

Epidemiological prevalence of aortic stenosis in dogs in Poland

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Summary

The aim of the study was to determine the epidemiological prevalence of aortic stenosis (AS) among dogs in Poland.

Among 287 dogs, diagnosed with congenital heart disease at the Department of Internal Diseases and the Clinic of Horses, Dogs and Cats, Faculty of Veterinary Medicine, at the Wrocław University of Environmental and Life Sciences in Poland, in the years 2004-2011, there were 97 dogs with diagnosed AS. Diagnosis was based on clinical signs and physical examination, including auscultation and echocardiography (two-dimensional and Doppler). AS constituted 33.8% of all diagnosed congenital heart defects. In our clinic, aortic stenosis and pulmonic stenosis share the 1st place among the most commonly presented congenital malformations. Out of all AS cases diagnosed in the clinic, 65.6% were mild, 20.3% severe, and 14.1% moderate. The predominant form of AS was subaortic stenosis, with 90.7% affected dogs. Other types were less common: valvular aortic stenosis and supra-ventricular aortic stenosis accounted for 8.3% and 1% of all AS cases, respectively. Females seem to be less predisposed than males. Among various breeds, the sex predisposition seems to be significant in the Golden Retriever breed, in which 3 times more males than females are affected.

The epidemiological prevalence of aortic stenosis among dogs in Poland is similar to that described in other European countries and America. Clinical signs usually do not appear in mild and moderate cases, so these dogs can live normally and reproduce for many years. In order to decrease the incidence of AS, it is important to do screening tests of predisposed breeds and exclude animals with all classes of this malformation from breeding.

Keywords: aortic stenosis, congenital heart malformations, dogs

Congenital heart defects play a major role in the morbidity and mortality of dogs under one year of age (3). Aortic stenosis (AS) is one of the most commonly reported defects, and it shares the first place with patent ductus arteriosus (PDA) and pulmonic stenosis (PS) (2, 3, 23). Aortic stenosis is an abnormal narrowing of the left ventricular outflow tract (LVOT), often due to the presence of a fibrous band of tissue. This defect is divided into three categories according to the site of lesions: subvalvular (SAS), valvular, and supra-ventricular, and to severity (depending on the pressure gradient across the stenotic area):

- mild – pressure gradients (PG) 16-40 mm Hg (velocities $v = 2.3-3.2$ m/s) or 20-49 mmHg (corresponding to velocities of 2.5-3.5 m/s)
- moderate – PG of 40-80 mm Hg ($v = 3.2-4.5$ m/s) or 50-80 mm Hg ($v = 3.5-4.5$ m/s)
- severe – PG above 80 mm Hg, velocities over 4.5 m/s (5, 11-13).

SAS has been reported as the most common form of AS in dogs (over 95%) (6, 12, 16). All types of stenosis progressively lead to the symmetric and concentric hypertrophy of the left ventricle (LV) as a result of high ejection pressure (16). Abnormal pressure develops to maintain cardiac output (9, 20). The hypertrophy of LV with myocardial ischemia can cause ventricular and supra-ventricular arrhythmias (1, 7). In SAS, fibrous tissue is placed just below the aortic ring. According to different degrees of stenosis, this tissue can be formed as subtle fibrous nodules or even as an extensive fibrous band or a fibromuscular tunnel encircling the LVOT (10).

Typically, aortic stenosis is a progressive disease with maximal severity within the first 12 to 15 months (5). Prognosis depends on the severity of malformation. Dogs with mild SAS have the best prognosis and can live full life without any signs of congenital disease. Animals with moderate stenosis have a fair to good prognosis. They often develop late complications, such as endocarditis or

signs of a reduced cardiac output. In the case of severe SAS, dogs are at a high risk of sudden death and develop clinical sign of left-sided heart failure.

The aim of the study was to determine the epidemiological prevalence of aortic stenosis among dogs in Poland on the basis of dogs diagnosed at the Department of Internal Diseases and the Clinic of Horses, Dogs and Cats, Faculty of Veterinary Medicine, at Wrocław University of Environmental and Life Sciences, Poland, and to compare it with other countries.

Material and methods

Among 287 dogs diagnosed with congenital heart disease at the Department of Internal Diseases and the Clinic of Horses, Dogs and Cats from 2004 to 2011, there were 97 dogs with AS.

Diagnosis was based on clinical signs and physical examination, including auscultation and echocardiography (two-dimensional and Doppler). Echocardiographic examination was carried out with an Aloka Prosound 4000+ with 3.5-8 mHz transducer. Patients were examined in standing and lying positions, and as recommended by the Echocardiography Committee of the Specialty of Cardiology of the American College of Veterinary Internal Medicine: in the standard right parasternal long- and short-axis views, left apical four- and five-chamber view, and subcostal view (22). In a few cases, autopsy was performed.

Results and discussion

There were 97 dogs with aortic stenosis aged from 1 month to 10 years. AS constituted 33.8% of all diagnosed congenital heart defects.

Thirty-one breeds were represented, and the most affected were Boxer, Golden Retriever, Bull Terrier, and Dogue de Bordeaux. Pure breed dogs were more commonly seen than mixed breeds (2%). Among dogs with AS, there were two times more males than females – 61 (62.9%) vs. 36 (37.1%). Sex distribution within each breed is shown in Table 1.

In most cases, no specific clinical signs were seen, and patients with SAS were identified during routine physical examination by auscultation. Systolic ejection murmur was detected, loudest at the left heart base. Two-dimensional and Doppler echocardiography were

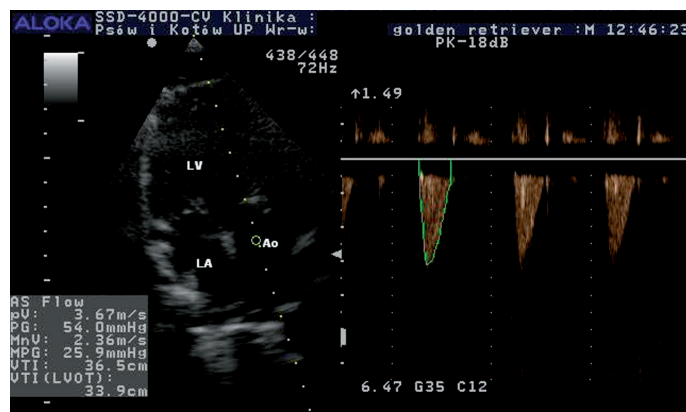


Fig. 1. Continuous-wave flow velocity measurement in the stenotic aorta. Left apical five-chamber long axis view of the heart of a dog with aortic stenosis

used to make the final diagnosis of AS and to classify its severity. Characteristic findings in AS included a concentric hypertrophy of the left ventricle with hyperechoic and ischemic subendocardial regions, especially in the papillary muscles, and the narrowing of LVOT. Dogs with SAS have various-sized fibrous nodules or ridges in the aortic subvalvular area. The aortic valve leaflets in some cases became thickened and misshapen as a result of turbulent flow. The aorta was dilated over the valve as a result of high pressure blood flow. Color Doppler showed systolic turbulent flow in LVOT. By pulsed-wave Doppler and continuous-wave Doppler, we performed a measurements of LVOT velocity and pressure gradient, which allowed us to classify the degree of stenosis (Fig. 1). In our clinic, 65.6% of AS cases were mild, 20.3% severe, and 14.1% moderate. The highest LVOT velocity amounted to 7.53 m/s in a Pug dog with a multiple malformation consisting of AS, PS, AR, and VSD. Aortic stenosis was very often part of a complex heart malformation (Tab. 2). The most commonly observed complex pathology was AS with concomitant PS – 15.6%. The predominant form of AS was SAS (90.7% of affected dogs). Other types were less common: valvular aortic stenosis and supra-aortic stenosis accounted for 8.3% and 1% of all AS cases, respectively.

Tab. 2. Multiple heart defects associated with aortic stenosis in dogs

Malformations associated with AS	Number of dogs
AS + PS	15
AS + AR	3
AS + AR + Tricuspid dysplasia	3
AS + PS + AR + VSD	2
AS + PDA	1
AS + PS + PDA	1
AS + PS + TR	1
AS + PS + PDA + AR + PR	1
AS + AR + Tricuspid dysplasia + Mitral dysplasia	1

Explanations: AS – Aortic Stenosis, PS – Pulmonic Stenosis, AR – Aortic Regurgitation, TR – Tricuspid Regurgitation, PDA – Patent Ductus Arteriosus, PR – Pulmonic Regurgitation, VSD – Ventricular Septal Defect

Tab. 1. Breed and sex distribution in dogs with aortic stenosis

Breed	Number of dogs	%	Male	Female
Boxer	27	27.8	12	15
Golden Retriever	15	15.5	11	4
Bullterrier	7	7.2	5	2
Dogue de Bordeaux	5	5.1	4	1
American Staffordshire Terrier	4	4.1	3	1
German Shepherd	3	3.1	2	1
Newfoundland	3	3.1	2	1
Mongrel	2	2.1	0	2
Other	31	32.0	22	9
Total number	97	100	61	36

Aortic stenosis is one of the most common congenital heart defects diagnosed in dogs (6). The exact prevalence is difficult to determine, but a number of studies report AS to be the 1st or 2nd most common congenital heart disease (2-4, 17, 23). In our clinic, aortic stenosis and pulmonic stenosis share the 1st place among the most commonly presented congenital malformations. In our study, AS constituted 33.8% of all congenital defects, which corresponds with the literature frequency of 17-35% (2, 12, 16, 23). Females seemed to be less predisposed than males. These results are similar to those reported by Oliveira et al. 2011, but male domination is not confirmed by other available literature. Among various breeds, there seems to be a significant sex predisposition in Golden Retriever, in which AS affects 3 times more males (11 males to 4 females). According to the literature, breeds predisposed to this defect include Newfoundland, Golden Retriever, German Shepherd, Boxer, Rottweiler, Bull Terrier, English Bulldog, Great Dane, German Short-Haired Pointer, Bouvier des Flandres, Samoyed, and Dogue de Bordeaux (8, 10, 15, 16). Our results were similar, except for American Staffordshire Terrier, but the number of these dogs was too small to determine the actual predisposition. In the Newfoundland breed, studies have revealed a genetic base of SAS as an inherited autosomal dominant trait with variable penetrance (18, 21). It is suggested, that this malformation is an acquired disease based on a genetic and congenital predisposition (24).

All of our results are based on the most recent classification of stenosis prepared by the European Society of Veterinary Cardiology. However, there was a group of 29 dogs that, according to this classification, were not affected by AS, although characteristic symptoms of stenosis, such as the concentric hypertrophy of the left ventricle, could be observed. These dogs had velocities of 1.91-2.21 m/s. Boxers were predominant in this group (34.5%). Bearing in mind these results, in some cases we should look into all the signs, instead of adhering to a rigid classification.

There is no effective therapy of SAS. Dogs with mild stenosis are usually asymptomatic and do not need any treatment (11). In moderate and severe cases, symptoms usually occurs (24). In these degrees of stenosis, treatment may be considered. Beta-blockers therapy is a non-invasive method of treatment that we apply. Open-heart surgery is not common in dogs, because of the complexity of the procedure, need for a cardiopulmonary bypass, and high cost to the owners. It is possible, however, to surgically excise the subvalvular lesion. Balloon valvuloplasty is less invasive, and the stenosis is dilated by one or two smaller balloons. Dogs treated by classic surgery or balloon valvuloplasty did not show any differences in time of survival compared to those treated only by beta-blockers, such as atenolol (14, 15). In view of these results, in our clinic we did not perform any procedures in AS.

Epidemiological prevalence of aortic stenosis among dogs in Poland is similar to that described in other European countries and America. Clinical signs usu-

ally do not appear in mild and moderate cases, so these dogs can live normally and reproduce for many years. In order to decrease the incidence of AS, it is important to do screening tests of predisposed breeds and exclude animals with all classes of this malformation from breeding. The knowledge about congenital heart defects among general practice veterinarians is still too low. It is important to spread information about AS among veterinarians, as well as among owners and breeders to warn them about this congenital malformation. An appropriate breeding program and cooperation between veterinarians and breeders are the best methods of limiting the genetic spread of this congenital heart disease.

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