Title: Treatment of severe anemia with Sanguinate in patients unable to receive red blood cell transfusion

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Learning Objectives: Sanguinate, a pegylated carboxyhemoglobin (bovine) from Prolong Pharmaceuticals, was designed as an oxygen transfer agent and a carbon monoxide-releasing molecule to suppress vasoconstriction to target critical care patients with severe anemia unable to receive red blood cells (RBC). Administration to 29 patients under FDA emergency IND (eIND) provisions showed clinical improvement in ≥1 condition in 86% of patients and no serious adverse events. Further efficacy and safety data are needed.

Methods: During November 2015-July 2016, 10 patients age ≥18 who refused RBCs based on Jehovah's Witness beliefs were treated in critical care units at Pennsylvania Hospital's Center for Bloodless Medicine and Surgery for acute severe anemia, hemoglobin (Hgb) ≤5 g/dL or ≤7 g/dL following a decline of ≥5 g/dL in 7 days. 1 patient was treated on an eIND; 9 were treated under an open label Phase I trial. Sanguinate 40 mg/mL in 500 mL premixed solution was administered over 2 hours. All patients received erythropoietic-stimulating agents, IV iron, vitamin K, and aminocaproic acid. Patients were assessed daily for survival, adverse events, and improvement in hemodynamic, neurologic, and respiratory status to determine need for additional Sanguinate. Patients were followed for up to 14 days.

Results: 8 patients (80%) had pre-treatment Hgb <5 g/dL and 2 (20%) had Hgb <6 g/dL after decline of >5 g/dL. Patients received 1-3 total doses. Overall survival was 50%. At pre-treatment Hgb >4 g/dL, survival was 66.67%. 1 patient required diuretics for transient volume overload attributed to Sanguinate. No serious adverse events occurred as a result of Sanguinate administration; the 5 deaths were related to anemia and end organ damage.

Conclusions: This series supports Sanguinate use in patients with profound anemia that cannot receive RBCs who otherwise would have a high likelihood of hypoxic organ damage and death. These data support previous experience's safety profile. Earlier, more frequent use of Sanguinate before irreversible hypoxic events occur addresses an unmet medical need with the potential to improve outcomes.