Immediate impact of coronary revascularization on global and regional myocardial function evaluated by speckle tracking echocardiography

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On behalf: No.

Topic(s):
Tissue Doppler, Speckle Tracking and Strain Imaging

Citation:

Funding Acknowledgements:
No.

Background: The immediate effect on myocardial function and deformation after coronary revascularization is incompletely studied. Effective revascularization along with perioperative myocardial injury compromises improved regional and global left ventricular function and leads to the risks of adverse perioperative events following coronary artery bypass grafting (CABG) surgery. Global longitudinal strain (GLS) assessed by speckle-tracking echocardiography (STE) has been reported as a better predictor and a more sensitive marker for postoperative ventricular remodeling.

Purpose: This study aimed to evaluate changes of left ventricular (LV) systolic function and GLS in the perioperative period during CABG and to investigate the value of GLS using two-dimensional STE in predicting short-term outcome.

Methods: A total of 22 patients who underwent elective CABG surgery (EuroSCORE II 1.84±1.2) were evaluated. Transesophageal echocardiography was performed, 2D and three-dimensional echocardiography (3DE) data was acquired before sternotomy, before cardiopulmonary bypass (CPB), after bypass and after chest closure. LV GLS and tissue motion annular displacements (TMAD) of the mitral valves were quantified by 2D STE using CMQ software. LV volumes and ejection fraction (EF) were evaluated by 3DE at the same timepoints. Short-term outcomes were defined as death, stroke, myocardial infarction, acute kidney dysfunction, rehospitalization and repeated revascularization in a one-month period after surgery.

Results: Both 2D and 3DE of all patients were analyzed. The cohort had a mean age of 68.2±7.2 years and 9.1% was women. Before sternotomy, GLS was -15.7±2.9%. Despite little change in 3D LVEF, GLS was immediately impaired after coronary artery bypass graft (before bypass vs after chest closure, -15.9±3.6% vs -13.5±4.0%, P=0.001). There was strong correlation between GLS and 3D LVEF (r=0.77, P<0.001), moderate correlations between GLS and absolute value of TMAD (r=0.61, P<0.05), between GLS and percentage of TMAD (r=0.64, P<0.05). Patients with poor outcome (n=6) had a lower longitudinal strain (LS) in the apical 2-chamber (A2C) views (-14.5±4.6% vs -10.8±1.3%, P=0.007) but no statistical difference between A3C and A4C views. The ROC analysis demonstrated a cutoff value -11.8% for A2C-LS to predict adverse events (AUC 0.81, P=0.027, 95% CI 0.632-0.993), with an 83.3% sensitivity and 81.2% specificity, followed by 3D LVEF (AUC=0.29), absolute and percentage of TMAD (AUC=0.21, 0.23) as less sensitive predictors of poor postoperative outcome.

Conclusion: Direct effects of myocardial deformation related to revascularization can be characterized by STE during CABG surgery. GLS could be a more sensitive parameter in the perioperative environment, which correlates well with LV global function assessed by 3D LVEF and TMAD. Early impairment of anterior and inferior wall myocardial strain after CABG may contribute to short-term adverse clinical outcome.
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