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Case Report

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Perioperative Management of a Patient with Rheumatoid Arthritis Undergoing Coronary Artery Bypass Grafting: A Case Report

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Abstract

Rheumatoid arthritis (RA) is an autoimmune and inflammatory disease that is associated with an increased risk of heart disease. However, when these patients undergo open-heart surgery, several points must be considered compared to other patients undergoing surgery. The case we reported was a middle-aged woman who underwent scheduled coronary artery bypass surgery. The patient had a history of long-term corticosteroid use due to inflammatory RA. We performed several necessary and care measures compared to other open-heart surgery patients. These measures were performed from induction of anesthesia to cardiopulmonary bypass (CPB) and during extubation. Intraoperatively, the patient exhibited heparin resistance, manifested by an inadequate activated clotting time (ACT) response of 250 seconds following an initial dose of 300 units/kg of heparin. This was successfully managed through the administration of fresh frozen plasma (FFP) and supplemental heparin, achieving the target ACT for safe CPB initiation. Furthermore, to mitigate systemic inflammatory response and hemodilution, a modified pump prime solution containing albumin, FFP, and heparin was utilized. Anesthesia, pump, and nursing measures for inflammatory patients undergoing open-heart surgery should differ from those for patients without inflammation.

Keywords: Anesthesia, Cardiopulmonary Bypass (CPB), Coronary Artery Bypass Grafting, Heparin Resistance, Rheumatoid Arthritis (RA)

Introduction

Rheumatoid arthritis (RA) is a prevalent, chronic inflammatory disease of the synovial joints [1]. The prevalence of this inflammatory autoimmune disease is approximately 460 cases per 100,000 individuals. It has also been stated that RA doubles the risk of cardiovascular diseases (CVDs). Systemic inflammation induced by RA serves as a significant driver of accelerated atherosclerosis, and its complications are the leading cause of mortality. This persistent inflammatory activity elevates the risk of carotid plaque development and subsequent cerebrovascular events [2, 3]. The main process underlying coronary artery disease (CAD) is atherosclerosis, in which inflammation is influential in its manifestation. The progression of atherosclerosis is closely associated with inflammation, which contributes to ischemic heart disease and myocardial injury [4]. The clinical presentations of this disease are varied and include fatigue, weight loss, skin rash, and peripheral neuropathy. It has also been reported that CVD accounts for half of all deaths among RA patients, culminating in numerous complex complications [5]. A therapeutic approach for RA patients with severe vascular stenosis is coronary artery bypass grafting (CABG). Given that these patients are at a higher risk of complications following CABG compared to other patients, adherence to specific precautions and supportive measures is essential. However, the perioperative management of patients with RA undergoing cardiac surgery remains poorly

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standardized, especially regarding airway precautions, anticoagulation response, and pump prime modification. Therefore, this case report aimed to describe the perioperative challenges and management strategies in a patient with RA undergoing CABG, with emphasis on anesthesia, anticoagulation monitoring, and perfusion considerations.

Case presentation

Preoperative

The patient was a 56-year-old female, 161 cm tall and weighing 61 kg. Her medical history was significant for diabetes mellitus, hyperlipidemia, and hypertension. The patient presented with complaints of throat burning (unrelated to exertion) and shortness of breath. Following a diagnostic scan, she was scheduled for angiography. The angiography report revealed three-vessel disease (3VD). Given a significant 70%–90% stenosis in the left anterior descending artery, 100% stenosis in the left circumflex artery, and 90% stenosis in the right coronary artery, the patient was scheduled for CABG. Further comprehensive history taking led to a diagnosis of RA. The patient's serology report indicated a C-reactive protein level of 72 mg/L and a rheumatoid factor level of 250 IU/mL. For this patient, considering the autoimmune disease, corticosteroid use, and the risk of spinal injury (atlantoaxial subluxation), and given that cervical vertebral instability was not confirmed, minimal cervical spine extension was performed during intubation.

Intraoperative

After induction of anesthesia, 300 units/kg of heparin were administered before cannulation; however, the activated clotting time (ACT) increased only to 250 seconds. An additional 5000 units of heparin increased the ACT to 290 seconds, which was still below the target level required for safe initiation of cardiopulmonary bypass (CPB). In the setting of an inadequate ACT response and suspected reduced heparin responsiveness, one unit of fresh frozen plasma (FFP) was administered. This decision was made to improve anticoagulant response, potentially by replenishing antithrombin III and other plasma factors involved in heparin activity. Following administration of FFP and an additional 5000 units of heparin, the ACT increased to 412 seconds, allowing cannulation and initiation of CPB. To attenuate the inflammatory response associated with CPB and to reduce the adverse effects of hemodilution, the pump prime solution was supplemented with three vials of 5% albumin, one unit of FFP, and 10,000 units of heparin. Albumin was added to help maintain colloid oncotic pressure and improve intravascular volume stability during bypass. The ACT subsequently reached 467 seconds and remained within an acceptable range during CPB. An additional 5,000 units of heparin were injected, and thirty minutes after that, the ACT was re-evaluated and resulted in 408 seconds.

Postoperative

The platelet count decreased from 455,000 preoperatively to 165,000 postoperatively. Although this reduction raised concern regarding altered perioperative coagulation dynamics, it should be interpreted cautiously, as postoperative thrombocytopenia after CPB may also reflect hemodilution, platelet consumption, and bypass-related inflammatory activation rather than heparin resistance alone.

Discussion

CABG is a commonly used cardiac surgery [6]. RA is an inflammatory disease with a prevalence that is four times greater in women compared to men. Managing chronic inflammatory diseases requires attention to both medications and potential comorbid conditions, as various organs and systems can be affected. RA is one such disease that involves multiple body systems, including the cardiovascular system.

A meta-analysis involving 41,920 subjects demonstrated that the risk of developing CVD and myocardial infarction among RA patients increased by 48% and 68%, respectively.

In these patients, alterations in insulin resistance, lipid distribution, and vascular endothelial degradation occur due to the production of inflammatory mediators from the synovial membrane. These inflammatory mediators also influence blood pressure, and as a result, atherosclerosis progresses.

A study indicated that systemic inflammation causes microvascular endothelial dysfunction in RA patients.

Therefore, RA patients are at an elevated risk of developing CAD, and rigorous, regular monitoring of the cardiac status in these individuals is of paramount importance.

In addition, RA is not only associated with CAD but also with various types of ischemic and non-ischemic cardiac disorders. In these patients, a series

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of highly critical considerations must be strictly adhered to during and after cardiac surgery, as failure to do so can lead to irreversible outcomes. Joint-related clinical manifestations are common in these patients; although the disease primarily affects peripheral joints, such as the wrist, metacarpophalangeal joints, and proximal interphalangeal joints, rarer forms can also involve axial skeletal segments, including the atlantoaxial joint. Therefore, extreme caution must be exercised during neck extension for intubation, as it is one of the most common and dangerous events related to cervical spinal instability. Management strategies include fiberoptic bronchoscopic intubation (using a bronchoscope guide) and, when cervical vertebral injury has not been confirmed, minimizing neck extension during intubation [5, 7, 9]. Another crucial consideration in these patients is preventing an increase in the ACT, which, if uncorrected, can culminate in catastrophic events. The progression of RA is associated with the impairment of the coagulation and fibrinolysis systems, ultimately leading clinically to a hypercoagulable state (increased tendency to coagulation).

The main markers of coagulation and fibrinolysis include platelets (PLTs), D-dimers, and fibrinogen. RA patients commonly present with a significant increase in PLT count along with immune, inflammatory, and metabolic disorders.

In the present case, the initial ACT was 250 seconds after administration of 300 units/kg of heparin and increased only to 290 seconds after an additional 10,000 units of heparin. Because this response was considered inadequate for safe initiation of CPB, one unit of FFP and an additional 5,000 units of heparin were administered, after which the ACT increased to 412 seconds. These findings supported the clinical suspicion of reduced heparin responsiveness. In this context, FFP was intended to improve heparin's anticoagulant effect, potentially by replenishing antithrombin III and other plasma factors involved in heparin activity. Another important point in this case was adding three vials of 5% albumin, one unit of FFP, and 10,000 units of heparin to the pump prime solution. This strategy was used to attenuate the inflammatory response associated with CPB and to reduce the adverse effects of hemodilution while helping to maintain colloid oncotic pressure and intravascular volume stability. In addition, although the platelet count decreased significantly after surgery, this finding should be interpreted cautiously, since postoperative thrombocytopenia after CPB may also result from hemodilution, platelet consumption, and inflammatory activation rather than heparin resistance alone [10,11].

This report describes a single case, so the findings cannot be generalized to all patients with RA undergoing CABG. In addition, some laboratory data relevant to anticoagulation interpretation, such as antithrombin level, were not available. Therefore, the exact mechanism of the reduced ACT response cannot be confirmed.

Conclusion

Patients with RA undergoing CABG may present with specific perioperative challenges related to airway management, anticoagulation response, and inflammatory stress. Individualized anesthetic and perfusion strategies, repeated ACT monitoring, and multidisciplinary planning are essential for safe management. This case emphasizes that RA patients should not be managed as routine cardiac surgical cases.

Ethics Approval and Consent to Participate

Ethical approval was not required for this retrospective case report in accordance with institutional guidelines. Written informed consent was obtained from the patient before treatment and for participation in this report.

Consent for Publication

Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

Data Availability Statement

All data generated or analyzed during this study are included in this published article. No additional datasets were generated

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Authors' Contributions

SEHZ was responsible for the study conception and design; AA was responsible for the clinical management of the case and data acquisition, analysis, and interpretation; and ANM and AR were responsible for manuscript drafting and final approval of the submitted version.

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Conflict of Interest

The authors declared no conflicts of interest.

Declaration of Generative Artificial Intelligence (AI) in Scientific Writing

The authors declare that ChatGPT, a generative artificial intelligence tool developed by OpenAI, was used solely for language editing and improving the grammar, readability, and clarity of the manuscript.

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