

Central Cyanosis: An Atypical Presentation of Protamine Reaction

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BACKGROUND

- **Protamine** is a cationic peptide commonly used to **reverse heparin** after cardiac and electrophysiologic procedures.¹
- Adverse reactions occur in up to 10% of patients and are typically categorized as

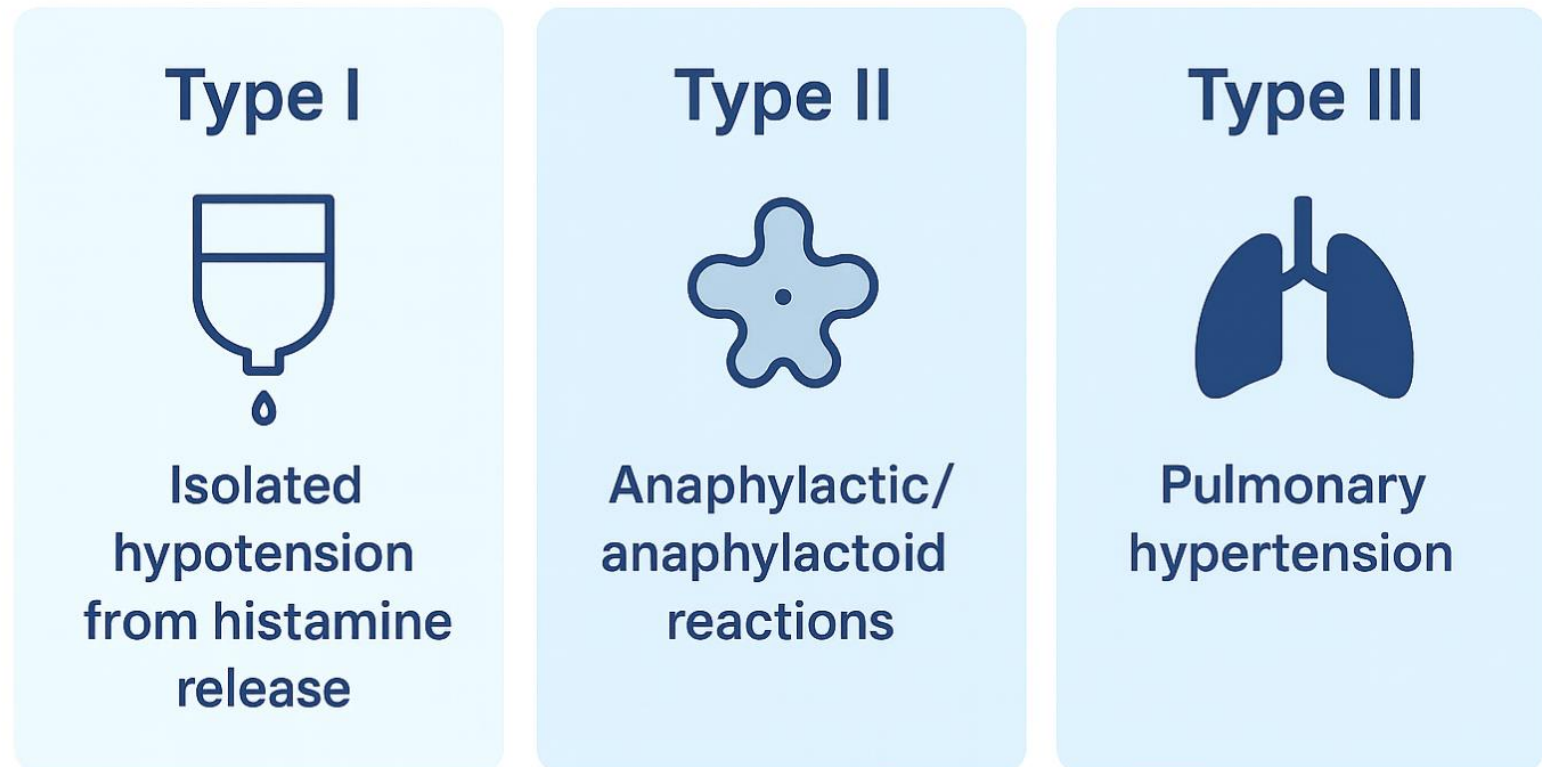


Figure 1. Types of protamine reactions.

- **Risk factors**^{1,2} include:
 - **previous protamine exposure**
 - NPH insulin use
 - Vasectomy
 - Fish allergy
 - **Rapid administration**

We present a case of Type III protamine reaction in a 41-year-old male undergoing radiofrequency ablation with pulmonary vein isolation for recurrent atrial fibrillation.

CASE PRESENTATION

- **41-year-old male** undergoing **radiofrequency ablation with pulmonary vein isolation** for recurrent, symptomatic atrial fibrillation.
- **PMHx:** Typical atrial flutter s/p CTI ablation
- Physical exam: Mallampati 1, normal mouth opening, full neck ROM, Thyromental distance >3 FB, BMI 25, ASA 3
- IV induction with propofol, fentanyl.
- Anticoagulated with heparin during procedure.
- Received protamine for reversal at conclusion of case.

INTRAOPERATIVE PERIOD

Events

- Upon drape removal:
 - **Mottled, cyanotic discoloration from head to mid-torso**
 - **Hypotension**
 - HR 50s, O₂ 99%,
- Low dose norepinephrine started → BP improved but cyanosis persisted
- **TTE** showed:
 - No pericardial effusion
 - **New biventricular systolic dysfunction**
 - EF fell from **50-55% → 40**
- **ABG:**
 - Adequate oxygenation
 - **K⁺ 6.3 mmol/L**

Interventions

- Immediate steps
 - **Trendelenburg** to increase venous return
 - **IV calcium chloride** for inotropic support
 - **Additional norepinephrine** infusion
 - **Time** for protamine metabolism and hemodynamic recovery
 - Epinephrine considered but not needed

Resolution

- Cyanosis and RV dysfunction gradually resolved
- Patient extubated without complications
- Admitted to the ICU overnight for surveillance

Type III Protamine Reaction

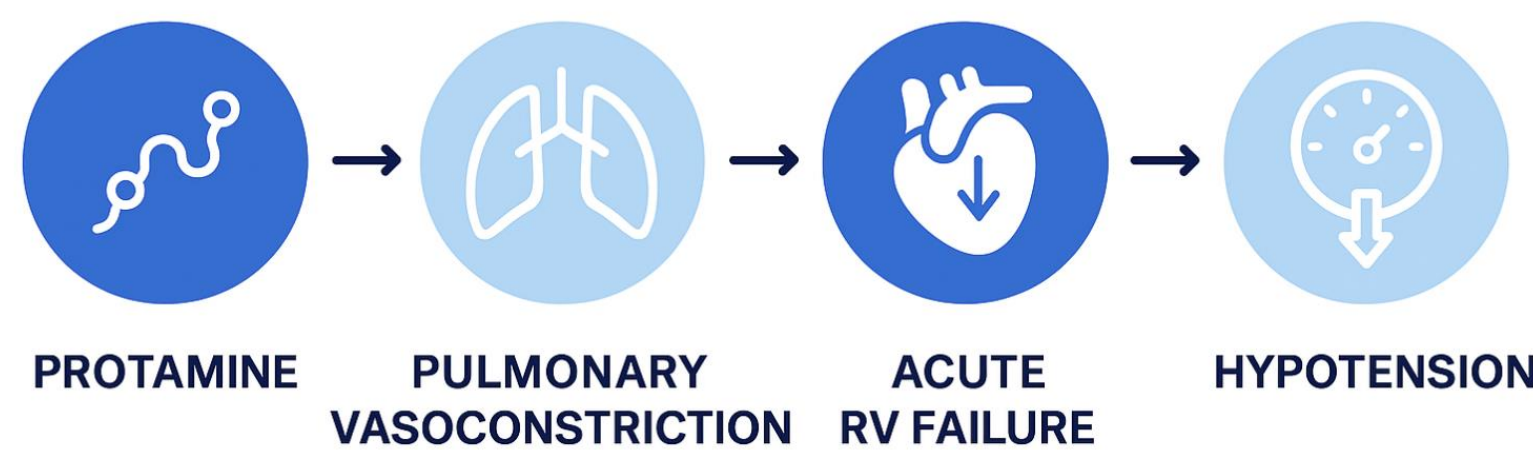


Figure 2. Pathophysiology of Type III protamine reaction.

DISCUSSION

- The case demonstrates a **Type III protamine reaction** presenting atypically with central cyanosis without hypoxemia.
- Type III reaction is mediated by **thromboxane A₂**.¹
- The most plausible mechanism is **acute pulmonary vasoconstriction** leading to:
 - ↑ Pulmonary vascular resistance
 - **Acute RV dysfunction**
 - ↓ Left ventricular preload → systemic hypotension
 - Venous congestion → mottled/central cyanotic appearance
- Management of protamine-induced pulmonary hypertension/RV failure³:
 - Improve **RV preload** (Trendelenburg)
 - Support **RV contractility** (calcium chloride, catecholamines)
 - Allow time for protamine metabolism

CONCLUSIONS

- This case highlights the following:
 - **Protamine reactions are rare but potentially life-threatening, requiring rapid clinical recognition and intervention.**
 - **Type III protamine reaction causes acute pulmonary hypertension leading to RV failure, which may present atypically as central cyanosis.**
 - **Treatment includes hemodynamic support while awaiting protamine metabolism.**

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