

Influence of Heart Rate on Diagnostic Parameters for Epicardial Coronary Stenosis with Concomitant Microvascular Disease

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Background: Presence of concomitant microvascular disease (MVD) affects the diagnosis of epicardial stenosis (ES) during cardiac catheterization. The diagnosis is also affected by factors like heart rate (HR) and percentage area stenosis (AS). For better diagnosis, this study evaluates the influence of HR on fractional flow reserve (FFR) and alternative diagnostic indices, pressure drop coefficient (CDP) and lesion flow coefficient (LFC), for various degrees of ES with MVD. We hypothesize that FFR, CDP, and LFC, assessed *in vivo*, are independent of HR. **Methods:** Simultaneous measurements of hyperemic coronary-arterial pressure drop (Δp) and average peak flow velocity (APV) were performed on 10 pigs (52 ± 5 kg), using a dual sensor guidewire. ES and MVD were created using angioplasty balloons and 90 μ m polystyrene microspheres, respectively. Vessel area was measured using IVUS catheter. CDP and LFC were calculated as $(\Delta p) / (0.5 * 1.05 * APV^2)$ and $(1 - k) / \sqrt{0.5 * \rho * u_m^2}$, respectively; k is $(1 - AS)$ and u_m is the velocity at the site of stenosis. FFR, CDP and LFC were assessed for “AS<50%” and “AS>50%”, for HR<120 and HR>120 bpm. A 2-way repeated measure ANOVA was performed with 500 measurements to determine the influence of HR on diagnostic parameters for variable AS with MVD. $p < 0.05$ was considered statistically significant. **Results:** The mean values of FFR (0.84 ± 0.02 for both HR <120, >120), CDP (65.11 ± 18.93 : HR<120, 86.16 ± 18.9 : HR>120), and LFC (0.14 ± 0.02 for both HR< 120, >120) were not significantly different ($p > 0.05$) for variable HR conditions. The mean values of FFR (0.90 ± 0.02 : AS <50%, 0.78 ± 0.01 : AS >50%), CDP (35.80 ± 19.10 : AS<50%, 115.48 ± 18.25 : AS>50%), and LFC (0.09 ± 0.02 : AS<50%, 0.20 ± 0.02 : AS>50%) were significantly different ($p < 0.001$) under variable AS conditions. **Conclusion:** For ES with concomitant MVD, HR has insignificant influence on FFR, CDP, and LFC.

