Quadruple Imaging Stress Echocardiography as the new Standard

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Background: The new standard adopted in Stress echo (SE) 2020 is the Integrated Quadruple (IQ) imaging approach, optimizing the versatility of SE to include in a one-stop shop the "big 4": regional wall motion abnormalities (RWMA); coronary flow velocity reserve (CFVR); left ventricular contractile reserve (LVCR); and B-lines at lung ultrasound.

Purpose: to assess the feasibility of IQ-SE in the prospective, large scale, multicenter, international effectiveness SE2020 study

Methods: 138 all-comers patients (age 62±11, 83 males) referred to clinically-driven exercise (n=59), dipyridamole (n=75) or dobutamine (n=4) SE for known or suspected coronary artery disease and/or heart failure were enrolled by 7 different laboratories of 4 countries (Italy, Russia, Serbia, Bulgaria). All readers had passed the quality control reading for RWMA. All underwent IQ-SE, with evaluation of RWMA (17-segments model, Wall Motion Score Index, WMSI, each segment from 1= normal to 4= dyskinetic), CFVR (stress/rest ratio of peak diastolic velocity on left anterior descending coronary artery), LVCR (stress/rest ratio of systolic blood pressure by cuff sphygmonanometer/end-systolic volume from 2D by biplane Simpson rule), and B-lines (4-regions scan on antero-lateral chest, each space scored from 0 = black, to 10= white). Standard positivity criteria were adopted for RWMA (WMSI stress>rest),CFVR (<2.0), LVCR (<2.0 for exercise and dobutamine, <1.1 for dipyridamole) and B-lines (stress>rest).

Results: RWMA, LVCR and B-lines were feasible in all; CFVR in 88%. The positivity rate was 20% for RWMA, 26% for CFVR, 37% for LVCR, 12% for B-lines. The positivity rate with full IQ-SE rose to 50% when at least 1 of the 4 criteria was considered (see Figure).

When comparing patients with reduced (<50 %, n=22) vs normal ( ≥ 50 %, n=116) resting ejection fraction, the positivity rate was higher for RWMA (38% vs. 17%, p=0.029), LVCR (67% vs. 32%, p=0.003), CFVR (40% vs. 24%, p=0.132) and B-lines (24% vs 12%, p=0.085). Peak stress WMSI was significantly but only weakly related with LVCR (r= -0.278, p<0.001), CFVR (r= -0.431, p<0.001), or B-lines at peak stress (r=0.179, p= 0.036).

Conclusions: In the effectiveness SE2020 study, the IQ-SE is extremely feasible, user-friendly, and substantially increases the positivity rate of RWMA alone in patients with both normal and reduced ejection fraction. It provides a versatile view of 4 key variables, only marginally inter-related, of recognized prognostic relevance: epicardial coronary artery stenosis (RWMA), coronary microcirculation (CFVR), myocardial function (LVCR) and alveolar-capillary barrier (B-lines) vulnerability. SE is really unique to the cardiac imaging game because of its versatility!