



## CASE REPORT

### Estimation of mitral regurgitation by three methods in an asymptomatic Anatolian shepherd dog with degenerative mitral valve disease

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### Asemptomatik dejeneratif mitral kapak hastalığı olan bir kangal köpeğinde üç farklı metotla mitral regurgitasyonun belirlenmesi

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#### Öz

Selçuk Üniversitesi Veteriner Fakültesi Küçük Hayvan Hastahanesine kardiyak üfürüm şikayetiyle getirilen 8 yaşlı bir Kangal köpeğinde dejeneratif mitral kapak hastalığı teşhis edildi. Regürjitasyon şiddeti renkli akım Dopler muayeneyle sol atriyumdaki maksimum regürjitant jet alan oranı (ARJ/LAA), Doppler muayenelerle proksimal isovelosite yüzey alanı (PISA) ve çıkarma metodlarıyla kantite edildi. Her üç kantitatif metod da mitral yetmezlik olan Kangal köpeğinde hastalığın değerlendirilmesinde önemli bulundu.

**Anahtar kelimeler:** Dejeneratif mitral kapak hastalığı, ekokardiyografi, mitral regurgitasyon, Kangal köpeği

#### Abstract

An 8 years old male Anatolian shepherd dog (ASH) was referred to the Small Animal Hospital of the Faculty of Veterinary Medicine of Selçuk University with a history of cardiac murmur. The diagnosis was asymptomatic degenerative mitral valve disease. The severity of regurgitation was quantified by the maximal ratio of the regurgitant jet area signal by color Doppler to Left atrium area (ARJ/LAA), the proximal isovelocity surface area (PISA) and the subtraction methods by Doppler examinations. The each quantification methods was valuable to assess the severity of disease in ASH with MR.

**Keywords:** Degenerative mitral valve disease, echocardiography, mitral regurgitation, Anatolian shepherd dog



Degenerative mitral valvular disease (DMVD) is the most common heart disease, causing mitral regurgitation (MR) in dogs (Bonagura and Schober 2009, Terzo et al 2009). Dogs with mild to moderate disease are usually asymptomatic because of compensation of left ventricle (LV) function (Haggs-trööm et al 2009). It is reasonable to surmise that the blood volume ejected into the left atrium (LA) in systole is the major determinant of the degree of left heart volume overload in these dogs (Kittleson and Brown 2003). One of the methods commonly used to assess semi-quantification MR severity in dogs with DMVD consists of calculating the maximal ratio of the regurgitant jet area signal to LA area (ARJ/LAA) using color flow Doppler mode (Kittleson and Brown 2003, Muzzi et al 2003, Gouni et al 2007, Chetboul and Tissier 2012). The other methods to determine regurgitant volume (RegV) quantitatively are a) the proximal isovelocity surface area (PISA) method, and b) the subtraction method (Doiguchi and Takahashi 2000, Boon 2012 Chetboul and Tissier 2012, Paiva et al 2012).

An 8 years old male Anatolian shepherd dog (ASH) was referred to the Small Animal Hospital of the Faculty of Veterinary Medicine of Selçuk University with a history of cardiac murmur. Clinical and laboratory examinations, electrocardiographic study, chest radiography and blood pressure measurements were performed. The dog had also standard 2-D, M-mode, and Doppler examinations in accordance with techniques described by Boon (Boon 2012). The severity of regurgitation was semi-quantified by ARJ/LAA method. Quantitation of regurgitant volume (RegV) and regurgitant fraction (RF) were assessed by both PISA method and subtracting method (Boon 2012).

At the physical examination of the dog, the clinical examination findings were found to be normal. The only abnormality at physical examination was the III. degree holosystolic murmur on the left apical region of the heart. Hemogram and serum biochemistry panel results were in normal limits. The dog had normal blood pressure. In the radiographic assessment, the heart was slightly big [Vertebral heart scale (VHS): 10.6]. The severity of the heart disease was classified according to the American College of Veterinary Internal Medicine (ACVIM) consensus statement based on radiographic heart (VHS) and echocardiographic LA size (LA/Ao: 1.75). It was the stage B2.

Table 1. The ARJ/LAA and, the values of RegV and RF determined by PISA and Subtracting methods of the dog.

Methods	RegV (mL)	RF (%)
ARJ/LAA	-	20-40
PISA	42.9	34
Subtracting	40.9	31

ARJ/LAA: Maximal ratio of the regurgitant jet area signal to left atrial area, PISA: Proximal isovelocity surface area, regurgitant volume (RegV): Regurgitant fraction (RF)



Figure 1. Left apical four-chamber view, both mitral valves are fibrotic and nodular.



Figure 2. 1. Left apical four-chamber view shows central regurgitant jet which filled 20-40% of the left atrium.



Figure 3. Measurement of appeared hemispheric circle in the proximal surface of insufficiant mitral valve.

In 2-D echocardiographic examinations, both mitral valves were fibrotic and nodular (Figure 1). On the color flow Doppler examination, there was a central regurgitant jet, filled 20-40% of the LA (Table 1, Figure 2). According to the results of both PISA method (Figure 3) and subtracting method, RegV and RF values were quite similar to each other (Table





1). ARJ/LAA method has both advantage and disadvantage (Boon 2012). Easy of data acquisition, and its good reproducibility are the major advantage of this method. ARJ/LAA corresponds very well to the degrees of MR and the severity of the disease (Muzzi et al 2003, Gouni et al 2007). However, this technique is a semi-quantitative method for the assessment of the regurgitant volume (Chetboul and Tissier 2012). We agreed that ARJ/LAA method was rapid and reproducible. The observed ARJ/LAA (20-40 %) was mostly comparable with the stage of heart failure (B2).

The PISA method is used to quantify mitral valve regurgitation by Doppler technique. In the case of MR, in which there is an eccentric jet or there is no PISA, RegV is determined by subtracting method (Doiguchi and Takahashi 2000, Boon 2012, Chetboul and Tissier 2012, Paiva et al 2012). The both methods have good correlation ( $r^2 = 0.94$ ) (Doiguchi and Takahashi 2000). The main advantage of these two quantitative methods is the more discriminative in the assessment of MR severity compared to the ARJ/LAA method, providing assessment of both RegV and RF (Kittleson and Brown 2003, Gouni et al 2007). The disadvantage of both PISA method and subtracting method is more time-consuming. It may sometimes be difficult to judge the precise location of the orifice and the flow convergence shape in the PISA method (Utsunomiya et al 1991). The primary problem in subtracting method is the calculation of the cross-sectional area of the aorta by using a diameter measurement. Because the calculation involves squaring the radius (Kittleson and Brown 2003). Although, both methods are more time-consuming, we observed these two quantitative methods are more discriminative of MR severity compared to ARJ/LAA method.

Mitral insufficiency is usually considered as moderate and severe, for RF values higher than 30-50% and 75%, respectively (Kittleson and Brown 2003, Gouni et al 2007, Chetboul et al 2009). RF in our dog was 34% for the PISA method and 31% for the subtracting method (Table 1). Therefore, we may inform that the dog had moderate mitral insufficiency. RegV is another parameter which can be used in the quantification of MR. RegV in our dog was 42.9 ml for the PISA method and 40.9 ml for the subtracting method (Table 1). In several studies performed on dogs with DMVD, RF was significantly correlated with clinical parameters (ISACHC class, heart murmur grade), and the LA size as assessed by the LA/Ao ratio (Kittleson and Brown 2003, Muzzi et al 2003, Gouni et al 2007, Chetboul et al 2009, Serres et al 2009). The values of RegV and RF obtained by two methods in our dog were comparable with the stage of heart failure (B2) and moderate mitral regurgitation.

Correlation of ARJ/LAA in mitral regurgitation with both RegV and RF is controversial. ARJ/LAA has been shown to be significantly correlated with RF (Muzzi et al 2003, Chetboul and Tissier 2012). However, these results were different to those of Spain et al. (1989) and Grossmann et al. (1995) in

humans and Kittleson and Brown (2003) in dogs. However, it was determined that ARJ/LAA (20-40%) was quite close to the RegV and RF values determined by both PISA (RF: 34%; RegV: 42.9 mL) and subtracting (RF: 31%; RegV: 40.9 mL) methods in this case (Table 1). ARJ/LAA was easy to obtain as opposed to the PISA and the subtraction method. However, each quantification method was valuable to assess the severity of disease in ASH with MR and all were in good accordance with echocardiographic heart size. Therefore, each of these non-invasive methods may be useful to serially assess severity of MR in DMVD in order to monitor the disease.

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