

PHYSIOLOGIC LESION ASSESSMENT (TCTAP A-065 TO TCTAP A-070)

TCTAP A-065

Consistency of Quantitative Flow Ratio and Fractional Flow Reserve Evaluation in Patients With Coronary Artery Tortuosity

Zhenjun Ji,¹ Renhua Sun,² Wenjie Zuo,¹ Genshan Ma¹
¹Southeast University, China; ²Tancheng No.1 People's Hospital, Yancheng, China



BACKGROUND Coronary artery tortuosity is a common phenomenon in patients with coronary artery disease (CAD). Severe tortuosity may increase the risk of acute postoperative complications (such as recurrent myocardial infarction in target vessels) in patients receiving percutaneous coronary intervention (PCI). Tortuosity was defined as the presence of ≥ 3 consecutive curvatures of 90° to 180° in a major epicardial coronary artery ≥ 2 mm in diameter, measured at the end of diastole. Invasive flow reserve fraction (FFR) examination based on pressure guide wire and adenosine-induced congestion is considered a standard method for functional measurement of coronary stenosis severity. However, the application of FFR is limited because of the defects of pressure wire, the inconvenience and side effects of adenosine, and the increase in operation time and cost. Contrast quantitative flow ratio (cQFR) is a new method for evaluating coronary function based on angiography. We aimed to compare the ability of QFR and fractional flow reserve (FFR) in assessing the severity of tortuosity.

METHODS The study was approved by the Ethics Committee of Zhongda Hospital, Southeast University. From 2013.07 to 2019.12, 460 CAD patients receiving FFR examination were enrolled from Zhongda Hospital, Southeast University. The inclusion criteria were: (1) Willingness to participate in the research and sign informed consent; (2) 18-80 years old male or non-pregnant female; (3) Patients with CAD who received coronary angiography and FFR examination. Exclusion criteria: (1) Previous coronary artery bypass surgery history; (2) Chronic coronary artery occlusion; (3) Ostial lesions of main coronary arteries; (4) The bifurcation lesions classified as 1,1,1 by Medina; (5) Donor collateral artery; (6) Poor imaging quality not enough to meet the QFR measurement. Experienced cardiologists used the Phillips AlluraXperFD20 digital subtraction angiography machine to perform angiography. It was required that multiple positions were clear, target lesions exposed, and at least two orthogonal positions were used for angiography to evaluate target vessel conditions and provide image support for subsequent analysis. Then, the pressure wire (Abbott, Minnesota) was used for FFR measurement. Quantitative coronary angiography (QCA) and QFR calculation were performed offline by two certified technicians using QFR workstations (AngioPlus, Pulse Medical Imaging Technology, Shanghai Co., Ltd., Shanghai, China), and patient data were blinded to the technicians. All QCA and QFR analyses were based on previously recorded angiography. The data were analyzed by SPSS 23.0 and GraphPad Prism 8. For continuous variables conforming to normality, independent sample T-test was used for comparison between two groups, and one-way ANOVA was used for comparison between multiple groups. The Chi-square test or Fisher's exact test were used to compare binary variables. Pearson analysis was used for correlation analysis. The receiver operating characteristic curve (ROC) was analyzed to determine the predictive ability of QFR for FFR < 0.80 of target vessels.

RESULTS (1) 460 CAD patients with 497 target vessels were divided into "no tortuosity group" ($n=374$), "mild tortuosity group" ($n=29$), and "severe tortuosity group" ($n=94$). There were no significant differences in age ($P=0.881$), stent implantation history of target vessels ($P=0.108$), and tandem lesion ($P=0.454$) among these three groups, although there was a significant gender difference among the three groups ($P=0.008$). (2) There were no significant differences in FFR ($P=0.113$) and cQFR ($P=0.075$) values among the three groups. FFR values in the no tortuosity group, mild tortuosity group, and severe tortuosity group were 0.856 ± 0.0780 , 0.862 ± 0.061 , and 0.838 ± 0.076 , respectively, and cQFR values were 0.864 ± 0.083 , 0.852 ± 0.071 , and 0.843 ± 0.087 , respectively. There was also no significant difference in minimal luminal diameter (MLD) ($P=0.598$), percent area stenosis (%DS) ($P=0.685$), and lesion length ($P=0.653$) among the different groups. (3) Correlation analysis showed that cQFR

was positively associated with FFR value ($P < 0.001$) in total patients. There were also positive associations in the total tortuosity group ($r=0.790$, $P < 0.001$), mild tortuosity group ($r=0.699$, $P < 0.001$), and severe tortuosity group ($r=0.810$, $P < 0.001$). (4) ROC analysis showed that cQFR showed a significantly better ability to predict FFR < 0.80 of target vessels than that of %DS ($P < 0.001$) among all patients. The AUC of cQFR and %DS were 0.903 and 0.748, respectively. The AUC of cQFR and %DS was (0.880 vs. 0.760, $P=0.0013$) in total tortuosity group, (0.891 vs. 0.609, $P=0.0085$) in the mild tortuosity group, and (0.878 vs. 0.800, $P=0.0383$) in severe tortuosity group.

CONCLUSION cQFR and FFR had similar abilities in assessing the severity of myocardial ischemia in patients with coronary artery tortuosity, which still remained to be validated by larger samples.

TCTAP A-066

Agreement Between Different Angiography-Derived Modalities With Wire-Based Fractional Flow Reserve Systems and 30 Month Clinical Outcomes in Evaluation of Non-Hemodynamically Significant Obstructive Coronary Artery Disease, a Single Centre Experience

Han Bing Chow,¹ Chandan Bhavnani,² Kian Hui Ho,¹ Tan Chen Ting,¹ Francis Shu,¹ Keng Tat Koh,¹ Yen Yee Oon,¹ Asri Bin Said,³ Alan Fong,¹ Tiong Kiam Ong¹

¹Sarawak Heart Centre, Malaysia; ²Hospital Serdang, Malaysia; ³Universiti Malaysia Sarawak, Malaysia



BACKGROUND Coronary physiology assessment of non-flow limiting stenoses is recommended in contemporary guidelines in patients with stable coronary artery disease (CAD). Application of computational fluid dynamics to derive fractional flow reserve (FFR) eliminates the potential complications associated with hyperemia and introduction of pressure sensor wires into the coronary arteries. Angiography-derived FFR has shown consistent accuracy with wire-based systems in lesion selection for percutaneous coronary intervention (PCI). To date, comparison between different angiography-derived FFR systems has not been performed, particularly in the subset of patients with non-hemodynamically significant CAD, where PCI was deferred.

We aim to assess the agreement between different wire-free FFR systems (coronary angiography-derived fractional flow reserve (CAFFR) and quantitative flow ratio (QFR)) with wire-based FFR and the associated 30-month clinical outcomes of PCI deferral. The primary end point was a composite of death from any cause, myocardial infarction (MI) or target vessel revascularization (TVR).

METHODS A prospective, single centre study was conducted from December 2019 to June 2020 involving 69 patients (93 vessels) with angiographic stenosis of 30%-90%. After excluding patients with CAFFR of < 0.80 or poor-quality images, data from 29 patients (31 vessels) were analysed. Wire-based FFR was performed in 14 patients (48%) for comparison, at the operator's discretion. QFR analysis was carried out offline on patients with 2 angiographic views 25 degree apart to compare respective values.

RESULTS Among the study cohort, 83% were male. The mean age was 59 ± 12.6 years old. 12 (41%) patients were diabetic, 18 (62%) were hypertensive, 17 (59%) had dyslipidemia and 18 (62%) had a smoking history. The mean LVEF was $52 \pm 11.4\%$. 22 (76%) of the patients had a recent acute coronary syndrome. LAD artery was assessed in 16 (52%) vessels. The mean CAFFR, FFR and QFR was 0.80 ± 0.05 , 0.89 ± 0.05 and 0.83 ± 0.05 respectively. In the Bland-Altman plots (abstract figure 1-3), there were no significant discrepancies between the values with narrow limits of agreement and there was no significant proportional bias. In general, all three modalities showed good correspondence in hemodynamically significant (< 0.80) and non-significant values (> 0.80). There were zero procedural complications from CAFFR measurement and similarly for QFR measurements which was conducted offline. At 30 months, all 29 patients were alive. 2 patient (6.8%) met the primary end point (TVR for angina). 89.6% (26) patients remained in CCS class 1 on follow up.

CONCLUSION The 30-month outcome data illustrates the efficacy of PCI deferral utilizing non-wired based techniques that is comparable to the gold standard wired FFR. Future research with a larger sample size and longer follow-up is desired.