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# Extracorporeal circulation in the elderly: Anesthesia in patients undergoing myocardial revascularization in the Intensive Care Unit (I.C.U)

# Circulação extracorpórea em idosos: Anestesia em pacientes submetidos à revascularização miocárdica em Unidade de Terapia Intensiva (UTI)

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**ABSTRACT**

To describe cardiopulmonary bypass in the elderly under anesthesia of patients undergoing myocardialrevascularization in the Intensive Care Unit. Cardiopulmonary bypass (CPB) can alter plasma concentrations of drugs used during anesthesia for cardiac surgery and cause effects on the central nervous system, leading patients to a greater degree of sedation, which alters the time of patient awakening. Method: This is a descriptive-qualitative-exploratory study, of a comprehensive nature, of the systematic type. Results: The three groups were compared in terms of weight, height, age and bodymass index (BMI). Regarding intubation time and wake-up time, it was observed that the CPB group had higher values for these variables, with a significant difference. Conclusion: The short duration of action of propofol of approximately 6 to 9 minutes can be explained by the high clearance and rapid distribution of the drug. Propofol concentration at the site of action also increases rapidly due to the rapid equilibrium between plasma and brain concentrations (< 4 minutes).

**Keywords:** Extracorporeal circulation, Elderly, Anesthesia, Cardiology, I.C.U.

## 1 INTRODUCTION

Cardiopulmonary bypass (CPB) under anesthesia in elderly patients undergoing coronary artery bypass grafting can change plasma concentrations of drugs used during anesthesia for cardiac surgery and cause effects on the central nervous system, leading patients to a greater degree of sedation, whichalters the awakening time of patients [1, 2, 3].

Hemodilution, blood loss, fluid mobilization and the effects of hypothermia can change the pharmacokinetics of drugs. The reduction in hepatic blood flow can modify the biotransformation of highly extracted drugs by the liver, affecting their elimination. On the other hand, in off-pump cardiac surgery, volume expansion with crystalloids promotes hemodilution and changes in plasma protein concentration and plasma protein binding [4, 5, 6, 7].

The pharmacokinetic profile of propofol favors rapid recovery from anesthesia and its short duration of action facilitates continuous infusion administration. The coupling of pharmacokinetic programs to the infusion pump allows drug administration at a rate capable of maintaining a constant plasma concentration using target controlled infusion (TCI), resulting in the maintenance of the hypnotic effect for the period desired time and rapid recovery after stopping the infusion [8, 9, 10].

The effects of CPB in patients undergoing CABG with CPB or hemodilution in patients undergoing CABG without CPB promote pharmacokinetic and pharmacodynamic changes on propofol,which are controversial. The objective of this study was to evaluate the interference of cardiopulmonary bypass in awakening from anesthesia in patients undergoing myocardial revascularization with or without the use of CPB, evaluating the degree of postoperative sedation and the time of awakening of patients, in addition to evaluating the correlation between monitoring using the bispectral index (BIS) or clinical assessment (Ramsay et al.13 sedation scale) [11, 12, 13].

## 2 METHOD

This is a descriptive-qualitative-exploratory study, of a comprehensive nature, of the systematictype. Due to the growing amount and complexity of information in the health area, it has become essential to develop devices, in the context of scientifically based research, capable of delimiting moreconcise methodological steps and providing professionals with better use of the elucidated evidence. innumerous studies. In this scenario, the systematic study emerges as a

methodology that provides the synthesis of knowledge and the incorporation of the applicability of results from significant studies in practice [14].

It is characterized by an approach focused on care under anesthesia and clinical care in the Cardio and Extracorporeal Circulation ICU and teaching based on knowledge and the quality of evidence. Therefore, it involves defining the clinical problem, identifying the necessary information, conducting a search for studies in the literature and their critical evaluation, identifying the applicabilityof data from publications and determining their use for the patient [14].

Systematic analysis is a review method that combines evidence from multiple primary studies using statistical instruments in order to increase objectivity and validity of findings. The design and hypotheses of the studies should be very similar, if not identical. In the meta-analysis approach, each study is synthesized, coded and entered into a quantitative database. Subsequently, the results are transformed into a common measure to calculate the overall effect size or measured intervention [14, 15]

In turn, it is a rigorous synthesis of all research related to a specific issue, focusing primarily on experimental studies, commonly randomized clinical trials. It differs from other review methods, as it seeks to overcome possible biases in each of the stages, following a rigorous method of search and selection of studies; assessment of relevance and validity of the studies found; collection, synthesis andinterpretation of data from research.


## 3 RESULTS AND DISCUSSION

The results obtained showed that elderly patients under anesthesia and myocardial revascularization in the ICU differed in their behavior in relation to the time of awakening and the intensity of postoperative sedation after the interruption of the target-controlled infusion. The greater intensity of postoperative sedation observed in the CPB group can be explained by hypothermia in patients in this group and by the depression of the central nervous system caused

by CPB [15].

Hypothermia also causes a decrease in hepatic blood flow with consequent reduction in propofolmetabolism. All these factors can increase the time of awakening of patients (calculated between the end of propofol infusion and the moment when patients responded to verbal commands) in this group, justifying the longer time of tracheal intubation in the postoperative period [16].

The greater degree of sedation observed in the CPB group shows a possible greater depression of the central nervous system caused by CPB. The BIS is related to the hypnotic component of anesthesia without considering the patient's movement response or the hemodynamic response to the painful stimulus, giving a degree of depth of anesthesia. In the current study, monitoring results demonstrated that the BIS value decreased immediately after anesthesia induction in both groups investigated, a fact that can be explained by the rapid onset of action and rapid distribution of the hypnotic agent to the central nervous system [17].

In patients with coronary disease evaluated in the present study, the infused dose of propofol was adequate for hypnosis. The anesthesiologist can set propofol target concentrations ranging from 2 to 6 µg.mL-1 for general anesthesia or 0.5 to 1.5 µg.mL-1 for sedation. Target-controlled infusion pharmacokinetic models rapidly achieve desired propofol target concentrations. However, propofol infusion must be cautious until the desired effect is achieved due to variability between individuals in the pharmacokinetics and pharmacodynamics of propofol. Patients' response to propofol during surgery is highly variable and the speed and dose of administration will be according to the individual needs ofthe patients [18].

The factors that influence the dose of propofol are: age, weight, pre-existing diseases, type of surgery and concomitant clinical treatments. The short duration of action of propofol of approximately5 to 8 minutes can be explained by the high clearance and rapid distribution of the drug. Propofol concentration at the site of action also increases rapidly due to the rapid equilibrium between plasma and brain concentrations (< 3 minutes). These pharmacokinetic characteristics of propofol lead to rapidonset of the hypnotic effect and loss of consciousness. Regardless of the compartmental model chosen,the distribution of propofol to the site of action is considered almost instantaneous and the free fractionof the drug controls the intensity of the pharmacological effect. Previous studies have reported up to a 3-fold increase in free drug fraction during cardiac surgery with CP6. An increase in free drug supply of approximately 300% could contribute to ensuring a rapid increase in propofol concentration at the site of action, with a relevant effect on the pharmacokinetics of this agent. Some studies also showed agreater hypnotic effect of propofol as

a result of CPB [19].

For this reason, the cerebral effects of CPB can interfere with the degree of hypnosis. Results obtained in previous studies confirm that sufentanil, at the low concentrations used, does not interfere with the effect of propofol measured by BIS. The clinical evaluation of the patient during awakening inthe ICU is extremely important in the postoperative period of cardiac surgery, as it allows for early extubation of the patient. This evaluation performed by the sedation scale and also by the BIS allows abetter follow-up of the patients [20].

## 4 CONCLUSION

This study achieved its objective insofar as it carried out a systematic survey of elderly patientsundergoing myocardial revascularization in the intensive care unit under anesthesia. Many studies werefound to have a solid basis, but there is a need for constant exploration of the proposed theme in order to consolidate the methodology of scientific research regarding this topic in question.

However, the challenge of the supreme golden rule of Cardiac Surgery remains: The day after the operation, the patient must be stable, awake, alert and extubated. Any bleeding will have stopped, diuresis will be within normal parameters, as well as routine exams. He will be ready to be transferredfrom the ICU to the room.

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