

Transfusion-Associated Circulatory Overload
Public Forum:
Quebec Haemovigilance Committee
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Agenda

- Signs and symptoms
- Diagnostic criteria
- Incidence
- Demographics
- Morbidity and mortality
- Risk factors



TACO: Presentation

Clinical

Acute dyspnea

Orthopnea

Cyanosis

O₂ desaturation

PAOP >18mm Hg; CVP>12

Tachycardia

↑ Systolic pressure

↑ Pulse pressure

Pedal edema

Jugular venous distension

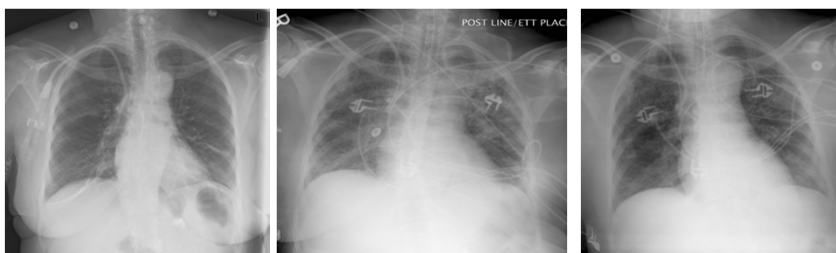
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TACO: Presentation

Radiographic

CT ratio > 0.53 and vascular pedicle width >65 mm



1:50 AM

9:15 AM

12:05 AM

EKG: New ST segment and T wave changes

Acknowledgement: M. Looney

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TACO: Presentation

Laboratory

- Troponin T > 0.1 ng/ml
- ↑↑ BNP or NT – Pro - BNP

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Most Frequent Presentation

- Dyspnea (77%)
- Hypertension (43%)
- O₂ desaturation (36%)

Robillard et al. Transfusion Medicine 2009;19:280

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Diagnostic Criteria

#1

- Hypoxemia: $PaO_2/FiO_2 < 90\%$ on room air
- Bilateral infiltrates on CXR in presence of clinically evident left atrial hypertension
- During or within 6 hours of transfusion

#2

- Pulmonary edema within 6 hours
- New onset or exacerbation of at least 3 symptoms/signs

References:

Toy et al. Critical Care Medicine 2005;33:721-6
NHSN Biovigilance Component. 2010

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Differential Diagnosis

- TRALI
- Anaphylaxis / severe allergic reaction
- Not transfusion-related

	<u>TACO</u>	<u>TRALI</u>
BP:	↑	↓ or No change
CXR:	Cardiomegaly	No change
Clinical:	JVD, Pedal edema	No changes
Telemetry:	↑PAOP & ↑CVP	WNL/ ↓

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BNP – Brain Natiuretic Peptide

Zhou: When post-to-pre transfusion ≥ 1.5
Sensitivity: 81%
Specificity: 89%

Tobian: ≥ 1.5 post-to-pre transfusion
Sensitivity: 92.5%
Specificity: 87.5%

Li: Ability to descriminate TACO from TRALI
Positive predictive value: 74-78%

Transfusion 2005;45:1056-63
Transfusion 2008;48:1143-48
Transfusion 2009;49:13-20

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Demographics of TACO

Quebec Hemovigilance System: 2000-2006

Age Distribution	%
0-17	2.6%
18-49	6.9%
50-59	7.3%
60-69	19.3%
70+	64%

Robillard et al. Transfusion 2008;48:204A

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Clinical Impact of TACO

- Increases morbidity
 - 21% of cases life-threatening (Robillard)
- Increases ICU stay (Li, 2009)
- Increases hospital length of stay (Popovsky 1996) in orthopedic surgery
- 1 RBC is sufficient to trigger the reaction!
(Popovsky 1985 & 1996, Robillard 2008)
 - >20 – 53% of cases

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Importance of TACO: FDA Mortality Data

	% of Fatalities			
	FY05	FY06	FY07	FY09
TRALI	47%	56%	65%	30%
TACO	2%	13%	10%	27%

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Mortality

	<u>Case Fatality %</u>
French Hemovigilance	3.7
Quebec Hemovigilance	1.4
UPMC	8.3

David Vox Sang 2002
Robillard et al. Transfusion 2008;48:204
Narick et al. Transfusion 2011;51:127A

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Risk Factors

- Setting
- Volume
- Flow rate

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Risk Factors: ICU Patients

Medical ICU

- 6% incidence
- Risk factors
 - Positive fluid balance (1.4 vs. 0.8L)
 - Faster rate of transfusion (225 ml/hr vs. 168 ml/hr)
 - LV dysfunction

Li et al. Transfusion 2011;51:338

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Risk Factors: General Hospital Setting

	<u>O.R.</u>
Female gender	2.1
Past CHF	5.6
Hx hemodialysis	3.5
Recent surgery	2.3
Mechanical Ventilation	2.7
Recent vasopressors	9.7
Positive fluid balance	1.2

Murphy E. Transfusion 2010;50:127A-128A

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TACO: Role of RBC Volume

Quebec Hemovigilance System

Age	# RBC/Case
0-17	1.20
18-49	3.24
60-69	2.23
70+	1.84
Mean	2.11

P. Robillard (personal communication)

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Transfusion Flow Rate: RBC

Requirements/Recommendations

- Circular of Information (USA): “As patient can tolerate, but in less than 4 hours”
- AABB Technical Manual, 17th Edition
 - 240 ml/hr (adults)
 - 4 ml/min

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Flow Rate: RBC

Problem

- No accounting of recipient weight (blood volume)
- No accounting of the patient's underlying cardiac reserve

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Flow Rate: RBC (cont.)

Problem: Flow rate is poorly controlled

- 2005 study: 47 cases of TACO
 - Mean: 4.5 ml/min. (270 ml/hr)
 - Range: 0.9 – 48.1 ml/min.

Implications:

- TACO occurs with low flow rates as low as 0.9 ml/min.
 - Need better quality control of infusion process
 - Need data for better nursing transfusion guidelines

Andrzejewski C. (personal communication)
Popovsky MA. Transfusion Reactions, 2007

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Flow Rate: FFP & Platelets

	AABB Recommendation	Appropriate
FFP	300 ml/hr	?
Platelets	300 ml/hr	?

Ref: 17th Edition AABB Technical Manual, 2012

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TACO: Flow Rate

FFP

- Prevalence: 1 in 68 patients
- 14 of 24 cases occurred in ICU
- Flow rate = 647 +/- 315 ml/hr

Narick C et al. Transfusion 2011;51:127A

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Conclusions

- TACO is a leading cause of transfusion morbidity & mortality
- Cellular and non-cellular products can trigger TACO
- Role of volume and flow rate is emerging
- Risk factors are better understood
- Strategies to mitigate are needed