Contrast-induced microvascular dilatation: implications for fractional flow reserve measurements

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Background The use of adenosine is sometimes considered as a limiting factor for of fractional flow reserve (FFR) measurements. The present study sought to quantify the potential of contrast medium (CM) to induce microvascular dilatation as assessed by the changes in Doppler flow velocity measurements.

Methods In 30 patients, Doppler-derived flow velocity measurements were obtained in 10 right coronary arteries (RCA) and 20 left coronary arteries (LCA) free of significant stenosis. Flow velocity was measured at baseline and after 8mL intracoronary (IC) bolus administrations of arterial blood at body temperature, saline and CM compared to intracoronary boluses of adenosine at room temperature. The hyperemic value was expressed in percent of the maximum flow velocity reached in a given artery (Q/Qmax, %). To translate the IC adenosine dose into its effect on FFR, a model based on standard coronary physiology linked the degree of hyperemia to the relative distal coronary pressure (P/Pr).

Results Doppler flow velocity varied among 8mL IC boluses of arterial blood, saline and contrast (p<0.001), and all pairwise comparisons were significant (p<0.001 for blood and contrast; p=0.041 for saline and blood; and p=0.013 for saline and contrast). Hyperemic response after injection of 8mL of CM reached 59±17% of that achieved maximum hyperemia. While Baseline, arterial blood and saline achieved respectively 38±12%, 45±14% and 51±14% of Q/Qmax. The incidence of transient atrio ventricular blocks was 38% after injection of 200 μg, while it was not observed with CM. According to our theoretical model, when cm reach 50±17% of that achieved maximum hyperemia after adenosine in Doppler flow velocity it correspond to a P/Pr ratio of 0.85, where FFR is 0.79 and the resting P/Pra of 0.90.

Conclusion CM reaches approximately 60% of the maximal flow velocity as compared to Adenosine IC. This corresponds to a difference of only 6% when “translated” in terms of FFR.

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