Fractional Flow Reserve: A Good or a Gold Standard?

“Coronary pressure NEVER lies.”
—Koolen and Pijls (1)

“...the authors took the responsibility and consequences of their actions by STRICTLY adhering to treating patients with FFR < 0.80 and deferring patients with FFR > 0.80.”
—Pijls and Tonino (2)

We thank Dr. Johnson and colleagues and Dr. Fan and colleagues for their interest in our work (3).

Fractional flow reserve (FFR) has come a long way over the last 20 years, from an upstart to what is now commonly proposed as an infallible gold standard for the detection of myocardial ischemia. The brilliance of the pioneer clinical scientists who forged their way forward against skepticism may understandably have moved them to exceptional heights of eloquence and may explain why the inherent limitations of this valuable technique have never been openly discussed. Our reflections on FFR variability (3) do not question the value of FFR, a tool that we use every day in our laboratory as a guide to treatment decisions. We simply addressed the potential limitations of a dichotomous interpretation of FFR results. Our aim was to help clinicians see that FFR, like all other measurements in medicine, does not carry strict dichotomous implications for which treatment is best, and this is especially true close to the cutoff.

Dr. Johnson and colleagues point out that we used only the data salvaged from oblivion through publication by Kern et al. (4), because the original DEFER study data seem to have been mislaid, unfortunately—an increasingly common problem with pivotal FFR datasets. They are also right that our methodology perhaps influenced our results. However, may we correct them:

we underestimated FFR variability (SD of difference) at only 3.2%. The DEFER study reported only mean absolute difference, from which SD of difference can be derived as 3.7%. We have explored this issue in more details in a recent publication (5), from which readers can test the FFR intrinsic variability in their own samples.

Dr. Johnson and colleagues and Dr. Fan and colleagues also cast doubts on our analysis because of the old pressure guidewire technology used in the DEFER study. Do they suggest that the positive results of the DEFER study should be re-examined? Also, should these concerns be extended to the validity of other early pivotal FFR studies? We should recall that the most important piece of evidence on the diagnostic efficiency of FFR in identifying ischemia-generating stenoses comes from a study of 46 patients, investigated nearly 20 years ago with even older pressure wires (6). Reassuringly, using state-of-the-art wire technology, Ntalianis et al. (7) recently reported the test–retest variability of FFR to be 5% when taken more than 24 h apart, demonstrating elegantly that FFR measurement variability is a true biological phenomenon.

We do agree with Dr. Fan and colleagues that clinicians should assess test–retest reproducibility of FFR in their own hands and make repeated measurements of FFR when facing intermediate values. We merely recommend parsimony, both with adenosine and with references to golden infallibility. Clinicians must integrate many aspects of lesion and patient characteristics into their decisions. If clinicians sometimes stent stenoses with an FFR = 0.81, or indeed defer some with an FFR ≈ 0.74, they are not automatically irresponsible or careless.

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REFERENCES
Precise Location of Ideal Common Femoral Artery Puncture Site

The article by Toggweiler et al. (1) on vascular access with largesheath cannulation of the common femoral artery was an excellent review for physicians performing transcatheter aortic valve or endovascular aneurysm repair procedures. However, I believe their description of the ideal femoral puncture site was not good. From a clinical, interventional perspective, the ideal common femoral puncture site is between the femoral bifurcation and the inferior border of the inferior epigastric artery (2). The inferior border and the origin of the inferior epigastric artery are commonly not the same. This is shown in Figure 1 of the paper by Toggweiler et al. (1). Punctures above the inferior sweep or lowest border of the inferior epigastric artery are commonly associated with retroperitoneal hemorrhage.

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Reply

Reply: Precise Location of Ideal Common Femoral Artery Puncture Site

We thank Dr. Feldman for his interest in our paper (1). We agree with Dr. Feldman. Retroperitoneal bleeding may occur

Figure 1. Basic Iliofemoral Anatomy

The external iliac artery passes under the inguinal ligament, at which point it is renamed the common femoral artery. The inferior epigastric artery arises from the external iliac artery, just above the inguinal ligament and serves as a useful landmark to demarcate the retroperitoneal space (A). The average minimal artery diameter Q5 of the common iliac artery, the external iliac artery, and the common femoral artery are shown (B).