بسم الله الرحمن الرحيم

INDICATIONS FOR USING BLOOD PRODUCTS IN CARDIAC SURGERIES

COAGULATION DISORDER IN POST CARDIAC SURGERIES

EXCESSIVE BLEEDING MEANS

1. Chest tube drainge > 10ml/kg in first hour after operation
2. Chest tube drainge > 20 ml/kg in first 3 hour after operation
3. Any sudden ↑ of 300 ml/hr or greater after minimal initial drainge

BLEEDING PATIENT IN CARDIAC SURGERY

1. PATIENT FACTORS

- MEDICAL HISTORY (ASPIRIN,. . .)
- CONCURRENT SYS. DIS. (UREMIA,. . .)
- SYSTEMIC FIBRINOLYSIS (STREPTOKINASE)

BLEEDING PATIENT IN CARDIAC SURGERY

2. INSULT OF C.P.B.
(C.P.B. ITSELF ACT TO IMPAIR HEMOSTASIS MORE THAN PATIENT FACTORS)

- ACTIVATE FIBRINOSIS
- IMPAIRS PLATELETS
- AFFECT COAGULATION FACTORS
- HYPOTHERMIA : ALSO AFFECT HEMOSTASIS AS WELL

TABLE 35.8 Antihemostatic Effects of Hypothermia

Hemostatic Component	*Effect of Hypothermia*
Factors	Increased anti–factor Xa activity; heparan?
	Slows enzymes of the coagulation cascade
Platelets	Splanchnic sequestration
	Partial activation
Fibrinolysis	Enhanced
Endothelium	Tissue factor release

FIRST OF ALL DIFFERENTIATE COAGULOPHATY FROM BLEEDING DUE TO SURGERY

TABLE 35.9 **Ways to Prevent Excessive Bleeding in Decreasing Order of Importance**

Intervention[b]	*Purpose*
Ligatures	Repair all vascular trespass
Neutralize	Heparin fully neutralized
Blood pressure	Avoid hypertension after aortotomy
Suction	Limit cardiotomy suction
Drugs	Cease platelet-inhibiting drugs in advance
Preoperative	Diagnose and treat first
Oxygenator	Membrane oxygenators for long cases
ε-Aminocaproic acid (EACA)	Antifibrinolytic prophylaxis
Temperature	Rewarm sufficiently
Go	Act with deliberate speed (tardiness begets bleeding)
Intravenous	Limit fluids, hemoconcentrate, and diurese
Extracorporeal circuit	Minimize volume

[a]These maneuvers do not all apply to the treatment of excessive bleeding after operation.
[b]The entries in this column form a mnemonic device: the initial letters of each entry, when rearranged, form the words STOP BLEEDING.

TABLE 35.10 Treatment Plan for Excessive Bleeding After Cardiac Surgery

Action	*Amount*	*Indication*
Rule out surgical cause	—	No oozing at puncture sites; chest radiograph
More protamine	0.5–1 mg/kg	ACT > 150 seconds or aPTT > 1.5 times control
Warm the patient	—	"Core" temperature < 35° C
Apply PEEP[a]	5–10 cm H_2O	—
Desmopressin	0.3 µg/kg IV	Prolonged bleeding time
Aminocaproic acid	50 mg/kg, then 25 mg/kg/hr	Increased D-dimer or teardrop-shaped TEG tracing
Tranexamic acid	10 mg/kg, then 1 mg/kg/hr	Increased D-dimer or teardrop-shaped TEG tracing
Platelet transfusion	1 U/10 kg	Platelet count < 100,000/mm^3
Fresh frozen plasma	15 mL/kg	PT or aPTT > 1.5 times control
Cryoprecipitate	1 U/4 kg	Fibrinogen < 1 g/L or 100 mg/dL
Fibrinogen	2 g	Fibrinogen < 100 mg/dL

ACT, Activated coagulation time; *aPTT*, activated partial thromboplastin time; *TEG*, thromboelastograph.

[a]Positive end-expiratory pressure (PEEP) is contraindicated in hypovolemia.

PREVENTION OF BLEEDING IN CARDIAC SURGERIES

1. Preoperative factors : existing dis. of hemostasis must be identified and treated (uremia - hepatic failure,...)

2. Physical factors : Limiting craniotomy suction use: hypothermia - Incomplete surgical hemostasis - Membrane oxygenator better than bubble - Small priming volume is better - Removal of platelet rich plasma at the induction anesthesia - Shorter C.P.B. is better

PREVENTION OF BLEEDING IN CARDIAC SURGERIES

3. Pharmacologic factors:

A. Heparin and protamine factors: too little heparin and protamine and too excessive make problems

B. Desmopressin ⟶ an analog of vasopressin releases coagulation system mediators from vascular endothelium ⟶ F VIII activity ↑ (2-20 fold) and after 30'- 90' (maximal effect) - F XII ↑, VWF ↑ -optimal dose 0.3 -/kg (IV - SC - intranasal are all acceptable) - use in uremia , cirrhosis , aspirin therapy and some surgeries (cardiac - spine) is useful

C. Synthetic antifibrinolytics (EACA , Tranexmaic acid)

D. Aprotinin (inhibits a host ↓ protease e trypsin - plasmin , ...)

MANAGEMENT OF THE BLEEDING PATIENT

IT SHOULD BE STATED THAT THERE ARE NO DATA TO SUPPORT USE OF COAGULATION PRODUCTS AS A PROPHYLACTIC METHOD TO "REDUCE BLEEDING"

STANDARD BLOOD PRODUCTS FOR C.V. TEAM

1. FFP

2. CRYOTEPRECIPITATE

3. PLATELATE

4. PACKED CELLS

5. P.C.C. (REVERSE WARFARIN)

THE RISKS OF TRANSFUSION HAVE SHIFTED FROM VIRAL TRANSMISSION TO TRANSFUSION – RELATED ACUTE LUNGE INJURY (T.R.A.L.I.) AND IMUNOSUPPRESION

F.F.P. AND PLATELATE CARRY A HIGH RISK OF T.R.A.L. I

1%–8% CARDIAC SURGERY PATIENTS GET T.R.A.I.L. FROM TRANSFUSION

25% – 50% OF PATIENTS AFTER CARDIAC SURGERY RECEIVE F.F.P. WITHOUT ANY BENEFIT

In the presence of incomplete data, the ASA's 2015 updated practice guidelines offer these recommendations:[116]

1. Transfusion is rarely indicated when the Hb concentration is more than 10 g/dL and is almost always indicated when it is less than 6 g/dL, especially when the anemia is acute.
2. A restrictive transfusion strategy (Hb <8 g/dL) should be employed to reduce the patient's transfusion requirements and decrease the potential harmful effects of transfusions.
3. Multimodal protocols and algorithms should be employed to reduce intraoperative blood loss and transfusion requirements. These pathways include point-of-care testing to direct care.
4. The use of a single Hb trigger for all patients and other approaches that fail to consider all important physiologic and surgical factors affecting oxygenation is not recommended.
5. When appropriate, intraoperative and postoperative blood recovery, acute normovolemic hemodilution (ANH), and measures to decrease blood loss (i.e., deliberate hypotension and pharmacologic drugs) may be beneficial.

Indications for the use of platelets are somewhat difficult to define. The most recent guidelines published in 2015 by the ASA Task Force on Perioperative Blood Management[116] provide the following recommendations regarding management for platelet transfusions:

1. Monitor platelet count, except in situations of massive transfusion.
2. Monitor platelet function, if available.
3. Consider use of desmopressin in patients with excessive bleeding or suspected platelet dysfunction.
4. Platelet transfusion may be indicated despite an adequate platelet count if there is known or suspected platelet dysfunction (e.g., cardiopulmonary bypass, bleeding, recent use of antiplatelet therapy, congenital platelet dysfunction).
5. Prophylactic platelet transfusion is rarely indicated in surgical or obstetric patients when the platelet count is greater than 100×10^9/L and is usually indicated when the platelet count is less than 50×10^9/L. The determination of whether patients with intermediate platelet counts (50-100 $\times$ 10^9/L) require therapy should be based on the patient's risk for bleeding.

In 2015 the ASA Task Force recommended the following guidelines regarding the administration of FFP:

1. Prior to the administration of FFP, coagulation studies should be obtained when feasible.
2. For the correction of coagulopathy when the international normalized ratio (INR) is greater than 2, in the absence of heparin.
3. For the correction of coagulopathy due to coagulation deficiencies in patients transfused with more than one blood volume (approximately 70 mL/kg) when coagulation studies cannot be easily or quickly obtained.
4. Replacement of known coagulation factor deficiencies with associated bleeding, disseminated intravascular coagulation (DIC), or both, when specific components are not available.
5. Reversal of warfarin anticoagulation when severe bleeding is present and prothrombin complex concentrations are not available.

According to the 2015 ASA Task Force on Perioperative Blood Management,[116] transfusion of cryoprecipitate is rarely indicated when the fibrinogen levels are greater than 150 mg/dL in nonobstetric patients. The following indications were provided regarding the administration of cryoprecipitate:

1. When testing of fibrinogen activity reveals evidence for fibrinolysis
2. When fibrinogen concentrations are less than 80 to 100 mg/dL in patients experiencing excessive bleeding
3. Obstetrical patients who are experiencing excessive bleeding despite a measured fibrinogen concentration greater than 150 mg/dL
4. In patients undergoing massive transfusion when the timely assessment of fibrinogen concentrations cannot be determined
5. In patients with congenital fibrinogen deficiencies and when possible, in consultation with the patient's hematologist
6. In bleeding patients with von Willebrand disease types 1 and 2A who fail to respond to desmopressin or vWF/FVIII concentrates (or if not available)
7. In bleeding patients with von Willebrand disease types 2B, 2M, 2N, and 3 who fail to respond to vWF/FVIII concentrates (or if concentrates are not available)

The End