



Transfusion Camp 2023-2024

Day 1: Seminar 1B Pediatric, September 22, 2023

Plasma, PCC & Fibrinogen Cases, Dr. Valérie Arsenault, Ziad Solh and Lani Lieberman

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

Please remind trainees 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 14-day-old full-term male newborn (4 kg) is brought by paramedics to the emergency department (ED) accompanied by his parents because he suffered from generalized seizures without fever.

Pregnancy was normal. Baby was delivered at home by a midwife. Baby was breastfed exclusively.

At arrival, antiepileptic medication is administered which stop the seizures. However, he remains with decreased level of consciousness, cyanosis, hypoxia and bulging anterior fontanelle. ED team proceeds with resuscitation maneuvers with endotracheal intubation and installation of a venous catheter. Bloody oozing is noticed from the catheter site insertion. Initial blood work is sent quickly to the laboratory.

Here are the results:

| Blood work | Patient | Normal range |
|------------------------------|---------|----------------|
| Hb (g/L) | 75 | 100-200 |
| Platelet ($\times 10^9/L$) | 246 | 140-450 |
| INR | 4.2 | 0.8-1.1 |
| APTT (seconds) | 87 | Control 33 sec |
| Fibrinogen (g/L) | 2.3 | 2-4 |

Urgent cerebral CT is done and shows an extensive frontotemporal subdural hematoma and intraventricular hemorrhage.

1. What is the most likely cause of hemorrhage in this patient?
 - A) Disseminated intravascular coagulation
 - B) Hemophilia
 - C) Vitamin K deficiency
 - D) Von Willebrand disease

2. Which one of the following is the most appropriate management strategy at this time?
 - A) 10-20 ml/Kg of plasma, vitamin K 1 mg po
 - B) 10-20 ml/Kg of plasma, vitamin K 1 mg IV
 - C) PCC (prothrombin complex concentrates) 25-50 U/kg, vitamin K 1 mg IV



- D) PCC 25-50 U/kg, vitamin K 1 mg po
3. How fast should you run the PCCs into the patient?
- A) A 25 U/kg dose (100 U) as fast as you can push in by syringe
 - B) A 25 U/kg dose (100 U) over 1 minute (25 U/kg/min)
 - C) A 25 U/kg dose (100 U) over 8 minutes (3 U/kg/min)
 - D) A 25 U/kg dose (100 U) over 30 minutes (0.8 U/kg/min)
4. The neurosurgeon wants to know when to expect that the INR will be normalized so they can proceed with decompressive craniectomy and emergency drainage of the subdural bleed.
- A) Collect the INR sample immediately after infusion, proceed with the procedure, and give additional doses of PCC if the post-infusion INR>1.5 and the patient has ongoing bleeding
 - B) Re-check the INR after PCCs to determine if additional doses are required before starting the procedure
 - C) The effect of PCCs will be seen immediately after administration in all patients and there is no need to re-check the INR
 - D) The effect of the treatment (PCCs and vitamin K) takes 6 hours to normalize the INR, so delay the procedure for 6 hours
5. Which of the following is an appropriate indication for PCC administration?
- A) Elective reversal of oral anticoagulant therapy before a scheduled invasive procedure.
 - B) Rapid reversal of warfarin therapy or vitamin K deficiency in patients exhibiting major bleeding.
 - C) Reversal of warfarin therapy or vitamin K deficiency in patients requiring a surgical procedure within 12 to 24 hours.
 - D) Treatment of INRs over 8 to 10 without bleeding or need for surgical intervention.

Case 2

A 15-year-old adolescent (45 kg) presents to the emergency department feeling unwell for 2 weeks with fever, myalgias, malaise and anorexia. The patient was seen earlier today by the pediatrician who noted jaundice and referred the patient to a tertiary care pediatric emergency. On physical exam, the patient has mild abdominal distention (query ascites) and splenomegaly. There is no bruising except at intravenous puncture sites. The laboratory investigations show markedly elevated liver enzymes (ALT 234 IU, N<40 IU), a bilirubin of 76 $\mu\text{mol/L}$ (N<20), albumin 24 g/L (N>35 g/L), INR of 1.8 (N<1.2), fibrinogen of 1.2 g/L (N>2 g/L). The platelet count is $65 \times 10^9/\text{L}$ (N> $150 \times 10^9/\text{L}$). The hepatologist has recommended an urgent liver biopsy to determine the cause and severity of the liver disease. The transjugular liver biopsy is scheduled in 4 hours.

6. Which one of the following is the most appropriate transfusion strategy for this patient in preparation for the liver biopsy?
- a. No need for transfusion at this time



- b. Transfuse 1000 IU of PCC and 4 grams of fibrinogen concentrate (or 10 units of cryoprecipitate in the UK)
 - c. Transfuse 1 adult dose of platelets
 - d. Transfuse 3 units (15 ml/kg) of plasma to ensure INR is <1.5 before the procedure
7. The radiologist has requested that the INR be corrected to 1.2 or less. What should you do?
- a. Call your staff physician and get direction on how to proceed
 - b. Delay the procedure for 1 day and see if the next radiologist will do it without INR correction
 - c. Discuss with the radiologist performing the procedure, the risks of plasma, explain why plasma is unlikely to lower the INR, and alert them to the 2019 Society for Interventional Radiology Guidelines
 - d. Transfuse 3 units plasma in an effort to lower the INR and get the liver biopsy completed
8. The patient subsequently develops a variceal bleed with hypotensive shock. Her INR is now 3.4 (N<1.2) and fibrinogen is 1.6 g/L (N>2). You should:
- A. Transfuse 1 unit of plasma and repeat INR
 - B. Transfuse 5-10 mL/kg of plasma (2 units or 500 mL)
 - C. Transfuse 15 ml/kg of plasma (3 units or 750 mL)
 - D. Transfuse 4 grams of fibrinogen concentrate (or 10 units of cryoprecipitate in the UK)

Case 3a

A 16-year-old patient (65 kg) is admitted to the ICU from the ER with endocarditis within 4 hours of presenting to the hospital. The patient is not bleeding, is intubated for airway protection and on two inotropes. The patient's temperature is 39° C. Blood work is as follows: Hemoglobin 108 g/L, platelet count $18 \times 10^9/L$ (N>150x10⁹/L), INR 1.6 (N<1.2), aPTT 42 s (N<36 s), and fibrinogen 1.3 g/L (N>2.0 g/L). The peripheral blood smear shows occasional fragments (schistocytes). Blood cultures are positive for gram-positive organism in 2/2 bottles; final culture results are pending. You make the correct diagnosis of sepsis related DIC. The patient is not bleeding and no procedures are planned in the next 6 hours.

9. Which one of the following is the most appropriate transfusion strategy for this patient?
- a. No transfusion indicated at this time
 - b. Transfuse 1 adult dose of platelets
 - c. Transfuse 1 adult dose of platelets and 4 units of plasma
 - d. Transfuse 1 adult dose of platelets and 4 grams of fibrinogen concentrate (or 10 units of cryoprecipitate)

Case 3b

A 17 year old patient is seen in the ER with profuse vaginal bleeding and hemorrhagic shock 6 hours after a pregnancy termination. The patient's BP is 90/50, HR 112, temperature is 38.1° C. Blood work is as follows: Hemoglobin 65 g/L, platelet count $28 \times 10^9/L$ (N>150x10⁹/L), INR 1.4 (N<1.2), aPTT 40s (N<36s), and fibrinogen 1.1 g/L (N>2.0). Ultrasound shows retained products of conception. She is hemodynamically unstable and you have ordered 2 units of uncrossmatched (you decide it would be imprudent to wait 60 minutes for crossmatched blood) O D-negative and K-negative red cells.



10. Which one of the following is the most appropriate transfusion strategy for this patient in addition to transfusing red blood cells?
- No transfusion indicated at this time
 - Transfuse 1 adult dose of platelets
 - Transfuse 1 adult dose of platelets and 4 units of plasma
 - Transfuse 1 pool of platelets and 4 grams of fibrinogen concentrate (or 10 units of cryoprecipitate)

Case 3c

A 14-year-old patient (weight 55 kg) is admitted to the hematology service following a diagnosis of acute promyelocytic leukemia (APL). APL is associated with a high rate of early hemorrhagic deaths from ICH. The patient is afebrile with stable vital signs and the patient's only complaints are fatigue and a petechial rash on their legs. Blood work is as follows: Hemoglobin 74 g/L, platelet count 18, WBC 63, INR 1.4, aPTT 39 s, and fibrinogen 0.9 g/L. The patient is to start emergency induction chemotherapy tonight, and is not bleeding.

11. Which one of the following is the most appropriate transfusion strategy for this patient?
- No transfusion indicated at this time
 - Transfuse 1 unit RBC and 1 dose of platelets
 - Transfuse 1 unit RBC and 4 grams of fibrinogen (or 10 units of cryoprecipitate)
 - Transfuse 1 adult dose of platelets and 4 grams of fibrinogen (or 10 units of cryoprecipitate)

Case 4

You are providing the anesthetic for an 11-year-old undergoing scoliosis surgery with a pre-op weight of 39 kg. Pre-op blood work: hemoglobin 118 g/L, MCV 78, Platelet count 288. No INR was done pre-op as the bleeding assessment tool (bleeding questionnaire eg. MCMDM1) was negative for a bleeding history. At the 2 hour mark of the surgery, approximately 2500 mL of blood loss is recorded and you have transfused 3 units of red blood cells. STAT blood work reveals: hemoglobin 78 g/L, PLT count 134 (N>150), INR 2.1 (<1.2), PTT 45 (N<36) and fibrinogen 1.3 (N>2). The surgeon expects to lose another 1000 mL over the next hour. You have not administered any plasma, platelets or fibrinogen yet.

12. Which one of the following is the most appropriate component strategy for this patient?
- Transfuse 1 dose platelets (10-15 mL/kg)
 - Transfuse 2000 IU of PCC
 - Transfuse 3 units (15 mL/kg) of plasma and 2 grams of fibrinogen (50 mg/kg) or 5 units of cryoprecipitate
 - Transfuse or 2 grams of fibrinogen or 5 units of cryoprecipitate

Case 5

A 4-year-old boy known for liver cirrhosis is admitted with fever and peripheral edema with abdominal distension and pain. He is found to have an albumin level of 20 g/L with abdominal imaging showing ascites. Vital signs show: T 38.9, RR 30, HR 159, sats 99% on room air, BP 81/43. Weight 16 kg. Blood cultures are drawn. An urgent diagnostic paracentesis is performed.



13. What is your treatment plan?
- A. Antibiotics alone
 - B. Bolus of crystalloid + antibiotics
 - C. Transfuse 5% albumin + antibiotics
 - D. Transfuse 25% albumin + antibiotics
14. Which of the following are known indications for albumin use?
- A. Large volume paracentesis
 - B. Resuscitation
 - C. Severe burns
 - D. Severe hypoalbuminemia

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