

CASE REPORT

Prophylactic hypothermia and neuromuscular blockade to limit myocardial oxygen demand in a critically anemic Jehovah's Witness after emergency surgery[†]

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Abstract

Management of anemic patients refusing blood transfusion remains challenging. Concomitant coronary artery disease further complicates management. We sought to decrease the likelihood of cardiac events by employing hypothermia and neuromuscular blockade, in addition to limited phlebotomy, in a critically anemic Jehovah's Witness patient following emergent colectomy. The patient's hemoglobin concentrations were trended with serial blood gases. Neuromuscular blockade was instituted with cisatracurium, followed by hypothermia to a target of 32°C. The patient's lowest hemoglobin levels occurred on postoperative day 3 before beginning to rise. There were no postoperative cardiac events reported during the patient's course of stay. She recovered well with no evidence of anemia or cardiac events at 1-year follow-up. We conclude that targeted hypothermia with neuromuscular blockade, as an adjunct to accepted techniques, may be an alternative for critically anemic patients with coronary artery disease refusing blood transfusion.

INTRODUCTION

The management of anemia in patients who are Jehovah's Witnesses remains challenging. Their religious beliefs prevent them from accepting blood transfusions, even in the face of almost certain mortality [1]. Limiting postoperative morbidity and mortality becomes increasingly difficult in patients with concomitant coronary artery disease. In 2002, Carson *et al.* [2] reported a case series in which 57% of patients refusing blood transfusion with postoperative hemoglobin concentrations between 4.1 and 5.0 g/dl experienced cardiac events, infection

or death. Even with currently accepted techniques, alternative strategies should be explored to prevent further complications in these patients.

CASE REPORT

Our patient is an 84-year-old female Jehovah's Witness who was admitted for the evaluation of anemia after annual screening examinations. The patient complained only of fatigue. Her history included Parkinson's disease and coronary artery disease.

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She underwent a screening colonoscopy 7 years prior, which demonstrated no abnormalities. Her physical examination was unremarkable.

Her initial hemoglobin concentration measured 6.1 g/dl. The remainder of her laboratory studies was unremarkable.

She was started on erythropoietin and iron supplementation, without blood transfusion due to her religious beliefs. Colonoscopy demonstrated near-obstructing synchronous masses in the descending and ascending colon. She spoke with a member of our institution's bloodless surgery program, and established that she would accept albumin. She refused transfusion of other blood products.

On Day 5, she developed abdominal pain, distention and obstipation. A CT scan demonstrated colonic obstruction. She was taken emergently for an exploratory laparotomy with subtotal colectomy and end ileostomy creation. She lost 150 ml of blood and received 2 l of crystalloid. There were no intraoperative complications.

Postoperatively, she remained intubated and sedated. Laboratory studies demonstrated a hemoglobin of 5.8 g/dl. Despite adequate sedation and pain control, she remained tachycardic at 120 bpm. Her mean blood pressure ranged between 60 and 65 mmHg; base deficit measured 8.9 mEq/l. To prevent hemodilution, crystalloid was limited to 42 ml/h. Oliguria was treated with 5% albumin boluses. To decrease oxygen demand, neuromuscular blockade was initiated with cisatracurium. She remained tachycardic and oliguric. Next, hypothermia was implemented, targeting a goal of 32°C. This was accomplished with a cooling blanket and ice packs applied to the axilla, groin and around her head. Body temperature was monitored by a bladder probe. She continued to receive IV iron sucrose, vitamin B6, thiamine and epoetin alfa daily. Mean body temperature decreased to 35.01°C; her tachycardia resolved, and her urine output reached a target of 0.5 ml/kg/h. Phlebotomy was limited, and samples were drawn in pediatric tubes. On postoperative day 3, her hemoglobin concentration trended down to 4.6 g/dl, with no signs of ongoing hemorrhage. The following day, her hemoglobin rose to 5.2 g/dl, and her base deficit decreased to 2.2 mEq/l. She was rewarmed, cisatracurium was discontinued, and she was extubated on postoperative day 7. She was discharged on postoperative day 11 with a hemoglobin of 6.8 g/dl, and experienced no cardiac events during her hospitalization.

One year postoperatively, she was doing well and her hemoglobin concentration was 15.2 g/dl, with no evidence of new cardiac events.

DISCUSSION

In 1999, Hebert *et al.* [3] demonstrated that a more restrictive transfusion threshold was associated with decreased mortality in critically ill patients. Since then, there has been a trend towards a more conservative transfusion strategy, with a goal of maintaining hemoglobin concentrations at a minimum of 7 g/dl in patients without cardiac disease or acute hemorrhage, and 10 g/dl in patients with coronary artery disease. Physicians caring for Jehovah's Witnesses, however, often encounter more significant anemia. As demonstrated by Carson *et al.*, the odds of death in postoperative patients increases 2.5 times for every gram decrease in hemoglobin <8 g/dl. Our patient, with both a hemoglobin of 4.6 and cardiac disease, had a significant increase in her risk of mortality [2].

Viele and Weiskopf attempted to find the lowest tolerable hemoglobin concentration in humans by conducting a retrospective

review, which identified 61 Jehovah's Witnesses with hemoglobin concentrations <8 g/dl; 50 of these patients died in the hospital, with 23 deaths (46%) attributed to anemia. All patients without cardiac disease whose deaths were attributed primarily to anemia had hemoglobin concentrations <5 g/dl. These were similar to our patient, who met this criteria, but did, in fact, also have concomitant cardiac disease [4].

The use of hypothermia to decrease oxygen demand in a severely anemic patient has not yet been supported by any large-scale randomized trials. It is, however, an important component of cardiac surgery, and recently has been shown to improve neurological outcomes in reperfusion after cardiac arrest [5]. It has also been demonstrated to reduce oxygen demand without reducing oxygen delivery in pigs, providing effective protection from ischemia [6], and to increase survival in pigs undergoing stepwise normovolemic hemodilution when compared with normothermic pigs [7].

Convention dictates that hypothermia should be avoided in high-risk postoperative patients due to an association with myocardial ischemia. This risk is probably related to increased myocardial work due to shivering, as patients who shiver typically have a higher heart rate, cardiac index and lower mixed-venous oxygen saturation [8, 9]. Even in patients who are not shivering, it is well established that chemical paralysis decreases basal metabolic rate, which may benefit the critically anemic.

Although our patient had a good outcome, we acknowledge that this approach may not be applicable to every patient, as these interventions are not without risk that should be weighed by all parties. The importance of techniques that are widely accepted in the treatment of non-transfusable patients should not be overlooked—this includes minimizing phlebotomy, supplementation with IV iron, vitamin B6, thiamine and erythropoietin, as well as consultation with hematologists and bloodless surgery specialists.

Hypothermia and paralysis in the setting of a non-transfusable patient are likely to remain controversial until these methods are supported by high-quality evidence. To our knowledge, there are no reports of utilizing these techniques in a Jehovah's Witness with critical anemia. Further studies are necessary to evaluate the efficacy of this approach, and to define criteria to identify patients who may benefit from this approach.

CONFLICT OF INTEREST STATEMENT

None declared.

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