ORBCoN
Ontario Regional Blood Coordinating Network

Inspiring and facilitating best transfusion practices in Ontario.

Welcome

ORBCoN Ontario Regional Blood Coordinating Network

TRANSFUSIONISTS TALK

bloody easy

TRANSFUSION MADE BLOODY EASY

March 25, 2026

9:30 to 10:30 a.m. (EDT) and 2:30 to 3:30 p.m. (EDT)

Major Transfusion Reactions:

Keep Calm & Carry On Problem Solving …

Donna Berta RN, BScN, Clinical Project Coordinator – Nursing, ORBCoN

Land Acknowledgement

As we gather, we begin by acknowledging that this virtual event is hosted from the traditional territories of the Mississauga and Haudenosaunee nations, and within the lands protected by the “Dish with One Spoon” wampum agreement.

Please acknowledge and reflect on the land where you are joining.

Disclosure

This video conferenced event will be recorded, archived, and excerpts may be used for educational purposes.

By participating, you indicate your consent to recording, archiving and use for educational purposes.

Speaker Disclosure

- No commercial product conflicts of interest to declare.

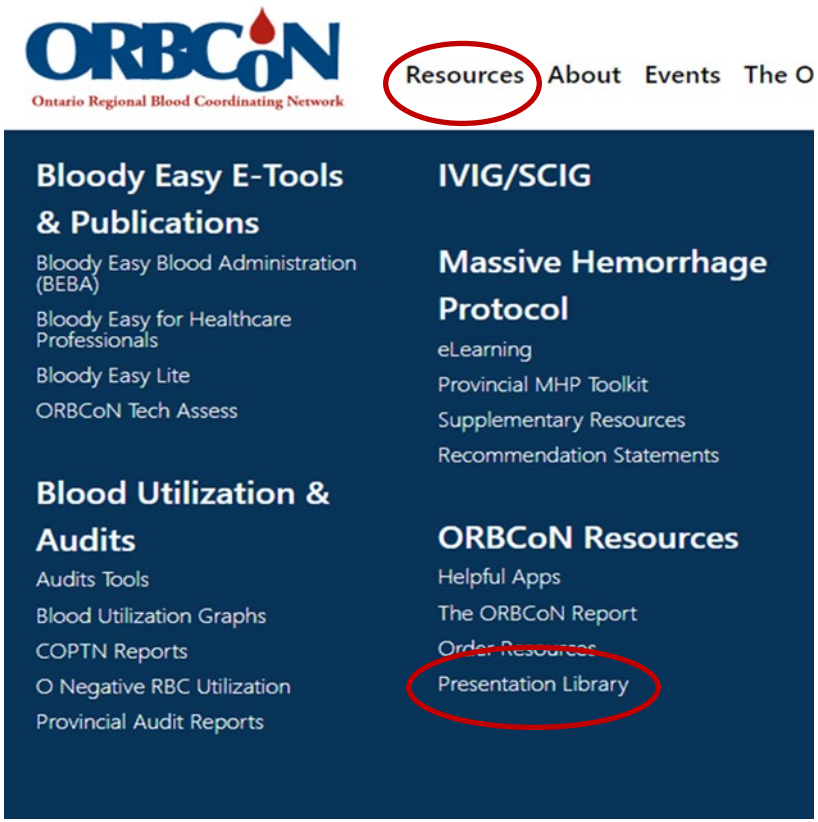
- Canadian Society for Transfusion Medicine, Standards Committee, member.
- Ontario Immune Globulin Advisory Panel, member.
- Ontario Transfusion Transmitted Injuries Surveillance System, Education Committee, member.

- Some information is shared for your interest & reference.
- All patient case information is fictitious, fabricated for this learning opportunity.

Presentation Information

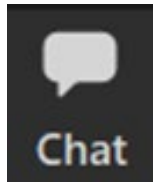
This presentation is being recorded.
As of April 6, 2026, slides & recording will be posted on www.transfusionontario.org.

- Click Resources tab
- Select Presentation Library
- Scroll to Transfusionists Talk



Questions for Speaker

During the presentation, enter comments & questions via the Zoom **Chat** function.



If there are more questions than time permits, answers will be posted with the event recording at www.transfusionontario.org

Practice Polling Question

What is your current role?

a) Front Line Nurse (RN, RPN).
b) Nursing Educator.
c) Transfusion Medicine Lab Technologist.
d) Other.

Transfusion Knowledge Question 1 - Pre

Characteristics of an acute hemolytic transfusion reaction (AHTR) include (select all applicable):

a) All AHTRs are preventable, the cause is always an error.
b) The first sign of an AHTR is often fever (+/- chills, rigors).
c) One of the risks of receiving uncrossmatched blood is AHTR.
d) For AHTR, a key management strategy is aggressive hydration, while avoiding volume overload; maintain urine output > 1 mL/kg/hr.

Transfusion Knowledge Question 2 - Pre

Transfusion Associated Circulatory Overload (TACO) symptomatology includes (select one, most appropriate response):

a) Respiratory distress (including decreased oxygen saturation), and hypotension.
b) Respiratory distress (including decreased oxygen saturation), and hypertension.
c) Respiratory distress (including decreased oxygen saturation), hypotension, and possibly fever.
d) Respiratory distress (including decreased oxygen saturation), hypertension, and possibly fever.

Major Transfusion Reactions: Keep Calm & Carry On Problem Solving …

Event Registration

Which major transfusion reaction would you prefer to learn about?

Acute Hemolytic Transfusion Reaction (AHTR)
Transfusion Associated Circulatory Overload (TACO)

Learning Objectives

By engaging in this learning, participants will be able to:

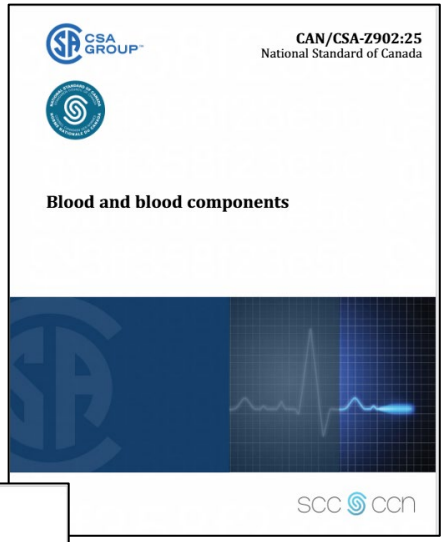
1. Understand the etiology, pathophysiology, and symptomatology of AHTR and TACO transfusion reactions.

2. Define nursing actions to care for patients experiencing AHTR and TACO transfusion reactions.

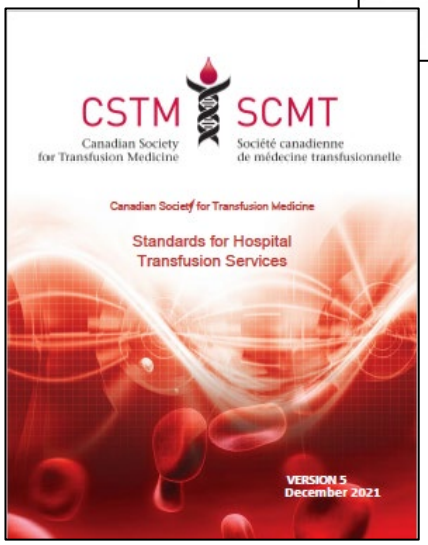
3. Apply the discussion of transfusionists questions about AHTR and TACO transfusion reactions to their practice.

Transfusion Reactions: Standards/Requirements (1)

Canadian Standards Association Blood and blood components CAN/CSA Z902:25



Accreditation Canada Transfusion Services Standard (2018)



Canadian Society for Transfusion Medicine Standards for Hospital Transfusion Services Version 5 (revised December 2022)

Accreditation Canada Diagnostics Medical Laboratory Accreditation Requirements version 9 June 2023

Transfusion Reactions: Standards/Requirements (2)

CSTM Clauses Pertinent to Direct Patient Care (Clause 7.2 Adverse Reactions p. 69-73)

- 7.2.1.1 Policies, processes and procedures shall be established for documentation, reporting, investigation, and follow-up of all adverse reactions involving blood components and blood products. 1.4/ 14.8
- 7.2.1.2 Policies, processes and procedures shall be established to manage potential adverse reactions that may occur during the transfusion. 17.6.3/ 17.6.4
- 7.2.2.1 A list of common signs and symptoms of suspected adverse reactions shall be included in both the nursing and TS manuals. 18.2.1
- 7.2.2.2 All adverse reactions shall be reported to the TS. Serious and unexpected adverse reactions shall be reported immediately. Unexpected reactions include any for which reaction signs and symptoms are not listed in the manufacturer's Circular of Information or product insert. Serious reactions include, but are not limited to: 18.2.1

a. immediate hemolytic reactions
b. delayed hemolysis
c. transfusion-related acute lung injury (TRALI)
d. transfusion acute circulatory overload (TACO)
e. systemic allergic reactions, including anaphylactic shock
f. bacterial sepsis
g. other transfusion-transmissible infections
h. transfusion-associated graft versus host disease (TA-GVHD)
i. post-transfusion purpura
j. other serious reactions
k. deaths

Major Transfusion Reactions: Keep Calm & Carry On Problem Solving …

Complex, overlapping, often evolving signs & symptoms.

Obscured by factors related to underlying medical conditions.

Focus on the clinical problem, a change from baseline; initial recognition & patient care.

Presenting signs & symptoms as well as severity (think ABC) guide the process.

Signs & symptoms are not specific for each type of reaction.
All possible signs & symptoms do not present with every reaction.

Transfusion Reactions: Signs & Symptoms (1)

* Generalized and extrapolated from TTISS-ON Acute Transfusion Reaction Chart

Vital Sign	* Significant Value
Temperature (^{O} C)	≥ 38^{0} C ***and*** increase of at least 1^{0} C from pre-transfusion
BP (mmHg) Systolic Blood Pressure (SBP)	Hypotension: SBP ≤ 80 mmHg ***and*** From pre-transfusion SBP ≥ 30 mmHg absolute decrease ***or*** 15 to 25% relative decrease
Pulse (per minute)	Pulse > 100 ***and*** From pre-transfusion, 15 to 25% relative increase
Respirations (per minute)	Respirations > 20 ***and*** From pre-transfusion, 15 to 25% relative increase
Oxygen Saturation (SpO_2) (%)	≤ 90% ***or*** decrease of at least 5% from pre-transfusion SpO_2

Transfusion Reactions
Signs & Symptoms (2)

- **Pre-transfusion** symptoms related to the patient's underlying medical condition (e.g., fever re: severe neutropenia, hypotension re: acute bleeding) are ***NOT*** contraindications to blood transfusion.
- Monitor the patient very closely with more frequent vital signs and assessments to identify any subtle change.
- If feasible, a more cautious, slower rate of transfusion may be prudent.

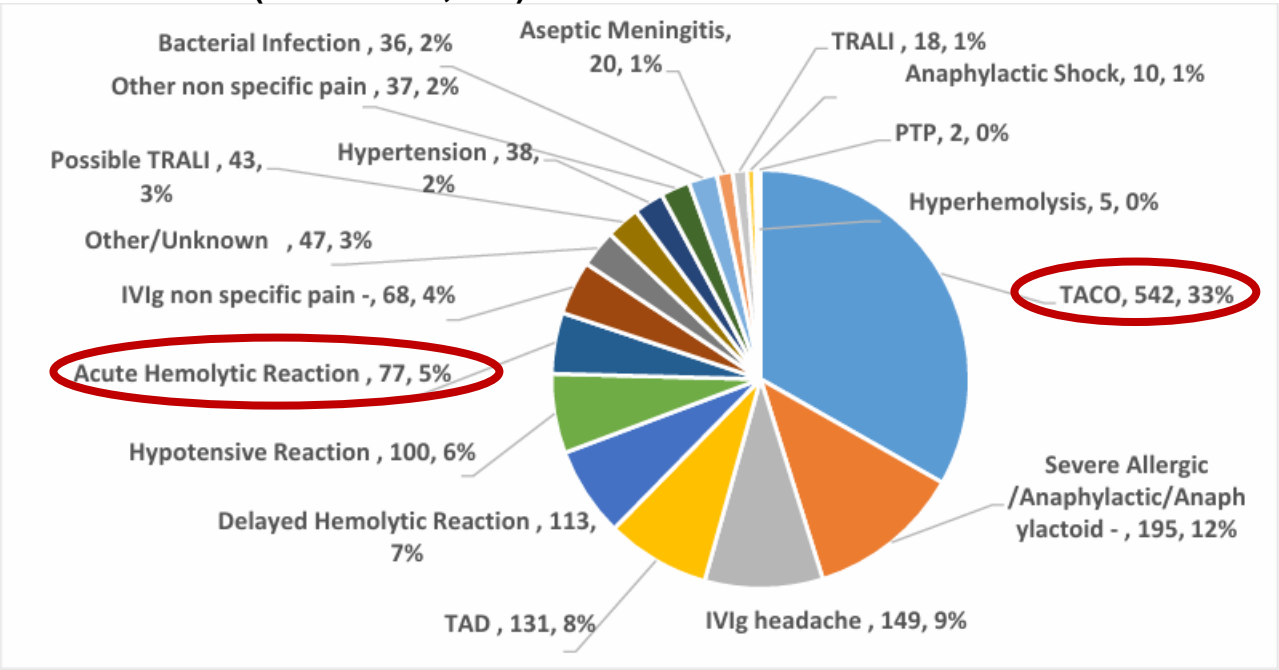
- For early detection, as appropriate the patient should be asked to report ASAP any symptoms which develop during or following completion of the transfusion.

Transfusion Reactions Ontario Prevalence

TTISS-ON 2019-2023 Report

Voluntary reporting by 159 ON hospitals that transfuse blood,

Figure 1: Reaction Type (N, %) of Blood Component & Product Major Acute Transfusion Reactions Reported 2019-2023 (total N = 1,631)



Key Themes:

- TACO was the most common (33%) moderate-to-severe reaction reported.
- TACO & AHTR are highly associated with negative patient outcomes. A significant portion (50% & 40%, respectively) required considerable medical intervention and/or were life-threatening, based on their adjudication.

AHTR (1): Etiology & Pathophysiology

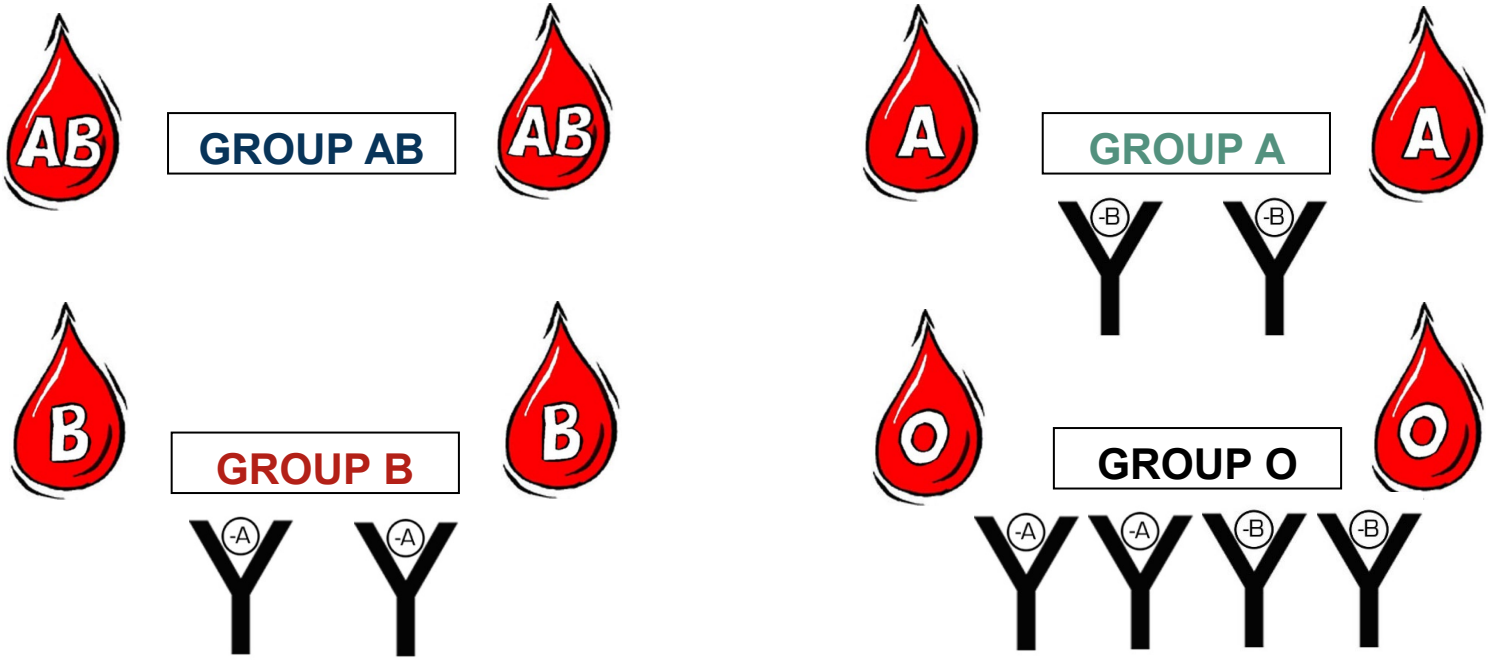
1. ABO-incompatibility (wrong blood transfused)

- Preventable, an error was made.

- Mislabelling of the group & screen blood sample collected from the patient.
- Clerical error in TML (pre-transfusion testing or issuing).
- Misidentification of the patient or the blood at the time of blood administration.

- Severity is related to the amount of incompatible blood transfused.

AHTR (2): Etiology & Pathophysiology
ABO Blood Group System Review



ABO Antibodies (anti-A, anti-B; Isohemagglutinins)

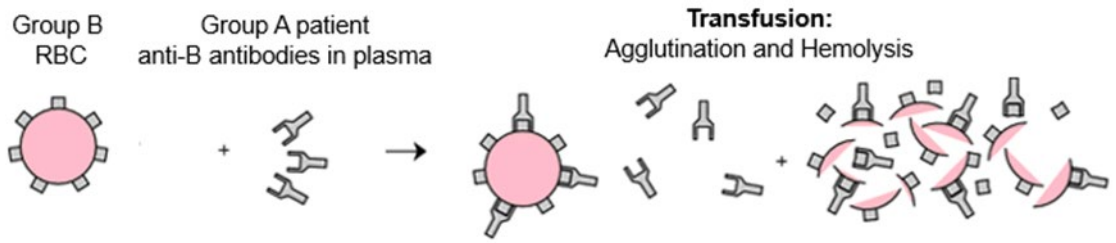
- are naturally acquired, starting at 4 months of age.

If, the antigen is present on the surface of the red blood cells,
then the corresponding antibody will NOT be in the plasma.
If, the antigen is NOT present on the surface of the red blood cells,
then the corresponding antibody will be in the plasma.

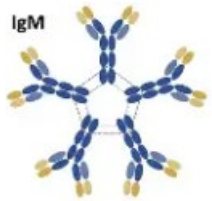
NOTE: ABO group specific RBCs require a second, confirmation ABO blood group determination.

AHTR (3): Etiology & Pathophysiology ABO-incompatibility Review

RBC unit Group B transfused to patient Group A (microscope, schematic)



- Anti-A & anti-B antibodies are primarily IgM; react at body temperature.
- IgM composition: five individual antibody "monomers" bound together by disulfide bonds. Each IgM has a total of 10 places to bind antigen.



- Antibody "binding" to antigen of transfused RBC activates complement system.
- Cascade of events follow; lysis/breakdown of membrane of red blood cells.
- Free hemoglobin is released into the intravascular space (the circulation), leading to end-organ damage (possible acute tubular necrosis, renal failure).
- Complement anaphylotoxins trigger the inflammatory response (proinflammatory effects); Possible disseminated intravascular coagulopathy (DIC).

Reference: Panch SR, Montemayor C; Rossi's Principles of Transfusion Medicine, Ch 47.

AHTR Patient Case 1 Question

Fred is a charming 86-year-old. He underwent surgical repair of a hip fracture; post-op Day 1 Hb is 68 g/L; he is hypotensive & unable to ambulate with the physiotherapist. A 1-unit RBC transfusion is ordered. As you are drawing his group & screen blood sample, he tells you he has had transfusions in the past; when he was in an MVA at age 45 years & when he had heart bypass surgery 20 years ago. Fred tells you he was told he needs “special blood”.

Your next action is:

a) Smile & nod, Fred is indeed charming.

b) Call TML & provide the information Fred has conveyed to you.

c) Ask Fred & his son, who is visiting just now, if they recall the name of the hospital where Fred had his heart surgery.

AHTR (4): Etiology & Pathophysiology cont'd

2. Red Blood Cell Alloantibody(ies) (non-ABO)

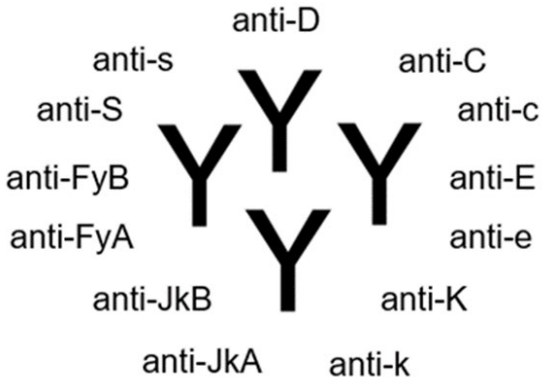
- Many antigens (as well as ABO) on the surface of human red blood cells.
- Alloantibody: antibody formed in response to exposure to a blood group antigen that is not present on that person's red blood cells.
- Patient can form antibody(ies) related to a transfusion or pregnancy.
- Some people are more likely to form antibodies e.g., Sickle Cell Disease.

- If subsequent RBC transfusion, AHTR may result if
  - Red blood cell alloantibody(ies) in the patient's plasma decrease to lower than the level detected by the antibody screen test.
  - Clerical error during the antibody screen testing.
  - Antibody screen test reagents (laboratory assays) have some limitations; failure to detect a red blood cell antibody can occur.
  - Uncrossmatched blood is transfused to a patient who has alloantibody(ies).

AHTR (5): Etiology & Pathophysiology Clinically Significant Antibodies Review

- If exposed to “foreign” red blood cell antigens via transfusion or pregnancy, antibodies against these non-ABO antigens may be formed. Risk is 1 in 13, though majority of these antibodies are not clinically significant.

- Clinically Significant Antibodies: If a patient has formed any of these antibodies, then is transfused an RBC unit that has the corresponding antigen on those red blood cells, hemolysis can occur.



- “Screen” part of Group & Screen test is an antibody screen (detection) test. The screen determines if there any antibodies in this patient’s plasma that could cause hemolysis when mixed with red blood cells from a blood donor.
- If clinically significant antibody(ies) are identified, compatible RBC units for transfusion must be negative for corresponding antigen(s) (e.g., anti-c & anti-FyA identified in the plasma of patient blood sample, then RBC units for transfusion must be antigens c- & FyA-).

- If clinically significant antibody identified, patient should be counselled, provided “antibody card” or information; option medical alert bracelet.

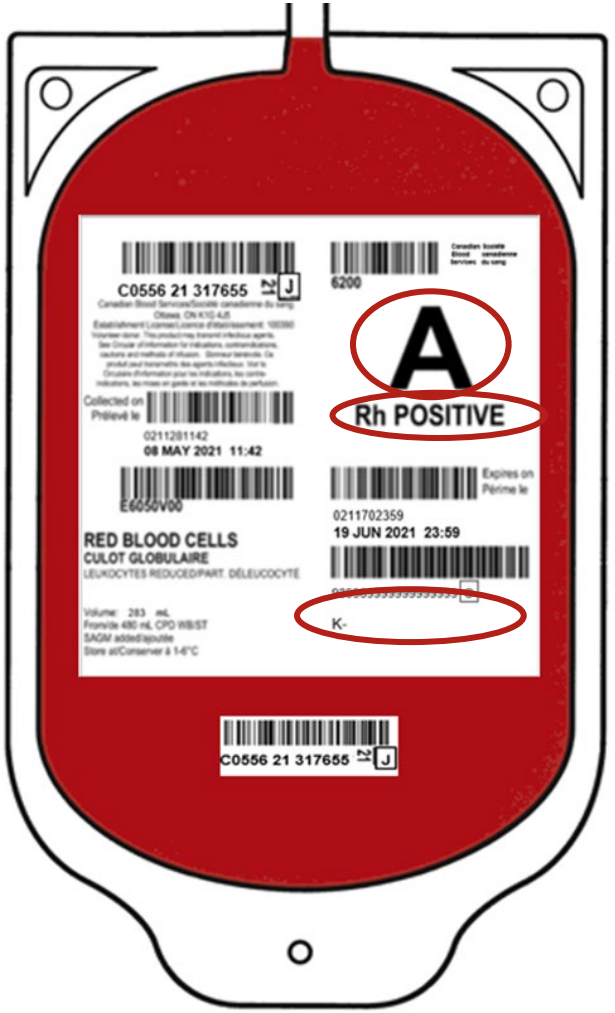
AHTR (6): Etiology & Pathophysiology
CBS Label: Antigen Negative RBC

Canadian Blood Services (CBS) performs a group & screen test on each blood donor as part of their procedures.

Phenotype:

- Refers to which antigens are detectable on the red blood cells.
- Indicated on the CBS label if the donor is antigen negative (the red blood cells in that unit do not have that antigen on their surface and the unit would be compatible for a patient with that antibody).

NOTE: This RBC is Kell negative (K-). For patients with child-bearing potential, who require transfusion providing K- RBCs decreases the incidence of K-immunized pregnancies (and potential HDFN). In Canada this is established practice, except in emergency transfusion scenarios.



AHTR (7): Etiology & Pathophysiology Uncrossmatched Blood

(Ringel, 2022; Fiorellino, 2018)

- Crossmatch: procedure to detect incompatibilities between one person's plasma (patient) against another person's red blood cells (donor blood); Completing group & screen test, crossmatch: 45 to 60 minutes.
- Uncrossmatched blood: used in life-threatening bleeding scenarios where waiting for crossmatched blood could risk the patient's life, i.e., massive hemorrhage protocol (MHP).
- AHTR case reports in MHP scenarios are rare (though some severe).
- From 2018 data, AHTR probability is less than 1 in 1000 MHP patients.
- Possible explanation:
    - Some transfused incompatible blood is lost due to ongoing bleeding.
    - Alloantibody concentration is decreased by the blood loss.
    - Immune system response may be "paralyzed" by the trauma & hemorrhagic shock
- In MHP scenarios:
    - Collect group & screen sample ASAP (sample is the patient's blood verses the transfused blood).
    - As long as bleeding has not stopped, risk of AHTR appears to be low.

AHTR (8): Etiology & Pathophysiology cont'd

3. Group O platelets transfused to non-group O patient

- Uncommon, rare AHTR.
- Group O platelets are suspended in group O plasma.
- Anti-A & anti-B, in the group O plasma, can lead to hemolysis of red blood cells with the A or B antigen on their surface.

- Some TMLs titre anti-A & anti-B in all group O platelets; low titre for out of group transfusions.
- Since 2022 Canadian Blood Services (CBS) modified platelet manufacturing.
- Platelets are suspended in 60% Platelet Additive Solution (PAS-E) & only 40% plasma.
- The reduced volume of plasma in these platelets may further reduce the risk of ABO hemolysis.

AHTR (9): Etiology & Pathophysiology cont'd

4. Non-immune

- Lysis/breakdown of red blood cell membrane; free hemoglobin is released into the intravascular space.

- RBC transfusion concurrently with hypo-osmolar solutions.

- Thermal injury:
  - transfusion of accidentally frozen RBCs.
  - transfusion of overheated RBCs (e.g., device malfunction).

- Mechanical injury:
  - pressurized or rapid transfusion through small gauge needle.
  - device malfunction.

AHTR Patient Case 2 Question

Wilma, a 50-year-old admitted 5 days ago with a GI bleed, was transferred to the Medical Unit from ICU today. She required multiple transfusions the day she was admitted. Her Hb has been 72-68 g/L the past 3 days. A 1-unit RBC transfusion has been ordered & initiated.

Vital Signs	Temperature (°C)	BP (mmHg)	Pulse (per minute)	Respirations (per minute)	Oxygen Saturation (%)
Baseline (20 min. pre-transfusion)	36.7	118/80	80	16	97
15 min. after start of transfusion	**38.7**	112/76	88	16	97

Wilma also says she feels cold, not quite right.

Is this likely an AHTR?

a) Yes.

b) Maybe, needs to be ruled in/out.

c) No.

AHTR (10): Symptomatology

- Signs & symptoms may occur within minutes of start of transfusion, up to 24 hours post-transfusion.
- Fever may be the initial & only sign (+/- chills, rigors).
- Hemoglobinuria: free hemoglobin in the urine causing dark brown, reddish colour & related to intravascular red blood cell lysis.
  (hematuria: whole red blood cells in the urine causing pink, red colour & indicative of urinary tract bleeding)
- Traditional triad: fever, flank pain, reddish urine
- Less common:
  - Hypotension, Tachycardia
  - Respiratory distress, Dyspnea
  - Pain (infusion site, flank, back)
  - Anxiety, verbalizing “something is wrong”
  - Nausea/Vomiting
  - Oliguria, Renal Failure
  - Diffuse Bleeding, Disseminated Intravascular Coagulation (DIC)

AHTR (11): Patient Care

The following actions should be taken IMMEDIATELY if a possible acute transfusion reaction is suspected

1. Stop the transfusion
2. Maintain IV access:
   - Either flush IV site with 0.9% sodium chloride flush syringes and then infuse an IV line with any IV solution TKVO
   - Or infuse 0.9% sodium chloride IV line TKVO

   [2CSA(11.4.11);3CSTM(5.9.4.4);11AC(22.6)]
3. Check vital signs
4. Verify that patient armband identification matches the transfusion label or tag
5. Verify that the blood component unit number/ blood product lot number matches the transfusion label or tag
6. Notify the prescriber but remain with the patient
7. Provide patient care as ordered by the prescriber
8. Report every reaction to Blood Bank/TML. If clarification is needed call Blood Bank/TML.

   [2CSA(18.1.1,18.2.1);3CSTM(5.9.4.11,7.2.1);11AC(26.0-1)]
9. Document the possible reaction on the patient's health record

BEBA v3 p. 61

Always STOP the transfusion

Maintain IV access.

Remain at the patient's bedside.

Use critical thinking skills to assess

- get more information (# 3)
- rule out what can be ruled out (# 4 & 5).

Confer with the prescriber.

Implement the plan & reassess.

Inform TML, can help to ensure necessary testing is carried out.

Document per hospital policy/procedure .

AHTR (12): Patient Care cont'd

- If AHTR is suspected, **DO NOT** re-start the transfusion.
- Re-confirm patient armband identification & CBS label unit number matches that on the transfusion label/tag.
- Closely monitor vital signs (at minimum, q 15 minutes) & for evolving symptom: hypotension, tachycardia, respiratory distress, flank/back pain, urine colour.
- Per Prescriber order:
    - Aggressive hydration while avoiding volume overload, maintain urine output > 1 mL/kg/hr., supportive care.
    - **Blood work** (not from infusion site): TML Clerical Check - right patient, right blood; Testing on pre-transfusion sample & possible reaction sample; Group & Screen & Direct Antiglobulin Test (DAT)
      (DAT to determine if patient's red blood cells are coated with antibody, complement, or both; does not prove or disprove AHTR; TML will further evaluate positive DAT)
      Hemolysis work up
    - First post-transfusion void, urine sample for urinalysis (hemoglobinuria).

AHTR (13): Patient Care cont'd

- Return residual blood and tubing (clamped) to TML.
- Supportive Care
  - IV fluid, renal sparing vasopressors, oxygen, respiratory support
  - ICU, continuous monitoring
- Hemolysis work up:
  - CBC & Reticulocyte Count: decreased hemoglobin
  - Blood film: red cell agglutinates, spherocytes
  - Haptoglobin: decreased
  - Bilirubin, lactate dehydrogenase (LDH), aspartate aminotransferase (AST): elevated
- As indicated assess & treat:
  - Acute kidney injury (AKI): creatinine, electrolytes; Nephrology consult.
  - DIC: INR, PTT, fibrinogen, D-dimer; blood support to maintain minimal platelet, INR, & fibrinogen levels.

AHTR (14): Prevention

- Ensure transfusion indication is appropriate; consider alternatives as appropriate.

- Group & Screen Blood Sample Collection
  - Patient must be wearing an identification armband.
  - Immediately after blood sample collection, label tube at patient's bedside.
  - Electronic (verses manual) patient identification for sample collection reduced but did not eliminate wrong blood in tube errors (potential for ABO-incompatible transfusion); workarounds were identified. (Kaufman, 2019)

Patient Identification	Wrong Blood In Tube Errors
Manual	1 in 3,046 samples collected
Electronic/Scanning	1 in 14,606 samples collected

- UK Serious Hazards of Transfusion (SHOT) Annual Report: "near-miss" instances 79 times more common than actual ABO incompatible transfusion.

AHTR (15): Prevention

- Wrong ABO blood group/ABO-incompatible transfusion

Time Frame	Risk
2016 (BE 4)	1 in 40,000 per unit of RBC
2022 (BE 5.1)	1 in 354,000 per RBC transfusion episode

- With Pre-transfusion testing – ask patient/family:
  - Have they had previous transfusion?
  - If so, did they experience any side effects/reactions; was it suggested they carry blood antibody information?
  - All information obtained should be relayed to TML for follow up

    (In Canada: Sickle Cell Disease patients antibody registry via CBS).
- Blood Administration
  - Patient must be wearing an identification armband.
  - Unequivocal patient identification **AND** blood identification.
  - All checks at the patient's bedside.
  - Electronic/Scanning devices – per policy & procedure; avoid workarounds.

Transfusion Associated Circulatory Overload (TACO)

TACO Patient Case 1 Question 1

Barney, a 74-year-old admitted 3 days ago with pneumonia is improving with IV antibiotic therapy. His health history is significant for medically managed congestive heart failure (including daily furosemide), type II diabetes, & osteoarthritis. He was hypotensive on admission; his furosemide has been on hold. Today his Hb is 74 g/L; 1-unit RBC transfusion, infuse over 1-2 hours ordered. At the end of transfusion, Barney says he feels short of breath. On chest auscultation, RN identifies new bilateral crackles.

Vital Signs	Temperature (°C)	BP (mmHg)	Pulse (per minute)	Respirations (per minute)	Oxygen Saturation (%)
Baseline (20 min. pre-transfusion)	36.7	116/78	76	20	95
End of transfusion	**38.1**	**160/86**	96	**32**	**88**

Is this likely TACO?

a) Yes.

b) Maybe, needs to be ruled in/out.

c) No.

TACO Patient Case 1 Question 2

Barney, a 74-year-old admitted 3 days ago with pneumonia is improving with IV antibiotic therapy. His health history is significant for medically managed congestive heart failure (including daily furosemide), type II diabetes, & osteoarthritis. He was hypotensive on admission; his furosemide has been on hold. Today his Hb is 74 g/L; 1-unit RBC transfusion, infuse over 1-2 hours ordered.

What are factors (risks) associated with TACO (select all that apply):

a) 74-year-old
b) Congestive heart failure
c) Requires daily diuretic
d) Recent pneumonia
e) Potential positive fluid balance (furosemide on hold, receiving IV meds)
f) RBC transfusion
g) Rapid infusion rate

TACO (1): Etiology & Pathophysiology

- Risk: 1 in 100 transfusion episodes.
- **TACO: leading cause of transfusion related morbidity & mortality.**

- Occurs with any blood component/product; more often RBC transfusion.

- TACO results from pulmonary edema caused by increased hydrostatic pulmonary capillary pressure.
- Blood hydrostatic pressure represents a specific pushing force created by pumping action of the heart & the volume of blood contained within vessels.
- Unclear mechanism by which blood products increase intravascular pressure (e.g., inflammatory process, endothelial damage, distinct features of pulmonary vasculature).

- Pathogenesis incompletely understood.

Reference: Bulle et al., The Recipe for TACO, 2022

TACO (2): Etiology & Pathophysiology cont'd

- Two hit model suggested.
- First Hit: existing disease/comorbidity that limits patient's ability to compensate for increase in vascular volume (e.g., cardiac, renal factors).
- Second Hit: the transfusion (e.g., volume & rate of transfusion, viscosity, colloid osmotic pressure, proinflammatory mediators).
- About 1/3 of TACO reactions include fever; unclear why fever in some patients & not others; suggested association between volume stress & fever.

TACO (3): Etiology & Pathophysiology cont'd

Patient risk factors (First Hit) **CRAP**

- Cardiorespiratory Dysfunction:
  myocardial infarction, congestive heart failure, left ventricular dysfunction, chronic diuretic therapy

- Renal Dysfunction:
  elevated creatinine; dialysis therapy

- Age – Extremes of:
  over 60 years, neonates & young children (small size)

- Positive Fluid Balance:
  imbalance of intake & output; weight increase

TACO Patient Case 1 Question 3

At the end of transfusion, Barney says he feels short of breath. On chest auscultation, RN identifies new bilateral crackles.

Vital Signs	Temperature (°C)	BP (mmHg)	Pulse (per minute)	Respirations (per minute)	Oxygen Saturation (%)
Baseline (20 min. pre-transfusion)	36.7	116/78	76	20	95
15 min. after start of transfusion	**38.1**	**160/86**	96	**32**	**88**

Which of Barney's signs & symptoms support TACO diagnosis (select all that apply):

a) Fever
b) Hypertension
c) Widened pulse pressure
d) Increased respiratory rate
e) Decreased oxygen saturation
f) New bilateral crackles on chest auscultation

TACO (4): Symptomatology

2018 TACO definition (International Society of Blood Transfusion, International Haemovigilance Network, Association for the Advancement of Blood & Biotherapies)

Minimum of 3 Criteria

- Onset: during or up to 12 hours following transfusion
- And: 1 or more required (NOTE: without other cause, new worsening)

Respiratory Distress	Pulmonary Edema
Acute or Worsening	Physical: Left heart findings – crackles, orthopnea, cough, S3 heart sound, frothing/pink sputum
Tachypnea, Dyspnea, Cyanosis, ↓Oxygen Saturation (%), Bronchospasm, Wheezing	Radiography: bilateral effusions, widened vascular pedicle, lobar vessel enlargement, peri-bronchial cuffing, Kerley lines, alveolar edema, enlarged cardiac silhouette

- And: 1 or more required (NOTE: without other cause, new worsening)

Cardiovascular Changes	Fluid Overload	Biomarkers: Markers of hydrostatic pressure, noncritically ill; Klanderman 2019
Tachycardia, Widened pulse pressure, ↑BP (if cardiogenic shock, ↓BP)	Positive fluid balance ↑ Weight	BNP (B-type natriuretic peptide) TACO unlikely: post-transfusion < 300 pg/mL
JVP distention / ↑ CVP Peripheral edema	Diuretic response Dialytic response	NT-proBNP (N-terminal prohormone cleavage fragment of BNP) Favours TACO: post/pretransfusion ratio > 1.5 TACO unlikely: post-transfusion < 2000 pg/mL

TACO (5): Patient Care

The following actions should be taken IMMEDIATELY if a possible acute transfusion reaction is suspected

1. Stop the transfusion
2. Maintain IV access:
   - Either flush IV site with 0.9% sodium chloride flush syringes and then infuse an IV line with any IV solution TKVO
   - Or infuse 0.9% sodium chloride IV line TKVO

   [2CSA(11.4.11);3CSTM(5.9.4.4);11AC(22.6)]
3. Check vital signs
4. Verify that patient armband identification matches the transfusion label or tag
5. Verify that the blood component unit number/ blood product lot number matches the transfusion label or tag
6. Notify the prescriber but remain with the patient
7. Provide patient care as ordered by the prescriber
8. Report every reaction to Blood Bank/TML. If clarification is needed call Blood Bank/TML.

   [2CSA(18.1.1,18.2.1);3CSTM(5.9.4.11,7.2.1);11AC(26.0-1)]
9. Document the possible reaction on the patient's health record

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<u>Always STOP the transfusion</u>
Maintain IV access. *<u>Infusion rate TKVO</u>*.
Remain at the patient's bedside.

Use critical thinking skills to assess
- get more information (# 3)
- rule out what can be ruled out (# 4 & 5).

Confer with the prescriber.
Implement the plan & reassess.
Inform TML, can help to ensure necessary testing is carried out.

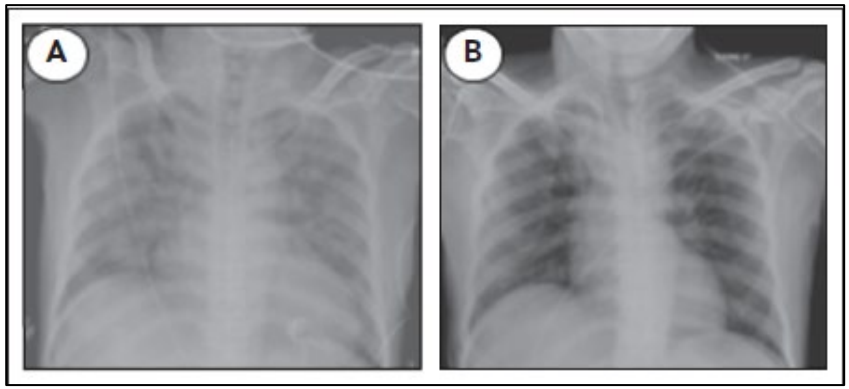
Document per hospital policy/procedure .

TACO (6): Patient Care cont'd

- Patient in Fowler's position.
- Oxygen via nasal cannula at 2 L/min; titrate to maintain a saturation of greater than 90% (per local hospital policy & procedure or as Prescriber orders)
- Closely monitor vital signs (at minimum, q 15 minutes); auscultate chest; monitor respiratory distress for progression (continuous oxygen saturation device); if fever, monitor for progression; monitor for evolving symptom.
- Per Prescriber order:
    - IV Diuretic & document fluid balance
    - Blood work (not from infusion site): TML Clerical Check - right patient, right blood; Testing on pre-transfusion sample & possible reaction sample; Group & Screen & Direct Antiglobulin Test (DAT)
      (DAT to determine if patient's red blood cells are coated with antibody, complement, or both; does not prove or disprove AHTR; TML will further evaluate positive DAT)
    - If ordered, Chest x-ray & Biomarker (if test available)
    - If required, continuous positive airway pressure or mechanical ventilation.

TACO (7): Patient Care cont'd

- Chest x-ray: Bilateral pulmonary edema.



A: at the time of TACO reaction B: after TACO had resolved

- If TACO suspected, pending patient's response to diuretic/clinical status & viability (expiry) of blood, **possibly** re-start the transfusion at slowest rate of infusion feasible (Prescriber order required).
- Document reaction per local hospital policy & procedure; patient may be prone to circulatory overload during subsequent transfusion episodes.
- Educate patient/family re: TACO; if future transfusion, pretransfusion diuretic potentially required.

TACO (8): Prevention

- Ensure transfusion indication is appropriate; consider alternatives as appropriate.
- Transfusion Reaction Nursing Debrief: Learn by sharing summary of a recent transfusion reaction with nursing team.

- Non-urgent, not actively bleeding inpatients, transfuse 1 unit/dose & re-assess the need for additional transfusion.
  Advocate for patients, question all orders for more than 1 unit/dose; discuss with Prescriber.

- Implement standardized, evidence-based, pre-transfusion TACO risk screening strategy for each transfusion to consistently evaluate/identify risk factors.
  Incorporate in electronic transfusion order set, order set pop-ups or if paper-based, a screening checklist as part of transfusion chart label.

TACO (9): Prevention cont'd

- Patients with TACO risk
  - Response to diuretic is considered evidence of TACO.
  - **Pre-transfusion** diuretic; "make room for the transfusion volume".
  - Furosemide IV: Action: onset 5 minutes, peak ½ hr., duration 2 hr. Administer: undiluted, rate ≤ 20 mg/minute.
  - Transfuse at the slowest rate feasible; blood components are viable for up to 4 hours after removal from the temperature-controlled environment.
- Furosemide Dose
  - Ideal dose: prevent circulatory overload & not cause harm e.g., hypotension.
  - Rotin July 2025: Generated a furosemide dose–response curve in TACO susceptible patients using the multiple comparisons procedure and modelling (MCP-Mod) methodology.
    Results: Dependent on patient characteristics,10 to 40 mg of furosemide IV would be required for diuresis volume 400 mL
    (sufficient to offset a 1 RBC unit transfusion).
    Plan: trial evaluating furosemide for TACO prevention.

Transfusion Knowledge Question 1 - Post

Characteristics of an acute hemolytic transfusion reaction (AHTR) include (select all applicable):

a) All AHTRs are preventable, the cause is always an error.
b) The first sign of an AHTR is often fever (+/- chills, rigors).
c) One of the risks of receiving uncrossmatched blood is AHTR.
d) For AHTR, a key management strategy is aggressive hydration, while avoiding volume overload, maintain urine output > 1 mL/kg/hr.

Transfusion Knowledge Question 2 - Post

Transfusion Associated Circulatory Overload (TACO) symptomatology includes (select one, most appropriate response):

a) Respiratory distress (including decreased oxygen saturation), and hypotension.
b) Respiratory distress (including decreased oxygen saturation), and hypertension.
c) Respiratory distress (including decreased oxygen saturation), hypotension, and possibly fever.
d) Respiratory distress (including decreased oxygen saturation), hypertension, and possibly fever.

Sunsetting of TTISS & TESS Programs March 31, 2026

Transfusions are among the commonest acts in healthcare – saving lives, but sometimes causing harm

Blood
Safety
Contribution
Program:

Created after the Krever Commission on the tainted blood tragedy, and considered a national responsibility for safety and trust's sake:
Canada's hemovigilance (transfusion harm/error tracking) **system**.

Transfusion **T**ransmitted **I**njuries **S**urveillance **S**ystem

Transfusion **E**rror **S**urveillance **S**ystem

The cost of operating this part of the healthcare system – observing for *all* transfusion-related harms (*transmitted infections, overloading, immune intolerance reactions, and so much more*) – is ~ $2 million:
A nickel per Canadian, & <0.1% of the $2.5 billion national blood operating budget

An announcement by
Public
Health
Agency of
Canada
to sunset the BSCP leaves a fraction of the surveillance system intact.

This decision should be reversed and the support for this safety system continued.

Canadian Recipient Hemovigilance System Consensus Conference March 23-24, 2026

Convened experts, stakeholders, & decision-makers to reach agreement on recommendations for the design of a renewed national hemovigilance system.

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Many thanks to my ORBCoN and Transfusion Medicine family for their ongoing mentorship and support.

Your participation is appreciated!

Save the Date!

Transfusionists Talk –
Transfusion Made Bloody Easy

Discussion of challenging, unusual, interesting transfusion scenarios.

Dates: **June 24, 2026**
September 23, 2026

Times: 9:30 – 10:30 a.m. (EDT)
2:30 – 3:30 p.m. (EDT)

To submit topics/cases, email:
bertad@mcmaster.ca

Save the Date!

Transfusion Medicine Boot Camp for Nurses

Patient Experiences - Lessons for Learning

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Time: 9:00 a.m. – 1:00 p.m. (EST)
Registration will open late-October.

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Major Transfusion Reactions: Keep Calm & Carry On Problem Solving …

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