TRALI & TACO (TNT)

Triple A of Transfusion Medicine

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Statistics

- **1:1000 to 1:10,000 per blood product transfused**
- **1:600 to 1:2500 per patient transfused**
- **Medicare records 2007 14.3 :100k, 2010 23.5:100k**
  - Menis M et al. Transfusion 2014;54:2182-93
- **Seen with all blood products but FFP is the riskiest, prior to all male plasma**
- **Seen in products with as little as 10-20ml of retained plasma if donor antibodies match patient antigen**
  - Win et al. Transfus Med. 2008 Oct;18(5):273-5
- **Cryo and IVIg may also cause it**

Who's at Risk?

- **Prospective studies**
  - **8% transfused ICU patients**
  - **2.5% transfused cardiac surgery patients**
  - **Risk related to mechanical ventilation and increased pump time**
    - Gajic O et al. Am J Respir Crit Care Med 2007;176:886-91
    - Vlaar AP et al. Crit Care Med 2010 38:771-8
- **Medicare patient review – risk increases with:**
  - **Increased transfusions** — **Females**
  - **Pulmomary fibrosis** — **Smokers**
- **Additional risk factors:**
  - **Chronic alcohol use** — **Positive fluid balance**
  - **Peak airway pressure >30cm** — **Liver transplant**

Clinical Picture

- **Sudden deterioration in lung function within 2-6 hours of transfusion**
  - **Tightness in chest, shortness of breath, cough**
  - **With or without fever and rigors**
- **Low O2 levels, hypotension, tachcardia,**
- **Crepitations on auscultation**
- **Copious frothy edema**

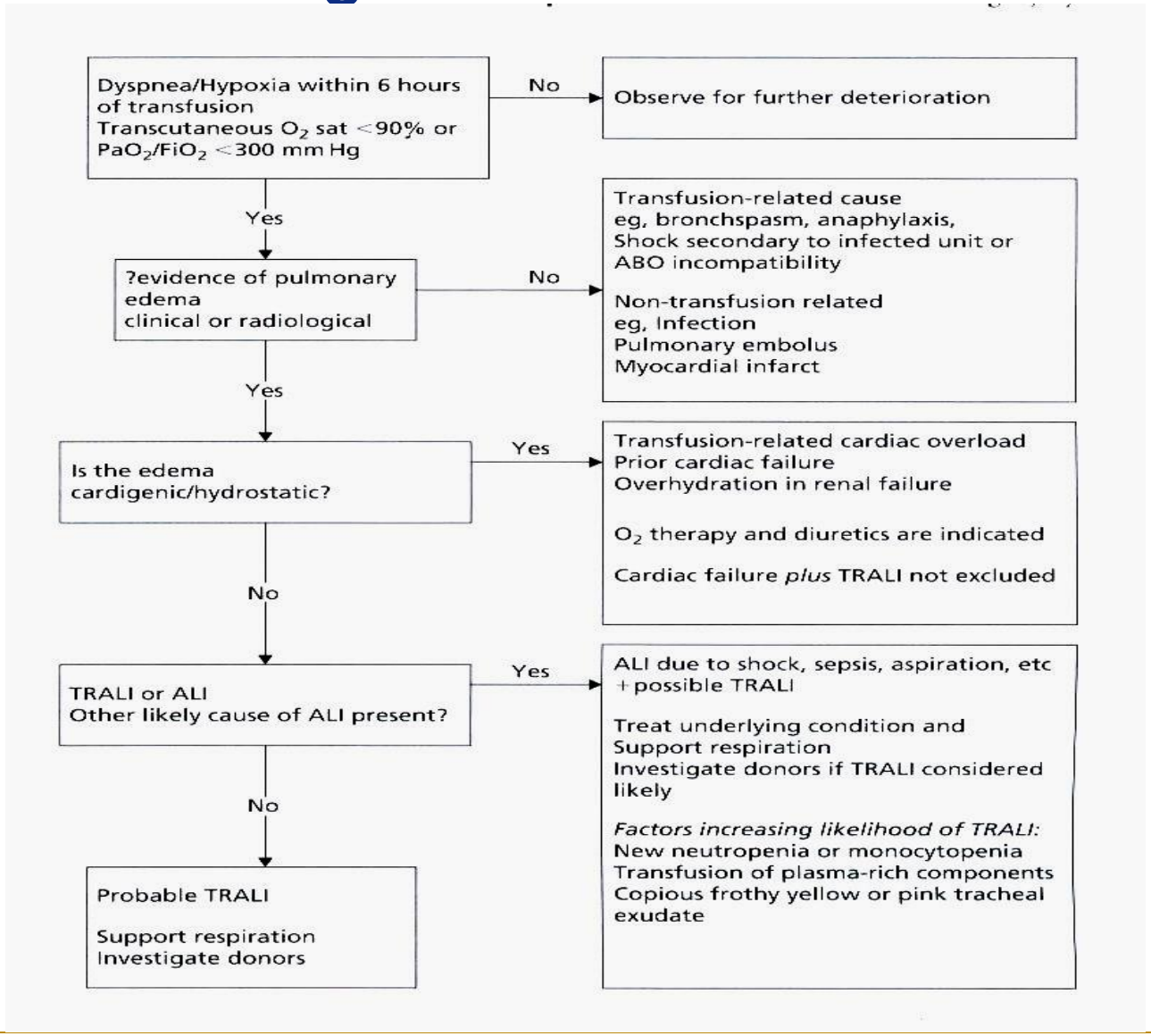
Diagnostics

- Chest X-ray – bat wing pattern to total whiteout
- Pulmonary artery wedge pressure normal
- Hypotension unresponsive to fluids
  - 15% show hypertension
- Neutropenia followed by neutrophilia with class I HLA antibodies
- Monocytopenia with class II HLA antibodies
- May start to improve within 6 – 24 hours

Differential

- Diagnosis of exclusion
- Rule out other causes of acute lung injury
- Anaphylactic transfusion reaction
  - Bronchospasm and laryngeal edema
  - Erythema and urticaria, head, neck, trunk
- TACO – coming later in the lecture
- Bacterial contamination
  - Fever, hypotension, vascular collapse
  - Respiratory distress not a key symptom

Differential Diagnostic Flowchart



Diagnostic Tips and Traps

- **Shortness of breath,(SOB)**
  - **Transcutaneous 02 sat <90% room air**
  - **Arterial p02 <60 mmHg**
  - **Pa02/Fi02 of less than 300mmHg**
- **SOB with edema**
- **SOB without edema, think allergic reaction, shock due to bacterial contamination, ABO incompatibility, cardiac arrhythmia, infection, pulmonary embolus**

To Be or Not To Be

- **If the Pa02/Fi02 is less than 300mmHg, is it TRALI? Not necessarily.**
- **Cleveland Clinic 16,847 cardiac surgery patients**
- **Transfused patients had more risk adjusted pulmonary complications than non-transfused.**
- **Same of percentage of non-transfused and transfused patients had Pa02/Fi02 ratio less than 300mmHg, 65%.**
- **Conclusion: Ratio is diagnostic of lung injury but it can be unrelated to TRALI and may be due to nature of cardiac surgery**
  - Koch et al. Ann Thorac Surg 2009 Nov;88(5):1410-8

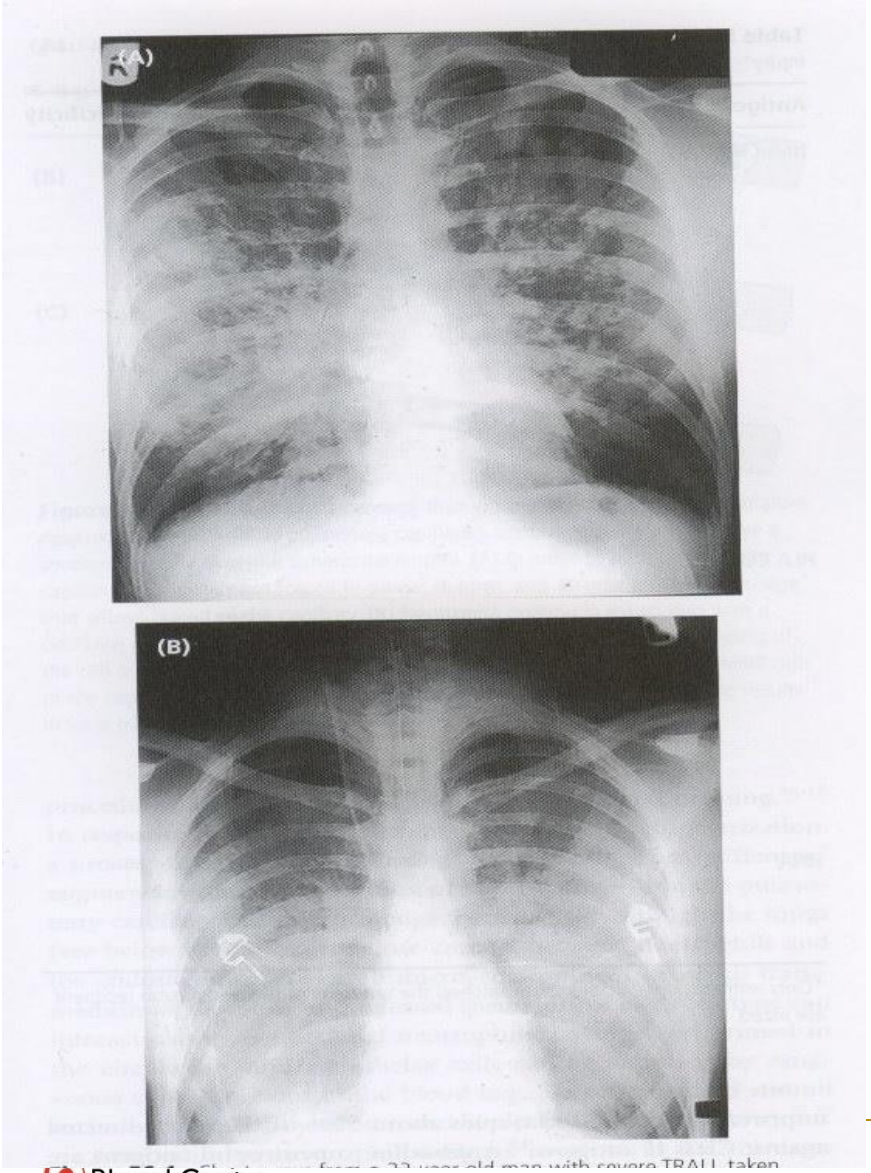
Diagnostic Traps

- **SOB with edema, cardiac or not**
  - **X-ray**
    - **Trali – patchy, nodular, peripheral except for apices and costophrenic angles**
    - **Cardiac – Upper lobe distension, edema in perihilar and basal areas**
- **Left atrial pressure –**
  - **Trali - normal**
  - **Cardiac – elevated**
- **Echo to rule out cardiac dysfunction**
- **Inflammatory cytokines IL-6, IL-8 elevated prior to transfusion TRALI not TACO – first hit of 2 hits**
- **Anti-inflammatory IL-10 elevated prior to TACO – non-inflammatory hydrostatic edema but low in TRALI[A,B] .**

A. Roubinian NH et. al. Transfusion 2015;55;1838-46

B. Kapur R Ann Transl Med 2017 Aug;5(16):339

TRALI X-ray



CHF X-ray

X-rays

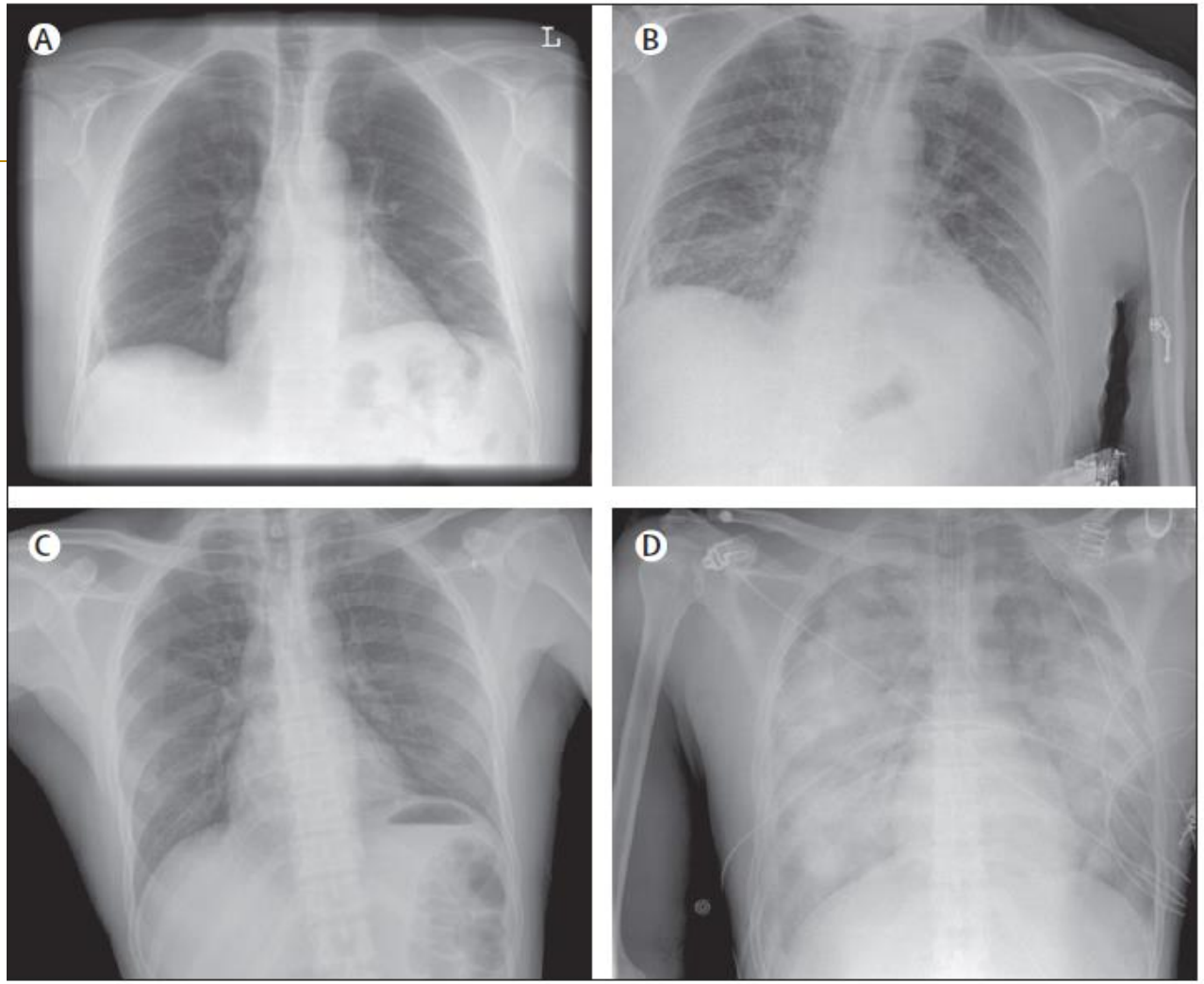


Figure 3: Chest radiographs of patients presenting with transfusion-related acute lung injury (TRALI)
Chest radiographs of two patients before (A, C) and after (B, D) onset of TRALI. Radiographs A and C show normal pulmonary vasculature with no signs of pulmonary oedema; B and D show infiltrative changes suggestive of pulmonary oedema. D shows the classic severe bilateral infiltrative changes that present with TRALI; however, frequently such changes are less apparent with chest x-rays, as shown in B.

Vlaar AP et al. Lancet 2013 382;984-94

Cardiac or Non-cardiac Edema

- **B-type naturetic peptide**
  - **Trali - <250pg/ml**
  - **Cardiac – 2x previous level or >250pg/ml**
  - **Post:pre transfusion Bnp ratio <1.5 = TRALI**
    - Zhou L et al. Transfusion 2005;45:1056-63
  - **TACO >1000pg/ml NT-proBNP 93.8%sen/83.3%spec**
  - **>1923pg/ml NT-proBNP 87.5%sen/95.8%spec**
    - Tobian et al. Transfusion 2008 Jun;48(6):1143-50
  - **Other: too much overlap in BNP and NT-proBNP values in TACO and TRALI so no diagnostic significance**
    - Li et al. Transfusion 2009 Jan;49(1):13-20
- **Edema fluid - >70% serum protein = TRALI**

Pulmonary Edema in TACO & TRALI

- **Does etiology matter? Yes**
- **Mayo Clinic compared:**
  - **transfused critically ill patients with or without TRALI**
  - **transfused critically ill patients with or without TACO**
- **TRALI patients compared to their controls had statistically significant higher mortality rates for hospital, one year and two year periods.**
- **TACO patients compared to their controls did not have statistically significant higher mortality rates for hospital, one year and two year periods.**
- **Both TACO and TRALI patients had longer ICU and hospital lengths of stays than their respective controls**
  - Li, et al. Chest 2010 137(4): 783-9

Canadian Consensus 2004

Table 56-2. 2004 Consensus Conference Definition of TRALI[66]

I. TRALI criteria
  A. ALI
    1. Acute onset
    2. Hypoxemia
      a. Research setting:
        1) $PaO_2/FiO_2 \leq 300$, or
        2) $SpO_2 < 90\%$ on room air
      b. Nonresearch setting:
        1) $PaO_2/FiO_2 \leq 300$, or
        2) $SpO_2 < 90\%$ on room air, or
        3) other clinical evidence of hypoxemia
    3. Bilateral infiltrates on frontal chest radiograph
    4. No evidence of left atrial hypertension (ie, circulatory overload)
  B. No preexisting ALI before transfusion
  C. During or within 6 hours of transfusion
  D. No temporal relationship to an alternative risk factor for ALI
II. Possible TRALI
  A. ALI
  B. No preexisting ALI before transfusion
  C. During or within 6 hours of transfusion
  D. A clear temporal relationship to an alternative risk factor for ALI

Acute Lung Injury & pTRALI Risk Factors

ALI – Direct lung injury[A]
Aspiration
Pneumonia
Toxic inhalation
Lung contusion
Near drowning
ALI – Indirect lung injury
Severe sepsis
Shock
Multiple trauma
Burn injury
Acute pancreatitis
Cardiopulmonary Bypass
Drug Overdose

pTRALI[B]
Chronic alcohol abuse
Current smoker
Shock
Positive fluid balance

pTRALI – new TRALI within 6 hours of transfusion WITH alternate risk factor for ALI

Mortality rate pTRALI – 42%, similar to ALI

?pTRALI = Transfused ARDS[C]

pTRALI & TACO - similar recipient factors relative to TRALI and transfused controls[D]

age>70, BNP >1000pg/ml

Fluid balance > 3 liters positive

A. Kleinman S et al. Transfusion 2004;44:1774-1789 B. Toy P. et. Al. Transfusion 2015;55:947-952
C. Toy P et. al. Transfusion 2017;57(3);709-713 D. Roubinian NH. Transfusion 2017 Jul;57(7):1684-90

Raising the Index of Suspicion

- **University of Cincinnati set up computer to generate an alert.**
- **Alert based on Pa02/Fi02 is less than 300mmHg in a patient who was issued blood within 12 hours.**
- **ICU rounds detected 9 of 14 patients requiring 2-3 hours of time**
- **Computer detected 13 of 14 requiring 1-1.5 hours of time**
  - Finlay-Morreale et al. J Am Med Inform Assoc 2008 May-June; 15(3): 383-5
- **Serious underreporting of both TRALI and TACO to transfusion service– 5-15% of cases reported**
  - Hendrickson JE Transfusion 2016 Oct;56(10):2587-96
  - Clifford L Transfusion 2013;53:1205-16

Triggers for Reporting TRALI

- **Survey of critical care physicians, hematologists, hemovigilance workers, transfusion medicine physicians using case vignettes and questionnaire.**
- **Positive indicators for reporting for all disciplines**
  - **Symptoms within one hour of transfusion**
  - **Transfusion of FFP**
  - **Absence of acute lung injury before transfusion**
- **Sepsis is a negative indicator for reporting**
- **Massive transfusion is a negative indicator for transfusion medicine physicians but a positive indicator for all others**
- **Critical care physicians trigger on massive transfusion and age of blood products**
- **Conclusion: Pre-transfusion inflammatory condition is a reason to withhold reporting and decision-making is different dependent on the specialty**
  - Vlaar et al. Transfusion 2010 50(2) 443-51
- **Similar study, same authors and survey group, similar findings 8 years later**
- **Additional positive indicators for reporting – younger patient, platelet transfusion, multiple products transfused**
  - Peters AL Blood Transfus 2017 Apr 5:1-8

New Syndrome

- **Delayed TRALI Syndrome**
- **Acute lung injury 6-72 hours after transfusion**
- **Transfusion increases risk of ALI in critically ill patients, odds ratio 2.13**
- **Occurs in 25% of critically ill patients receiving transfusion**
- **40% mortality rate**
- **Risk increases with number of transfusions**
  - Marik et al. Crit Care Med 2008 Nov;36(11):3080-4
- **May be related to proinflammatory fragments of mitochondrial genome termed mtDNA damage associated molecular patterns DAMPS**
  - Simmons JD J Trauma Acute Care Surg 2017 Jun;82(6):1023-29

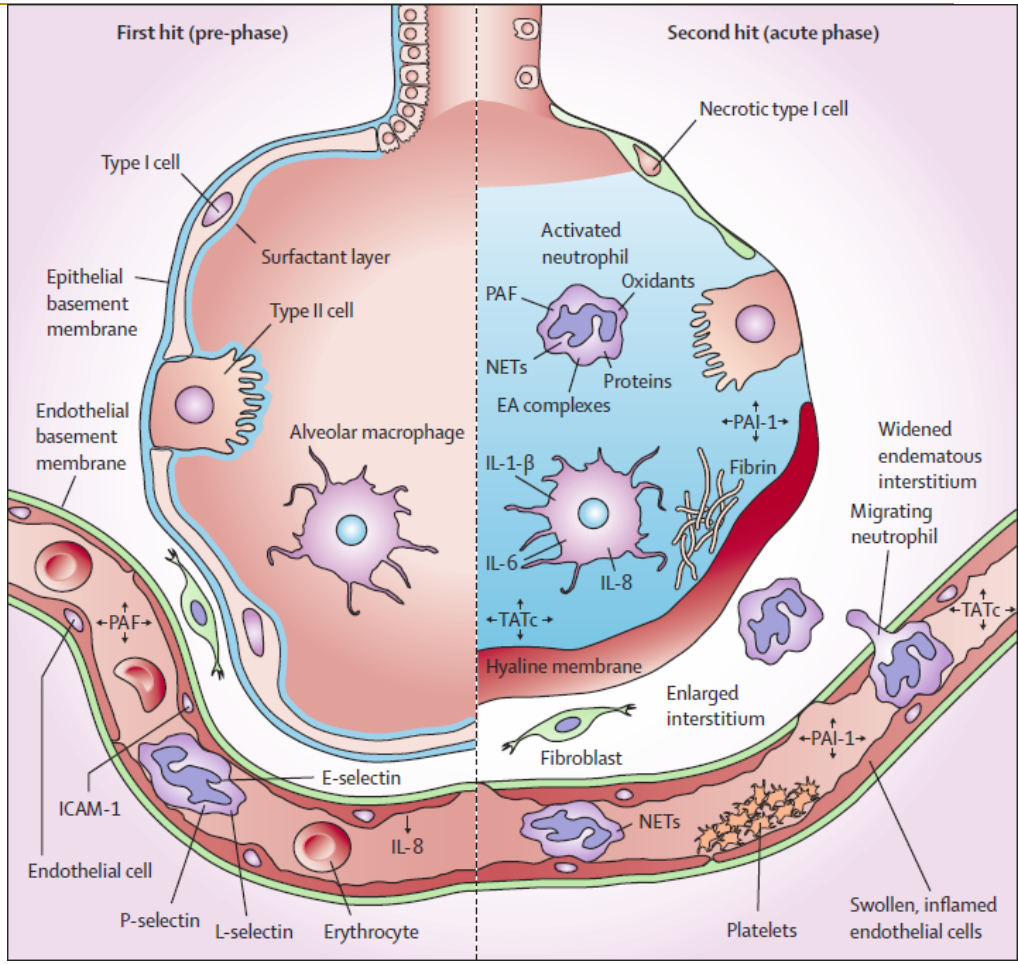
Pathophysiology

- Similar to ALI
- Interstitial and intralveolar edema
- WBCs outside capillary and in interstitial space and air spaces
- Increased wbc in capillaries adherent to wall
- WBC activation leads to endothelial damage and leakage of fluid into air spaces

Figure 56-2. Sections of lung from a fatal case of TRALI. Note the presence of granulocytes in the capillaries (arrow indicates neutrophils).

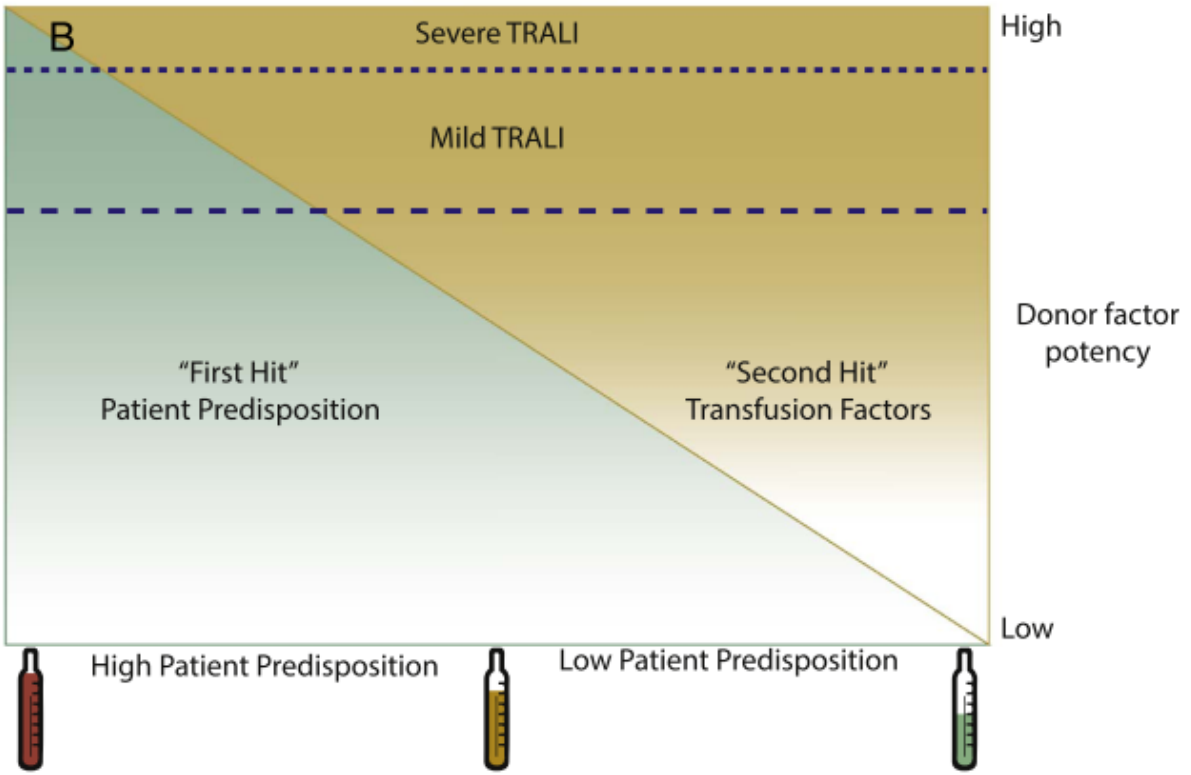
Two Step Theory

- 1st Priming stimulus – may be underlying patient condition
- Activation of endothelium
- Causes stiffening, impedes flow through capillaries
- Causes prolonged contact with vessel wall leads to activation stimulus
- 2nd activation stimulus – endothelial membrane receptors or HLA antibodies
- Causes release of granules leading to wall damage
- Allows leakage of fluid and wbc



Vlaar AP et al. Lancet 2013 382;984-94

Threshold Theory



- **Trali can occur in healthy individuals**
- **Patient with high predisposition requires low donor factor potency**
- **Donor with high potent factor requires less patient sensitivity**

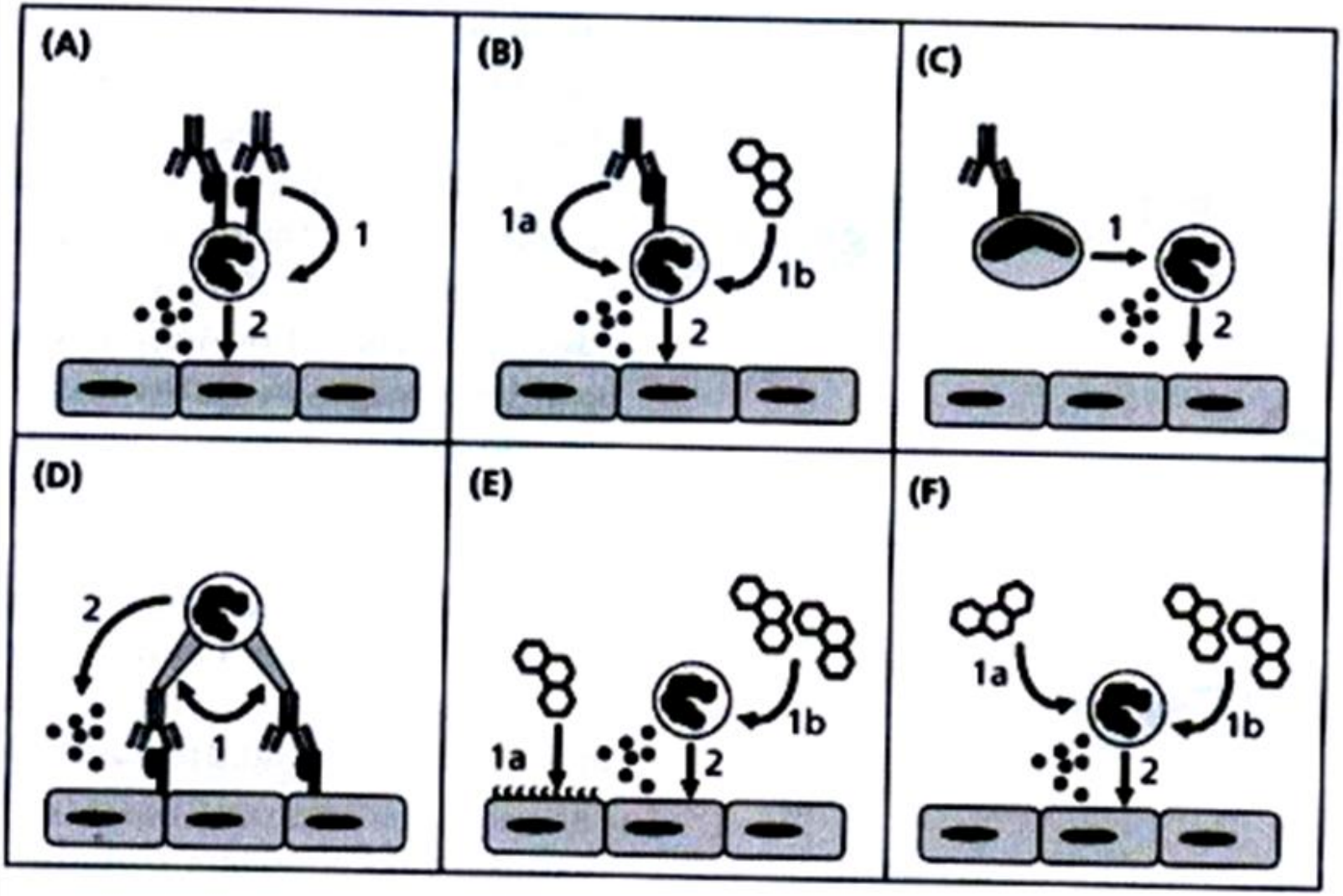
Morsing KSH Blood Rev 2018 Jan;32(1):1-7

Antibodies

- 75-90% TRALI cases caused by donor HLA antibodies
- 20% type 1, 20% type 2, 40% both, 20% HNA
- Class 1and HNA can bind to wbc to cause activation (A,B)
- Class 2 bind to moncytes which release cytokines to activate neutrophil (C)
- Rat model – Class 2 antigens expressed on PMN – inflammation, then transfused antibodies activate PMN[A]
- Class 2 and HNA-3 antibodies have more potential to cause TRALI than Class 1[B].
- Class 1, 2 and HNA bind to endothelium to sequester wbc and activate them[C] (D)
- Cognate antigen – antibody match 1/3 to 1/2 suffer TRALI, dependent on strength and volume of antibody transfused

A. Kelher M. et. Al Transfusion 2016;56;3004-3011
B. Storch E et al. Blood 2014,124(12) pg. 1868-72
C. Looney MR J Clin Invest 2006;116:1615-23

Mechanisms



Other Causes

- **Patient antibodies –10% of TRALI**
  - **Pt antibodies activate donor wbc, more likely to occur in multiparous females, multi-transfused patients, and transplants**
  - **Rarely interdonor TRALI – antibodies from one component react with antigens from another**
- **Bioactive lipids – polar and non-polar**
  - **Polar lyso-phosphatidylcholines, Platelet Activating Factor PAF attach to receptor on wbc causing priming – cause in autologous TRALI**
  - **Non-polar- arachidonic acid and HETE increase 5-20 fold 35 day blood, auto transfusion into volunteers 2 hours after injection with lipopolysaccharide to induce systemic inflammation (hit 1) did not induce mild TRALI[A]**
    - **BAL, CXR, LFT, PaO2/FIO2 ratio**
  - **CD-40 soluble ligand binds to its receptor on mono & neutros**
  - **Anti CD 36 antibodies may also cause TRALI**
  - **Hemin and neutrophil extracellular traps, new areas of research[B]**

A. Peters AL et. Al Vox Sang 2017,112:25-32

B. Peters AL et al. Blood Reviews 2015 (29) pgs. 51-61

Treatment

- Respiratory support 02 to mechanical ventilation – 75% require short term
- Fluid support
- Vasopressors if fluids don't work
- Diuretics and steroids don't work
- Begin improvement in 6-24 hrs
- CXR shows clearance of edema 2-4 days
- Mortality 5-30% depending on underlying patient conditions though 40-50% is reported in severe patients
- Mouse study – lowered levels of IL-10 in TRALI, injection of IL-10 alleviated lung injury[A]

A. Kapur R. et. al. Blood 2017 Feb 15 epub. DOI 10.1182/blood-2016-12-758185

Pediatric and Neonatal Populations

- **Equivalent clinical picture as adults**
- **Dutch PICU – 4 year retro study 2294 patients, 304 transfused, 21 got TRALI 6.9% = adult ICU pts. [A]**
  - **None reported to BB**
  - **Mean time from start of transfusion to TRALI – 2 hrs.**
  - **Risk factors:**

Higher PRISM III score	Sepsis
DIC	Prior mechanical ventilation
Lower platelet count <100	More positive fluid balance

  - **No difference in number or type of components transfused**
  - **Mortality rate 76% TRALI vs. 11% transfused**
  - **Length of mechanical ventilation 183 hours vs. 25 hours**
- **Particular cause – directed donation by mother who has antibodies to child HLA**
- **Dad and child should not donate for mom either**

A. Mulder HD et. al. Journal of Critical Care 2015(30);55-59

Lab/Donor Investigation

- **Investigation takes time, donors are not captive**
- **Establish clinical diagnosis and treat**
- **Investigate donors of units transfused within 6 hours.**
- **Patient and donor should be HLA typed and all antibodies detected should be identified**
  - **Or HLA type patient and look for antibodies in donor**
- **Other selection by product type, plasma, platelet, cryo, rbc**
  - **Older protocol outdated due to AABB standards for male plasma, HLA antibody tested female platelet donors**

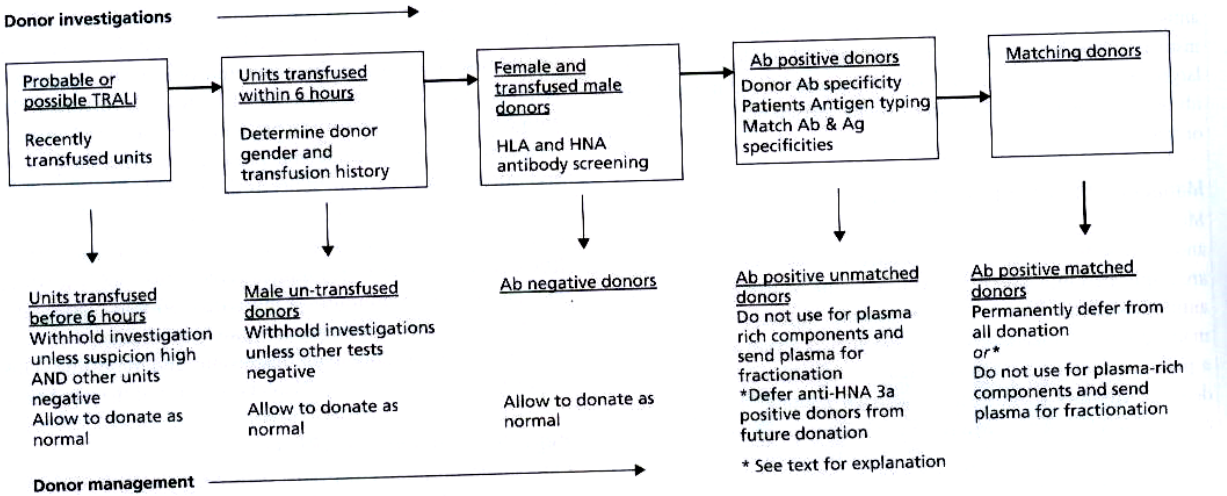


Figure 56-7. Flow chart for investigation and management of donors.

Donor Management

- **Deferring all involved donors excludes needlessly but some centers employ this strategy**
  - **Lookback study showed only 1/3 of patients receiving products from implicated HNA antibody donor had reaction though not TRALI.**
  - **Another study had 54 of 55 patients with matching antigens to donor antibody who received 109 products. No TRALI reported though other transfusion reactions were reported.**
- **Defer implicated donor from plasma-rich products**
- **Permanently defer donors with HNA-3 antibodies which is found in 95% of severe TRALI cases**
- **Untested donors may be flagged for examination of future transfusions.**
  - Eder et al. J Clin Apher 2009;24(3):122-9

Prevention of the 2nd Trali Reaction

- Not much is reported on how to prevent a 2nd trali reaction in a patient.
- Thought to be at higher risk for 2nd reaction
- Judicious use of blood components
- Close monitoring before and after
- Fresh or washed products not shown to have a benefit BUT
- On going trial WAR-PRC – Mayo Clinic and Duke looking at washing rbc to prevent transfusion related respiratory complications

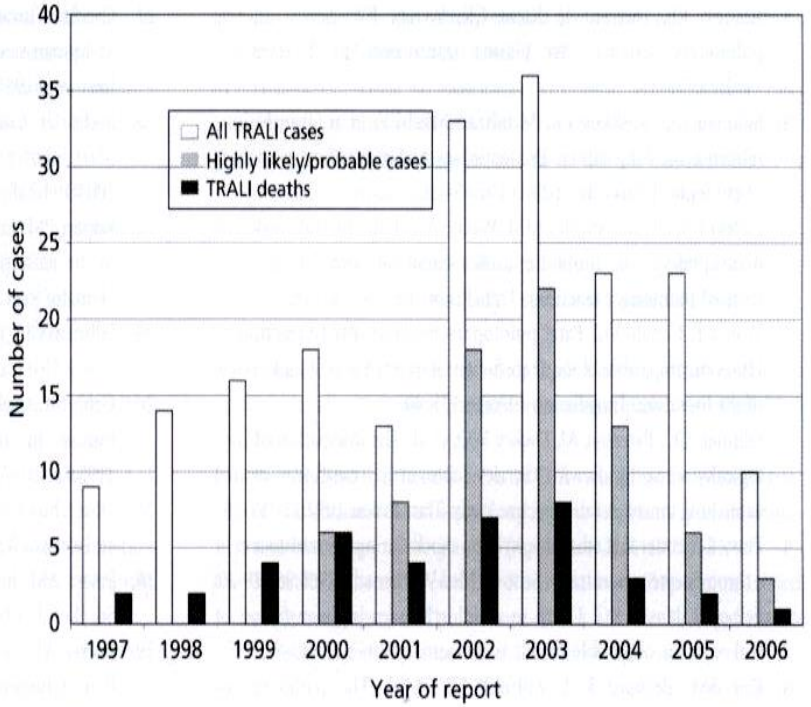
Warner, MA BMJ Open 2017 Aug 18;7(8)

Who Has Antibodies?

- **Most common in females with multiple pregnancies**
  - **Mom forms antibodies to fetal wbcs**
  - **0 pregnancy, 2% females have antibody**
  - **3 or more, 26.3% females have antibody**
- **Percentage also varies by time since last pregnancy with lower percentage with longer the time**
- **Frequency of HLA antibodies in men is less than 2%.**
- **These data based on EIA testing.**
- **Supports testing females with a history of pregnancy**
  - Triulzi et al. Transfusion 2009 Sept;49(9):1779-82
- **Transfusion less likely to cause antibodies**
- **Males 4-5% antibodies, nulliparous female – 10%**
  - Sigle JP Vox Sang 2013 105:244-52
- **Male antibodies tend to disappear within 1-2 years, female antibodies persist for extended periods of time**
  - Nakamura J HLA 2017 May;89(5):285-92

Prevention for Plasma

- **Eliminate female FFP**
- **Use for cryo or recovered plasma**
- **Shift to FP24**
- **Hemovigilance studies in UK indicate 66% reduction when using male only FFP**
- **Use solvent detergent plasma**
  - **Antibodies neutralized by soluble antigens & dilution**
  - **Reduce use of FFP**



- **Use additive solution rbcs to reduce plasma exposure**
  - Transfusion 2008 Feb;48(2):393-7
- **Meta-analysis, of papers on male only plasma strategy**
  - **Decreased odds ratio 0.61 of TRALI**
  - **Decreased odds ratio 0.69 in 30 day mortality related to TRALI**
    - Muller MCA et al. Transfusion 2015; 55:164-75

Prevention for Platelets

- **Deferring multiparous women would reduce apheresis platelets by 550,000 per year**
- **Public health question, absolute safety vs availability for patients**
- **Blood centers increasing split components and male recruitment**
- **NYBC – testing females since 2009**
- **AABB standards as of October 2016 – previously pregnant females and pregnancy since last donation – Need HLA testing**
- **French hemovigilance data – platelet storage solution does not reduce risk of TRALI for apheresis platelets[A]**

A. Andreu G, Transfus Med Rev 2018 Jan;32(1):16-27

Future Potential Therapies

- **Increasing IL-10 levels**
- **Down-modulating c-reactive protein**
- **Targeting reactive oxygen species**
- **Blocking IL-8 receptors**

Semple JW Crit Care Med 2018 Jan 30

TACO Definition

a generally accepted one: TACO is an adverse outcome occurring in transfusion recipients who are unable to effectively physiologically process the associated fluid challenge due to either high infusion rates and/or volumes or an underlying cardiac, renal, and/or pulmonary pathology.

Table 1. Definitions for Transfusion-associated Circulatory Overload

NHSN TACO Definition 2016
New onset or exacerbation of ≥3 of the following within 6 hr of transfusion:
Acute respiratory distress (dyspnea, orthopnea, and cough)
Evidence of positive fluid balance
Elevated brain natriuretic peptide
Radiographic evidence of pulmonary edema
Evidence of left heart failure
Elevated central venous pressure
ISBT TACO Definition 2011
Any four of the following occurring within 6 hr of completion of transfusion
Acute respiratory distress
Tachycardia
Elevated blood pressure
Acute or worsening pulmonary edema of frontal chest radiograph
Evidence of positive fluid balance

A. Andrzejewski C Transfusion 2013;53:3037-47

TACO

- Hydrostatic edema - Occurs within 6 hours
- Respiratory distress with hypoxemia - PaO2/FIO2 less than 90%
- Increased left atrial pressure with jugular vein distention, Pulmonary artery pressure >18mm, CVP > 12mm
- Elevation of BNp > 1.5 post – pre transfusion
- Tachycardia, Pedal edema, Pulmonary rales
- Chest x-ray worsening pulmonary edema
- Hypertension with wide pulse pressure
- Cardiomegaly – cardio-thoracic ratio >0.53
- EKG changes - new ST segment elevation, T wave changes
- Fever may accompany 1/3 of cases[A]

A. Parmar N et al. Vox Sang 2017;112:70-78

Incidence – Coming to a Patient Near You

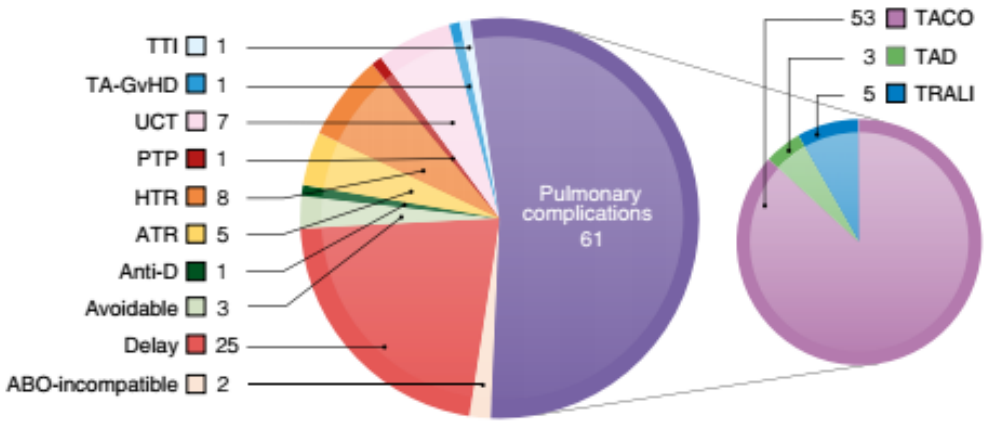
- **Median age 76, 2/3 cases >70+, 20% 60-69**
- **Thought to be 1:10,000, more recognition – 1:5000 – 1:1000**
- **Passive 1:6000, active surveillance 1:167 in platelet transfusion[C]**
- **Electronic algorithm – review medical records, four academic medical centers – 1% of patients[A]**
- **Retro review – 5% of non-cardiac surgical patients transfused in OR[B]**

A. Roubinian NH et al. Vox Sang 2017;112(1):56-63

B. Clifford L et al. Anesthesiology 2015; 122:21-8

C. Raval Vox Sang 2015;108(4) 387-92

Outcomes



- **Requires more intensive hospital care, increases hospital stay, and 3x mortality[A]**
- **SHOT 2017 – UK 6 years[B]**
  - **115 deaths – 61 pulmonary**
  - **53 were TACO, 5 TRALI**
- **Case control study[C], 163 transfused non cardiac surgery patients with TACO and 726 transfused controls with no TACO**
  - **More likely to require mechanical ventilation**
  - **Prolonged intensive care 11.1 days vs. 6.5 days**
  - **Longer length of stay 19.9 vs. 9.6 days**
  - **Decreased survival 72% vs. 84%**
- **Case control study[D,] 200 with TACO, 405 controls – similar findings**

A. Murphy EL, Transfusion 2010; 50(Suppl 2):127A-8A
B. Bolton-Maggs PH Transfus Med 2017,27(6):393-400
C. Clifford L Anesthesiology 2017 Mar,126(3):409-18
D. Roubinian NH Crit Care Med 2018 Jan 3

Causes – Not just Blood

- **Positive fluid balance > 1 liter**
  - **TACO orthopedic patients – one institution – 2.5 liter positive prior to transfusion**[A]
- **Transfusion rates > 200ml/hour**
- **Female**
- **History** [B,C,D,E] **of :**
  - **CHF with left ventricular dysfunction on echo** **CRF with dialysis**
  - **Mechanical ventilation** **vasopressor use** **B Adrenergic use**
  - **Recent emergency surgery particularly cardiac** **Isolated FFP use**
  - **Mixed product transfusion vs. isolated rbc** **Increased intraop fluid administration**
  - **Pre-transfusion diuretic use**
- **Assume volume overload but may be capillary leakage ie. ALI with volume overload** [C]
- **Two hit scenario** [C]
  - **#1 – limited fluid adaptability, renal or cardiac failure**
  - **#2 – transfusion which increases colloid oncotic pressure in intravascular space by drawing fluids into space**

A. Popovsky MA et al. Immunohematology 1996;12:87-89
B. Rana R et al. Transfusion 2006; 46:1478-83
C. Bosboom JJ Transfusion 2018 58(2):498-506
D. Clifford L Anesthesiology 2017 Mar;126(3):409-18
E. Roubinian NH Crit Care Med 2018 Jan 3

Is there TACO in Pediatrics?

- How to define it? Current definition is adult
- Pediatric hospital – ICU unit
- TRALI defined as 4 of 5 symptoms-
  - Acute respiratory distress, tachycardia,
  - Increased blood pressure, pulmonary edema on CXR
  - Fluid balance positive by 1 ml.
- Comparisons:
  - Normal pediatric values – Nelson
  - 10% and 20% thresholds from the patient's own values determined 6 hours prior to transfusion
- Followed 6, 12 and 24 hours post transfusion

Findings to Provoke More Questions

	Six hour	12 hour	24 hours	Time
Criteria				
Nelson	46%	65%	76%	
10%	3%	11%	20%	
20%	1.5%	4%	12%	

- **900 admissions to ICU, 144 received transfusion**
- **Can't use adult definition – too vague**
- **Incidence too high using normal pediatric values but appropriate threshold value is unknown**
- **Timing is not known, maybe longer is better > 6 hours post transfusion**
- **Frequency unknown – very underreported in hemovigilance studies**
- **Best clinical criteria is unknown – is use of BNP valuable?**

DeCloedt L Transfusion 2018 epub doi:10.1111/trf.14504

Management

- Stop transfusion
- Oxygen, IV Diuretics
- Place patient in sitting position
- PREVENTION IS THE KEY
- Physician checklist and order set [A]
- Be aware of risk factors in the patient
- Transfuse slower
- Give diuretics ahead of time
- Consider transfusing half units

PHYSICIAN PRE-TRANSFUSION CHECKLIST

Consent	☐ Patient advised of risks of TACO, TRALI, bacterial infection, and hemolytic reaction ☐ Contents of discussion documented in chart
Diuretics	**Does my patient have a history of:** ☐ Age greater ≥ 70 years ☐ Renal dysfunction (Creatinine > 100 mmol/L) ☐ Left Ventricular dysfunction (LVEF ≤ 60%) ☐ Prior or current CHF (including prior Furosemide use) ☐ **If YES to *any* of the above:** prescribe IV Furosemide pre-transfusion, on Line 11 of order set *(unless currently hypovolemic)*
Complete order set: "Transfusion – Adult Patient RBC/platelets/Plasma/PCC"	

TACO: Transfusion-Associated Circulatory Overload, TRALI: Transfusion-Related Acute Lung Injury

A. Tseng E. Transfus med 2016;26(2) 104-10

Transfusion Rates

Table 17-6. Infusion Rates and Times for Adult Patients in Various Clinical Settings*

Category Designation	Category Description	Potential Clinical Settings	Suggested Times or Rates of Infusion†	Comments
IA	Patient at severe risk for volume overload	Patients with CHF, COPD, ARF, severe anemia, or history of TACO (multiple episodes)	3.5 hours or 42 mL/hr to 2.5 hours or 60 mL/hr	All products issued in 0.5-unit increments so that 4-hr/ maximum transfusion time is not violated
IB	Patient at risk for potential fluid overload	Patients with CHF, COPD, ARF, severe angina, or history of TACO (few episodes)	3.5 hours or 84 mL/hr to 2.5 hours or 120 mL/hr	Full units issued
II	Patient with minimal to no fluid overload concerns	Majority of patients requiring transfusion therapy	3.5 hours or 84 mL/hr to 2.5 hours or 120 mL/hr to 1.5 hours or 200 mL/hr	Full units issued
III	Patient in need of urgent fluid resuscitation	Patients with acute trauma and/or sudden massive blood loss	As fast as possible	Primarily for emergency and life-threatening situations

*Based on a focus study at Baystate Medical Center, Springfield, MA.
†One unit of Red Blood Cells = 300 mL.
CHF = congestive heart failure; COPD = chronic obstructive pulmonary disease; ARF = acute renal failure; TACO = transfusion-associated circulatory overload.

Transfusion Reactions 4th edition Mark Popovsky pg. 574

TNT Treatment

- **Rx for Transfusion Service Physician**
  - **Antacids**
  - **Antianginals**
  - **Antiarrhythmics**