Materials and Methods

CT Image Acquisition and Reconstruction

All cardiac computed tomography (CT) examinations were performed using a second generation dual-source CT scanner (SOMATOM Definition Flash, Siemens Healthineers, Forchheim, Germany). Before contrast administration, a non-enhanced calcium scoring image was acquired in a prospective electrocardiogram (ECG)-gated mode with a tube voltage of 120 kV and tube-current time product of 50 mAs. Cardiac CT angiography was performed using the retrospective ECG-gated data acquisition mode using a triple-phase injection method (70 mL of iopamidol followed by 30 mL of 50% blended iopamidol with saline and 20 mL of saline at 5 mL/s). ECG-based tube current modulation was not used to allow the cardiac valves to be imaged during the entire cardiac cycle. Automatic tube potential selection with tube current modulation was conducted during CT angiography. The mean effective dose of cardiac CT was 0.62 ± 0.17 mSv for the calcium scoring scan, 9.94 ± 4.75 mSv for the cardiac CT angiography, and 11.09 ± 5.07 mSv for the total scan. From the raw data sets, CT angiography images were generated using iterative reconstruction (sinogram-affirmed iterative reconstruction). Image reconstruction was performed with a medium kernel (I36f), and the reconstruction slice thickness was 0.75 mm with 0.5 mm increments. For all patients, 10 transverse data sets were reconstructed every 10% of the cardiac cycle. Reconstructed images were transferred to an image server and analyzed using dedicated three-dimensional software (Aquarius iNtuition, Ver 4.4.11, TeraRecon, San Mateo, CA, USA).

Statistical Analysis

Agreement between CT and transthoracic echocardiography (TTE) to predict valve replacement was assessed using weighted kappa statistics. To compare diagnostic performance for non-repairable findings between CT and TTE according to etiology, logistic regression analysis using generalized estimating equation was performed. Logistic regression analysis was performed to explore the value of each finding of non-repairable mitral valve (MV) to predict valve replacement. The MV leaflet calcium score and mitral annular calcification calcium score were converted into binary variables for logistic regression using the best cutoff value that was determined by receiver operating characteristic curves. The optimal cutoff value for each variable was set using Youden’s method for both the entire population and patients excluding rheumatic etiology. Multivariable logistic regression analysis was performed for adjusting CT and TTE findings for clinical variables. For multivariate logistic regression analysis, factors that were statistically significant in a univariate model were chosen with criteria for variable inclusion of 0.05 and for variable exclusion of 0.10.