Comparison of various instantaneous pulmonary arterial wedge pressure measurements with prognostic validation

A.I. Nagy[1], J. Johnson[2], L.H. Lund[3], A. Manouras[4]

[1]Semmelweis University, Heart Center, Budapest, Hungary; [2]Karolinska University Hospital, Centre for Fetal Medicine Department of Obstetrics and Gynecology, Stockholm, Sweden; [3]Karolinska Institute, Department of Medicine, Stockholm, Sweden; [4]Karolinska University Hospital, Theme of Heart and Vessels, Stockholm, Sweden

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Background: Current recommendations on the diagnosis of pulmonary hypertension due to left heart disease (PH-LHD) emphasize the need for standardization of pulmonary arterial wedge pressure (PAWP) measurement. Instead of mean PAWP values instantaneous mid-A wave pressures or, in case of atrial fibrillation (AF), measurement 130–160 ms after the QRS onset is recommended. Recently, PAWP at the QRS onset has also been proposed. Our aim was to compare the various instantaneous PAWP measurements and assess the prognostic value of the derived diastolic pressure gradients (DPG) in heart failure (HF) patients.

Methods and results: PAWP and pulmonary arterial pressure (PAP) tracings of 116 patients with PH-LHD were manually analyzed offline. PAWP was measured in 4 different ways: 1. mean value [PAWPM]; 2.mid-A wave value in sinus, and at 10 ms intervals 130–160 ms following QRS onset in AF [PAWPR]; 3. at the onset of the QRS complex [PAWPQRS]; 4. pre C-wave point value [PAWPC]. The pre C-wave point was chosen as a reference for truly end-diastolic pressures. The corresponding DPGM, DPGR, DPGQRS and DPGC were calculated. The patients were followed for 17 (8–27) months and the prognostic value of the various DPG measurements for predicting all-cause mortality was assessed. The pre C-wave point was identifiable in 35 patients (30%); on average it occurred 171 ms after the QRS-onset whereas the A wave-onset and A-wave peak happened on average 62 and 149 ms after the QRS-onset, respectively. All three instantaneous PAWP measurements gave significantly lower values than PAWPM [19.3 (15.4–25.0)]. PAWPR did not differ from PAWPC [18.1 mmHg (14–22) vs. 19.2 mmHg (13–22.8), p=0.9], whereas PAWPQRS was lower [15.8 mmHg (12.2–19.9), $p<0.001$]. Accordingly, all instantaneous DPG measurements were higher than DPGM, yielding lower prevalence of negative DPG (29%, 17% and 45%, for DPGR, DPGQRS and DPGM, respectively). In AF (n=30), DPGR values at 130–140–150–160 ms demonstrated increasing scatter and progressively overestimated DPGQRS. For prognostic assessment, in case of both DPGQRS and DPGR, 6 mmHg was identified as a best cut-off value for predicting all-cause mortality, at which both indices provided superior prognostic information than DPGM [DPGR: HR 2.7; CI 1.1–6.9, p=0.029; DPGQRS: HR 2.6; CI 1.1–6.4, p=0.037, high-risk cases 17 for both; DPGM: HR 2.8; CI 1.0–7.6, p=0.045, high-risk cases 10].

Conclusions: PAWP measured at the mid-A wave provides a reliable assessment of the end-diastolic PAWP in sinus rhythm. On the other hand, ECG-gated measurements yield more robust evaluation of PAWP in AF. Finally, both approaches carry significant and similar prognostic information in PH-LHD.