

# Impact of the Three-Dimensional Geometry of the Atrioventricular Valve Annulus on Atrioventricular Valve Regurgitation After Fontan Palliation

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## Abstract

**Purpose:** Atrioventricular valve regurgitation is a known risk factor for adverse outcomes in patients who undergo Fontan palliation. However, the mechanism of atrioventricular valve regurgitation development has not been clarified in these patients. We aimed to assess the relationship between atrioventricular valve regurgitation and annulus morphology and examine the mechanism of atrioventricular valve regurgitation in Fontan palliation.

**Patients and Methods:** A total of 102 patients who underwent Fontan palliation and three-dimensional transthoracic echocardiography were retrospectively evaluated. The dataset of the atrioventricular valve obtained by three-dimensional transthoracic echocardiography and the following parameters were measured to characterize the three-dimensional geometry of the atrioventricular valve annulus: annulus area, annulus height, and bending angle. The atrioventricular valve was classified into the following five groups: common atrioventricular valve, single tricuspid valve, single mitral valve, tricuspid valve in two separate valves, and mitral valve in two separate valves. The atrioventricular valve annulus parameters were compared between the five groups. The atrioventricular valve regurgitation severity was assessed by the vena contracta width, and its relationship with the atrioventricular valve annulus parameters was evaluated.

**Results and Discussion:** Atrioventricular valve morphology was the common atrioventricular valve in 33 patients, single tricuspid valve in 22 patients, single mitral valve in 32 patients, and two separate valves in 15 patients. The common atrioventricular and single tricuspid valves had a larger annulus area, smaller height, and larger bending angle than the other atrioventricular valve morphologies. The frequency of greater than or equal to moderate atrioventricular valve regurgitation was higher in patients with the common atrioventricular and single tricuspid valves. In the common atrioventricular and single tricuspid valves, vena contracta width correlated with annulus area, and functional single ventricular size. The annulus area was an independent determinant of vena contracta width after adjustment for functional single ventricular size.

**Conclusion:** Atrioventricular valve regurgitation was observed significantly more frequently in patients with the common atrioventricular and single tricuspid valves than with the other atrioventricular valve morphologies after Fontan palliation. The increased annulus area and functional single ventricular size are suggested to be important features in the mechanism of atrioventricular valve regurgitation.

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