Blood Component Therapy in Perioperative Critically Ill Patients

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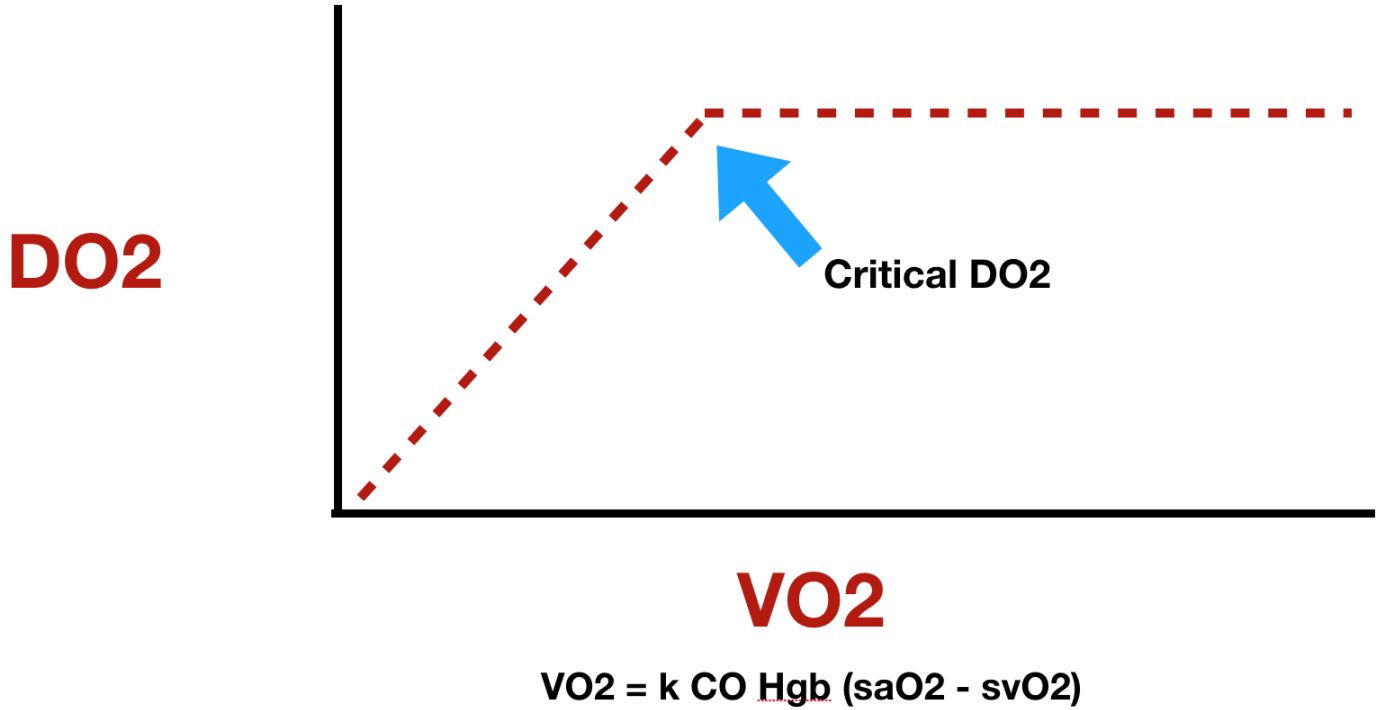
Delex PHARMA INTERNATIONAL INC.
meeting the gaps in critical care

The blood is the life

DRACULA

IC FORUM
DPI CME TRAINING PROGRAM TRADEMARK

DO2 = 1.36 x CO x Hgb x saO2 + 0.003 paO2



VO2 = k CO Hgb (saO2 - svO2)

In “normals”

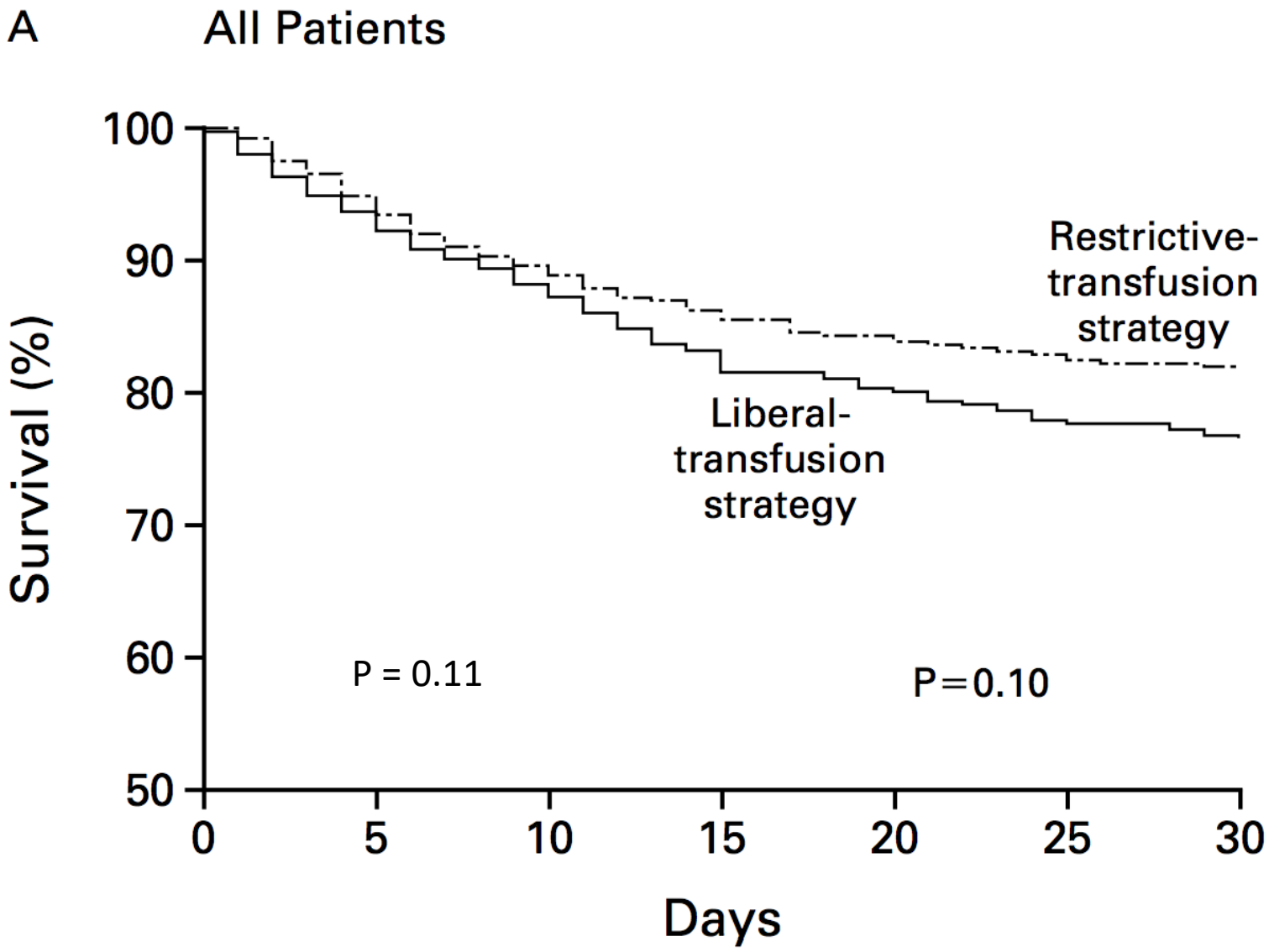
- ASA recommends Hgb > 6
- At Hgb <5.3 (Hct <16%)
  - Human cognitive function decreases, but is rapidly reversible by RBC transfusion

A 45M undergoes emergent exploratory laparotomy for suspected peritonitis. There is no significant blood loss. Anemia is noted on CBC.
At what level will you transfuse pRBCs?

A. 10
B. 9
C. 8.5
D. 7

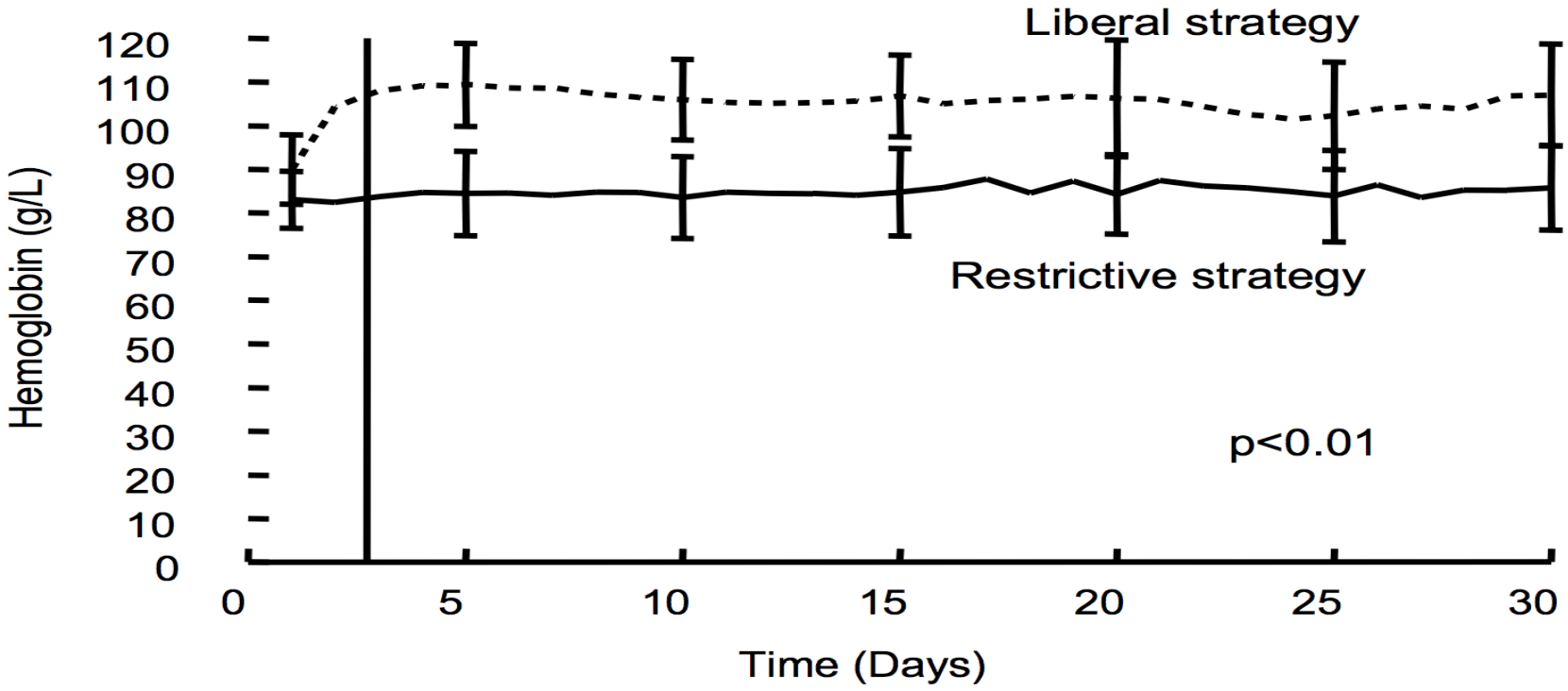
TRICC

Hebert et al, NEJM 1999



TRICC

Hebert et al, NEJM 1999



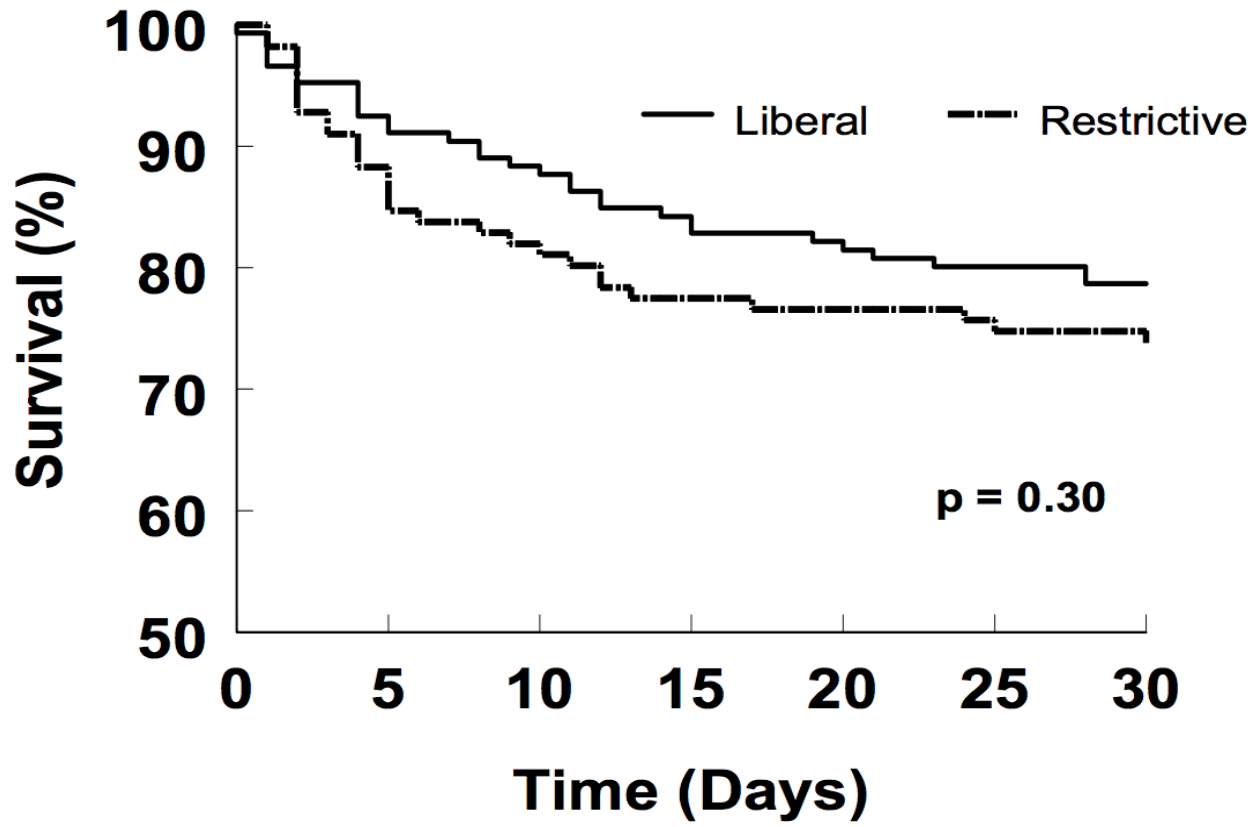
A 45M with known IHD undergoes emergent exploratory laparotomy for suspected peritonitis. There is no significant blood loss. Anemia is noted on CBCAt what level will you transfuse pRBCs?

A. 10
B. 9
C. 8.5
D. 7

TRICC

Hebert et al, NEJM 1999

Patients with Ischemic Heart Disease (n=257)



A 45M undergoes emergent CABG. Anemia is noted on CBC.

What is an appropriate Hgb target?

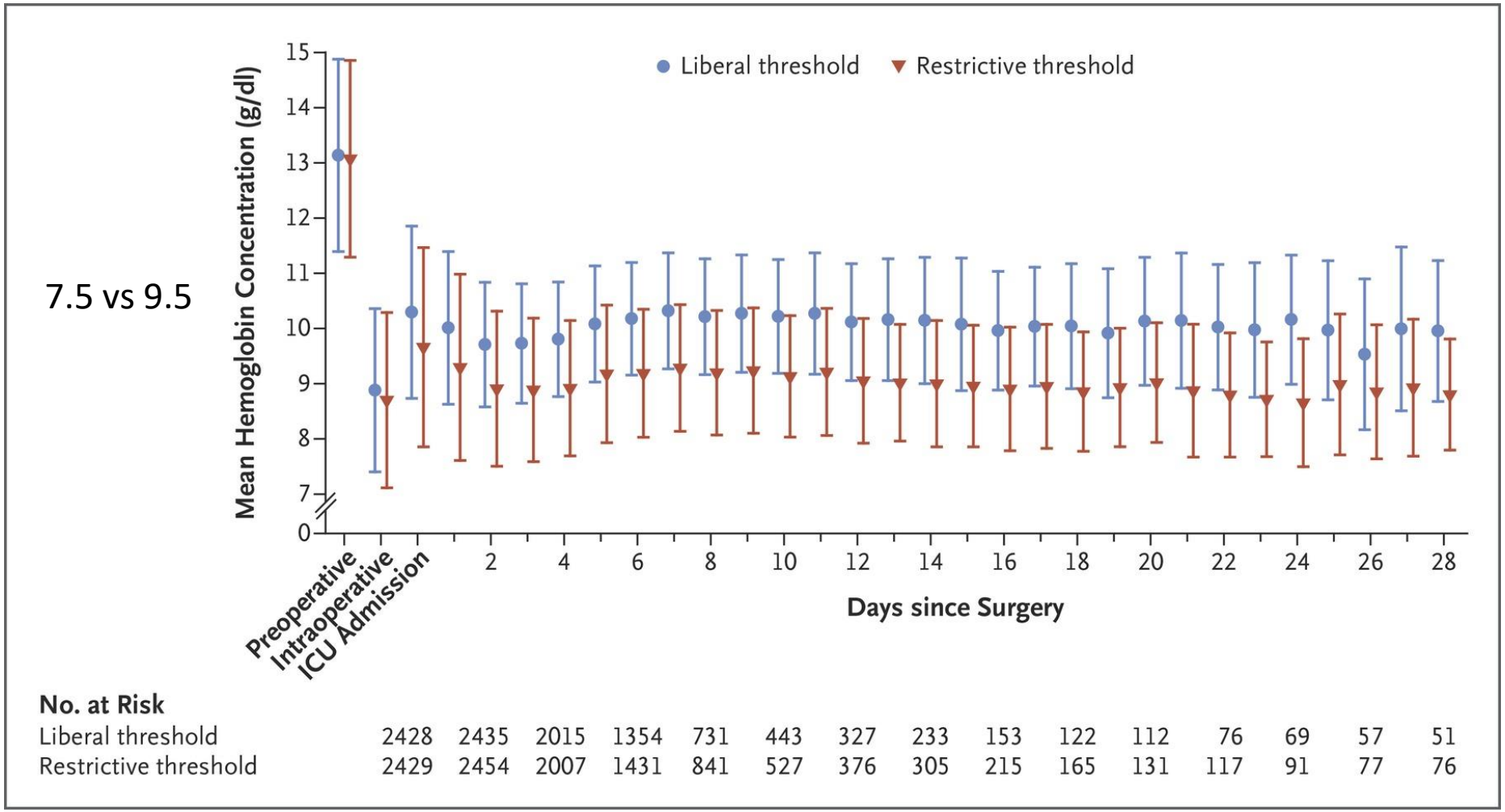
A. 11
B. 9.5
C. 8.5
D. 7.5

TRICS III Trial

Mazer et al, NEJM 2017

Euroscore >=6, not LVAD and not heart transplants

7.5 vs 9.5



No. at Risk

Liberal threshold	2428	2435	2015	1354	731	443	327	233	153	122	112	76	69	57	51
Restrictive threshold	2429	2454	2007	1431	841	527	376	305	215	165	131	117	91	77	76

TRICS III Trial

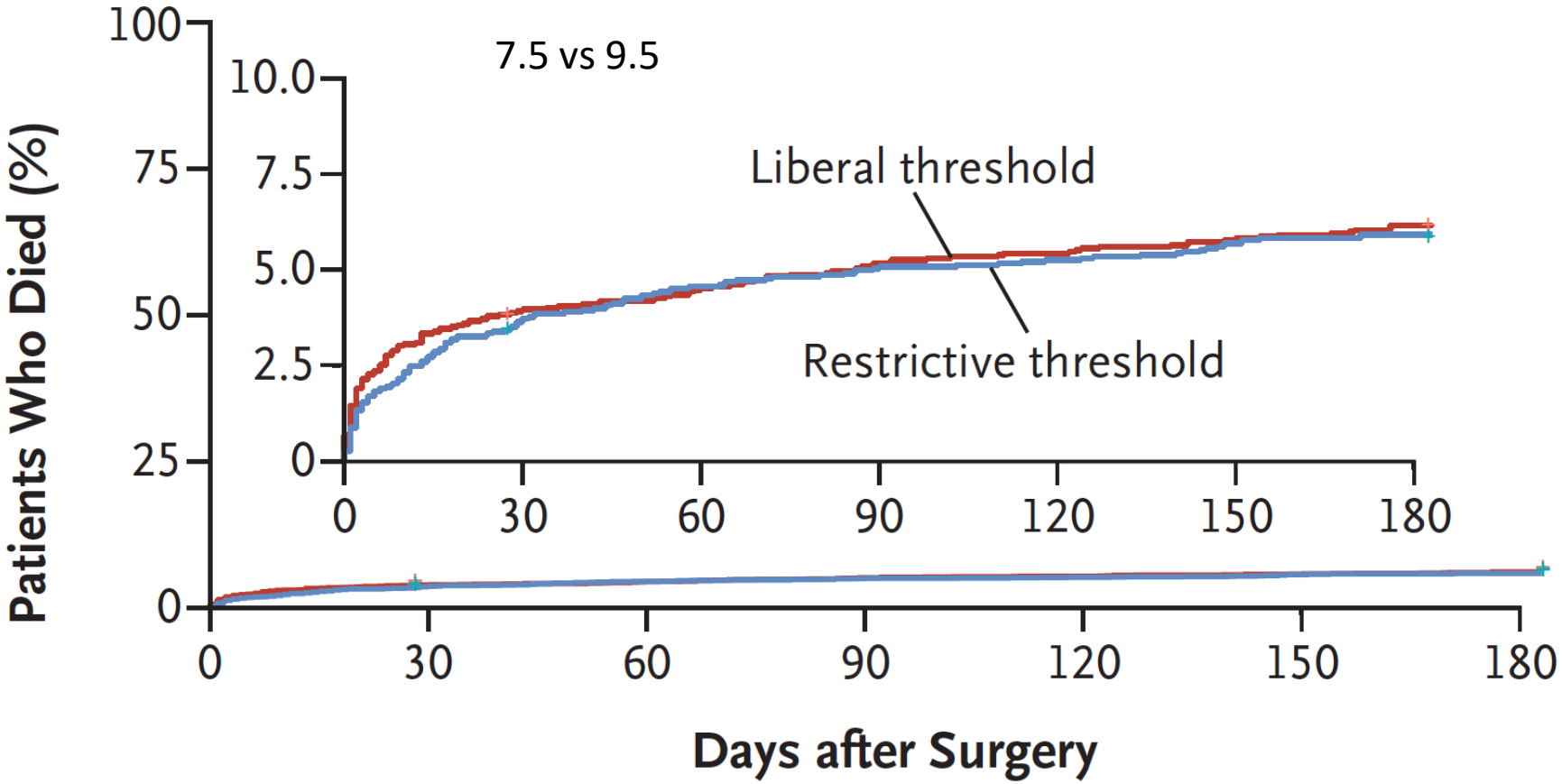
Mazer et al, NEJM 2017

Table 3. Primary and Secondary Outcomes in the Per-Protocol Population.

Characteristic	Restrictive Threshold (N = 2430)	Liberal Threshold (N = 2430)	Odds Ratio or Hazard Ratio (95% CI)
Primary outcome			
Composite-outcome event — no./total no. (%)	276/2428 (11.4)	303/2429 (12.5)	0.90 (0.76–1.07)
Death — no./total no. (%)	74/2427 (3.0)	87/2429 (3.6)	0.85 (0.62–1.16)
Stroke — no./total no. (%)	45/2428 (1.9)	49/2429 (2.0)	0.92 (0.61–1.38)
Myocardial infarction — no./total no. (%)	144/2428 (5.9)	144/2429 (5.9)	1.00 (0.79–1.27)
New-onset renal failure with dialysis — no./total no. (%)	61/2428 (2.5)	72/2429 (3.0)	0.84 (0.60–1.19)

TRICS III Trial

Mazer et al, NEJM 2018



Which patient subgroup will benefit from whole blood?

A. All critically ill patients
B. All critically ill surgical patients
C. Patients that require massive transfusion
D. Nobody

Whole Blood Vs Packed RBCs

Whole Blood

- Blood + plasma
- Deficient in coagulation factors, high levels of K+, ammonia, and H+
- Use limited to acute blood loss, where volume resuscitation is also required

Packed RBCs

- Blood with plasma removed
- No clotting factors
- Use in chronic anemia, where circulatory overload is likely

What patient subset most likely will require the Massive Transfusion Protocol?

A. Trauma patients
B. Cardiac surgery
C. Solid organ transplantation
D. Obstetric hemorrhage

Patients requiring “ultra-massive transfusion”

Dzik et al, Transfusion 2016

- Solid organ transplantation (21%)
- Cardiac or vascular surgery (16%)
- General surgery (11.5%)
- Trauma (11.5%)
- Medical disease (6%)
- Obstetric hemorrhage (1%)

Hypovolemic Shock

PARAMETER	CLASS I	CLASS II (MILD)	CLASS III (MODERATE)	CLASS IV (SEVERE)
Approximate blood loss	<15%	15–30%	31–40%	>40%
Heart rate	↔	↔/↑	↑	↑/↑↑
Blood pressure	↔	↔	↔/↓	↓
Pulse pressure	↔	↓	↓	↓
Respiratory rate	↔	↔	↔/↑	↑
Urine output	↔	↔	↓	↓↓
Glasgow Coma Scale score	↔	↔	↓	↓
Base deficit[a]	0 to –2 mEq/L	–2 to –6 mEq/L	–6 to –10 mEq/L	–10 mEq/L or less
Need for blood products	Monitor	Possible	Yes	Massive Transfusion Protocol

[a] Base excess is the quantity of base (HCO_3^-, in mEq/L) that is above or below the normal range in the body. A negative number is called a base deficit and indicates metabolic acidosis.

Data from: Mutschler A, Nienaber U, Brockamp T, et al. A critical reappraisal of the ATLS classification of hypovolaemic shock: does it really reflect clinical reality? *Resuscitation* 2013,84:309–313.

Massive Transfusion

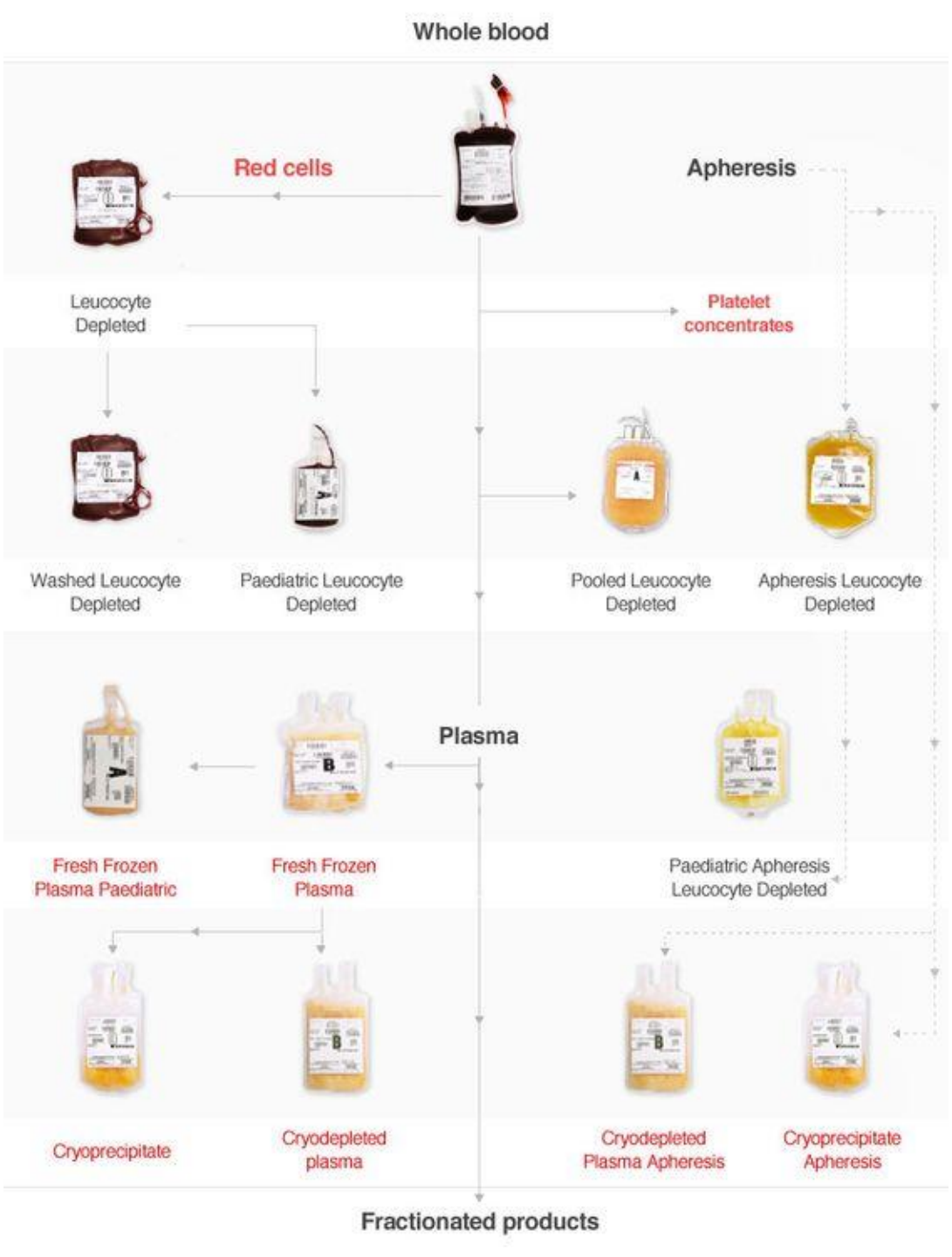
- Whole blood volume (or more) is replaced over 24 hrs, ~10 units of RBCs within 24 hrs
- Or, 50% blood volume replaced over 3 hrs

- Latest recommendation is for RBCs, FFPs and platelets to be given at 1:1:1 (less deaths from bleeding but unchanged overall mortality, compared to 1:1:2 RBCs)

Beware Transfusion Complications

- Hemolytic reactions
- Febrile reactions
- Infections
- Immunosuppression
- Metabolic alkalosis
- Hyperkalemia
- Hypocalcemia
- Fluid overload
- Transfusion-related acute lung injury

Other Blood Components



Indications for plasma (FFP)

- Active bleeding in the presence of known/suspected coagulopathy
- Massive transfusion of RBCs
- Prior to HIGH risk invasive procedures:
  - Thoracic
  - Abdominal
  - Spinal
  - Neurologic
- Prior to LOW risk procedures when coagulopathy is severe (index >2)

Indications for 4F-Prothrombin Complex

Recombinant technology or pooled factors from 1000s of donors

- Hypertherapeutic warfarin in presence of bleeding
- NOAC-associated bleeding
- Emergency invasive procedures required with therapeutic warfarin

Indications for Cryoprecipitate

- Specific deficiencies of: von Willebrand factor, VIII, XIII, fibrinogen:
- DIC
- Some cases of peripartum bleeding

Indications for Platelets

- Platelets < 10
- Platelets < 50 with active bleeding, planned invasive procedures or a qualitative platelet disorder
- Platelets <100 with neurosurgical procedures, CNS injury, multisystem trauma, or require an intrathecal anesthetic catheter
- Normal platelets, actively bleeding with qualitative platelet dysfxn: chronic antiplatelets, congenital platelet disorders, uremia
- Special cases: HIT, TTP

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A patient has a Hgb of 10, saO2 of 99% and a cardiac output of 7 L/min. What is the DO2?

A. ~545 ml/min
B. ~745 ml/min
C. ~945 ml/min
D. ~1145 ml/min

Which cardiac surgery patient was excluded from the TRICS III trial?

A. LVAD insertion
B. CABG
C. OPCAB
D. MV replacement

What is the transfusion threshold for a patient who has just undergone CABG?

A. 10
B. 8.5
C. 7.5
D. 7.0

What is/are potential complication(s) of large volume pRBC transfusions?

A. Metabolic alkalosis
B. Hyperkalemia
C. Hypocalcemia
D. All of the above

A polytrauma patient is admitted, with an SBP of 75, HR 130, obtunded. Emergency surgery is planned. What is the appropriate management?

A. pRBCs, platelets and plasma at 1:1:1 ratio
B. pRBCs only
C. Cryoprecipitate
D. Check labs and correct coagulopathy as needed