

Transaxillary direct view mitral and tricuspid valve repair

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Clinical vignette

A 63-year-old male was referred to our department for severe degenerative mitral valve regurgitation and progressive exertional dyspnea [New York Heart Association (NYHA) class II], without any history of atrial fibrillation. Preoperative transesophageal echocardiography (TEE) demonstrated preserved left ventricular ejection fraction and dimensions, confirming severe mitral regurgitation caused by P2 segment prolapse and marked annular dilatation, associated with moderate tricuspid regurgitation. Following a comprehensive preoperative evaluation, a combined minimally invasive mitral valve repair and tricuspid annuloplasty via a direct-view right transaxillary approach was scheduled (1).

Surgical techniques

Preparation

Two-lung ventilation was achieved using a single-lumen endotracheal tube; neither a double-lumen tube nor an endobronchial blocker was used. The patient was placed in a supine position with a soft surgical roll positioned beneath the right scapula to elevate the right side of the chest by approximately 30°. A regional serratus anterior plane block was routinely performed to enhance early postoperative pain management. A venous cannula was positioned into the right internal jugular vein to ensure uncompromised venous drainage from the superior vena cava during multi-valve surgery and right atriotomy.

Exposure

Cardiopulmonary bypass (CPB) was established via peripheral cannulation of the femoral artery and vein through a 2-cm skin incision above the inguinal fold using the Seldinger technique under TEE guidance.

A 5-cm incision was made along the right anterior axillary line, at the level of the fourth intercostal space. Once the pleural cavity was entered, a soft-tissue retractor and an intercostal spreader were positioned. Carbon dioxide (CO₂) insufflation was then started to facilitate subsequent deairing and reduce the risk of air embolism. CPB was initiated and the pericardium was opened longitudinally, under the sternum, far from the phrenic nerve, extending from the aortic reflection down toward the diaphragm. The rib spreader was then removed. Seven pericardial stay sutures were placed (three anteriorly and four posteriorly) and anchored to the skin edge; this maneuver effectively pulls the heart closer, bringing the target structures within 10 cm of the skin line and ensuring direct line-of-sight visualization. Moreover, opening the pericardium high helps displace and hold the left lung away from the operative field; this structural exposure remains maintained even after weaning from CPB and during final hemostasis, enabling safe and clear management of cardiac structures throughout the entire closure phase despite continued two-lung ventilation.

The superior vena cava was prepared with scissors, while the oblique sinus was gently opened with the aid of the suction device; both the superior and inferior venae cavae were then snared. After preparing the fatty pad of the interatrial groove with electrocautery, a single suture was placed and exteriorized through the thorax, with the aim of retracting the right atrium while accessing the left atrium. An aortic needle was placed into the ascending aorta for cardioplegia delivery and subsequent root venting. Aortic cross-clamping was achieved using a flexible, soft-coated clamp introduced directly through the main minithoracotomy access. Cold Del Nido cardioplegia was administered into the aortic root to obtain rapid cardiac arrest.

Operation

Access to the mitral valve was obtained via a left atriotomy along the previously prepared interatrial groove. An atrial retractor was placed through the chest wall to optimize direct-vision exposure. Following initial inspection, annular sutures were placed, bringing the mitral valve closer to the surgeon and facilitating a more precise valve analysis. Since a P2 prolapse emerged as the main mechanism causing the regurgitation, two neo-chordae were implanted using standard long-shafted instruments; a soft rolled ruler was used to access the papillary muscle and subvalvular apparatus. A prosthetic annuloplasty ring was then positioned and tied using an automatic knot-tying device. Saline testing was carried out to confirm the adequacy of the repair, checking leaflet coaptation and annular stability. The left atriotomy was then closed with a double-layer running polypropylene suture. Direct access to the right atrium was then achieved through a standard right atriotomy. Stay sutures were exteriorized through the chest wall to obtain adequate exposure. The tricuspid valve apparatus was carefully exposed under direct vision, and an annuloplasty ring was placed to reduce the dilated annulus and restore valvular competence. The right atrium was closed with a running suture.

Completion

Once proper de-airing was performed, the aortic cross-clamp was removed and the patient was gradually weaned from cardiopulmonary bypass. Neither the mitral nor the tricuspid valve showed residual insufficiency on intraoperative TEE. A pericardial

drain and a right pleural drain were placed. The pericardium was partially closed, and the ribs were stabilized and approximated with a single non-absorbable suture. While closing the subcutaneous tissues of the chest, a microcatheter for perineural analgesia was positioned in the muscular fascia to improve postoperative pain control.

Comments

Clinical results

CPB time was 99 minutes and cross-clamp time was 66 minutes. The postoperative course was uneventful, with an intensive care unit stay of one day and discharge home on postoperative day 5.

Advantages

The main strength of the transaxillary strategy lies in its ability to serve as a versatile, single-access platform for combined procedures. In the context of double-valve surgery—specifically simultaneous mitral and tricuspid interventions—the approach offers a centered working trajectory where both the left and right atriotomies can be accessed sequentially without modifying the thoracic incision or altering the patient's surgical positioning. The direct-vision transaxillary setup substantially reduces complexity and this efficiency stems directly from physiologic ergonomics and optimized geometric exposure. By exploiting the natural rightward orientation of the heart valvular plane, anchoring high pericardial stay sutures directly to the skin edge pulls the cardiac structures toward the minithoracotomy, reducing the working depth to less than 10 cm and maintaining direct coaxial alignment between the surgeon's eyes and standard long-shafted instruments (2,3). By streamlining technical execution and maintaining contained ischemic times, the transaxillary approach expands the safety margin and clinical feasibility of minimally invasive double-valve surgery, and it enhances recovery and rehabilitation while reducing patient's trauma and offering superb cosmetic results (4).

Caveats

Successful execution of combined mitral and tricuspid procedures via a transaxillary access relies heavily on rigorous preoperative preparation and strict protocol adherence rather than technological reliance. Achieving complete, unobstructed exposure is the critical prerequisite for procedural safety. Because the approach relies on direct vision, proper patient positioning and precise placement of pericardial traction sutures are non-negotiable; sub-optimal field visualization cannot be compensated by camera zoom or robotic articulation and should not be accepted at any point. Preoperative computed tomography (CT) angiography is not routinely performed in all patients. Instead, it is undertaken when an aortic valve procedure is planned and in selected patients with risk factors for aortic atherosclerosis or peripheral vascular disease, as well as in elderly patients, typically >80 years of age. When performed, CT angiography also allows assessment of the aortoiliac and femoral anatomy relevant to peripheral cannulation. Finally, although the platform simplifies multivalve workflows, surgical teams must

maintain a thorough familiarity with core minimally invasive principles to ensure reproducible outcomes (5).

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Footnote

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Conflicts of Interest: The authors have no conflicts of interest to declare.

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