CASE REPORT

Successful coronary artery bypass grafting under cardiopulmonary bypass in a patient with factor 12 deficiency

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INTRODUCTION

Factor 12 is a contact factor that initiates the intrinsic pathway of coagulation. Patients with factor 12 deficiency do not have an increased risk of bleeding[1]. However, its deficiency is associated with prolonged activated partial thromboplastin time (APTT)[1] and activated clotting time (ACT). ACT is used to monitor heparin anticoagulation during cardiopulmonary bypass[2]. Thus, prolonged ACT values cause difficulty in monitoring adequate heparinization in patients with factor 12 deficiency undergoing cardiopulmonary bypass.

CASE REPORT

A 59-year-old male patient with a history of hypertension, dyslipidemia, and triple-vessel disease was admitted for CABG. He had an abnormally high APTT level of 147 seconds (normal range: 21-35 seconds). His INR was 1.1, which was within the normal range. His bleeding and clotting time were normal. All other routine investigations were normal. He did not have any history of excessive bleeding following trauma or minor surgery, and there was no family history of bleeding disorders. Upon repeat testing, the APTT level was found to be 180 seconds, and the ACT value was 557 seconds.

The patient's factor 12 was measured at 2.8% (normal range: 42%-160%). Therefore, the patient was diagnosed with factor 12 deficiency.

As monitoring heparin anticoagulation with ACT posed challenges, a literature survey was conducted. It was decided to adopt the modified ACT technique described by Gerhardt and colleagues[3], with some modifications. In the initial test, Gerhardt and colleagues created a titration curve by measuring ACT through the mixing of various ratios of patients' blood with fresh frozen plasma (FFP). According to the titration curve, they determined that combining 1.5ml of patients' blood with 0.5ml of FFP and 0.1ml of calcium gluconate normalized the ACT. 0.1ml of calcium gluconate was added to neutralize the calcium chelators present in the blood and FFP.

We decided to proceed with the same blood-to-FFP ratio initially without creating a titration curve. We mixed 1.5ml of the patient's blood with 0.5ml of group-specific FFP and 0.1ml of calcium gluconate. The ACT value was measured at 121 seconds. This process was repeated twice, yielding ACT values of 135 seconds and 119 seconds, respectively. Consequently, we opted to stick with the same ratio, avoiding resource expenditure associated with creating a titration curve as outlined in the original article.

Intraoperatively, prior to heparinization, the ACT value was 654 seconds. Using the aforementioned technique, the ACT reading reduced to 128 seconds. Heparinization was performed, and ACT levels were measured and maintained above 400 seconds throughout the bypass using the same technique for ACT measurement. Coronary artery bypass grafting was completed successfully. Following the reversal of heparinization with protamine, the ACT was checked using the above-mentioned technique, and it read 130 seconds.

Postoperative recovery was uneventful, with no postoperative bleeding or thrombotic complications.

DISCUSSION

There is conflicting evidence regarding the association of Factor 12 deficiency with myocardial infarction or venous thrombosis. A meta-analysis revealed that even if there is a correlation with myocardial infarction or venous thrombosis, it is weak.

ACT is a bedside test that is used to assess the effectiveness of heparin anticoagulation[2]. Due to its low cost, ease of performance ACT remains a popular method for coagulation monitoring. In the case of factor 12 deficiency, which results in

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abnormally high ACT, monitoring ACT during a cardiopulmonary bypass procedure can become problematic.

Various techniques have been described in the literature to address the issue of abnormally high ACT values in factor 12 deficient patients undergoing cardiopulmonary bypass (CPB) procedures. One approach is to administer fresh frozen plasma (FFP) before the CPB procedure to increase factor 12, a method initially proposed by Woods[3].

Another technique involves monitoring heparinization using factor 10a, but this method is both expensive and time-consuming[4]. Despite our use of the modified ACT technique described by Gerhardt and colleagues[3], it carries the potential disadvantage of a possible discrepancy in antithrombin 3 levels between donor FFP and the patient's blood. This discrepancy may lead to abnormal results, necessitating the creation of a titration curve, which demands time, labor, and resources[4].

An alternative strategy is to heparinize following the normal CPB procedure without monitoring the ACT, an approach detailed in four case reports[4]. However, caution is advised when employing this strategy, as one case report indicated that the reversal of heparinization with protamine, without monitoring ACT, led to graft thrombosis and hypokinesis[4].

Factor 12 deficiency results in impaired fibrinolysis, as activated factor 12 plays a role in converting prekallikrein to kallikrein, which, in turn, aids in fibrinolysis. Consequently, the use of antifibrinolytic agents should be avoided due to the potential risk of graft thrombosis[4].

CONCLUSION

With the modified ACT technique, coronary artery bypass grafting under cardiopulmonary bypass can be done safely in a patient with factor 12 deficiency.

Learning points

- Factor 12 deficiency does not increase risk of bleeding.
- Factor 12 deficiency leads to prolonged ACT, making it difficult to monitor heparinization during cardiopulmonary bypass.
- Anti-fibrinolytics should be avoided in factor 12 deficiency patients whenever possible.

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