ORAL CONTRIBUTIONS

855 Quantitative Left Ventricular Function by Magnetic Resonance Imaging

Tuesday, March 09, 2004, 4:00 p.m.-5:00 p.m.
Morial Convention Hall, Hall D-1

4:00 p.m.

855-1

Effects of Off-Pump Versus On-Pump Coronary Surgery on Early and Late Postoperative Left Ventricular Function: A Randomized Trial Using Cardiovascular Magnetic Resonance Imaging

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Introduction: There is biochemical evidence that off pump coronary artery bypass grafting (OPCABG) reduces myocardial injury when compared to the use of cardiopulmonary bypass (ONCABG), but the functional significance of this is uncertain. We hypothesized that OPCABG surgery would result in improved early and later left ventricular function compared with ONCABG surgery.

Methods: In a single centre randomised trial, 30 patients undergoing multi-vascular total arterial revascularisation were randomly assigned to OPCABG and 30 patients to ONCABG surgery. Patients underwent pre-operative, early (day 6) and late (6 months) post-operative cine MRI for global left ventricular function and regional wall motion assessment.

Results: The two surgical groups were well matched in terms of pre-operative (age, cardiopulmonary risk factors, pre-operative medical use) and peri-operative (number of distal anastomoses, inotropic requirements) factors. The mean pre-operative cardiac index was similar in the two surgical groups (2.9 +/- 0.7 ONCABG; 2.9 +/- 0.8 OPCABG; p = 0.9). Early post-operatively, the cardiac index was significantly higher in the OPCABG group (2.7 +/- 0.6 ONCABG; 3.2 +/- 0.8 OPCABG; p = 0.04). The mean pre-operative ejection fraction was 62% +/- 12% in the ONCABG group and 62% +/- 11% in the OPCABG group (p = 0.9). In the early post-operative period this decreased to 59% +/- 11% in the ONCABG group and increased to 65% +/- 12% in the OPCABG group (p = 0.03 for the change in EF). When assessed at 6 months, the mean cardiac index was 3.1 +/- 0.6 in the ONCABG group and 3.1 +/- 0.8 in the OPCABG group (p = 0.7). Ejection fraction at 6 months was significantly improved compared to pre-operative measurements for both groups (P<0.05 for each), but not significantly different between the two surgical groups (p = 0.5). Conclusion: In patients undergoing isolated coronary artery grafting, OPCABG surgery results in significantly better left ventricular function early after surgery, but at 6 months both surgical groups show a similar benefit in left ventricular function from revascularisation.

4:15 p.m.

855-2

Transmural Difference of Diastolic Function in Physiological Hypertrophy Versus Pathological Hypertrophy Using Tagged Magnetic Resonance Imaging

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Back Ground: Athletes tend to develop remodeling primarily in the form of eccentric hypertrophy while concentric hypertrophy is prevalent in aortic stenosis (AS). The transmural patterns of contraction and relaxation in athletes and in AS have not been studied thoroughly. Our goal was to study the transmural patterns of contraction and relaxation in these types of remodeling using tagged magnetic resonance imaging (MRI).

Methods: Eleven elite rowers, 13 patients with AS and 13 healthy adults underwent C-SPAMM myocardial tagging MRI. Left ventricular endocardial, midwall and epicardial circumferential shortening, relaxation rates, and time to peak relaxation were analyzed in anterior, lateral, posterior and septal segments using semiautomatic tracking of the grid intersection points.

Results: Time to peak relaxation rate was substantially higher in athletes compared to healthy adults and patients with AS. These differences were evident through all segments and in all the layers. Average time to peak myocardial relaxation (100 is defined as end-systole) was 128.9 +/- 17.6, 152.5 +/- 16.9 and 142.8 +/- 16.6 in athletes, volunteers and patients with AS, respectively (p<0.01 in athletes vs. other groups). Peak midwall and epicardial relaxation rates were reduced in AS compared with physiological hypertrophy and normal individuals (-1.14 +/- 0.4, -1.3x0.5 and -1.7x0.5 1/sec, respectively - p<0.01). Maximal endocardial shortening is enhanced in AS compared to normal volunteers (37.2% +/- 7.3% vs. 31.1% +/- 6.4%, respectively, p<0.001) in contrast to the midwall, where shortening was lower in AS (20.3% +/- 5.1% vs. 23.9% +/- 6.6%, respectively, p=0.023). Myocardial shortening in athletes was similar to normal volunteers.

Conclusions: This study demonstrates distinctive patterns of relaxation in normal individuals, physiologic hypertrophy and pathological hypertrophy. A shortened time to peak relaxation rate is evident in athletes and this may be a measurable marker of enhanced diastolic relaxation to improve mechanical efficiency in this sub-group. Reduced myocardial relaxation rate and shortening are evident in pathological hypertrophy and can be used as quantifiable markers of negative remodeling.
AIMS Magnetic resonance imaging (MRI) is often considered to be the gold standard in measuring left ventricular function and volumes.\cite{Mistry2010AssessmentOL} Assessment of left ventricular function with magnetic resonance imaging vs. echocardiography, contrast echocardiography, and single-photon emission computed tomography in patients with recent ST-elevation myocardial infarction.\cite{Utilityoffastcine} Comparison of left ventricular ejection fraction and volumes in heart failure by echocardiography, radionuclide ventriculography and cardiovascular magnetic resonance, are they interchangeable? \cite{EurHeartJ2000} Moreover, CMR has been shown to be valuable for the assessment of regional contractile function as well \cite{HundleyWG}. Comparison Between the Quantitative Assessment of LV Volumes, Mass and Function by the 2D and the 3D Cine-MR Techniques. Table 2. Cardiovascular magnetic resonance imaging (CMR) has become an indispensable tool for a comprehensive in vivo assessment of cardiac anatomy and function. This protocol shows detailed measurements of mouse heart left ventricular function, myocardial strain, and hemodynamic forces using 7-Tesla CMR. First, animal preparation and positioning in the scanner are demonstrated. Survey scans are performed for planning imaging slices in various short- and long-axis views. Quantification of right ventricular function with magnetic resonance imaging in children with normal hearts and with congenital heart disease. \cite{AmHeartJ1995} Jauhiainen T, Jarvinen VM, Hekali PE, Poutanen VP, Penttila A, Kupari M. MR gradient echo volumetric analysis of human cardiac casts: focus on the right ventricle.\cite{JauhiainenT} The use of contrast-enhanced magnetic resonance imaging to identify reversible myocardial dysfunction. \cite{SimonettiOP} Aims: Improving the health status (symptoms, function, and quality of life) of patients with heart failure with reduced ejection fraction (HFrEF) is a primary treatment goal. Angiotensin receptor neprilysin inhibitors (ARNI) improve short-term health status in clinical practice, but the sustainability of these improvements is unknown.\cite{Irondeficiency} Iron deficiency is a major heart failure co-morbidity present in about 50% of patients with stable heart failure irrespective of the left ventricular function. Along with compromise of daily activities, it also increases patient morbidity and mortality, which is independent of anaemia. Several trials have established parenteral iron supplementation as an important complimentary therapy to improve patient well-being and physical performance.