MEDLAB BASICS · STUDY SHEET

Transfusion Reactions and HDFN

Reaction types with timing, mechanism and lab findings, the reaction workup, NHSN definitions, donor infectious disease testing, HDFN, RhIG and fetal bleed testing

14 sources + more detail

medlabbasics.com/sheets/lab-transfusion-reactions.html
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1 Acute reactions (within 24 hours)

REACTION	ONSET	MECHANISM	LAB FINDINGS	PREVENTION
Acute hemolytic (AHTR)	Minutes to 24 h, often within the first hour	Recipient antibody (usually anti-A or anti-B) destroys donor red cells; most often a patient or sample identification error	Pink or red plasma, hemoglobinuria, positive DAT (may be negative if all incompatible cells are gone), eluate antibody, LD and bilirubin up, haptoglobin down, DIC	Correct labeling and bedside identification
Febrile nonhemolytic (FNHTR)	During or within 4 h	Antibodies to donor white cells, or cytokines that build up in the stored unit	Rise of at least 1 °C to 38 °C or more, or chills; workup negative for hemolysis	Leukoreduced components (prestorage for cytokine reactions)
Allergic (mild)	During or within 4 h	Recipient reacts to a plasma protein in the unit	Hives, itching, flushing; no lab test predicts it	Antihistamine; the transfusion may resume after mild hives
Anaphylactic	Seconds to minutes	Often unexplained; some patients are IgA deficient with anti-IgA, or haptoglobin deficient	Hypotension, bronchospasm, laryngeal edema, no fever; test IgA and anti-IgA	Washed cellular components; plasma from IgA-deficient donors
TRALI	During or within 6 h	Donor anti-HLA or anti-neutrophil antibodies (or stored-unit mediators) activate the recipient's neutrophils in the lung	Hypoxemia, bilateral infiltrates, no circulatory overload; BNP not high; donor tested for HLA and HNA antibodies	Plasma from male donors or HLA antibody-negative female donors
TACO	Within 12 h	Volume or rate more than the heart can handle	Pulmonary edema, high blood pressure, raised BNP or NT-proBNP	Slow rate, smaller volumes in at-risk patients
Septic (bacterial)	During or shortly after	Contaminated unit; platelets most often (room temperature); Yersinia enterocolitica in red cells	Fever rise of 2 °C or more, rigors, shock; Gram stain and culture of the bag and the patient, same organism in both	Platelet bacterial testing or pathogen reduction; aseptic collection
Hypotensive	During or within 1 h	Not fully known; reported with bedside leukoreduction filters	Isolated drop in blood pressure (adult: systolic falls 30 mm Hg or more to 80 or less) once other reactions are excluded	Stop the transfusion; it resolves quickly

SAFETY Any fever or chills during transfusion is treated as a possible acute hemolytic reaction until the workup says otherwise. Stop the transfusion, keep the line open with saline, and send the unit, the set and a new sample to the blood bank.

2 Delayed reactions

REACTION	ONSET	MECHANISM	LAB FINDINGS	PREVENTION
Delayed hemolytic (DHTR)	Usually 2-14 days	Anamnestic response in a patient sensitized before; the antibody was too weak to detect at the crossmatch (Kidd is the classic)	Unexplained fall in hemoglobin, new positive DAT, new antibody in the eluate and serum, spherocytes, mild rise in LD and bilirubin	Check records for past antibodies; give antigen-negative blood for life
Delayed serologic (DSTR)	24 h to 28 days	New alloantibody without hemolysis	New positive DAT or antibody screen; hemoglobin holds	Record the antibody; antigen-negative units from now on
Post-transfusion purpura (PTP)	5-12 days (typically 7-10)	Patient lacking HPA-1a, sensitized by pregnancy or transfusion, makes anti-HPA-1a; her own platelets are destroyed too	Platelets fall abruptly, often to under 20% of the pretransfusion count; anti-HPA antibody	IVIG; HPA-1a-negative platelets if needed
TA-GVHD	2 days to 6 weeks	Viable donor T cells engraft and attack the host (immunocompromised host, or a donor homozygous for an HLA haplotype the recipient shares)	Fever, rash, diarrhea, liver enzymes up, pancytopenia from marrow aplasia; donor white cells in the patient (chimerism); nearly always fatal	Irradiation (25 Gy) or approved pathogen reduction; leukoreduction does not prevent it
Iron overload	After 10-20 red cell units	About 250 mg of iron per unit, no way to excrete it	High ferritin and transferrin saturation; organ damage	Chelation, exchange transfusion or phlebotomy

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Transfusion Reactions and HDFN

3 Workup of a suspected reaction

1. Clerical check first: patient identity, sample label, unit label, tag and records. A mismatch means another patient may be at risk of the swapped unit.
2. Visual check: centrifuge the postreaction sample and compare its plasma with the pretransfusion sample. New pink or red plasma means hemolysis; check urine for hemoglobin.
3. DAT on the postreaction EDTA sample. If positive, run a DAT on the pretransfusion sample; positive after and negative before points to coated donor cells, so do an elution.
4. Repeat ABO and Rh on the postreaction sample (and on the pretransfusion sample and the unit when indicated).
5. Further tests when the first three are abnormal or symptoms suggest it: antibody screen and crossmatch on pre and post samples, LD, bilirubin, haptoglobin, DIC screen; Gram stain and cultures of the bag for sepsis; BNP for TACO; IgA and anti-IgA for anaphylaxis.

EXAM TIP Positive DAT after, negative before, with mixed-field reaction: transfused cells are coated. Eluate shows the antibody. Recheck the clerical work before anything else.

SAFETY Report suspected TRALI and septic reactions to the blood supplier at once so co-components from the same donation can be pulled. A transfusion fatality goes to the FDA (CBER) as soon as possible, with a written report within 7 days.

4 Donor infectious disease testing

AGENT	TEST ON EACH DONATION
HIV	Anti-HIV-1/2 and HIV-1 RNA (NAT)
Hepatitis B	HBsAg, anti-HBc and HBV DNA (NAT)
Hepatitis C	Anti-HCV and HCV RNA (NAT)
HTLV-I/II	Antibody
West Nile virus	RNA (NAT)
Trypanosoma cruzi (Chagas)	Antibody, once per donor (current or at least one earlier donation)
Syphilis	Serologic test for Treponema pallidum
Babesia	NAT in states where FDA requires it, unless the unit is pathogen reduced
Bacteria (platelets)	FDA-recommended bacterial testing, or pathogen reduction

EXAM TIP CMV is not on the list: up to 70% of donors are seropositive. CMV-safe means leukoreduced or CMV-seronegative (or pathogen reduced) for at-risk patients such as low-birthweight infants and seronegative transplant recipients.

5 HDFN at a glance

FEATURE	ANTI-D (RH)	ANTI-K (KELL)	ABO
Who	D-negative mother, D-positive fetus, mother sensitized earlier	K-negative mother sensitized by transfusion or pregnancy	Usually a group O mother with a group A or B baby
First pregnancy affected?	Rarely (the sensitizing pregnancy is spared)	Can be, after a past transfusion	Yes, because anti-A and anti-B occur naturally
Severity	Can be severe: anemia, hydrops, kernicterus	Severe anemia; the antibody also suppresses red cell production	Usually mild jaundice; A and B are weak on fetal cells
Prenatal titer	Useful; each lab sets a critical titer between 8 and 32 (16 is common)	Poor predictor; 8 is the threshold now supported	Not done
Newborn DAT	Strongly positive	Positive	Often weak or negative
Prevention	RhIG	K-negative blood for girls and women of childbearing age	None

EXAM TIP Anti-K disease brings more anemia and fewer reticulocytes and less bilirubin than the titer would suggest, because the antibody destroys red cell precursors in the marrow as well as circulating cells.

6 RhIG and the fetal bleed

- Candidate: D-negative mother, not already immunized to D (anti-D from RhIG given earlier does not count), baby D-positive or not known to be D-negative.
- Not a candidate: D-positive mother, including weak D types 1, 2 and 3 by genotype; mother already immunized to D. Partial D mothers are managed as D-negative.
- Doses: 300 µg at 26-28 weeks and within 72 hours of delivery (or of a miscarriage, ectopic pregnancy, invasive procedure or trauma). If 72 hours is missed, give it anyway, up to 28 days.
- Screen every D-negative mother after delivery of a D-positive baby with the rosette test. Positive means a bleed over about 10 mL of whole blood: quantify by Kleihauer-Betke or flow cytometry.

STEP	FORMULA	EXAMPLE: 30 FETAL CELLS IN 2,000
Percent fetal cells	Fetal cells ÷ cells counted × 100	1.5%
Bleed (mL whole blood)	% fetal cells × 5,000 mL ÷ 100	75 mL
Vials	Bleed ÷ 30; round up from .5, down below .5; add 1	2.5 → 3, + 1 = 4 vials of 300 µg

EXAM TIP One 300 µg vial covers 30 mL of fetal whole blood or 15 mL of fetal red cells. The Fetal-Maternal Hemorrhage calculator does this arithmetic.

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