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Review article

Use of OPCAB in Czechia 2010–2015: Have we learned any lessons?

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ARTICLE INFO

Article history:
Received 14 October 2017
Received in revised form
9 January 2018
Accepted 13 January 2018
Available online 13 February 2018

Keywords:
Revascularization
Cardiopulmonary bypass
Off-pump

ABSTRACT

Introduction: Off-pump coronary artery bypass grafting (OPCAB) is a well-established technique for coronary revascularization, which is used worldwide as well as in the Czech Republic (CZ). However, the number of patients undergoing this procedure varies from department to department. We wanted to see if the very latest publications regarding off-pump coronary revascularization had changed the way the procedure was viewed by Czech heart surgeons.

Methods: Data from the Czech National Register of Cardiac Surgery were used to evaluate trends in the number OPCAB cases, in patients with ischemic heart disease, and to analyze the factors that surgeons routinely used when opting for the OPCAB strategy. The study period was 2010–2015.

Results: OPCAB was performed at all 12 cardiac surgery departments in the CZ. Overall, we found a slight decrease of the total number of isolated revascularizations in the CZ per annum between 2010 and 2015 (from 3884 to 3569), the percentage of OPCAB cases also declined over the study period (from 26.7% to 24.9%). Over the study, the average age of OPCAB patients increased (66.2 vs. 68.1 years) and included patients with increasingly greater numbers of comorbidities. The average total OPCAB surgery time decreased (3.3 vs. 3.1 h) and compared to standard revascularization, OPCAB took significantly less time (3.1 vs. 3.3 h, $P < 0.001$). The number of peripheral anastomosis performed off-pump was significantly lower than on cardiopulmonary bypass (CPB) and, in general, has decreased (2.1 vs. 3.0, $P < 0.001$ in 2010 and 1.9 vs. 2.9, $P < 0.001$ in 2015 resp.).

Conclusions: The prevalence of OPCAB in Czech Republic has decreased. However, it is unclear whether this is due to the recent widely respected prospective randomized clinical trials. Published papers have not shown the superiority of OPCAB in high-risk patients, yet Czech cardiac surgeons prefer this strategy, especially in patients with a history of renal insufficiency. In that point, the community of Czech cardiac surgeons seems to have become more conservative with a trend toward incomplete revascularization.

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https://doi.org/10.1016/j.crvasa.2018.01.005

Contents

Introduction

Surgical revascularization plays a crucial role in the treatment of coronary artery disease (CAD). With considerable progress in interventional cardiology, it has become an integral part of patient care by (1) reducing the need for oral medication, (2) improving quality of life, and (3) improving overall long-term prognosis. Randomized studies in the 1990s showed the superiority of aortocoronary bypass (ACB) relative to medication. A total of 41% of conservatively treated patients required revascularization surgery within 10 years. In addition, ACB patients had a significantly lower 5-, 7-, and 10-year mortality compared to conservatively treated patients. Benefits of ACB surgery were particularly evident in cases of left main disease (LMD), triple vessel disease (3VD), and in high risk patients [1,2]. Comparable results were obtained in randomized trials comparing the results of revascularization and percutaneous coronary intervention. They reaffirmed that the beneficial long-term effects of aortocoronary bypass, especially in patients with diffusion sclerosis of the coronary arteries [3,4].

Today beating-heart myocardial revascularization is considered to be the next developmental stage of the same procedure performed using extracorporeal circulation with cardiac arrest. It is paradoxical that it was this technique, i.e., without circulatory support, that Vineberg used in 1950 [5] when he first tried to revascularize the myocardium by grafting the internal thoracic artery to the heart. Also, the first successful endarterectomy of coronary arteries, by Bailey [6] and Longmire [7], was also performed on a beating heart, as well as the first successful aortocoronary bypass in 1961, by Robert Goetz.

Extracorporeal circulation with cardiac arrest, using a cardioplegic solution, was introduced into practice by Favaloro in 1967, and the beating-heart method was abandoned for almost 20 years. Since then, myocardial revascularization using cardiopulmonary bypass has been referred to as ''standard revascularization.'' In the 1990s Benetti and Buffalo published a retrospective analysis favoring off-pump techniques because of a reduction in serious post-operative complications (renal failure, stroke, respiratory failure, SIRS) [8,9]. They started a wave of comparisons with ''standard techniques'' that has continued for over 20 years. The discussion initially focused on the negative impact of extracorporeal circulation devices. It was also assumed that cannulation of large arteries and veins increased operational risks. In addition, it has been confirmed that blood contact with the artificial surfaces of extracorporeal tubular systems triggers a systemic inflammatory response in the organism (SIRS), which was formerly known as post-perfusion syndrome. Despite the mild, often subclinical course of inflammation, the brain, intestine, kidneys, heart, and coagulation disorders were subsequently affected [10]. In rare cases, there can be a serious clinical manifestation, known as multiorgan failure (MOF). The humoral component of the non-specific inflammatory response activates complement, kallikrein–kinin, hemocoagulation, and the fibrinolytic system. The result is increased levels of oxygen radicals, increased capillary permeability, and pain. All cellular components of the blood are involved in the cellular response of the body, resulting in leukocytosis, thrombocytopenia (by an average of 17% [11]) with subsequent bleeding, and physical damage to erythrocytes. The non-pulsatile flow of blood during extracorporeal circulation is also currently considered to be the cause of post-operative renal failure [12]. For these reasons, CPB-surgery was considered to be extremely non-physiological and risky. Newly developed miniECC with reduced surface of the tubing system avoiding or minimizing above mentioned pathophysiological mechanisms is used exclusively in specialized centers. In the Czech Republic there is only one department, using miniECC routinely, in ca. 40% of all isolated ACBs (personal communication). Therefore this technique represents marginal method in our conditions, especially from the financial reasons. The first on-pump/off-pump comparison demonstrated that non-use of CPB in direct myocardial revascularization significantly reduced the release of the pathological process mediators described above [13,14] and subsequent clinical outcomes were promising [15,16]. The literary sources for OPCAB can be divided into three groups: (1) the first are observational data from large groups that repeatedly show the benefit of revascularization on the beating heart, especially in high-risk patients; (2) large-format, randomized trials in patients with relatively low surgical risk that do not show a significant difference in the main cerebrovascular outcomes compared to standard on-pump revascularization (on the other hand, they confirm smaller post-operative blood loss, lower transfusion rates, and shorter length of stay after OPCAB, however, this is offset by a higher number of incomplete revascularizations and a lower long-term graft patency); and (3) small randomized trials from