Papillary muscle approximation to the septum as an adjunct technique for addressing tricuspid regurgitation in congenital heart disease

Objective:
Standard approaches are not always effective in addressing tricuspid regurgitation (TR) caused by distortion of RV geometry. RV papillary muscle approximation (RVPMA) is a promising technique that may improve leaflet coaptation by relieving leaflet tethering forces caused by papillary muscle displacement. We assessed the safety and long-term results of using RVPMA to address TR in patients with congenital heart disease.

Methods:
RVPMA consisted of suturing the anterior papillary muscle to a point of the septum to optimize coaptation of the anterior leaflet with the septal and posterior leaflets. TR was graded as 0 (none), 1 (trivial), 2 (mild), 3 (moderate), or 4 (severe).

Results:
Of 825 TV repairs during 2012-2021, 207 (25.1%) involved RVPMA as an adjunct procedure. The anatomy was Ebstein's anomaly in 11 (5.3%), Tetralogy of Fallot in 32 (15.5%), pulmonary atresia with intact ventricular septum in 19 (9.2%), hypoplastic left heart syndrome in 58 (28.0%), and other tricuspid dysplasia in 86 (41.5%) of patients. Seventy-five percent (157/207) of patients had more than one mechanism of TR (leaflet tethering, annular dilatation, leaflet prolapse, or leaflet dysplasia). Median (IQR) TR grades were 3 (2.5, 4) pre-operatively, 2 (1, 2.5) at discharge, and 2 (2-2.5) at latest follow-up. Discharge and follow-up TR grades were significantly lower than pre-op (p < 0.001). There were 11 (5.3%) early TV re-repairs, 2 of which were due to dehiscence of the PMA sutures, and 6 (2.9%) early deaths. At a median (IQR) latest follow-up of 3.2 (0.7, 6.8) years, there were 21 (10.7%) late TV re-repairs, none of which were due to failure of the PMA, and 14 (7.1%) late deaths. Re-addressing TR was the primary indication in 20/32 (62.5%) of re-operations. None of the patients (n=15) undergoing isolated TV repair required re-operation. No deaths were directly related to the TV. Univariate logistic regression identified older age as a protective factor for TV re-operation (OR 0.93, p = 0.015), while a systemic right ventricle (OR 2.92, p = 0.011), multiple mechanisms of TR (OR 5.21, p = 0.028), undergoing a concomitant procedure addressing the subvalvular apparatus (OR 2.39, p = 0.030), and higher TR grade at discharge (OR 2.67, p = 0.009) were risk factors.

Conclusions:
RVPMA is a safe and effective technique that may improve the repair of TR in congenital heart disease. Future studies should compare outcomes of TV repair with and without RVPMA.

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