

AbstractID:9749 Title :Physiological Assessment of Coronary Artery Disease Based on Angiographic Image Data

Coronary arteriography is the standard method for determination of coronary anatomy and assessment of atherosclerosis. However, there are definite limitations to the use of visual estimation to assess the severity of coronary artery disease and luminal stenosis. These limitations include the large intraobserver and interobserver variability that results from subjective visual grading of coronary stenotic lesions. This is especially true in the case of an intermediate coronary lesion (30% -70% diameter stenosis), where coronary arteriography is very limited in distinguishing ischemia-producing intermediate coronary lesions from non-ischemia-producing ones. Furthermore, pathologic findings have shown a lack of correlation between the severity of coronary stenosis as estimated from coronary arteriogram and the actual severity of stenotic lesions measured in postmortem hearts. Because of the major limitations of standard coronary arteriography, a method for functional measurement of stenosis severity such as measurement of fractional flow reserve obtainable during cardiac catheterization is desirable. The fractional flow reserve measurement would provide a valuable functional information in addition to the anatomical data obtained during routine coronary arteriography.

Fractional flow reserve was introduced to provide a physiological measure of coronary stenosis by quantifying the reduction in maximum coronary blood flow from the theoretical maximum normal flow in the presence of a lesion. Currently, fractional flow reserve is approximated by dividing the pressure distal to the stenosis by the aortic pressure. The distal pressure is measured using a pressure-sensing wire that has passed across the stenosis, and the aortic pressure is measured simultaneously at the catheter tip with a pressure transducer. Pressure-based fractional flow reserve has proven to aid the evaluation of the flow-limiting potential of stenoses as well as the therapeutic gain of angioplasties. However, an alternative technique that can measure fractional flow reserve using only angiographic images would be a valuable tool in the cardiac catheterization laboratory because the acquired image is used for visual assessment of stenosis severity can also be used to quantify physiological alterations imposed by the stenosis. In other words, fractional flow reserve could potentially be

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measured using only image data without the need to pass a pressure wire across stenosis. The blood flow through the stenotic lesion is measured with a first-pass distribution analysis technique and the theoretical normal blood flow is estimated by using a measurable parameter that correlates well with it. Scaling laws relationships indicate that the total coronary arterial volume can be used as a surrogate measure of normal blood flow. The details of the methodology for fractional flow reserve quantification using angiographic image data will be discussed.

This lecture will provide a novel view of the emerging techniques for assessment of the physiological significance of coronary lesions measured in the cardiac catheterization laboratory.

Educational objectives:

1. Understand the current techniques available for measurement of fractional flow reserve in the cardiac catheterization laboratory.
2. Understand the methodology for coronary blood flow measurement using angiographic image data.
3. Understand the methodology for fractional flow reserve measurement using angiographic image data.