

NORWICH UPPER AIRWAY SYNDROME (UAS): A MULTI-PRONGED ISSUE

In 2004, European Norwich Terrier breeders initiated a study of breathing problems in the breed. The first and most extensive study was conducted at the University of Berne in Switzerland. Soon after the conclusion of the Berne study, another Norwich-specific study was done at the University of Zurich. That study's results were published in 2005, but only in German. Instead of waiting for its English translation, I decided to brush up on my German. I read the study in the original, enlisting the help of my German mother-in-law. What follows is not an official translation, but rather a summary of what I comprehended from reading these Swiss studies. I also spent literally hundreds of hours talking to veterinary respiratory specialists across the USA so that I would better understand the subject. I do hope that sharing the little I know about the European studies will help other Norwich breeders deal with diagnostic procedures on affected dogs as well as make better decisions in their breeding plans. I will share the interviews I conducted with specialists in this country in a separate article to be published in the *Fall News*. All information contained in this article is a result of my solitary research. I am not a member of the NNTC sub-committee on Norwich UAS, and I bear sole responsibility for any inaccuracies or omissions.

Study at the University of Berne, Switzerland

The most extensive study of Norwich breathing was conducted at the University of Berne, where over 200 European Norwich were scoped. It is of utmost importance to note that the dogs were assigned *randomly* to the research. This was not just a study of dogs that exhibited symptoms of respiratory disorders. My understanding is that all Swiss Norwich breeders participated in this study, along with many other European breeders. It was a systematic study that established a grading system for UAS in the breed. Unfortunately, the official study results have not yet been published, so that what we know has been related to us by the participants, especially a report given to the Swiss kennel club for the Swiss-owned dogs.

The grading was based on a point system in checking the following:

- Length and thickness of the soft palate
- Edema of the laryngopharynx
- Laryngeal sacculles and glottal folds
- Epiglottis (shape and cysts)
- Roof of the pharynx
- Tonsils
- Trachea(size and shape)
- Form, stability and placement of the laryngeal cartilage

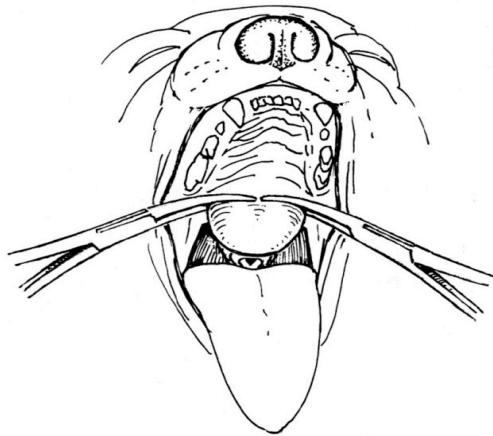
Each part of the dog's respiratory system was assigned points, based on visual examination via endoscope. Tracheas suspected of collapse were also x-rayed on inhale and exhale to determine the severity of the collapse. Points were added and dogs received grades similar to school grades, except

that instead of A- or B-, they received A2 and B2 grading respectively. Based on the anatomical criteria, the possible grades were A1, A2, B1, B2, C1, C2, D1, D2, E1, E2.

Study at the University of Zurich, Switzerland (Published in 2005)

The Berne study inspired an independent research project conducted at the University of Zurich that compared Norwich respiratory functions to those of brachycephalic breeds. The examination methods used by Dr. Marisa Rosaspina's team were more extensive than in the Berne study. In addition to laryngoscopy, the dogs underwent rhinomanometry (which I will explain a bit later), measurements of the nostrils, and radiographs of the skull and the thorax.

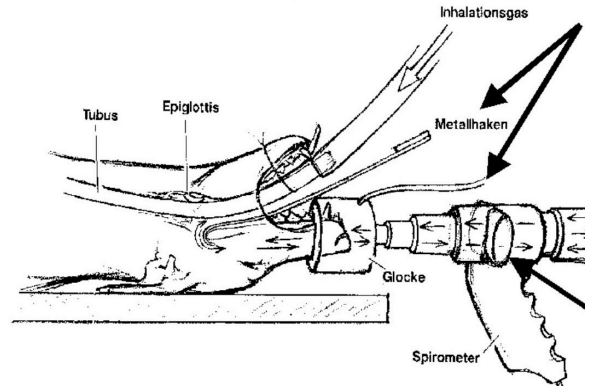
Dogs participating in this study included 23 Norwich Terriers and 8 Beagles representing the mesocephalic breeds, and 8 brachycephalic dogs. Cephalic index refers to the size and shape of the skull. All dogs are classified into three groups based on that index: dolichocephalic (long-headed), mesocephalic (moderate-headed), or brachycephalic (broad-headed). A brachycephalic skull is relatively broad and short, typically with the breadth at least 80% of the length. Dog breeds such as [Pugs](#) and [Bulldogs](#) belong in this group, where the muzzle practically disappears. A mesocephalic skull is of intermediate length and width, and both Norwich Terriers and Beagles belong in this category. A dolichocephalic skull is a relatively long skull, typically with the breadth less than 80% or 75% of the length. Think Whippet or Borzoi.



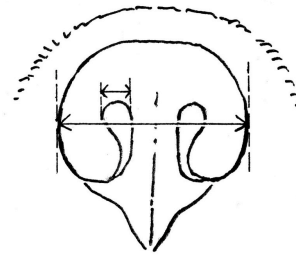
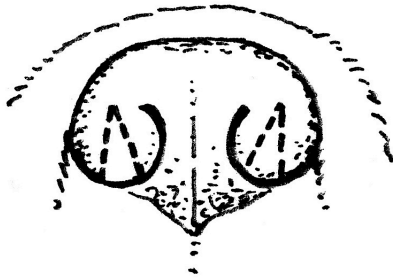
The Zurich researchers visually examined the dogs' soft palates for size, thickness and presence of any deformities. The drawing on the left illustrates an example of an elongated soft palate, the most common abnormality of the palate found in Norwich. Nineteen of the 23 Norwich in the study were diagnosed with this condition.

As in the Beerne study, all the dogs in the Zurich study underwent laryngoscopy. A flexible tube of an endoscope, equipped with a camera, travelled down the dog's respiratory tract. Laryngoscopy required anesthesia. The most common abnormalities found in the Norwich were enlarged tonsils and everted laryngeal sacculles (ELS). Of the 23 Norwich examined, 20 exhibited enlarged tonsils and 17 had ELS. Other respiratory disorders included narrowed tracheas in 2 Norwich and laryngeal collapse in one Norwich. The brachycephalic group exhibited a similar incidence of respiratory tract malfunctions. The 8 Beagles in the study all tested clear.

The illustration on the right pertains to Rhinomanometry, another diagnostic procedure used in the Zurich study by Dr. Rosaspina. Rhinomanometry (“rhino” means “nose” in Greek, and “manometry” refers to taking measurements) is a relatively new method used to measure the airflow and pressure within the nose during respiration. Nasal resistance or obstruction can be calculated from the figures obtained. This is a highly accurate method of measuring the airflow and thereby indicating constrictions in the dog’s nasal passages. The metal hook marked as “Metallhaken” in the drawing separates the nasal passages from the rest of the respiratory tract. The anesthetized dog has the metal hook inserted and then wears a mask connected to a rhinomenometer. To create a seal between the mask and the dog’s palate, ordinary pizza dough was used, where the drawing shows the bell-shaped mask marked as “Glocke.” The device pumps air into the dog’s nasal cavities and measures the return of the airflow. During the procedure, the dog is breathing through a tube inserted into his mouth and throat. Based on the Rhinomanometry test, the Norwich in the study showed resistance in the airflow, indicating stenotic nares (constricted nasal passages). The incidence of stenotic nares was higher in the brachycephalic dogs. The Beagles showed no restriction in nasal passages.



Using both visual observation and measurements, the study determined that only brachecyphalic dogs had pinched nostrils. The drawing on the left shows severely pinched nostrils in a brachycephalic dog, with a dashed line indicating a suggested surgical correction of cutting away tissue. The illustration on the right shows slightly constricted nostrils. None of the 23 Norwich Terriers or the 8 Beagles exhibited that condition. It is important to note that even though their nostrils were of proper size, Norwich did exhibit restricted airflow though their nasal cavity as measured by Rhinomanometry.



Zurich Study At A Glance

Norwich statistics out of 23 dogs:

19 had elongated soft palate

20 had enlarged tonsils

17 had everted laryngeal sacculles

6 had constricted glottis

1 had laryngeal collapse

2 had narrowed tracheas

8 Brachycephalic dogs exhibited similar problems

Control group of 8 Beagles had NONE of the above issues

The object of the Zurich study was to compare the Norwich breed and brachycephalic dogs in reference to respiratory problems. The diagnostic procedures described above indicated that brachycephalic syndrome affects the Norwich breed, although Norwich Terriers belong to the mesocephalic group of dogs. To complete the study, researchers compared the skulls of the Norwich Terriers, the Beagles and the brachycephalic dogs through x-rays and skull measurements. The authors of the study concluded that Norwich are clearly not a brachycephalic breed, and so they found no correlation between skull size and respiratory problems.

The ultimate conclusion of the study was to suggest that brachycephalic syndrome be renamed, as it does not only affect brachycephalic breeds. It clearly affects the Norwich breed as well.

The Zurich study comparing Norwich to brachycephalic breeds initiated yet another study, still in progress. This new study, under Dr. Daniel Koch, is questioning Dr. Marisa Rosaspina's conclusion that skull size is not related to respiratory problems. Initial results of this latest study indicate that, indeed, Norwich do not have skulls similar to brachycephalic breeds, but that within the Norwich Terriers examined, there is a clear pattern of dogs with shorter muzzles and wider skulls being more affected with UAS. To quote Dr. Koch: **"It is very probable, that the shortened nose and the narrow nostrils are the main origin for the enhanced under-pressure in the upper airways and that all other signs, as well as the overlong soft palate, are secondary manifestations."**

To read more about this new study that will conclude in December 2008, please go to <http://www.research-projects.uzh.ch/p3008.htm>

Cellular Oxygenation Study at the University of Zurich (Published in 2004)

While perusing a wonderful online library of research papers at the University of Zurich, I came upon a fascinating study by Dr. Daniel Koch. The aim of his research was to estimate the tissue oxygen saturation of brachycephalic dogs. Dr. Koch was demonstrating that by measuring blood serum VEGF and EPO, an objective grading system can be established for brachycephalic syndrome. Imagine! A blood test that would objectively indicate the degree of oxygen deprivation on a cellular level! I love numbers because you cannot skew them with interpretation too easily. A blood test giving VEGF levels offers a more objective grading system than an interpretational test like a visual examination. It also offers a much less invasive and a much less costly alternative to laryngoscopy.

VEGF stands for vascular endothelial growth factor, a signaling protein that I like to call “a messenger of bad news”. Whenever VEGF levels rise, it’s always bad news. EPO stands for erythropoietin, a hormone regulating red blood cell production. EPO is a “good guy”. The authors of this study made a few assumptions, namely that hypoxia (shortage of oxygen in the body) induces the release of VEGF and lowers the production of EPO. Researchers measured serum VEGF and EPO levels before physical exercise and then 4 hours afterwards. Eight brachycephalic dogs and 8 mesocephalic dogs participated in the study. The study concluded that measuring a dog’s VEGF values before and 4 hours after exercise provides an instrument to estimate not only oxygen saturation, but also the success of any surgical correction in brachycephalic dogs. Similarly, dogs that underwent corrective surgeries can be evaluated by measuring VEGF levels post- exercise to determine the success of the surgery.

Interestingly, page 12 of this study specifically lists Norwich Terriers as a mesocephalic breed that can benefit from this test. I have contacted various respiratory specialists across the USA hoping to repeat the above study and confirm the usefulness of serum VEGF reading as a biological marker for UAS, especially in dogs that do not exhibit signs of respiratory distress but that are breeding stock and thus should be screened for UAS. I believe this is a promising test, obviously much less invasive and costly than a purely diagnostic endoscopy, but so far I have not been successful in generating enough interest. If any readers of this article have suggestions for research facilities that might be interested in repeating the Zurich oxygenation study on Norwich Terriers in America, I would welcome your input.

By presenting solid scientific data on Norwich breathing problems, this article has, I hope, enhanced Norwich breeders’ awareness of UAS as a serious condition in the breed. My future article will include a more practical guide to understanding symptoms associated with various expressions of UAS, the ABCs of respiratory tract anatomy, a discussion of protocols used for scoping Norwich in the USA, and some ideas about a likely mode of inheritance. I have spent literally hundreds of hours researching the subject. I am asking for only one reward. Please take UAS seriously when planning your future breedings. Please understand that there is much more to UAS than an occasional occurrence or an easy surgical fix. According to published research, open to peer review, UAS is more than a problem with sacculs everting. The scientific data indicates that it’s a multi-pronged issue, widespread and serious. Laryngeal collapse and tracheal collapse can be life threatening. They do not exist in isolation from other less serious conditions. Let’s work together on a better understanding of UAS to eventually eradicate this problem from the Norwich breed.

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