

Transfusion Camp 2023-2024

Seminar for Day 4, April 5 2024

Major Haemorrhage Cases, developed by Drs. Marc Bienz and Jeannie Callum

Please start session by asking trainees if they have any questions from the didactic sessions.

Please remind students that although one answer is bolded as the correct answer, there may be more than one reasonable answer to the questions. The purpose of the seminar is to promote discussion and explore why certain answers may be more appropriate in certain situations.

Case 1

A 62 year old man with atrial fibrillation is brought by land transport to the emergency department after being struck while commuting to work by bicycle 30 minutes ago. He has a medical bracelet stating he is on warfarin. He is intubated at the scene for a low GCS. He is hypotensive (systolic blood pressure 85 mmHg) and tachycardic (127 bpm). He has received 2 L of Ringer's lactate (no RBCs). His abdomen is distended, he has a positive FAST and CT shows a ruptured spleen and an unstable pelvic fracture. Significant traumatic brain injury is also suspected but CT shows no acute hemorrhage. The patient is being prepped for urgent laparotomy for splenectomy and pelvic fixation. Tranexamic acid 1 gram bolus administered within 60 minutes of arrival.

Question 1: Which of the following is the first best intervention to support his coagulation?

- A) Administer 4 grams of fibrinogen concentrate (or 10 units of cryoprecipitate)
- B) Administer 2000 IU of PCC
- C) Initiate viscoelastic monitoring to guide any transfusion therapy
- D) Transfuse 4 units of plasma

Question 2: One gram of tranexamic acid was administered as an IV push on arrival to hospital within 60 minutes of injury. It is now 90 minutes after the initial trauma occurred and the patient is about to be taken to the OR. The patient has suspected on going hemorrhage. The best approach to giving additional tranexamic acid in this situation is:

- A) Bolus 1 gram now
- B) Measure the fibrinogen level and if <1.0 g/L, administer 1 gram of TXA
- C) Order D-dimers and only administer if the levels are above the normal range.
- D) Order viscoelastic testing and only administer if there is excessive lysis

Question 3: Which of the following has led to more appropriate and selective use of plasma during an MHP?

- A) Early MHP activation for acute gastrointestinal bleeding
- B) Requiring the transfusion of 4 units of red blood cells before a multicomponent MHP cooler is issued
- C) Reserving plasma transfusion for patients with a Shock Index (SI) score > 1 or Assessment of Blood Consumption (ABC) score > 2
- D) Use of a 1:1:1 ratio-based protocol

Question 4: When managing a massively bleeding patient, the most important laboratory test at protocol activation to ensure appropriate blood product utilization is:

- A) Activated partial thromboplastin time (aPTT)
- B) Blood group and antibody screen
- C) Fibrinogen level
- D) Hemoglobin level

Case 2

A 37 year old G3P2 is post-vaginal delivery of an uncomplicated pregnancy. Her hemoglobin was 102 g/L and her MCV was 74fL pre-delivery. The nurse pages you because her HR has increased to 120 from 85 bpm, sBP dropped from 110 to 85 mmHg, she has just passed a huge amount of blood per vagina approximately 1 hour post-partum, and the uterine tone is not satisfactory. The patient is disoriented and is difficult to rouse.

Question 5: Which of the following is NOT thought to contribute to post-partum hemorrhage?

- A) Congenital coagulation factor deficiency
- B) Deficiency of vitamin K-dependent coagulation factors
- C) Retained placenta
- D) Uterine atony

Question 6: Recent small clinical trials have suggested that replacing clotting factors with a combination of a coagulation factor concentrates may be an alternative strategy to plasma. If a decision was made to use prothrombin complex concentrates instead of plasma (e.g., due to unavailability at the local hospital due to smaller hospital size) for the management of post-partum hemorrhage, which of the following would be the most important additional factor concentrate to add?

- A) Factor XIII
- B) Fibrinogen
- C) Recombinant activated factor VII
- D) Von Willebrand Factor

Case 3

A 24-year-old woman is on route to the trauma room direct from the scene by helicopter transport. She was a passenger on a motorcycle involved in a high-speed motor vehicle collision. She is expected to arrive in under 15 minutes. You are told she has head, thoracic and orthopedic injuries. She was thrown approximately 25 meters away. You are told she is tachycardic and hypotensive despite 2L balanced crystalloid administered by air ambulance.

Question 7: Which of the following normal practices can be waived in the setting of massive blood loss?

- A) Attachment of patient wristband with unique identifiers
- B) Careful inversion of laboratory specimen test-tubes prior to delivery to the lab
- C) Advanced directives prohibiting the use of blood transfusion (eg., Jehovah's Witnesses)
- D) Screening for red blood cell antibodies

The patient survives initial damage control resuscitation efforts and is brought to the OR, where she becomes progressively more stable after her spleen is removed and the pelvis packed. She has been transfused a total of 8 units of RBCs, 4 units of plasma, 2 platelet pools and 4 grams of fibrinogen concentrate. Her most recent labs show: hemoglobin 82 g/L, INR 1.9, platelet count 65, and fibrinogen 2.1.

Question 8: What secondary complications should you watch for in a massively transfused patient?

- A) Hypercalcemia
- B) Hypokalemia
- C) Hypothermia
- D) Hyponatremia

Question 9: The patient survives to the ICU phase of care. She is still requiring boluses and inotropes for fluid resuscitation. Her most concerning ongoing issue is her traumatic brain injury. There is no obvious ongoing blood loss. Blood work shows all metrics are within target range, including hemoglobin at 98 g/L. Her lactate is still high at 8, although this is down from 12. Her pH has also improved from 7.10 to 7.33. Given her ongoing need for fluid boluses and inotropes, what is the role of intravenous albumin for her resuscitation?

- A) Albumin increases the mortality rate, compared to saline, in trauma patients and therefore is contraindicated.
- B) Albumin should be administered for critical hypoalbuminemia (<20)
- C) Resuscitation with albumin should be started after 2 L of crystalloid
- D) There is no role for albumin in the resuscitation of hypovolemic trauma patients

Case 4

You are part of the multidisciplinary transfusion committee in your hospital and the committee is tasked to review the current massive hemorrhage protocol (MHP). The current transfusion and laboratory protocol appear as follows:

	Current MHP
Box 1	4 PRBC
Box 2	4 PRBC 4 units of plasma 1 bag of platelets
Box 3 and beyond	4 PRBC 2 units of plasma 1 bag of platelets 2 grams of fibrinogen or 5 units of cryoprecipitate
Laboratory testing at each blood draw: CBC, INR, activated partial thromboplastin time, fibrinogen, electrolytes, calcium, (ionized), blood gas (pH and base excess) and lactate.	
Transition to laboratory-guided blood component and calcium administration as soon as possible aiming for the following resuscitation targets: (1) hemoglobin >80 g/L; (2) INR <1.5 (3) Fibrinogen >1.5 g/L (4) platelets > 50 x10 ⁹ /L; (5) ionized calcium >1.15 mmol/L.	

Question 10: Which of the following is NOT an appropriate recommendation to improve the current MHP.

- A) Platelets can be ordered “as needed” based on results of the blood tests obtained and not issued systematically in every box.
- B) Fibrinogen replacement needs to be issued with box 1
- C) APTT testing is only required at baseline and does not need to be repeated if the baseline INR and APTT are normal
- D) When transitioning to laboratory-guided blood component administration, the target INR should be <1.8. Patients with post-partum hemorrhage or post cardiac surgery may benefit from a fibrinogen target of >2.0 g/L.

For more information on this topic, refer to:

- Provincial Massive Hemorrhage Protocol (ORBCON, 2020)
- Stanworth SJ, Dowling K, Curry N, et al. Haematological management of major haemorrhage: a British Society for Haematology Guideline. *Br J Haematol.* 2022;198(4):654-667.
- Rossaint R, Afshari A, Bouillon B, et al. The European guideline on management of major bleeding and coagulopathy following trauma: sixth edition. *Crit Care.* 2023;27(1):80.
- Kietai S, Ahmed A, Afshari A, et al. Management of severe peri-operative bleeding: Guidelines from the European Society of Anaesthesiology and Intensive Care: Second update 2022. *Eur J Anaesthesiol.* 2023;40(4):226-304.
- Task Force on Patient Blood Management for Adult Cardiac Surgery of the European Association for Cardio-Thoracic S, the European Association of Cardiothoracic A, Boer C, et al. 2017
- EACTS/EACTA Guidelines on patient blood management for adult cardiac surgery. *J Cardiothorac Vasc Anesth.* 2018;32(1):88-120.

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