This text is a short summary of the webinar as presented by Dr H.A.W. Hazewinkel, former professor in companion animal orthopaedics, and president of the International Elbow Working Group (IEWG), for the Northern Newfoundland Club on Saturday, January 16, 2021.

Elbow dysplasia in Newfoundland dogs

Elbow dysplasia (ED) has an incidence of approximately 20-25% in the Newfoundland (NF) population (OFA, Lavrijsen et al, 2014). ED is an umbrella concept for at least four different entities all situated in the elbow joint and all eventually leading to osteoarthritis (OA). These 5 entities are called the primary diseases and are all five recognised in a survey of a group of 622 NF with 119 affected animals (19,1%), of these with the following primary disease (abbreviation and % of ED positives): fragmented coronoid process (FCP; 94.1%), Osteochondritis Dissecans (OCD; 10.9%), elbow incongruity (INC, 8.4%), and ununited anconeal process (UAP, 1.7%).Of these 119 affected animals was 5% diagnosed with OA, without recognizable primary disease (Lavrijsen et al, 2014).

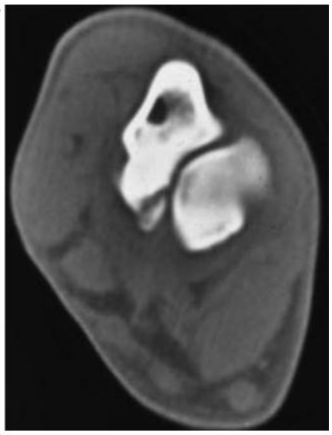

Fig. 1 Fig.2 Fig.3 Fig. 4

Fig. 1 New bone formation at the margins of the joint as part of the changes due to osteoarthritis, with incongruity of the elbow joint (step between radius and ulna inside the elbow joint) and a fragmentation of the coronoid process due to overloading of the longer ulna.

Fig. 2 In the inner side of the elbow joint, an indentation can be noticed together with a loose (cartilage, thus invisible on radiographs) flap with some mineralisation, typical for OCD

Fig.3 Near the arrow, a black area representing the separation of the anconeal process from its origin on the ulna, indicating the presence of a UAP.

Fig. 4 Result of a CT-scan of an elbow joint with a FCP, visible between the ulna and the radius.

Each entity is best visible, when present, on a particular radiological view. The inside-out view with elbow flexed is good to recognise UAP (Fig 3), the inside-out with elbow in extension is good to recognise FCP, INC and OA (see specimen Fig.1), whereas the more oblique view is good to recognise OCD (Fig 2). When only the presence of new bone formation (OA) is registered as a sign that there is something wrong in the elbow joint (ED), than a view inside-out with elbow in extension (and preferably also a view perpendicular on the former one) are necessary.

For a better knowledge of the presence of the primary diseases, and a better surgical approach of those dogs who need surgical treatment, at least 2-3 views are advocated by the International Elbow Working Group (IEWG).

Some of these abnormalities are visible on radiographs starting at the age of 25 weeks, on CT the FCP can be recognised starting at the age of 18 weeks (Lau et al, 2000a, 2000b).At screening for ED, the judging scheme of the IEWG is in use (Table 2), where both the size of new bone formation (= osteophytes) is registered and the absence or presence (suspect or evident) is used. ED screening is performed in mature dogs, in most countries at the age the HD screening is also taking place (Table 2).

Judging alone is not enough to improve the elbow status of the Newfoundland population: conclusions should be drawn which sire or dam can be used for improving the breed. As far as elbows (and hips) are concerned, only the ED0 (and best hip scores) should be used for further breeding. Also the elbow and hip status of the offspring reflects the genetic status of the parent dogs, and this feed-back should be included in decision making which animals to in/exclude from breeding. The value of the use of negative (or positive) breeding dogs has been evaluated by Dr Audell (Sweden) in Rottweiler's and Bernese Mountain dogs (number of included dogs is given in Table 1), and is given here as an illustration that it is very unwise to breed with dogs with (at least in open registration) unknown joint status (given here as a question mark).

Breeding results from parents dogs (number of dogs) with known (normal/positive) or unknown elbow and hip status(?)

	Elbow Dysplasia		Hip Dysplasia
Rottweilers parents (1356)		**Rottweiler parents (3000)**	
Normal x normal	27%	Normal x normal	24%
Normal x ED	47%	Normal X HD	35%
ED x ED	50%	HD x HD	62%
? x ?	55%	? x ?	42%
BerneseMountaindogs (1130)		**BerneseMountaindogs (2386)**	
Normal x normal	34%	Normal x normal	24%
Normal x ED	52%	Normal x HD	41%
ED x ED	58%	HD x HD	-
? x ?	60%	? x ?	34%

Lars Audell (Sweden) at IEWG meeting in San Francisco

Table 1 (left) Results of breeding of Rottweiler's and Bernese Mountain dogs with known elbow and hip status. The use of two parent animals negative for elbow dysplasia (or in another cohort for hip dysplasia) have half the incidence of offspring positive for ED (or HD) than when (in open registration) stud dogs were used with unknown (= ?) elbow (or hip) status

Elbow Dysplasia Scoring		Radiographic Findings
0	Normal elbow joint	Normal elbow joint, No evidence of incongruency, sclerosis or arthrosis
1	Mild arthrosis	Presence of osteophytes < 2 mm high Minor sclerosis of the base of the coronoid processes
2	Moderate arthrosis or suspect primary lesion	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 (suspect INC) Indirect signs for a primary lesion (UAP, FCP, OCD)
3	Severe arthrosis or evident primary lesion	Presence of osteophytes > 5 mm high Step > 5 mm between radius and ulna (obvious INC) Obvious presence of a primary lesion (UAP, FCP, OCD)

Table 2 (right) ED grading system according to IEWG (IEWG proceedings). Grade 1: mild OA, small osteophytes (<2 mm), no signs of primary disease; Grade 2: more serious osteophytes (2-5 mm), INC of 3-5 mm, suspect sign of primary disease(s); Grade 3 osteophytes >5 mm, or INC >5 mm, and/or obvious signs of primary disease (= UAP, FCP, OCD)

In summary, the 4 known entities belonging to the group of orthopaedic diseases known as ED (being FCP, OCN, INC and UAP) are all seen in Newfoundland's and are known to cause joint pain and eventually osteoarthritis (OA). To prevent OA to develop further, it is generally advised (Theyse et al, 2000) to remove the detached irritating fragments (in case of FCP, OCD and UAP) and to restore congruity in severe cases of elbow incongruity. OA can be treated by adapting activity, decreasing body-weight, giving NSAIDS (i.e., aspirin-like medicine especially designed for dogs), and possibly omega-3 fatty acids (fish-oil), but the pain can be very severe and seriously determine the quality of life of the animal. To diagnose (or exclude) the four primary diseases, at least 3 different radiologic views per elbow joint are necessary. Both the degree of OA and the presence of primary disease leads to the elbow grading according to IEWG; the presence of the latter plays a more dominant role in the grading system. The use of ED-negative breeding stock is of utmost importance to improve the breed; no dogs with un-known elbow status should be used, based on the evaluation of results in other breeds. Early removal of loose bodies from the elbow joint will slow down the process of OA development.

Congenital radial head luxation
Or called in Newfoundland 'Newfoundland forelimb anomaly'.

Although known for more than 50 years, the incidence of the following disease in the Newfoundland breed is unknown due to either its low incidence or its misdiagnosis. Congenital radial head luxation is not grouped among ED by the IEWG. The dog will be painful on walking, the elbow is more broad than normal (especially at the outer side), and the dog has hyper extended wrist joints with outward placement of the front feet; the rear legs are normal (Fig.5). This disease starts at young age (3-4 months) and increases in severity during growth.

Fig.5 Fig. 6 Fig.7

Fig. 5 Five months old Newfoundland with 'congenital radial head luxation', with broadened elbow joints, flat feet (carpal hyperextension) and outward rotation; the flexion of the elbow joint is severely hindered.

Fig. 6 The radius is not straight and does not articulate with the upper arm (as in Fig 7) but is bended to the outside, and as a consequence the head of the radius does not articulate with the upper arm.

Fig.7 For comparison, a normal developed elbow joint with straight radius and ulna, both articulating with the upper arm.

The radiograph of the elbow joint will reveal different grades or outward displacement of the radial head (Fig.6), which does normally articulates with the upper arm (Fig.7), but in this disease it is placed besides and behind the upper arm (Fig. 6). Congenital radial head luxation has a poor prognosis when left untreated; the elbows will not function as hinge joints. The animal will be stiff in its front legs, with hyper extended front feet. The mode of inheritance is still unknown.

Owners of a Newfoundland puppy with this entity are invited to contact: Mrs Barbara Jennett forelimbanomaly@gmail.com to provide 2 radiographs per elbow joint plus DNA of the dog, and/or to donate for genetic research in this disease in the NF breed in the USA.

Hip dysplasia in Newfoundland dogs

The incidence of hip dysplasia is around 25% of the Newfoundland's born these days, without a gender preference (Lavrijsen et al, 2014). Hip dysplasia (HD) is characterized by a loose connection between hip ball and hip socket; the connection includes joint capsule, tendons and hip-surrounding muscles. The joint capsule is relaxed when the thighbone is placed approximately 90 degrees on the length axis of the dog, whereas the joint capsule is wrung, and thus tighter and shorter, when the hip joint is (over-)extended or flexed. At clinical investigation of hip joints, the dog is placed on dorsal recumbancy and the thighbone hold 90 degrees on the length-axis with the stifles directed to the sealing. By moving the stifle in an outward direction, the head of the thighbone will pop into the socket, especially when luxated. For making standard HD-radiographs, the hind legs are extended, thus the joint capsule wrung, and as a consequence the connection of the head inside the socket is flattered on radiographs; the quality of the joint is inspected (form changes, presence of bony reactions and also the Norberg angle measured). The Norberg value of the dog (= the sum of both Norberg angles) reflects the lateral displacement of the ball within the socket in this extended position of the hip joint.

Other techniques will provoke the ball out of the socket, e.g. the distraction techniques as described by Smith, Vezzoni and Flückiger (Flückiger, 2000). With a fulcrum (or with manoeuvring only), the heads are forced out of the sockets with the dog under general anaesthesia (Fig 8). On radiographs the distance between de midpoint of the head of the thighbone and the midpoint of the socket can be measured during distraction, the distance is divided by the ray of the head (to normalize for the size of the dog), i.e, the distraction index (Fig. 9). The distraction index has been published for the main breeds by Dr Smith. With another radiologic technique the roof of the socket can be projected (the so-called 'dorsal acetabular rim'), and the angle of the roof determined: the larger that angle, the more easy the head can slip out of the socket.

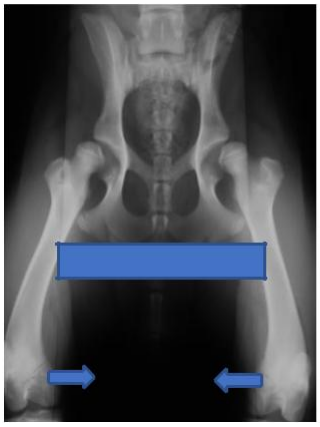

Fig. 8

Fig. 9

Fig. 10

Fig.8 Distraction technique: with a fulcrum placed between the tights and pressure to move both stifle joints towards each other, the hip joints will be distracted, i.e. the balls move in the sockets.

Fig. 9 The distance between the midpoint of the head (blue dot) and the midpoint of the socket (blue diamont) divided by the ray of the head= the distraction index, which must be <0.3 in most breeds (here: 0.7) representing severe joint laxity.

Fig. 10 Due to osteoarthritis the joint capsule thickens, making the joint less lax. In addition, new bone formation is seen around the neck of the balls (compare with Fig. 8) and at the margins of the sockets, making movement more painful.

There are a variety of surgical techniques to treat HD, depending on the severity of laxity and clinical signs, of deformation due to osteoarthritis (Fig. 10), and the financial possibilities. These techniques include (1) removal of the thighs muscle (=pectineal myectomy) to change the muscle power influencing the position of the head to the pelvis, (2) sawing free a segment of the pelvis including the socket and fixing that fragment with the aid of a twisted plate (=TPO), (necessitating before surgery: contact between head and socket, and both bal land socket without deformation), (3) total joint prosthesis in full-grown dogs even with severe deformation (Fig. 10) and/or severe luxation, (4) joint removal (femoral head and neck excision) which is more successful in dogs under 20 kg and unilateral.

In more chronic cases, the dog will suffer from OA whereas in young dog the suffering originates from the pain due to joint laxity. The latter is characterized by poor musculature around the hip joint, tendency to sit rather than to run, waggle during walking, bunny hopping during galloping. The clinical signs of OA in the older dogs are (1) painful upon rising (especially when too much activity preceded the period of rest), and improving locomotion after some exercise, (2) walking with the hind feet near each other and tendency of bunny hopping, (3) painful during walking up-stairs or jumping in the car. The pathological signs of OA include damaged joint cartilage and, inflamed and thickened joint capsule (with consequently a less lax, but stiffer joint), new bone formation at the edges of the joint (osteophytes) with deformation of the ball and socket (Fig. 10). Conservative treatment of OA includes adapted activity and decrease in body-weight, NSAIDs (aspirin-like drugs for dogs), and omega-3 fatty acids (fish oil).

HD is a disabling disease, especially in large breed dogs like the Newfoundland's. As presented in Table 1, the policy of decreasing the incidence of HD, is to breed only with parent dogs with known HD-free joints. When lowering the incidence for the population does hamper, the breeders should stick more strict to the rule, only to breed with known HD-free dogs, to include in the follow-up evaluation also the littermates who are treated (or euthanized) for HD prior tot he official screening age, and also include the littermates of which screening has not been performed or not send in for official screening. Only when these measures do not accelerate the quality of the hip status in the breed, other ways (distraction index, dorsal acetabular roof measurement, in the future perhaps DNA-screening) can be explored.

Preferred reading:

The reader is referred to the webpage of the International Elbow Working Group (IEWG):

http://www.vet-iewg.org/proceedings/

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