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REVASCULARIZATION STRATEGIES IN PATIENTS WITH ST-ELEVATION MYOCARDIAL INFARCTION AND MULTI-VESSEL CORONARY ARTERY DISEASE, MULTI-VESSEL STAGED PCI VERSUS CULPRIT VESSEL ONLY PCI: A SYSTEMATIC REVIEW

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Abstract:

Percutaneous coronary intervention (PCI) is the standard modality for treatment of ST-elevation myocardial infarction (STEMI) that results in improved outcomes as compared to medical therapy alone. The favorable revascularization strategy has been a debate as some centers prefer culprit vessel only PCI while others favoring staged multi-vessel PCI. Although the older guidelines might favor a culprit vessel only PCI technique but the current evidence now points in favor of staged multi-vessel PCI in patients with multi-vessel coronary artery disease. The vast data of randomized clinical trials conducted on patients with multi-vessel coronary artery disease have shown favorable outcomes in terms of all-cause mortality, repeat revascularization, myocardial infarction and composite of death, MI and stroke as compared to the patients who underwent culprit vessel only PCI at hospitalization. The purpose of our study is to shed light on the preferred revascularization strategy in patients with multi-vessel coronary artery disease. We conducted a thorough search of clinical trials and meta-analysis on the topic of favorable revascularization strategy in patients with multi-vessel coronary artery disease and it showed the superiority of staged multi-vessel PCI over culprit vessel only PCI.

Keywords: *Staged multi-vessel PCI, Culprit vessel only PCI, Percutaneous Coronary Intervention, ST-Elevation Myocardial Infarction, Revascularization.*

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INTRODUCTION:

Atherosclerosis can lead to a wide variety of pathological consequences in the body and ST-elevation myocardial infarction (STEMI) is still one of the most dreaded complications with high mortality and morbidity. Percutaneous coronary intervention (PCI) has formed the mainstay of management of STEMI and has resulted in improved outcomes. In most of the cases the atherosclerotic disease is not just limited to the culprit vessel that has lead to STEMI but disease in the non-infarct territory is also very common[1]. There are multiple treatment strategies that are used while doing PCI in the management of STEMI; multi-vessel percutaneous coronary intervention (PCI) at the time of the index procedure, staged PCI of non-culprit vessels guided by hemodynamic assessment, and a conservative approach with primary PCI of only the culprit vessel and subsequent medical therapy[2]. We will limit our discussion to the comparison of staged PCI of non-culprit vessel in a multi-vessel disease versus PCI of only the culprit vessel followed by medical therapy.

The current American College of Cardiology, American Heart Association guidelines and European Society of Cardiology all favor conservative approach of PCI of the culprit vessel followed by medical management as compared to the technique of staged PCI of multi-vessel non-culprit vessels[3]. These guidelines are generally based on a small number of observational studies and a few small randomized clinical trials of inadequate statistical power[4]. The current recommendations are on the verge of modification and in favor of a staged PCI approach to a non-culprit vessel due to recent clinical data[5]. We have conducted this study to work out the most effective treatment strategy in the management of STEMI via PCI and to give conclusive evidence to the debate of staged multi-vessel PCI versus PCI of only culprit vessel strategy.

METHODS AND MATERIALS:

The PubMed database was searched for publications with the medical subject heading “Staged multi-vessel PCI versus culprit vessel only PCI” and “revascularization strategy”. Our selection criteria was English language, cardio-vascular relevance, full free text article, randomized clinical trials and meta-analysis. No specific time frame was selected in our search for randomized clinical trials and meta-analysis.

RESULTS AND DISCUSSION:

From the CREDO-Kyoto AMI Registry, 2,010 STEMI patients with multi-vessel disease undergoing primary PCI were analyzed. 681 multi-vessel disease patients underwent staged PCI for angiographically significant non-culprit vessels within 90 days (staged PCI group), while 630 multi-vessel disease patients received primary PCI only (culprit-only PCI group). The cumulative 5-year incidence and adjusted risk for all-cause death were significantly lower in the staged PCI group compared with the culprit-only PCI group (9.5% vs. 16.0%, P<0.001; HR, 0.69; 95% CI: 0.50-0.96, P=0.03)[6]. The results of the trial showed that the staged PCI strategy for angiographically significant non-culprit vessels was associated with lower 5-year mortality compared with the culprit-only PCI strategy in STEMI patients with multi-vessel disease who underwent primary PCI.

David A Wood conducted the COMPLETE (Complete vs Culprit-only Revascularization to Treat Multi-vessel Disease after Early PCI for STEMI). 4,041 patients with STEMI and multi-vessel CAD were randomized to staged non-culprit vessel PCI or culprit-vessel only PCI. For non-culprit vessel PCI planned during the index hospitalization (actual time: median 1 day), CV death or MI was reduced with complete revascularization compared with culprit-vessel only PCI (HR: 0.77; 95% confidence interval [CI]: 0.59 to 1.00). For non-culprit vessel PCI planned to occur after hospital discharge (actual time: median 23 days), CV death or MI was also reduced with complete revascularization (HR: 0.69; 95% CI: 0.49 to 0.97; interaction p = 0.62)[7]. The trial concluded that among STEMI patients with multi-vessel disease, the benefit of complete staged revascularization over culprit-vessel only PCI was consistent irrespective of the investigator-determined timing of non-culprit vessel intervention.

The DANAMI-3-PRIMULTI trial investigated whether a staged in-hospital complete revascularization strategy improved outcome in patients with STEMI and multi-vessel disease. In this sub-study, they investigated potential bleeding complications related to a second in-hospital procedure. Bleedings were assessed using BARC and TIMI criteria. Six hundred and twenty-seven (627) patients were randomized 1:1 to either PCI of the infarct-related artery (IRA) only (n=313) or complete revascularization during a staged procedure before discharge (n=314). We found no significant difference in TIMI major+ minor bleedings related to the primary PCI. There were neither major nor minor bleedings in relation to the second procedure in the complete revascularization arm. The results of the trial showed that in multi-vessel diseased STEMI patients, a staged complete in-hospital revascularization strategy or any

second in-hospital procedure did not result in an increase in serious bleeding events[8].

Kongyong Cui et al conducted a study to compare the impact of diabetes status on long-term outcomes after staged complete revascularization with that after culprit-only PCI. The rate of the 5-year composite primary endpoint for diabetic patients was close to that for non-diabetic patients (34.5% vs. 33.7%; adjusted hazard ratio [HR] 1.012, 95% confidence interval [CI] 0.815-1.255). In non-diabetic patients, the 5-year risks of MACCE (31.8% vs. 35.5%; adjusted HR 0.638, 95% CI 0.500-0.816), MI (4.6% vs. 9.2%; adjusted HR 0.358, 95% CI 0.200-0.641), unplanned revascularization (19.9% vs. 24.9%; adjusted HR 0.532, 95% CI 0.393-0.720), and the composite of cardiac death, MI or stroke (11.4% vs. 15.2%; adjusted HR 0.621, 95% CI 0.419-0.921) were significantly lower after staged PCI than after culprit-only PCI. In contrast, no significant difference was found between the two groups with respect to MACCE, MI, unplanned revascularization, and the composite of cardiac death, MI or stroke in diabetic patients[9]. The study concluded that in non-diabetic patients, an approach of staged complete revascularization is superior to culprit-only PCI, whereas the advantage of staged PCI is attenuated in diabetic patients.

Varunsiri Atti et al performed a meta-analysis of randomized trials to assess the comparison of staged revascularization with culprit-only PCI. Ten randomized controlled trials were included, representing 7,030 patients: 3,426 underwent multi-vessel PCI and 3,604 received culprit vessel-only PCI. Compared with culprit vessel-only PCI, multi-vessel PCI was associated with no significant difference in all-cause mortality (RR: 0.85; 95% CI: 0.68 to 1.05) and lower risk for re-infarction (RR: 0.69; 95% CI: 0.50 to 0.95), cardiovascular mortality (RR: 0.71; 95% CI: 0.50 to 1.00), and repeat revascularization (RR: 0.34; 95% CI: 0.25 to 0.44). Major bleeding (RR: 0.92; 95% CI: 0.50 to 1.67), stroke (RR: 1.15; 95% CI: 0.65 to 2.01), and contrast-induced nephropathy (RR: 1.25; 95% CI: 0.80 to 1.95) were not significantly different between the 2 groups[10]. The meta-analysis concluded that multi-vessel PCI was associated with a lower risk for re-infarction, without any difference in all-cause mortality, compared with culprit vessel-only PCI in patients with ST-segment elevation myocardial infarction.

Giuseppe Tarantini et al performed a meta-analysis to compare the results of staged multi-vessel PCI versus culprit only PCI. Thirty-two studies (13 prospective and 19 retrospective) with 54,148 patients were taken and analyzed for outcomes. Pairwise meta-analyses showed that staged multi-vessel PCI was associated with lower short-term and long-term mortality compared with culprit only PCI. Staged multi-vessel PCI was also associated consistently with improved survival in network analyses[11]. The results of the meta-analysis show that patients with multi-vessel coronary artery disease presenting with STEMI undergoing primary PCI, a staged multi-vessel revascularization strategy may improve early and late survival.

CONCLUSION:

STEMI is a major cause of cardiovascular mortality in patients with atherosclerotic cardiovascular disease. PCI forms the main stay of therapy of such patients and it can be done via different techniques but most common are staged multi-vessel PCI of non-culprit vessel and PCI of only culprit vessel. The results of various clinical trials and meta-analysis show that a staged multi-vessel PCI of non-culprit vessel has got favorable outcomes and results in lower all-cause mortality, myocardial infarction (MI), re-vascularization and the composite of death, MI and stroke as compared to PCI of only culprit vessel. The level of evidence is strong enough to challenge the older view of favoring culprit only vessel PCI strategy and it will likely result in the shift of trend towards staged multi-vessel PCI approach. However, the results obtained in the sub-set of diabetic patients show that there is no statistically significant difference between these two techniques. So probably adequately powered randomized clinical trials will be needed to further compare the efficacy of these revascularization strategies and to elucidate whether the favorable outcome of staged multi-vessel PCI is also present in certain high risk patients such as those having diabetes mellitus or triple coronary artery disease.

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