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Assessment of left atrial function via strain analysis derived from two-dimensional speckle tracking echocardiography in dogs
(2D スペックルトラッキング心エコー図法によるストレイン解析を用いた
犬の左心房機能の評価)

Two-dimensional speckle tracking echocardiography (2D-STE) is an angle-independent imaging that allows the assessment of myocardial deformation expressed by strain and strain rate (SR) for detection of left atrial (LA) dysfunction in various cardiac diseases. However, the data on normal values for LA strain/SR in dogs are few. Such normal values along with repeatability are useful before clinical investigation. Therefore, this study aimed to assess the feasibility of LA strain and SR and provide the normal values in healthy dogs, elucidate the relations of 2D-STE derived parameters with conventional echocardiographic parameters including investigation of multiple effect that might influence on LA function such as age, heart rate, body weight. In addition, most of echocardiographic parameters are known to be affected by cardiac loading and such load dependency on LA strain analysis remains unclear in dogs. Therefore, in this study, with the purpose of evaluating the usefulness of dog's left atrial strain imaging method, the following two chapters were focused on.

In the first chapter, 6 healthy beagles were used for repeatability study to confirm the feasibility of using 2D-STE and 120 conscious dogs were recruited for establishing the normal reference interval of LA strain and SR in dogs. All dogs were underwent standard echocardiography and offline analysis for LA strain and SR. The results of chapter 1 demonstrated that the intra-, inter-day and inter-observer variations of strain/SR variables showed adequate repeatability (coefficient of variation <20%). LA strain during conduit function showed moderate correlation with diastolic doppler based parameters. In multiple regression analysis, only age was significantly related to all of indices indicating conduit function.

In the second chapter, this study evaluated the impact of acute volume load change on LA strain, SR in experimental cardiac loading dog models. 6 healthy beagles were anesthetized and increased cardiac preload in the heart by intravenous infusion of fluid. A Swan-Ganz catheter was placed to directly measure mean pulmonary capillary wedge pressure (PCWP). Transthoracic echocardiography was performed before (baseline) and at 15, 30, 45, 60, 75 and 90 minutes after volume loading began. At each assessment point, apical 4-chamber images focused on LA were digitally recorded for later strain analysis via 2D-STE. Our findings

indicated that All of left atrial phasic functions analyzed by strain and SR were enhanced during experimental cardiac volume loading in healthy dogs. Mean PCWP was significantly greater than baseline and there were significant relationships between PCWP and LA functional parameters. These current results indicated that the left atrial phasic function obtained by strain analysis could be increased after volume overload and the increase in LA pressure is the main cause of increased LA functional indices. Therefore, LA strain indices should be concerned for diagnosis of dog with volume loading stated diseases particular in dogs with an early stage of disease progression.

This study demonstrates that 2D-STE represents a feasible technique to assess LA function within clinical acceptability. However, age, body weight, heart rate and volume load effect should be considered when interpreting LA deformation indices in dogs with heart disease.