Clinical outcome of coronary artery bypass graft surgery versus percutaneous coronary intervention in patients with severe left ventricular disfunction: the CROWN study.

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ABSTRACT

Ischemic heart disease represents the most common cause of heart failure in industrialized countries. Nevertheless, the role of coronary artery bypass grafting (CABG) in patients with coronary artery disease and left ventricular dysfunction has long been a matter of debate. The uncertainty surrounding the role of CABG in ischemic heart disease has been further increased by the proliferation of studies supporting medical and percutaneous interventional therapies, which emerged as valid alternatives to surgery in high-risk patients.

Although CABG is increasingly being performed in patients with reduced ejection fraction, current literature lacks sufficient data directly comparing the clinical outcomes of surgical versus percutaneous revascularization in patients with left ventricular dysfunction.

The goal of our study is to compare the clinical outcomes of patients with critical coronary artery disease and severe left ventricular dysfunction undergoing surgical coronary artery bypass grafting with those of patients treated by percutaneous coronary intervention (PCI). This is a retrospective, observational, single-center cohort study enrolling adult patients undergoing either isolated coronary artery bypass surgery or percutaneous coronary intervention at our institution.

BACKGROUND

Ischemic heart disease is the most common cause of heart failure in industrialized countries. However, the role of coronary artery bypass grafting (CABG) in patients with coronary artery disease and left ventricular dysfunction has long been debated.

Until a few years ago, clinical guidelines were based on trials from the 1970s that, while recommending CABG in ischemic heart disease, excluded patients with an ejection fraction (EF) below 35% because of their higher rate of complications. [1–3] The uncertainty surrounding the role of CABG in ischemic heart disease has been further amplified by the proliferation of studies supporting medical and percutaneous interventional therapies, which have emerged as valid alternatives to surgery in high-risk patients. [4,5]

The clinical decision about the best treatment for patients with coronary artery disease and left ventricular dysfunction has also been hindered by the lack of randomized trials comparing revascularization strategies.

Within this context, the STICH trial, a multicenter randomized study, was designed to assess the role of cardiac surgery in patients with coronary artery disease and left ventricular dysfunction (EF <35%). Among the 1212 patients enrolled, 610 were treated with CABG plus optimal medical therapy and 602 with medical therapy alone. The results showed no significant difference in all-cause mortality between the two groups; however, CABG demonstrated superiority in reducing cardiovascular mortality and the composite endpoint of all-cause mortality or hospitalization for cardiovascular causes. [6]

Another critical concern about surgical management in patients with coronary artery disease and severe left ventricular dysfunction is the relationship between the extent of myocardial ischemia and the incidence of adverse events. Although the presence and extent of ischemic myocardium are commonly used as guiding criteria for revascularization in stable patients, several trials have failed

to demonstrate a consistent association between these parameters and clinical outcomes. [7,8] It should also be noted that most studies have focused only on medical or percutaneous therapy, while excluding patients with impaired left ventricular function.
The REVIVED-BCIS2 trial addressed this gap. This prospective, multicenter, randomized controlled trial compared PCI with optimal medical therapy alone in patients with severe left ventricular dysfunction, aiming to clarify the predictive role of myocardial ischemia on clinical outcomes. Results demonstrated that ischemic burden had no significant association with clinical outcomes. [9]

The scientific community agrees that the primary goal in managing patients with stable coronary artery disease is to reduce the risk of death and ischemic events and/or to improve quality of life. However, among patients with coronary artery disease and moderate-to-severe myocardial ischemia, it remains unclear whether an invasive strategy (PCI or CABG) combined with medical therapy results in better outcomes than medical therapy alone. The ISCHEMIA trial was designed to address this question. It demonstrated that, in patients with stable coronary artery disease and moderate or severe ischemia, an initial invasive approach offered no advantage over optimal medical therapy in terms of cardiovascular events or mortality. [10]

According to the current ESC guidelines, in patients with chronic coronary syndrome and an EF ≤35%, the choice between revascularization and medical therapy should be based on a comprehensive assessment of coronary anatomy, the relationship between left ventricular dysfunction and coronary disease, comorbidities, life expectancy, risk–benefit ratio, and patient preferences. Moreover, in surgical candidates, CABG is preferred over medical therapy alone, as it improves long-term survival. [11]

Despite CABG being increasingly performed in patients with reduced EF, the literature lacks of data directly comparing the clinical outcomes of surgical versus percutaneous revascularization in patients with left ventricular dysfunction.

STUDY OBJECTIVE

Primary objective

To compare the clinical outcomes of patients with critical coronary artery disease and severe left ventricular dysfunction (EF ≤ 35%) undergoing coronary artery bypass grafting (CABG) with those treated by percutaneous coronary intervention (PCI).

STUDY DESIGN AND DURATION

This is an retrospective, observational, monocentric cohort study in which adult patients with critical coronary artery disease and severe left ventricular dysfunction undergoing coronary artery bypass surgery or percutaneous coronary intervention will be enrolled.

The study will last six months: four months for patients enrollment and data collection and two months for statistical analysis and scientific paper writing.

The trial will start after obtaining favourable opinion from the local Ethics Committee.

INCLUSION CRITERIA

- Age >= 18 years old;
- Written informed consent;
- Indication to CABG surgery (both «on-pump» and «off-pump») or to PCI;
- Preoperative EF ≤35%.

EXCLUSION CRITERIA

- Inability to give written informed consent;
- Emergency surgery;
- Combined cardiac surgical procedures;
- Previous cardiac surgery.

STUDY PROCEDURES

All patients affected by coronary artery disease who underwent surgical treatment (coronary artery bypass grafting, CABG) or percutaneous treatment (percutaneous coronary intervention, PCI) between January 2019 and December 2023, and who meet the inclusion and exclusion criteria, will be included in the study. Each patient will be enrolled following an interview and the subsequent signing of the informed consent form. Data will then be recorded in a dedicated database. In detail, the following information will be collected: anamnestic data, description of the performed procedure, preoperative and postoperative laboratory test results, preoperative, intraoperative, and postoperative echocardiographic parameters (including follow-up visits up to 2 years after the procedure), length of stay in the Intensive Care Unit and in the general ward, and data regarding any intraoperative and postoperative complications (death, shock, pericardial effusion, stroke, myocardial infarction, need for postoperative PCI, rehospitalization, heart failure). All data recorded in the database are routinely collected for all patients undergoing this type of intervention, and no additional examinations will be performed on patients included in the study.

END-POINTS

Primary end-point

Primary end-point will be all-cause mortality.

Secondary end-points

Secondary end-points will be:

- mortality from cardiovascular causes;
- acute myocardial infarction;
- rehospitalization from cardiovascular reasons;
- repeated revascularization;
- stroke.

STATISTICAL ANALYSIS AND SAMPLE SIZE CALCULATION

Sample size calculation

Considering the average number of patients undergoing CABG and PCI every year at our institution and taking into account the inclusion and exclusion criteria, we estimate to enroll 300 patients.

Statistical analysis

Data will be collected in a specific database (Microsoft Excel worksheet). The Kolgomorov-Smirnoff test is used to check for variables distribution. Continuous variables with a normal distribution are summarized by mean and standard deviation. Continuous variables with a non-normal distribution are expressed with median and interquartile range.
Categorical variables are reported as absolute frequency distribution and percentage. Continuous data are analyzed using the unpaired t-test or the Mann – Whitney test according to their distribution. Categorical data are compared with the Fisher's exact test. Statistical findings were considered significant if p value was less than 0.05. Statistical analysis will be performed with the statistic software SPSS (IBM).

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