Developing a Blood Conservation Program

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Disclosure
- I have no conflicts of interest related to this presentation
- I do have interest in conflicts related to this presentation

Transfusion patterns
- 14,000,000 units of pRBCs transfused annually
- 60% of blood transfusions take place perioperatively
- 20% occur in cardiac surgery

THE WALL STREET JOURNAL
THE INFORMED PATIENT I OCTOBER 29, 2008
Hospitals Seek to Limit Use of Transfusions
New Efforts to Recycle Blood and Treat Anemia Are Aimed at Cutting Costs and Risks
- Estimated $25 Billion
- 30 Million Units

Parallel Efforts
- STS recommendations
  - Chair- Vic Ferraris, U. Kentucky
- Duke/NIH group
  - first met in January 2006
  - >50% of cardiac surgery morbidity/mortality is related to transfusion (Cailiff)

Who cares about blood use?
- AABB
- The Joint Commission
  - http://www.jointcommission.org/patient_blood_management_performance_measures_project
- Society for Thoracic Surgeons
- American Red Cross
- Academic and community hospitals
Is Blood Conservation even a good idea?

- Cost
- Infection risk
  - HIV: 1 in 1-2,000,000
  - Hep B: 1 in 200-360,000
  - Hep C: 1 in 1-2,000,000
  - vCJD: rare
- Lung injury (TRALI)
- Immunosuppression

Early guidelines for red cells

- The “10/30” rule of 1942 was abandoned by an NIH Consensus Conference in 1988. Trigger-based vs. symptom-based transfusion strategy debated.

Transfusion provides no mortality benefit if Hb > 8.0 g/dL?

- Retrospective study of 8787 elderly hip fracture patients with significant comorbidities.
- Transfused cohort compared to non-transfused cohort.
- Did red cell transfusion change mortality if patients had Hb > 8.0 g/dL? No.

ICU randomized trial

- Is there any difference when ICU patients are transfused for Hb of 7.0 vs. 9.0 g/dL?

No significant differences

- Except in healthier ICU patients

If transfusion had an obvious benefit, why was it so difficult to prove?
NSTE MI quality study

- Retrospective study of 74,981 NSTE MI patients (non-CABG) from CRUSADE National Quality Improvement Initiative database.
- Compared the untransfused cohort with 12,724 who were transfused.
- What was the association of transfusion alone to adverse outcome (mortality/MI)?


Negative association persisted after adjustment

The higher rate of death and MI among patients receiving blood transfusions remained significant after adjustment for a comprehensive list of patient and hospital characteristics. After adjustment, patients undergoing transfusion remained 67% more likely to die and 44% more likely to experience either death or MI than those who did not undergo transfusion during their care.

Predictors of Postoperative Transfusion; The Big 6

- Advanced age
- Small body size or preoperative anemia (low RBC volume)
- Anti-platelet & anti-thrombotic drugs.
- Prolonged operation (CPB time) – high correlation with type of surgery.
- Emergency operation
- Other co-morbidities (CHF, COPD, HTN, PVD, renal failure, etc.)


Anemia is bad- is transfusion worse?

- Role of hemodilutional anemia and transfusion during cardiopulmonary bypass in renal injury after coronary revascularization: implications on operative outcome
- CPB hemodilution to hematocrit <24% is associated with a systematically increased likelihood of renal injury (including ARF) and consequently worse operative outcomes.
- This effect is exacerbated when CPB is prolonged with intraoperative packed red blood cell transfusions and in patients with borderline renal function


Transfusion and ARF

N=208 with and 208 without PRBC on CPB

Post bypass Hct
- Yes = 21.7 ± 3.6%
- No = 20.1 ± 3.0%

RI
- ≥ 5.6 creatinine >50%

ARF
- creatinine ≥ 2.1mg (≥ 188μmol)


Relationship of blood transfusion and clinical outcomes in patients with acute coronary syndrome

- 24,112 enrollees in 3 international trials with ACS
- 10% had at least one transfusion
- 30 day mortality OR 3.94
- 30 day death/MI OR 2.92
- Conclusion: Transfusion in the setting of ACS is associated with higher mortality

Rao et al. JAMA. 2004;292:1555-1562
Perioperative blood transfusion and postoperative mortality

- 8787 patients >60 yo
- Postoperative transfusion did not influence 30- or 90-day mortality after adjusting for trigger hemoglobin level, cardiovascular disease, and other risk factors for death
- Non-cardiac (hip fracture) surgery

Impact of preoperative anemia on outcome in patients undergoing CABG

- Preoperative anemia and intraop tx. were independent but additive risk factors for adverse outcome
- At the same hemoglobin level, risk of suffering a postop complication increased significantly with transfusion
- Direct relationship between # of units of RBC’s and incidence of adverse outcome

Low-Output after CABG

- 8004 patients having Isolated CABG
- LOF=
  - IABP
  - 2 Inotropes at 48 hrs
  - Need for return to CPB

But what about transfusion?

- Preoperative anemia and intraop tx. were independent but additive risk factors for adverse outcome
- At the same hemoglobin level, risk of suffering a postop complication increased significantly with transfusion
- Direct relationship between # of units of RBC’s and incidence of adverse outcome
Transfusion in CABG and reduced long-term survival

- N=10,289
- Increased early mortality declining up to six months
- Late risk continuing out to 10 years


Morbidity and mortality associated with RBC Transfusion

- N=11,963
- Transfusion was associated with increased risk of every postop morbid event
  - Renal failure, vent, infection, cardiac, neurologic
  - Increased mortality (OR 1.77)
  - Each unit of pRBCs incrementally increased risk


Quality of Life after RBC transfusion for CABG

- N=12,536
- Duke Activity Status Index
- After adjustment for comorbidity, postop functional status was incrementally worse for each unit of pRBC or platelets received


Effect of peri-operative red blood cell transfusion on 30-day and 1-year mortality following coronary artery bypass surgery

- N=3024 isolated CABG
- endpoints
  - 30 day and 1 year mortality
- conclusions: Peri-operative RBC transfusion after CABG is associated with an increased risk of mortality during a 1-year follow-up period, with a large proportion of deaths occurring within 30-days


Association between Intraoperative Blood Transfusion and Mortality and Morbidity in Patients Undergoing Noncardiac Surgery

- Table 1: Impact of intraoperative transfusion on 30-day mortality and 30-day complications


Cardiothoracic Surgery 2005;592-8
Platelet transfusions during CABG surgery are associated with serious adverse outcomes

- N=1720, data from Phase III clinical trials
- Increased risk of:
  - infection
  - vasopressor use
  - respiratory medications
  - stroke
  - death

Transfusion increases the risk of postoperative infection after cardiovascular surgery

- N=15,592 cardiac surgical procedures
- Endpoints
  - septicemia/bacteremia
  - deep or superficial SWI
- Conclusions: risk of infection increased incrementally with each unit of blood transfused

To transfuse or not transfuse

- "We agree…the beneficial effects of RBC transfusions have not yet been precisely described in defined subsets of anemic patients undergoing heart surgery."
- "For all patients undergoing cardiac surgery…aggressive blood conservation techniques…should be utilized to the fullest extent possible"

Preoperative Recommendations (I)

- Improve identification of patients at risk of requiring transfusion
  - When appropriate, delay surgery in patients with low hematocrit
    - Erythropoietin (IIa)
    - Iron therapy
  - When appropriate, delay surgery in patients receiving antiplatelet therapy
- Maximize use of autologous donation/transfusion

Intraoperative Recommendations (I)

- Minimize blood loss/maximize hemostasis
- Consider use of OPCAB when appropriate (IIa)
- Minimize hemodilution
- Avoid transfusion of mediastinal shed blood
- Consider use of autologous intraoperative donation/transfusion (IIa)
- Follow heparin/protamine protocol (IIb)
  - Heparin concentration/protamine titration
Intraoperative Recommendations (II)

- Maintain patient temperature >35.5
- Intraoperative cell-saver
- Routine use of antifibrinolytics
  - EACA in routine cases
    - recommended dose: 5 gm pre-CPB, 5 gm on pump, 1 gm/hr x 5 hr
  - Aprotinin has subsequently been removed from the market

Postoperative Recommendations

- Avoid hemodilution
  - use vasopressors (phenylephrine, norepinephrine, etc.) for BP support instead of fluids if C.I. OK
- Transfusion triggers
  - pRBC’s for Hgb<7 (we initially used threshold of 8)
  - coagulation factors based on labs when possible
  - Consider use of DDAVP when discreet surgical bleeding considered unlikely (IIb)

Transfusion Triggers

- may consider factors such as severe comorbidities, active bleeding, etc.
- On CPB transfuse for Hgb<7
  - STS recommends 6 (IIa)
- Post CPB transfuse for Hgb < 7 (this applies to the postoperative period as well)
- Use of thromboelastography
  - Develop algorithm using TEG data for transfusion/reexploration
  - May be helpful to assess clopidogrel effect

Shotgun vs. Focused Use of Coagulation Factors

Goals we hoped to achieve

- Implement a coordinated program to reduce the need for transfusions
- Transfusions should be evidence-based
- Decrease transfusion rate to 50% in first year of instituting recommendation
- It is NOT the goal to avoid transfusions when clinically indicated
  - (and when, exactly would that be?)

Lessons Learned so Far

- Multidisciplinary approach is critical
- Difficult to achieve participation, much less buy-in, by all parties
- "Recommendations" do not necessarily carry much weight
- Continuous monitoring and feedback is essential to improvement
- Science can have a difficult time competing with "faith" in terms of impacting practice