

Revascularization in CAD Patients

Who Benefits?

Cardiovascular disease accounts for more deaths in Canada than any other disease; half of the deaths are due to CAD. CAD can be treated with revascularization, using techniques such as CABG and PCA. But who benefits from these procedures and when should they be performed?

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With approximately 8 million people affected, cardiovascular disease (CD) accounts for more deaths than any other disease in Canada. Half of these deaths are due to coronary artery disease (CAD).

Who should be referred for revascularization?

Once CAD has been diagnosed, a three-step process begins:

1st step: Risk stratification

We need to determine the likelihood of the patient having an adverse outcome. This process involves the identification of predictors associated with an adverse outcome (Table 1).

Table 1

Predictors associated with adverse outcomes

- Age
- Male gender
- Diabetes
- Non-invasive test with high-risk results
- Clinical instability
- Left ventricular dysfunction
- Multivessel/left main disease

2nd step: Risk/benefit equation

The spontaneous risk is weighed against the risk/benefit associated with available treatment strategies: Medical therapy vs. myocardial revascularization.

3rd step: Medical advice

Since revascularization strategies carry the risk of fatal and non-fatal complications, this procedure is only recommended:

- to reduce the likelihood of fatal and non-fatal cardiovascular events in high-risk patients;
- when an unacceptable level of angina or congestive heart failure (CHF)-related symptoms persist; or
- when the patient experiences troubling side-effects from medication.

Who benefits and how?

The coronary lesions prone to causing acute coronary events (*i.e.*, plaque rupture and thrombosis) are angiographically non-significant, with a large, inflammatory component and a thin, fibrous cap. A direct correlation exists between the number of vessels with significant CAD and the amount of angiographically non-significant lesions, suggesting that the higher mortality rate of patients with multivessel CAD occurs due to the higher burden of potential sites for acute thrombosis.

Table 2

Considerations before myocardial revascularization

- Number of lesions, especially those jeopardizing regions of contracting myocardium
- Mass of jeopardized viable myocardium
- Characteristics of the lesions
- Ventricular performance
- Patient comorbidities and general condition

Table 2 outlines the main factors to consider before referring a patient for myocardial revascularization. It is recognized that these factors, when combined, provide insight into the consequences of acute vessel occlusion.

Patients who benefit most (survival rate) are those with a significant number of severe lesions associated with a significant mass of jeopardized, viable myocardium, especially in the presence of poor left ventricular (LV) performance (Table 3).

Patients who also benefit from revascularization—through a reduction in the likelihood of a non-fatal cardiovascular event (CHF and re-hospitalization)—include:

- patients without proximal left anterior descending stenosis with one- or two-vessel CAD; and
- patients with recurrent stenosis in association to a large area of viable myocardium.

In the major randomized clinical trials, the likelihood of non-fatal myocardial infarction (MI) is similar in medically- and surgically-treated patients.

Patients who obtain an improvement in quality of life are those who have not been successfully treated by medical therapy and can undergo

Table 3

Patients who benefit most from revascularization

- Patients with significant left main disease
- Patients with three-vessel severe CAD, especially if there is severe proximal LAD stenosis
- Patients with LAD stenosis, especially if located proximally
- Patients without LAD stenosis, but with one- or two-vessel CAD who have survived sudden cardiac death or sustained ventricular tachycardia
- Patients with multiple saphenous vein graft stenoses, especially when there is significant stenosis of a graft supplying the LAD

Note: The benefit is larger if LV ejection fraction is < 50%, or if there is severe demonstrable ischemia.

CAD: Coronary artery disease
LAD: Left anterior descending
LV: Left ventricular

revascularization with acceptable risk, especially if they have severe angina and LV dysfunction.

Who should be referred for CABG? What about PCA?

The main factors that need to be considered before recommending a specific technique are:

- the likelihood of a successful revascularization (based on angiographic characteristics);
- the need for complete revascularization;
- the likelihood of restenosis if percutaneous transluminal coronary intervention (PCI) is chosen;

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- the risk and potential consequences of acute percutaneous transluminal coronary angioplasty (PTCA) failure;
- comorbid conditions that may increase the risk associated with the procedure; and
- patient preference.

It is worth noting that coronary artery bypass grafting (CABG) and percutaneous coronary angioplasty (PCI) are considered equivalent in terms of mortality, but CABG is currently more efficient at keeping patients symptom-free without the need for further revascularization. In the largest study to use “state-of-the-art” revascularization techniques, the one-year, clinically-driven repeat revascularization rate was 3.5% for CABG and 16.8% for PCI.

In summary, patients eligible for either technique are those in whom equivalent degrees of revascularization can be achieved by either PCI or CABG, and have no particular high-risk conditions.

Table 4 lists the criteria for selecting which of the two procedures should be prescribed first in individual patients.

To achieve a good outcome in patients with multivessel disease and LV dysfunction, particularly if angina or ischemia is severe, revascularization should be complete.

The major advantage CABG has over PTCA is its ability to achieve complete revascularization and its efficiency for dealing with two particular anatomic features: left main disease and chronic total coronary occlusions.

Patients eligible for either CABG or PCI are those in whom equivalent degrees of revascularization can be achieved by either technique, and who have no particular high-risk conditions.

Table 4

Criteria for selecting the correct first-line treatment

CABG should be recommended first in patients:

- With left main disease
- With chronic total coronary occlusions
- With associated cardiac structural defects requiring surgery
- With LV dysfunction and complete revascularization not feasible with PCI
- In whom performing PCA is impossible as a consequence of absent adequate peripheral vascular access

PCI is preferred for:

- Fragile patients, as a consequence of advanced age and/or other severe comorbid conditions
- Younger patients (< 50) in order to delay CABG
- Poor surgical candidates
- Patients with one- or two-vessel CAD without significant proximal LAD CAD.

CABG: Coronary artery bypass grafting
 LV: Left ventricular
 PCI: Percutaneous coronary intervention
 PCA: Percutaneous coronary angioplasty
 CAD: Coronary artery disease
 LAD: Left anterior descending



Internet Readings

1. American College of Cardiology Foundation: Clinical Guidelines: www.acc.org/clinical/statements.htm
2. Cardiosource: www.cardiosource.com

It is worth noting that operative mortality increases with more severe LV dysfunction.

PCA's advantage is that it can be repeated without adding significant risk, which is not the case for CABG.

Who is not a candidate for revascularization?

Some patients will not benefit from myocardial revascularization. The absence of viable myocardium can be suspected if:

- typical angina is not present;
- there is a lack of adequately sized R waves (or presence of deep Q waves); and
- there is an absence of reversible perfusion defects or contractile reserve in the region perfused by the target artery.

Some patients present with significant CAD in very small diameter vessels. This may happen because the vessel is originally small or as a consequence of a diffuse pattern of CAD, which may generate a global reduction of the coronary arter-

Frequently Asked Questions

1. What are the main markers of adverse in-hospital outcome associated with CABG?


- Advanced age
- Prior CABG
- LV dysfunction
- Peripheral vascular disease
- Chronic obstructive pulmonary disease
- Dialysis or creatinine ≥ 2 mg/dL (177 μ mol/L)
- Obesity (body mass index ≥ 31)

2. What patients are non-candidates for revascularization?

- Non viable myocardium
- Very small diameter target vessels
- Bad quality distal vascular beds
- Non favourable risk/benefit equation

ies luminal diameter. In these circumstances, the surgical procedure becomes technically impossible and the endovascular procedure has a poor long-term outcome.

Occasionally, this diffuse pattern of disease involves the distal vascular beds and the impaired blood flow cannot be improved by resolving the stenosis upstream.

Finally, there are some patients in whom the high risk of complications associated with either technique does not offset the potential long-term benefit associated with the myocardial revascularization procedure. 

References available—contact *Perspectives in Cardiology* at cardio@sta.ca.

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