

YIA-3

History of open heart surgeries strongly predicts a type of restrictive ventricular characteristics (constrictive or restrictive) in repaired adult patients with congenital heart disease

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Background:

Adults with congenital heart disease (ACHD) often have histories of multiple open heart surgeries (OHS) that may cause restrictive hemodynamics characterized by high central venous and ventricular end-diastolic pressures (CVP, EDP). Constrictive change due to pericardial adhesion and restrictive remodeling of myocardium after OHS might coexist. Their characteristics and clinical features have not been well described.

Methods:

We studied 64 consecutive postoperative ACHD patients with biventricular physiology (29 ± 10 years old, tetralogy of Fallot's in 37, 29 males). We obtained intracardiac pressure waveforms by cardiac catheterization and calculated the ratio of the right ventricular to left ventricular systolic pressure-time area during inspiration versus expiration (systolic area index; SAI, JACC 2008) that is the gold standard for differentiating ventricular constriction ($SAI > 1.1$) from restrictive physiology ($SAI < 1.1$). We compared the SAI with clinical profiles, including hemodynamic parameters and peak oxygen uptake (peak VO_2).

Results:

Of clinical variables, the number of OHS was the only determinant of SAI ($r = 0.45$, $p < 0.001$). We divided our patients into four subgroups based on the number of OHS; ACHD who had undergone OHS never ($n=3$), once ($n=33$), twice or three times ($n=21$), and more than three times ($n=7$). The percentage of $SAI > 1.1$ for each group was 0%, 36%, 62% and 0%, respectively, suggesting their ventricular characteristics would shift from constrictive to restrictive as the number of OHS increased. Age, sex, ejection fraction of both ventricles, and cardiac index were not significantly different between the groups ($p > 0.1$). However, ACHD with greater number of OHS showed smaller left ventricular end-diastolic volume (80, 87, 90, 71 mL/m², respectively, $p = 0.024$), lower peak VO_2 (27, 27, 24, 17 mL/kg/min, respectively, $p < 0.01$), higher CVP (4, 3, 7, 15 mmHg, respectively, $p < 0.001$), higher EDP of both ventricles, and higher levels of serum brain natriuretic peptide (9, 32, 49, 163 pg/mL, respectively, $p < 0.02$).

Conclusion:

In postoperative ACHD patients with biventricular physiology, most patients show constrictive changes. And restrictive myocardial damages may add on the constrictive characteristics with the histories of multiple OHS, resulting in advanced ventricular diastolic dysfunction.