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IMAGING VIGNETTE

CT for the Transapical Off-Pump Mitral Valve Repair With Neochord Implantation Procedure

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THE ADVENT OF TRANSAPICAL ECHOCARDIOGRAPHY-GUIDED MITRAL VALVE (MV) REPAIR WITH implantation of polytetrafluoroethylene neochordae (NeoChord, St. Louis Park, Minnesota) has identified some critical aspects of the procedure that require accurate understanding of cardiac anatomy (1,2). In particular, transapical access, used for transcatheter aortic valve replacement, does not provide direct alignment with the MV, which is more posterior with respect to the aortic valve (**Figure 1**). Thus, posterolateral ventricular access provides a better approach to the MV, reducing the risk of the device interfering with the native subvalvular apparatus and enabling a more physiological axis orientation of implanted neochordae (**Figure 2**) (1,2). Cardiac computed tomography has recently been used as an additional tool for pre-operative procedure planning (**Figure 3**, Online Video 1) and for post-operative assessment of implanted neochordae (**Figures 4 and 5**, Online Videos 2, 3, 4, and 5). Ideal access can be identified by projecting the desired neochordae trajectory inside the left ventricle, starting from the diseased MV leaflet toward the left ventricular epicardial surface between the papillary muscles.

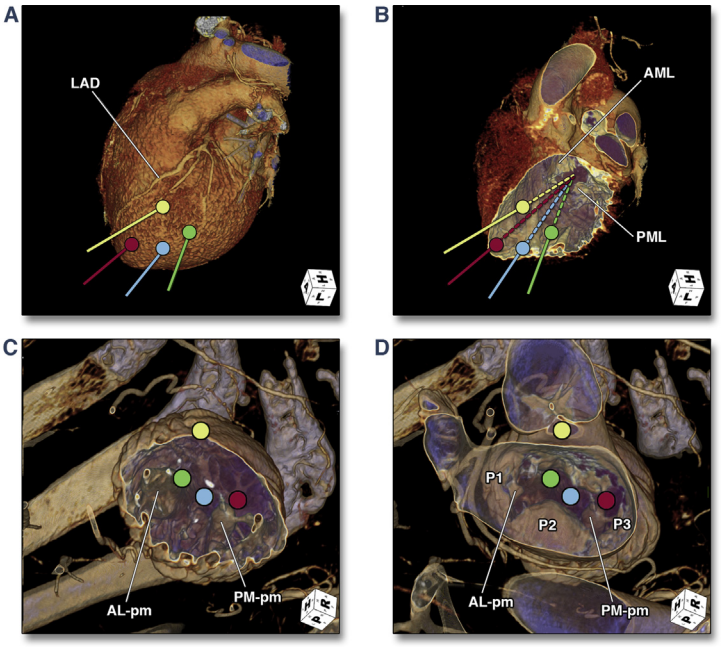
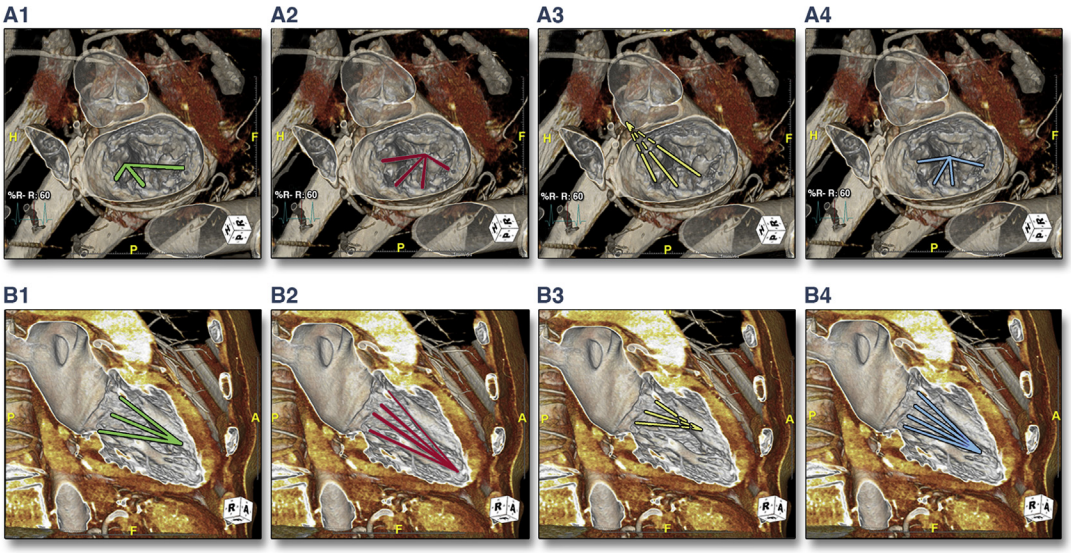


FIGURE 1 Prospective Ventricular Access Sites for Transapical Neochord Repair

Volume-rendered, cardiac computed tomography reconstruction (TeraRecon, Foster City, California) reveals 4 different prospective neochordae trajectories with respect to different ventricular access sites. **(A)** Epicardial LV entry **(dots)** with trajectory lines identify anterior access (corresponding at 5th intercostal space, **yellow**), anteroseptal access (corresponding to the 6th intercostal space, **red**), posterolateral access (corresponding to the 5th intercostal space, **blue**), and lateral access (corresponding to the 4th intercostal space, **green**). **(B)** Intraventricular continuation of the trajectory lines with the apical myocardium removed shows their convergence on the central MV plane coaptation line. Each entry site is discussed separately in **Figure 2**. **(C)** Surgical view of mid-ventricular and apical portions of the LV. Respective **dots** identify endocardial position of each entry site relative to the papillary muscles. **Red and green access points** approximate the papillary muscles bases, **blue** represents the midpoint between the two, and **yellow** is directed more anterior and superior. **(D)** Surgical view of the MV. The MV leaflets relative to each access site can be identified. AL-pm = anterolateral papillary muscle; AML = anterior mitral leaflet; LAD = left anterior descending coronary artery; LV = left ventricle/ventricular; MV = mitral valve; P1/2/3 = posterior leaflet scallops; PML = posterior mitral leaflet; PM-pm = posteromedial papillary muscle.

FIGURE 2 Ventricular Access Simulations



Volume-rendered, computed tomography reconstructions in diastole of the MV can be analyzed from a standard surgical view **(A1–A4)**, intercommissural view with cutplane through the anterior LV wall **(B1–B4)**. Trajectories of implanted neochordae from ventricular access (VA) are drawn to different MV segments are simulated. The neochordae orientations are represented from VA sites: lateral **(A1 and B1)**, anteroseptal **(A2 and B2)**, anterior **(A3 and B3)**. These orientations have the potential risk of damaging the AL-pm (lateral and anterior) or PM-pm (anteroseptal), as well as interfering with the subvalvular apparatus. Moreover, the working angle is not favorable to reach the medial and lateral segments of the MV; when neochordae are implanted, there is asymmetrical alignment with respect to the posterior mitral leaflet, causing unequal tension. Posterolateral access **(A4 and B4)** is considered the ideal VA site located between lateral and anteroseptal sites. Trajectories arise between the papillary muscles with the safest and symmetrical working angle. Abbreviations as in Figure 1.

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