LETTERS TO THE EDITOR

To the Editor—Hemodynamic collapse following protamine sulfate: The impact of acute pulmonary vasoconstriction

We read with great interest the case report by Geurink and colleagues[1] of a patient who had acute cardiovascular collapse after protamine infusion.[1] We would like to share a similar experience in a 23-year-old woman with orthotropic heart transplantation via biatrial anastomosis. She presented with palpitations and dyspnea on exertion related to paroxysmal supraventricular tachycardia. Her other post-transplant comorbidities included moderate-severe right ventricular (RV) enlargement and dysfunction. Her baseline heart rate was around 100 beats per minute (bpm), but she had frequent, sustained episodes of narrow complex tachycardia with rates of 120–140 bpm. Electrophysiology study revealed a focal atrial tachycardia arising from the mid posterior right atrial septum that was successfully ablated.

Post ablation, she received 30 mg of protamine for heparin reversal preceded by a 5 mg test dose. However, a few minutes later, she developed pulseless electrical arrest. Cardiopulmonary resuscitation was performed and return of spontaneous circulation was achieved. Emergent echocardiogram showed a severely enlarged and dysfunctional RV. Emergent pulmonary angiogram excluded pulmonary embolism, but revealed elevated pulmonary artery pressures of 60/15 mm Hg (mean 42 mm Hg), which was increased from a baseline of 38/23 mm Hg (mean 30 mm Hg) at cardiac catheterization a few days prior. During her resuscitation she was intubated and ventilated and initiated on inhaled nitric oxide, with significant improvement in pulmonary pressures. She initially required RV inotropic support with milrinone in the intensive care unit, but that was weaned off over 72 hours and she subsequently did well and was discharged 1 week later with no further episodes of paroxysmal atrial tachycardia on follow-up.

Our case highlights that protamine can also lead to acute pulmonary vasoconstriction. Patients with poor RV function are at risk for hemodynamic decompensation with this, and avoidance of protamine should be considered. Pulmonary vasoconstriction has been attributed to activation of the complement cascade by large heparin-protamine complexes, which is formed by faster rate of protamine infusion.[2] Therefore, if protamine is warranted, it is important to administer it slowly with a rate of no more than 50 mg over 10 minutes as per labeling guidelines.

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Author's Reply—Hemodynamic collapse following protamine sulfate: The impact of acute pulmonary vasoconstriction

We appreciate the response from Lee and colleagues[1] detailing a case of hemodynamic collapse from acute pulmonary vasoconstriction after protamine infusion during an atrial tachycardia ablation. Protamine reactions occur in approximately 1% of ablations, which is less frequent than after cardiopulmonary bypass, during which larger doses of protamine are given.[2] Nevertheless, pulmonary vasoconstriction is 1 of the 3 classified protamine reactions in addition to hypotension from rapid infusion and anaphylaxis.[3]

The case by Lee and colleagues[1] was characterized by electromechanical dissociation in the setting of severe right ventricular enlargement and severe right ventricular dysfunction but without pulmonary embolus. These findings differ from our case of anaphylaxis, in which the patient had elevated peak airway pressures consistent with bronchospasm, circulatory collapse, and an absence of significant right heart enlargement or dysfunction.[4]

Both cases highlight that supportive care (inotropic support and mechanical circulatory support as needed) is critical acutely in a protamine reaction. Prevention consists of both limiting protamine dosing to 50 mg over 10 minutes based on protamine labeling and minimizing protamine in patients with higher risk features for a reaction, such as vasectomy, prior protamine exposure, and NPH insulin use, as well as patients without the reserve to tolerate sequalae from protamine reactions (right and left heart failure). Future trials of hemostasis techniques that allow reduced or no protamine infusion are needed, especially in the population of patients at increased risk of protamine reaction and subsequent poor outcomes.

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