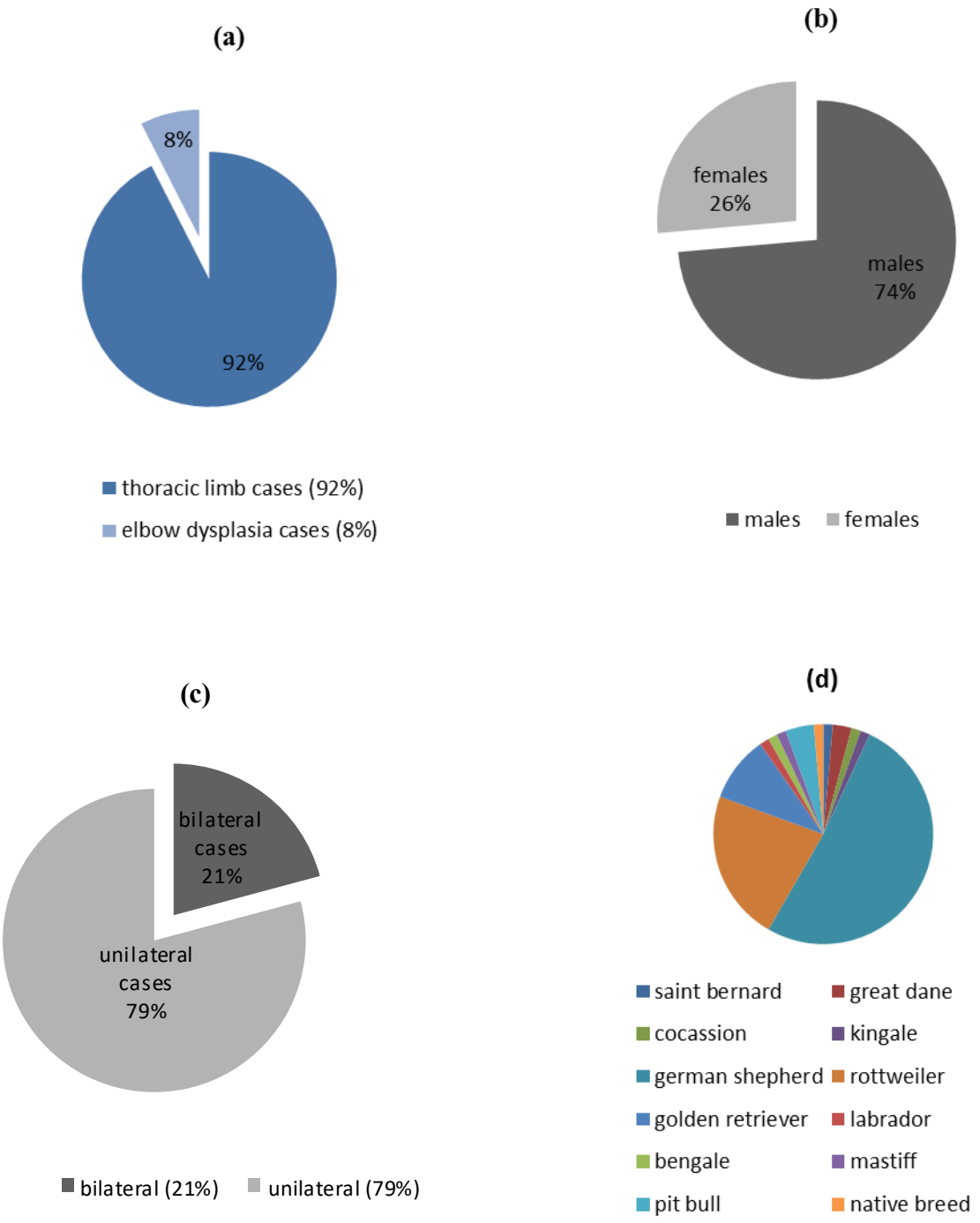


Fig. (1): Illustrated charts for the details of the presented cases a, bcc'd.

Table (3): Distribution of UAP lesion among different breeds.

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 (4): Distribution of JI 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 (5): Distribution of FCP 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 (6): Distribution of OCD 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 (7): Distribution of OA 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 (8): Distribution of lesion combinations diagnosed in the sample of ED dogs.

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

JI= joint incongruency, UAP =ununited anconeal process, FMCP = fragmented medial coronoid process, OCD = osteochondrosis, OA= osteoarthrosis.

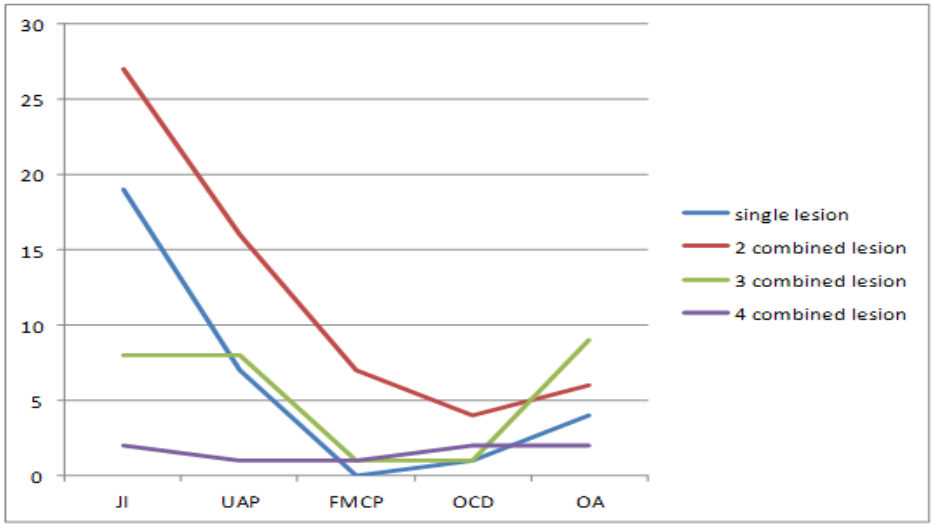


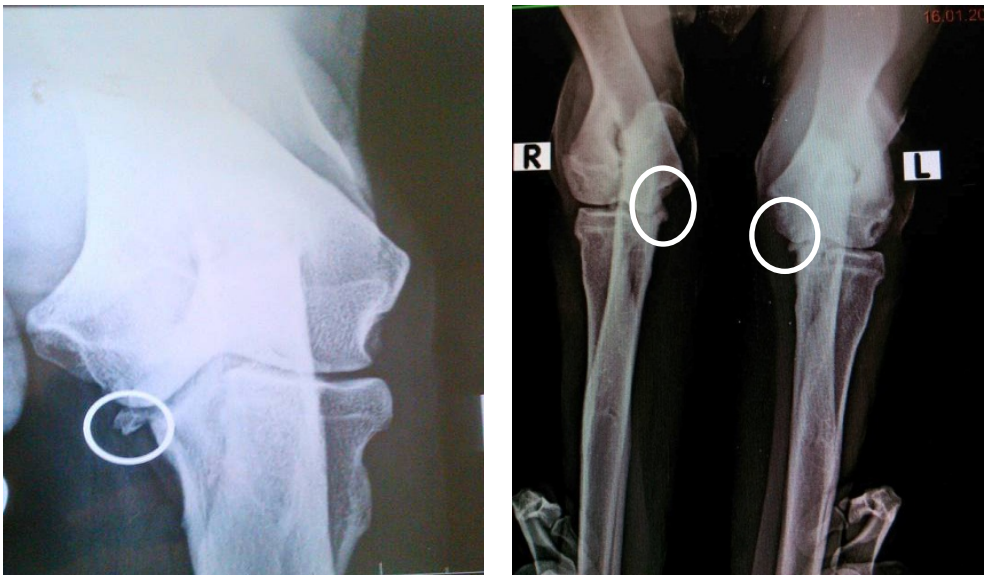
Fig. (2): The distribution of lesion combinations through ED cases.

Fig. (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 Rottweiler.

Fig. (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.

Fig. (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.

Fig. (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.



(d) (f)

Fig. (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.

Fig. (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.

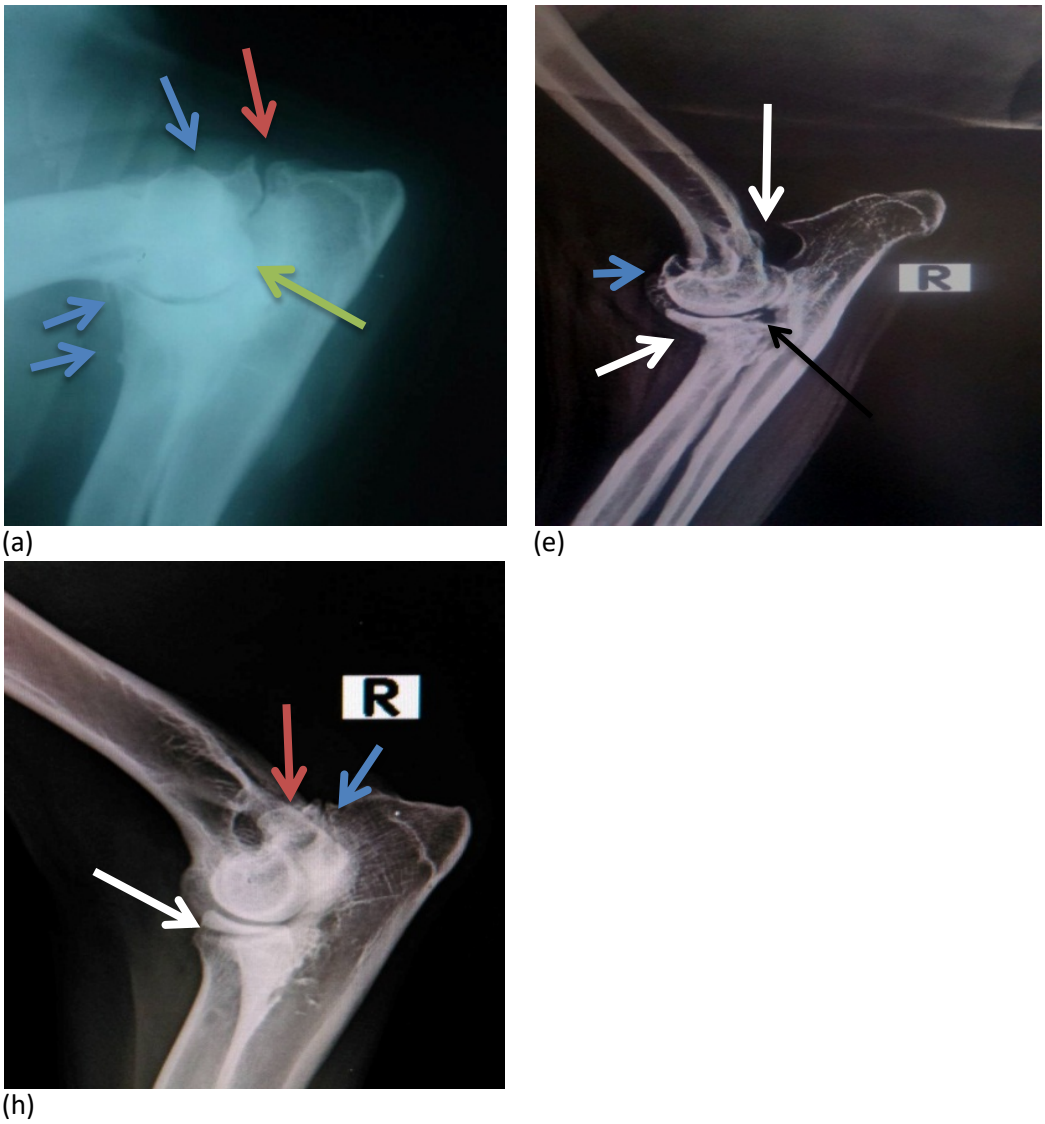
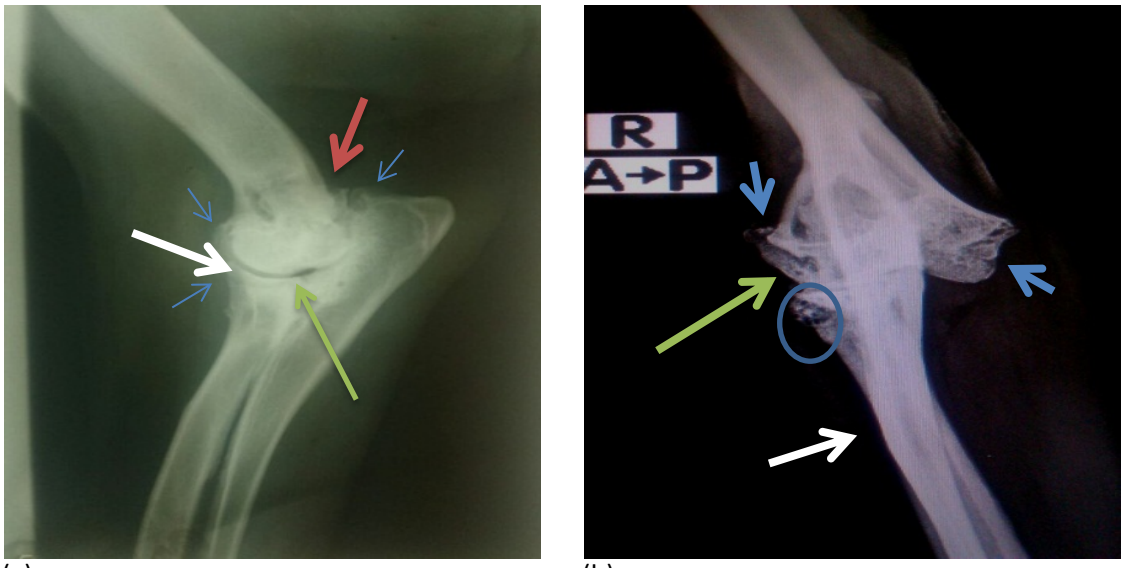


Fig. (9): Mediolateral radiographic views of a UAP in different dogs showing the dislocated fragments (red arrow), the radioulnar step (white arrows), the osteophyte development (blue arrows), the subchondral bone defect due to osteochondrosis in medial humeral condyle (green arrow), and the FMCP (Black 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)

Fig.(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 is a developmental disease syndrome in young dogs, occupied an important position among the disorders of the forelimb in 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 **(Sinibaldi, Arnoczky, 1975; Read *et al.*, 1990; Grondalen and Lingass, 1991**). The age between 6 and 12 months was usually presented;almost the age range was mentioned by **(Fitzpatrick *et al.*, 2009).** 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.*, 1968).** In German shepherd dogs, published prevalences were between

15and 20% in Sweden **(Grondalen, 1996)** and between 30, 47% in Germany **(Tellhelm, Erhardt, Mues and Beuing, 2000).** 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 **(Padgett,Mostosky, Probst,Thomas, Krecke,1995; Ubbink, Hazewinkel, Van De Broek And Rothuizen, 1999)**. Most studies of heritability of the ED have used radiographic scoring for phenotype determination **(Guthrie, 1989; Guthrie and Pidduck, 1990; Janutta, Hamann,Klein, Tellhelm and Distl,2005).** 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 **(Gustaffson, 1975)**. 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.,* 1981; Berzon and Quick, 1980; Denny and Gibbs, 1980; Dietz *et al.,* 1972).** Crepitation was noted by **(Carlson and Sevrin, 1961**) with flexion and extension of the affected joint. Also, the lameness could be unilateral or bilateral according to **(Lang, Busato, Baumgartner, Flückiger and Weber, 1998).** 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 **(Berzon and Quick, 1980; Olsson, 1974; Bennett *et al.,* 1981; Fluckiger, 2003; Robins, 1980; Wind, 1986).** 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 **(Berzon and Quick, 1980; Mason *et al.,* 1980).** Additional antero-posterior medial oblique projection to detect many varieties of ED is mentioned by **(Robins, 1978).** According to **(Wind, 1999),** the extended lateral projection makes evaluation of overall congruity of the joint and allows a clear outline of the medialcoronoidprocess. As a

consequence, radiographic diagnosis was based on at least two projections (The mediolateral and craniocaudal projections) for diagnosis of OCD and FCP **(Wind and Packard, 1986)**. Moreover**, (Morgan, Wind and Davidson,2000)** 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 **(Blond *et al.*, 2005; Mason *et al*, 2008)**, 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 **(Remy *et al*, 2004).**

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.

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