# IMPACT OF ADVANCED HEMODYNAMIC MONITORING ON MYOCARDIAL REVASCULARIZATION SURGERY IN HIGH-RISK PATIENTS

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**Abstract:** Coronary artery bypass grafting is a critical procedure for patients with advanced coronary

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disease, especially those classified as high risk due to comorbidities such as heart failure, hypertension and diabetes. Advanced hemodynamic monitoring has proved essential in this context, allowing continuous and accurate surveillance of cardiac and vascular parameters, which can reduce intra- and post-operative complications. This abstract aims to assess the impact of advanced hemodynamic monitoring during coronary artery bypass graft surgery in high-risk patients. The aim is to explore the advantages of this type of monitoring, the technologies used and the benefits in terms of clinical outcomes and reduction of complications. This is a literature review with a qualitative approach, carried out in the PubMed, SciELO, LILACS, BVS and Google Scholar databases. In order to optimize the search, descriptors such as Hemodynamic Monitoring, Cardiac Surgery, High Risk Patients and Fluid Management were used. For time delimitation, the research considered publications between the years 2019 and 2022, a period that reflects the latest advances in hemodynamic monitoring technologies in high-risk cardiac surgeries. Advanced hemodynamic monitoring includes the use of devices such as the pulmonary artery catheter and non-invasive bioimpedance systems, which provide real-time data on cardiac output, blood pressure, oxygen saturation and systemic vascular resistance. In high-risk patients, these devices allow for precise adjustments in the administration of fluids and vasoactive drugs, promoting better hemodynamic stability. Studies indicate that this approach reduces the incidence of serious complications, such as cardiogenic shock and arrhythmias, optimizing post-operative recovery. Therefore, advanced hemodynamic monitoring is a crucial tool in CABG surgeries, especially for high-risk patients. Its implementation improves intraoperative management, reducing the risk of complications and promoting better clinical outcomes. Therefore, its use should be considered an integral part of strategies for complex cardiac surgeries.

## INTRODUCTION

**Keywords:** General Surgery, Revascularization; Hemodynamics; Cardiology.

Coronary artery bypass grafting (CABG) surgery is widely used in the treatment of patients with coronary artery disease, especially those with multiple vessels compromised and in advanced stages of the disease. However, when performed in high-risk patients, such as the elderly or patients with

severe comorbidities, CABG presents significant challenges in terms of safety and efficacy. In these cases, advanced hemodynamic monitoring has been identified as a crucial strategy for intraoperative and postoperative management, allowing for more precise management of tissue perfusion, cardiac function, and circulatory parameters (SOUZA et al., 2020).

Advanced hemodynamic monitoring involves the use of technologies that allow continuous evaluation of critical parameters such as cardiac output, central venous pressure, venous oxygen saturation, and systemic vascular resistance. This information is essential to guide precise therapeutic interventions, especially in highly complex surgeries such as CABG, where abrupt variations in circulatory parameters can lead to serious complications, such as cardiogenic shock, ventricular dysfunction, and multiorgan failure (COSTA, 2021).

In high-risk patients undergoing CABG, advanced hemodynamic monitoring has been associated with a reduction in perioperative complications and an improvement in clinical outcomes. Studies have shown that, by allowing early intervention in the face of changes in hemodynamic parameters, this monitoring can reduce mortality, length of hospital stay, and the need for prolonged vasopressor and ventilatory support. In addition, continuous monitoring allows for a more detailed assessment of the response to fluid and vasoactive drug therapy, crucial for maintaining hemodynamic stability in patients with severe cardiac dysfunction (PEREIRA et al., 2022).

Despite the widely recognized benefits, the implementation of advanced hemodynamic monitoring still faces challenges, such as the high cost of devices and the need for specialized training for surgical and critical care staff. However, in high-risk patients, the cost-benefit tends to be favorable, considering the potential reduction of serious complications and the shorter postoperative recovery time. With the advancement of monitoring technologies and the expansion of access to these resources, it is expected that the use of advanced hemodynamic monitoring will become increasingly widespread, especially in highly complex surgeries, such as CABG (SANTOS et al., 2021).

This study aims to evaluate the impact of advanced hemodynamic monitoring during coronary artery bypass grafting in high-risk patients. It is intended to explore the advantages of this type of

monitoring, the technologies used and the benefits in terms of clinical outcomes and reduction of complications.

## MATERIALS AND METHODS

This is a literature review with a qualitative approach, carried out in the PubMed, SciELO, LILACS, BVS and Google Scholar databases. In order to optimize the search, descriptors such as "Hemodynamic Monitoring", "Cardiac Surgeries", "High-Risk Patients" and "Fluid Management" were used. For the temporal delimitation, the research considered publications between the years 2019 and 2022, a period that reflects the most recent advances in hemodynamic monitoring technologies in high-risk cardiac surgeries.

Inclusion Criteria:

Articles published between 2019 and 2022, considering recent technological advances.

Studies that address hemodynamic monitoring in cardiac surgeries, focusing on high-risk patients.

Publications in English or Portuguese, accessible in full text.

Studies that discuss clinical outcomes related to the use of advanced monitoring technologies.

Systematic review studies, observational surveys, and clinical trials that include innovative therapies and intraoperative monitoring.

Exclusion Criteria:

Articles published before 2019, due to continuous technological evolution.

Studies that exclusively address pediatric patients or noncardiac surgeries.

Studies without evaluation of clinical benefits or that deal with hemodynamic monitoring in a superficial way.

Reviews without methodological rigor or opinion articles.

The research seeks to answer the following guiding question: What are the clinical advances and benefits of hemodynamic monitoring in high-risk cardiac surgeries between 2019 and 2022.

## THEORETICAL FOUNDATION

Advanced hemodynamic monitoring is an essential resource for the management of patients undergoing coronary artery bypass grafting, particularly those classified as high-risk. These patients, often affected by comorbidities, such as heart failure, systemic arterial hypertension and diabetes, have a more complex physiological response during and after surgery, requiring strict control of circulatory parameters to avoid serious complications. Through continuous monitoring of variables such as cardiac output, mean arterial pressure, and venous oxygen saturation, it is possible to adapt therapeutic interventions in real time, minimizing the risks of hemodynamic instability (SILVA et al., 2021).

During coronary artery bypass grafting, the use of advanced hemodynamic monitoring allows early detection of circulatory changes that could go unnoticed with conventional methods. The rapid identification of drops in cardiac output, for example, allows immediate correction with adjustment of vasoactive drugs or fluid replacement, preventing progression to multiple organ failure. In addition, monitoring systemic vascular resistance helps in the accurate determination of the need for vasopressors, preventing prolonged hypotension, which is associated with a worse prognosis in these patients (OLIVEIRA et al., 2020).

The adequacy of fluid therapy is another critical issue in the management of high-risk patients undergoing CABG. In individuals with severe cardiac impairment, excessive fluid administration can lead to volumetric overload, contributing to pulmonary edema and congestive heart failure. On the other hand, hypovolemia can also result in decreased cardiac output and inadequate tissue perfusion. Advanced hemodynamic monitoring provides real-time data that allows you to accurately adjust the

volume of fluids administered, avoiding both overload and hypovolemia (PEREIRA, 2019).

Recent studies indicate that advanced hemodynamic monitoring also improves postoperative outcomes in high-risk patients. By allowing faster and more precise interventions during the intraoperative period, patients tend to have a more stable recovery, with a lower incidence of complications such as cardiogenic shock, arrhythmias, and postoperative infection. Reduced length of stay in intensive care units (ICU) and lower need for ventilatory support are additional benefits observed in patients who have undergone more accurate and continuous monitoring (ALVES et al., 2022).

However, the large-scale implementation of this technology still faces barriers. The high cost of equipment and the need for specialized training for medical staff limit its availability in many health centers, especially in developing countries. In addition, some studies point out that, despite the apparent benefits, advanced hemodynamic monitoring is not completely risk-free, as it can lead to incorrect interpretations of data, depending on the professional's experience, resulting in inadequate interventions (COSTA et al., 2021).

Finally, the integration of advanced hemodynamic monitoring with other technologies, such as intraoperative cardiac ultrasound and the use of biomarkers for the early detection of myocardial lesions, offers an even more comprehensive view of the patient's hemodynamic status. This multimodal approach may become the norm in the near future, especially in high-risk surgeries, where each additional parameter monitored contributes to greater treatment accuracy (MACHADO, 2020).

## CONCLUSION

Advanced hemodynamic monitoring represents a crucial advance in the intraoperative management of high-risk patients undergoing coronary artery bypass grafting. By offering accurate real-time data on circulatory status, this technology allows for a more personalized and agile approach, reducing the incidence of hemodynamic complications and improving clinical outcomes. Patients who benefit from this technology have a faster and more stable recovery, with lower rates of prolonged

hospitalization and postoperative complications, such as cardiogenic shock and congestive heart failure.

In addition, advanced monitoring allows for more precise management of fluid therapy, avoiding both volumetric overload and hypovolemia, factors that could impair the prognosis of these patients. The application of more targeted and immediate interventions ensures greater safety during the procedure, especially in individuals with severe comorbidities.

However, the large-scale implementation of this technology still faces challenges, mainly related to high costs and the need for specialized training. Therefore, although its benefits are clear, its application must be accompanied by policies that encourage the training of professionals and the accessibility of health centers to this essential tool.

In conclusion, advanced hemodynamic monitoring has the potential to become a standard practice in high-risk coronary artery bypass graft surgeries, especially when integrated with other technologies and therapeutic approaches. Its effective use not only contributes to the safety and success of the procedure, but also improves the quality of life of patients in the postoperative period, reducing complications and recovery times.

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