BRACHYCEPHALIC BREEDS AND BRACHYCEPHALIC OBSTRUCTIVE AIRWAY SYNDROME (BOAS)

Report, Strategy and Recommendations
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INTRODUCTION

Brachycephaly, or short skull, is one of the ancient features in domestic dogs. Brachycephalic breeds have existed for centuries, and today, some of these breeds are among the most popular and loved dog breeds globally. Any actions taken in brachycephalic dogs should be set to this wider perspective in order to achieve permanent and meaningful results to improve the health and welfare of these breeds.

Population-based epidemiological data (for example breed surveys as well as insurance claim data) has shown that a significant proportion of individuals in some of the brachycephalic breeds are affected by Brachycephalic Obstructive Airway Syndrome or BOAS (Nordic Kennel Union: Statements and proposals regarding respiratory health in brachycephalic dogs. 2017). The shortened forehead occurring in these breeds is a result of discrete mutations - however, the different factors causing BOAS are complex. Any efforts in trying to solve BOAS based problems call for collaboration between several stakeholders. In fact, focusing only on one of these various factors may lead to more serious and increasing problems and welfare issues in brachycephalic breeds. All involved, including national and global kennel organizations, breed clubs, breeders, show judges, veterinarians, welfare authorities and even the owners of brachycephalic dogs, must collaborate in order to successfully achieve meaningful results on the prevalence of BOAS related problems.

In this report, we, the Scientific Commission of the Fédération Cynologique Internationale (FCI), examine BOAS from a scientific and cynological point of view. However, in order to give a meaningful input to the current debate around this complex issue of brachycephalic dogs, we will also show that there is a need not only for common actions, but that each affected breed also needs to have an individual breeding strategy.

I. WHAT IS BOAS?

Brachycephalic Obstructive Airway Syndrome (BOAS) or Brachycephalic Syndrome (BS) is a conformation-related respiratory disorder in dogs belonging to the group of brachycephalic breeds. Misconfiguration of respiratory soft tissue restricts airflow and increases negative pressure within the airway. Airway resistance caused by these tissue anomalies is believed to induce pathological remodelling of additional tissues, including tonsil and laryngeal saccule eversion, oedema of the nasopharynx, laryngeal collapse, tracheal hypoplasia or collapse, and exacerbation of the thickening and elongation of the soft palate. Affected individuals can have stenotic nares, elongated soft palates and oversized, caudally protruding nasal turbinate; consequently, they develop breathing difficulties, heat and exercise intolerance, and in more severe cases, cyanosis and collapse.

An earlier study (Packer et al. 2015) compared multiple breeds with relatively small numbers of dogs, and suggested that the shorter the muzzle, the greater the BOAS problem. A More recent study (Liu et al., 2017) suggests that for specific breeds, there may not be a direct, comparable link between CFR (CFR = length of muzzle: length of skull) and BOAS. Anatomically, the CFR measurement cannot determine the main internal BOAS lesions along the upper airway. For extreme brachycephalic dogs, the snout length only includes the region of the nasal planum and nasal vestibule, while other common BOAS lesions, such as overcrowded and aberrant nasal turbinates, elongated soft palate, and macroglossia, are found in areas that are measured by the cranial length (Liu et al. 2017). Recently, Ravn-Mølby et al. (2019) found no significant effect of muzzle length as a conformational feature in the development of BOAS in French Bulldogs. The same study revealed that the nostril stenosis score has a large impact on the functional ability of the dog. Additional findings from the study also corroborate several other studies that indicate neck girth and body condition as further risk factors for BOAS.

The clinical presentation of BOAS is heterogeneous, suggesting determinants independent of skull conformation also contribute to airway disease in brachycephalic breeds. However, Norwich Terriers, as a mesocephalic breed, are predisposed to Upper Airway Syndrome (UAS), a disease whose pathological features overlap with BOAS. Recent research on Norwich Terriers revealed that airway oedema caused by the disruption of the *ADAMTS3* gene predisposes dogs to respiratory obstruction (Marchant et al, 2019). These results suggest a new paradigm in the understanding of canine upper airway disease etiology.

Prevalence and incidence across breeds

The prevalence and incidence of BOAS in various brachycephalic breeds is difficult to assess. There are several reasons for this: sparse literature data, a lack of diagnostic criteria, a lack of data being shared between primary practice and referral centres, a lack of systematic data collected from the registered dogs, an unknown number of unregistered dogs resulting from uncontrolled breeding without any health recommendations, and a number of imported dogs with unfamiliar breeding lines. Although many brachycephalic breeds have health schemes, which the breed clubs for these breeds across Europe are promoting, only a proportion of the pet population is registered in FCI's national organization members or in The Kennel Club (the official kennel club in United Kingdom). Different scientific studies suggest a variable prevalence for BOAS in brachycephalic dogs from less than 10 % up to 50 %. These data have to be taken with caution due to the relatively small population observed and a lack of statistical data in most studies.

Moreover, the prevalence of BOAS affected dogs showed an overrepresented number of French Bulldogs, Pugs, and English Bulldogs. These breeds are also the most popular brachycephalic breeds, and breeds that have been studied the most

II. BREEDING APPROACH TO TACKLE THE BOAS ISSUE

Traits to be considered

Defining trait(s) to be selected is one of the main prerequisites for the implementation of a breeding strategy. In the case of a complex issue caused by multiple traits like BOAS, selection can be made either on the diagnosis of the disease itself, or on trait(s) phenotypically or genetically correlated, i.e. on morphology or an exercise assessment test in the case of BOAS.

- Diagnosis of BOAS should be considered in any breeding strategy against the disease. Yet, given the progressive nature of the disease, the most direct interventions, such as the removal of a dog from breeding, can only occur at a late stage, i.e. potentially after a dog has already been used for breeding.

- As dog morphology is clearly affecting the likelihood of developing BOAS, it should be considered in breeding strategies. Yet, it has to be underlined that (i) there is still no consensus on a specific quantitative trait that could be used as a predictor for the risk of developing BOAS and that (ii) traits associations may differ according to breeds. Potentially, a combination of traits could be selected as a synthetic index to be used as predictors in selection, yet the definition of the combination, as well as the logistic difficulty in implementing a generalized morphometric characterization constitute important obstacles for such implementation. Alternatively, qualitative assessment should be considered at every stage of the breeding process to encourage the use of dogs with a healthy morphology relative to BOAS.

- Exercise tests may be considered as another option in predicting the risk of BOAS among dog breeds. These tests have the advantage of already being used by some clubs and countries, and they are generally accepted by breeders and owners. It has to be underlined that it is unclear to which extent these tests are good predictors of BOAS.

Selection interventions

In order to be efficient, breeding strategies against BOAS should be multi-fold, i.e. take advantage of the different elements that are being considered by breeders for the selection of their reproducers. The below list presents a non-exhaustive list of potential interventions that can be included within a breeding strategy against BOAS.

As the conformation of the breed to an official standard is fundamental to dog breeding, it is essential that the standard provides a description of morphological types that are as healthy and functional as possible. Over the last years, some changes have been made in that direction by the country of origin of the most emblematic brachycephalic breeds. Yet it is difficult to determine whether those changes had any impact on the BOAS issue within the breeds, either because these changes were too limited to have any impact, or because the changes were not fully implemented by judges, breed clubs and breeders.

Breeding organizations should seek to promote dogs showing no predisposition to BOAS, while discouraging the breeding of affected dogs to the greatest possible extent. Corresponding interventions should include:

- enforce/encourage the phenotypic evaluation of a large number of dogs, on traits directly or indirectly related to BOAS (see above),
- communicate the results widely (within pedigrees, specialized media, breed clubs, websites of national kennel organizations and databases),
- recommend the use of healthy dogs only, with healthy ancestry and offspring, as well as ban the breeding of affected dogs.

Selection interventions should be a part of clear strategies designed by kennel organizations and breed clubs and they should include concrete objectives and consider the specific framework of the breed at a national level (BOAS incidence, demographic situation, legal framework).

III. RECOMMENDED ACTIONS

Breeding should improve the quality of dogs

The breeding of dogs has a long history. The basic idea of breeding in any population of dogs has always been to *improve the overall quality* of the stock. Quality does not mean only the conformation and breed specific features, but also the various properties a given breed has. These properties have remained unchanged in many breeds throughout their history because of systematic and purposeful breeding programs that
breed clubs and breeders have followed. Humans and our societies have also greatly benefited from these features and properties of purebred pedigree dogs.

Many of the brachycephalic breeds have been companion animals throughout their history. Being a pet and a family dog is one of the most important purposes of dogs in modern society, and thus, many brachycephalic breeds with their loveable disposition have achieved a position among the most popular dog breeds worldwide.

This has also led to some side effects, and these breeds or their look-a-likes are widely bred and marketed outside the organized dog community. However, specific breeding programs and strategies, including those concerning dog health and welfare, only affect organized breeders. Therefore, any actions taken to restrict or prevent organized dog breeding may lead to an increase of breeding and numbers of dogs that are not registered nor controlled by anyone.

The animal welfare legislation concerns all animals, regardless of where or by whom they have been bred, whether they are registered or unregistered animals. Unfortunately, those actions that are only affecting organized breeders and kennel organizations may lead to even more serious problems. The situation in Netherlands, where the authorities have applied a CFR measurement of 0.3 to all brachycephalic breeds registered by the Dutch Kennel Club (Raad van Beheer), is only affecting the organized dog community and breeders. Even CFR has recently been found to not be a major risk predictor for BOAS. Thus far, we are not aware of any actions that have been taken for dogs that are bred unregistered or in other organizations outside RvB, which is a member of the international umbrella organization, the FCI.

Dog health and welfare have always been in the centre of any actions taken by the FCI and its members. Most European countries except for the United Kingdom are either full or associate, or contract partners of the FCI. Within UK, the FCI has a mutual contract with their main organization, The Kennel Club. Any actions taken by the FCI have a fundamental effect on health and welfare issues in registered pedigree dogs throughout Europe. With nearly 100 members worldwide, actions taken by the FCI can even have a global effect.

As the expert commission in breeding, dog welfare and health within the FCI, the Scientific Commission proposes the following actions to be taken regarding the brachycephalic breeds and BOAS.

<u>Strategies</u> in BOAS applying to all brachycephalic breeds

1. **Implement methods to examine breeding animals for respiratory function and temperature monitoring.**

There is a recent agreement between the Kennel Club and the FCI to facilitate the Cambridge method (Liu et al., 2017) to assess the risk for BOAS. Dogs free from any clinical signs of BOAS and with anatomical features compatible with a decreased risk for BOAS create a potential breeding stock in a given breed provided that their overall health and anatomy are also acceptable. Applying the Cambridge method or any similar assessments to monitor BOAS requires collaboration with veterinarians.

2. **Promote central national registration of dogs diagnosed and operated for BOAS.**

Dogs that have been operated for BOAS cannot be bred from. To create such a registry calls for cooperation between national kennel organizations, breeders, dog owners and veterinarians.

3. **Work internationally towards written breed standards with non-exaggerated wording that consider the importance of health.**

The breed standards should be critically assessed from a health and welfare point of view, and interpretations and commentaries of the breed standards should be provided as part of the judges' and breeders' education. This calls for cooperation between the countries of origin of the breeds, the breed clubs and the FCI.

4. **Develop ways and means to set up breeding programs and breeding control for the unregistered populations of brachycephalic dogs. This action has to be taken by authorities.**

It is essential that unregistered dogs are also monitored for BOAS as they form a substantial and increasing population of brachycephalic dogs. Their breeding is not under the control of national kennel organizations, breed clubs, nor the FCI. Therefore, this remains for the authorities to control and conduct.

5. **Increase education of show judges, breeders and dog owners. Produce a guideline for clubs to organize and execute lectures/seminars.**

Judges should be provided with special training to assess respiratory distress and the anatomical risk factors (exaggerations) associated with BOAS at dog shows. The education should be organized by the national kennel organizations with the help of veterinarians. However, it is important to understand that the judges are not making diagnoses at dog shows.

Breeders should get more education in the selection of breeding stock regarding BOAS. This education should be organized nationally and in cooperation with breed clubs and the help of veterinarians.

Dog owners should get more education to be able to assess BOAS related symptoms in their dogs. This education is the responsibility of the breeders and the breed clubs with the help of veterinarians.

6. **Construct national and international BOAS health surveys to assess the progress in brachycephalic dogs.**

These surveys should be online and conducted by the breed clubs and facilitated by the national kennel organizations with the help of veterinarians. Evaluation of the progress should be done after each new generation of dogs (every 5 years). The reports have to be sent to the national kennel organization (member of FCI) and to the FCI.

7. **Promoting the collaboration and common actions between and with different stakeholders, including the national canine organizations, veterinarians and authorities, is essential.**

We only increase welfare problems if mutual understanding of actions is not achieved. Promoting collaboration is the responsibility of us all.

General breeding recommendations regarding BOAS (National Canine Organizations):

1 . **Dogs clinically affected by BOAS, as well as dogs operated for BOAS, should never be used for breeding.**

2. **Easily available and comparable health monitoring (such as the Cambridge method) should be included as a tool for the selection of all breeding stock.**

3. **Easily available and comparable health monitoring should also include the offspring.**

4. **Select breeding stock with less exaggerated anatomical features** (for example: stenotic nostrils, heavy skin folds over the nose, short and thick neck, obesity).

Breed specific recommendations regarding BOAS (Breed Clubs)

The Dutch authorities have included in their list of brachycephalic breeds the following 12 breeds:

Affenpinscher, Boston Terrier, English Bulldog, French Bulldog, Griffons (Belge, Bruxellois, Petit Brabançon), Japanese Chin, King Charles Spaniel, Pekingese, Pug and Shih Tzu. The CFR in all these breeds should be 0.3.

However, all these breeds are separate populations, and regarding their conformation, breed history and effective populations, they are very different from each other. Therefore, it is not reasonable to apply the same CFR nor breeding strategies to all brachycephalic breeds.

Especially Affenpinscher, Griffons, Japanese Chin, King Charles Spaniels, Pekingese and Shih tzu have smaller populations and breeding stocks in many countries. Therefore, concentrating on CFR would only lead to breeding programs with a severe increase in closely related dogs (inbreeding) which would jeopardize overall healthy breeding. The breed standards and conformation in these breeds are also very different from each other. A better strategy would be to assess all these breeds separately.

In Boston Terriers, English Bulldogs, French Bulldogs and Pugs, more restricted breeding strategies could be applied as the size of the populations is larger and a lot of breeding stock is available in many countries. However, standards in these breeds also have substantial differences, and other health issues should also be taken into consideration as well as the population size and genetic diversity within each local population. This calls for breed specific breeding strategies.

The breed specific strategies should be applied in collaboration by the breed clubs and national kennel organizations in each country. The national populations and populations in neighbouring countries should be taken in consideration.

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