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Strategies for the coronary surgeon to remain "competitive and co-operative" in the PCI era

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ABSTRACT

Background: The advent of percutaneous intervention has made surgical treatment of coronary artery disease less favored by patients though the evidence that supports CABG in certain patient subsets is strong.
Methods: Literature review was done using Pubmed, Scopus, Google and Google Scholar with MeSH terms-coronary artery bypass grafting, internal mammary artery, drug eluting stent, stroke, myocardial revascularization.
Results: The adoption of evolving techniques like anaortic off pump grafting, bilateral internal mammary artery use, hybrid and minimally invasive coronary revascularization techniques, intra-operative graft assessment, and heart team approach can lead to better outcomes following surgery as is evidenced by recent literature.
Conclusions: Though the adoptability of the newer strategies may vary between centers a close coalition between coronary surgeons and cardiologists would ensure that the management of coronary artery disease is based on evidence for the benefit of the patient.

1. Introduction

Coronary artery disease (CAD) is predicted to be the cause for 14.2% deaths by 2030.[1] The advances made in the percutaneous treatment of CAD and the advent of various generations of stents has broadened the indications of PCI in recent times. However there is overwhelming evidence in the literature comparing CABG with medical therapy and variations of PCI in specific patient subsets showing the superiority of CABG in terms of the long term survival benefits and repeat revascularization rates.[2,3] The inherent invasiveness of conventional CABG with the attendant risks of peri-operative stroke and morbidity have proved decisive in the decline of its popularity in the present era of absorbable stents.

Evolving surgical strategies likely aortic no touch technique/total arterial coronary revascularization [TACR], bilateral internal mammary artery (BIMA) use, multiple arterial grafting (MAG), minimally invasive CABG, hybrid coronary revascularization (HCR) techniques and intra-operative graft assessments have to routinely become part of coronary surgeon's armamentarium to stay competitive and take the practice to the next level. At the same time, the emphasis on close coalition with the core team of cardiologists with input

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from the family physicians who have the first level contact with the patient and the patient himself/herself should guide the decision making process. Hence the approach to treating CAD with a "Heart Team (HT)" concept seems to be the need of the hour. This review discusses the evidence based, adoptable strategies for the coronary surgeon to remain competitive yet co-operative and potentially alter the way CAD is treated for better patient outcomes.

2. Bilateral internal mammary artery (BIMA) use

Although the use of single internal mammary artery (SIMA) has become part of a standard practice protocol in CABG, the routine use of BIMA has found a patronage of only 4–12% as per the statistics based on Society of Thoracic Surgeons Database.[4] There are consistent reports in the literature quoting the superiority of BIMA over SIMA grafting. The advantage of two arterial grafts supplying vital areas of myocardium afford better protection from long term adverse events especially considering the inferior patency rates of saphenous venous grafts (SVG) for the same territories. Weiss et al in a recent meta-analysis have documented that the long term survival of BIMA group was significantly higher than SIMA group.[5]

As observed by Lytle et al in a previous landmark study, the incremental benefit of using BIMA for the first 12 years in the younger subset of patients would be in its value in the prevention of repeat revascularizations and the real survival benefit of BIMA vs SIMA use would be apparent beyond this time-frame.[6] In a follow up study by the same author, it was noted that the general survival benefit associated with BIMA grafting extended for twenty post-operative years. As expected from the pilot study the increasing advantage of a BIMA graft became apparent only in the second decade after surgery.[7]

Concerns about deep sternal wound infections [DSWI] have limited BIMA use by surgeons. The reported incidence of DSWI with BIMA use vary from 0.3% to as high as 16% in different series. The risk factors associated with DSWI are female sex, obesity, and diabetes.[8] The use of skeletonized harvest technique for BIMA with the proposed advantage of the preservation of sternal blood supply has clearly shown reduction in the incidence of DSWI by some groups.[9] However the same reduction in the incidence of DSWI could not be replicated with a pedicled BIMA harvest technique.

Thus though the retrospective and other observational studies have registered a long term survival benefit for BIMA grafting, a randomized prospective trial to validate this is the need of the hour. The ART trial was designed to this end.

The ART, a multi-centric prospective trial comparing the long-term survival benefits of BIMA versus SIMA grafting is now underway involving 3102 patients either assigned to BIMA or SIMA arms. As expected the short term outcomes of BIMA and SIMA grafting with respect to mortality appear to be comparable in this trial. In concordance with the previous studies BIMA and SIMA groups were comparable in the other short term outcomes like, major complications, myocardial infarctions, stroke, and repeat revascularization rates. However there was an increased incidence of DSWI and sternal wound reconstructions in BIMA group [1.9% (BIMA) vs 0.6% (SIMA)].[10]

The long term results of ART is expected to resolve the ongoing debate on the choice of BIMA vs SIMA and the attendant risks.

3. Stroke prevention and no touch technique

One of the major limitations of CABG is the higher incidence of stroke peri-operatively and during early follow up when compared to PCI in similar patient subsets. Peri-operative stroke hikes the risk for peri-operative mortality, extends the hospital stay and adds to the economic burden. In SYNTAX trial the higher incidence of peri-operative stroke was found to even out with the PCI group at the end of 2 years. By the end of 5 years, the incidence of stroke in PCI group was 2.4% as against 3.7% in the CABG group which was not statistically significant. In the early SYNTAX follow up data the incidence of stroke was higher in the CABG group especially in patients with a higher SYNTAX score. This difference evened out at mid-term follow up.[2] Despite the fact that most of the peri-operative strokes documented in the SYNTAX trial occurred in the waiting period for surgery and might have contributed to the higher early stroke rates in the CABG cohort, another well planned randomized trial (FREEDOM)[3] also drew similar conclusions on this, with a higher stroke rate in the peri-operative period. At 5 years, while the CABG group was still trending towards a higher incidence of stroke (5.4% as against 2.4% in the PCI group). This trial was done on patients with multi-vessel disease (increased disease burden) and diabetes mellitus [DM] (independent risk factor for stroke) and returned similar results as in SYNTAX. The results with regard to the incidence of stroke after CABG were similar in the ASCERT study also with a higher early stroke rate in the CABG arm and a decreasing incidence of the complication with longer duration of follow up.[11] These studies thus expose the disadvantage of CABG in the incidence of early and peri-operative period.

Etiology of peri-operative stroke after CABG is multifactorial. Embolism and the water shed infarcts resulting from the low perfusion pressures are implicated frequently. Roach et al in a large multicenter study had classified the neurological outcomes after elective coronary artery bypass and found that the Type 1 group which included the peri-operative stroke subsets to be strongly associated with ascending aortic atherosclerosis.[12] A prospective study spanning 30 years involving various modalities of surgical revascularization reported the risk of intra-operative stroke to be higher with increasing atherosclerotic disease burden.[13]

The avoidance of aortic manipulation has been thus proposed to decrease the incidence of peri-operative stroke. Although off pump CABG (OPCAB) has been found to have lower incidence of stroke rate when compared to the conventional CABG, its utility may be limited if partial clamping of aorta is practiced. Wolf et al had studied the incidence of solid micro-emboli by transcranial Doppler in patients undergoing CABG with or without aortic clamping. The reduction in the number of solid micro-emboli was significant in the clampless