ORIGINAL ARTICLE

Quantitative relationship between coronary vasodilator reserve assessed by ^{82}Rb PET imaging and coronary artery stenosis severity

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Abstract

Purpose The relationship between myocardial blood flow (MBF) and stenosis severity has been determined previously using cyclotron-produced radiotracers such as ^{15}O-H$_2$O and ^{13}N-ammonia. An attractive alternative to overcome the limitations related to the use of cyclotron might be to use the generator-produced ^{82}Rb as a flow tracer. The current study was undertaken to investigate the relationship between MBF and coronary vasodilator reserve (CVR) as measured by ^{82}Rb positron emission tomography (PET) and the percent diameter stenosis as defined by quantitative coronary arteriography.

Methods We prospectively evaluated 22 individuals: 15 patients (60±11 years of age) with angiographically documented coronary artery disease (CAD) and seven age-matched (56±9 years) asymptomatic individuals without risk factors for CAD. Dynamic ^{82}Rb PET was performed at rest and after dipyridamole vasodilation. MBF, CVR and an index of 'minimal coronary resistance' (MCR) were assessed in each of the three main coronary territories.

Results Rest and stress MBF in regions subtended by vessels with less than 50% diameter stenosis was similar to that of the individuals with no risk factors for CAD. As a result, CVR was also similar in the two groups (1.9, interquartile [IQ] range from 1.7 to 2.7 vs. 2.2, IQ range from 2 to 3.4 respectively, p=0.09). CVR successfully differentiated coronary lesions with stenosis severity 70% to 89% from those with 50% to 69% stenosis (1, IQ range from 1 to 1.3 vs. 1.7, IQ range from 1.4 to 2), respectively, p=0.001. In addition, hyperaemic MBF (r^2=0.74, p<0.001), CVR (r^2=0.69, p<0.001) and MCR (r^2=0.78, p<0.001) measurements were inversely and non-linearly correlated to the percent diameter stenosis on angiography.

Conclusion MBF and CVR are inversely and non-linearly correlated to stenosis severity. Quantitative ^{82}Rb PET can be a clinically useful tool for an accurate functional assessment of CAD.

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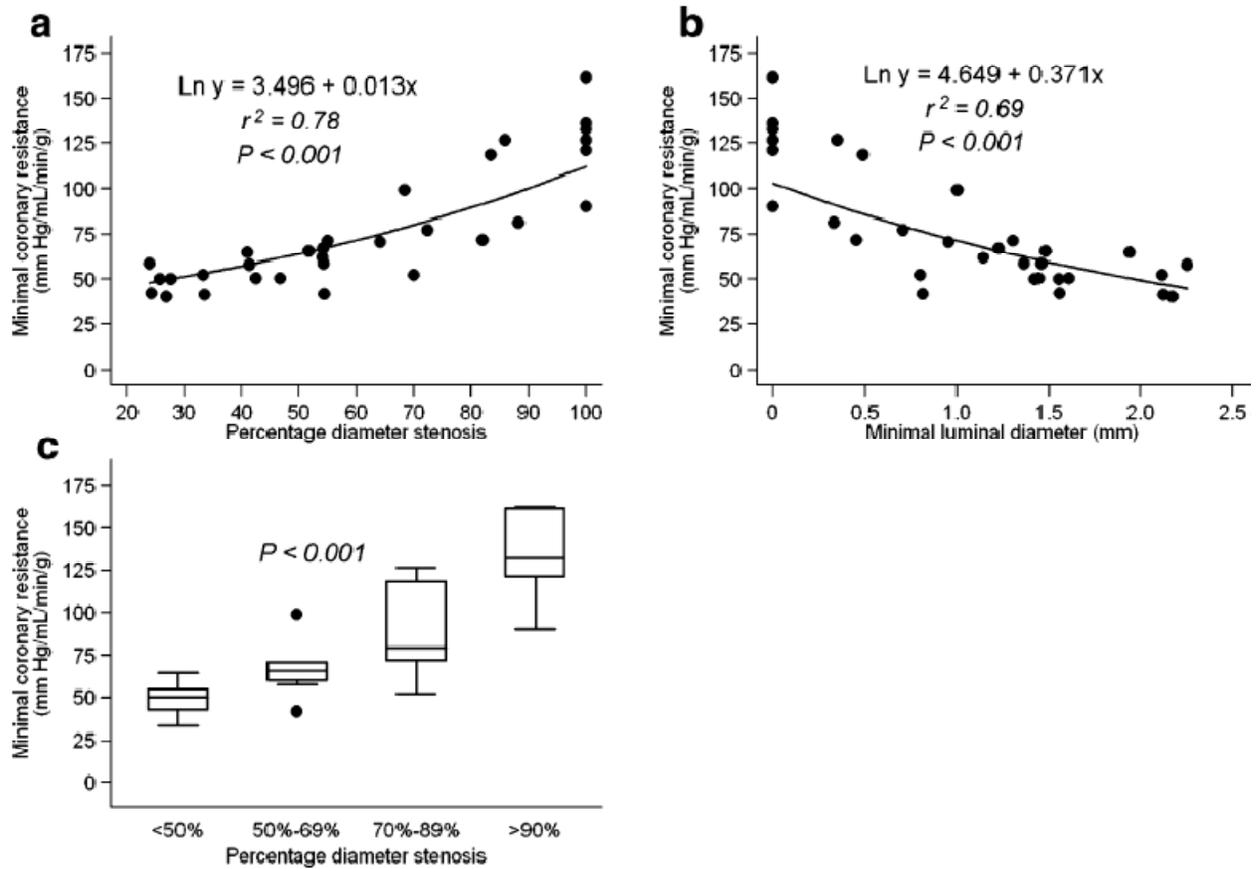London, UK

Representative Results:

Fig. 5 a. Scatter plot of the relation of MCR and quantitative coronary angiography measurements of percent diameter stenosis. b. Scatter plot of the relation of MCR and quantitative coronary angiography measurements of MLD. c. Median values of MCR with IQ range (25–75 percentiles) and with upper and lower adjacent values; asterisk, p value from Kruskal–Wallis analysis for four groups (<50%, 50–69%, 70–89% and >90% diameter stenosis)