CASE PRESENTATION

Complete staged coronary revascularization using FFR in a patient presenting with acute STEMI. A case report

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Abstract: PPCI is the preferred reperfusion strategy in patients with STEMI within 12h of symptom onset, provided it can be performed expeditiously by an experienced team. Multivessel disease (MVD) is common in patients presenting with STEMI, ranging from 20 to 50% in different trials. There is a consensus among the ESC and ACC/AHA guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation that obtaining complete coronary revascularization leads to a better outcome than treating only the IRA. Although four studies have been published (PRAMI, CvLPRIT, DANAMI-3-PRIMULTI, Compare-Acute) there is still a lack of evidence about the optimal timing for complete revascularization (immediate vs. staged), the guidelines favoring the staged approach. We are conducting a randomized trial in Oradea's Clinical Emergency Hospital Cathlab, comparing the mortality at one month and one year between patients with STEMI and MVD that received complete revascularization in an immediate vs. staged procedure. This article will present the case of a patient with complete staged FFR guided revascularization who presented in the setting of STEMI associated with coronary MVD. Although the above-mentioned trial's indication for non IRA PCI is angiography-guided (>75% stenosis), the use of FFR is employed when there is ambiguity.
Keywords: STEMI, multivessel disease, FFR-guided, complete.

Rezumat: Revascularizarea primară percutană efectuată în timp util de o echipă experimentată, este metoda de revascularizare de elecție la pacienții cu STEMI care se prezintă în primele 12 ore de la debutul simptomatologiei. Boala coronariană multivasculară (BCM) este frecventă la pacienții cu STEMI având o prevalență între 20 și 50% în diferite studii. Există un consens între ghidurile de tratament STEMI ale ESC și ACC/AHA asupra faptului că obținerea unei revascularizări complete duce la rezultate mai bune decât aboradarea doar a arterei responsabile de infarct. Există o lacună în ceea ce privește timpul optim de completare a revascularizării coronariene (imediat sau stagiat), deși au fost publicate patru studii (PRAMI, CvLPRIT, DANAMI-3-PRIMULTI, Compare-Acute), ghidurile înclinând spre o abordare stagiată. În cadrul laboratorului de cateterism al Spitalului Clinic Județean Oradea desfășuram un studiu randomizat ce compară mortalitatea la o lună și la an între pacienții cu STEMI și BCM la care se face revascularizare completă imediată sau stagiată În acest articol vom prezenta cazul unui pacient cu STEMI și BCM la care s-a obținut revascularizare completă stagiată, ghidată de FFR. Deși studiul menționat folosește evaluarea angiografică ca metodă de estimare a leziunilor semnificative în arterele neresposabile de infarct (stenoză >75%), FFR este utilizat în cazurile ambigue.
Cuvinte cheie: STEMI, boală coronariană multivasculară, FFR-ghidată, completă.

INTRODUCTION

Patients presenting with acute ST-segment elevation myocardial infarction (STEMI) are effectively treated with emergency angioplasty which restores blood flow to the coronary artery and, by doing so, rescues the myocardium supplied by the infarcted related artery (IRA). 20% to 50% of patients presenting with STEMI have multivessel coronary disease (MVD) meaning that they present major stenoses in coronary arteries that are not responsible for the myocardial infarction. Several studies (PRAMI, DANAMI-3-PRIMULTI, CvLPRIT, Compare-Acute) have shown the benefits in terms of a lower rate of repeat revascularization and non-fatal myocardial infarction (MI) (in the

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PRAMI trial) in the non-IRA intervention arm, causing a shift in the guidelines approach toward this subset of patients. Thus, there is now a consensus towards complete revascularization of MVD patients presenting with STEMI, the ESC guideline stating that "revascularization of non-IRA lesions should be considered before hospital discharge". There was no impact on mortality in none of the studies. PCI of non-IRA was done either during the index procedure (PRAMI and Compare-Acute), staged during hospital admission (DANAMI-3–PRIMULTI), or any time before discharge (immediate or staged) (CVLPRIT). Indication for PCI in non-IRA was angiography-guided in lesions with ≥50% stenosis (PRAMI), >70% stenosis (CVLPRIT), or fractional flow reserve (FFR)-guided (DANAMI-3–PRIMULTI and Compare-Acute). Taking in account the structure of the trials presented above, there is no consensus about the optimal timing for complete revascularization (during the PPCI or staged) or the method for estimating the severity of the stenosis. The undergoing COMPLETE trial, which has already shown in its COMPLETE-SHOCK subgroup better outcomes for IRA only PCI in multivessel patients presenting with STEMI and shock, might provide further insight. Our center currently carries out an ongoing trial comparing mortality at one month and one year as primary endpoints between patients presenting with STEMI, MVD and not in cardiogenic shock, who undergo full revascularization in the PPCI setting versus a staged approach in witch the IRA is revascularized during PPCI and the rest of the significant stenosis in a single second procedure before discharge from the hospital.

Careful and stepwise evaluation of the fractional flow reserve (FFR) index has been performed over the years, culminating in the landmark Fractional Flow Reserve Versus Angiography for Multivessel Evaluation (FAME) and Fractional Flow Reserve-Guided Percutaneous Coronary Intervention Plus Optimal Medical Treatment Versus Optimal Medical Treatment Alone in Patients with Stable Coronary Artery Disease (FAME II) trials. Findings from these studies demonstrated unequivocally the overall inadequacy of angiography versus FFR to correctly assess stenosis severity.

CASE PRESENTATION

A 65 years old female patient with cardiovascular risk factors (hypertensive, dyslipidemia, age) without any prior presentation for cardiovascular disease, is admitted on the cardiology ward with a diagnosis of acute coronary syndrome (unstable angina). The general objective examination reveals a stable general condition, normal rhythmic heartbeats without any heart murmurs and no pulmonary stasis. The electrocardiogram performed on admission shows no particular ischemic modifications and the cardiac enzymes value levels are in the normal range. Complete blood count and biochemistry laboratory tests are within normal range. Noninvasive cardiac evaluation by echocardiography shows a nondilated left ventricle (LV) with a mild depressed systolic function (ejection fraction 48%), hypokinesis of the inferior posterior wall, mild mitral regurgitation and moderate tricuspid regurgitation without signs of pulmonary hypertension. The treating physician decides to do a ECG stress test (Bruce protocol) witch causes the appearance of ST-segment elevation in the inferior lateral leads associated with angina during the third step of the test. The patient is rushed to the cathlab for emergency coronarography. The coronarography shows proximal-middle section occlusion of the right coronary artery (RCA) and two seriated moderate stenosis of the proximal to mid segment of the left anterior descending artery (LAD) (Figure 1,2,3,4 – the arrows point at the stenosis).

The patient was randomized in the B group meaning she will receive a staged complete revascularization with the IRA being revascularized in the PPCI setting and the other lesions in a second procedure before discharge. We performed PPCI with DES implantation on the ACD obtaining a good angiographical, proce-

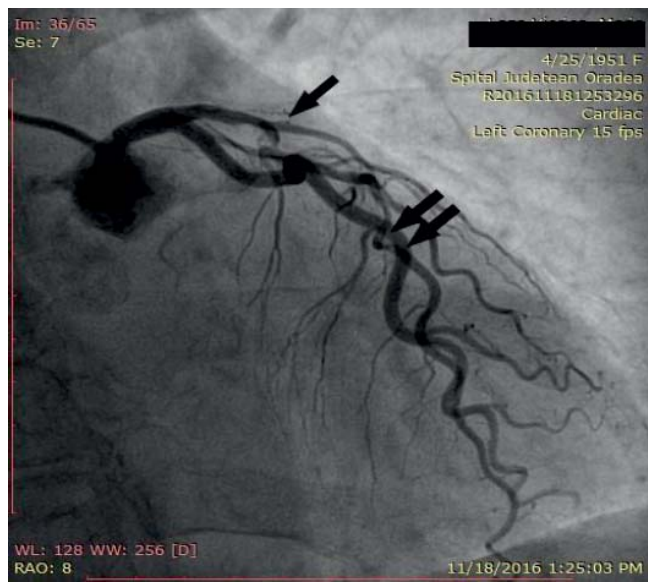

Figure 1. Left coronary artery RAO 30°, Cranial 30°.

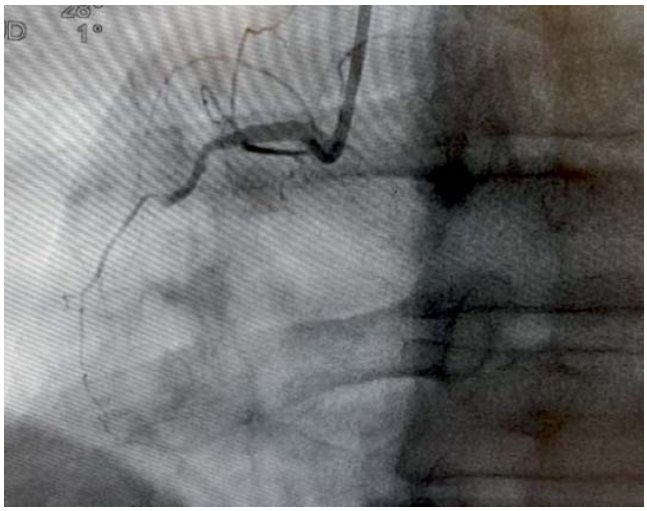

Figure 2. Proximal-mid section occlusion of the RCA (LAO 28°).

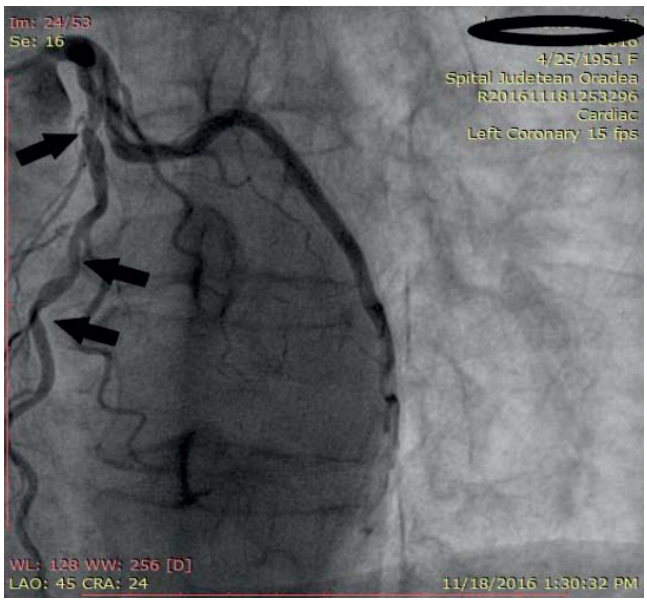

Figure 3. Left coronary artery – LAO 30°, Cranial 30°.

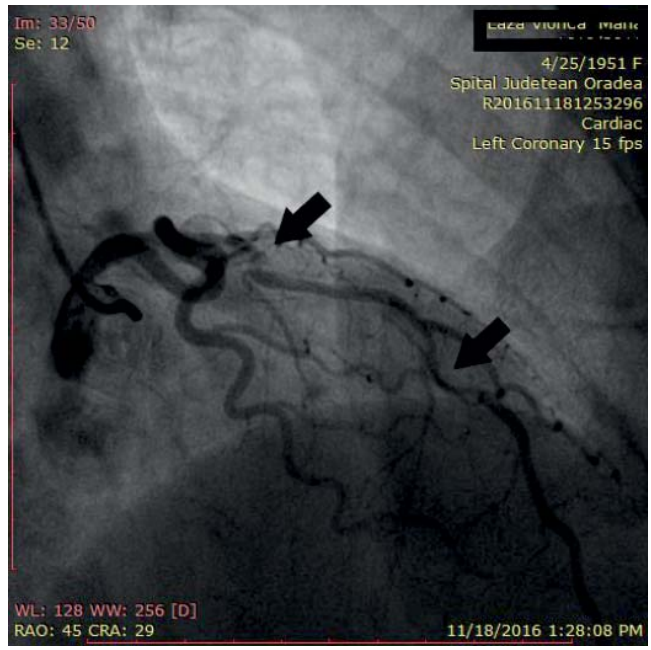

Figure 4. Left coronary artery – RAO 45°, Cranial 29°.

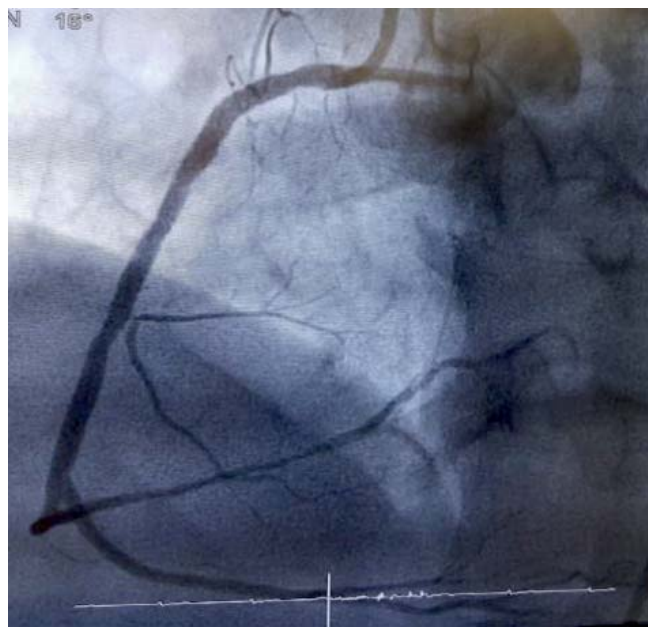

Figure 5. Result on the RCA after stenting with DES in the proximal-middle segment.

dural and clinical result (Figure 5). Four days after the procedure the patient underwent a second coronarography with FFR (QUANTIEN™ Integrated FFR System, St. Jude, Abbott Vascular) evaluation that clearly showed the severity of both lesions on the LAD (Figure 7).

The FFR was necessary due to the tortuosity of the vessel which made the angiographical estimation of the stenosis impossible. Taking into account the result of the coronary physiology testing, we proceeded with PTCA and implantation of two DES on the proximal and mid segment of the LAD with good result (Figure 6). The patient was put on medical therapy consisting of ticagrelor 90 mg twice/day, AAS 100 mg once/day, atorvastatin 80 mg once/day, carvedilol 12.5 mg twice/day, ramipril 10 mg once/day and pantoprazole 20 mg once/day. Her one month and one-year outcome was good without any need for hospitalization or target lesion revascularization (TLR).

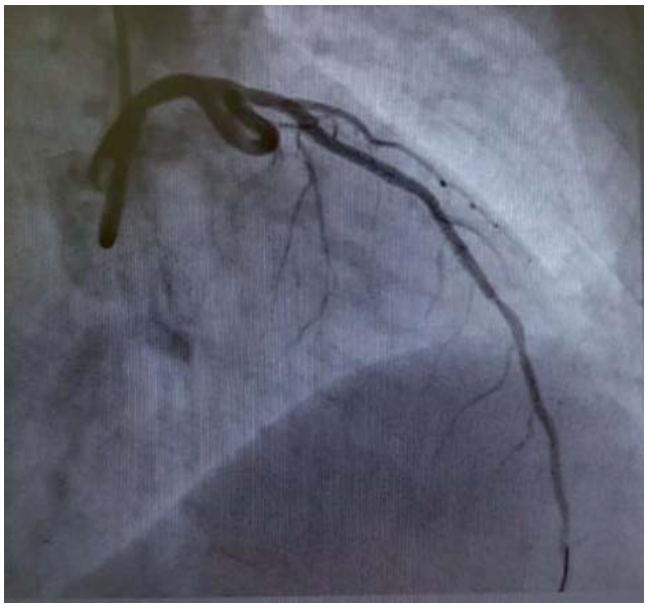

Figure 6. Result on the LAD after stenting with two DES in the proximal and middle segment.

Figure 7. FFR pullback on the LAD.

DISSCUTION

The emergence of PTCA was a milestone in the treatment of ischemic coronary artery disease patients with impact on the prognosis and also on the evolution of symptoms. Another breakthrough was the use of mechanical revascularization in the setting of acute coronary syndromes and especially STEMI leading to lower mortality and morbidity in this set of patients. Many things regarding patient selection, time or, should I say, times of revascularization, the optimal technique and equipment have been revised and have their well-established place in the guidelines. Still, there are some questions that await answers like those about the best management of non-IRA lesions. Such unresolved issues are: the best criteria to guide PCI (angiography, FFR, or assessment of plaque vulnerability) and the best timing for complete revascularization if indicated (during index PCI or staged, including staged during hospitalization vs. after discharge). These options seem to be at the discretion of the operator without a clear-cut guidelines indication. We hope that further trials and meta-analysis will shed new light upon these problems, probably the results from the COMPLETE trial and ISCHEMIA trail (for patients with stable coronary disease). We mentioned the ISCHEMIA trial because a patient with revascularization of the IRA is basically turned into a stable coronary artery disease patient for which the result of the above-mentioned trial would apply. It is our desire that the small trial we are conducting „complete revascularization during PPCI versus staged revascularization with the IRA during the PPCI setting and completeness of revascularization obtained in one session before discharge, in patients presenting with STEMI and multivessel disease" can contribute to the body of evidence. The case presented is one of the patients enrolled in this trial. The trial comprises 100 patients randomized in two groups in a 1:1 fashion, group A receiving immediate complete revascularization while group B staged complete revascularization during the same admission. Another important issue is how to approach questionable stenosis. This case presented two non-IRA stenosis on the LAD that were particularly hard to asses partly because the angiogram represents a luminal image of the vessel and by that causes error in appreciating the true atherosclerotic burden in the context of diffuse disease and absence of a free atherosclerotic portion of the vessel for comparison purpose and on the second hand the vessel has a 3D track on the epicardium while the angiography is a 2D image which is prone to overlapping, foreshortening and by that hiding or exaggerating the severity of a lesion.

CONCLUSIONS

The treatment of a patient with multivessel coronary artery disease, especially in the setting of STEMI, is a challenging one requiring many times the employment of additional invasive techniques such as physiological coronary assessment (FFR, iFR etc.) or intracoronary imaging. There is a gap in the body of evidence about

the optimal criteria to guide PCI and the best time for complete revascularization. Further trials are needed to answer once and for all these questions and improve the outcome of patients with this disease.

Conflict of interest: none declared.

References:

1. 2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation: The Task Force for the management of acute myocardial infarction in patients presenting with ST-segment elevation of the European Society of Cardiology (ESC) Borja Ibanez Stefan James Stefan Agewall Manuel J Antunes Chiara Bucciarelli-Ducci Héctor Bueno Alida L P Cafori o Filippo Crea John A Goudevenos Sigrun Halvorsen .European Heart Journal, Volume 39, Issue 2, 7 January 2018, Pages 119–177, https://doi.org/10.1093/eurheartj/ehx393 Published: 26 August 2017
2. The FAME Trials: Impact on Clinical Decision Making Guy R Heyndrickx Gábor G Tóth ICR - Volume 11 Issue 2 Winter 2016
3. Complete revascularisation versus treatment of the culprit lesion only in patients with ST-segment elevation myocardial infarction and multivessel disease (DANAMI-3—PRIMULTI): an open-label, randomised controlled trial Thomas Engstrøm, MD Dr Henning Kelbæk, MD Steffen Helqvist, MD Dan Eik Høfsten, MD Lene Kløvgaard, RN Lene Holmvang, MD et al.Published:August 04, 2015DOI:https://doi.org/10.1016/S0140-6736(15)60648-1
4. Randomized Trial of Preventive Angioplasty in Myocardial Infarction David S. Wald, M.D., Joan K. Morris, Ph.D., Nicholas J. Wald, F.R.S., Alexander J. Chase, M.B., B.S., Ph.D., Richard J. Edwards, M.D., Liam O. Hughes, M.D., Colin Berry, M.B., Ch.B., Ph.D., and Keith G. Oldroyd, M.D., for the PRAMI Investigators*N Engl J Med 2013; 369:1115-1123September 19, 2013
5. CVLPRIT TRIALImmediate multivessel PCI in patients with acute STEMI – results of the CvLPRIT trial in perspective Thiele Prof. Holger Thiele Zeymer Prof. Uwe Zeymer, FESC The Lancet 01 FEB 2015
6. Fractional Flow Reserve–Guided Multivessel Angioplasty in Myocardial Infarction Pieter C. Smits, M.D., Ph.D., Mohamed Abdel-Wahab, M.D., Franz-Josef Neumann, M.D., Bianca M. Boxma-de Klerk, Ph.D., Ketil Lunde, M.D., Carl E. Schotborgh, M.D., Zsolt Piroth, M.D., David Horak, M.D., Adrian Wlodarczak, M.D., Paul J. Ong, M.D., Rainer Hambrecht, M.D., Oskar Angerås, M.D., March 30, 2017 N Engl J Med 2017; 76:1234-1244 DOI: 10.1056/NEJMoa1701067.