Clinical case in perspective

Cases from Poland

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**Fractional Flow Reserve (FFR)**

**ESC Guidelines Recommendations**

**Guidelines on myocardial revascularization**

FFR-guided PCI is recommended for detection of ischaemia-related lesion(s) when objective evidence of vessel-related ischaemia is not available.


**ESC Guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation**

In lesions whose severity is difficult to assess, intravascular ultrasound or fractional flow reserve (FFR) measurements carried out 5 days after the index event are useful in order to decide on the treatment strategy.


**2013 ESC guidelines on the management of stable coronary artery disease**

<table>
<thead>
<tr>
<th>FFR is recommended to identify hemodynamically relevant coronary lesion(s) when evidence of ischaemia is not available.</th>
<th>I</th>
<th>A</th>
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</thead>
<tbody>
<tr>
<td>Revascularization of an angiographically intermediate stenosis without related ischaemia or without FFR &lt; 0.80 is not recommended.</td>
<td>III</td>
<td>B</td>
</tr>
<tr>
<td>Revascularization of stenoses with FFR &lt; 0.80 is recommended in patients with angina symptoms or a positive stress test.</td>
<td>I</td>
<td>B</td>
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Global adoption of FFR

Rough estimate of FFR adoption in different regions of the world. Figures show % of FFR adoption in clinical practice (not p values!)
Case presentation

**Demography:**
Age: 60 y.
Sex: female

**Risk Factors:**
Diabetes: Yes (insulin)
Hypertension: Yes
Dyslipidemia: Yes
Smoking: Yes
Family history of CAD: No

**Past Medical History:**
Post MI: No
Post CABG: No
Post PCI: No

**Clinical presentation (20.10.2009):**
Directly transferred to the cathlab by an ambulance
STEMI inf.; ST↑ - II, III, aVF; ST↓ - I, aVL, V1-V3
Primary PCI: RCA – 20.10.2009

- Direct stenting, BMS 3,5 x 19 mm, 14 atm
- TIMI-3
How to treat this patient?

1. Optimal Medical Therapy (OMT)?

2. Elective PCI: CX at second stage + OMT?

3. Invasive assessment (IVUS, FFR) of the left main?

4. CABG?
How to treat this patient?

1. Optimal Medical Therapy (OMT) ?

2. Elective PCI: CX at second stage + OMT ?

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4. CABG ?

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PCI: CX – 9.11.2009

– Stable angina CCS II, EF=50%
– Optimal result of pPCI: RCA
– DES 3,0 x 28 mm, 14 atm

J. Legutko, J. Jakala. University Hospital in Krakow, Presented at EuroPCR 2012
Optimal Medical Therapy

- Aspirin 75 mg
- Clopidogrel 75 mg
- Bisoprolol 10 mg
- Perindopril 10 mg
- Atorvastatin 80 mg
- Pantoprazol 20 mg
- Insulin
Repeat hospitalization – 24.06.2010

- Stable angina CCS II/III, EF=50%
- Optimal Medical Therapy
- Optimal result of pPCI: RCA and CX
- No disease progression by angiography
How to treat this patient?

1. Optimal Medical Therapy (OMT) ?

2. Invasive assessment (FFR, IVUS) of the left main ?

3. PCI: LMCA + OMT ?

4. CABG ?

J. Legutko, J. Jakala. University Hospital in Krakow, Presented at EuroPCR 2012
How to treat this patient?

1. Optimal Medical Therapy (OMT) ?

2. Invasive assessment (FFR, IVUS) of the left main

3. PCI: LMCA + OMT ?

4. CABG ?
FFR and IVUS: LMCA

FFR (LAD) = 0.69
Adenosine i.v. infusion, (180 µg/kg/min.)

FFR (LCX) = 0.76
Adenosine i.v. infusion, (180 µg/kg/min.)

J. Legutko, J. Jakala. University Hospital in Krakow, Presented at EuroPCR 2012
Ostial left main stenosis – FFR vs. IVUS
Ostial left main stenosis – FFR vs. IVUS

NTG i.c. bolus of 1000 μg

NTG i.c. bolus of 500 μg

NTG i.c. bolus of 250 μg

$LA_{\text{min}} = 9,0 \text{ mm}^2$

$LA_{\text{min}} = 6,7 \text{ mm}^2$

$LA_{\text{min}} = 4,0 \text{ mm}^2$
Ostial left main stenosis – FFR vs. IVUS

1 year follow-up

NTG ic bolus of 250 μg

La_min = 10.8 mm²
Borderline Left Main Stenosis
Comparison of FFR and IVUS

**FFR≤0,75 – MLA≤5,9mm²**
Area Under Curve = 0,81250
Sensitivity = 0,6905
Specificity = 0,8542
P<0,001

**FFR≤0,80 – MLA≤7,5mm²**
Area Under Curve = 0,86512
Sensitivity = 0,8868
Specificity = 0,7027
P<0,001

Prospective Application of Pre-Defined Intravascular Ultrasound Criteria for Assessment of Intermediate Left Main Coronary Artery Lesions

Results From the Multicenter LITRO Study

Figure 4: Survival Free of Cardiac Death in Both Groups

Figure 5: Survival Free of Cardiac Death, Myocardial Infarction, and Any Revascularization in Both Groups
FFR and IVUS: LMCA

FFR (LAD) = 0.69
Adenosine i.v. infusion,
(180 µg/kg/min.)

FFR (LCX) = 0.76
Adenosine i.v. infusion,
(180 µg/kg/min.)

LAmin = 4.1 mm²

J. Legutko, J. Jakala. University Hospital in Krakow, Presented at EuroPCR 2012
HEART TEAM APPROACH

Clinical Cardiologist (non-interventional)

Interventional Cardiologist

Cardiac Surgeon

Anesthesiologist

Radiologist

Cardiac Surgeon

Vascular surgeon

PATIENT
PCI: LMCA – 5.07.2010

- Direct stenting
- DES 3.5 x 18 mm, 14 atm
- Balloon postdilatation 4.0 x 10 mm, 14 atm

LA_{min} = 11.1 \text{ mm}^2
Case summary

ANGIO-guided revascularization

1st proc. 10.2009
2nd proc. 11.2009
3rd proc. 05.2010
4th proc. 06.2010
5th proc. 07.2010

CAG + pPCI: RCA
CAG + PCI: LCX
CAG
FFR/IVUS
PCI: LMCA

FFR-guided revascularization

1st proc. 10.2009
2nd proc. 11.2009

CAG + pPCI: RCA
FFR/IVUS + PCI LMCA and CX
Case summary

ANGIO-guided revascularization

1st proc. 10.2009  
2nd proc. 11.2009  
3rd proc. 05.2010  
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CAG + pPCI: RCA
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CAG
FFR/IVUS
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ESC Guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation

J. Legutko, J. Jakala. University Hospital in Krakow, Presented at EuroPCR 2012
FFR vs. IVUS
in non Left Main Lesion Assessment

Minimum Lumen Area (MLA) 2.50 mm²
Percent Plaque Burden 75 %
Plaque type PIT

Adenosine i. v. infusion 140 µg/kg/min.

**Minimum Lumen Area (MLA)**

**IVUS-guided PCI of the RCA?**

**FFR-guided PCI of the RCA?**

- **FFR = 0.97**
- Adenosine i.v. infusion, (180 µg/kg/min.)

**YES!**

**NO!**

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*Legutko J, et al. Post Kardiol Interw 2011; 7, 3 (25):*
167 consecutive patients, with intermediate coronary lesions evaluated by FFR or IVUS (FFR-guided, 83 lesions vs. IVUS-guided, 94 lesions). Cutoff value of FFR in FFR-guided PCI was 0.80, whereas that for minimal lumen cross sectional area in IVUS-guided PCI was 4.0 mm$^2$. MACE: death, MI, ischemia-driven TVR at 1 year.

FIRST: Fractional Flow Reserve and Intravascular Ultrasound Relationship Study

Ron Waksman, MD,* Jacek Legutko, MD,† Jasvinder Singh, MD,‡ Quentin Orlando, DO,§ Steven Marso, MD,‖ Timothy Schloss, MD,¶ John Tugaeon, MD,‖ James DeVries, MD,** Nicholas Palmer, MD,†† Michael Haude, MD,‡‡ Stacy Swymelar, BS,* Rebecca Torguson, MPH*
Washington, DC; Krakow, Poland; St. Louis, Kansas City, Washington, Missouri; Erie, Pennsylvania; Columbus, Ohio; Lebanon, New Hampshire; Liverpool, United Kingdom; and Neuss, Germany

A  All lesions, n=367

B  Ref.D<3,0 mm

C  Ref.D=3,0-3,5 mm

D  Ref.D>3,5 mm

Conclusions: Anatomic measurements by IVUS show a moderate correlation with the FFR values. The optimal cutoff for an MLA to FFR 0.8 is vessel dependent. Plaque morphology characteristics do not correlate with FFR. The utility of IVUS MLA as an alternative to FFR to guide intervention in intermediate lesions may be limited in accuracy and should be tested clinically.

30 days follow-up

SPECT - 1 month after PCI: LAD 13 METs, no symptoms

Legutko J, eta al. Post Kardiol Interw 2011; 7, 3 (25):
Is FFR impacting the treatment strategy? (example of the R3F registry)

- 945 patients evaluated with angio, then FFR for final treatment decision
- FFR guidance reduced PCIs by 6%, but **changed the treatment for 45% of patients**

45% of patients changed therapy with FFR guidance
Thank you for your attention!

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