

Totally Endoscopic Multivalve Surgery Using A Three Dimensional Endoscopic System Without Robotic Assistance: The Initial Experience

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Background: Endoscopic valve surgery has become an established alternative to conventional sternotomy. However, its application has largely been limited to single-valve procedures, while totally endoscopic multi-valve surgery remains technically challenging. This study aimed to evaluate the feasibility, safety, and early outcomes of totally endoscopic multi-valve cardiac surgery using a three-dimensional endoscopic system without robotic assistance.

Methods: This prospective descriptive study included consecutive patients undergoing concomitant mitral and aortic valve surgery, with or without additional procedures, between December 2023 and December 2025. Peripheral cardiopulmonary bypass was established via the femoral vessels and the right internal jugular vein. All procedures were performed through a 4-5 cm right mini-thoracotomy at the fourth intercostal space. Aortic cross-clamping was achieved using a transthoracic Chitwood or Glauber clamp, and myocardial protection was provided with antegrade Custodiol cardioplegia(See **Fig1, Fig2**). Surgical procedures were performed under 3D endoscopic visualization without robotic assistance(See **Fig3**).

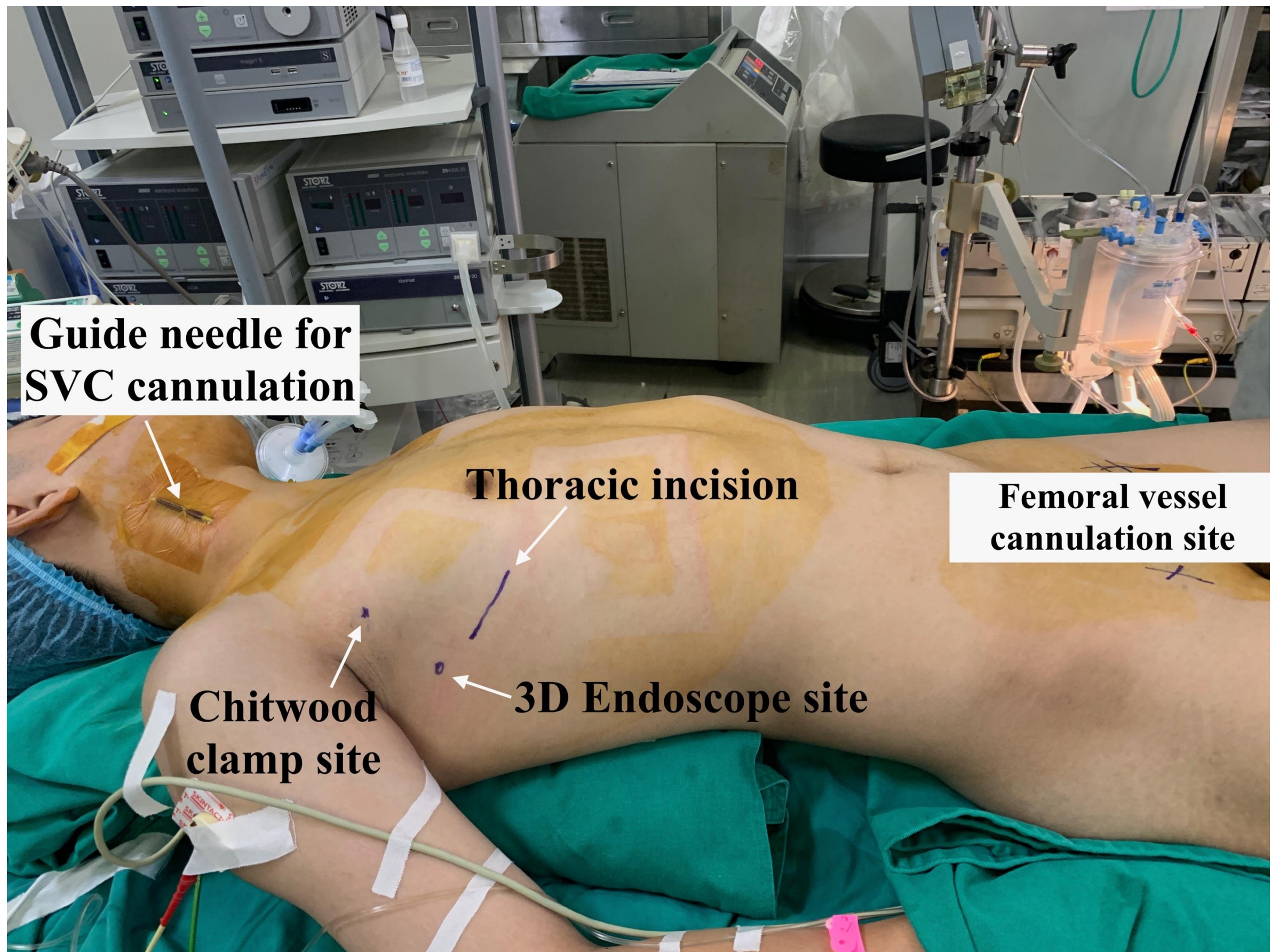


Fig1: Patient preparation

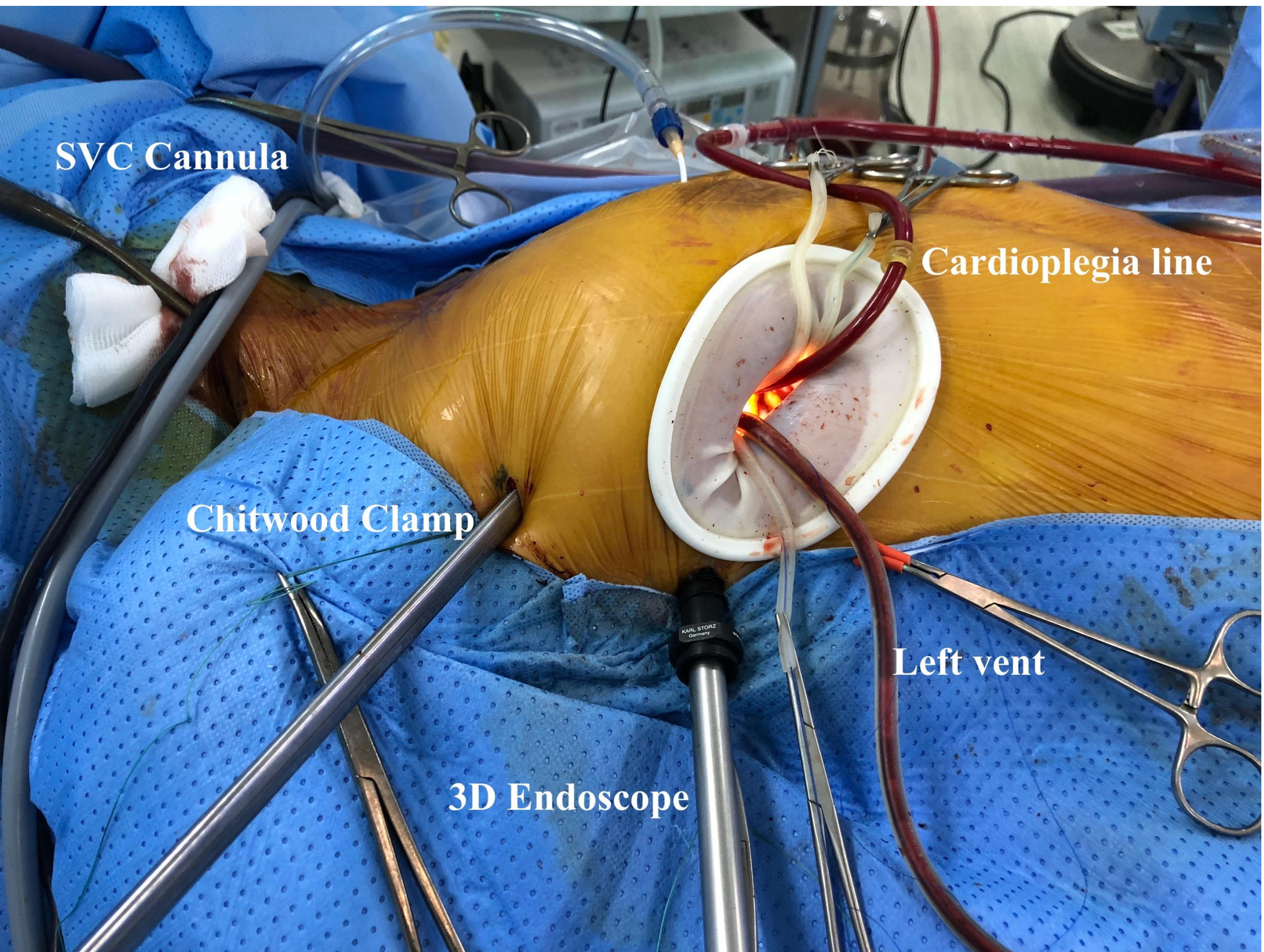


Fig2: Instruments setting up



Fig3: Surgical view

Conclusions: Totally endoscopic multi-valve surgery using a three-dimensional endoscopic system without robotic assistance is feasible and safe for patients requiring concomitant multi-valve interventions. However, operative times remain prolonged, and the procedure requires substantial surgical expertise, a well-coordinated multidisciplinary team, and adequate technical support.

Results: A total of 38 patients (20 males and 18 females; mean age 56 ± 8 years) underwent totally endoscopic multi-valve surgery. Surgical combinations included mitral valve replacement or repair combined with aortic valve replacement, with selected concomitant procedures such as tricuspid valve repair, MAZE procedure, left atrial appendage closure, atrial septal defect or patent foramen ovale closure, and left atrial thrombus removal. No conversion to median sternotomy or conventional open surgery was required. There was no 30-day mortality. Two patients (5.3 percent) experienced major cerebrovascular complications. The mean operative time was 360.9 ± 56.4 minutes, cardiopulmonary bypass time was 277.6 ± 46.9 minutes, and aortic cross-clamp time was 186.2 ± 38.1 minutes. The mean duration of mechanical ventilation was 53.3 ± 33.6 hours, and the mean intensive care unit stay was 4.95 days.