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Quantitative methods for assessing contractile reserve in patients with diastolic heart failure

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Aim: The effectiveness of isometric handgrip exercise on changes of cardiovascular hemodynamics parameter in patients with diastolic heart failure is unknown. We assessed the effect of several hemodynamic parameters and it changes during handgrip maneuvers in patients with different stages of diastolic heart failure during chemotherapy and their improvements after 4 months follow up (4mFU) treatment with single pill combination of ACE inhibitor ACE) and beta –blocker(BB) .Methods: The study population included 65 patients- female / mean age of 45 ± 12 years/ 55 with breast cancer and undergoing chemotherapy / 30 pts with HFpEF and 25 pts with HFmrEF / and 10 pts with HFnEF and without chemotherapy.The effect of handgrip maneuver on hemodynamic parameters were studied by speckle tracking echocardiography. Following maximal squeeze by 100%, during the next 3 minutes patients were instructed to apply pressure at 50%. The global longitudinal strain were extracted by 3, 4 and 2 chamber apical view images on 70-85 fr/s and MAP and HR were performed at basal level, 1st, 2nd and 3rd minutes during handgrip stress test. The contractility /force/ of LV were also calculate as ratio SBP / ESV . Patients with HFmrEF and HFpEF received for 4 months treatment with single pill combination ACE (perindorpril)/ BB (bisoprolol) 5/5 mg.Results:Heart rate(HR) and mean arterial pressure(MAP) increased significantly after handgrip maneuver / from 75 ±6 beats /min to 101 ±12 beats/ min, 109 ± 15 mmHg to 118 ± 19mmHg, $p < 0,05$ / .Pulmonary artery systolic(s) and diastolic (d) pressure(PAP),pulmonary capillary wedge pressure (PCWP) , cardiac index(CI) , LVEF did not change significantly($p > 0,5$) after handgrip maneuvers . On the other hand, LV force (SBP/ ESV ratio) ,MAP and HR decreases significantly ($p < 0,01$) in group with HFmrEF. In same group were found significantly decreased GLVLS at 2nd and 3rd minutes during stress- test comparable with other 2 groups with HFpEF and HFnEF. After 4mFU and treatment with 5/5 mg doses combination of ACE / BB were found improvement in parameters: HR /$p < 0,001$/, MAP /$p < 0.01$/ and contractile reserve as well as LV force /$p < 0, 01$/ and GLVLS /$p < 0,001$/.Conclusion: Cardiovascular response to handgrip maneuver may be a marker of failure to respond to compensatory mechanisms. Patients with good LV reserve had a rise in stroke –work with little or no change in LVEDP. Patients with poor contractile reserve had a fall in stroke- work reserve together with a substantial rise in LVEDP. It is concluded that the stress imposed by sustained handgrip provides a simple test for evaluation of LV contractile reserve in patients, who will develop cardiotoxicity during chemotherapy treatment. The treatment with combination with small doses ACE/BB is a big challenge in patients with HFmrEF and HFpEF to improve the contractile reserve.