The Optimal Right Atrial Volume Measurement Technique by 2-Dimensional Echocardiography —A Comparative Study to 3-Dimensional Echocardiography—

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Abstract

Purpose: Accurate right atrial volume (RAV) assessment can be achieved by 3-dimensional echocardiography (3DE). However, 3DE has the disadvantage of requiring a complicated and time consuming post-processing analysis. The aims of this study were to compare the 3DE and 2-dimensional (2DE) RAV measurements and to explore the possible applications of the optimal 2DE derived RAV (2D-RAV) measurement technique.

Subjects and Methods: We studied 57 patients who underwent both 2DE and 3DE. The RA maximum view (RA-Max) was defined as the section with the maximum RA short diameter. The RA minimum view (RA-Min) was defined as the section with the minimum RA short diameter. 2D-RAVs were obtained by the following techniques: 1) the biplane area-length technique using the above two sections (Bi-AL); 2) the biplane disk summation technique using the above two sections (Bi-DS); 3) the single-plane area-length technique using RA-Max (Max-Si-AL); 4) the single-plane disk summation technique using RA-Max (Max-Si-DS); 5) the single-plane area-length technique using RA-Min (Min-Si-AL); and 6) the single-plane disk summation technique using RA-Min (Min-Si-DS). We compared each 2D-RAV with the 3D-derived RAV (3D-RAV), and assessed agreement between the 2D-RAV and 3D-RAV by a Bland-Altman plot.

Results: We found a good correlation between each 2D-RAV and 3D-RAV (Bi-AL, r=0.99; Bi-DS, r=0.99; Max-Si-AL, r=0.88; Max-Si-DS, r=0.87; Min-SI-AL, r=0.95; Min-Si-DS, r=0.93. $p<0.01$ for all). The Bland-Altman plot showed that the biplane technique closely correlated with 3D-RAV, but the single-plane technique using RA-Max resulted in an overestimation, and the RA-Min resulted in an underestimation (bias (limits of agreement, LOA): Bi-AL, 0.8 ml (LOA: −6.5 to 8.0 ml); Bi-DS, 2.9 ml (LOA: −12.8 to 7.0 ml); Max-Si-AL, 20.2 ml (LOA: −7.7 to 48.1 ml); Max-Si-DS, 15.1 ml (LOA: −14.2 to 4.4 ml); Min-Si-AL, −13.6 ml (LOA: −31.5 to 4.3 ml); Min-Si-DS, −14.8 ml (LOA: −35.6 to 6.1 ml)).

Conclusion: The results we obtained by the Bi-AL using RA-Max and RA-Min were closely correlated with the results by the 3D-RAV; this suggests that the Bi-AL RAV assessment is the optimal 2D-RAV measurement technique.

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