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REVIEW ARTICLE

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Percutaneous Intervention and Coronary Artery Bypass Graft Surgery Instable Angina

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ABSTRACT

Stable angina pectoris represents a prevalent and clinically significant manifestation of coronary artery disease. Despite advances in medical therapy, many patients continue to experience symptoms that necessitate revascularization. Among the current strategies, percutaneous coronary intervention (PCI) and coronary artery bypass grafting (CABG) are widely used, both aiming to restore myocardial perfusion impaired by coronary artery stenosis or occlusion. This article provides a comprehensive overview of stable angina's clinical presentation, diagnostic evaluation, and current treatment options. Emphasis is placed on appropriate patient selection for each revascularization modality, including the application of the SYNTAX II score and other clinical parameters. Special populations such as diabetic, renal failure, and heart failure patients are also addressed, in line with contemporary evidence and guidelines.

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Introduction

Stable angina is typically characterized by chest discomfort or pain resulting from transient myocardial ischemia due to obstructive coronary artery disease. Timely diagnosis and effective treatment are essential to improve quality of life and reduce cardiovascular risk.

Clinical Presentation and Diagnosis

The main symptom of stable angina is a feeling of heaviness and pain in the retrosternal area [1]. In most patients, the pain is typically burning or stinging in nature. This pain is usually left-sided and may radiate to the jaw, shoulder, back, and left arm. Sometimes, the pain can be atypical and spread to the right arm, right shoulder blade, and epigastric region. Symptoms typically occur during physical activity and may subside upon stopping the activity or with the use of nitroglycerin.

In diabetic patients, symptoms are usually atypical and may manifest as general discomfort. In some cases, diabetic patients may not feel any symptoms at all. In such cases, the symptoms are masked, making diagnosis more difficult. For accurate diagnosis, the patient's medical history, differential diagnosis of diseases, and the use of appropriate diagnostic methods are essential.

The risk factors of ischemic heart disease play a significant role in making the diagnosis. These risk factors include hypertension, atherosclerosis (presence of known arterial narrowings), diabetes mellitus, smoking, and family history.

To confirm the diagnosis of stable angina, both invasive and non-invasive examinations are necessary [2]. Non-invasive procedures include ECG, echocardiography (ECHO), stress test, stress echocardiography, and cardiac computed tomography.

Medical Management and Indications for Intervention

All patients with stable angina, regardless of whether they have undergone an intervention or not, should receive optimal medical therapy. This includes aspirin, P2Y12 inhibitors (if there is a history of acute coronary syndrome), and statin therapy [3]. For patients with reduced ejection fraction of the heart, the use of angiotensin-converting enzyme inhibitors, beta-blockers, and other classes of medications should also be considered.

Despite optimal medical therapy, patients with persistent symptoms should be evaluated through invasive testing. In some cases, regardless of whether medical therapy has been initiated, coronary angiography (CAG) may be indicated based on the results of non-invasive tests.

Indications for Invasive Testing Include

- Electrocardiographic changes and significant clinical symptoms observed during a stress test,
- Wall motion abnormalities detected during stress echocardiography,
- Coronary artery obstructions identified on coronary computed tomography (CT) angiography,
- Other similar findings that suggest a high likelihood of obstructive coronary artery disease.

If coronary artery obstructions are detected during coronary angiography (CAG), revascularization procedures should be performed to reduce symptoms and improve quality of life in patients with stable angina.

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Revascularization Strategies and Scoring Systems

The method of revascularization should be chosen individually for each patient, taking into account the condition of the coronary arteries, comorbidities, risk factors, life expectancy, and quality of life.

In patients with single-vessel disease and no significant comorbidities, percutaneous coronary intervention (PCI)—including stent implantation or balloon angioplasty—is appropriate, provided that the coronary anatomy is suitable.

In cases of multivessel coronary artery disease, the choice of revascularization method is more complex, and a specific scoring system has been developed to assist in this decision. The SYNTAX II score is used to compare the risks of surgical intervention (coronary artery bypass grafting — CABG) and percutaneous coronary intervention (PCI), as well as to predict potential risks in advance [4].

SYNTAX II Score Components

- The coronary arteries are divided into segments, and a specific assessment is performed for the stenosis present in each segment.
- The role of the occluded artery in supplying the left ventricle is specifically taken into account.
- The length and type of the stenosis are classified into three categories:
  - Type A – Mild Stenoses
  - Type B – Moderate Stenoses
  - Type C – Complex and Technically More Challenging Stenoses
- The degree and duration of the occlusion are considered.
- Bifurcation lesions — requiring special expertise.
- Clinical indicators including age, renal function, ejection fraction, gender, and comorbidities like COPD or peripheral artery disease.

SYNTAX Scores

- 0–22: Low risk
- 23–32: Intermediate risk
- ≥33: High risk

For intermediate and high scores, CABG is generally preferred due to better long-term outcomes.

Special Considerations

Left Main Coronary Artery Stenosis

Approximately 4% of patients requiring coronary intervention have left main coronary artery stenosis [5]. Previously, these cases were routinely referred for CABG. However, recent advances in PCI techniques and drug-eluting stents have made stenting a viable alternative in selected patients.

Diabetes Mellitus

Diabetes is a critical prognostic factor in coronary artery disease. These patients are at increased risk for restenosis, thrombosis, and renal dysfunction. Drug-eluting stents have significantly improved PCI outcomes in diabetic populations. However, CABG remains superior in long-term outcomes when anatomically feasible.

Chronic Kidney Disease

Both PCI and CABG carry higher procedural risks in this population. For patients with multivessel disease and end-stage renal disease, CABG has shown superior long-term results.

Heart Failure

Assessment of myocardial viability is crucial before revascularization, using cardiac MRI, contrast stress echocardiography, or PET. In patients with reduced LVEF and viable myocardium, CABG is typically preferred.

Previous CABG Surgery

Repeat surgery should be avoided if possible due to elevated risks. PCI is preferred when feasible, with redo-CABG reserved for highly symptomatic patients not amenable to PCI.

Patient Selection for PCI

Proper selection of suitable patients for PCI increases the success rate and long-term positive outcomes.

When selecting patients for PCI, the following factors should be carefully considered [6]:

- Coronary anatomy — vessel size, calcification, tortuosity.
- Presence of multivessel disease or severely reduced LVEF.
- Comorbidities including diabetes and prior restenosis.
- Patient preference.

Ideal candidates for PCI are as follows:

- Patients with stable angina despite optimal therapy;
- Favorable anatomy (e.g., single-vessel disease);
- LVEF > 40%;
- Low procedural risk profile.

Challenges and Limitations of PCI

Factors contributing to PCI failure include:

- Advanced age,
- Female gender,
- Unstable angina,
- Severe comorbidities,
- Left main or multivessel disease,
- Diabetes and renal dysfunction.

Stent Technology

Since the 1990s, the use of coronary stents has transformed the management of obstructive coronary artery disease. Bare-metal stents reduced restenosis compared to balloon angioplasty, but drug-eluting stents (DES) have further minimized restenosis risk, particularly in high-risk populations such as diabetics [7].

Coronary Artery Bypass Grafting (CABG)

The first CABG was performed in 1964, with subsequent improvements including use of the internal mammary artery graft in 1967 [8]. CABG remains the preferred option in patients with complex or multivessel disease, diabetes, and significantly reduced LVEF.

Patient selection for CABG is guided by anatomical suitability, comorbidities, and patient preference. The EuroScore is a validated tool for surgical risk stratification [9].

Conclusion

Stable angina remains a prevalent challenge in cardiology, requiring individualized treatment decisions based on symptoms, diagnostic findings, and comorbid conditions. While optimal medical therapy is essential, timely selection of PCI or CABG—guided by SYNTAX II, EuroScore, and clinical judgment—ensures improved outcomes and quality of life.

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