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Case report

Multivessel coronary artery disease – how to reach Heart Team's optimal decision

Ivan Ilic[1,2], Dragan Topic[1]

[1] Institute for cardiovascular diseases Dedinje, Belgrade, Serbia, [2] Medical school, University of Belgrade, Belgrade, Serbia

Abstract We present a case of a 71-year-old gentleman who suffered an inferoposterior ST elevation myocardial infarction treated with thrombolytic therapy where coronary angiography showed triple vessel disease and coronary artery bypass graft (CABG) was suggested. Based on the results of coronary physiology and non-significant values of FFR, Heart team denied revascularization and recommended medical therapy. Data from 11 randomized studies involving more than 11,000 patients comparing PCI to CABG in patients with multivessel disease (MVD) showed pronounced benefit of surgical revascularization in patients with more complex coronary anatomy (higher SYNTAX score) and diabetes. If there is a complex MVD with left main stenosis, the advantage should be given to CABG, as well as in the case of complex MVD and diabetes, while PCI has an advantage in patients with lower SYNTAX score, the ones with advanced age and comorbidities where PCI would offer faster postprocedural recovery. In retrospective analysis by Basman et al., patients subjected to hybrid revascularization techniques had similar mortality as patients that underwent CABG or multivessel PCI and similar incidence of composite outcomes.

Key words coronary artery disease, PCI , CABG

Introduction

We present a case of a 71-year-old gentleman who suffered an inferoposterior ST elevation myocardial infarction that was treated with thrombolytic therapy. Regarding risk factors for atherosclerosis, he used to smoke and received medication for hypertension and dyslipidemia. Coronary angiography was done 18 days after STEMI and a triple vessel disease was seen and coronary artery bypass graft (CABG) was suggested. At admission, he reported occasional chest pain (CCS Class II) and had moderately limited activity (NYHA II). He denies any other illnesses. The echocardiogram showed slightly reduced left ventricular systolic function of with ejection fraction of 45% and akinesia of the basal half of the septum and inferior wall, hypokinesia of the basal half of the posterior wall.

Calculated Synergy Between PCI With Taxus and Cardiac Surgery (SYNTAX) score was 14 and SYNTAX II score predicted equipoise between percutaneous coronary intervention (PCI) and CABG-with 4-year mortality of 6.0% and 7.1% respectively (Figure 1).

Given the low SYNTAX score and previous MI, we opted for coronary physiology – an invasive examination of the significance of narrowing by measuring the fractional flow reserve (FFR), coronary flow reserves (CFR) and index of microcirculatory resistance (IMR) by using coronary wire for pressure and temperature measurement Pressure Wire X (Abbott Vascular, Plymouth, MN, US) and continuous adenosine infusion. The acquired values were as follows: right coronary artery (RCA) FFR 0.84, CFR 1.3, IMR 24.8; circumflex artery (Cx) - FFR 0.95, CFR 2.6, IMR 18.3 and left anterior descending (LAD) FFR 0.90, CFR 1.9, IMR 10.9 (Figure 2).

Based on the results of coronary physiology and non-significant values of FFR with low CFR and borderline IMR values that indicated presence of microvascular dysfunction without significant narrowing of the epicardial coronary arteries, Heart team denied any form of revascularization and recommended maximum medical therapy.

Multivessel coronary artery disease (MVD) and adequate method of revascularization has been a matter of debate in the cardiology community for more than 20 years[1]. The concept of "Heart Team" (HT) was established for multidisciplinary approach to individual patient in order to reach an evidence-based decision regarding the appropriate treatment. In case of a patient with coronary artery disease (CAD), the role of HT is to adequately evaluate anatomical complexity of coronary disease, the possibility of complete revascularization, the assessment of surgical risk of procedure and possible complications of any method of revascularization. The aim of the assessment is to determine the risk – benefit ratio in terms of procedural risks (risk of death, myocardial infarction, heart failure) and periprocedural complications (cerebrovascular event, kidney failure, complications at puncture site, need for transfusion, new onset arrhythmia or wound infection) versus possible benefits in terms of prolongation of life, absence of

Address for correspondence: Clin. Assist Ivan Ilić, Institute for cardiovascular diseases Dedinje, Belgrade, Serbia. E-mail: ivan1ilic@yahoo.com

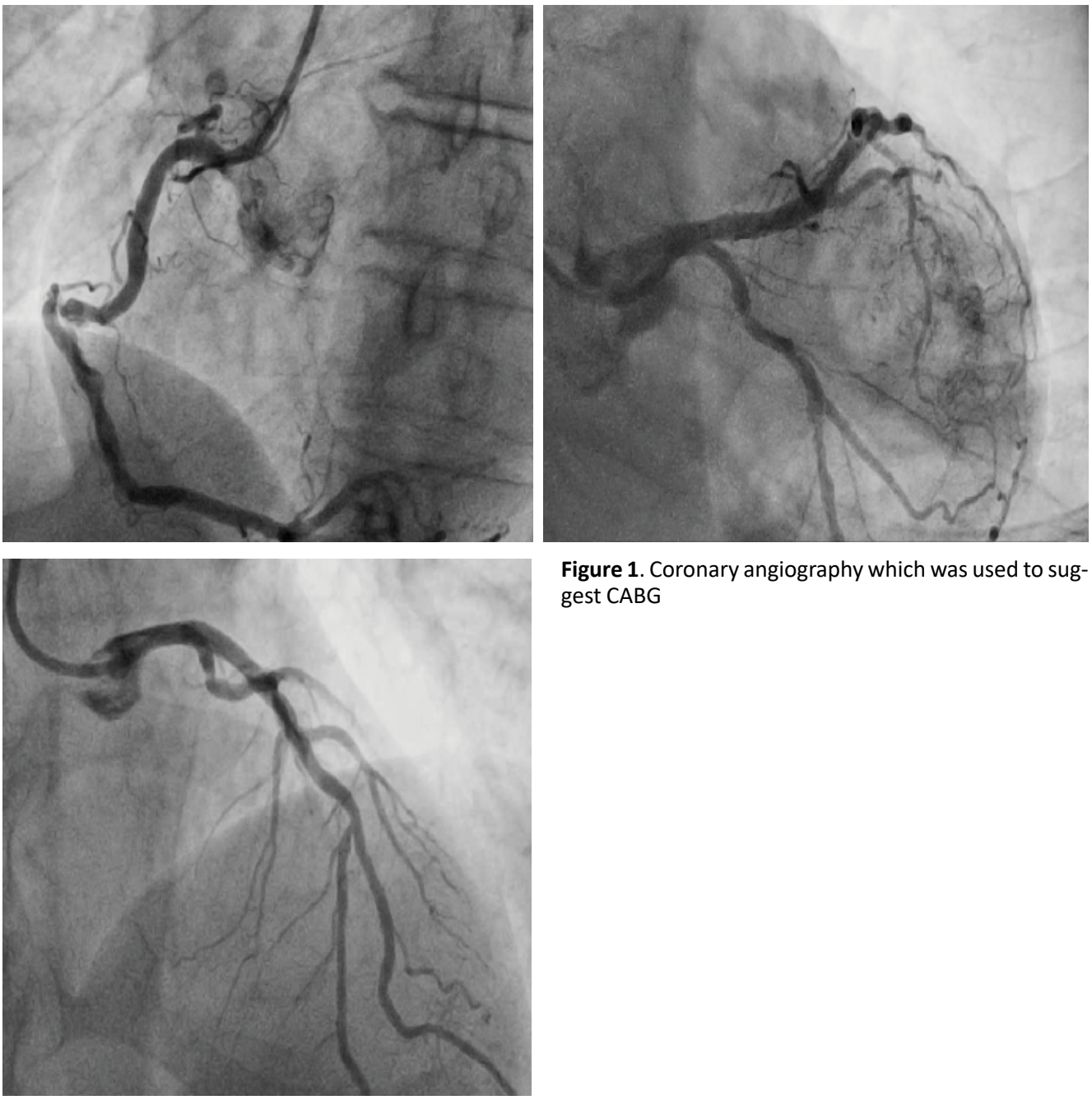

Figure 1. Coronary angiography which was used to suggest CABG

myocardial infarction and improvement in quality of life. The superiority of surgical treatment in case of a patient with MVD has been repeatedly examined in relation to PCI with the development of advanced techniques in interventional cardiology[3]. In daily practice, despite the development in interventional techniques – new generations of drug eluting stents (DES), intravascular imaging (IVUS, OCT), use of coronary physiology (CFR, FFR) and advanced antithrombotic therapies in patients with MVD, the advantage is almost always given to surgical treatment. Current recommendations from European Society of Cardiologists and the European Association of Cardiothoracic Surgeons give absolute advantage to surgical treatment in patients with anatomically complex MVD (high SYNTAX score), while in the intermediate complexity of coronary disease (SYNTAX<22) outcomes, except for myocardial infarction, are similar. If the patient suffers from diabetes, the things are slightly different. Aggregated data from 11 randomized studies involving more than 11,000 patients and comparing PCI to CABG in patients with MVD showed lower five-year mortality rates in those treated with surgical revascularization compared to those treated with PCI (11.5% after PCI to 8.9% after CABG; HR 1. 28, 95% CI 1. 09-1·49;p=0. 0019), including diabetes patients (15. 5% *vs.* 10. 0%; 1. Forty-eight, one. 19-1. 84; p=0. 0004), but not in patients who did not suffer from diabetes (8.7% *vs* 8.0%; 1.08, 0.86–1.36; p=0.49). Additionally, the benefit of surgical revascularization was more pronounced in patients with more complex coronary anatomy (higher SYNTAX score)[4].

A special attention should be devoted to a patient with significant stenosis of left main stem. Previously, available data from randomized studies and meta-analyses showed similar results regarding death, myocardial infarction and repeated revascularization if patients underwent CABG or PCI with DES stent[2,5]. The aforementioned meta-analysis demonstrated similar five-

Figure 2. Measured coronary physiology parameters in RCA, Cx and LAD

year mortality (10.7% after PCI *vs* 10.5% after CABG; p=0·52)[4]. In patients with complex coronary anatomy and LM stenosis, despite fewer patients with these characteristics in randomized studies, surgical treatment would probably be the best treatment option[2,4].

Previous research in this field has been designed before significant advances in interventional cardiology like development of coronary physiology and imaging techniques, which means that, in previously published randomized trials, not many patients had these techniques applied during PCI. Therefore, when choosing revascularization techniques in MVD, complete revascularization of all hemodynamically significant lesions should be sought, either based on anatomical or functional significance obtained using non-invasive or invasive tests to prove it (CFR and FFR)[6].

An interesting alternative is a hybrid approach - combining the surgical revascularization with LIMA (left internal mammary artery) graft and PCI of other lesions in patients with MVD. In retrospective analysis by Basman et al., after propensity matching, patients subjected to hybrid revascularization techniques had similar mortality as patients that underwent CABG or multivessel PCI (5.0% vs. 4.0% vs. 9.0%) and similar incidence of composite outcomes - death, repeated revascularization and myocardial infarction (HCR 21.0% vs CABG 15.0%, P = .36; HCR 21.0% vs PCI 25.0%, P = .60). Despite higher preprocedural SYNTAX score, hybrid revascularization achieved a lower residual score after revascularization than multivessel PCI[7].

Finally, approach to a patient with MVD should be individualized primarily based on the anatomy of coronary artery lesions. If there is a complex MVD with LM stenosis, the advantage should be given to CABG, as well as in the case of multivessel complex MVD and diabetes. In the absence of these characteristics, the severity of CAD should be analyzed while paying respect to patient's preference. The advantage to surgery should be given in patients with very complex lesions (long lesions, chronic total occlusions, calcifications) where percutaneous complete revascularization would be difficult to achieve, while PCI has an advantage in patients

of advanced age, with high risk of cerebrovascular complications, bleeding and infection of the surgical wound, as well as in those where functional capacity is reduced where PCI would offer faster postprocedural recovery.

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Sažetak

Višesudovna koronarna bolest – kako doneti naoptimalniji zaključak kardiohirurškog tima

Ivan Ilić[1,2], Dragan Topić[1]

[1]Institut za kardiovaskularne bolesti Dedinje, Beograd, Srbija, [2]Medicinski fakultet, Univerzitet u Beogradu, Srbija

Predstavili smo slučaj muškarca starog 71 godinu koji je lečen trombolitičkom terapijom nakon akutnog infarkta sa ST elevacijom. Koronarografija je pokazala trosudovnu koronarnu bolest I predloženo je hirurško lečenje bajpas graftom (CABG). Urađena je koronarna fiziologija i na osnovu neznačajnih vrednosti frakcione rezerve protoka (FFR) "Heart team" je indikovao maksimalnu medikamentnu terapiju. Podaci iz 11 studija koje su uključile preko 11000 pacijenata pokazali su korist od CABG-a kod pacijenata sa kompleksnom koronarnom anatomijom (visok SYNTAX skor) i dijabetesom, dok perkutana koronarna intervencija (PCI) ima prednost kod pacijenata sa nižim SYNTAX skorom, starijih sa komorbiditetima, gde PCI nudi brži postproceduralni oporavak. U retrospektivnoj analizi Basmana i saradnika pokazano je da hibridni metod revaskularizacije ima sličnu incidenciju smrti i kompozitnih ishoda kao CABG i višesudovna PCI.

Ključne reči: *koronarna bolest, CABG, PCI*