BACKGROUND

Plasminogen activator inhibitor type 1 (PAI-1) plays a unique role in the balance between the coagulation and fibrinolytic mechanism. Plasmin formation is catalyzed by two major plasminogen activators: tissue-plasminogen activator (t-PA) and urokinase-type plasminogen activator (u-PA). When fibrin clot forms, it provides a surface to increase the efficiency of plasmin generation by formation of a ternary complex of fibrin, t-PA (or u-PA), and plasminogen. Therefore fibrinolysis occurs on the clot surface and rarely in the circulation. PAI-1 inhibits plasminogen activators (t-PA and u-PA) by forming stable complexes endocytosed via low-density lipoprotein receptor mechanism, thus inhibiting intravascular fibrinolysis (1). With deficiency of PAI-1 levels, increased fibrinolysis and clinical hemorrhage may result.

True prevalence of PAI-1 deficiency is unknown because of difficulty in establishing the diagnosis. It is difficult because activity assay is accurate in detection of elevated levels and not at the lowest levels; also the reported normal ranges begin at zero, therefore making it difficult to distinguish deficiency state from that of normal state. It is important to analyze both antigen levels and activity levels for possible qualitative or quantitative PAI-1 deficiency.

Clinical manifestation of PAI-1 deficiency includes menorrhagia, epistaxis, and delayed bleeding. Postsurgical and post-trauma bleeding may include intracranial hemorrhage, hemarthrosis, and muscle hematoma. The most effective treatment or prevention for bleeding symptoms is antifibrinolytic agents, such as tranexamic acid and e-aminocaproic acid. They help control inappropriate plasmin generation and minimize hyperfibrinolytic bleed. Their efficacy have been documented as prophylactic medications in preventing bleeding associated with surgical procedure (2).

CASE PRESENTATION

This is a 5 month old male with ASD and pulmonary stenosis presented for surgical repair. Patient had no history of abnormal bleeding or hematological evaluation. During surgery patient received one unit of FFP and one unit of washed RBC. Surgery was uneventful and patient was extubated and transported to PICU without any bleeding complications. A few years later patient came back for sternal wire removal and the diagnosis of PAI-1 deficiency was known. The patient had a few episodes of incessant bleeding such as nose bleeding that were treated with PO aminocaproic acid. This time the patient received one unit of FFP transfusion per the hematologist request and aminocaproic acid infusion 75 mg/kg/hour through the procedure. Surgery was uneventful, and no abnormal hemorrhage was noticed during the surgery, or on follow up visit. Patient was successfully extubated in OR, and subsequently discharged home without any bleeding complications.

After extensive literature search via pub med, there has not been a single pediatric cardiac surgery case report describing patients with congenital PAI-1 deficiency. Thus we present a unique case of a PAI-1 deficiency infant undergoing ASD repair and pulmonary valvotomy surgery with his diagnosis unknown to surgical and anesthetic providers.

ANESTHETICS DISCUSSION

The most lethal anesthetic complication is surgical and post-surgical bleeding. We used aminoproic acid 33-75 mg/kg/hr intra op and followed the effects with serial thrombo elastogram. Tranexamic acid 7.5-10 mg/kg/hour could have been used. In sight of recent reports of seizures with tranexamic acid, aminocaproic acid may be preferred. In either case TEG should be followed to assess the effectiveness of the therapy.

Intra op bleeding can be measured in patients with PAI-1 deficiency by using antifibrolics and following serial thrombo elastogram. Postoperative bleeding is successfully managed in the majority of the surgical cases because aminoproic acid and tranexamic acid can sufficiently suppress hyperfibrinolysis and increase anti-fibrinolytic activity.

REFERENCES