

Effect of Intraoperative Hemolysis on Complications Development in Patients with Coronary Artery Disease

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Abstract:

The assessment of the degree of IOH was made by the level of free hemoglobin (Hb) on the analyzer HemoCue Plasma/Low Hb, Sweden. In accordance with [Hb] in the blood plasma patients with CABs are divided into 3 groups: 1 – without IOH ($\text{Hb} \leq 0.1 \text{ g/L}$), $n=43$, 2 – with low IOH (lIOH) – with $[\text{Hb}] > 0.1 \text{ g/L}$ and $< 0.5 \text{ g/L}$, $n=42$, 3 with high IOH (hIOH) corresponded to $[\text{Hb}] \geq 0.5 \text{ g/L}$, $n=38$. The detection of complications was made in the perioperative (during the operation and the first day after it) and in the early - up to 1 month by dynamic observation of patients. It was detected such complications as arrhythmias, myocardial infarction, stroke, progression of heart failure, death. The study also sought to determine whether specific patient characteristics or surgical techniques influenced the relationship between IOH and postoperative complications [3-5]. By examining these factors, the research aimed to identify patients at highest risk for IOH-related complications and to develop targeted interventions to minimize these risks.

Key words: coronary bypass; hemolysis; degree

Introduction

This investigation sought to comprehensively evaluate the impact of intraoperative hemolysis (IOH) on the development of postoperative complications in patients with coronary artery disease (CAD) undergoing coronary artery bypass surgery (CABG). The study aimed to elucidate the relationship between the degree of IOH, as measured by free hemoglobin levels, and the incidence and severity of various postoperative complications. A particular focus was placed on understanding the potential mechanisms by which IOH may contribute to adverse outcomes following CABG [1-3]. This includes exploring the potential for IOH to exacerbate existing comorbidities, trigger inflammatory responses, and contribute to organ dysfunction. By defining this relationship, the study sought to inform strategies to mitigate IOH during CABG and ultimately improve patient outcomes [3-5].

Purpose: It was to study the effect of intraoperative hemolysis (IOH) on complications development in patients with coronary artery disease after CABs.

Methods: This prospective observational study enrolled 123 patients undergoing coronary artery bypass grafting (CABG). Intraoperative hemolysis (IOH) was quantified using a HemoCue Plasma/Low Hb analyzer (HemoCue AB, Ängelholm, Sweden) to measure free hemoglobin ([Hb]) levels in plasma [6]. Measurements were taken at

three specific time points: (1) pre-operatively, prior to initiation of cardiopulmonary bypass (CPB); (2) immediately following connection to the CPB circuit; and (3) 15 minutes before weaning from CPB. The highest recorded [Hb] value for each patient was used for group assignment.

Patients were stratified into three groups based on their maximum intraoperative free [Hb] concentration:

- Group 1: No IOH: Free [Hb] $\leq 0.1 \text{ g/L}$ ($n=43$)
- Group 2: Low IOH (lIOH): Free [Hb] $> 0.1 \text{ g/L}$ and $< 0.5 \text{ g/L}$ ($n=42$)
- Group 3: High IOH (hIOH): Free [Hb] $\geq 0.5 \text{ g/L}$ ($n=38$)

Postoperative complications were systematically monitored and recorded during two distinct periods:

- Perioperative Period: Encompassing the intraoperative phase and the first 24 hours postoperatively.
- Early Postoperative Period: Spanning from 24 hours to one month after surgery.

The following specific complications were tracked and analyzed:

- Cardiac Arrhythmias: Including both atrial and ventricular arrhythmias, documented by continuous electrocardiographic

monitoring.

- Myocardial Infarction (MI): Diagnosed based on elevated cardiac biomarkers (e.g., troponin) and characteristic electrocardiographic changes.
- Stroke: Identified through clinical neurological examination and confirmed by neuroimaging (e.g., CT scan, MRI).
- Progression of Heart Failure: Assessed by clinical evaluation, including signs and symptoms of worsening heart failure, and changes in echocardiographic parameters.
- Mortality: All-cause mortality within the one-month follow-up period.

Results

In the majority of patients with coronary artery disease ($n = 94$ or 76.4%), the postoperative period after CABs was with positive dynamic. The 29 (23.6%; $p < 0.001$) patients have had cardiovascular genesis complications. Arrhythmias were most commonly detected in operated patients (21.95%, $p < 0.001$), less frequently – heart failure progression (9.8%, $p < 0.001$), myocardial infarction – in 4.1%, $p = 0.003$, stroke – in 1.6%, $p = 0.323$. The fatal outcome was in 2 people (1.6%, $p = 0.010$). The analysis of complications in groups with different levels of IOH revealed their greatest frequency in the group with hIOH. Thus, in the 3rd group, the incidence of complications was observed in 22 (57.9%) patients ($p < 0.001$), in the group with lIOH – in 5 (11.9%) patients ($p < 0.001$), and in the group without IOH – only in 2 (4.7%) operated patients ($p < 0.001$). In the group with hIOH, the frequency of arrhythmias was 52.6%, in the group with lIOH – 11.9%, $p < 0.001$, without IOH – only 2.32%, $p < 0.001$. Myocardial infarction, which is one of the most dangerous complications of CABs, was in 5 patients (4.07%), and it was observed only in patients of the 3rd group with hIOH (13.2%, $p < 0.001$). In 10 (26.3%) patients of the 3rd group, progression of heart failure was observed, which is more than in the lIOH group – 2 (4.8%, $p < 0.001$) and without IOH – in 1 (2.3%) patients, $p < 0.001$. In 2 (5.3%, $p < 0.001$) patients of the group of the hIOH showed the development of stroke. Fatal outcomes were in two (5.3%) patients of the 3rd group ($p < 0.001$).

Conclusion

- Strong Correlation: A statistically significant positive correlation ($p < \text{insert p-value}$) was observed between the severity of intraoperative hemodynamic instability (IOH) and the incidence of postoperative complications following coronary artery bypass grafting (CABG). IOH severity was measured using Hb levels (hemoglobin concentration, specify units: g/dL or g/L).
- High IOH Group: The group with high IOH ($\text{Hb} \geq 0.5 \text{ g/L}$) exhibited a significantly higher frequency of postoperative complications compared to groups with lower IOH levels.
- Key Predictor: The degree of IOH, as reflected by Hb levels, serves as a crucial predictor of adverse postoperative outcomes after CABG.
- Clinical Significance: These findings underscore the clinical importance of meticulous hemodynamic monitoring and management during CABG to minimize the risk of complications.

- Future Research: Further research is warranted to elucidate the underlying mechanisms linking IOH to postoperative complications and to explore potential strategies for mitigating this risk.
- This study demonstrates a strong association between intraoperative hemodynamic instability and the incidence of postoperative complications following CABG.
- Patients experiencing high IOH had a significantly increased risk of arrhythmias, myocardial infarction, heart failure progression, stroke, and mortality. These findings highlight the importance of meticulous hemodynamic monitoring and management during CABG to minimize postoperative complications.

Abbreviations:

CABG: coronary artery bypass grafting

IOH: intraoperative hemolysis

CAD: coronary artery disease

Conflict of Interest: The authors declare that there are no conflicts of interest

References

1. Vasilevich V.V. (2018). Factors of hemolysis in on pump cardiac operations. *13th Bialystok International Medical Congress for Young Scientists: book of abstracts*. Bialystok.. p. 305. (In English).
2. White, J.M., Flashka. (1973), An automated procedure, with use of ferrozine, for assay of serum iron and total iron-binding capacity. *Clin. Chem.*, 19 (5), pp. 526–528. (In English).
3. Maksimovich Y. (2017), Nitrites and nitrates concentration in patients with coronary artery bypass/ Maksimovich Y., Stelmakh A., Dubovik A., ChmaraN., Kashcheua Y. // International Scientific Conference SCIENCE4H EALTH 13-15.04.2017 RUDN. University, Moscow, Russia P.137.
4. Maksimovich Ye. (2017), Early complications after coronary bypass operation/ Maksimovich Ye., Chmara N.//Abstr. the 16th International congress of medical sciences (ICMS) for students and young doctors 11-14 May. Bulgaria. P.254.
5. Maksimovich, Ye. N. (2018), Endothelial vasoactive properties in patients after coronary artery bypass surgery with different level of hemolysis / Ye.N. Maksimovich: abstract // Pathophysiology,– Vol. 25(3). P.177.
6. Maksimovich, E.N. (2018), Faktory` intraoperacionnogo gemoliza pri koronarnom shuntirovanii s ispol'zovaniem ickusstvennogo krovoobrashheniya / E.N. Maksimovich, V.V. Vasilevich, D.D. Truxovskaya, Yu.A. Koshheev, V.V. Kruglik // Sbornik materialov konferencii studentov i molody`x ucheny`x, posvyashhennoj 60-letiyu uchrezhdeniya obrazovaniya "Grodenskij gosudarstvenny`j medicinskij universitet", 26-27 aprelya 2018 g.: sbornik statej. – Grodno,. S.315-316.



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