TACO,TRALI and ARDS Differential diagnosis and management

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What is the difference between Taco and TRALI?

TACO is characterized by pulmonary hydrostatic (cardiogenic) edema.

TRALI presents as pulmonary permeability edema (noncardiogenic).

With both, patients present with respiratory distress due to acute onset pulmonary edema.

With TRALI, patients also often have hypotension and fever, and can have transient leukopenia.

With TACO, one would typically expect hypertension and a lack of fever and leukopenia.

What is the difference between taco and TRALI blood pressure?

Hypertension is a constant feature in TACO whereas it is infrequent and transient in TRALI.

Raised levels of brain natriuretic peptide (BNP) or N terminal-pro BNP, may be informative.

What is the difference between Ali and TRALI?

TRALI is clinically defined as new ALI that develops during or within 6 hours of transfusion of any blood product.

In the absence of another ALI risk factor such as sepsis, pneumonia or aspiration, and when onset clearly develops after the transfusion, the diagnosis is clear.

Transfusion-related acute lung injury (TRALI)

Is defined as new acute lung injury (ALI) that occurs during or within six hours of transfusion, not explained by another ALI risk factor. Transfusion of part of one unit of any blood product can cause TRALI.

What is the new definition of TRALI?

Transfusion-related acute lung injury (TRALI) is a serious and potentially fatal complication of blood product transfusion in which a patient develops rapid onset lung injury and noncardiogenic pulmonary edema due to **activation of immune cells in the lungs.**

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In patients who have other ALI risk factors can also develop TRALI, and thus TRALI should not be excluded from consideration in these patients. The incidence of ALI in prospective studies of patient groups with ALI risk factors is less than 50%.

Thus, the presence of an ALI risk factor does not mean the patient will definitely develop ALI.

New ALI in a transfused patient with an ALI risk factor could be mechanistically due to the transfusion and/or the risk factor, i.e. TRALI and/or ALI due to the risk factor.

What are the characteristics of TRALI?

Acute onset of fever, chills

dyspnoea, tachypnoea, tachycardia, hypotension.

hypoxaemia and noncardiogenic bilateral pulmonary oedema leading to respiratory failure

during or within six hours of transfusion.

Diagnosis of TRALI:

Currently there is no definitive laboratory test for the diagnosis of TRALI.

Leucopenia or neutropenia has been observed in case reports (6-12) but has not been studied in small case series.

Leukocyte antigen-antibody match between donor and recipient (HLA class I or II, granulocytes or monocytes), and neutrophil priming activity in donor blood have been reported but are not diagnostic.

The mechanism of lung injury :

The mechanism of lung injury was initially thought to be microaggregates in stored blood causing micro-pulmonary emboli and lung damage, but this theory has been discredited

1. **The antigen-antibody hypothesis**
2. **The two-event hypothesis hypothesis.**
3. **Patient underlying condition**
4. **Cytokines**
5. **Genetic predisposition**
6. **Endothelial cell injury**

The actual incidence of TRALI is unknown because of lack of large current prospective studies that use a standard definition for the syndrome.

The lack of such studies account for the wide range in the reported incidence of TRALI, from approximately 1 in 500 to 1 in 100,000.

Transfusion-associated circulatory overload (TACO)

Transfusion-associated circulatory overload (TACO) is a common transfusion reaction in which pulmonary edema develops primarily due to volume excess or circulatory overload.

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A. Definition

Go to: ▸

Practice Points:

- TRALI is a clinical diagnosis
- Suspect TRALI when new ALI develops during or within six hours of transfusion
- Rule out other ALI risk factors such as sepsis and aspiration
- TRALI has been associated with all blood components that contain plasma
- Transfusion of even part of one unit has been associated with TRALI

What is the difference between TRALI and pulmonary edema?

TRALI may be distinguished from TACO and cardiogenic pulmonary edema by the absence of signs of circulatory overload, such as a normal central venous pressure (CVP) and normal pulmonary capillary wedge pressure (PCWP).

Clinical response to diuretics also suggests a diagnosis of TACO rather than TRALI.

What is the most common blood product for TRALI?

TRALI can be seen with any blood products.

Most often plasma or platelets are implicated.

Is BNP elevated In TRALI?

In fact, we found only very small elevations in BNP levels after the development of pulmonary edema in cases of TRALI, and this mild elevation was not different compared to that of transfused controls without pulmonary edema.

Practice points:

- Stop the transfusion immediately if TRALI is suspected.
- Obtain a white blood cell count and chest radiograph.
- Request Blood Bank to quarantine other units from the same donation(s).
- Request other units for transfusion if indicated (no special requirements).
- Follow institutional polices for a transfusion reaction workup.
- Return bags of units of blood transfused in the last 6 hours, indicating the last unit transfused prior to onset of signs or symptoms

Do you give diuretics for TRALI?

There is no specific treatment method for TRALI and transfusion should be terminated as soon as it is diagnosed.

Fluid therapy and vasopressor agent support may be required in patients with hypotension.

Therefore, it is **recommended to avoid diuretics.**

What is the difference between TRALI I and TRALI II?

TRALI has been separated into two types:

TRALI type I:(without an acute respiratory distress syndrome (ARDS) risk factor)

TRALI type II:(with an ARDS risk factor or with mild preexisting ARDS).

What is the difference between TACO and TRALI transfusion reactions?

With both, patients present with respiratory distress due to acute onset pulmonary edema.

With TRALI, patients also often have hypotension and fever, and can have transient leukopenia.

With TACO, one would typically expect hypertension and a lack of fever and leukopenia.

What is the physiology of TRALI?

In TRALI a transfusion activates neutrophils leading to pulmonary leukostasis, endothelial damage, capillary leak and pulmonary edema.

A number of elements (bioactive lipids, sCD40L, and leukocyte antibodies) found in blood products can active neutrophils and are risk factors for TRALI.

Who is at risk for TRALI?

Age, female sex, tobacco use, chronic alcohol abuse,

positive fluid balance, shock before transfusion.

ASA score and mechanical ventilation may be potential risk factors for TRALI.

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What antigens cause TRALI?

Human leukocyte antigen (HLA) class I, HLA class II, and neutrophil-specific antibodies in the plasma of both blood donors and recipients have been implicated in the pathogenesis of TRALI.

What are the symptoms of a taco transfusion reaction?

TACO characterised by:

Any four of the following symptoms occurring within 6 hours after completion of a transfusion:

1-acute respiratory distress

2-increased blood pressure

3-tachycardia

4-onset

5- exacerbation of acute pulmonary oedema (verified by chest X-ray, if possible), and a positive fluid balance.

Diagnosis of TACO:

To diagnose TACO, the CDC requires that at least three of the following six criteria be met within 6 h of the transfusion:

acute respiratory distress

elevated BNP

increased central venous pressure

signs of left-sided heart failure

positive fluid balance

pulmonary edema on radiology.

Risk factors for TACO:

Diseases that increase the amount of fluid in the body, including liver, heart, or kidney failure.

Conditions that require many transfusions.

High and low extremes of age are a risk factor as well.

How can we prevent TRALI?

Screening of all donors for anti-neutrophil or anti-HLA antibodies.

TACO is characterized by pulmonary hydrostatic (cardiogenic) edema, whereas TRALI presents as pulmonary permeability edema (noncardiogenic).

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What is the difference between TRALI I and TRALI II?

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TRALI type I (without an acute respiratory distress syndrome (ARDS) risk factor)

TRALI type II (with an ARDS risk factor or with mild preexisting ARDS).

the Berlin definition of ARDS 2011

This definition was further refined in 2011 by a panel of experts and is termed the Berlin definition of ARDS.

ARDS is defined by timing (within 1 week of clinical insult or onset of respiratory symptoms);

radiographic changes (bilateral opacities not fully explained by effusions, consolidation, or atelectasis).

origin of edema (not fully explained by cardiac failure or fluid overload); and severity based on the PaO2/FiO2 ratio on 5 cm of continuous positive airway pressure (CPAP).

The 3 categories are mild (PaO2/FiO2 200-300), moderate (PaO2/FiO2 100-200), and severe (PaO2/FiO2 ≤100).

ARDS risk factors:

- Bacteremia
- Sepsis
- Trauma, with or without pulmonary contusion
- Fractures, particularly multiple fractures and long bone fractures
- Burns
- Massive transfusion
- Pneumonia
- Aspiration
- Drug overdose
- Near drowning
- Postperfusion injury after cardiopulmonary bypass
- Pancreatitis
- Fat embolism

Differential Diagnoses

- Aspiration Pneumonitis and Pneumonia
- Bacterial Pneumonia
- Bacterial Sepsis
- Goodpasture Syndrome
- Hemorrhagic Shock
- Heroin Toxicity
- Hypersensitivity Pneumonitis
- Mechanical Ventilation

- Multiple Organ Dysfunction Syndrome in Sepsis
- Noninvasive Ventilation
- Hospital-Acquired Pneumonia (Nosocomial Pneumonia) and Ventilator-Associated Pneumonia
- Perioperative Pulmonary Management
- Pneumocystis jiroveci Pneumonia (PJP)
- Pulmonary Eosinophilia
- Respiratory Failure
- Salicylate Toxicity
- Septic Shock
- Toxic Shock Syndrome
- Transfusion Reactions
- Tumor Lysis Syndrome
- Ventilator-Associated Pneumonia
- Viral Pneumonia

In ARDS, if the partial pressure of oxygen in the patient's arterial blood (PaO2) is divided by the fraction of oxygen in the inspired air (FiO2), the result is 300 or less. For patients breathing 100% oxygen, this means that the PaO2 is less than 300.

In addition to hypoxemia, arterial blood gases often initially show a respiratory alkalosis.

However, in ARDS occurring in the context of sepsis, a metabolic acidosis with or without respiratory compensation may be present.

New Global Definition of ARDS

- Intubation not required
- High flow nasal oxygen (HFNO) ≥ 30 L/min
  or NIV/CPAP ≥ 5 cm H_2O end-expiratory pressure

Hypoxemia levels of:
- $PaO_2/FiO_2 \leq 300$ mmHg
  or $SpO_2/FiO_2 \leq 315$ mmHg with $SPO_2 \leq 97\%$

- Bilateral opacities confirmed by one of the following:
  chest radiograph, computed tomography,
  or ultrasound with a well-trained operator

- In resource limited settings the following are not required:
  PEEP, oxygen flow, or specific respiratory support devices

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As the condition progresses and the work of breathing increases, the partial pressure of carbon dioxide (PCO2) begins to rise and respiratory alkalosis gives way to respiratory acidosis.

Patients on mechanical ventilation for ARDS may be allowed to remain hypercapnic (permissive hypercapnia) to achieve the goals of low tidal volume and limited plateau pressure ventilator strategies aimed at limiting ventilator-associated lung injury.

To exclude cardiogenic pulmonary edema, it may be helpful to obtain a plasma B-type natriuretic peptide (BNP) value and echocardiogram.

A BNP level of less than 100 pg/mL in a patient with bilateral infiltrates and hypoxemia favors the diagnosis of ARDS rather than cardiogenic pulmonary edema.

The echocardiogram provides information about left ventricular ejection fraction, right ventricular function, wall motion, and valvular abnormalities.

	Cardiogenic	Renal	ARDS
Distribution of Pulmonary edema	90% even	70% central	45% Peripheral 35% Even
Kerley B lines/ peribronchial cuffing	30%	30%	None
Pleural effusions	40%	30%	10%
Air bronchograms	20%	20%	70%

Other abnormalities observed in ARDS depend on the underlying cause or associated complications and may include the following:

- Hematologic – In septic patients, leukopenia or leukocytosis may be noted. Thrombocytopenia may be observed in septic patients in the presence of disseminated intravascular coagulation (DIC).

Von Willebrand factor (VWF) may be elevated in patients at risk for ARDS and may be a marker of endothelial injury.

- Renal – Acute tubular necrosis (ATN) often ensues in the course of ARDS, probably from ischemia to the kidneys. Renal function should be closely monitored.

- Hepatic – Liver function abnormalities may be noted in either a pattern of hepatocellular injury or cholestasis.

- Cytokines – Multiple cytokines, such as interleukin (IL)–1, IL-6, and IL-8, are elevated in the serum of patients at risk for ARDS.

How do you categorize ARDS?

ARDS is divided into three categories: mild, moderate, and severe. The category is determined by comparing the level of oxygen in the blood with the amount of oxygen that needs to be given to achieve that level.

What are the Berlin principles for ARDS?

The Berlin definition uses the PaO2/FiO2 ratio to distinguish

mild ARDS (200 < PaO2/FiO2 ≤ 300 mmHg)

moderate ARDS (100 < PaO2/FiO2 ≤ 200 mmHg)

severe ARDS (PaO2/FiO2 ≤ 100 mmHg).

Jun 13, 2019

What is the criteria for Ali ARDS?

The American-European Consensus Conference (AECC) on ARDS in 1994 defined ALI as respiratory failure of acute onset with a PaO2/FiO2 ratio ≤300 mmHg (regardless of the level of positive end expiratory pressure, PEEP)

bilateral infiltrates on frontal chest radiograph, and a pulmonary capillary wedge pressure ≤18 mmHg

What is the Murray score for ARDS?

The Murray Score is used to grade the severity of lung injury in acute respiratory distress syndrome (ARDS).

A score greater than 2.5 will indicate ARDS.

a score between 1-2.5 indicates mild to moderate lung injury.

and a score of zero rules out lung injury.

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Murray score

	0	1	2	3	4
P/F ratio (kPa)	≥40	30-39.9	23.3 – 29.9	13.3 – 23.2	<13.3
PEEP (cmH_2O)	≤5	6-8	9-11	11-14	≥15
Compliance (ml/cmH_2O)	≥80	60-79	40-59	20-39	≤19
CXR quadrants infiltrated	0	1	2	3	4

Compliance is calculated as

$$\frac{\textit{Tidal volume (mL)}}{(P_{Plateau} - \textit{PEEP})}$$

THANK YOU!