

Complications pulmonaires transfusionnelles

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Objectifs

- [Décrire la surcharge volémique aux soins intensifs
- [Expliquer la contribution de la transfusion
- [Décrire les divers tests utiles, dont les BNP, au diagnostic différentiel des complications pulmonaires transfusionnelles

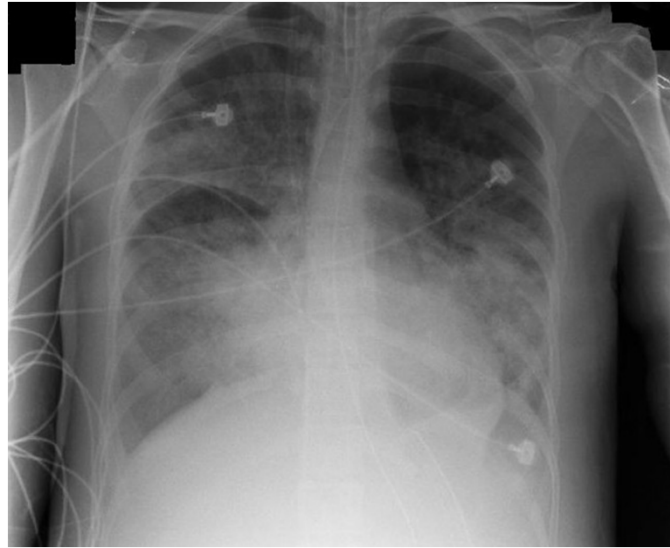
Incidence

- [Complications transfusionnelles pulmonaires
 - Les plus fréquentes
- [Deux sous-types classiques
 - TRALI (transfusion related acute lung injury)
 - TACO (transfusion associated circulatory overload)

Clinique

- [Homme, 71 ans, hypertension artérielle sous triple thérapie
- [Admis pour hémorragie digestive haute
- [TA 89/58, FC 118, Hb: 59, INR: 2,4
- [2 L de cristaalloïdes à l'urgence
- [2 culots + 4 PFC en 1 h aux SI
- [Insuffisance respiratoire hypoxémique post-gastroscopie

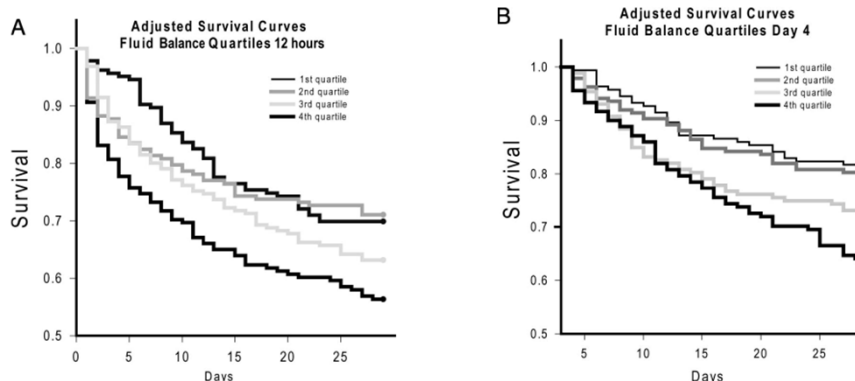
Radiographie



Surcharge volémique

- [Multifactorielle
 - Relative: dysfonction cardiaque
 - Absolue: hypervolémie
- [Soins intensifs:
 - mortalité plus élevée
 - sevrage ventilatoire plus long

Choc septique et volémie



Boyd J, Crit Care Med 2011

Choc septique et volémie

Table 4. 12-hr fluid balance: Survivors vs. nonsurvivors within CVP groups

CVP Group	Net Fluid Balance		<i>p</i>
	Survivors	Nonsurvivors	
All Patients	3444 (1861–5984) mL	4429 (2537–6560) mL	<.001
CVP <8 mm Hg	3015 (1296–4987) mL	2281 (802–5711) mL	NS
CVP 8–12 mm Hg	2727 (1227–5491) mL	3112 (1559–4809) mL	NS
CVP >12 mm Hg	3975 (2387–6614) mL	5237 (3140–7773) mL	<.001

Boyd J, Crit Care Med 2011

ARDS et volémie

- Patients avec diagnostic d'ARDS
- Stratégie liquidienne libérale vs. restrictive
 - Bilan liquidien cumulatif à J7: + 6900 mL vs. -136 mL

ARDS et volémie

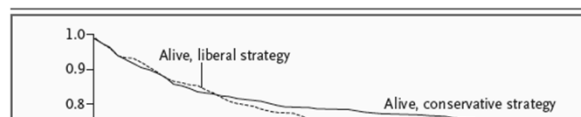


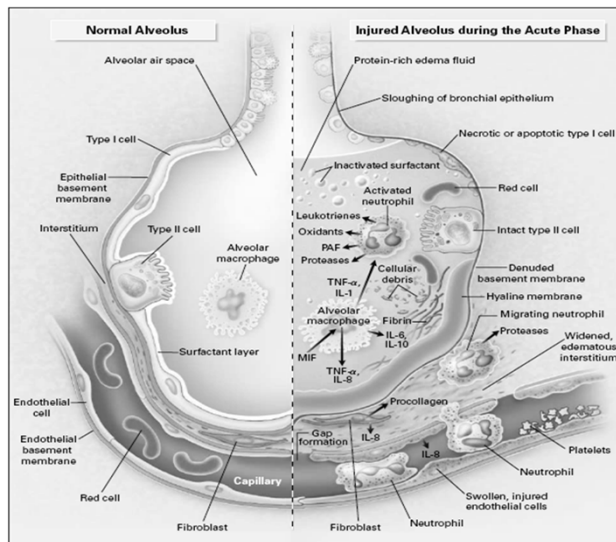
Table 3. Main Outcome Variables.*

Outcome	Conservative Strategy	Liberal Strategy	P Value
Death at 60 days (%)	25.5	28.4	0.30
Ventilator-free days from day 1 to day 28 [†]	14.6±0.5	12.1±0.5	<0.001

Figure 3. Probability of Survival to Hospital Discharge and of Breathing without Assistance during the First 60 Days after Randomization.

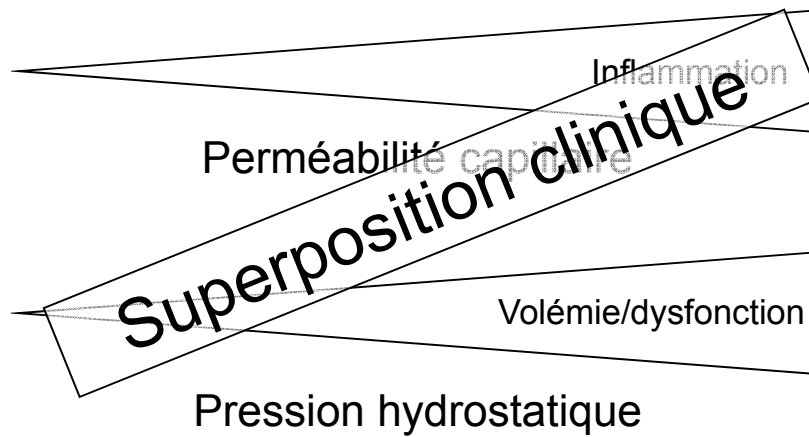
ARDSnetwork,
NEJM 2006

ARDS et inflammation



Ware, NEJM 2000

Soins intensifs



Transfusions aux SI

Table 1

Results of epidemiologic studies on anemia and blood transfusions in critical care

	ABC Trial [2] (Western Europe)	CRIT Study [3] (USA)	TRICC Investigators [9] (Canada)	North Thames Blood Interest Group [5] (UK)
<i>n</i>	3534	4892	5298	1247
Mean admission hemoglobin (g/dl)	11.3 ± 2.3	11.0 ± 2.4	9.9 ± 2.2	-
Percentage of patients transfused in ICU	37.0%	44.1%	25%	53.4%

— [25-55% des patients admis ont SI seront transfusés

Napolitano LM, Crit Care 2004

Transfusions et mortalité

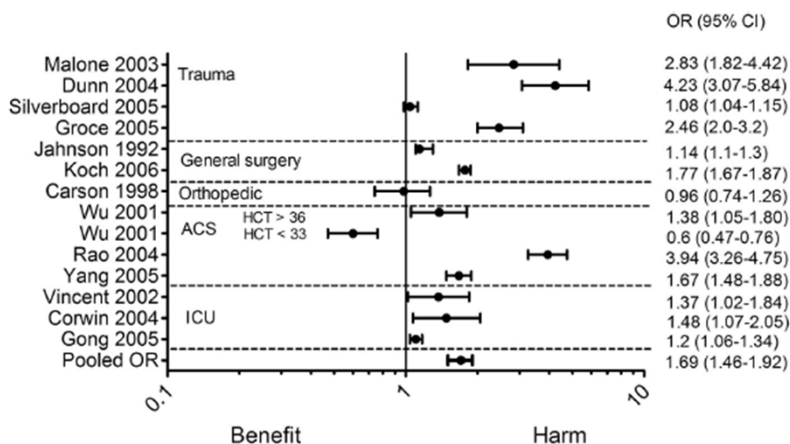


Figure 2. Association between blood transfusion and the risk of death (odds ratio [OR] and 95% confidence interval [CI]). ACS, abdominal compartment syndrome; ICU, intensive care unit.

Marik PE, Crit Care Med 2008

Complications pulmonaires

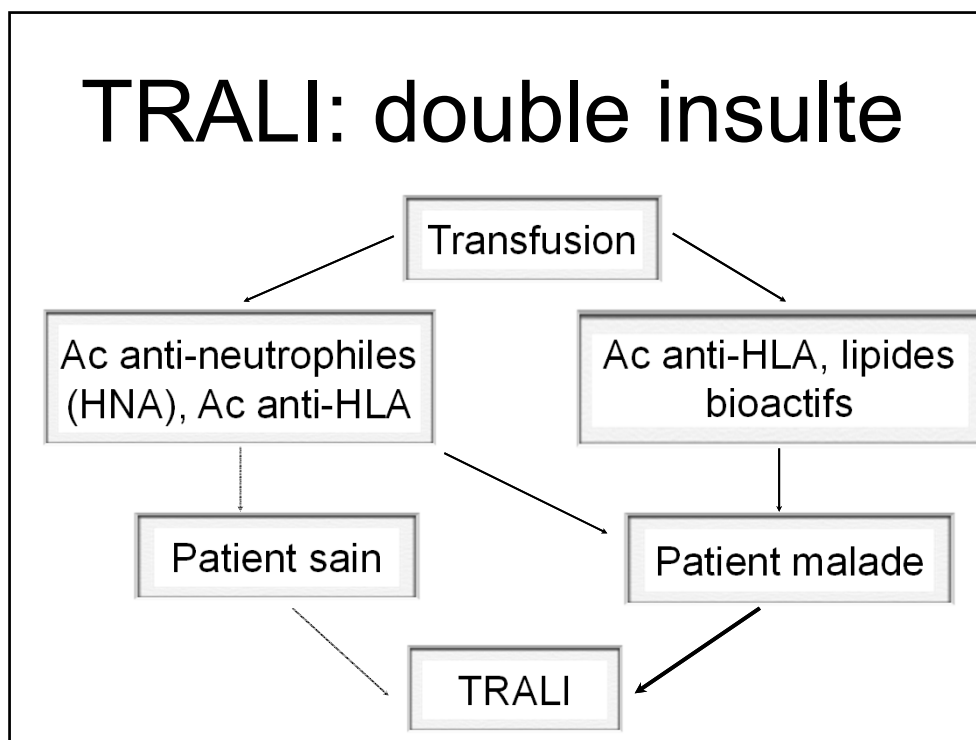
- Rôles des transfusions
 - Inflammation (immunomédiée ou non)
 - Augmentation de la volémie

TRALI

- Oedème pulmonaire bilatéral avec hypoxémie aiguë
- Absence d'hypertension de l'oreillette gauche
- Absence d'autre étiologie temporelle de lésion pulmonaire
- < 6 h post-transfusion

Consensus canadien, 2004

TRALI: double insulte



TRALI

- Cohorte aux SI (Mayo Clinic): 8%
- Majoration d'un ARDS installé: 12%

Gajic O, Am J Respir Crit Care Med 2007

TRALI

TABLE 3. TRANSFUSION-RELATED RISK FACTORS FOR ACUTE LUNG INJURY

Variable	Adjusted ^f	
	OR (95% CI)	P Value
Any high plasma volume components (FFP or platelets)	2.78 (1.21–6.38)	0.016
Number of units from female donors	1.51 (1.08–2.12)	0.016
Amount of plasma from female donors, L	5.09 (1.37–18.85)	0.015
Amount of plasma from female donors with at least one pregnancy, L	9.48 (1.38–65.35)	0.022
Number of pregnancies among donors	1.19 (1.05–1.34)	0.007
Number of HLA class II ⁺ units	3.08 (1.15–8.25)	0.025
Number of GIF ⁺ units	4.85 (1.32–17.86)	0.018
Mean LysoPC 16:0** (per 10-mol/L increase)	1.16 (1.02–1.32)	0.022
Mean LysoPC 18:0** (per 10-mol/L increase)	1.61 (1.08–2.38)	0.018

Gajic O, Am J Respir Crit Care Med 2007

TRALI

TABLE 3. Predictors of acute lung injury (suspected and possible TRALI combined) in a stepwise multivariate conditional logistic regression analysis when total plasma (A), female plasma (B), or male plasma (C) was entered in the model

Component	Odds ratio (95% CI)	p Value
(C) Total plasma	3.4* (1.2-10.2)	0.026
24-hr fluid balance	1.3* (0.9-1.9)	0.093
Sepsis	24.1* (1.1-530)	0.043
(A) Female plasma	25.6* (1.3-499)	0.032
24-hr fluid balance	1.3* (0.8-2.1)	0.213
Sepsis	41.8 (0.9-1779)	0.051
(B) Male plasma	2.7* (0.7-10.1)	0.134
24-hr fluid balance	1.2* (0.9-1.6)	0.271
Sepsis	11.4* (1.1-114)	0.039

* For each L of plasma or positive fluid balance.

Rana R, Transfusion 2006

Transfusions et ARDS

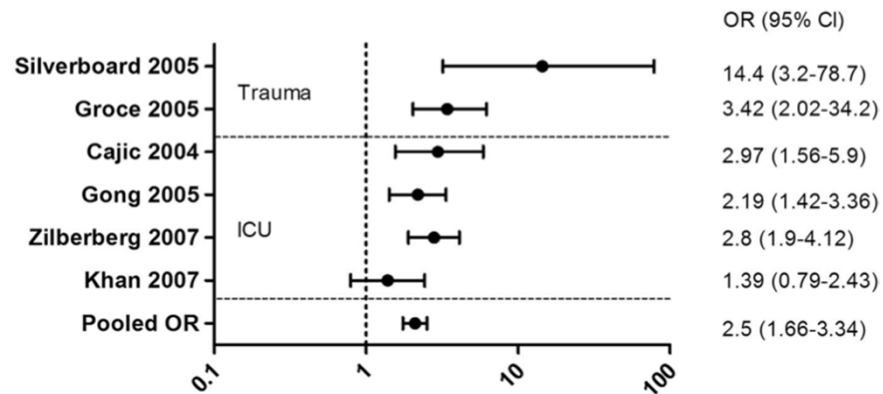


Figure 4. Association between blood transfusion and the risk of developing adult respiratory distress syndrome (odds ratio [OR] and 95% confidence interval [CI]). ICU, intensive care unit.

Marik PE, Crit Care Med 2008

TACO

— [Incidence de 1-8% toute population confondue

— [Cohorte aux SI (Mayo Clinic): 6%

Li G, Transfusion 2011

Critères cliniques

- Clinique: hypertension, gallop, jugulaires distendues
- Radiologie: pédicules vasculaires, index cardiothoracique
- Hémodynamie: PAPO > 18, PVC > 12
- Échocardiographie: Dysfonction systolique, valvulopathie, rapport E/E'
- Δ ST-T, Réponse rapide aux diurétiques

TACO

TABLE 3. Transfusion characteristics of TACO cases and matched controls

Variables	Matched pairs	Cases	Controls	OR (95% CI)	p value
Lowest Hb*†	51	8 (7-9)	8 (7-9)	0.78 (0.58-1.03)	0.081
Number of units (total)†	51	3 (2-7)	2 (2-3)	1.45 (1.12-1.88)	0.005
RBCs†	51	2 (1-4)	2 (1-2)	1.30 (0.99-1.70)	0.06
FFP†	51	0 (0-4)	0 (0-0)	1.39 (1.07-1.80)	0.005
PLTs‡					
Storage days for RBCs†	34	22 (17-30)	19 (16-29)	1.02 (0.97-1.08)	0.472
Total plasma (L)†	51	0.41 (0.07-1.02)	0.07 (0.07-0.15)	4.88 (1.55-15.36)	0.007
Transfusion rate (mL/hr)†	51	225 (135-350)	168 (100-205)	1.88 (1.06-3.33)	0.031
Fluid balance (mL)†	51	1445 (830-3520)	830 (350-1700)	1.38 (1.12-1.71)	0.003

* The minimal Hb value within the time of transfusion \pm 12 hours.

† Median (IQR).

‡ Only four TACO cases received PLT transfusion and no PLTs were used in control patients.

TACO

TABLE 4. Baseline predictors of the development of TACO before the onset of transfusion (comparison of TACO cases and randomly selected controls)

Variables	Cases (n = 51)	Controls (n = 51)	OR (95% CI)	p value
Univariate analyses				
Age (year)*	73 (57-81)	73 (59-81)	0.99 (0.96-1.02)	0.580
Gender (female), N (%)	24 (47)	24 (47)	1 (0.46-2.18)	1.000
History of cardiovascular disease, N (%)	38 (75)	27 (53)	2.60 (1.14-6.12)	0.025
Left ventricular dysfunction†	37 (72.5)	14 (27.5)	7.00 (3.00-17.21)	<0.001
PBV*	5.0 (4.3-5.7)	5.0 (4.1-5.5)	1.19 (0.84-1.73)	0.339
APACHE III*‡	71 (55-83)	71 (56-85)	1.00 (0.99-1.01)	0.944
FFP ordered for reversal of anticoagulant therapy, N (%)	17 (33)	7 (13.7)	3.14 (1.21-8.93)	0.023
Chronic kidney disease, N (%)	10 (19.6)	4 (7.8)	2.87 (0.89-11.08)	0.080
Hb*§	8.6 (7.3-9.6)	8.5 (7.9-9.6)	0.94 (0.72-1.20)	0.603
Sepsis, N (%)	10 (19.6)	9 (17.6)	1.11 (0.41-3.07)	0.836
Aspiration, N (%)	2 (3.9)	5 (9.8)	0.38 (0.05-1.84)	0.233
Alcohol Abuse, N (%)	9 (17.6)	12 (23.5)	0.70 (0.26-1.82)	0.464
Multivariate analyses				
Left ventricular dysfunction*	37 (72.5)	14 (27.5)	8.23 (3.36-21.97)	<0.001
FFP ordered for reversal of anticoagulant therapy, N (%)	17 (33)	7 (13.7)	4.31 (1.45-14.30)	0.008

Li G, Transfusion 2011

TACO

— [Autres facteurs de risque:

— Âge et volume transfusé (orthopédie)

Popovsky MA, Immunohematology 1996

— Âge et dysfonction cardiaque

Zhou L, Transfusion 2005

TRALI et TACO

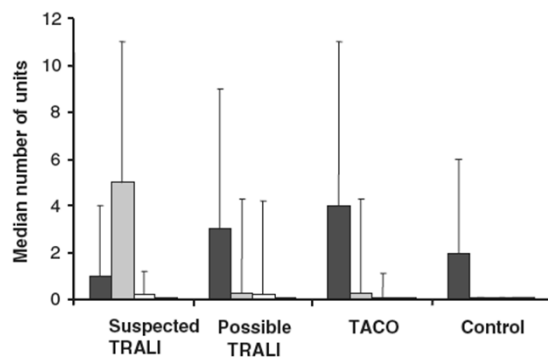


Fig. 2. Median number of specific product transfusions according to diagnostic group. (■) RBCs; (□) FFP; (□) PLTs; (■) cryoprecipitate.

Rana R, Transfusion 2006

Complications pulmonaires

- [TRALI: 1/1271 produits transfusés
- [TRALI possible: 1/534 produits transfusés
- [TACO: 1/356 produits transfusés

Rana R, Transfusion 2006

TACO/TRALI: même combat ?

- [Incidence similaire
- [Superposition de certains facteurs de risque
- [Aspects cliniques similaires aux soins intensifs
- [Rôle combiné probable dans la mortalité transfusionnelle

Hypertension de l'oreillette gauche

Diagnostic différentiel

- [Aspects cliniques
- [Facteurs de risque
- [Hémodynamie
- [Lavage broncho-alvéolaire
- [Anticorps anti-leucocytes
- [BNP

Inflammation vs. congestion

<u>TRALI</u>	<u>TACO</u>
T°↑	-
Hypotension	Hypertension
-	Jugulaires ↑, oedème, B3
Leucopénie	-
-	Amélioration rapide avec diurétiques

Facteurs de risque

— TACO:

- Âge (> 60 ans et < 3 ans)
- Bilan liquidien positif
- Nombre et volume de transfusions
- Dysfonction cardiaque
- Insuffisance rénale

Facteurs de risque

— [TRALI:

- Donneur féminin
- Produit riche en plasma
- Ambiance inflammatoire (sepsis)

Hémodynamie

— [PAPO (wedge) > 18 mmHg

- Peu spécifique de l'oedème hydrostatique

— [Rapport E/E'

- [Dysfonction cardiaque, valvulopathie

Lavage broncho-alvéolaire

- [Ratio protéines liquide pulmonaire/
protéines plasmatiques
 - > 0,65-0,75: oedème de perméabilité
 - Peu validé cliniquement

Anticorps anti-leucocytes

- [Anticorps seuls
 - Présents chez donneurs sans TRALI
 - TRALI avec anticorps négatifs
- [Anticorps chez donneur + antigène chez receveur
 - Retrouvé sans TRALI
 - TRALI sans crossmatch +

Brain Natriuretic Peptide

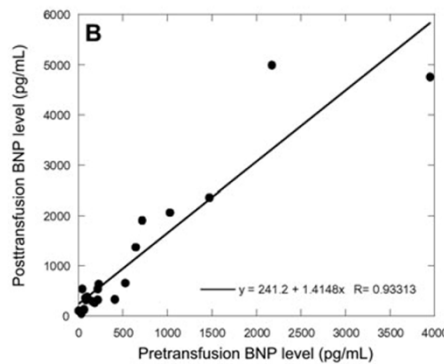
- { Sécrété par le ventricule
- { Surcharge en volume OU en pression
- { Insuffisance cardiaque
 - Association continue avec la sévérité (classe NYHA)
 - Association continue avec la mortalité

Insuffisance respiratoire

- { Urgence
 - VPP 89% pour insuffisance cardiaque si > 100
Maisel AS, NEJM 2002
- { Soins intensifs
 - < 200: VPP 91% - ARDS
 - > 1200: VPP 75% - Oedème hydrostatique
Karpalotis D, Chest 2007

TACO

- TACO vs. contrôle
- BNP > 100 et ratio post/pré > 1,5 associé au TACO



Zhou L, Transfusion 2005

TACO

- Oedèmes pulmonaires post-transfusionnels
- TACO ou TRALI déterminés par experts à l'aveugle

TABLE 3. Comparison of BNP and NT-pro-BNP between TACO, TRALI, and possible TRALI

Characteristic	TACO (n = 50)	Possible TRALI (n = 31)	TRALI (n = 34)	p Value
BNP before transfusion, pg/mL (n = 23)*	521.5 (143-2180.3)	85 (49-291)	170.5 (41-407.3)	0.128
BNP after transfusion (n = 73), pg/mL*	559 (287.8-1347.8)	446 (128-743.3)	375 (122.5-780.5)‡	0.038
NT-pro-BNP before transfusion (n = 61), pg/mL*	3410 (686-11951.5)	948 (232-2352)	664 (138.5-2402)‡	0.024
NT-pro-BNP after transfusion, pg/mL (n = 84)*	5197 (1695-15714)	2349 (919-4610)	1558.5 (628.5-5114)‡	0.004
NT-pro-BNP ratio† (n = 61)*	1.3 (1.0-3.8)	3.0 (1.4-9.0)	2.0 (1.3-5.9)	0.257

* The data are presented as median (IQR).
 † NT-pro-BNP after transfusion/NT-pro-BNP before transfusion.
 ‡ TRALI against TACO significantly different (p < 0.05).



Li G, Transfusion 2009

Conclusion

- [Éviter l'hypervolémie aux soins intensifs
- [Surcharge volémique transfusionnelle fréquente
- [TRALI fréquent, particulièrement aux soins intensifs
- [Superposition clinique TRALI/TACO difficile à différencier
- [BNP ≠ panacée !
- [Prévention: éviter la transfusion

CHUM

