SERIOUS HAZARDS OF TRANSFUSION SHOT

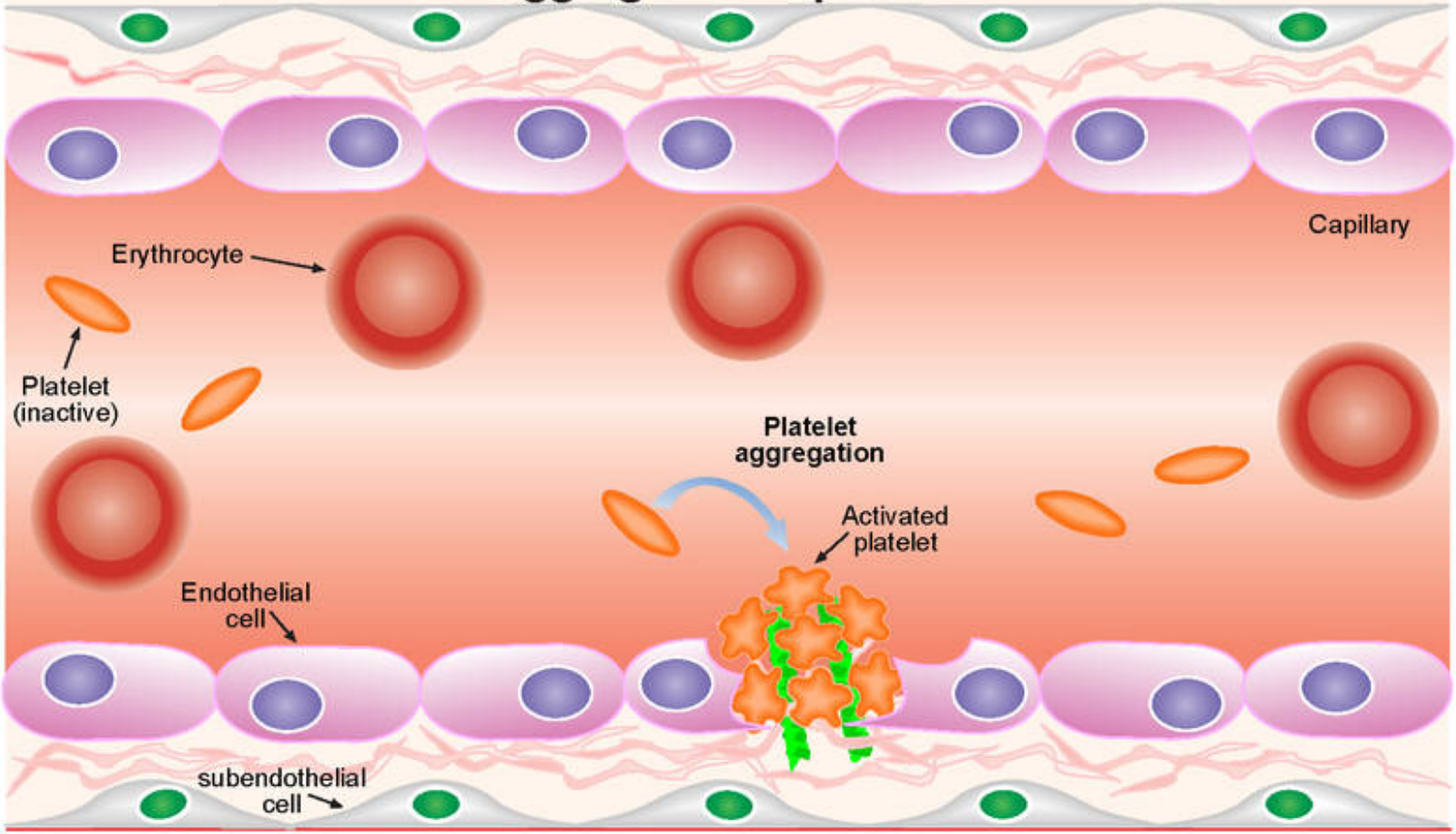
Reactions to platelets suspended in additive solution or plasma: Data from SHOT

BBTS Conference, Sept 2017

Janet Birchall, Consultant Haematologist, on behalf of the SHOT Steering Group

With thanks to Debbi Poles, Julie Ball and Ann Fogg

Aggregation of platelets



Platelets are recruited to sites of endothelium damage by detection of von Willebrand factor bound to exposed subendothelial collagen, using cell surface GPIb receptors. They can also directly bind to subendothelial collagen fibrils, using cell surface GPIV receptors and $\alpha 2\beta 1$ integrins. In addition, platelets bind other platelets, through GPIIb/IIIa receptors that recognise fibrinogen as an intermediate. In this way platelets aggregate to form seal the breach in the endothelium and initiate the blood clotting cascade that generates a meshwork of insoluble fibrin.

Reaction classification - International Haemovigilance Network/ International Society for Blood Transfusion & adopted by BSH and SHOT

	1 = Mild	2 = Moderate	3 = Severe
Febrile type reaction	A temperature ≥ 38 °C and a rise between 1and 2°C from pretransfusion values, but no other symptoms/signs	A rise in temperature of 2°C or more, or fever 39 °C or over and/or rigors, chills, other inflammatory symptoms/signs such as myalgia or nausea which precipitate stopping the transfusion	A rise in temperature of 2°C or more, and/or rigors, chills, or fever 39 °C or over, or other inflammatory symptoms/signs such as myalgia or nausea which precipitate stopping the transfusion, prompt medical review AND/OR directly results in, or prolongs hospital stay.
Allergic type reaction	Transient flushing, urticaria or rash	Wheeze or angioedema with or without flushing/urticaria/rash but without respiratory compromise or hypotension	Bronchospasm, stridor, angioedema or circulatory problems which require urgent medical intervention AND/OR, directly result in or prolong hospital stay, or **Anaphylaxis** (severe, life-threatening, generalised or systemic hypersensitivity reaction with rapidly developing airway and/or breathing and/or circulation problems, usually associated with skin and mucosal changes
Reaction with both allergic and febrile features	Features of mild febrile **and** mild allergic reactions	Features of both allergic and febrile reactions, at least one of which is in the moderate category.	Features of both allergic and febrile reactions, at least one of which is in the severe category.
Hypotensive reaction		Isolated fall in systolic blood pressure of 30 mm or more occurring during or within one hour of completing transfusion **and** a systolic blood pressure 80 mm. or less in the absence of allergic or anaphylactic symptoms. No/minor intervention required.	Hypotension, as previously defined, leading to shock (e.g., acidaemia, impairment of vital organ function) without allergic or inflammatory symptoms. Urgent medical intervention required.

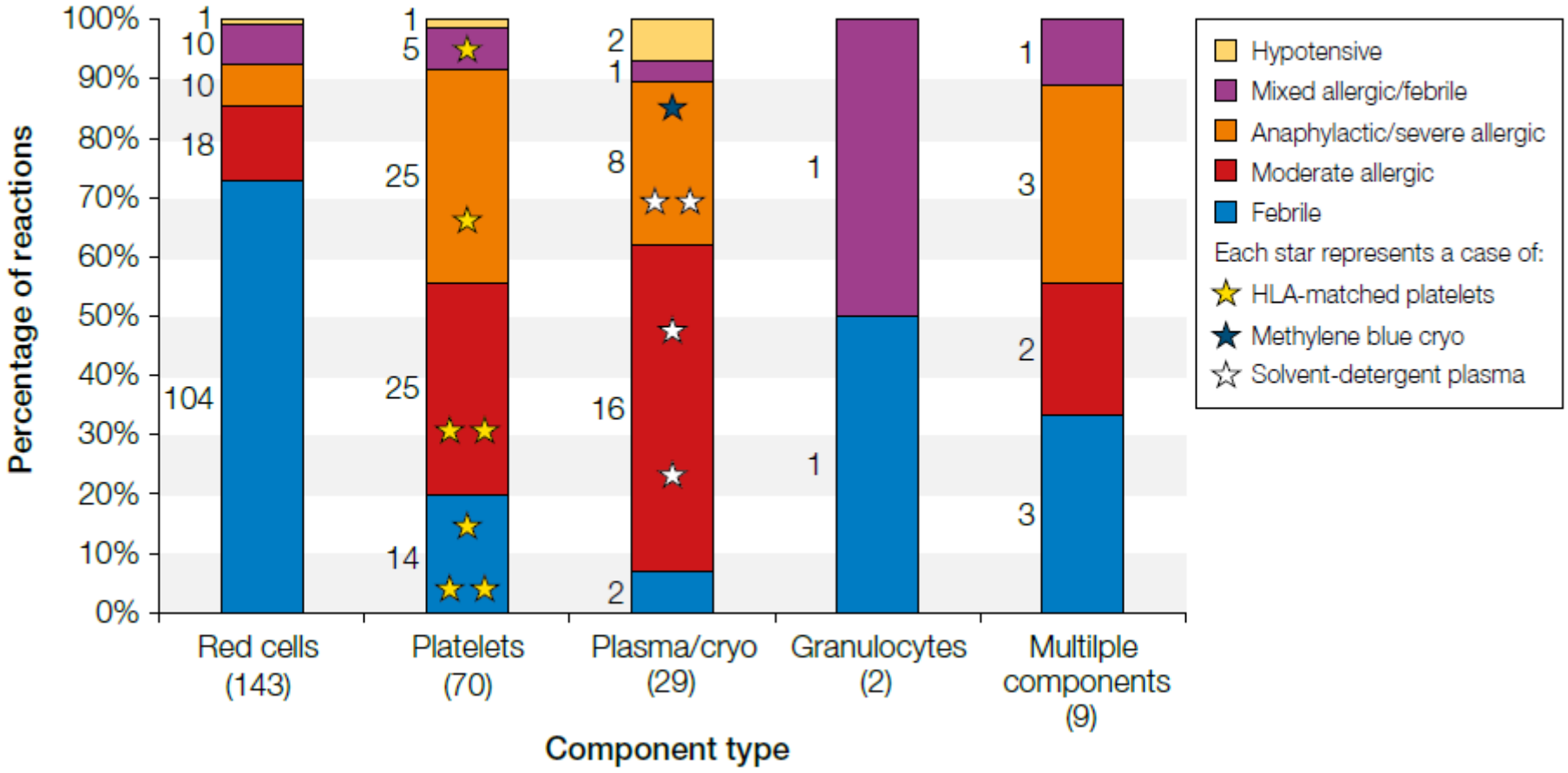
SHOT Acute Transfusion Reactions reported in 2016

Number of reactions

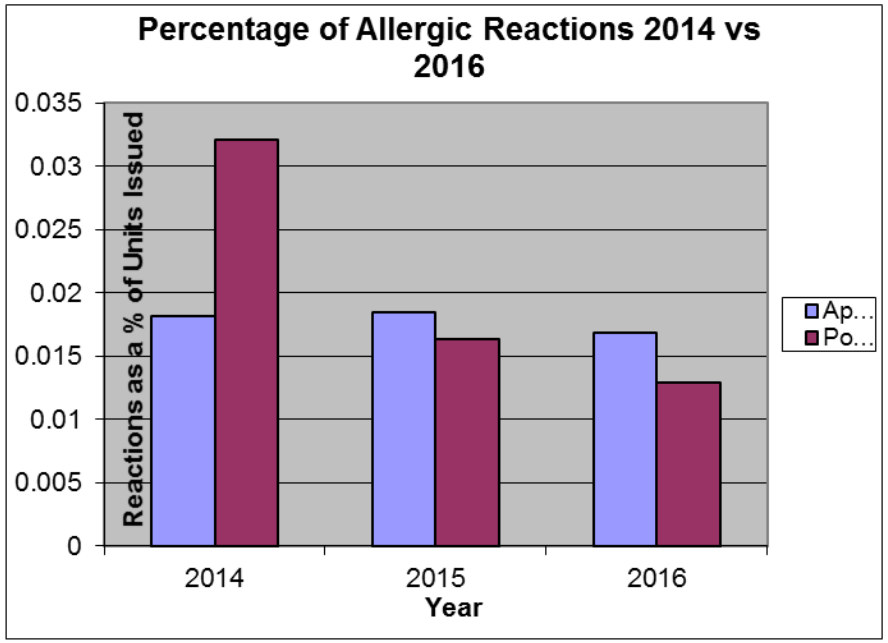
- Total number of reactions = 253
- Reaction rate
  - red cells 0.8/million in 2016
  - Platelets 2.3/million in 2016 (3.4/million 2015, 3.6/million 2014)
- Severe reactions = 76 reactions, allergic ~ x2 febrile

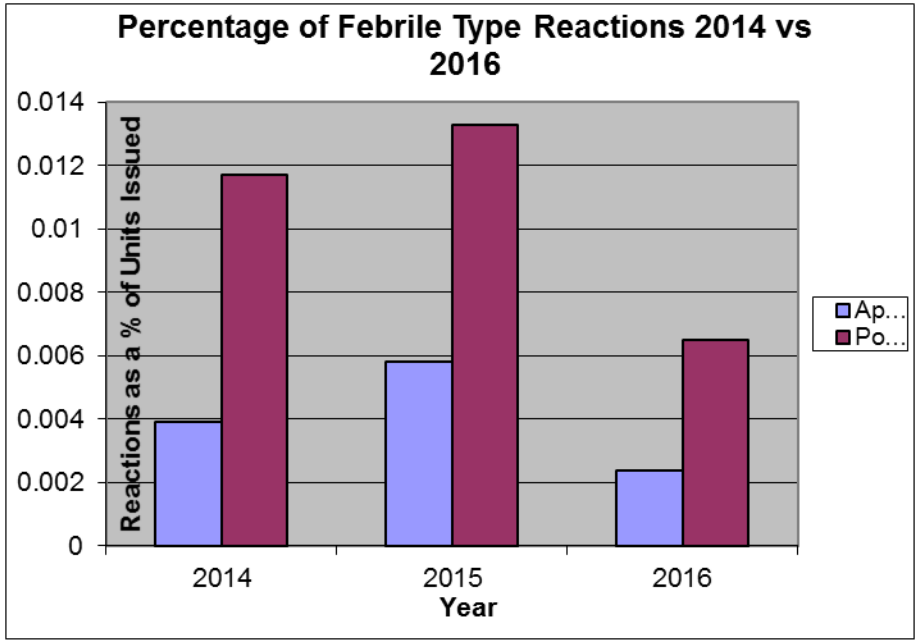
	Moderate	Severe	Total
Febrile	98	26	124
Allergic	61	46	107
Allergic/febrile	14	4	18
Hypotensive	4	0	4

Reaction by component type



SHOT platelet ATR data





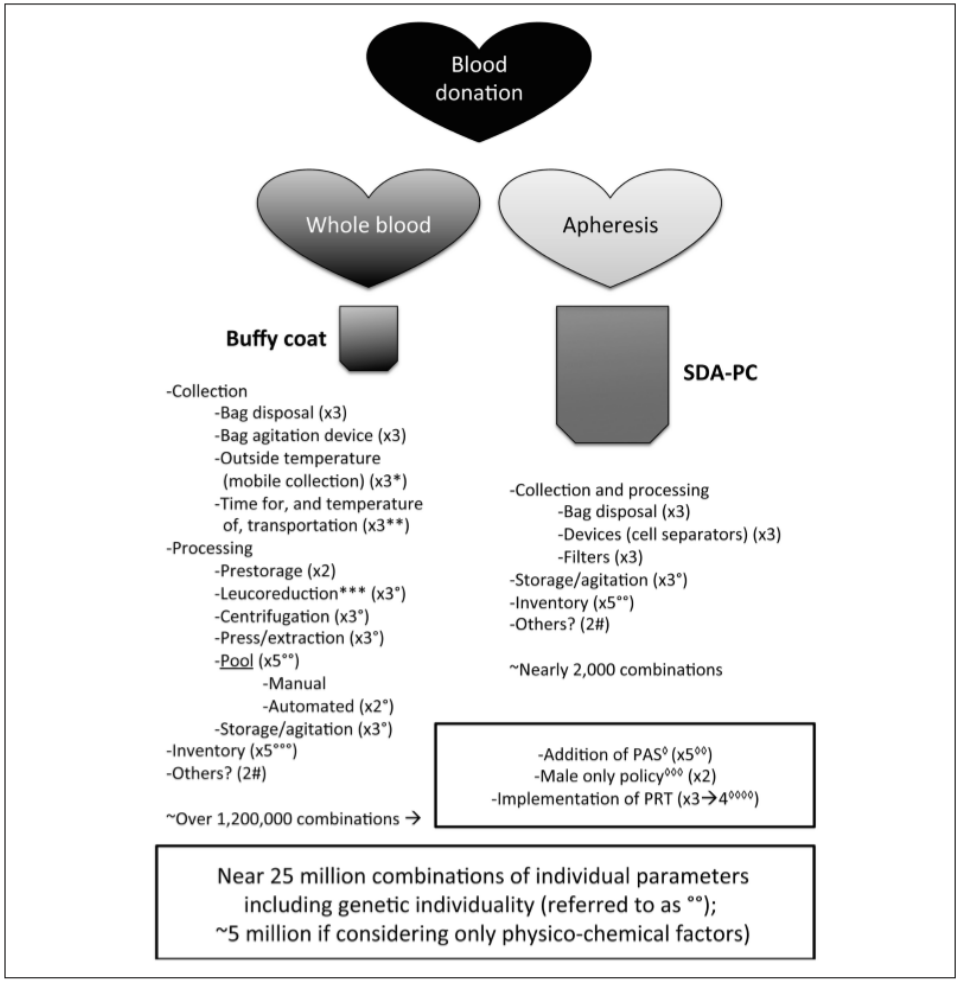
Platelet reactions 2016	Allergic reactions	Febrile reactions
Apheresis platelets	170/million	24/million
Pooled platelets	130/million	65/million

Literature search – reactions to platelets

Reaction rate dependant on:

- Donor characteristics
- Method of collection
- Collection – bag, agitation, temperature, transportation
- Processing – centrifugation, LR, pooling
- Storage
- Other – additive solution, pathogen reduction

Improving platelet transfusion safety: biomedical and technical considerations



*Blood Transfus 2016; **14:** 109-22* DOI 10.2450/2015.0042-15

frontiers in Immunology

REVIEW
published: 29 November 2016
doi: 10.3389/fimmu.2016.00534

Transfusion as an Inflammation Hit: Knowns and Unknowns

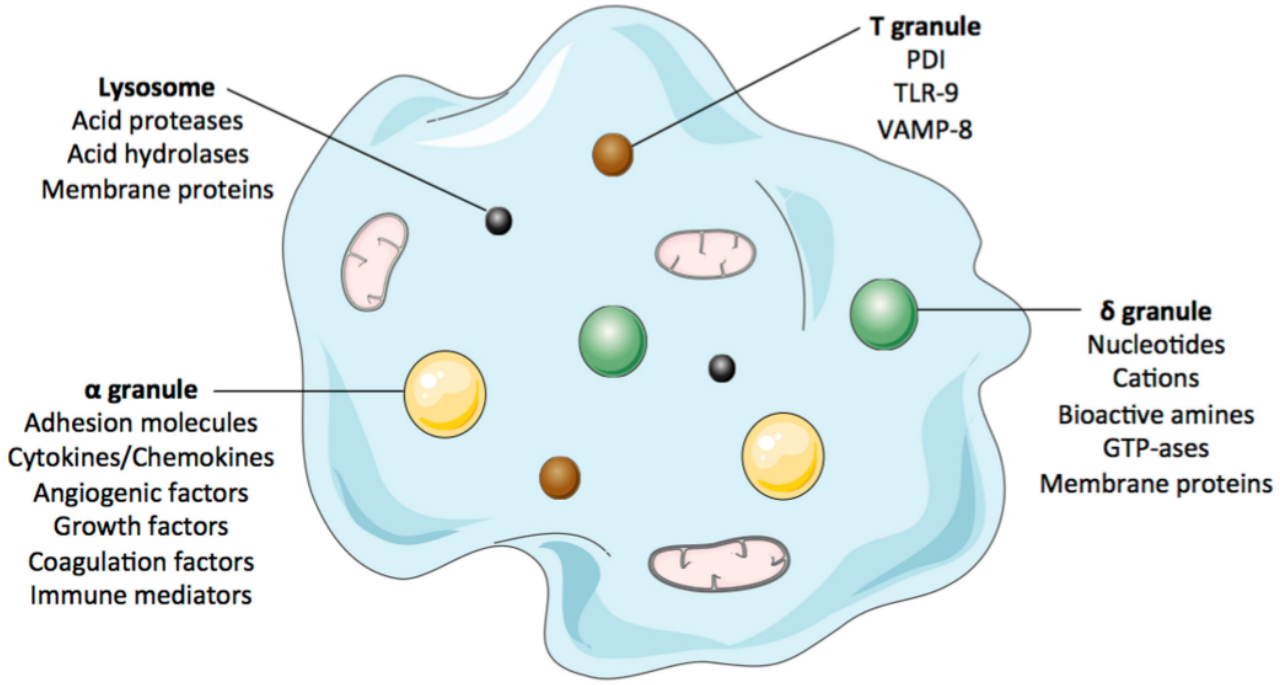


FIGURE 1 | The figure cartoons the platelet' main granules and their secretory content. Most products that can be released by platelets are listed in complementary **Table 2**.

Contents lists available at ScienceDirect

Transfusion and Apheresis Science

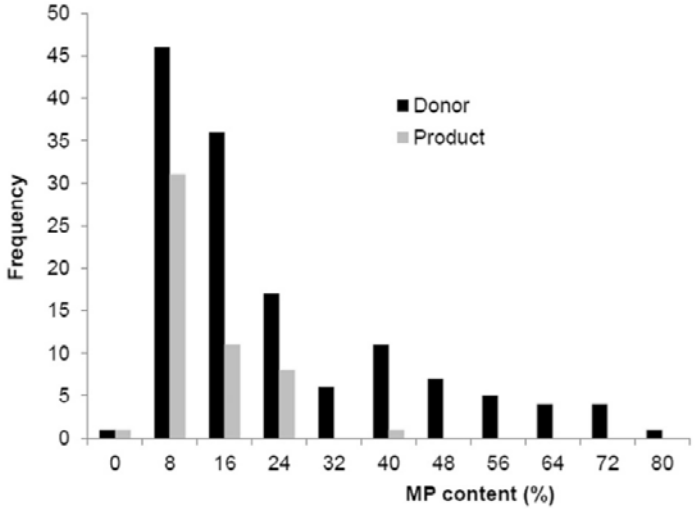
journal homepage: www.elsevier.com/locate/transci

Microparticle content of platelet concentrates is predicted by donor microparticles and is altered by production methods and stress

E. Maurer-Spurej et al./Transfusion and Apheresis Science 55 (2016) 35–43

Microparticle content (MPC) of platelet concentrates assessed against - donor, plasma/PAS, transport, ɣ irradiation, pathogen inactivation

Results – MPC ↓ by PAS v plasma, correlated with donor, ↑ pathogen inactivation



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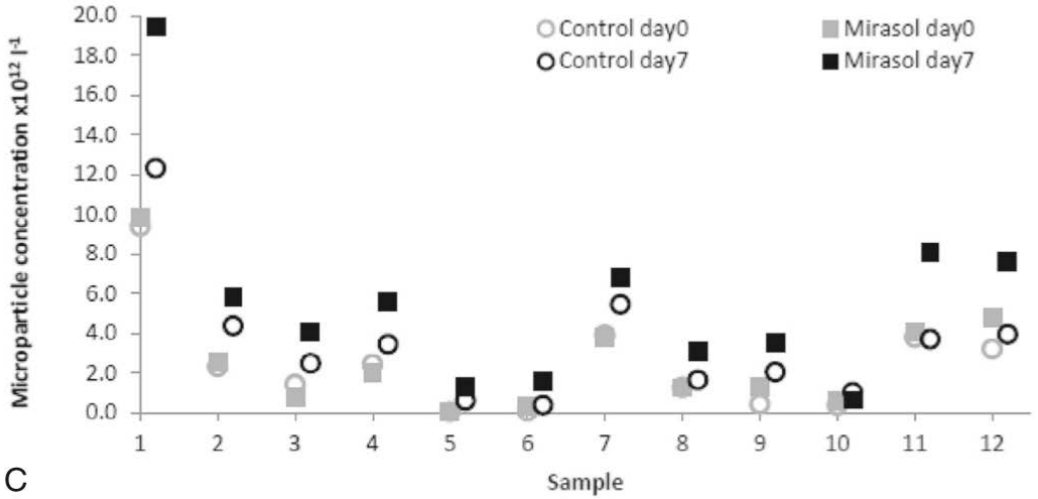


A comparison of adverse reaction rates for PAS C versus plasma platelet units

Volume 54, August 2014 **TRANSFUSION** 1927

Non randomised retrospective 6 centre study
PASC apheresis units = 65% PAS : 35% plasma

TABLE 4A. Type of transfusion reactions: number of PLT transfusions causing ARs*

	PAS C (N = 4160)		Plasma (N = 9845)		Total (N = 14,005)	
AR category	Trx†	Rxn	Trx†	Rxn	Trx†	Rxn
Allergic reaction, including anaphylaxis	12 (0.29)	12	81 (0.82)	81	93 (0.66)	93
Acute hemolytic transfusion reaction	0 (0.00)	0	0 (0.00)	0	0 (0.00)	0
Delayed hemolytic transfusion reaction	0 (0.00)	0	0 (0.00)	0	0 (0.00)	0
Delayed serologic transfusion reaction	0 (0.00)	0	0 (0.00)	0	0 (0.00)	0
FNHTR	7 (0.17)	7	49 (0.50)	49	56 (0.40)	56

CME The impact of platelet additive solution apheresis platelets on allergic transfusion reactions and corrected count increment

Non randomised retrospective single centre study
PAS v non-PAS apheresis platelets
PAS units = 65% PAS : 30% plasma

TABLE 1. ATR incidence by type of AP transfused

APs transfused	ATRs	Transfusions	Incidence	RR (95% CI)	p value
Non-PAS	72	3884	1.85%	Referent	Referent
PAS	12	1194	1.01%	0.54 (0.30-0.99)	0.04

TABLE 2. FNHTR incidence by type of APs transfused

APs transfused	FNHTR	Transfusions	Incidence	RR (95% CI)	p value
Non-PAS	27	3884	0.70%	Referent	Referent
PAS	7	1194	0.59%	0.84 (0.37-1.93)	0.69

Volume 54, June 2014 **TRANSFUSION** 1525

Anti-A and anti-B titers in group O platelet units are reduced in PAS C versus conventional plasma units

Apheresis platelets
PAS C units 65% PAS : 35% plasma

1:200 saline dilution of plasma, followed by an immediate-spin tube test using A1 and B red blood cells (Immucor, Norcross, GA), to assess the isohemagglutinin levels in group O units.

TABLE 1. A comparison of 200 titers in PAS C versus plasma PLT units*

Type O PLT unit titers	PAS C units	Conventional plasma units
>200 titer	2 (0.10)†	43 (1.22)
<200 titer	1953	3473
Total	1955	3516

* Data are reported as number (%) or number.
† $p < 0.0001$ using Fisher's exact test.

Volume 54, January 2014 **TRANSFUSION** 255

Pooled platelets in PAS and high titre (HT) haemolysin testing Unpublished data

N Win, B Hirst NHSBT 2017

Method

O or A platelet pools 70% PAS:30% plasma
14% (210/1,535) contained ≥ x1 HT BC
144 of 210 pools, containing HT BC, tested on automated PK730 blood gp analyser (More than 50% of 144 tested group O)

Result

All pools HT negative
134 pools contained x1 HT BC
10 pools contained x2 HT BC

Conclusion

Anti-A &anti-B diluted by PAS. PAS pooled platelets can be issued for out of group transfusion without HT testing.

ANNUAL SHOT REPORT 2016

MHRA working with SERIOUS HAZARDS OF TRANSFUSION SHOT
Affiliated to the Royal College of Pathologists

Recommendation

- Platelets in PAS associated with ↓ in allergic response. Hospitals should consider preferential use pooled platelets in PAS if history of allergic reactions including paediatric.
- Continued reactions → antihistamine cover → platelets 100% PAS

bjh guideline

Guidelines for the use of platelet transfusions

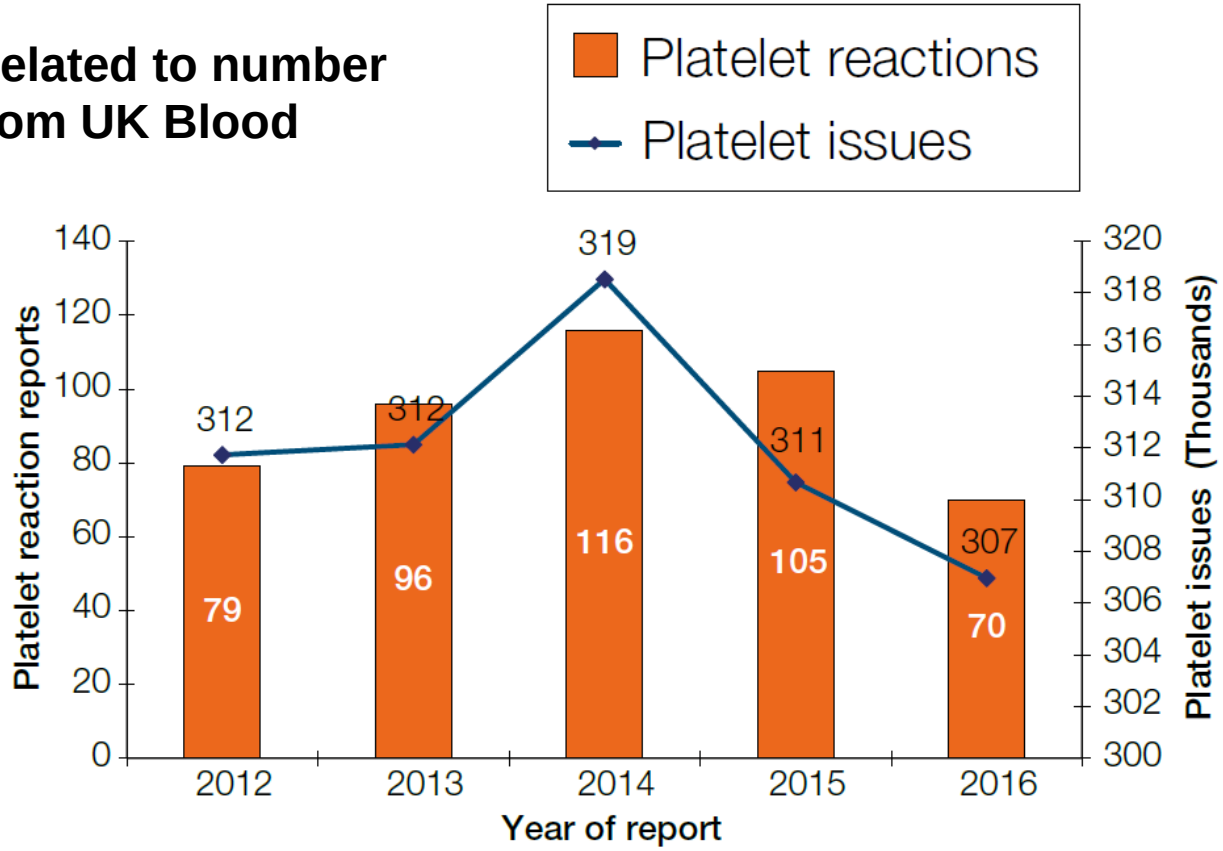
In patients with a history of allergic transfusion reactions, apart from mild, use platelets suspended in PAS. If reactions continue or are severe, washed platelets (re-suspended in 100% PAS) may be required (1B).

It is acceptable to use ABO incompatible platelets to reduce wastage. Platelets tested and negative for high titre haemagglutinins and non-group O platelets are associated with a lower risk of haemolysis. Pooled platelets suspended in Platelet Additive Solution (PAS) would also be expected to reduce this risk. (1B).

British Journal of Haematology, 2017, **176,** 365–394

Key SHOT message

Reactions related to number of issues from UK Blood Services

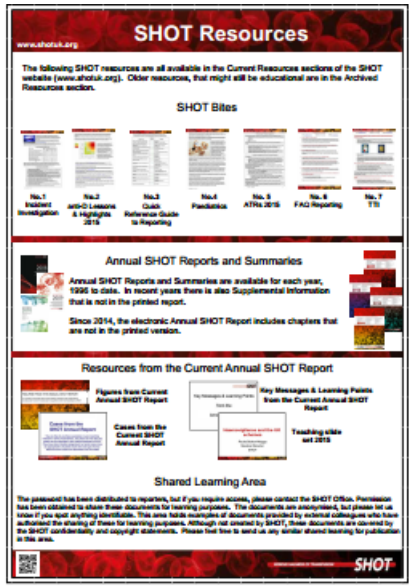


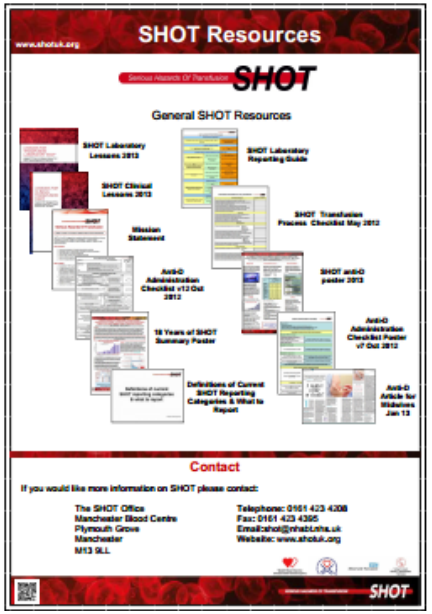
↓ number ATRs reported corresponds ↓ in blood issued Only patients likely to benefit should receive blood

Additional Information

Following documents available on website www.shotuk.org

- Teaching slide set
- SHOT Bites
- SHOT Cases
- Figures from SHOT Report
- SHOT reporting definitions





Also available:

- Previous SHOT reports
- SHOT summaries
- Supplementary information

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SHOT Symposium 2018

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