

The Clinical Value of Total Isovolumic Time

Gani Bajraktari

Akademisk avhandling

som med vederbörligt tillstånd av Rektor vid Umeå universitet för avläggande av filosofie/medicine doktorsexamen framläggs till offentligt försvar i hörsal D, Unod T 9.

Tisdagen den 10 juni, kl. 09:00.

Avhandlingen kommer att försvaras på engelska..

Fakultetsopponent: Professor Lars-Åke Brodin
School of Technology and Health, KTH Royal Institute of Technology,
Stockholm, Sweden



Institution/Department

Umeå universitet/Umeå University
Umeå 2008

Abstract

The objective of this thesis is to evaluate the use of total isovolumic time (t-IVT) 1) in predicting cardiac events following CABG surgery; 2) in predicting 6-MWT in patients with LV ejection fraction (EF) <45%; 3) prognosis of patients with chronic systolic heart failure (HF); 4) its predictive value of 6-MWT in heart failure irrespective of EF; 5) its response to age in comparison with other systolic and diastolic cardiac measurements; 6) in predicting response to CRT treatment of heart failure.

Study I

Methods: 74 patients before CABG who were followed up for 18±12 months. **Results:** At follow-up, 29 were hospitalized for a cardiac event or died. LV-ESD was greater (P=0.003), FS lower (p<0.001), E:A ratio and Tei index higher (all P<0.001), and t-IVT longer (P<0.001) in patients with events. Low FS [0.66 (0.50–0.87), P<0.001], high E:A ratio [14.13 (1.17–14.60), P=0.028], large LV-ESD [0.19 (0.05–0.84), P=0.029], and long t-IVT [1.37 (1.02–1.84), P=0.035] predicted events. **Conclusion:** Despite successful CABG prolonged t-IVT contributes to post-op cardiac events.

Study II

Methods: 77 patients with stable HF using 6-MWT. **Results:** E' wave (r=0.61, p<0.001), E/e' ratio (r=-0.49, p<0.001), t-IVT (r=-0.44, p<0.001), Tei index (r=-0.43, p<0.001) and NYHA class (r=-0.53, p<0.001) had the highest correlation with the 6-MWT distance. In multivariate analysis, only E/e' ratio [0.800 (0.665-0.961), p=0.017], and t-IVT [0.769 (0.619-0.955), p=0.018] independently predicted poor 6-MWT performance (<300m). **Conclusion:** The higher the filling pressures and the more dyssynchronous the LV, the poorer is patient's exercise capacity.

Study III

Methods: 107 systolic HF patients, 25% females. **Results:** Over a follow-up period of 37±18 months, t-IVT ≥12.3% sec/min, mean E/E_m ratio ≥10, log NT-pro-BNP levels ≥2.47 pg/ml and LV EF ≤32.5% predicted clinical events. The addition of t-IVT and NT-pro-BNP to conventional clinical and echocardiographic variables improved the χ^2 for prediction of outcome from (p<0.001). **Conclusions:** Prolonged t-IVT adds to the prognostic stratification of patients with systolic HF.

Study IV

Methods: 147 HF patients (50.3% male). **Results:** The 6-MWT correlated with t-IVT (r=-0.49, p<0.001) and Tei index (r=-0.43, p<0.001) but not with any of the other parameters. Group I (<300m) had lower Hb (p=0.02), lower EF (p=0.003), larger left atrium (p=0.02), thicker septum (p=0.02), lower A wave (p=0.01) and lateral wall a' (p=0.047), longer isovolumic relaxation time (r=0.003) and longer t-IVT (p= 0.03), compared with Group II (>300m). Only t-IVT ratio [1.257 (1.071-1.476), p=0.005], LV EF [0.947 (0.903-0.993), p=0.02], and E/A ratio [0.553 (0.315-0.972), p=0.04] independently predicted poor 6-MWT performance. **Conclusion:** The limited 6-MWT is related mostly to severity of global LV dyssynchrony or raised filling pressures.

Study V

Methods: 47 healthy individuals (24 female), arbitrarily classified into: M (middle age), S (seniors), and E (elderly). **Results:** Age strongly correlated with t-IVT (r=0.8, p<0.001) and with Tei index (r=0.7, p<0.001), E/A ratio (r=-0.6, p<0.001), but not with global or segmental systolic function measurements or QRS duration. The normal upper limit of the t-IVT (95% CI) for the three groups was 8.3 s/min, 10.5 s/min and 14.5 s/min, respectively, being shorter in the S compared with the E group (p=0.001). T-IVT correlated with A wave (r=0.66, p<0.001), E/A ratio (r=-0.56, p<0.001), septal e' (r=-0.49, p=0.001) and septal a' (r=0.4, p=0.006), but not with QRS. **Conclusions:** Age is associated with LV global dyssynchrony and diastolic disturbances.

Study VI

Methods: 103 HF patients (82.5% male) recruited for CRT. **Results:** Prolonged t-IVT [0.878 (0.802-0.962), p=0.005], long QRS duration [0.978 (0.960-0.996), p=0.02] and high tricuspid pressure drop (TRPD) [1.047 (1.001-1.096), p=0.046] independently predicted response to CRT. A t-IVT ≥11.6 s/min was 67% sensitive and 62% specific (AUC 0.69, p=0.001) in predicting CRT response. Respective values for a QRS ≥ 151ms were 66% and 62% (AUC 0.65, p=0.01). Combining the two variables was 67% sensitive but highly specific 88% in predicting CRT response. In AF, only prolonged t-IVT ≥11 s/min [0.690 (0.509-0.937), p=0.03] independently predicted CRT response (sensitivity 69% & specificity 79% (AUC 0.78, p=0.015). **Conclusion:** Combining prolonged t-IVT and broad QRS had higher specificity in predicting response to CRT, particularly in AF patients.

Keywords

Heart failure, cardiac resynchronization therapy, predictors, echocardiography, total isovolumic time, six-minute walk test, left ventricular dyssynchrony

Language

English

ISBN

978-91-7601-086-0

ISSN

0346-6612

Number of pages

89 + 6 paper