Defining the Incidence of Perioperative Transfusion-Related Pulmonary Complications in Pediatric Non-Cardiac Surgical Patients

Leanne Thalji, BM MSc[1]; Daniel Thum, MD[1], Timothy J. Weister, MSN RN[2]; Wayne Weber, RRT[2]; James R. Stubbs, MD[3]; Daryl J. Kor, MD MSc[1]; Michael E. Nemergut, MD PhD[1]

[1]Department of Anesthesiology and Perioperative Medicine; [2]Anesthesia Clinical Research Unit; [3]Division of Transfusion Medicine, Mayo Clinic, Rochester, MN

Background

- Transfusion-related acute lung injury (TRALI) and transfusion-associated circulatory overload (TACO) are the leading causes of transfusion-related fatalities
- Their burden in pediatric patients remains poorly defined

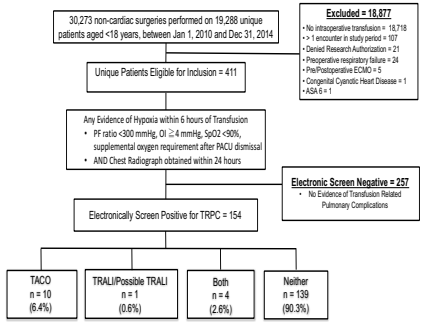
Objectives

- To delineate the incidence and epidemiology of transfusion related pulmonary complications (TRPCs), TRALI and TACO following intraoperative blood product administration in pediatric patients

Study Subjects

- All consecutive pediatric patients (<18 years) undergoing non-cardiac surgery between Jan 1, 2010 – Dec 31, 2014
- Exclusion criteria: Lack of research authorization, congenital cyanotic heart disease, pre-op respiratory failure, ECMO requirement, ASA 6, prior inclusion in study

Figure 1. Patient Flow Diagram



Methods

Data Collection

- Demographic, clinical and laboratory data collected from institutional database receiving automated data from electronic medical record

Statistical Analysis

- Overall incidence rates were calculated. Thereafter, sex- and surgical specialty-specific rates were calculated and tested using the Fishers exact test. Age-, and transfusion volume-specific incidence rates were calculated and compared using the Cochran-Armitage trend test. Product specific incidence is reported as frequency and percentage

Table 1. Incidence of TRPCs

	TACO n (%)	TRALI n (%)	Both TACO/TRALI n (%)	Any TRPC n (%)	No TRPC n (%)	p-value
Overall (n = 411)	14 (3.4)	5 (1.2)	4 (1.0)	15 (3.6)	396 (96.4)	-
Age, years						0.109
≤1 (n=121)	6 (5.0)	4 (3.3)	4 (3.3)	6 (5.0)	115 (95.0)	
> 1, ≤ 8 (n=92)	5 (5.4)	0 (0.0)	0 (0.0)	5 (5.4)	87 (94.6)	
> 8, ≤ 13 (n=98)	2 (2.0)	1 (1.0)	0 (0.0)	3 (3.1)	95 (96.9)	
> 13 (n=100)	1 (1.0)	0 (0.0)	0 (0.0)	1 (1.0)	99 (99.0)	
Sex						0.815
Male (n=204)	6 (2.9)	3 (1.5)	2 (1.0)	7 (3.4)	197 (96.6)	
Female (n =207)	8 (3.9)	2 (1.0)	2 (1.0)	8 (3.8)	199 (96.2)	
Surgical Specialty						0.088
Abdominal (n=62)	1 (1.6)	0 (0.0)	0 (0.0)	1 (1.6)	61 (98.4)	
Neurological (n=108)	1 (0.9)	1 (0.9)	1 (0.9)	1 (0.9)	107 (99.1)	
Orthopedic (n=51)	2 (3.9)	1 (2.0)	1 (2.0)	2 (3.9)	49 (96.1)	
Spine (n=83)	5 (6.0)	0 (0.0)	0 (0.0)	5 (6.0)	78 (94.0)	
HEENT (n=31)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	31 (100.0)	
Thoracic (n=4)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	4 (100.0)	
Vascular (n=7)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	7 (100.0)	
Transplant (n=26)	1 (3.8)	1 (3.9)	0 (0.0)	2 (7.7)	24 (92.3)	
Urology (n=5)	1 (20.0)	1 (20.0)	1 (20.0)	1 (20.0)	4 (80.0)	
Other (n=34)	3 (8.8)	1 (2.9)	1 (2.9)	3 (8.8)	31 (91.2)	
Transfusion Volume ml/Kg						0.480
<10 (n=107)	2 (1.9)	2 (1.9)	1 (0.9)	3 (2.8)	104 (97.2)	
10 – 19 (n=114)	3 (2.6)	0 (0.0)	0 (0.0)	3 (2.6)	111 (97.4)	
20 – 34 (n=89)	4 (4.5)	2 (2.2)	2 (2.2)	4 (4.5)	85 (95.5)	
>34 (n=100)	5 (5.0)	1 (1.0)	1 (1.0)	5 (5.0)	95 (95.0)	
Product Specific Incidence						-
RBC Only (n=300)	9 (3.0)	3 (1.0)	2 (0.7)	10 (3.3)	290 (96.7)	
Plasma Only (n=4)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	4 (100.0)	
Platelets Only (n= 33)	2 (6.1)	1 (3.0)	1 (3.0)	2 (6.1)	31 (93.9)	
Cryoprecipitate Only (n=2)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (100.0)	
Mixed Products (n=72)	3 (4.2)	1 (1.4)	1 (1.4)	3 (4.2)	69 (95.8)	

Results

- 411 patients were eligible for inclusion (Figure 1)
- There were no significant differences in baseline characteristics between those who did vs. those who did not experience a TRPC
- The overall incidence of TACO was 3.4% (14/411), with 5/411 (1.2%) meeting criteria for TRALI
- Incidence was comparable between sexes
- There was a non-significant trend towards increased TRPCs with younger age
- Incidence of TRPCs was similar between surgical specialties and transfusion volume categories
- RBC administration was the associated component for the majority of TRPCs, although platelets demonstrated the highest risk per component transfused
- None of the identified TRPCs were reported to the institutional blood bank

Conclusions

- The contemporary incidence of pediatric perioperative TACO is 3.4% (95% CI 2.0 – 5.6)
- The contemporary incidence of pediatric perioperative TRALI is 1.2% (95% CI 0.5 – 2.8%)
- Real-time recognition and reporting of these sinister complications is poor
- These findings should serve to highlight the occurrence and potential risks to perioperative providers

Future Directions

- Replication in multi-institutional study powered to identify relationships between patient, surgical and transfusion characteristics and incidence cases of TRALI and TACO
- Development of a pediatric Recipient Epidemiology and Donor Evaluation Study type group to facilitate ongoing pediatric transfusion research and blood management strategies