

Quadruple Imaging Stress Echocardiography as the new Standard

Authors:

Q. Ciampi¹, A. Zagatina², L. Cortigiani³, A. Djorkievic-Dikic⁴, M. Dekleva⁵, S. Severino⁶, R. Citro⁷, P. Colonna⁸, B. Villari¹, A. Arystan⁹, M. Paterni⁹, M. De Nes⁹, T. Bombardini⁹, C. Carpeggiani⁹, E. Picano⁹,
¹Fatebenefratelli Hospital, Division of Cardiology - Benevento - Italy, ²Medika Cardiology Clinic,
8–2, Dundicha St., Cardiology - Saint Petersburg - Russian Federation, ³Campo di Marte Hospital,
Cardiology - Lucca - Italy, ⁴Clinical center of Serbia, Cardiology - Belgrade - Serbia, ⁵Health Center
–Zvezdara–, Cardiology - Belgrade - Serbia, ⁶AO dei Colli-Monaldi Hospital, Cardiology -
Naples - Italy, ⁷AOU S. Giovanni e Ruggi, Cardiology - Salerno - Italy, ⁸Polyclinic Hospital of Bari,
Cardiology - Bari - Italy, ⁹Institute of Clinical Physiology, CNR, Cardiology - Pisa - Italy,

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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 sphygmomanometer/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!

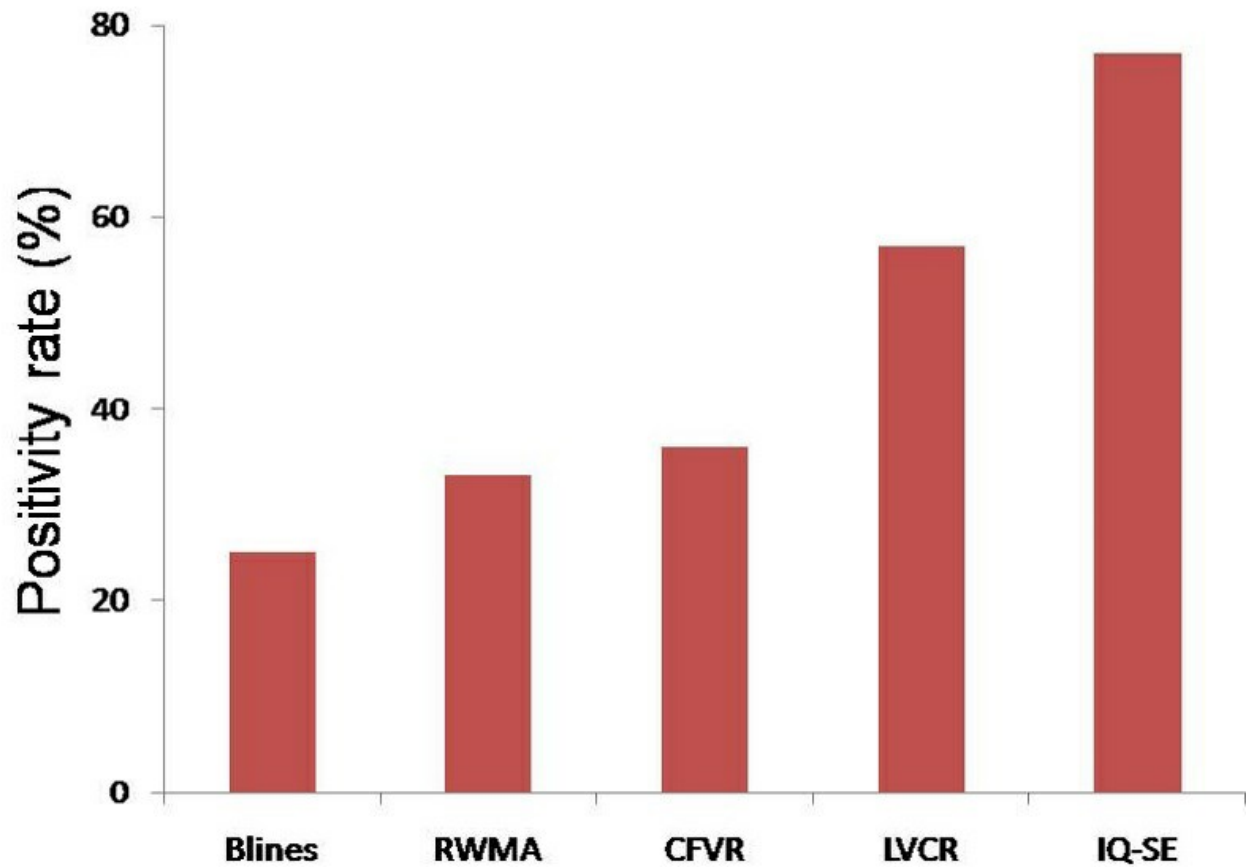


Figure 1