Echocardiographic Predictors of Difficult Mitral Valve Repair

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A thorough TEE examination of the MV requires the utilization of all echocardiographic modalities. In the initial pre-CPB period, 2-D echocardiography can define the extent and etiology of MV pathology. The severity and location of MV disease including subvalvular involvement, annular calcification and dilation, bi-leaflet prolapse and anterior mitral leaflet (AML) disease, along with the degree of left ventricular (LV) function, should all be assessed as this information when integrated together, can be helpful in determining whether MV replacement (MVR), repair, or neither is indicated. It is also important to diagnose if existing severe mitral regurgitation (MR) is primarily associated with ischemia, as opposed to rheumatic or myxomatous disease, since the extent of surgical treatment for ischemic MR remains controversial. Although the 2D anatomic images and color flow Doppler (CFD) modalities are used most often during interrogation of the MV in the operating suite, a complete echocardiographic evaluation using pulse wave (PWD) and continuous wave Doppler (CWD) can assist in determining the severity of blood flow disturbances associated not only with MR, but with mitral stenosis (MS). Furthermore intraoperative three-dimensional (3D) echocardiography is becoming recognized as a more accurate technique for identifying mitral leaflet clefts and commisural scallop pathology (1-3).
Clinical studies have suggested that the pre-CPB TEE exam prompts changes in surgery in 9-14% (4,5) of patients undergoing MV surgery. The population of patients influenced by the pre-CPB TEE exam includes those initially scheduled only for coronary bypass grafting (CABG) who also require a MV procedure. In addition, the pre-CPB exam also influences surgical decision-making in those patients scheduled for an MV procedure based upon the preop TTE or TEE exam, who actually only require a CABG due to “improvement” in the severity of MV disease as determined by the pre-CPB TEE examination in the operating room. The influence of changes in loading conditions during general anesthesia on trans-mitral flow and pressure, the potential changes in the patient’s overall medical condition since the time of the pre-operative echocardiographic exam, the technical limitations of TTE in comparison to TEE and the general subjectivity of the assessment among different echocardiographers, must all be taken into consideration when making the final surgical decision regarding the most appropriate MV procedure. In addition, while surgical experience remains an important variable in the overall success of MV repair, it is also important to identify echocardiographic risk factors that are predictive of a difficult valve repair including the presence of significant anterior leaflet disease, bileaflet disease, mitral annular calcification, rheumatic valvular disease with extensive subannular involvement... Functional MR with or without an ischemic etiology may also present a challenge for repair especially in the presence of significant annular dilation, increases in LV sphericity and/or extensive apical tethering defined by a tenting height greater > 10 mm or a tenting area > 2.5cm². (6,7).

The initial post-CPB TEE exam is essential in helping to determine the competency of the replaced or repaired MV, persistent MR and/or systolic anterior
motion (SAM). It is also important for the echocardiographer to fully understand normal flow patterns and acceptable transvalvular pressure gradients. Most small perivalvular jets detected by CFD are insignificant, although larger “leaks” may become associated with hemolysis, hemodynamic instability or valvular dehiscence. Hemodynamic loading conditions and LV function must also be taken into consideration in the assessment of residual MR. Following MV procedures, several studies have suggested that on the average, in approximately 5 -11% of cases (8-10) the post-CPB TEE exam may identify persistent lesions that require additional, immediate surgical intervention.

**Systolic Anterior Motion Following Mitral Valve Repair:**

Following MV repair, the presence of left ventricular outflow tract (LVOT) obstruction has typically been associated with systolic anterior motion (SAM). Risk factors for SAM include *preoperative* evidence of excessive or redundant posterior (PML) and/or AML tissue, non-dilated LV and a narrow mitro-aortic angle. In addition, *post-operative* evidence of persistent AML redundancy, excessive PML resection, a narrow mitro-aortic angle, the selection of an annuloplasty ring that is either too small or incorrectly oriented, and an hypertrophied/hyperdynamic LV may all contribute to the development of SAM a Venturi effect that “pulls” the AML and coaptation point toward the ventricular septum during systole. (11,12)

**Post-MV Repair Mitral Stenosis:**

Chronic MS following repair may develop from thrombus, calcification or pannus formation, which restricts native leaflet function. Rarely, acute MS may develop due to technical limitations involving excessively restrictive MV annuloplasty rings, or stenotic edge-to-edge repairs. Specific echocardiographic criteria for the diagnosis of early MS
after MV repair have not been well established. Two-dimensional echocardiographic diagnosis of MS following post-MV repair may be difficult especially in those patients undergoing an Alfieri, edge-to-edge repair in which the mid-portion of the anterior and posterior leaflet are intentionally sutured together to prevent MR. In addition, classical Doppler echocardiographic measures for quantifying native MS such as the pressure halftime, may not be applicable immediately following MV valvotomy or repair due to acute changes in orifice geometry and chamber compliance. Although some have suggested that significant residual MS following MV repair is defined by a persistent mean transvalvular gradient > 5 mm Hg or an area < 1.5 cm², the influence of concurrent MR and cardiac output must also be considered. Thus, the definitive diagnosis of residual MS following MV replacement or repair ultimately requires an integration of an in depth knowledge of the procedure, hemodynamics and a comprehensive intraoperative echocardiographic examination using all available modalities. (13-15)

REFERENCES


