BRACHYCEPHALIC AIRWAY SYNDROME, PART 1: A NEW UNDERSTANDING – IT IS AN INTRANASAL PROBLEM!

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In brachycephalic dogs, wrong breed selection has led to overemphasis of brachycephalia and almost complete loss of the nose. This structural deformity causes severe malfunction of the airway, often resulting in brachycephalic airway syndrome (BAS).

ANATOMY

BAS is a well-described combination of upper airway disorders in these breeds. Symptoms can vary broadly as well in intensity as in frequency of dyspneic episodes. We examined the anatomic specifics of the brachycephalic nose by computed tomography (CT) and compared them with those of the normocephalic nose (Figures 1, 2, and 3). The phenotypic appearance of the brachycephalic head depends on the shape of the skull and is strongly related to breed specific skeletal features. Such short-headed or round-shaped breeds are characterized by a short face, open orbitae, and display childlike traits.

The main problems in brachycephaly arise from the highly shortened facial bones and the resulting dislocation of nasal structures caused by the dorso-rotation of the teeth. Concomitant with increased stages of brachycephaly, the nares and the nasal entry get narrower; the rostral ending of the respiratory duct (meatus nasi ventralis), the nasal conchae and the whole ethmoidal bone are pushed into an increased upright position; and the nasolacrimal drainage system is characterized by an increased angle and a steeper course. Nasal conchal material is pushed into the respiratory duct in some animals with higher degrees of brachycephaly and hinders respiratory air flow.

MORPHOMETRIC MEASUREMENTS

Morphometric measurements of the skull revealed characteristic differences among the brachycephalic dog breeds (Figure 2). The pug had an even shorter craniofacial skull than the French and English Bulldogs.

ABERRANT CONCHAE

Extreme shortening of the craniofacial skull, and thus of the nasal cavity, leads to abnormal configuration of the conchae. Two main types of aberrant conchal growth can be described:

1. Rostral, aberrant conchae obstructing the nasal passage (RAC) and
2. Caudal aberrant conchae obstructing the choanae (CAC, Figure 3, B-4a).

Furthermore, these conchae are characterized by a low degree of branching and crude lamellae. The severe intranasal deformities in brachycephalic dogs described here are the basis for a new pathophysiologic understanding of BAS. Detailed structural analysis of aberrant, stenosing conchae (RAC, CAC) is an indispensable prerequisite for the development of an intranasal surgical therapy of BAS in the form of partial laser-assisted turbinectomy (LATE therapy).

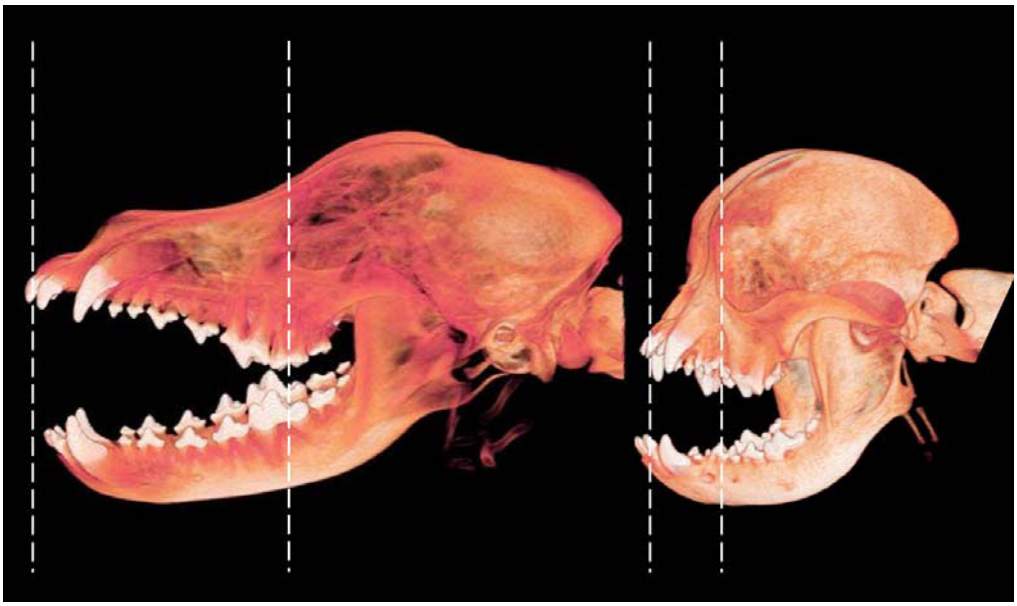

Figure 1. Three-dimensional CT-reconstruction of a normocephalic (*left*) and brachycephalic (*right*) skull.

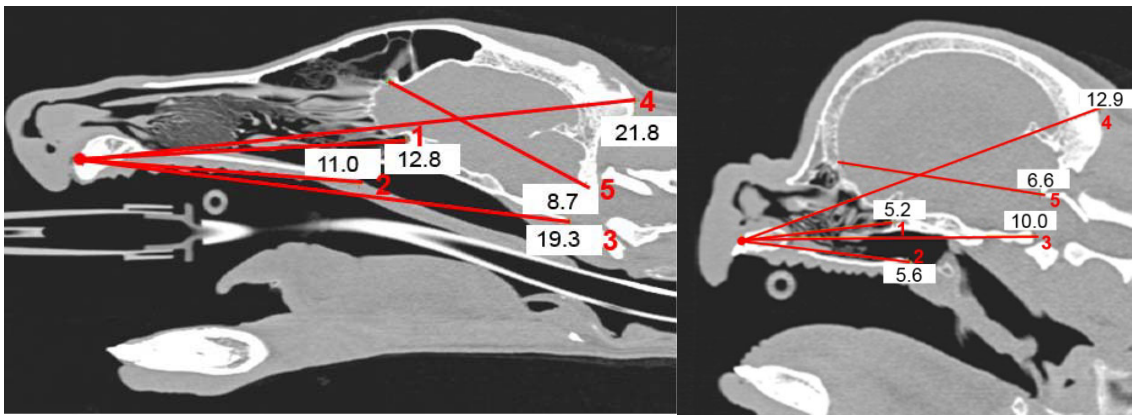

Figure 2. Examples for morphometric measurements of a normo- and brachycephalic skull. From Oechtering TH, Oechtering GU, Nöller C. Structural characteristics of the nose in brachycephalic dog breeds analysed by computed tomography, Tieraerztl Prax. 2007;35(K):177-187; with permission.

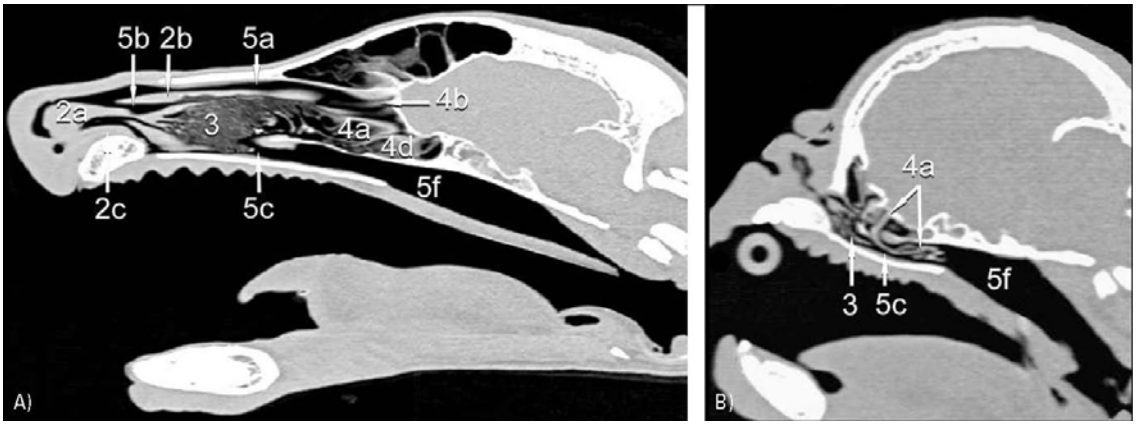

Figure 3. Sagittal CT scans of a normocephalic and a brachycephalic head. 2a = Plica alaris, 2b = Plica recta, 2c = Plica basalis; 3 = Concha nasalis ventralis; 4a = Concha nasalis media (Endoturbinate II), 4b = Concha nasalis dorsalis (Endoturbinate I), 4d = Endoturbinate IV; 5a = Meatus nasi dorsalis, 5b = Meatus nasi medius, 5c = Meatus nasi ventralis, 5f = Meatus nasopharyngeus. From Oechtering TH, Oechtering GU, Nöller C. Structural characteristics of the nose in brachycephalic dog breeds analysed by computed tomography. Tieraerztl Prax. 2007;35(K):177-187; with permission.

THERMOREGULATION

It is a very well known fact that brachycephalic dogs also suffer from severe heat susceptibility. If it is hot outside, humans begins to sweat and the evaporating water will cool the large surface of our skin and with that our blood. Dogs cannot sweat. Nevertheless, they also use the mechanism of evaporation cooling – they have their large surface inside the nose: an anatomic marvel of nasal turbinates. Panting is the most important element of thermoregulation in dogs. Both a patent intranasal airway for inspiration and an undisturbed oral expiration are essential for effective cooling.

Brachycephalic dogs lost their nose, not by chance but due to intentional breeding. With our recent research, we concentrated on the nasal influx and demonstrated severe obstruction of the intranasal as well as the rostral nasopharyngeal airways (choanae) in brachycephalic breeds. In the course of our recent investigations, we had strong indications that there is a substantial impairment of the oral (expiratory) airflow as well. These findings support the assumption that heat and stress susceptibility in brachycephalic dogs is a primary failure of peripheral thermoregulation and not of central mechanisms. More basic research on brachycephalia is needed to investigate the relation between anatomic malformation and functional impairment.