MAJOR LEG WOUND COMPLICATIONS AFTER SAPHENOUS VEIN HARVEST FOR CORONARY REVASCULARIZATION

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CVD	Cardiovascular disease
NCDs	Non-communicable diseases
CAD	Coronary artery disease
ECG	Electrocardiogram
ACE	Angiotensin converting enzyme
ARB	angiotensin receptor blocker
CCBs	calcium channel blockers
PCI	Percutaneous coronary intervention
CABG	Coronary Artery Bypass Grafting
SVGs	saphenous vein grafts
LAD	left anterior descending
LIMA	left internal mammary artery
RIMA	right internal mammary artery
BIMA	bilateral internal mammary arteries
RA	Radial Artery
GEA	Gastroepiploic_Artery
DM	diabetes mellitus
PVD	peripheral vascular disease
IABP	intra-aortic balloon pulsation
GSV	great saphenous vein
RCA	Right coronary artery
PDA	posterior descending artery
OM	obtuse marginal branch
PL	posterior left ventricular branch

CO2	carbon dioxide
EVH	Endoscopic vein harvesting
VGF	vein graft failure
BMI	body mass index
DVT	Deep vein thrombosis
VSMCs	vascular smooth muscle cells
Pt	Patient
ICU	Intensive care unit

Introduction

Cardiovascular disease (CVD) currently represents nearly half of non-communicable diseases (NCDs) which have overtaken communicable diseases as the world's major disease burden, with CVD remaining the leading global cause of death, accounting for 17.3 million deaths per year, and it is expected to grow to >23.6 million by 2030[(1).]

Of the cardiovascular diseases, acute myocardial infarction is the most common cause of death with a total mortality rate of 30% - 40% and a 25%-35% mortality rate before reaching the hospital. The underlying cause in most cases is atherosclerotic coronary artery disease[(2).]

Conventional risk factors for the development of Coronary artery disease (CAD) include: hypertension, hypercholesterolemia, diabetes, sedentary lifestyle, obesity, smoking, and a family history[(2).]

Unfortunately, they have an adverse influence on prognosis in those with established disease through their effect on the progression of atherosclerotic disease processes. However, appropriate treatment can reduce these risks[(2).]

A careful history is considered the cornerstone of the diagnosis of chest pain. **Tab(1)** In the majority of cases, it is possible to make a confident diagnosis with history alone, although physical examination and tests are often necessary to confirm the diagnosis[(2]

Table 1 : Traditional clinical classification of chest pain[2].

Typical angina (definite)	Meets all three of the following characteristics: • substernal chest discomfort of characteristic quality and duration; • provoked by exertion or emotional stress; • relieved by rest and/or nitrates within minutes.
atypical angina (probable)	Meets two of these characteristics.
Non-anginal chest pain	Lacks or meets only one or none of the characteristics.

The diagnosis and assessment of CAD also includes identifying risk factors and specific cardiac investigations such as ECG, Echocardiogram, stress testing and coronary imaging. These investigations may be used to confirm the diagnosis of ischemia, identify or exclude associated conditions, assist in identifying risk associated with the disease and evaluate the efficacy of treatment[2].

The exercise ECG remains the cornerstone of diagnostic testing of SIHD patients. On the other hand, exercise and pharmacological stress echocardiography aims to detect new or worsening wall motion abnormalities and changes in global LV function during or immediately after stress. In addition to the detection of inducible wall motion abnormalities[2,3]

All stress tests are designed to induce cardiac ischemia by using exercise or pharmacological stress agents either to increase myocardial work and oxygen demand[2].

All patients diagnosed with ischemic heart disease should have an echocardiogram to assess the ventricular function and regional wall motion abnormalities suggesting ischemia or an old infarction within a specific coronary artery territory[3].

cardiac catheterization where a coronary angiogram can define coronary anatomy with the aim of identifying flow-limiting atherosclerotic lesions[3]

The recent availability of multislice CCTA allows for the noninvasive visualization of anatomic CAD with high resolution images similar to invasive coronary angiography[2,3].

Laboratory tests such as a lipid profile, HbA1c, and renal function are routinely obtained as well. Troponin enzyme levels are useful in the current clinical setting[3].

Control of risk factors to prevent cardiac events:

Both lifestyle modifications and medical therapies are used to control risk factor :[2,4]

- Lifestyle modifications:
  - Smoking cessation
  - Regular physical exercise
  - a healthy diet
  - weight management
  - Psychosocial support

- Medical therapies aiming at vascular protection by controlling lipid, blood pressure and diabetes :
  - All patients with CAD should receive a statin
  - All patients with CAD and hypertension/diabetes/heart failure should receive an angiotensin converting enzyme (ACE) inhibitor (or angiotensin receptor blocker [ARB] as an alternative)

- Antiplatelet agents to prevent cardiovascular events: Treatment with antiplatelet agents is recommended for patients with CAD for vascular protection by preventing blood clot formation over any ruptured/eroded atherosclerotic plaques.[(2)]

Relieving symptoms of coronary artery disease[(2)]

First-line treatment for symptom relief

- Short-term therapy with nitrates, β-blockers and calcium channel blockers (CCBs) are first-line treatment options for patients with stable CAD[(2).]
- Sublingual nitroglycerin is the standard initial therapy for effort angina, because it promotes coronary arteriolar and venous vasodilation[(2).]
- To control heart rate and symptoms, β-blockers and/or CCBs are recommended[(2).]
    - β-blockers reduce heart rate, contractility, atrioventricular conduction and ectopic activity[(2).]
    - CCBs (dihydropyridines and non-dihydropyridines) induce vasodilation and reduction of the peripheral vascular resistance[(2).]

Second-line treatment for symptom relief

- Long-acting nitrates, ivabradine, nicorandil or ranolazine are recommended options for patients with stable CAD[(2).]

If symptoms persist despite the medical therapy, revascularization may be indicated[(2).]

Revascularization in patients with CAD[5]

Revascularization of patients with CAD is recommended to: Improve both symptoms and prognosis.

Revascularization can be achieved through either Percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG). The appropriate approach is dependent on the following[5]:

- Location of the stenosis
- Extent of the disease (i.e. single versus multivessel disease)
- SYNTAX score of the patient (an angiographic score that assesses lesion complexity)
- Surgical risk of the patient

Surgical revascularization

CABG is the most common cardiac operation performed worldwide. It has been shown to be the most effective revascularization method for many categories of patients affected by coronary artery disease[6].

Long-term conduit patency is considered the key factor for the success of the procedure. however, no guidelines on graft selection exist so the choice of revascularization strategy remains more a matter of art than of science[6].

Conduit classification

The first choice for surgeons to make is whether to use a venous or an arterial conduit. In general, the main advantage of arterial grafts is their long-term patency compared with saphenous vein grafts (SVGs) therefore, arterial grafts are more indicated in younger patients or in those with a life expectancy of more than 10 years. On the other hand, the technique of arterial grafting is more challenging

and time-consuming, that's why venous grafting is preferred in emergency situations and for patients with a higher operative risk[7].

The algorism for choosing the conduit in different situations of CABG is shown in **Fig(1)**

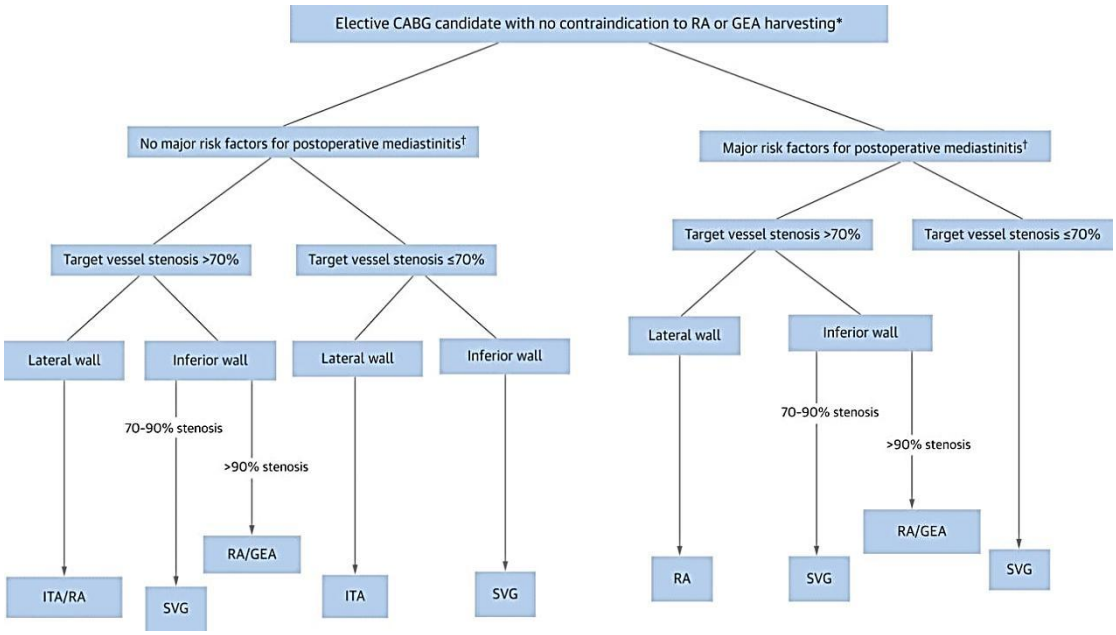

Figure 1: Algorithm for Graft Selection for the Second Target Vessel in Elective CABG Patients Without Contraindications to RA and GEA Harvesting[6].

i. Arterial conduits:

- <u>The Left Internal Mammary Artery</u>

The survival benefits associated with the use of the left internal mammary artery (LIMA) to the left anterior descending (LAD) coronary artery were established in a landmark paper from the Cleveland Clinic almost 30 years ago due to its superior long term patency[6].

The left internal mammary artery morphological features probably explain its superiority. It has a discontinuous internal elastic lamina and a relatively thin media with multiple elastic laminae and absence of a significant muscular component, that explains its reduced tendency for spasm and the development of atherosclerosis. it also

shows increased production of anti-inflammatory and vasoactive molecules, particularly nitric oxide more than any other conduit[6].

- The Right Internal Mammary Artery

The demonstrated successful performance and durability of the LIMA graft led many surgeons to believe that the same benefits could also apply to the Right Internal Mammary Artery (RIMA). Indeed, there is a significant increase in long-term survival in patients undergoing Bilateral Mammary Arteries (BIMA) grafting when compared with the patients undergoing lone LIMA grafting but it remains unclear whether this advantage is due to the use of the BIMA or simply ascribed to the benefits of using arterial conduits[7].

- The Radial Artery (RA) conduit:

The Radial Artery conduit was Introduced in coronary surgery in the 1970s & was "rediscovered" in the early 1990s[6].

Concerns about vasospasm, due to its muscular nature have been reduced after the demonstration of progressive morphofunctional remodeling of the artery toward an elastomuscular profile after implantation in the coronary circulation[6].

The severity of the stenosis of the target vessel is a key factor in determining RA patency. There is general agreement that the RA should be used only to bypass a vessel with >70% stenosis, and there is evidence that a 90% stenosis limit ensures a better RA patency rate, especially on the right coronary system[6].

Compared with the RIMA, the RA seems a better choice in patients at risk for post-operative sternal complications (diabetes, obesity, chronic pulmonary disease[6].