Cardiology & Cardiovascular Research

Review Article

Myocardial Revascularization – Where Do We Stand Through The Guidelines Window

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ABSTRACT

What is new in ESC and ACC revascularization guidelines. Why we need to embrace it in everyday practice. When we can use different antiplatelet therapeutic options in those patients. How can we implement mode of artificial intelligence after primary PCI. When and What is the right new definition of ACS. ESC 2023. new guideliness and urge for complete revascularization. ACC 2021. Main pathways Why and how to assess High Bleeding Risk (HBR), seen in about 20% of ACS patients. Can we measure periprocedural risk in ACS and what types of de-escalation antiplatelet therapy can be used.

CCS – Chronic coronary sydrom (stable angina) ESC 2019. guidelines. ACC 2023. What are patient risk profiles number 1, 2 and 3. Why we should use Guideline Directed Medical Therapy, the proven benefit in CCS. Different types of revascularization therapies, OMT (Optimal Medical Therapy) vs PCI vs CABG (Coronary Artery By Pass). What is OPTIMUM Registry and who are the patients ineligible for surgical revascularization. The role and definition of Prehabilitation. All those new aspects through intertwined evidence based cardiology facts concerning revascularization, across both side of the ocean.

Keywords

Revascularization, Myocardial, Guidelines.

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This article incorporate my view on both revascularization guidelines, from two shores of the ocean, European and ACC/AHA. Amercian College of Cardiology and its acronim ACC inspired my original idea as a mission of spreading knowledge in cardiology as Attributable Circulatory Concept (graph 1).

Attributable

Meaning that can help us in everyday work. Attributable because it has beneficial, aditive effect in the appropriatness of defining and understandning of coronary sindroms, both acute (ACS) and chronic coronary sindrom (CCS).

Circulatory

Circulatory refers to three main coronary treatment options : optimal medical therapy and revascularization percutaneous or surgical.

Concept

Last but not the least is the Concept of Care, reviewing the Patient oriented approach (graph 1) European Society of Cardiology (ESC) has its mission in designing, standardazing and helping doctors on the road of vast waves of new subspecialities and inovative farmaco-technologies. That is the reason, my view of ESC can arise as Effective Strength of Creating (Figure 1).

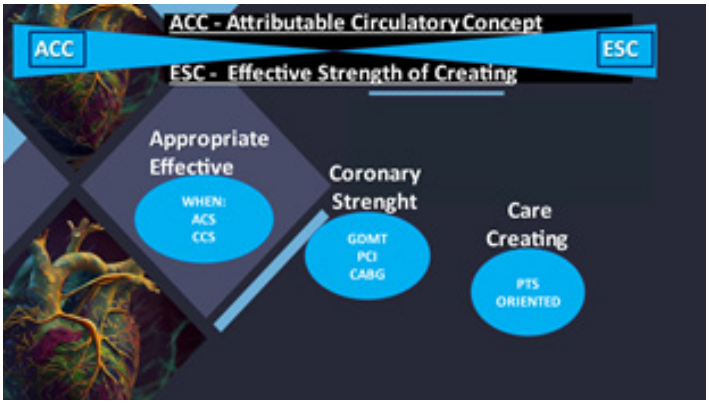

Figure 1: ACC/ESC Concept.

Patients oriented approach means respecting their wish, but also using the Heart team decision as the key for solving the revascularization problem. There are two main questions our patients are going to ask: Am I going to feel better or/and am I going to live longer? Those are also, two main goals we should aspire: Quality of life on one hand and on the other Mortality benefit (Figure 2).

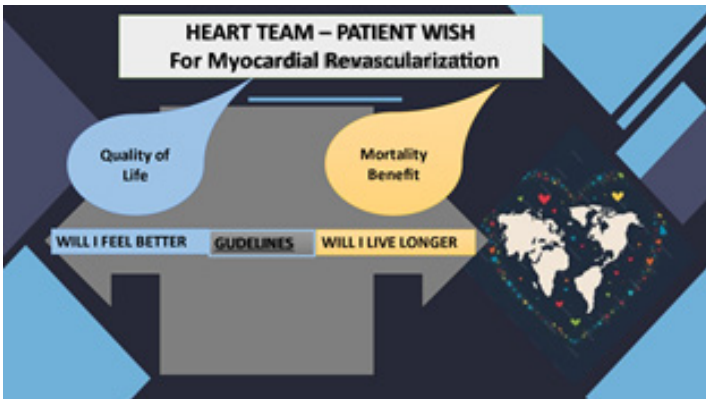

Figure 2: Heart team decision points the key of patients wish

As the seesaw in the middle are the Guidelines. The role of Heart Team is just to consider all those facts, leaning on guideline recommendations but not blindly following them, also to have in mind the level – quality of evidence (A, B-R, B-NR, C-LD, C-EO). The aim is only one, the benefit of our patient. Why is Appropriate defining the Coronary Syndroms - acute and chronic as a mirror of coronary artery disease and What is Appropriate in defining ACS?

Before finding the best treatment solution, first step is defining the problem, with its temporal and space orientation. To discuss Acute coronary sindrom we have to define it precisely, there are new 2023 guidelines from the European Society of Cardiology (ESC) and from ACC they are since 2021. Chronic coronarny sindrom, previosly called stable angina have new ACC guideliness from 2023. and the ESC since 2019. Even this time frames indicate those, ESC and ACC guidelines are complementary (Figure 3).

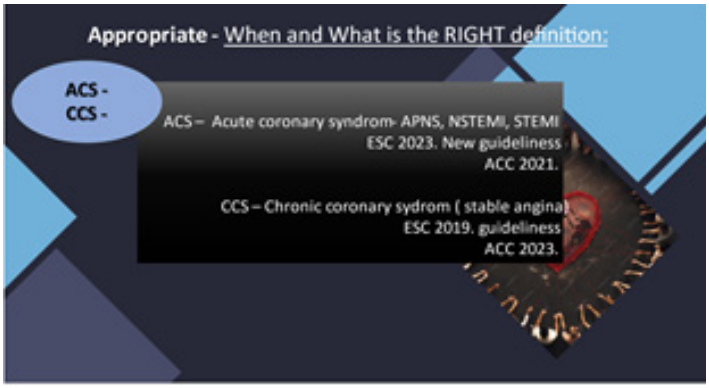

Figure 3: Defining time line guidelines for Coronary Syndroms.

Time trend of mortality for acute coronary sindrom is fascinatingly decreased, thanks to invasive percutaneous approach, primary PCI. Very steep curve is observed, decrease in mortality more than 30%. This extraordinary journy with primary PCI and use of dual antiplatelet therapy DAPT, statins and anticoagulation [1,2]. Chronic coronary sindrom, previously called stable angina, does not have the significant decline in mortality. It is rather plato curve, with all the broad spectrum of drugs incorporated in last years. But, for the both coronary sindroms, ACC and CSS, optimal medical therapy is the integral part. All by itself and as the unavoidable segment of revascularization. Neither can be done without antithrombotic therapy, that can be divided to antiplatelet therapy (single-SAPT, dual -DAPT) and anticoagulation therapy. Aspirin remains the basis, despite many trials recently done in order to drop it from the therapy to reduce bleeding risk either earlier or in case when the prolonged DAPT is needed [3-6].

Why is Appropriate to make adequates diagnosis of ACS ?

ESC 2023. New guidelines for ACS are constructed for easy remember, as the acronim ACS picturing the precise approach: A - Abnormal ECG, C - Clinical presentation and S- check if the patient is stable.

Following four Think review – Think of invasive management (STEMI, non STEMI), Think about antiagregation: always anthitrombotic therapy and imidiate anticoagulation with UHP or LMWH [8]. Think of revascularization: in STEMI, there is no doubt, invasive, primary PCI is always the first option if technicaly possible, if not than fibrinolyis for sure, in NSTEMI high risk imidiate or early innvasive approach is encountered, eventualy CABG. The priority of complete revascularization is emphasized, which is new, and also recommendations for functional inavsive testing and intravscular imiging [8].

Think of secondary prevention using all available group of drugs: antiagregation, lipid lowering drugs most desirable statins, smoking cessasiton, cardiac rehabilitation, psyhosocial consideration [8]. After each ACS secondary prevention medical therapy is "Conditio sine qua non".

Special review should be for older, frail patients, because the world population is growing older, age limits are increased, more octogenerians also are to be cured [8]. A holistic, global, universal approach (IA) should be used, but also individual one, with evaluation of both risks and benefits very carefuly [8]. There are a lot of comorbiditeis that can influence our decision. Not always frailty patient is the old one, old ones are mostly frail. There are a lots of patients with active carcinoma or with sequele, anemia without known etiology, rheumatological and nerulogical disorderes leading to disabilites etc. [9]. Use of Frailitiy Clinical Scale (FCS) should be encouraged, it is picturesque and precise [10]. It was introduced by the Canadian Study of Health and Aging (CSHA), to summarize the overall level of fitness or frailty of an older adult [10]. The Futility index should not be forgotten indicating predicted survival [11].

What is Appropriate in ACS?

Definining Acute Caronary Sindrom (ACS) starts with clinical presentations as it is shown on the ESC panel, from the asymptomatic to cardiac arrest [8]. ECG recording is from normal to malignant arrhythmia and according to that we devide ACS to STEMI and NSTEMI [8]. New guidelines incorporate high sensitive Troponin (hs Trop) to be done at presentation and after 1 h and 2h. The empasized importance is the trend in troponin, either its increasing or descreasig. %. TRAPI AMI trial introduced the rutine use of hs Trop for diagnosing myocardial infarction [12]. Having all these together we make diagnosis of myocardial infarction or not.

The following factors can influence the troponine concentration: age, renal failure, time onset of chest pain, sex, but also atrial fibrilation, malignant arrhytmias, heart failure, carcinoma [13,14]. When we have diagnosed infarction, let us see what is new in NSTEMI guidelines for timing in invasive strategy, comparing to last ones. Downgrade of early invasive strategy in 24h from I a to IIa level of recomendation. Incorporating now hs Troponin levels, and both ECG patterns and GRACE score mora than 140, rest tha same [8]. As early as possible in ACS, for high GRACE score above 140 , the risk is higher, and early invasive strategy save lives, specifically in this category [15]. More unstable patient is earlier invasive approach should be done. It reduced the rate of death, myocardial infarction and was superior to delayed intervention in high-risk patients [15,16].

What strategy in ACS is recommended

In cardio-surgical hospitals where you have invasive cardiology departement and all other hospitals from where the transoprt is within 2-4h, Immidiate invasive strategy is the matter of first choice. After successful fibrinolysis, Routine early use of PCI strategy is recommended. After failed fibrinolysis pharmaco invasive stategy is according to the guidelines [8].

As early as possible and as COMPLETE as possible in mulivessel disease, after successful PCI of Infarct related artery [17]. Staged complete revascularization of non infarct related artery should be done during index procedure in STEMI or in 45 days. Functional testing (FFR) if needed [8,18]. STEMI patients should be compeletely revascularized was upgraded, now class IA and was in 2017/2020 guidelines IIb recommendations. There is no doubts for completness of revascularization either during the index procedure OD within 45 days (IIA) in hemodinamically stable STEMI patients with multivessel coronary disease [8]. In Cardiogenic shock one should do PCI of culprit lesions (IRA) only [8]. NSTEMI have class IIb for the PCI of non infarcted artery [8].

ACC recommendations say almost the same: staged PCI of non IRA, but IIb recomendations is for the complete revascularization during the index STEMI hospitalization, unlike in ESC 2023 [19]. One should have in mind that those are older guidelines 2021.

The highlights from ESC 2023, for me, is the trial comparing complete revascularization vs culprit lesion only, for elderly patients, more than 75 years old - FIRE trial [20]. Significantly better outcome if you do complete revascularization in ACS patients (65% Non ST myocardial infarction and 35 % ST elevation MI). After PCI solving the culprit lesion, physiology guided non infarct related artery, almost 30% of them did not have another procedure, because of negative phisiology [20].

Antiplatelet dual therapy (DAPT) is the standard of care after ACS [8,18]. Aspirin, given first loading dose od 300mg, than 100mg maintainance dose of 100mg, for life and P2Y12 inhibitors are to be given as addition to Aspirin, given loading dose depending of is it clopidogrel, prasugrel or ticagrelor, and after that maintanence dose for a year [18]. Prasugrel in P2Y12 inhibitors naive patients proceeding to PCI. Ticagrelor is recommended irrespesctive of the treatment strategy [8,18]. The only exception are the High Bleeding Risk (HB R) patients [8]. Before ESC 2023 guidelines DAPT with pretreatement P2Y12 inhibitors, ticagrelor or clopidogrel was mandatory, obligatory, but preatreatment with P2Y12 inhibitors in 2023 DOWNGRADED to IIb recomendations [8]. Why is that? Because coronary anatomy on angiography is the most important to know, to assess it and decide which type of revascularization is going to be used. Assessment od coronary anatomy before administration of P2Y12 inhibitor is the most reasonable strategy in ACS, unless the invasive management is delayed [22]. In NSTEMI routine pretreatment is not recommended [18]. Giving the loading dose during the primary PCI procedure was not inferior to given it before in the emergancy ambulance [8,23]. So,both ESC 2023 guidelines and ACC/AHA expert consensus 2022, for DAPT pretreatement with P2Y12 inhibitor, ticagrelor or clopidogrel significantly downgraded to IIB recommendations, unlike before in ESC 2017/2020 was mandatory, obligatory IA [8,22,23]. Guidelines for long-term menagament therapy after ACS do recommend: DAPT for a year, statins as pleotropic agents influencing the plaue stabilization and modification of hemoreological properties, not only hipolipemic effect are IA class [8]. High doses, intensify low dose statins during the index ACS hospitalization (IC). But, adding another drug ezetimibe on top of high dose statin during index hospitlaization is just IIB [8].

Why we should assess High Bleeding Risk (HBR) ? Because, the 20% of all infarction patients, are HBR, especially folowing: age equal or more than 75, oral anticoagulation, prior major surgery (within 12 months, history of previous bleeding or stroke, anemia, chronic kidney disease (CKD), cancer etc. [24]. It is our imperative to assess High Bleeding Risk (HBR) patients with ACS and indication for oral anticoagulation (atrial fibrilation, mechanical valves, thromboelmbolic events) default strategy IA class, is up to one week triple therapy with both ASA, P2Y12 inhibitor and NOAK, following to 6 or 12 months NOAC plus single antiplatelet SAPT (I R), preferably P2Y12i . Strategy to reduce ischemic risk is one month triple therapy (IIA), following to 6 or 12 months NOAC plus single antiplatelet (IA). After a year single NOAK is recommended as IA [8].

HOW to assess High Bleeding Risk, though selecting patients who are most likely to have a favourable risk/benefit profile with long-term antiagregational therapy (ticagrelor) [25]. PEGASUS TIMI study gave birth to steps of ischemic risk factors and grading of bleeding risk after two-three years of myocardial infarciton. First step for prior hospitalization for bleeding risk and anemia carries very high bleeding risk. Second step is evaluating ischemic risk factors: recent myocardial infarction or use of P2Y12 inhibitor, multiple myocardial infarctions or stents, multivessle CAD, diabetes, renal failure, PAD - perifer artery disease [25]. Those having more than 2 ischemic risk factors should benefit from P2Y12i-prolonged ticagrelor therapy [25]. The relathionship between death, mortality and bleeding published by Braunwald et al. in 2005. was described very clearly [26]. Major bleeding leads to hypotension, ischemia, consequently cessation of DAPT leads to stent thrrombosis than we have the need for transfusion, all leading to increased mortality [26].

What are the best predictors of periprocedural bleeding? There are few score but PRECISE DAPT would be single out. It is a simple but most contributable one, to my opinion [27]. The most significantly relevant predictors of periprocedural bleeding incorporated in PRECISE DAPT score are: Hemoglobin, Leucocytes, Age, Creatinin clearance and Prior bleeding [27,28]. The cut of level of significance for higher bleeding is 25, above 25 favourable is prolonged DAPT, below 25 unfavourable for prolonged DAPT, on line calculator is easy to use [28]. So, long-term DAPT after PCI definitely fails to benefit patients at High Bleeding Risk [29]. GLOBAL-LEADERS trial DAPT for 1 month, followed by ticagrelor monotherapy for 23 months was not superior to standard DAPT for 12 months followed by aspirin alone in the prevention of all cause mortality and new Q wave myocardial infarction two years after PCI [30]. SMART-CHOICE [31], TWILIGHT [32] trials with P2Y12 inhibitor use monotherapy after short DAPT was not inferior to long DAPT 12 months. But, the results of STOP DAPT-3 trial (5966 pts) showed the opposite, a strategy of de-escalation to prasugrel immediately, one month post-PCI was not beneficial in Korean patients and could be be harmful, particularly among ACS patients [33]. DAPT should remain the standard strategy one month after coronary stent implantation [33]. Unlike, STOP DAPT-2 trial (1529 pts), which was done with clopidogrel, whereas one month of DAPT followed by clopidogrel monotherapy was noninferior to 12 months of DAPT followed by aspirin monotherapy at preventing net adverse clinical events [34].

What can be done in High Bleeding Risk (HBR) - Modulation of dual antiplatelet therapy (DAPT), that in this case means reducing (de-escalation) the intensity of platelet inhibition [35]. This de-escalation therapy can be done in three following ways: switching to less potent P2Y12 inhibitor (mostly we think of that), by dose reduction or discontinuation of one antiplatelet drug [35]. TALOS-AMI HBR sub study [36], pubished in Eurointervention showed significant benefit with deescalation therapy, significantly less edverse cardiac events [36]. There were no differences in treatment effect for the primary endpoint regardless of HBR status (p for interaction=0.904) [36]. Prolonged anthitrombotic therapy with P2Y12 inhibitor (DAPT) in HBR pts should not be recomended IIB and after 12 months discontinuation of antiplatelet regimen in patients treated with an OAK should be done IA [8]. On the other hand, prolonged DAPT when needed after deafult strategy one year DAPT in ACS can be done in four following ways: monotherapy either with Aspiriin IA recommendation or P2Y12 inhibitor which is just IIB, though in high ischemic and low bleeding risk we have options to add small, vascular dose of NOAC (rivaroxaban) or add second P2Y12 inhibitor in low bleeding risk is IIA and in moderate bleeding risk patients is IIB [8]. There are proposed opptions for shortening DAPT in ACS : a month of DAPT either guided by genotype testing or platelet funtion guided tests (multyassay and verfy now), that is less expenssive and faster [37]. Clopidogrel monotherapy in HBR is the option or Ticagrelor alone after 3 months of DAPT with Aspirin, or Aspirin monotherapy for 6 months after 3 months of DAPT [37].

What is Appropriate in defining - CCS – Chronic coronary syndrom (stable angina)

Huge population of previosly called patient with stable angina, lately changed to chronic coronary syndrom [38]. The new guidelines for CCS are ACC 2023. unlikely to ESC dateing from 2019 [39]. The patient therapy approach consists of three main paths: life style changes, guideline direstied medical therapy (GDMT) and taking into account patients preferences [39]. Also, underlining the specific symptoms, clinical characteristics, Clinical Fraility Scale (CFS) and incorporating also anatomical/functional characteristics of the coronary angiographic lesion. ACC 2023. take home messages consist of ten main notifications [40]: patients centered care, use of broad non-pharmacological therapies (etc healty habits, exercise), - cardiac rehabilitation for eligible patients to provide significant CV benefits (about 10% reduction in CV mortality and morbidity for increase in individual steps caunt by 1000 steps) [40].

- *SGLT2i & GLP1 agonists* in eligible pts with &without DM
- *Beta-blocker use in long term* therapy is NOT recommended to improve outcomes in CCS patients in the ABSENCE of myocardial infarction in the past year, EF LV ≤50% either a

calcium-channel blocker or beta-blocker is recommended as first-line antianginal therapy

- *Statins* - remain first-line therapy for lipid lowering and pleiotropic effects, but use of several adjunctive therapies (eg, ezetimibe, PCSK9 - proprotein convertase subtilisin/kexin type 9 inhibitors, inclisiran, bempedoic acid) in select populations.
- *Shorter durations of DAPT* are safe and effective (when HBR and the ischemic risk low.
- Use of dietary supplements OTC (including fish oil and omega-3 fatty acids or vitamins) is NOT recommended – given lack of benefit in reducing CV events.
- *Routine periodic anatomic or ischemic testing* without a change in clinical or functional status is *NOT recommended* (for risk stratification nor to guide Tx decision-making).
- E-cigarettes are NOT recommended as first-line therapy for smoking cessation (lack of long-term safety data).

All these following trials have ONE thing in common: Optimal medical therapy is not inferior to elective revascularization in Chronic coronary syndrom patients (COURAGE, BARI 2D, STICH, STICHES, ORBITA, FAME 2, ISCHEMIA, REVIVED BCIS2, FAME 3) [41] ORBITA and ORBITA-2 trials together suggest the American and European guidelines for stable coronary artery disease may require updating [42]. Restricting stenting to patients with inadequate response to maximal chest pain medications, by selecting those group of patients with the least to gain by the drugs and a lot of adverse effects [42].

ACC recommendations for patient risk stratification should incorporate all available information, including noninvasive, invasive or both cardiovascular diagnostic testing results to classify patients as low (<1%), intermediate (1%-3%), or high (>3%) yearly risk for cardiovascular death or nonfatal infarction IB [39]. More prominent picture depicting the same comes from Anna G. Perez et al. 2021. Describing the tree possible risk profiles to classify those CCS patients: Profile 1- green one: low risk where medical therapy is enough, Profile 2 - yellow one, the intermediate –risk patient in whom we should think twice to revascularize or not and Profile 3 - red one, high risk, with low threshold for revascularization (including untractable angina, reduced EF, severe ischemia on functional testing and high coronary anatomy) and should be revascularized [43].

In all patients, new guidelines emphasize the role of comprenhesive, universal approach, including Socio economical, cultural factors named Social Determinants of Health (SDOH) and support on one hand and on another clinical, functional analysis and testing (using non invasive imiging), have in their centre shared decision making with the patients preference and attitude towards exposed risk [39]. The most used non invasive methods are: Exercise or dobutamine stress echocardiography, SPECT or PET, Calcium score alone and with functional imaging, CCTA, CMR and use of biomarkers (hs Troponin, NTpro BNP) [39]. In patients with chronic coronary syndrom optimization of GDMT is recommended to reduce MACE IA [39]. Those who have newly reduced LV systolic function, clinical heart failure assessing of coronary anatomy and guided potential revasculatrization is mandatory IA [39]. When revascularization is the option, we should keep in mind that significant decerease in CV mortality, is on the account on lower risk of spontaneous myocardial infarction in elective angiography with the use of medical therapy together [44].

Factors that can influence type of revascularization are: Diabetes mellitus, Chronic kidney disease, Comorbiditites of other organs, Left ventricular dysfunction, Previosly CABG done, Completness of revascularization, Posibilities and tolerance of DAPT, Quality of Life, Biological age vs vascular age (fraility index) [42-44]. Considering all of that, the ISCHEMIA trial gave the freedom to clinical cardiologist for the decision making in stable coronary disease, except in those with significant left main disease, low ejection fraction, ACS within 2 months, NYHA III/IV, unstable angina and severe valvular disease where invasive approach is of no doubt. ISCHAEMIA trial included 5179 pts with moderate or severe ischemia on non invasive testing, and conclusion is: early invasive strategy do not decrease risk of CV event or all mortality causes. But, it has benefitial effect in decreasing spontaneous AMI at the expense of number peri-PCI myocardial infarcion [45]. The review on meaning of Guideline Directed Medical Therapy in this trial is: cessastion of smoking in 90% of patients, controled hypertension (systolic TA < 140 mmHg) in 77%, level of LDL <1.81 mmol/l in 59%. High level of optimisation in medical therapy meant from 20% to 40% in both groups (invasive and conservative) [45]. The use of six groups of drugs for chronic coronary syndrom are the same both for ESC and ACC guidelines: Antiplatelets, statins, beta blockers, ACEi/ARBs, aldosteron antagonists, calcium channel blockers [46]. Guideline Directed Medical Therapy is obligatory to use in both types of revascularization, percutaneous or surgical. Sometimes, we have overlapping between these modes of revascularization, especially in high perioperative risk patients, that surgents refuse to operate because of unacceptable risk for surgery. Than the paliative, but complex percutaneous procedures are done. Complex PCI patient is broder definition than complex PCI lesion, but it is the part of it. Complex PCI patient implies to: Comorbidities (HF, DM, advanced age, PAD, UA,prior surgery), Complex coronary artery disease (multivessel disease, LM, heavy calcification, long lesion, high thrombus burden, complex bi/trifurcaton, ostial lesion, venous grafts), Operater experience and Hemodynamic compromise (low EF, low CO) [47]. The first registry of 726 patient turned down from cardiac surgery, declared to be inelgible, in 21 US hospital, is OPTIMUM - *O*utcomes of *P*ercu*T*aneous revascularization for management of surgically *I*neligible patients with *MU* ltivessel or left *M*ain coronary artery disease [48]. Following PCI in those complex patients, short-term mortality was lower than surgeons' predicted estimation, similar to surgical risk model predictions but over 4-fold higher than estimated by the NCDR CathPCI model. What is of great importance - Quality of their life expressed as patients' health status, improved significantly through six months [49].

STICH trial CABG in Ischemic Heart Failure included 1212 pts with ischemic cardiomyopathy (LV EF ≤35%) that had gone either

surgical revascularization (CABG) vs OMT (otpimal medical therapy) after 10 years of follow up, revascularization was superior (it included also Surgical ventricular reconstruction (SVR) in addition to coronary artery bypass grafting) [50]. But, we have to be aware of newly introduced HfrEF therapy that can prolong life, that was not available before. REVIVED trial consisted of PCI vs OMT in ischemic cardiomyopathy (LV EF ≤35%). After 5 years follow up no difference in mortality was observed [51]. In 2023. at Complex Coronary Cases, conclusion was in favor of revascularization even with PCI, because patient nowadays want to live long, healthy life. LV dysfunction reduces that longevity, increases stroke and stroke rates are increased with CABG compared to PCI. So, percutaneous revascularization is prefered by almost patients, though it is lesser invasive procedure with emphasis to early benefit of Quality of Life and similar rate of late QoL [52]. Revascularization Guidelines continue to give considerable importance to ischemic burden, except in those with: significant LM disease, EF LV > 35%, ACS within 2 months, NYHA III/IV, APNS and severe valvular disease where there is no doubt. The most recent European guidelines class I indication - revascularization in patients with large territory of ischemia (>10% myocardium). The most recent iteration of the ACC/AHA revascularization guidelines class IIB indication, downgraded revascularization (via either CABG or PCI) in patients with non-left main SIHD and normal EF (representing a change from the prior 2011 CABG guidelines) [53]. Functional invasive testing is like the room with a clear view", so the use of FFR/iFR is supported in undocumented ischemia and angiographically intermediate stenoses (I A)- [53] *The FAME 2 results indicate that the presence of significant demonstrable ischemia (as noted by a positive FFR test) is important to risk-stratify patients before pursuing PCI* [53].

Fractional Flow Reserve versus Angiography for Multivessel Evaluation (FAME, FAME 2, FAME 3) trials, although not with the same results, brought one conclusion: FFR-guided PCI plus optimal medical therapy can provide the best cardiovascular outcome and should be generally recommended in patients with chronic coronary syndrome [53,54].

FAME - FFR-guided stenting in patients will do better than those stented based on angiography alone, FAME 2 - those with positive FFR and undergo PCI will have fewer events than positive FFR treated only medically (regardless of status: ACS versus stable angina) [54]. The presence of not significant demonstrable ischemia (noted by negative FFR > 0,80) is important for prognostic risk-stratification [55]. *The rate of VOCE (vessel-oriented clinical endpoint, cardiac death/vessel-related MI, vessel-related revascularization) was lowest in the group with FFR >0.8. (55)* FAME 3 - FFR-guided PCI was not noninferior to CABG considering death, MI, stroke, repeat revasc. at 1 year (in 3 VD) [54]. ISCHEMIA - Ischemia severity was not associated with increased risk of adverse outcomes. More severe CAD was associated with increased risk for all-cause mortality, but the invasive strategy did not lower that risk at 4 years [54]. Controversis in the latest Guidelines (updated from 2015) for revascularization CABG and PCI - 2021 made by ACC/AHA/SCAI which are NOT endorsed by surgical Societies STS/AATS are following: CABG in 3VD - Downgrade from 1 < 2b to improve SURVIVAL , CABG in reduced LV function from 1 < 2a, use of radial artery as adjunct to IMA elevated from 2a < 1 [53]. But multidisciplinary approach based on management programs to optimize the best care in surgery is given IB class of recommendation. Optimizing analgesia, minimize opioid exposure, prevent complications and reduce time to extubation, length of stay (LOS) and health care costs [53].

Rehabilitation program before surgery, is called Prehabilitation [56]. It includes multimodal prehabilitation program: exercise, education, nutrition and psychology. Prehabilitation reduced lenght of stay after cardiac surgery and improved outcome [57]. But, Psychological interventions in patients after coronary revascularization who have symptoms of depression, anxiety or stress, treatment with cognitive behavioral therapy, psycholocal counseling and /or pharmacological intervention is beneficial to improve quality of life and cardiac outcomes(I-B) [53].

Telemetry continual monitoring is the example of implementing the mode of artificial intelligence after revascularization and before it. Using it, we are erasing the time and distance between the patient and the doctor, unveiling the heart s secrets: malignant arrhythmias, significant AV blocks, desturation, even new ischemia by continual monitoring vital parameters for as long as we think we need [58]. Current knowledge gaps include the true economic cost of telemedicine infrastructure, feasibility of use in specific cardiology contexts, and sex/gender differences in telemedicine use. Future telemedicine developments will need to address these concerns before acceptance of telemedicine as the new standard of care [59].

Modern medicine through all the virtual availabilities is helping doctors in making diagnosis and threating patients, not the disease. Invasive percutaneous interventions, including simple angiography and functional testing, are the queens of cardiology, to uncover the critical stenosis and to treat it. But, not each stenosis is to be treated. The problem is that it is overused and indications are not always respected. So, I came up the idea and designed simple score that can help in estimation which patient and when, should be send to angiograpy either for the first time or after revascularization, to detect (re)stenosis. GAR²DE²NIA score is designed to predict highly suspicious probability of significant coronary disease in patients who have not been proven to have CAD or the probability of new significant coronary stenosis in those who have previously already been revascularized (cardiac surgery, percutaneous intervention or vascular surgery). GAR²DE²NIA is an acronym that incorporates the following parameters: Gender, Age, Renal impairement, Respiratory disease, Diabetes Mellitus, Echochardiographic abnormalities, ECG abnormalities, New symptoms, Ischaemia, Atril fibrillation. The established cut-off value for the risk of significant coronary stenosis is 4.

You can try it, **https://gar2de2nia.com/**

It is free, you can email me if you have any questions, doubts or praise (preis) [59].

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