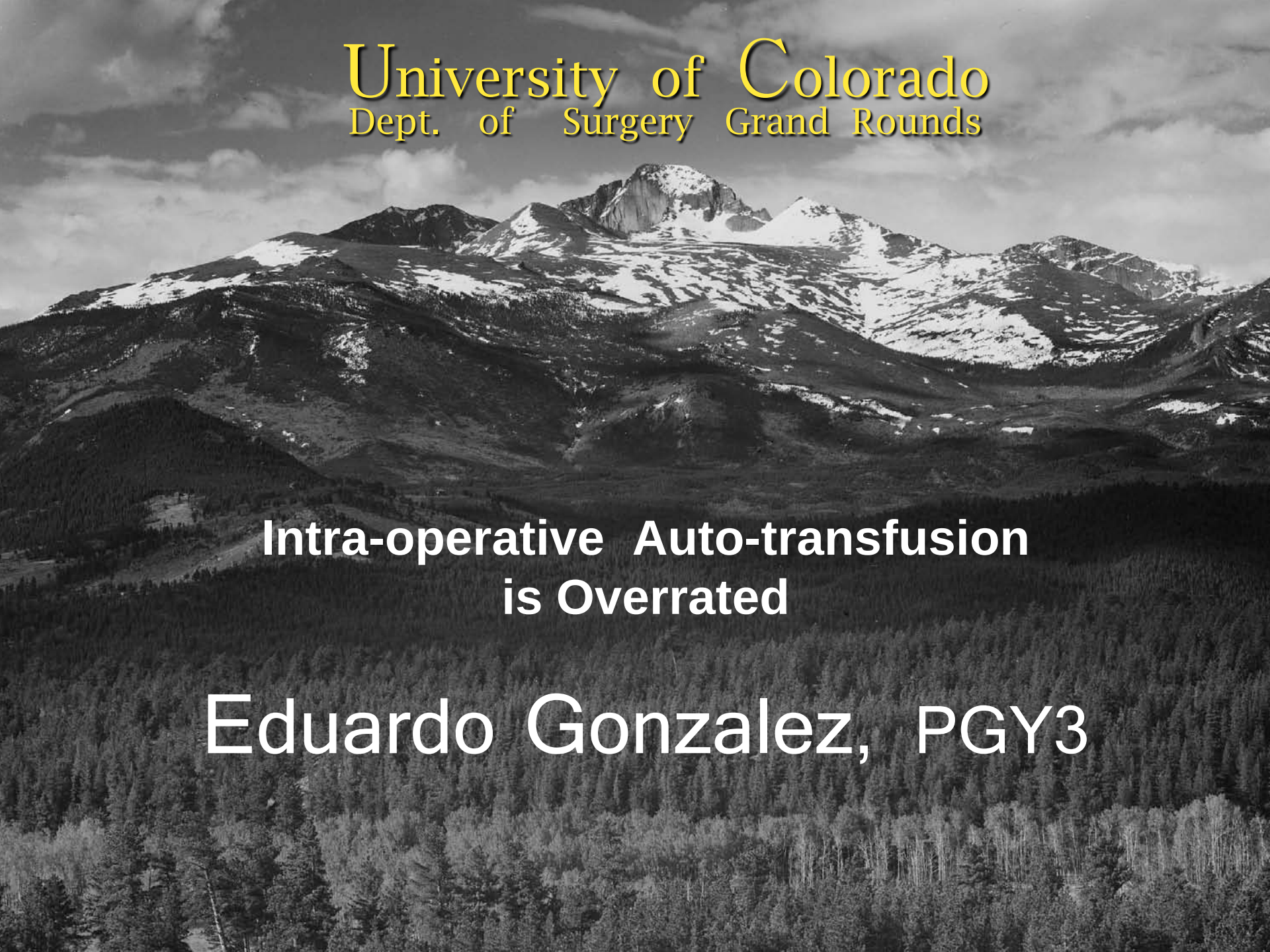

University of Colorado
Dept. of Surgery Grand Rounds
Intra-operative Auto-transfusion
is Overrated
Eduardo Gonzalez, PGY3

Minimizing peri-operative allogenic t

Alternatives to allogenic transfusions *also* come with risk,
and a cost-benefit outcome is hard to replicate

Comparison of Pharmacologic Strategies for Transfusion Avoidance in Surgery.

Drug	Trials (n)	Patients (n)	Red blood cell transfusion relative risk reduction (RR) (95% CI)	Red blood cell transfusion absolute risk reduction (ARR) (95% CI)	Saved units RBCs (95% CI)
Aprotinin	61	7027	RR 0.70 (0.64 to 0.76)	ARR 20.4% (15.6% to 25.3%)	1.1 units (0.69 to 1.47)
Tranexamic acid	18	1342	RR 0.66 (0.54 to 0.81)	ARR 17.2% (8.7% to 25.7%).	1.03 units (0.67 to 1.39)
ε-Aminocaproic acid	4	208	RR 0.48 (0.19 to 1.19)	NA	NA

Source: Adapted from Henry,[74] by permission of Cochrane Database System Review.

cell salvage

intra-Op post-Op

To review and compare current knowledge on
safety and cost-effectiveness
of intra-operative cell salvage, and
assess the methodological quality of the current studies

Intra-operative cell salvage

- Product quality
- Contraindications
- Adverse effects
- Clinical outcomes
- Cost - benefit

Product quality

Oxygen-transport and survival of RBC's equivalent to stored allogenic RBC's

Transfusate is devoid of WBC's, functional PLT's and reduced in coagulation factors

Hematocrit lower (20-30%) with unwashed vs washed method (50-60%)

Free-Hgb in plasma levels are strikingly high

Potential bacterial contamination

- ***Bland et al**, J Thorac Cardiovasc Surg 1992;* 30% of processed units were contaminated with bacteria
- ***Feltracco et al,** Transplant Proc. 2007*; 68.4% of cell-saver blood samples found to be positive for micro-organisms.
- ***Waters et al** Anesthesiology 2003*; 99% reduction in bacterial contamination with cell washing and leukocyte depletion filtration

Washed units must be if stored 4C <6h, and used <24h

Contraindications

RBC lysis remains the principal absolute contraindication

Pharmacological agents

- Clotting agents (Avitene, Surgicel, Gelfoam, etc.)
- Irrigating solutions (betadine, antibiotics meant for topical use)
- Methylmethacrylate

Contaminants

- Urine
- Bone chips
- Fat
- Bowel contents
- Infection
- Amniotic fluid

Malignancy

Haematological disorders

- Sickle cell disease
- Thalassaemia

Miscellaneous

- Carbon monoxide (electrocautery smoke)
- Catecholamines (phaeochromocytoma)
- Oxymetazoline (Afrin)

Papaverine

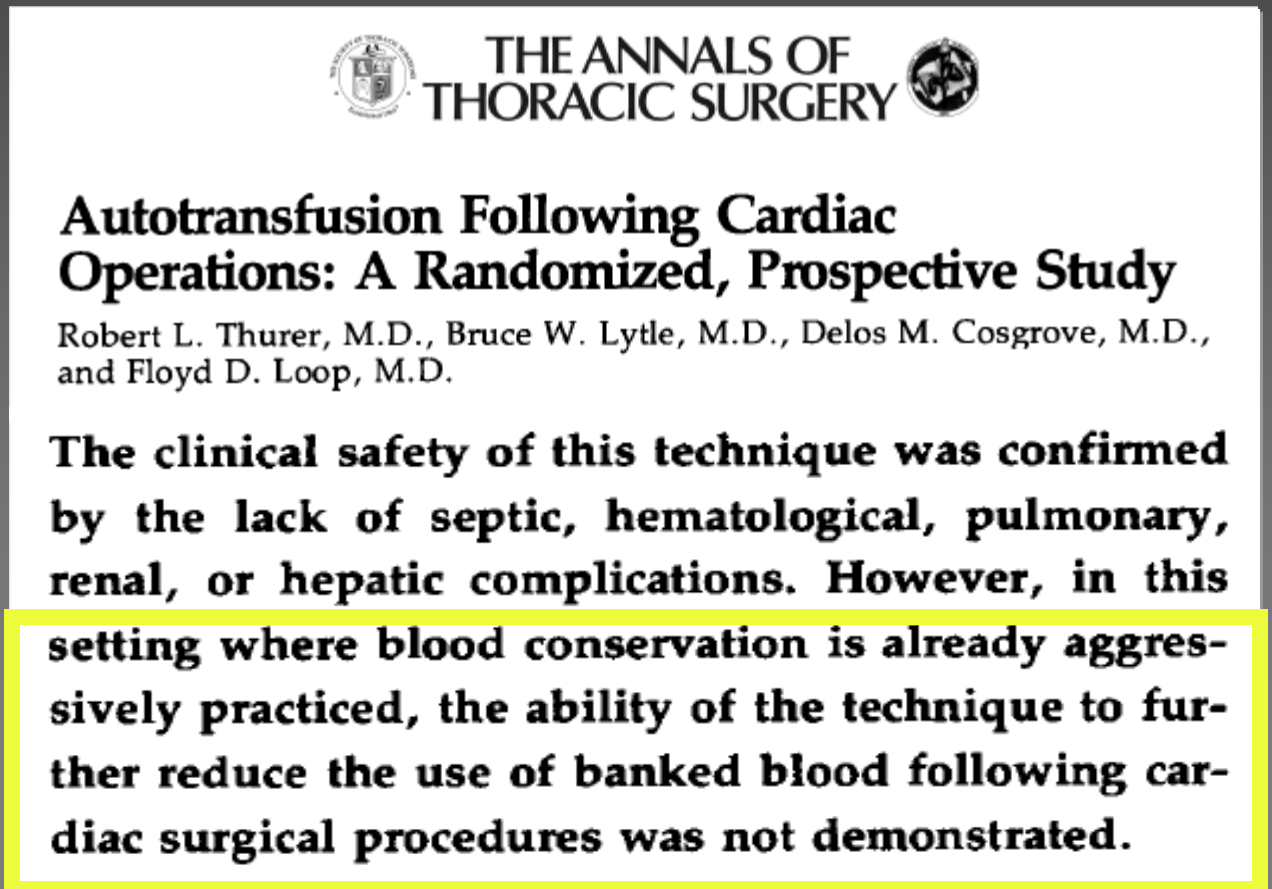
Adverse effects

- air embolism
- “salvaged blood syndrome”
- coagulopathy
- infection
- fat embolism

Clinical Outcomes

Design of initial clinical trials designed to prove safety

- **Davies** 1987 et al, *Anaesthesia and Intensive Care* 1987;
- **Dietrich** 1989 et al; *Journal of Thoracic and Cardiovascular Surgery* 1989;
- **Thurer** 1979; *Annals of Thoracic Surgery* 1979;27(6): 500–7.



THE ANNALS OF THORACIC SURGERY

Autotransfusion Following Cardiac Operations: A Randomized, Prospective Study

Robert L. Thurer, M.D., Bruce W. Lytle, M.D., Delos M. Cosgrove, M.D., and Floyd D. Loop, M.D.

The clinical safety of this technique was confirmed by the lack of septic, hematological, pulmonary, renal, or hepatic complications. However, in this setting where blood conservation is already aggressively practiced, the ability of the technique to further reduce the use of banked blood following cardiac surgical procedures was not demonstrated.

COCHRANE Review

21% absolute risk reduction (ARR) of exposure to allogeneic blood

75 trials

→orthopaedic (32) → cardiac (31) → vascular (4)

40 un-washed, 27 washed cells

46 post-operative, 11 intra-operative, 9 intra+post –operative

Randomized trials using controls (23):

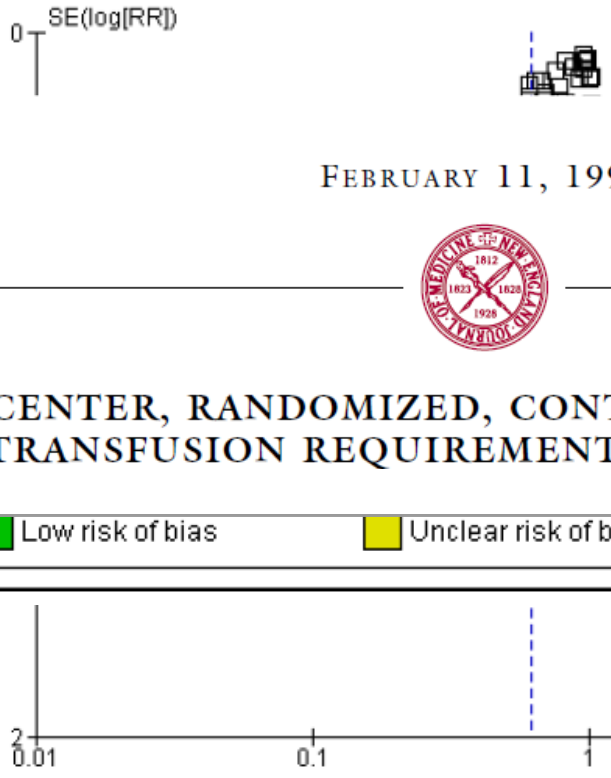
- *Cardiac surgery* (13): saving of 1 unit blood per patient (WMD -0.93 units; 95% CI -1.27 to -0.59 units).
- *Orthopaedic surgery* (7): 0.82 units of blood per patient (WMD -0.82 units; 95% CI -1.36 to -0.27 units).
- *Vascular surgery* (3): not statistically significant (WMD 0.02 units; 95% CI -0.34 to 0.38 units).

COCHRANE Review

75 trials

→ 28 (

Funnel plot of comparison: 1 Cell Salvage - Blood Transfused (All Studies), outcome: 1.1 No. exposed to allogeneic blood (All Studies).



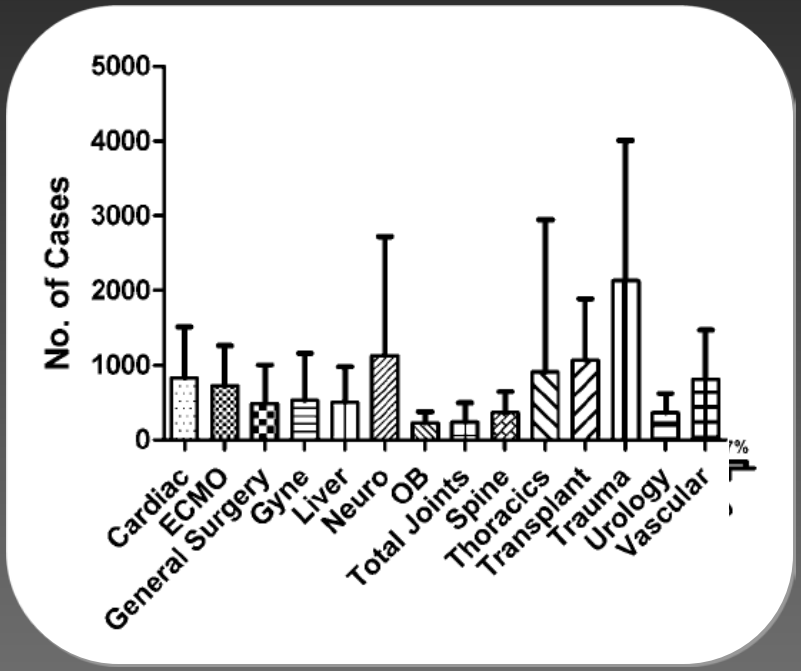
VOLUME 340 FEBRUARY 11, 1999 NUMBER 6

A MULTICENTER, RANDOMIZED, CONTROLLED CLINICAL TRIAL OF TRANSFUSION REQUIREMENTS IN CRITICAL CARE

Waters et al., 2011

TRANSFUSION 2011;51:2126-21

Academic, 12 site regional health care system
Review analysis
Prospective database in established cell salvage program
5 year review (2005-2010)
19,867 surgeries performed with blood salvage was
used.
median volume of blood returned to each patient was 405 mL (25th-75th percentile, 135-750 mL).



Mean 0.92 unit RBC unit equivalent (Hct 55%) was recovered
Recovered blood 750 to 405 mL (Hct 25-35%)

Waters et al., 2011

TRANSFUSION 2011;51:2126-21

46.5% failed to meet the criteria for IAT utility 1u RBC unit equivalent returned).

→ $6.7 million savings from prevented allogenic transfusions
→ $4.4 million operation cost
→ $2.3 million cost savings over 5 years

$474,199 per year
/ 12 hospitals
= $**39,517**
cost savings / per hospital / per year

Cardiac Surgery

Ann Thorac Surg 2007;83:S27–86

REPORT FROM THE STS WORKFORCE ON EVIDENCE BASED SURGERY

Perioperative Blood Transfusion and Blood Conservation in Cardiac Surgery: The Society of Thoracic Surgeons and The Society of Cardiovascular Anesthesiologists Clinical Practice Guideline*

Class II-B CPB pump re-infusion

Class I-A intra-op field blood salvage

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457. Hall RI, Schweiger IM, Finlayson DC. The benefit of the Hemonetics cell saver apparatus during cardiac surgery. Can J Anaesth 1990;37:618–23.

"Surprisingly there is no evidence-based preference for any form of intraoperative autotransfusion during CPB."

Cardiac Surgery

Ann Thorac Surg 2007;83:S27–86

Despotis GJ et al, Anesth Analg 1996;82:13–21.

Multivariate analysis demonstrated that processed cell salvage volumes were related to bleeding / transfusion.

“ with careful attention to intraoperative hemostasis in patients at low risk for operative bleeding, it may be that use of a cellsaving device is not a cost-effective measure ”

Vascular Surgery

Kelley-Pattesson et al, Vasc Surg 1993
Goodnough et al, J Vasc Surg1996
Ouriel et al, J Vasc Surg 1993
Huber et al, J Vasc Surg 1997

Not cost-effective during elective aortic reconstruction procedures and should only be used for
if considerable blood loss is anticipated.

Table II. CS salvage and perioperative PRBC transfusions

Indication for reconstruction	*Allogenic PRBC (units)*	*CS salvage (units)*
AAA		
All AAAs (N = 63)	2.8 ± 3.2	3.7 ± 3.2
≥6 cm (N = 34)	3.2 ± 3.3	3.6 ± 2.5
Concomitant procedure (N = 14)	4.6 ± 3.9	4.4 ± 2.8
Suprarenal crossclamp (N = 8)	4.4 ± 3.4	5.2 ± 3.6
AIOD		
All AIODs (N = 75)	3.1 ± 3.0	2.1 ± 1.7
Concomitant procedure (N = 28)	4.8 ± 3.6	2.3 ± 1.4
Suprarenal crossclamp (N = 10)	3.1 ± 1.3	2.7 ± 3.2

No clinical factors could accurately *predict* the high volume of blood loss that could be salvaged during the procedure in order to make use of the Cell Saver cost-effective.

Conclusions

- All alternatives to allogenic transfusions come with risk
- Intra-operative autotranfusion; one of many alternatives to allogenic blood
- Poor methodolgy of studies
- Risk for bias
- Expensive solution, expensive problem…
- Cost-effectiveness hard to replicate
- Overrated ….. Overused