Blood Management in Pediatric Jehovah’s Witness

Daniel Gomez CCP
Nationwide Children’s Hospital
Ohio State University
Conversation in the hallway...

**Surgeon:** We have a JW patient next week. Can we do this case?

**Perfusionist:** What wt, hct & procedure?

**Surgeon:** 5kg, 35% & VSD.

**Perfusionist:** Awe, S*&T!!...better call/email fellow colleagues ASAP.
What to think about?

- JW belief’s- Genesis; Leviticus; Acts
  - Any blood removed needs disposal
- Consent
  - Parents vs Child?
- Can we transfuse?
  - <18 yo?
  - ‘Letter of Understanding’
- What can we transfuse?
  - Red…Yellow…Manufactured…None
  - Treatments are a ‘matter of conscience’
How did we start down this road?

1997 - NCH, CTS, Cardiology & JWO

BCP formed

The program’s mission states, “It was established to assure access to the best pediatric care for those families who object to the use of blood and blood products.”

Presently when admitted, all patients are offered the program.
What is involved?

- Pre-op: Cardiac JW
- r-EPO/Fe$^{2+}$
- Multi-vitamin
- Delay surgery when possible
- No cath lab diagnostics/interventions
- Special wrist-band (BCP)
- Most important......
Required for scheduling

Surgeons aware of kg cut-offs

re: perfusion circuit sizes

The Heart Center at Nationwide Children's Hospital
# Pediatric

## GUIDELINES FOR PEDIATRIC PATIENTS

1. Patients/Families requesting a physician who is willing to provide blood conservation techniques should be referred to 722-KIDS for a referral to a physician who has agreed to participate in the Blood Conservation Program.

2. Patients who are coming to Children’s Heart Center may be directly referred to the Cardiothoracic/Heart Center administrative assistant at 722-3103.

3. Pediatric patients/families requesting the Blood Conservation Program and are unwilling to accept blood or blood products should be offered the *Letter of Understanding* form to complete (AD-16). One copy of the form is placed on the paper chart and one copy is given to the parents/guardians. If parents do not wish to sign the form, document that it was offered.

4. If the pediatric patient is being prepared for surgery, the parents/guardians will complete the special consent, "Consent for Surgery, Sedation, Anesthesia, Special Procedures for Minor Jehovah’s Witnesses and other Minor Patients Refusing Blood Transfusions." (Form AD-16b)

5. Patients/families may be offered an ID band for the patient, “No Blood Requested,” available through Patient Placement.

6. Parents/guardians may sign form MR-9 “Authorization to Access and Release Protected Health Information” in order to permit family members, friends, pastors or Jehovah’s Witness Hospital Liaisons to access their medical record.

7. Questions regarding the Blood Conservation program may be directed to the Blood Conservation Coordinator at 722-6422.
vs. Adults

Guidelines for Adult Patients with a Congenital Disease:

1. A competent adult may refuse blood or blood products even when the circumstances are life threatening. Forms for pediatric patients are not applicable to adult patients who request blood conservation and refuse blood or blood products.
2. It is recommended that these adult patients sign an Advance Directive which specifically outlines their wishes. This Advance Directive should be copied and placed on the patient’s paper chart.
3. Adult patients with a congenital disease must confer with their attending physician to determine whether the hospital will be able to meet their needs.
4. The attending physician must contact the program manager of the unit(s) and coordinate the care of the adult patient. There must be adequate staff (physicians, surgeons, anesthesiologists and nurses) willing to care for adult patients who refuse blood during their hospitalization. Staff may request not to be assigned to patients because of ethical conflicts. (HR Policy HR-ER 9 “Release Form Assigned Patient Care”).
5. The adult patient may sign form MR-9 “Authorization to Access and Release Protected Health Information” in order to permit family, friends, pastors, or Jehovah’s Witness Hospital Liaisons to access his/her medical record.
6. Once the patient is admitted, legal services should be notified.
7. The competent adult patient’s Advance Directive should be on the paper chart.
8. Questions regarding the Blood Conservation Program may be directed to the Coordinator at 722-6422.

The Heart Center at Nationwide Children’s Hospital
1. Improve multimodality approach to preserve hct
2. Adopt team approach to blood conservation
3. CPB circuit primes <1500ml to reduce ill effects
4. RAP should be employed
5. Anes: reduce volume load and increase SVR when appropriate
6. Colloid good alternative to crystalloid
7. ANH should be employed
8. Meticulous surgical technique
9. Cell washing kept to minimum pre/post cpb
10. Hemoconcentration warranted when fluid overload, to concentrate plasma proteins and red cell mass
Perioperative Blood Transfusion and Blood Conservation in Cardiac Surgery: The Society of Thoracic Surgeons and The Society of Cardiovascular Anesthesiologists Clinical Practice Guideline*

- r-EPO pre-op
- Txn trigger <7g
- TA
- UF ped/adult
- RAP/VAP
- ANH
- Cell salvage
- TQM

Ann Thorac Surg 2007;83:S27–86
Through the years....
# Circuit 1993 - Present

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<td>3/16</td>
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Suckers
Circuit Perspective
Techniques

Arterial sampling = double stopcock

Prime
- 25% Albumin….most of the time
  - If no, 2x mannitol dosing
- TA
  - 100mg/kg (max 1000gm); pre/pump/post
- Dexmethasone
  - 1mg/100ml of prime (max 10mg)

How did we arrive at these?….email correspondence
Gentlemen,
Over the last 2 weeks, I reviewed articles regarding the use of agents to replace Aprotinin. I wanted to share with you the information that I collected, so we can find the best alternative.

I think, first, we need to answer the following questions:
1- Is one agent (Amicar or Tranexamic acid) is superior to the other one?
2- If one of them is better, what is the best dose to use in our patient population?
3- If these drugs do not have any anti-inflammatory effect, what is the role of steroids, if any?
4- If steroid is beneficial, what would be the dose and what drug should we use?
5- Does the data out there support the way we do our practice, Bloodless surgery and early extubation?
6- What approach should we take?
1- Is one agent (Amicar or Tranexamic acid) is superior to the other one?

From reviewing many articles, I am enclosing the review article by Michael Eaton from Rochester New York, eleven comparative studies of lysine analogs in pediatric heart surgery have been published, including more than 1000 patients, where 340 patient received EACA and 404 patient received TA. Most of these studies were prospective, randomized, controlled trials. These studies have shown that both EACA and TA appear effective in reducing bleeding (Decreased 11-44%) and transfusion (incidence reduced by 20-50%). Other studies included mixed groups of cyanotic and noncyanotic patients. McClure and Izsak found an improvement in intraoperative bleeding with EACA, but postoperative bleeding was improved only in cyanotic patients. Similarly, Zonis et al., found no benefit of TA in the group as a whole, but decreased bleeding and transfusion requirements in the cyanotic group. This same group subsequently did a similar study on 56 infants and children and found no benefit of TA in reducing bleeding or the incidence of transfusion in the whole group or the cyanotic group of patients. The efficacy of these agents is less clear in reoperations, where even though the intraoperative blood loss was decreased in the EACA group, the 24 h blood loss and transfusion was not different. Reaid et al studied 43 children undergoing repeat sternotomy randomized to TA or placebo. Final analysis showed no difference between the two groups.

**Conclusion:** Both EACA and TA appear effective in reducing bleeding and transfusion in cyanotic patients, provided adequate dose is administered. Their efficacy in other high risk and mixed populations is not well established.
4- If steroid is beneficial, what would be the dose and what drug should we use?

Here are the data that I was able to find and would like to refer to two review articles that I am attaching:

The cytokines often associated with release during and after CPB include TNF, IL-1B, IL-2, IL-6, IL-8 and IL-10. Most randomized studies show that the use of steroids to be associated with amelioration of some aspects of the inflammatory response, including improved hemodynamics, reduced complement activation, reduced levels of proinflammatory cytokines (TNF, IL-1B, IL-6 and IL-8), increased level of IL-10 and reduced integrin receptor up regulation.

- Checchia et al: Dexamethasone (1mg/kg) significantly decreased troponin I level when compared to placebo (1 death in the steroid group, no wound infection, no sternal dehiscence and no incidents of GI bleeding).
- Mott et al: double blinded study with the steroid group receiving 1mg/kg of methylprednisolone + 4 more doses over 24 hours, only looked at post pericardiotomy syndrome (they defined it as temp>100.5, pericardial friction rub, patient irritability and small pericardial effusion), they came to the conclusion that steroids might be actually harmful.
- Varan et al: compared high dose Methylprednisolone (30mg/kg) to moderate dose (2mg/kg) and they found no significant difference in clinical parameters (mechanical ventilation, ICU stay, inotropes, blood loss and urine output) or in IL-6, IL-8 CRP. (small study size of 30 patients)
- Schroeder et al showed that the use of 30 mg/kg of methylprednisolone pre-operatively (4 hours before bypass) and 30 mg/kg in the bypass prime was superior to just intraoperative 30mg/kg methylprednisolone in regard to biochemical markers, ICU stay and clinical outcome.

**Conclusion:** Amicar and TA may have some antiinflammatory effects, but may be not as effective as Aprotinin. The use of steroids may be beneficial, but dosage is not clear. There is no clear advantage of high dose steroids VS low dose.
5- Does the data out there support the way we do our practice, Bloodless surgery and early extubation? And What approach should we take?

I think our practice is unique in many aspects, especially the practice of bloodless surgeries and the practice of early extubation. For this reason, if the use of antifibrinolytic agents would result in reducing the incidence of administration of blood products by 20-40%, this might have been acceptable in another practice but this would totally change the way we practice here. For this reason, I think the way that our surgical colleagues proposed to do a study comparing the different dosages of TA plus steroids is an ideal way to start. I also think that we should also add Amicar to the mix.

I am sure that a lot of this information is not new to you, but I think we should start discussing this matter more and more and this would be a start. As I said, this would have a major impact on the way we practice.

Please let me know what you think and if anyone has more information that we can benefit from as a group.
ANH

Calc dilutional hct ≥ 21% after ANH & RAP/VAP
Complications: poor A-line / IJ, unstable
   TOF
ACD vs Heparin
   8mL: 52mL autologous blood
   10-20% est CBV
   Replace with 1:1 crystalloid &/or 5% Albumin (human)
Neonates
   Minimum 60 mL
Blood Storage
   Stored @ RT for 8hrs per NCH BB
   Transfer bag of cellsaver in ‘continuous’ loop
   Fluid loop yes/no? Cellsaver wand?
RAP/VAP

**Any** patient with a crystalloid prime circuit
10-50mcg bolus via anesthesia
2-3mins
66% of prime volume = good
Rousou et al, The primeless pump: a novel technique for intraoperative blood conservation

VAP
Venous Antegrade Prime

Rousou et al, The primeless pump: a novel technique for intraoperative blood conservation
Techniques

- MUF: ~90%; A-V w/ plegia circuit
- Fresenius™ C.A.T.S.
  - All cases
  - If PRBC used in prime, washed 1st
    - Normosol R vs 0.9% NaCl
  - Set-up in continuous circuit
- Circuit flushed
- ABx PlateletWorks™, TEG, HMS available
Early Extubation in Congenital Heart Surgery

Rodolfo A. Neirotti, MD, FETCS,1 Donald Jones, DO,2 Richard Hackbarth, MD3 and Gwen Paxson Fosse, RN, MSA1

1Pediatric Cardiac Surgery, 2Department of Anaesthesia and 3Pediatric Intensive Care Unit, DeVos Children’s Hospital, Grand Rapids, Michigan, USA

Background: The concept of early extubation following congenital heart surgery is not new. Changes in health care have generated increasing interest in this technique. Some of the problems following surgery are related to the endotracheal tube and mechanical ventilation, and the interventions necessary to maintain them.

Methods: To evaluate the impact of early extubation (within 6 h postoperatively) on children undergoing congenital heart surgery, retrospective data were obtained from records of 1000 consecutive patients.

Results: Early extubation occurred in 80.2% of patients (73% in the operating room). Early extubation was not limited to simple anomalies; it was also possible for complex anomalies such as Fallot’s tetralogy (including those patients with pulmonary atresia, absent pulmonary valve and complete atroventricular septal defects; n = 106), where 91% of patients had early extubation, and Fontan operations (n = 17), where 88% did. There were no deaths related to early extubation. Preoperative intubation was a risk factor for postoperative ventilation. As expected, the patients requiring ventilation after surgery were younger, smaller and more critically ill than those that met the criteria for early extubation.

Conclusions: A change in attitude combined with appropriate anaesthetic and surgical techniques permitted safe, early extubation in a large number of patients. Patient populations vary between institutions. Early extubation is not always possible, but for those patients in whom it is feasible, the benefits include simplified postoperative care and increased patient and family satisfaction. When combined with clinical practice guidelines, it can result in a significant reduction in the cost of patient care after cardiac surgery. (Heart, Lung and Circulation 2002; 11: 157–161)
Technique to Early Extubation

Preoperative sedative
- Midazolam 0.5-0.7mg/kg; up to 20mg

Mask induction
- Sevoflurane 4-6%

Maintenance
- Propofol 50-100mcg/kg/min or
- Dexmetatomidene (Precedex) 1mcg/kg over 10min; 0.2-0.7mcg/kg/hr (ran thru to ICU)
- Pancuronium 0.1mg/kg
- Isoflurane 1-2%
- Fentanyl 7-10mcg/kg, s/p cpb 0.1mg/kg morphine

Rewarm
- Milrinone 25-50mcg/kg rewarm; 0.25mcg/kg/min
- Mg²⁺ 50mg/kg; max 2gm
Post-op Considerations

- Improve post-op blood conservation
  - r-EPO / Fe²⁺
- Early extubation
  - Ease of care
  - Reduce infection
- Limit blood draws
  - i-Stat™ hct lower than main lab…CPB mode
- React to overall patient well-being
- Transfusion trigger?
The CRIT Study: Anemia and blood transfusion in the critically ill—Current clinical practice in the United States

Howard L. Corwin, MD; Andrew Gettinger, MD; Ronald G. Pearl, MD, PhD; Mitchell P. Fink, MD; Mitchell M. Levy, MD; Edward Abraham, MD; Neil R. Macintyre, MD; M. Michael Shabot, MD; Mei-Sheng Duh, MPH, ScD; Marc J. Shapiro, MD

Objective: To quantify the incidence of anemia and red blood cell (RBC) transfusion practice in critically ill patients and to examine the relationship of anemia and RBC transfusion to clinical outcomes.

Design: Prospective, multiple center, observational cohort study of intensive care unit (ICU) patients in the United States. Enrollment period was from August 2000 to April 2001. Patients were enrolled within 48 hrs of ICU admission. Patient follow-up was for 30 days, hospital discharge, or death, whichever occurred first.

Setting: A total of 284 ICUs (medical, surgical, or medical-surgical) in 213 hospitals participated in the study.

Patients: A total of 4,892 patients were enrolled in the study.

Measurements and Main Results: The mean hemoglobin level at baseline was 11.0 ± 2.4 g/dL. Hemoglobin level decreased throughout the duration of the study. Overall, 44% of patients received one or more RBC units while in the ICU (mean, 4.6 ± 4.9 units). The mean pretransfusion hemoglobin was 8.6 ± 1.7 g/dL. The mean time to first ICU transfusion was 2.3 ± 3.7 days. More RBC transfusions were given in study week 1; however, in subsequent weeks, subjects received one to two RBC units per week while in the ICU. The number of RBC transfusions a patient received during the study was independently associated with longer ICU and hospital lengths of stay and an increase in mortality. Patients who received transfusions also had more total complications and were more likely to experience a complication. Baseline hemoglobin was related to the number of RBC transfusions, but it was not an independent predictor of length of stay or mortality. However, a nadir hemoglobin level of <9 g/dL was a predictor of increased mortality and length of stay.

Conclusions: Anemia is common in the critically ill and results in a large number of RBC transfusions. Transfusion practice has changed little during the past decade. The number of RBC units transfused is an independent predictor of worse clinical outcome.

(Crit Care Med 2004; 32:39-52) 

Key Words: anemia; blood transfusion; transfusion practice; transfusion risks
The mean pretransfusion hemoglobin was 8.6 +/- 1.7 g/dL.

Figure 4. Pretransfusion hemoglobin.

(Crit Care Med 2004; 32:39 –52)
Jehovah’s Witness / HLHS
surgery/cardiology

Our practice has changed…

Stage I Hybrid Procedure

- Median sternotomy
- Bilateral PA bands
- PDA stent as a newborn
- No CPB needed
Jehovah’s Witness / HLHS

Comprehensive Stage 2
- DKS
- Aortic arch repair / takedown
- PDA stent
- Bidirectional Glenn
- PA debanding (PA Augmentation)
- Atrial septectomy
- Age 5 months
- Weight 5.9 kg, BSA 0.29 m²
- Epogen and Fe supplements
  - Base 47%; ICU 38%
  - r-Epo 500u/kg SQ 1ea/wk
  - s/p surgical repair: r-Epo 500u/kg M,W,F SQ & Fe until discharge
- Fontan- bloodless
Specific Goals

- Transfusion rate overall < 40%
  - < 3.5 Kg < 90%
  - 3.5 to 8 Kg < 50%
  - 8 to 15 Kg < 30%
  - > 15 Kg < 10%

- Develop Heart Center patient satisfaction survey

- Intensive following of treatment of specific patient populations: ie. HLHS, VSD and AV canal

- Compare all measure against benchmarks periodically
# Monthly Heart Center QI

**Format for QA meeting, first Friday of Month 7:30 to 9:00 AM**

- 3 – 30 minute sessions
  - Dedicated presentation/discussion from designated service line
  - Review of monthly M&M
  - 15 minutes - Pressing issues
  - 15 minutes - Review previous initiatives, progress report

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The Heart Center at Nationwide Children’s Hospital
Performance Improvement

Blood Management

How can we do better?

- R & D re: perfusion products
- Surgical time to limit bleeding
- New hemostatics agents
- New medications
- Lower transfusion trigger vs. outcome
- Teamwork with on-going communication
Never underestimate the importance of teamwork!

The Heart Center at Nationwide Children’s Hospital
Blood Management in Pediatric Jehovah’s Witness

Daniel Gomez CCP
Nationwide Children’s Hospital
Ohio State University