Fractional Flow Reserve Assessment of a Coronary Artery Fistula

Joseph Petit, Ramin Assadi, Anthony Hilliard

Loma Linda University Medical Center

Key words: Fractional Flow Reserve; coronary artery fistula

Citation: Petit J., Assadi R., and Hilliard A. Fractional Flow Reserve Assessment of a Coronary Artery Fistula. International Cardiovascular Forum Journal. 2015;4:64-65 DOI: 10.17987/icfj.v4i0.123

A 63 y/o male with a past medical history of hypertension, chronic obstructive pulmonary disease, and obesity was admitted to an outside hospital for an abdominal incisional hernia repair and cholecystectomy. Post-operatively he developed shortness of breath (SOB) and multiple runs of paroxysmal atrial fibrillation. A CT scan was negative for pulmonary embolism, but showed a left anterior descending (LAD) coronary artery to main pulmonary artery (MPA) fistula. He was transferred to our facility for further management.

Upon transfer, the patient was able to ambulate without SOB and no arrhythmias were recorded on telemetry. He underwent a stress echocardiogram—a dobutamine stress echocardiogram was performed as the patient had limited functional capacity on the initial treadmill study in part due to his recent surgery. It showed normal left and right ventricular function with an ejection fraction of 60%, at rest. During pharmacologic stress, his peak heart rate was suboptimal only reaching 67% of his predicted maximum heart rate. His EF improved to 65% without evidence of any regional wall motion abnormalities.

Given his initial presentation at the outside hospital and his current clinical status at our institution and no objective signs of cardiac limitation a right and left heart catheterization was performed. The right heart pressures were slightly elevated. A shunt run showed no step up in oxygen saturation (Table 1) suggesting similar pulmonary and systemic flows. A left heart catheterization was then performed showing no significant coronary artery disease but demonstrated a fistula originating at the mid LAD connecting to the MPA, with only a small connection between the aneurysmal fistula and the MPA (Image 1). Intravascular ultrasound (IVUS), with a Volcano 5F Eagle Eye, measured the mid LAD diameter at 7 mm², compared to a 13.2 mm² diameter in the proximal LAD, with a 37.3% plaque burden. The os of the fistula measured 3.4 mm².

Given no step in oxygen saturation and only minimal flow into the MPA, further testing for ischemia was performed by placing a Volcano Verrata 0.014 inch wire was positioned distal to the LAD fistula and fractional flow reserve (FFR) was performed. The baseline resting pressure difference was 0.88. With intravenous adenosine infusion at 140mg/kg/min the pressure gradient increased to 0.84. Based on these findings—no oxygen step up on shunt run and an FFR measurement >0.80 closure of the coronary fistula.

Coronary artery fistulae are a rare congenital anomaly that often present with nonspecific symptoms causing a wide range of problems including shunting resulting in myocardial ischemia, LV failure, pulmonary hypertension and arrhythmias. Current national guidelines state, “small to moderate coronary arteriovenous fistula in the presence of documented myocardial ischemia, arrhythmia, otherwise unexplained ventricular systolic

Figure 1:

Table 1: Right Heart Catheterization Blood Oxygen Saturations

<table>
<thead>
<tr>
<th>Location</th>
<th>Oxygen Saturation Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right Atrium</td>
<td>59</td>
</tr>
<tr>
<td>Right Ventricle</td>
<td>56.6</td>
</tr>
<tr>
<td>Proximal main Pulmonary Artery</td>
<td>59.3</td>
</tr>
<tr>
<td>Distal main Pulmonary Artery</td>
<td>59.4</td>
</tr>
<tr>
<td>Right Pulmonary Artery</td>
<td>60.3</td>
</tr>
<tr>
<td>Left Pulmonary Artery</td>
<td>61.2</td>
</tr>
<tr>
<td>Aorta</td>
<td>98</td>
</tr>
</tbody>
</table>

* Corresponding author. E-mail: jpetit@llu.edu

ISSN: 2410-2636 © Barcaray Publishing
or diastolic dysfunction or enlargement, or endarteritis should be closed via either a transcatheter or surgical approach after delineation of its course and its potential to fully obliterate the fistula”(1). However, when these criteria are not met there is often clinical ambiguity regarding their definitive management. We report the use of FFR as an adjunctive tool in this clinical situation to help confirm or possibly refute traditional tools used to demonstrate the hemodynamic consequences of coronary artery fistula. Fractional flow reserve is a key tool in the interventionist’s armamentarium for evaluating the hemodynamic significance of coronary artery stenosis with robust data supporting deference of revascularization when the pressure difference remains >0.80².

In this case, we feel the addition of FFR for assessment of shunt significance provided important adjunctive data given that the patient had symptoms of SOB and findings of non-sustained atrial arrhythmias which could be attributable to a coronary fistula but were only observed immediately in a post-operative setting. Moreover, objective traditional data of hemodynamic significance on noninvasive and invasive studies were inconclusive. Our rationale for the application of FFR in coronary artery fistula is that there is “competition of flow”—antegrade flow to the distal vessel and antegrade flow to the fistula. We propose that if a fistula is hemodynamically significant at rest or with stress than antegrade flow to the distal vessel should be impaired similar to that which is seen with a coronary stenosis. In our patient, flow was abnormal at rest and with maximal hyperemia with intravenous adenosine (0.88 and 0.84) but not the meeting criteria for revascularization and with no oxygen step-up on saturations, despite the size of the fistula we deferred closure. The patient’s reported symptoms and arrhythmias resolved a few days after his noncardiac surgery and he has had no recurrence of these symptoms more than 9 months after this initial evaluation. In summary, we believe this case example supports the consideration of FFR as an adjunct evaluation in the assessment of hemodynamic significance of coronary artery fistulae.

Statement of ethical publishing
The authors state that they abide by the statement of ethical publishing of the International Cardiovascular Forum Journal³.

Conflict of interest:
There is no conflict of interest for any of the authors.

Address for correspondence:
Joseph Petit, MD
Loma Linda University Medical Center
11234 Anderson Street, Ste. 2426, Loma Linda, CA 92354
Phone Number: 909-558-7674
Fax Number: 909-651-5938
E-mail: jpetit@llu.edu

References
3. Shewan LG, Coats AJS, Henein M. Requirements for ethical publishing in biomedical journals. International Cardiovascular Forum Journal 2015;2:2 DOI: 10.17987/icfj.v2i1.4