TRICUSPID DYSPLASIA IN DOGS

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Abstract

The aim of the study was to estimate prevalence of tricuspid dysplasia (TD) in dogs with respect to breed, age, sex, clinical signs, and echocardiographic findings and to compare this data with literature. TD was found in 15 dogs (6.5% of congenital cardiac disease) of 215 dogs with congenital heart defects. All dogs had right heart enlargement on thoracic radiographs, echocardiography, and electrocardiography. Doppler echocardiography revealed tricuspid valve regurgitation. Seven dogs presented no clinical symptoms to date. TD took the form of Ebstein anomaly in all Labrador Retrievers, one Boxer, and one German Shepherd dog. TD predominated in males (11 males vs. three females). The body weight of the affected dogs, with the exception of the Miniature Schnauzer, exceeded 20 kg. Two dogs (Boxer and Bull Terrier) had additional congenital cardiac lesions in the form of mitral valve dysplasia. The most affected breeds in the study were the Labrador Retriever and Boxer.

Key words: dog, tricuspid dysplasia, congenital heart defect.

Tricuspid dysplasia (TD) represents a complex abnormal position or thickened valve leaflets, pathologically short or long chordae tendineae or papillary muscles. TD is a congenital heart disease, which rarely occurs in dogs and cats (16, 18-20). It is most commonly observed in large-breed dogs – over 20 kg of body weight, and is especially noted in Labrador Retrievers, Boxers, and German Shepherds, less frequently in Old English Sheepadogs, Great Danes, Weimaraners, and Irish Setters (6, 14). A retrospective study by Chetboul et al. (6) showed increased risk of TD in the Labrador Retriever by 35 and 7 times compared to other breeds and mongrels, respectively. A genetic study of Labrador Retriever suggested that TD is related to a single recessive gene susceptibility locus on CFA9 (1, 10). Small-breed dogs e.g. Yorkshire Terrier, Beagle, English Cocker Spaniel, French Bulldog, and Poodle may also be affected (11). The majority of affected dogs are of pure breed.

The aim of the study was to estimate prevalence of TD in Poland with respect to breed, age, sex, clinical signs, and echocardiographic findings and to compare this data with literature.

Material and Methods

Two hundred and fifteen dogs with congenital heart defects were patients of the Department. The dogs were presented for examination mostly at 8 months of age with loud heart murmur (14 dogs), exercise intolerance (eight dogs), respiratory distress (five dogs), ascites (four dogs), and hydrothorax (three dogs). Two dogs (Boxer and Bull Terrier) had additional congenital cardiac lesions in the form of mitral valve dysplasia. The dogs were referred for cardiologic examination to the Clinic, where thoracic radiographs (lateral and dorso-ventral), echocardiography using Aloka 4000+ (M- and B-Mode, colour, PW and CV Doppler) and electrocardiography were performed in accordance with acceptable standards.

The diagnostic procedures were done without the pharmacological sedation of animals.

Results

Tricuspid dysplasia was found in 15 dogs: three Boxers, three Labrador Retrievers, two Golden Retrievers, and one Bull Terrier, Doberman Pinscher, Great Dane, German Shepherd dog, Polish Lowland Sheepdog, Miniature Schnauzer, as well as Yorkshire Terrier. All dogs had right heart enlargement on thoracic radiographs, echocardiography, and electrocardiography. Doppler echocardiography revealed tricuspid valve regurgitation. Seven dogs showed no clinical symptoms to date. TD in the form of Ebstein’s anomaly was diagnosed in all Labrador Retrievers, in one Boxer, and in one German Shepherd dog (Fig. 1).

TD predominated in males (11 males vs. three females). With the exception of one Miniature Schnauzer, all affected dogs had a moderate to large body weight exceeding 20 kg.
Fig. 1. Dysplastic tricuspid valve – Ebstein’s anomaly in a 7 month Labrador Retriever.  
A. Echocardiography –apical four chamber view, with large right atrium and small right ventricle. LV - left ventricle, LA – left atrium.  
B. Autopsy in the same dog, enlarged right atrium (RA) and small right ventricle (RV)

Fig. 2. TD - Abnormal papillary muscle in enlarged right ventricle causing tricuspid regurgitation (TR) in 4-month-old Yorkshire Terrier. Right parasternal long axis view. RV – right ventricle, RA – right atrium, LV-left ventricle, LA – left atrium

Fig. 3. Necropsy of the dysplastic tricuspid valve in two dogs (A and B) with a lack of cordae tendineae between tricuspid valve and papillary muscle (arrows). The right figure (B) shows chaotic arrangement of chordate tendineae within the right ventricle
Discussion

Congenital and secondary tricuspid malformation are rare disorders in dogs. Secondary tricuspid insufficiency as a result of tricuspid endocardiosis, pulmonary hypertension, and right ventricular dilatation was occasionally observed in dogs, whereas in humans these cases are more common (14). The occurrence of tricuspid dysplasia ranges from 7.0% to 7.5% of all congenital heart defects (20).

However, prevalence and breed associations may exhibit geographical variations. In the study, TD made up 6.5% of congenital cardiac diseases. The disease can occur as a solitary anomaly or complex problem. The association of TD with mitral deformation is often observed because TD is a result of a developmental abnormality of the right ventricle, which can occur simultaneously with left ventricle developmental abnormalities (5, 7). In addition, TD has occasionally occurred simultaneously with ventricular septum defects, pulmonic stenosis, aortic stenosis, atrial septal defects, and persistent left cranial vena cava (8, 15). In the study, TD occurred with mitral dysplasia in 14% of TD cases.

Tricuspid dysplasia leads to right heart enlargement and signs of right heart failure: abdominal distension due to ascites, weakness, lethargy, jugular vein distension and pulsation, hepatomegaly, splenomegaly, and sometimes subcutaneous oedema. ECG examination may suggest right atrium and ventricular enlargement and may show arrhythmias. Echocardiography is the gold standard for TD diagnosis. The echocardiographic examination allows the assessment of mild, moderate, or severe TD. The classification is based on the degree of tricuspid leaflet deformation, regurgitation, and the size of right ventricle (7). TD may result in valvular insufficiency, stenosis, or both. All dogs examined in the study had severe tricuspid insufficiency (Fig. 2).

TD involved the leaflets and chordae tendinae and often papillary muscles (Fig. 3).

One of the forms of TD is Ebstein’s anomaly, which occurred in 1/3 of the dogs in the study. Similar frequency of TD and Ebstein’s anomaly was observed by Chetboul et al. (6). Ebstein’s anomaly is characterised by apical displacement of the septal and posterior tricuspid valve leaflets, leading to atrialisation of the right ventricle.

Surgery with artificial valve implantation is the only possibility that allows for full recovery. Successful surgery for TD in human medicine was described in 1962, while in animals this procedure is rarely performed because of the necessity to use extracorporeal circulation, as well as the technical challenges, high costs, and long convalescence (4). Nowadays, the surgical correction of TD described in human medicine is unfavourable in veterinary patients (9).

Pharmacological treatment is focused on maintaining the patient in the asymptomatic period for as long as possible. In rare cases in humans, the length of life exceeds 70 years (3). Survival of dogs with TD depends on the extent to which the normal function of the valves is compromised. Surprisingly, many dogs with severe TD exhibit no symptoms during a relatively long period – until they are in congestive heart failure. It is reasonable to use diuretics (furosemide, spironolactone), ACE inhibitors (enalapril, benazepril, imidapril), and, in some cases, positive inotropic drugs (digoxin, pimobendan) in different combinations. Positive inotropic drugs are given to improve glomerular filtration or to support left ventricular function during the end stage of the disease, when left sided heart failure develops (13). Antiarrhythmic drugs may become necessary in cases of arrhythmias. Supraventricular tachyarrhythmias are common but most dogs and cats do not develop any rhythm disturbances (12, 14, 17). Pharmacological treatment enables a short term improvement of clinical status. A well balanced diet with sufficient energy and low sodium is recommended e.g. Cardiac support diet, HD diet. In cases of deterioration oxygen therapy and evacuation of ascetic or/and pleural fluid may be needed.

Differential diagnosis includes myocarditis, tricuspid valve endocarditis, tricuspid endocardiosis, tricuspid valve prolaps, right ventricular dysplasia, right ventricular enlargement with tricuspidal regurgitation as a result of pulmonary insufficiency, and arrhythmogenic right ventricular cardiomyopathy (2).

To conclude, tricuspidal dysplasia was observed in 6.5 % of the dogs with congenital heart disease. The most affected breeds in the study were Labrador Retrievers and Boxers. Tricuspid dysplasia occurs 3 times more often in males than females.

References