

Introduction

Antithrombin or antithrombin III (ATIII) is a vitamin K-independent, natural anticoagulant that is the major inhibitor of thrombin. With the binding of heparin, a conformational change in antithrombin occurs that increases the inactivation of thrombin by antithrombin by 4000-fold. Antithrombin deficiency can be hereditary or acquired; the acquired form is frequently encountered in patients requiring mechanical circulatory support.

Formation of clots within the circuit of extracorporeal membrane oxygenation (ECMO) is a life-threatening emergency and requires emergent intervention. Decreased ATIII is associated with a hypercoagulable state, which can lead to dangerous complications for patients requiring mechanical circulatory support.

Case Presentation

A 56 year old male with known ischemic cardiomyopathy developed syncopal episodes associated with a ventricular arrhythmia. After initially presenting to an outside hospital the patient was transferred to our institution requiring multiple inotropes and vasopressors. Shortly after admission to our unit, veno-arterial ECMO was initiated. Cardiac catheterization with ECMO support showed complete occlusion of the left anterior descending artery. Heparin was initiated with a target PTT at 55-65 sec.

Hospital Course

VA-ECMO started

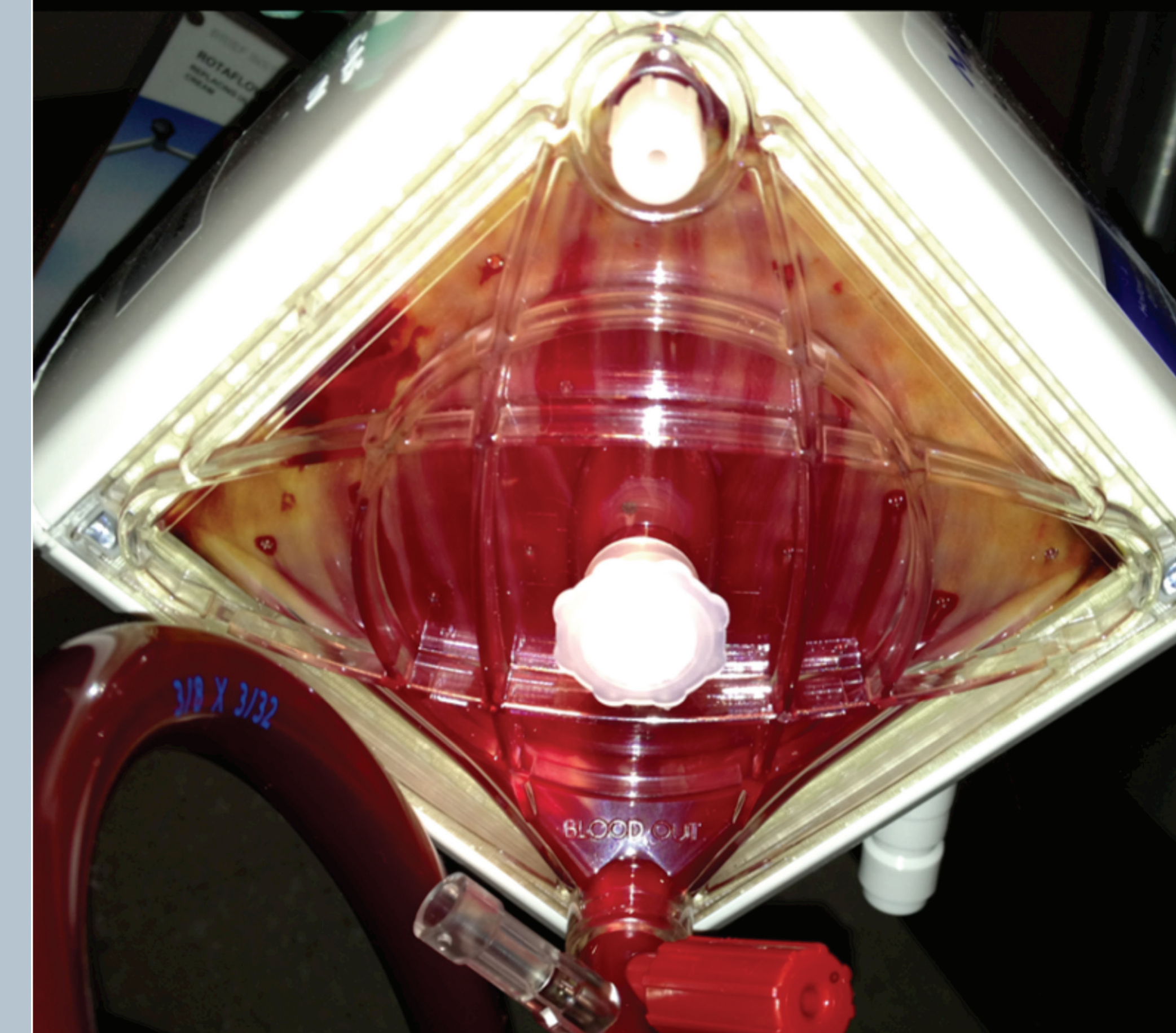
- POD#3: Extensive clots formed in the oxygenator despite appropriate PTT with heparin infusion. Circuit exchange required.
- POD#4: Extensive clot formed again within the oxygenator, requiring a second circuit exchange.
- POD#6: ECMO oxygenator was again noted to contain extensive clots (Figure Top).
 ATIII level : 52% (normal range 84- 134%)
 Anti-factor Xa level was 0.10 IU/mL (normal range 0.3 IU/mL or above)
 FiO2 100% to maintain Sat 80%

ATIII replacement therapy initiated:

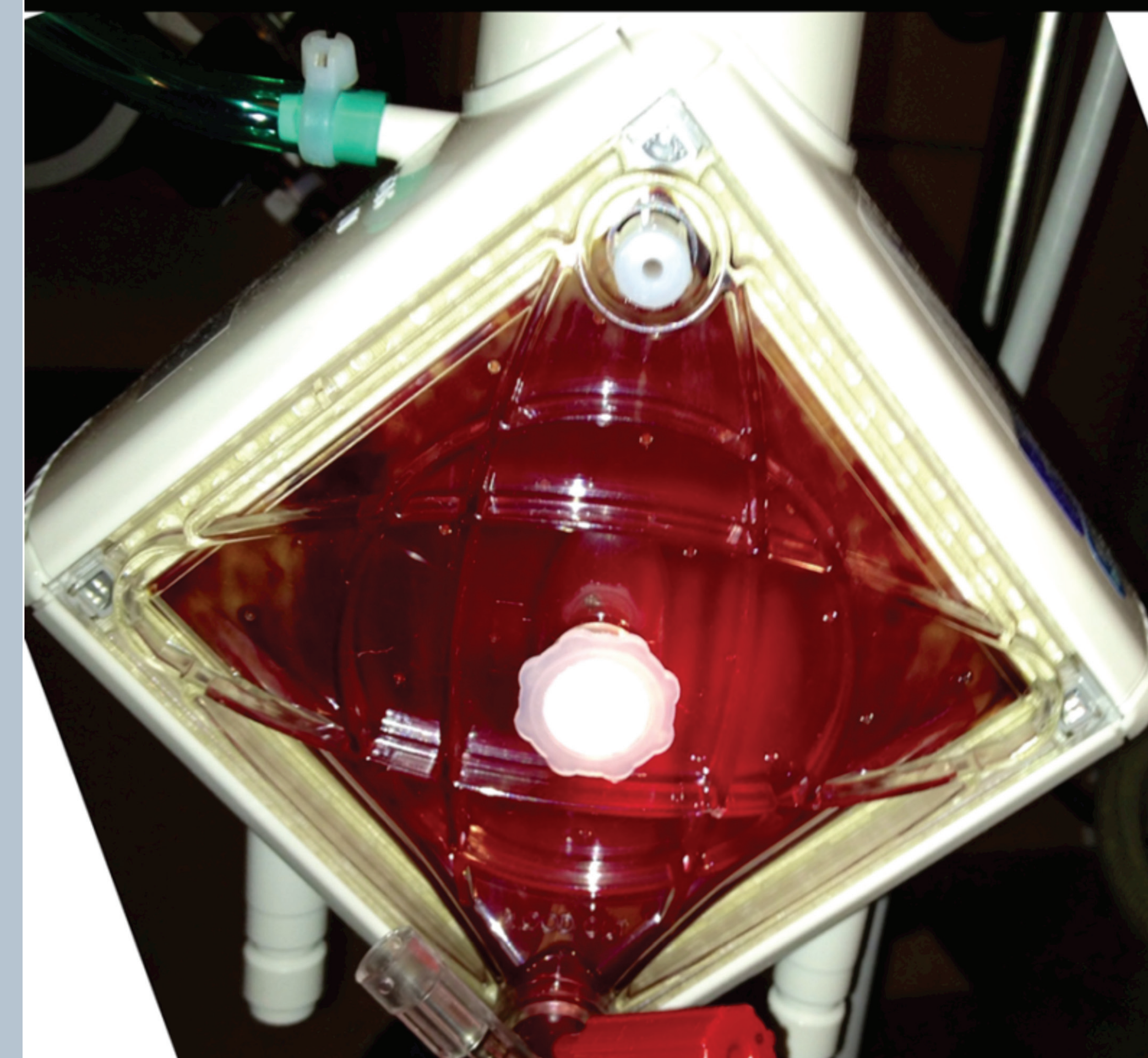
- POD#6: ATIII 2000 units IV.
- POD#7: Additional 2000 units of ATIII IV.
- POD#8-10: Over this time, clots in the oxygenator subsequently resolved (Figure Bottom). After ATIII replacement, oxygenation improved (O2 Sat 95%, with FiO2 55%). The oxygenator remained clot free until the patient underwent coronary artery bypass graft and ECMO removal on postoperative day 10.

Development/Resolution of Clot

Before AT III



After AT III



Discussion

Acquired ATIII deficiency is commonly seen in patients requiring mechanical circulatory support. The diagnosis of ATIII deficiency can be made by direct measurement of ATIII level although the ATIII assay may take several days to get results. Alternatively, rapid screening can be done measuring anti-factor Xa level. If the anti-factor Xa level is low and the patient clinically appears to be in a hypercoagulable state, ATIII deficiency is strongly suspected. ATIII replacement therapy is simple and effective for treating the clots formed in the ECMO device in these patients, removing considerable risk morbidity for the patient and preserving hospital resources in a situation where the circuit would otherwise need to be exchanged.

Conclusions

In patients on ECMO developing unexplained clots despite adequate anticoagulation therapy, ATIII deficiency should be considered. Prompt recognition of the ATIII deficiency and ATIII replacement can prevent clot burden complications in patients requiring ECMO and can avoid unnecessary ECMO circuit exchange.

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