Mechanisms to optimize low hemoglobin levels in a Jehovah’s Witness patient

Michael Ablavsky
HPI
- 66 yo M with 1 day of hematemesis.

PMHx/PSHx
- Hep C, liver cirrhosis, CVA
  - Child class C, MELD score 12.
- ex-lap for bowel obstruction

Social
- Jehovah’s Witness, IVDU

PE
- Afebrile, not tachycardic, normotensive.
- Lethargic, aphasic
- Abdomen: distended
Labs:
- Hb 14, plt 84, INR 1.4

EGD. HD #0
- Pooling of blood in distal esophagus. Unable to visualize site of bleeding. s/p 13 bands deployed. Bleeding continued.
- Hb 10.2→9.4

HD # 1
- Pressors for hypotension.
- TIPS attempted and aborted because of occluded right IJ vein

HD # 2
- Hb 7.9→6.3, INR >7.5, AST/ALT: 12800/3400
- Made DNR by family
- Patient expired.
Jehovah’s Witnesses

- Origin: 1870’s

- Jehovah’s Witnesses number some 8 million members worldwide. Doubled in last 16 yrs.

- Directed by a “governing body” of elders

- Headquarters: Brooklyn.
Jehovah’s Witnesses

- refusal of blood transfusions by the Jehovah's Witness community is based on
  - “But you must not eat meat that has its lifeblood still in it” Genesis 9 v4
  - “And wherever you live, you must not eat the blood of any bird or animal” Leviticus 7 v25
  - “None of you may eat blood, nor may any alien living among you eat blood” Leviticus 17 v12
  - “You should pour it out upon the ground as water” – prohibits banking or acceptance of blood.

- Accepting blood might compromise their spiritual life.
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<th>Generally not acceptable</th>
<th>May be acceptable</th>
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<td>Red cell fractions</td>
<td>Crystalloids and colloids</td>
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<td>Haemoglobin (human, animal, or synthetic, e.g. Hemopure®)</td>
<td>Recombinant erythropoietin</td>
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<td>Recombinant factor VIIa</td>
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<td>Intraoperative cell salvage*</td>
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<td>Cardiopulmonary bypass or extracorporeal membrane oxygenation*</td>
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<td>Epidural blood patch</td>
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<td>Transplants</td>
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Targeted therapies for severely anemic

- Stop / minimize blood loss
- Correct coagulation defects and promote hemostasis
- Optimize anemia tolerance
- Enhance hemoglobin and red blood cell production

ADEQUATE PERFUSION
Equipment

- Arterial tourniquets
- Anti-shock garments
  - Increasing peripheral vascular resistance.
  - Compress abdomen and lower limbs

- Esophageal Sengstaken-Blakemore / Minnesota Tube
  - Endoscopy unavailable / unsuccessful
  - Medical agents failed
  - Rife with complications
Optimizing anemia

- **Acute normovolemic hemodilution**
  - Removal of blood + rapid infusion of colloid or crystalloid
  - **Any blood lose will have lower hematocrit**
  - Enhances cardiac output
  - May not be acceptable – must have closed circuit
  - Some evidence suggests it may reduce allogeneic transfusion

- **Permissive hypotension**
  - Systolic 80-90, map 60-65, 30% reduction of baseline
  - Reducing blood loss

- **Cell Saver**
  - Blood suctioned, centrifuged, washed, reinfused
  - **Contraindications**: contamination, sickle cell disease.
Optimize anemia tolerance

- **Key principle in managing low Hb in Jehova’s Witnesses**

- **Deliberate hypothermia**
  - reduce O$_2$ consumption
  - increase dissolved portion of oxygen

- **Sedation / Paralysis**
  - Prevent agitation / shivers $\rightarrow$ decrease metabolic demand
  - mechanical ventilation $\rightarrow$ reduce work of breathing and supply high oxygen content
Prophylactic hypothermia and neuromuscular blockade to limit myocardial oxygen demand in a critically anemic Jehovah's Witness after emergency surgery

Michael J. Klein, * Timothy I. Carter, Michael C. Smith, Jonathan Wong, and Gainosuke Sugiyama
Correct coagulation defects

- Correct underlying coagulation defects
  - Platelet, Fresh frozen plasma, cryoprecipitate → NOT allowed
  - PCC – maybe
    - Factors II, VII, IX, X
    - urgent reversal of warfarin anticoagulation
  - Vit K
Correct coagulation defects

- Prohemostatic treatment
  - Tranexamic acid
    - may reduces rates of mortality and urgent surgery in upper GI bleeds
    - may reduce post operative blood losses and transfusion requirements
    - **Cochrane Review**: TXA can safely reduce death in trauma patient with bleeding.

- Recombinant activated factor VII
  - Several trials have shown control of bleeding from surgery, or severe trauma
  - Reduces need for RBC transfusion and improving hemostasis.
  - **Cochrane Review**: No evidence to support or reject administration for patient with liver disease and upper GI bleed.
Hb concentration and RBC production

- Hb concentration >7 can be tolerated
- Hb < 5-7 \(\rightarrow\) drastic increase in mortality

- Enhancing speed of Hb production
  - Key substrates must be coadministered
  - IV Iron
    - maximal erythropoietic response if adequate iron stores
  - Vit B12, folate
    - Little evidence to suggest benefit in acute setting
    - Potential benefit outweighs potential risk

- Limit regular phlebotomy
Hb concentration and RBC production

- **Recombinant Erythropoietin**
  - Stimulates *proliferation, differentiation, release of erythrocytes + Hb production*

- **Response rate can be dose dependent**
  - Inc. reticulocyte count → 3-10 days

- **Reviews**
  - Pre+post operative use of recombinant erythropoeitin have inc in Hb and reduction in allogeneic transfusion
  - Potential venous thromboembolism
Oxygen Carriers / Oxygen Solvents

Hemoglobin-based oxygen carriers (HbOC)
- Bovine hemoglobin, No ABO matching
- Deliver oxygen by facilitated diffusion
- Short intravascular half-life, profound vasoconstriction, MI

Perfluorocarbons (PFC’s)
- \( C_{\text{A}O_2} = 1.34 \times (\text{Hb}) \times (\text{SaO}_2) + 0.003 \times (\text{PaO}_2) \)
- Inert, artificial

- A bridge until erythropoiesis recovers
Severe anemia protocol for JW

Hb <7

Hypoperfusion, hemorrhage, Instability? NO

YES +HbOC +/- HbOC

control bleeding
correct coagulopathy
reduce oxygen consumption
inc supplemental O₂
Summary

- Lower Hb is associated with increased mortality in JW
- Multimodal approach
  - Enhance erythropoiesis
  - Reduce blood loss
  - Increase oxygen delivery
  - Reduce oxygen consumption
  - Avoid iatrogenic anemia
References


K. Berend, M. Levi
Management of adult Jehovah's Witness patients with acute bleeding