

Title: THE "PRESSURE RATE QUOTIENT" IS NOT AN INDICATOR OF MYOCARDIAL ISCHEMIA IN HUMANS—AN ECHOCARDIOGRAPHIC EVALUATION

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Introduction. Several hemodynamic indices, including the pressure rate quotient (PRQ=MAP/HR), have been suggested as early indicators of intraoperative myocardial ischemia.¹ We found in elective CABG patients, that a PRQ<1 was a poor indicator of ECG detected ischemia prior to cardiopulmonary bypass (CPB).² Controversy exists as to whether the ECG is an appropriate gold standard for detecting myocardial ischemia. We prospectively evaluated the PRQ<1 as an indicator of ischemia in CABG patients comparing transesophageal echocardiography (TEE) and ECG ST-segment analysis for the detection of myocardial ischemia.

Methods. Following HIC approval, thirty-four (n=34) adult patients for elective CABG surgery were prospectively studied for pre-CPB myocardial ischemia and postoperative myocardial infarction (PMI). Patients were monitored with peripheral and pulmonary artery catheters and received a standardized anesthetic. A Hewlett-Packard Computer processed ECG ST-segment analyzer was used to monitor leads II and V5; ischemia defined as new ST-segment deviation ≥ 1 mm from baseline ECG. Hemodynamic and ECG values were stored at two minute intervals. The pre-CPB period was divided into intraoperative epochs: pre-induction,

induction, intubation, 2 min post-intubation, incision, sternotomy, post-sternotomy, LIMA dissection, aortic cannulation, and immediately prior to CPB. After intubation, a TEE was positioned to obtain a short axis view of the left ventricle. Echocardiographic images were recorded after intubation; then 5 min before, during and after each intraoperative epoch. Tapes were analyzed independently by three investigators blinded to clinical outcome. Patients were followed for 72 hours post-operatively for ECG changes and elevations in CPK-MB fractions. Statistical analysis with coefficient correlation and Chi-square were performed.

Results. 537 epochs were successfully recorded in 34 patients. There were 16 ECG detected ischemic events in 5 patients, of which only 7/16 had a PRQ<1. In contrast, 108/520 non-ischemic epochs were associated with a PRQ<1. TEE proved to be a more sensitive detector of ischemia with 10 patients demonstrating new RWMA pre-CPB. In only 2/10 patients was the RWMA associated with a PRQ<1. Three patients exhibited ECG evidence of ischemia but not RWMA by TEE. There were four PMI's, one with pre-CPB ECG ischemia, one with pre-CPB RWMA, and two with post-CPB RWMA.

Discussion. This data confirms our previous findings,² that the PRQ is a poor indicator of myocardial ischemia. Additionally, this data supports previous studies that TEE is a more sensitive detector of ischemia than ECG. In conclusion, using either ECG or TEE the PRQ<1 was a poor indicator of myocardial ischemia.

References.

1. Anesthesiology 63, 651-662, 1985.
2. Anesthesiology 71, A48, 1989.

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Title: RIGHT VENTRICULAR WALL MOTION FOLLOWING CARDIOPULMONARY BYPASS

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Exclusive of septal contractility data, previous studies relating to right ventricular (RV) function during coronary artery bypass grafting (CABG) are limited to global performance estimates. This study was undertaken to delineate multidimensional and planar RV systolic function.

Methods. Sixteen adult CABG patients were studied. Studies fulfilled Human Investigation Committee criteria. Hemodynamic measurements were obtained with a 50 msec response RV ejection fraction (RVEF-3D) catheter (injectate port position verified by pressure waveform and saline contrast 2D-echo). 2D-echoes were obtained with a transesophageal 5.0 MHz phased-array transducer. Measurements included RVEF-3D, end-diastolic volume index (EDVI), long (LA) and short axis (SA) planed area excursion fraction (RVEF-2D_{LA} and 2D_{SA}), and LA maximum major and minor axes shortening fractions (RVEF-max major axis_{LA} and max minor axis_{LA}). Data were obtained following intubation, sternotomy and at procedure conclusion. Analyses were by correlation analysis and paired or Student's t test, as appropriate.

Results. CPB was associated with significant decreases in RVEF-2D_{LA} and RVEF-max major axis_{LA}. RVEF-3D and RVEF-max minor axis_{LA} decreased and RVEF-2D_{SA} increased (NS). The post-CPB RVEF-max major axis_{LA}/RVEF-2D_{LA} relationship was significant (r=0.65). Significant changes were unrelated to RCA disease, bypass grafting, cross-clamp time, CPB duration and CP dose.

Comment. These RV measurements allowed global and regional wall motion (RWM) quantification. Significant changes were found in the long axis, the most dominant being those which took place in the maximum major axis. The planes of the max minor axis and SA view bisect the max major axis sequentially. The absence of significant decreases in fractional shortening in these planes suggest the RWM abnormality (RWMA) was confined to the base of the RV free wall, i.e., the acute margin. This RWMA was unrelated to CPB parameters.

To conclude, this study identifies a previously unreported CABG-CPB associated RV RWMA. While the involved segment is known to be susceptible to ambient warming and air embolization, we were unable to document the precise etiology of our findings.

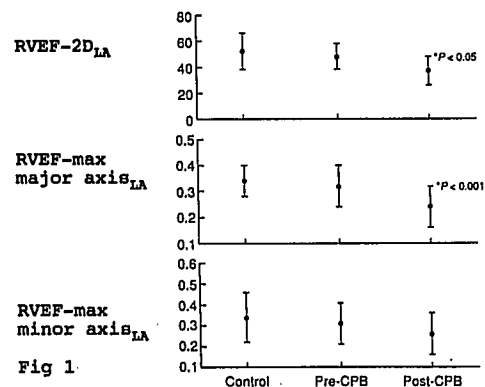


Fig 1