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### Left atrial mechanics in patients with acute pulmonary edema and preserved ejection fraction

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**Background:** The left atrium (LA) is a highly dynamic chamber that has 3 mechanical functions (reservoir, conduit, booster pump), as well as additional endocrine and regulatory properties. It is a marker of both the severity and chronicity of diastolic dysfunction and its remodelling has been shown to be a reliable predictor of clinical outcome in patients with heart disease. While LA function has been extensively studied in chronic heart failure, information about LA mechanics in patients with acute heart failure and preserved left ventricular ejection fraction (EF) are scarce.

**Purpose:** We sought to assess LA mechanics in a cohort of patients with acute pulmonary edema and preserved EF and compare it with a normal reference group.

**Methods:** We included 50 consecutive patients (22 men) with acute pulmonary edema, preserved EF and sinus rhythm in our study. Patients with significant mitral or aortic valve disease were not considered eligible. The control group consisted of 30 subjects (18 men) with no previous cardiovascular disease. We performed conventional transthoracic echocardiography for all patients and we assessed various parameters of LA mechanics. To evaluate the reservoir function, we determined the total ejection volume (EV), the total EF, the LA expansion index (LAEI) and the LA function index (LAFI). To evaluate the conduit function, we determined the passive EV and passive EF. For the booster pump function, we determined the active EV, active EF, the atrial filling fraction, the ejection force and the LA kinetic

energy (LAKE). We used T-test to compare the parameters between the two groups.

**Results:** The mean age in the study group was  $72 \pm 14$  years, while in the control group the mean age was  $56 \pm 16$  years ( $p=0.06$ ). The total EV did not differ significantly between groups ( $p=0.44$ ). The total LA ejection fraction was lower in the study group:  $29 \pm 10\%$  vs.  $51 \pm 9\%$  ( $p<0.001$ ), as well as the LAEI ( $45.1 \pm 24.6$  vs.  $110.9 \pm 32.1$ ,  $p<0.001$ ) and the LAFI ( $0.17 \pm 0.12$  vs.  $0.58 \pm 0.20$ ,  $p<0.001$ ). Among parameters assessing LA conduit function, there were no differences in passive EV ( $p=0.64$ ), but passive LA ejection fraction was significantly lower in the study group:  $15 \pm 7\%$  vs.  $28 \pm 11\%$ ,  $p=0.003$ . The same trend was noted for active LA ejection fraction ( $16 \pm 10\%$  vs.  $31 \pm 13\%$ ,  $p=0.005$ ). The ejection force was impaired in the study group:  $39.1 \pm 30.6$  kdynes vs.  $15.2 \pm 12.3$  kdynes,  $p<0.001$ . Other parameters evaluating LA booster pump function did not differ significantly between groups ( $p=0.12$  for atrial filling fraction,  $p=0.74$  for LAKE).

**Conclusion:** All three integrated phases of left atrial mechanics (reservoir, conduit, booster pump) are impaired in patients with acute pulmonary edema and preserved left ventricular EF. These findings highlight the importance of diastolic dysfunction in the pathogenesis of acute heart failure for these patients and they suggest that LA dysfunction might be a potential therapeutic target in this clinical setting.