Notes from Anicura Heart Study webinar Bull Terrier/Mini Bull Terrier Webinars - April 2021 (Dr.'s Mark Dirven and Hanneke Van Meeuwen)

There are 2 cardiac problems most commonly seen in the BT --- **Subaortic Stenosis** (**SAS**) and **Mitral Valve Dysplasia**, and these 2 conditions were the focus of the studies done in the Netherlands by Veterinary Cardiologists Dr.s Dirven and VanMeeuwen . The BTCA also recommends that breeders screen for these 2 anomalies prior to breeding.

Subaortic Stenosis / SAS is the most commonly seen cardiac issue in BT's. Screening looks for both blood flow velocity and a narrowed heart valve opening (if this has been present for some time it is accompanied by thickening of heart walls). The **doppler echocardiogram** is the tool used. The needed information obtained through testing is - what is the velocity of the oxygenated blood flow from the heart (out from left ventricle (LV)) into the body, and is there obstruction (narrowed opening)? As the blood exits the heart, if the LV has to generate more force (pressure) to produce normal blood flow, the pressure, over time, from the increased afterload thickens the walls of the heart, which can ultimately cause dilation (enlargement) and eventual failure of the LV. The more the thickness = the greater the severity of condition. Dogs with severe SAS will have louder murmurs, the more audible the murmur the more severe the condition.

Mitral valve dysplasia means a formation abnormality in the mitral valve causing leakage or obstruction, and involves the blood inflow to the heart from the lungs through the left atrium (LA). Leaking is also called **regurgitation**.

SAS range – **what do those values represent?** (the degree of stenosis is based on **blood velocity** and a pressure gradient and thereby assessing the potential for damage/thickening of the heart tissues.)

Normal *and* ***Mild*** aortic stenosis:
What is commonly referred to as "**normal**" is having normal LV size and LA size. (Left ventricle and left atrium). You may see the term WNL (within normal limits) listed by the cardiologist. **Mild affected** typically also have normal size LV and LA.

*Velocity of 1-2 meters/second is **normal** and 2-3 meters/second is **mild affected.**
*LVOT PG 10-20 mm Hg is considered **normal**
20-50 mm Hg is considered **mild affected**
(LVOT is left ventricular outflow tract, PG - pressure gradient and the pressure is measured in mm Hg (millimeters of mercury)

These dogs are asymptomatic (exhibit no problems). Quality and quantity of life is completely normal. No treatment necessary.

NOTE: The study revealed the average blood velocity in the adult subjects was 2.56 m/s. Only 18% of the dogs tested had aortic blood velocity of less than 2 m/s. An aortic blood velocity of more than 2 m/s occurs in dogs with a narrow aorta. A minimal to mild mitral valve leakage was often seen (74%).

***Moderate*:**

*normal LV and LA size
*LVOT PG 50-80 mm Hg
*Velocity of 3.5-4.5 meters/second

Variable prognosis. *Most* of these dogs will also live "normal" lives, although some may have exercise intolerance or syncope (fainting). If dogs in this range become symptomatic (difficulty breathing or fainting) treatment may be required.

Severe:

*Normal or increased LA size
*Concentric LV hypertrophy (thickened LV wall)
*LVOT PG greater than 80 mm Hg
*Velocity > 4.5meters/second (can even see velocities to 8 or 9 meters/sec.)

Many of these dogs are symptomatic but not all. The more severe the SAS the shorter the life expectancy and the lower the quality of life. In reality, this is the only range with poor prognosis, and no good treatment, little can be done. In the past Beta-blockers, balloon dilation and Surgery were tried but were not found to be highly successful treatments.

(Note: **OFA ranges are different, <2.0 is considered normal, not indicative of SAS, 2.0-2.2 is considered equivocal, and >2.2 is considered indicative of SAS.)**

Symptoms of stenosis:

*Low cardiac output heart failure.
*Exercise intolerance (difficulty breathing with exercise)
* Syncope – fainting
*Sudden cardiac failure – death

More take-aways from the study----Auscultation - listening to the heart, the cardiologist is listening for a heart murmur. A murmur indicates changes in the heart or is caused by increased blood flow (turbulent blood flow). In this study, if a murmur was heard, there was generally aortic stenosis. But conversely, **if you do NOT HEAR a murmur, heart disease can still be present or in progress.** The more the velocity, the more severe the SAS and the louder the murmur.

The Reynolds number is a measure of turbulence: $Re=pVD/m$ where
p is fluid density, V is flow velocity, D is diameter of opening and m is fluid viscosity.

Murmurs are graded 1 to 6. 1 is barely audible and 6 can be heard without stethoscope.

Some facts on Mitral Valve Dysplasia (MVD)

MVD in dogs is malformation of the heart's mitral valve. A normal mitral valve functions as a one-way valve, passing blood from the left atrium to the left ventricle. The deformity causes the valve to not shut tightly, which results in the backflow of blood into the left atrium. The backflow is called regurgitation. The amount of regurgitation depends on the severity of the abnormal valve. Our bodies always try to maintain balance. In this case, the heart has to work double duty to maintain the proper volume pumped in each contraction. Over time this increase in pressure can cause the valve to further weaken, and the heart to undergo overall enlargement of size and volume, the walls thicken and the component cells enlarge. A common term for this condition is "enlarged heart".

These dogs present with breathing difficulty, hacking cough, lethargy, lungs impaired by a back up of blood. This can go on for years. The bigger the leak, the bigger the murmur. Medications can be utilized, with variable results seen. Surgical approaches have not seen much success.

It is very hard to differentiate murmurs of SAS and MVD from each other by auscultation alone.

Disclaimers on the study and more findings:

Data from the study may be skewed. The sample subjects were drawn from a small, localized area, primarily Dutch dogs and a few from Belgium. This gene pool sample may not be adequately diverse/ representative of the entire population of Bull Terriers world-wide. The researchers who conducted the study are Board Certified Cardiologists and have much experience with Bull Terriers. All the adult and puppy subjects came from caring and conscientious breeders. All had previously been vet checked and all were asymptomatic.

Questions the researchers posed and set about to resolve **– Is auscultation a good screening test for EBT's? Answer – No.**

Why? They set about by screening 158 asymptomatic dogs. Murmurs were found in 35%, 1 in 3 had murmurs, but of mostly low intensity. 24% of the 35% are very mild 1 or 2, and only 1% was severe or loud.

Of the dogs with murmurs: all 55 with murmurs had *some* evidence of disease when echoed, but the vast majority were mild to very mild, and all were caused by SAS.

Of the 103 dogs tested without murmurs:
19% are "normal"

80% are affected (have heart disease) and there was **no way to differentiate** just by auscultation who has heart disease and who does not.

Of interest --The researchers suggest that if you exclude murmur dogs from breeding programs, you will exclude 1/3 of the breeding population. In smaller breeds this could be catastrophic.

Question – **I am considering buying/keeping puppy X, should having or not having a murmur bear any weight in my decision? Answer – no.**

In addition to the adult dogs tested, this study included 57 puppies, but only 30 were available at all stages of the research. This portion of research also brought up some interesting revelation. Testing occurred multiple times from 9 weeks of age to 18 months of age. At 9 weeks of age, by auscultation, only 3% (1 puppy) had a murmur. Of the puppies without evidence of murmurs 72% were doppler normal, 28% showed very mild stenosis present. By 18 months of age 77% had no murmur, and 23% (7 puppies) had a murmur. By 18 months, 28 of the 30 had aortic blood velocity of > 2.0 m/s. A minor mitral regurgitation was common (66%). Of the 77% with no murmur, 4% still had stenosis but there were no mitral valve abnormalities seen in this group. Of the 23% with murmurs, all had a mild form of SAS.

Puppies can have no structural disease evident and have a murmur. And conversely, there can be disease even if there is no murmur.

Conclusion - a murmur present in puppyhood does not guarantee that it will develop severity as the puppy ages, nor is there a guarantee that a murmur will not develop if one is not present initially. Dr. Dirven said the same happens in Boxers and Newfoundlands.

Dr. Dirven stated there is a gray area about what is "normal" for Bull Terriers. He asserted that you could make a final assessment of stenosis at 18 months, for they found the stenosis did not change after that point.

(**Note** Back in the late 1990's through the early 2000's the BTCA worked with Dr. John Bonagura from Ohio State Vet School, Dr. Nancy Morris, Cardiologist, and Dr. Bari Olivier from Michigan State Vet School on what we as a community should be (cardio) testing for and retaining records on. After working with our breed, they all suggested that they thought Bull Terrier cardiology findings would ultimately resemble those of Boxer's. Most especially that velocities in BT's might "normally" be slightly higher than other breeds. Only careful screening, compiling testing results and time would provide clear answers to these questions.)

Question – To breed or not to breed scenario? A 2-year-old bitch presents for a pre-breeding screen, asymptomatic, upon auscultation no murmur present, do we breed her?

Researcher's conclusions - We know heart murmurs exist in English Bull Terriers. Of the 103 dogs studied without murmurs, researchers found only 1 in 5 upon doppler echo had a normal heart.

Even without murmurs, the vast majority have some heart disease, albeit mostly very mild SAS. (Meaning elevated velocity) **Not having a murmur *is no guarantee* that there is no heart disease.**

Fact firmly emphasized by the researchers – **auscultation alone is not a good tool in assessing cardiac status in EBT's.**

Point of interest -The researchers attempted to see if the NTproBNP blood screening test would be effective as a tool to detect SAS. The test looks for increased levels of BNP which elevates with cardiac stress. Unfortunately, the test provided too many false negatives.

There are questions lingering – Not all is black and white. "What is normal" for Bull Terriers is still a gray area.

Question - In consideration of breeding, if normal dog velocity is <2.0 meters/second, **what do you do with a dog who's** 2.3 m/s (mild) or 3.5m/s (moderate) or 5.5 m/s (severe)? Remember that this test group average velocity was 2.56m/s.

All are abnormal, but if you exclude these dogs from the gene pool, what happens? The examples given were startling. I wish we had copies of the graph information. Remember overall research results state 85% of all dogs tested had some form of disease. Only 15% had truly "normal" hearts on echocardiogram. Of the 85% all are SAS, of these 92% are mild affliction and 8% are moderate or worse.

Dr. Dirven's statement is this – ***look at the whole health of the individual dog, not just one organ system.*** If you remove the dogs with any form of heart disease, what is left? His graphics were compelling. Are those remaining dogs free of all other forms of fault? Perhaps some of those left have kidney issues, or temperament or structural insufficiencies, or on and on until there are virtually not a handful left. Our gene pool is too limited to arbitrarily throw out the lot. We know well to select the best and healthiest - always breeding back to healthy animals, and most especially dogs from a healthy line of dogs. Keep breeding like to like, ever progressing toward our desired goal. And he reminded us that even though 85% of the tested dogs were affected, they fell into the mild range, they should have the same quality and quantity of life as normal dogs do. Breeding is always the balance of variables.

Of interest -Dr Dirven suggested breeders make final assessment of stenosis at 18 months – they found the stenosis did not change after that point. (Chris note – Dr. Bari Olivier says a popularly used dog or family of dogs should be cardio tested over a life time to monitor cardiac structure and function. Practical basis 2yrs, 4yrs and 6yrs, and if dog develops any symptoms

after that. There is some anecdotal evidence in his experience that there can be some cardiac change in structure and function.)

Last artifact of interest: The researchers looked at records of disease from Pet Insurance companies to see what maladies dogs were most often treated for and what ones actually resulted in death. Heart disease was the #1 most common diagnosis in dogs, but heart disease was 50th on the list for affecting long-lived-ness (quantity of life). The data showed GI issues were what resulted most often in termination of life.