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PCI IN SVG: HOW I DO IT?

Dr Ashok Seth, New Delhi

The commandments of SVG PCI - How I do it? Use guides with good support/backup - Multipurpose, amplatz, grafts guides (avoid Judkins right guide). Use 'stealth bomber approach" - Wire gently with soft tip wires and find path, use moderate support wires - Do not move extra support wires backwards and forwards too much. Pre-treat - Prevent slow flow. For large bulky thrombus - IC Reopro; thrombectomy devices. Predilate - Small balloon, feel the lesion compliance and pressure; in case of fuzzy, shaggy, ulcerated, thrombotic lesion, there is no need to predilate. Use protection devices liberally - Become expert with filter device, distal balloon occlusion device, proximal protection device. Immediate accessibility to - PA pressure monitoring, IABP, multipurpose probing catheters, adenosine → Nitroprusside.

MULTIVESSEL STENTING IN STEMI

Dr Praveen Chandra, Gurugram

In STEMI, primary PCI of culprit lesion is the treatment of choice. Approximately 50% of patients with STEMI have multivessel disease (MVD). Possible approaches for treatment of MVD in AMI: Total revascularization of critical lesions in cardiogenic shock; PCI of infarct related artery (IRA)/non-IRA in same sitting; perform PCI at the time of treating the culprit lesion based on FFR measurements; noninvasive (imaging) ischemia/viability testing and revascularize lesions perfusing ischemic/viable territories (staged procedure); leave the remaining lesions alone and act only if additional events occur (conservative approach). According to the CULPRIT-SHOCK trial, culprit lesion only PCI is superior to multivessel PCI. Deferring treatment of angiographically significant coronary lesions in noninfarct related arteries with an FFR >0.8 is safe and efficient.

HOW DOES OCT GUIDANCE HELP IN CALCIFIED LESIONS?

Dr Ajit Menon, Mumbai

Calcification correlates with advanced atherosclerosis, increased age and comorbidities. The presence of calcified and rigid lesions makes PCI challenging. Adjuvant techniques are often required to achieve satisfactory stent results. Angiography has been shown to have low sensitivity (48%) for calcium detection, except for severe calcification. Optical coherence tomography (OCT) precisely detects calcium as a signal poor or heterogeneous region with sharply delineated leading, and/or lateral borders. Based on pathology, OCT estimates the area of calcification more accurately than intravascular ultrasound (IVUS) since the light penetrates calcium without shadowing. OCT also enables the operator to distinguish between superficial and deep calcium with accurate measurement of the minimum distance from the lumen, the thickness of the calcified plate, and circumferential arc distribution. OCT could thus be a more useful clinical tool for quantifying calcified plaques.

ROTATIONAL ATHERECTOMY AND ELCA BASICS

Dr Samuel Mathew, Chennai

The presence of CAC may lead to: unsuccessful PCI owing to undilatable lesions; balloon ruptures; coronary dissection, perforation or rupture; asymmetric, malapposed and underexpanded stent; higher incidence of major adverse cardiac events; higher incidence of restenosis and target lesion revascularization; higher incidence of periprocedural MI; higher incidence of stent thrombosis.

Indications for use of ELCA: total occlusions - traversable by guidewire; underexpanded stents due to calcific and nonyielding vessel; in-stent restenosis; saphenous vein grafts; moderately calcified; failed balloon; ostial lesions; long lesions.

Lessons in heavily calcified lesions - Rota significantly reduces complications; not using Rota often leads to longer and much more difficult procedures, and the cost balances out because of the balloons you are using up; be quick to adapt - sometimes when balloon fails to dilate, you can switch to Rotablator with caution; slow flow and no reflow can be minimized; major complications can be reduced with good technique and experience.

WHAT IS THE SIGNIFICANCE OF OCT IN LEFT MAIN DISEASE?

Dr Ashwin B Mehta, Mumbai

OCT is a light-based imaging modality that yields high resolution *in vivo* images of the coronary artery (axial

resolution 10-20 μm). OCT has a resolution 10x greater than that of IVUS with 20x faster image capture. It thus provides precision information very quickly and assists the physicians in the treatment of cardiovascular disease, including left main coronary artery (LMCA) disease. OCT can be employed to assess atherosclerotic plaque and visualize thrombus, and to evaluate the lumen area with accurate automated measurements. During PCI, it can be of help in stent placement and may be used to assess stent apposition and tissue coverage and assist in the identification and quantification of stent coverage. OCT is indicated for the assessment of lesions and for guidance of stent sizing and implantation. Intracoronary imaging enables evaluation of the distribution of plaque including the extent of calcified plaque. OCT can even help assess the thickness of calcium plaques, which may affect the lesion preparation strategy. Dissections resulting from predilatation are also detected by OCT that can be taken into account when assessing the required stent length.

HOW DOES FFR ASSESSMENT HELP IN ACS?

Dr Florim Cuculi, Switzerland

Fractional flow reserve (FFR) assessment provides anatomical and physiological information that can help tailor treatment strategies in CAD. FFR is an evidence-based diagnostic tool of physiological significance of coronary artery stenosis in patients with stable CAD. Some randomized clinical trials have shown the efficacy of FFR-guided PCI in ACS. FFR values in the culprit vessel are higher during acute episodes when compared to measurements taken after the microcirculation has had some time to recover. These states are perhaps most marked in acute STEMI. Some studies support the use of FFR in evaluating the severity of non-culprit lesions during ACS following revascularization of the culprit vessel. The COMPARE-ACUTE trial compared FFR-guided complete revascularization (n = 295) with culprit artery only revascularization (IRA, n = 590) among patients with primary PCI presenting with STEMI. In STEMI patients, FFR-guided compete revascularization was superior to the IRA group in MACE points at 12 months. There were no differences in MI and mortality. FFR demonstrates diagnostic accuracy and reproducibility in AMI, especially in intermediate lesions. The measurement of FFR in non-culprit stenoses of patients with MI, can be reliably performed during the acute phase of the disease and allows for planning a more appropriate strategy of individualized treatment. FFR could become an essential tool for physicians not only in stable CAD, but also during PCI of patients with ACS.

HAS THE SCENARIO CHANGED WHEN IT COMES TO CHOOSING BETWEEN PCI AND CABG FOR MULTI-VESSEL DISEASE?

Dr MS Hiremath, Pune

For multivessel CAD, CABG generally has lower rates of MI and repeat revascularization than PCI, and shows a trend toward better survival as CAD complexity increases, but a higher rate of stroke. In the BEST trial among 880 Asian patients with multivessel CAD, complete revascularization was achieved more often with CABG than PCI. At 2 years, the primary endpoint (death, MI or target-vessel revascularization) was similar between groups (PCI, 11%; CABG, 8%), although the difference became statistically significant by 5 years (15% vs. 11%). On the primary endpoint, treatments did not differ in nondiabetic patients (hazard ratio, 1.07). PCI may offer early safety benefits for stroke, bleeding and potentially, mortality but poses a greater need for repeat revascularization. Later mortality is similar with the two procedures, but MI rates may be higher after PCI. Overall, the data suggests few differences, except for patients with diabetes and for those in whom complete revascularization cannot be attained. Technological and pharmacological advances have changed the practice of PCI, including the introduction of safer and more effective DES; more judicious use of PCI, based on FFR measurements; PCI optimization with IVUS and OCT; and improved antithrombotic and antiplatelet agents. The less invasive approach thus has an edge which most patients tend to prefer. Recommendations of either PCI or CABG for a coronary intervention should be individualized and evidence-based. The overall clinical scenario should take into account the clinical presentation, anatomic SYNTAX score, patient's age, comorbidities, renal function, mental and neurologic status, and the tolerance for long-term treatment with dual antiplatelet medications, as well as patient expectations and preferences.

WHAT IS THE ROLE OF FFR IN MULTIVESSEL DISEASE?

Dr G Sengottuvelu, Chennai

The use of an FFR-guided strategy for complete revascularization can considerably decrease the number of unnecessary interventions during multivessel PCI and the number of subsequent revascularizations. The significance of FFR in patients with multivessel coronary disease undergoing revascularization was shown in the FAME (Fractional Flow Reserve Versus Angiography for Multivessel Evaluation) study. FFR-guided PCI was associated with lower 1-year adverse events and

reduced costs. In the FAME 2 study, FFR-guided PCI, compared with medical therapy alone, improved the outcome. Patients without evidence of ischemia had favorable outcomes without PCI. The FIND study done in India revealed that FFR reduced CABG and number of stents.

Dr Sengottuvelu highlighted the fact that FFR is load dependent i.e., FFR value depends on the area of myocardium supplied by that vessel. In a nice case demonstration he showed in multivessel disease how the CTO of RCA with collaterals from LAD can falsely cause significant FFR of a borderline LAD lesion. FFR to LAD after treating the RCA CTO gave the true value of FFR. He also highlighted that FFR is the gold standard in left main and its importance when patient has other vessel disease. In these situations, other tests like nuclear perfusion imaging become less reliable. Finally, he emphasized the critical role of FFR in multiple serial lesions to identify the culprit lesion.

BIFURCATION PCI OPTIMIZATION WITH OCT

Dr Prabhu C Halkati, Belgaum

Routine stenting of both branches offers no benefit over stenting of the main branch (MB) only, with provisional stenting of the side branch (SB), making the provisional strategy the preferred approach. OCT is a high resolution intravascular (IV) imaging tool used to assess coronary lesions and evaluate the results of stenting. In bifurcation lesions, it is particularly helpful in guiding several steps, such as immediate automated online detection of the lumen area after pullback will assist in the rapid assessment of the vessel morphology and minimum lumen area; it is particularly useful for guidance of interventions in bifurcations, where knowing the reference diameter of the vessel distal and proximal to the SB is critical in correctly sizing the diameter and length, both of the stent and post-dilatation balloon. OCT visualization of the distal and proximal edges of the stent will rule out the presence of dissections, undetectable by angiography alone. OCT is thus a useful tool which helps in optimization of bifurcation stenting in the following conditions: assessment of size and length of the lesion of SB; severity of SB disease; stent strategy plan - provisional stenting vs. two stents; post-stent - plaque shift to SB (snow-plow).

DIAGNOSIS AND TREATMENT OF VULNERABLE PLAQUE

Dr CG Bahuleyan, Kerala

Vulnerable plaques are the lesions which destabilize and rupture, causing acute thrombosis of the coronary arteries. Vulnerable plaques exist in different proportion in patients with stable as well as unstable ischemic heart disease. These plaques are characterized by features like thin cap fibroatheroma (TCFA), large lipid core, spotty calcification, neovascularization, cholesterol crystals and accumulation of inflammatory cells like macrophages. Non-invasive methods like CT-coronary angiography and MRI help detect plaque characteristics. Although IV imaging, like IVUS, virtual histology IVUS, near-infrared spectroscopy (NIRS) and OCT, have been found to be more promising in the delineation of coronary plaques. By virtue of high resolution potential (10-20 times axial resolution), OCT provides better visualization of blood vessel wall details and lesion characteristics. Features like TCFA, lipid rich core and calcific nodule and deposits of macrophages can be identified. Further characterization of deeper aspects of plaques cannot be detected with OCT. Novel OCT based 3-D quantification of the fibrous cap and other advances in coronary imaging may help in predicting the relationship of vulnerable plaques and future clinical events more accurately. Clinical trials using statins have been shown to stabilize plaques by increasing the thickness of fibrous cap in patients with unstable angina. Patients with vulnerable plaques with no limitation of coronary flow can possibly be managed by aggressive medical treatment at present. Clinical case - 65-year-old male patient with MV disease and stable angina. The borderline mid LAD lesion showed characteristic features of vulnerable plaque on OCT analysis with reduction of minimal lumen area (MLA). Performing angioplasty and stenting similar lesion merely on the basis of vulnerable plaque characteristics is currently not evidence-based. However in this case, FFR indicated ischemia and therefore, stenting was done.

DEFERRED STENTING

Dr Anand Rao, Mumbai

Primary PCI with stenting is the current standard treatment for patients with STEMI. To date, attempts to avoid embolization by using thrombectomy or distal protection devices have not been efficacious. In patients undergoing primary PCI, deferred stent implantation is associated with improvement in surrogate outcomes, but does not appear to improve clinical outcome. In some trials, it has shown improvement in the microvascular blush grades and LVEF. Individualization is required in patients with large thrombus burden, especially when thrombectomy devices are in big question. Large scale

RCTs with long-term follow-up might shed further light on clinical endpoints such as death, heart failure and reinfarction.

ROLE OF IVUS IN CTO

Dr Ajith Pillai, Puducherry

In addition to optimizing stent expansions, routine use of IVUS significantly brings down the contrast usage and fluoroscopy time. Clinical utility of IVUS: wire penetration of proximal cap; re-entry in cases of subintimal GW passage; reverse-CART; when r-CART fails, IVUS helps in seeing/preventing complications: Identifies large subintimal plane; presence of intramural and extramural hematoma; prediction of no-reflow.

STENT THROMBOSIS: ROLE OF OCT

Dr G Sengottuvelu, Chennai

OCT, with its unique features of high resolution, plays a vital role in diagnosis and management of stent thrombosis. Not all stent thrombosis are equal. One needs to identify the specific cause of stent thrombosis, the etiology of which varies depending on the time course - subacute, late and very late. Identification of specific causes of stent thrombosis can help make the strategy specific to the cause and can prevent recurrent stent thrombosis.

MANAGEMENT OF INTRACORONARY THROMBUS

Dr Arun Srinivas, Mysore

Intracoronary thrombus subsequent to plaque rupture and causing partial or complete occlusion of a coronary artery is the basic pathophysiologic event in acute STEMI. The mainstay pharmacological treatments for thrombus-containing lesions include aspirin, heparin, GPIIb/IIIa platelet receptor antagonists, thienopyridines, direct thrombin inhibitors and thrombolytic agents. The 4 main contemporary technologies for mechanical thrombus extraction are manual aspiration catheters, power-sourced thrombectomy devices, ultrasound sonication and embolic protection systems. Thrombus aspiration should not be used as a routine strategy in patients with STEMI. Use of filter-based distal protection devices does not affect the incidences of complete ST resolution and peak creatine kinase. Routine thrombectomy does not enhance outcomes and should be reserved for large thrombus before or after stent implantation. It seems reasonable to perform adjunctive thrombectomy in patients with angiographically large thrombus burden before primary PCI.

LEFT MAIN BIFURCATION STENTING AND LESSONS FROM DKCRUSH 5

Dr Viveka Kumar, New Delhi

LMCA supplies 75% of the left ventricular myocardium (100% in a left dominant circulation), thus making its disease ominous. SYNTAX and EXCEL trials show the equivalence of PCI to CABG in patients with SYNTAX score of <32. However, major challenge persists in the form of involvement of left main bifurcation in 80% of the cases associated with a high restenosis and thrombosis rate. Main branch stenting (1 stent approach), provisional stenting and dedicated bifurcation stenting are the options available for tackling left main bifurcation. However, the best method has remained controversial. The initial experience from the Nordic bifurcation study, BBC ONE trial and CACTUS trial has shown no advantage of dedicated 2-stent strategy over a provisional one. But the applicability of this data to left main bifurcation remains flawed due to paucity of left main bifurcation cases in these studies. Provisional stenting is limited by the fact that crossover to a 2-stent strategy is required in more than one-third of the cases. Rescue or bailout stenting in these cases may be associated with imprecise stent placement, incomplete stent expansion or failure to deliver a stent leading to poorer outcome as compared to a dedicated 2-stent approach. Of the dedicated 2-stent strategies available (T stenting and protrusion, V stenting, Culotte technique and double kissing (DK) crush technique), DK crush technique has shown the best results. DKCRUSH-III trial compared DK crush technique with culotte technique and showed better 12-month MACE free survival with DK crush (93.8% vs. 83.7%). DKCRUSH-V trial compared DK crush with provisional stenting. At 12 months, primary endpoint (target lesion failure) was noted in 10.7% patients in the provisional stenting group and 5.0% in the DK crush group. DK crush also resulted in lower rates of target vessel MI (2.9% vs. 0.4%) and definite or probable stent thrombosis (3.3% vs. 0.4%). On subgroup analysis, DK crush performed better in both simple and complex bifurcation lesions. It remains important to note that DK crush is a challenging technique and the primary operators in the trial were required to perform at least 300 PCI/year and 20 left main PCI/year for 5 years to be a part of the trial.

Left main PCI should be attempted by experienced operators at high volume centers. While DK crush is the preferred dedicated 2-stent strategy for true bifurcation lesions, single-stent strategy may be used in cases with insignificant left circumflex ostial disease.