

Measurement of Renal Volume using Ultrasonography and Dual-Channel Computed Tomography in Beagle Dogs

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Purpose: Alterations in shape and size of the kidney occur commonly as a result of many renal diseases. Renal volume is a more sensitive index of renal size than renal length for the detection of renal abnormalities. In this study, we estimated the normal renal volume in adult beagle dogs by using ultrasonography and dual-channel CT and compared two different diagnostic modalities.

Materials and Methods: Ultrasonographic linear and area measurements and iodine-enhanced dual-channel CT were performed on both kidneys in 10 normal beagle dogs. Renal volumes were calculated from linear and area data applying three prolate ellipsoid (PE) models for each kidney on the ultrasonography: biplane length-diameter method (PE/A), biplane area-length method (PE/B) and single plane area-length method (PE/C). Dual-channel CT scan was initiated after 2 minutes with the beginning of contrast medium injection (300mgI/ml iohexol, 2ml/kg, 3ml/s, IV). On CT images, the renal volume was measured by 2-D growing (2-DG) image for each kidney using volume rendering software. Data were evaluated using the linear regression analysis and ANOVA.

Results: There was no significant difference between the right and left renal volume on the all methods ($p=0.01$). The mean kidney volumes were $22.01\pm 6.07\text{cm}^3$, $21.69\pm 5.74\text{cm}^3$, $19.79\pm 6.27\text{cm}^3$ and $27.39\pm 8.63\text{cm}^3$ on PE/A, PE/B, PE/C methods of ultrasound and computed tomographic 2-D growing methods, respectively. There were no significant difference between the PE/A, PE/B methods and 2-DG method ($p>0.05$). PE/C method was the best correlation when results from the three difference methods were compared to actual renal volume in previous study, however, there was significant difference between PE/C and 2-DG method ($p=0.04$). Body weight was significantly correlated with renal volume by imaging tools, ultrasonography and dual-channel CT.

Conclusion: Renal volume can be measured by ultrasonographic PE/A, PE/B methods and computed tomographic 2-DG method, however, the calculations using PE methods tend to more underestimate renal volume than dual channel CT method.

Key words: renal volume, ultrasonography, dual-channel CT, beagle

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