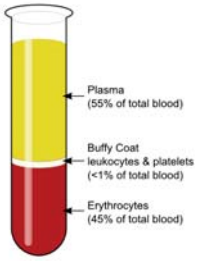
Blood products transfusion

Blood products are not used to treat diseases

Supportive therapies

Blood components

- Whole blood
  - Packed red blood cells
  - Fresh frozen plasma
    - Cryoprecipitate
    - Cryo-poor plasma
  - Platelet-rich plasma



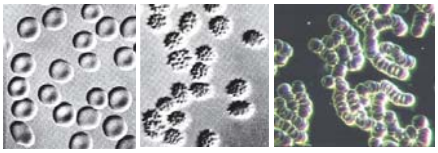
Blood donor selection

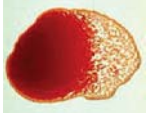
- History taking
- Blood examinations
- Blood type
  - Dog:
    - DEA 1.1, 1.2, 1.3, 3, 4, 5, 6, 7, 8 etc…
  - Cat:
    - A, B, AB
- Pathogen screening
  - Dog:
    - Babesiosis, Ehrlichiosis, HWD, Hemotropic mycoplasmosis
  - Cats:
    - FeLV, FIV, Hemotropic mycoplasmosis

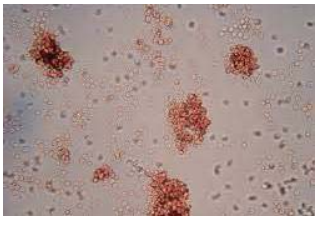
Alvedia
Alice Veterinary Diagnostic

Pretransfusion compatibility test

- Cross-match
  - Major
  - Minor

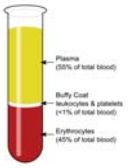


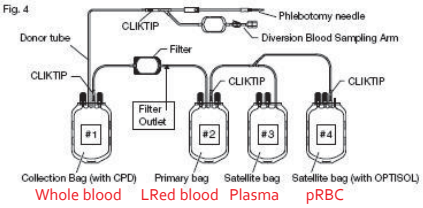


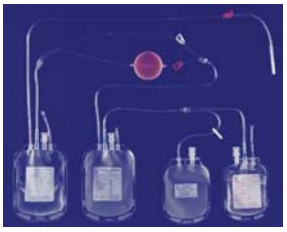


Collection of blood

- Whole blood
  - Packed red blood cells
  - Fresh frozen plasma







Collection of blood

- Whole blood
  - Packed red blood cells
  - Fresh frozen plasma

Collection of blood

- Whole blood
  - 0.14 ml CPDA-1/ 1 ml blood
  - 20 ml/kg of whole blood increases patients' PCV by 8~10%
  - Sedation (if necessary)
    - Dogs: butorphanol, Zoletil
    - Cats: ketamine+diazepam, Zoletil
  - Hair clipping
  - Gravity or suction

Collection of blood--Dog





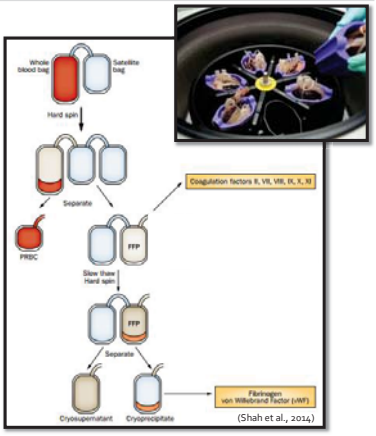
Collection of blood--Cat





Blood components

- Whole blood
  - Packed red blood cells
    - 2000rpm, 5-10 mins
  - Fresh frozen plasma
    - 2500rpm, 30mins
    - Cryoprecipitate
      - Thawing FFP at 0-6℃
      - Von Willebrand's factor, fibrinogen, factors XIII & VIII
    - Cryo-poor plasma
      - Factors II, VII, IX, X
  - Platelet-rich plasma



Administration of blood products

- Before transfusion.....
  - Corticosteroid, diphenhydramine.....?
- Transfusion rate (increased gradually)
  - 15 drops/ml
    - 240/ideal rate= Sec/drop
    - Ex. Ideal rate 20ml/hr→ 240/20=12 sec/drop
  - 20 drops/ml
    - 180/ideal rate = Sec/drop
- Monitoring during transfusion
  - BT/HR/RR/BP

體重 (kg)	每日總熱量(Kcal)或水量(ml)	速率(ml/hr)
1	132	6
2	214	9
3	285	12
4	348	15
5	407	17
6	463	19
7	515	21
8	566	24
9	615	26
10	662	28
11	707	29
12	752	31
13	795	33
14	837	35
15	879	37
16	919	38
17	959	40
18	998	42
19	1037	43
20	1075	45
21	1112	46
22	1149	48
23	1185	49
24	1221	51
25	1256	52
26	1291	54
27	1326	55
28	1360	57
29	1394	58
30	1427	59
35	1590	66
40	1746	73
45	1896	79
50	2041	85
55	2182	91
60	2319	97

體重 (kg)	每日總熱量(Kcal)或水量(ml)	速率(ml/hr)
1	80	80
1.5	108	72
2	135	67
2.5	159	64
3	182	61
3.5	205	58
4	226	57
4.5	247	55
5	268	53

Adverse effects of transfusion

- Acute immunologic
  - Acute hemolytic reaction
    - Blood type
  - Nonhemolytic fever and urticaria
- Acute nonimmunologic
  - Collecting, storage
- Delayed immunologic
  - Purpura
- Delayed nonimmunologic
  - Infectious

Adverse effects of transfusion

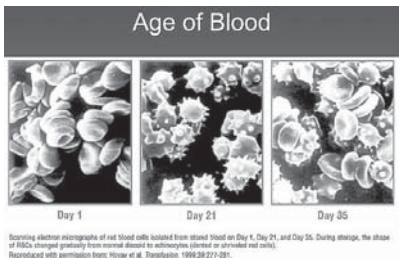
- Packed red blood cells
  - Storage-related changes
    - Metabolic effects
    - Shape changes
    - Microparticles
    - Oxidative injury
    - Nitric Oxide

Storage-related changes in pRBC

- Metabolic effects
  - Slowed glycolysis
    - Proton accumulation
    - 1-6℃
  - Hyperkalemia
    - Arrhythmias and fatal cardiac arrest in human pediatric patients

Storage-related changes in pRBC

- Shape changes
  - From biconcave disk to echinocytes and eventually spheroechinocytes
  - Critical in maintain adequate tissue oxygenation

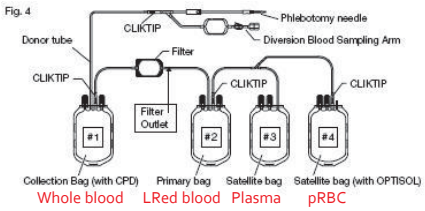


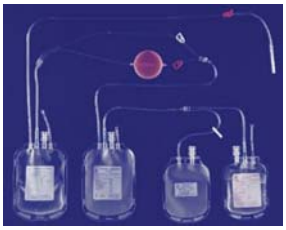
Storage-related changes in pRBC

- Microparticles (MPs)
  - In both healthy and diseased individuals
  - Submicron (<1um) membrane-derived exocytic vesicles
  - Erythrocytes, leukocytes, platelets, endothelial cells etc.
    - Antigen
    - Cell surface proteins
    - Cytoplasmic contents
    - Nuclear components
  - Has proven detrimental for blood transfusion recipients
    - Systemic inflammation
    - Cardiovascular
    - Hematologic
    - Oncologic
    - Transfusion-associated acute lung injury
    - Thrombotic complications
    - Ischemic brain injury

Storage-related changes in pRBC

- Microparticles (MPs)
  - Leukoreduction (LR)
    - Eliminate leukocytes and platelets





Storage-related changes in pRBC

- Oxidative injury
  - Superoxide radical and ferric methemoglobin
  - Membrane damage and cell lysis of RBCs
  - Increase over a 28 day storage period
- Nitric Oxide (NO)
  - Vasodilation
    - Improve capillary blood flow
  - Free hemoglobin and MPs
    - 1000 times faster than intact erythrocytes

VoxSanguinis

The International Journal of Transfusion Medicine

ISBT International Society of Blood Transfusion

Vox Sanguinis (2013)

ORIGINAL PAPER

DOI: 10.1111/vox.12058

Transfusion of 28-day-old leucoreduced or non-leucoreduced stored red blood cells induces an inflammatory response in healthy dogs

M. B. Callan,[1] R. T. Patel,[2] A. H. Rux,[3] S. Bandyopadhyay,[4] A. N. Sireci,[4] P. A. ODonnell,[1,2] T. Ruane,[1,2] T. Sikora,[1,2] K. Marryott,[1] B. S. Sachais[3] & E. A. Hod[4]

[1] Departments of Clinical Studies, School of Veterinary Medicine, University of Pennsylvania, Philadelphia, PA, USA
[2] Pathobiology, School of Veterinary Medicine, University of Pennsylvania, Philadelphia, PA, USA
[3] Department of Pathology and Laboratory Medicine, Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA, USA
[4] Department of Pathology and Cell Biology, Columbia University College of Physicians and Surgeons - New York Presbyterian Hospital, New York, NY, USA

Results & Discussions

Table 1 Changes in haemolysis rate and cytokine levels ex vivo in RBC unit supernatants with leucoreduction and time

	Non-LR units				LR units			
	Fresh		Old		Fresh		Old	
	Day 0	Day 7	Day 0	Day 28	Day 0	Day 7	Day 0	Day 28
Free Hb (mg/dl)	39·2 ± 11·6	127·5 ± 32·8**	47·8 ± 26·4	242·4 ± 80·7***,†††	61·2 ± 37·8	187·3 ± 51·0**	62·1 ± 22	302·3 ± 66·6***,†††
Haemolysis rate (%)	0·12 ± 0·03	0·29 ± 0·06**	0·13 ± 0·04	0·49 ± 0·14***,††	0·15 ± 0·06	0·41 ± 0·11***	0·16 ± 0·06	0·62 ± 0·11***,††
MCP-1 (pg/ml)	20·4 ± 6·5	30·6 ± 11·9	23·1 ± 12·9	89·9 ± 57·9***,†††,‡‡‡	20·8 ± 8·4	23·1 ± 8·8	19·8 ± 11·8	32·1 ± 11·8
IL-6 (pg/ml)	102·3 ± 245·6	65·2 ± 129·8	80·0 ± 171·1	72·4 ± 110·7	21·7 ± 31·5	14·9 ± 22·1	84·0 ± 173·1	71·5 ± 133·1
IL-8 (pg/ml)	1034·5 ± 845·6‡‡	1103·2 ± 1356·1	1268·4 ± 819·8‡‡	1286·7 ± 1314	25·2 ± 39·2	27·3 ± 40·0	54·8 ± 70·1	54·9 ± 63·6

Values are mean ± SD. **P < 0·01, ***P < 0·001 compared to Day 0 of the same LR group. ††P < 0·01, †††P < 0·001 compared to Day 7 of the same LR group. ‡‡P < 0·01, ‡‡‡P < 0·001 compared to same time-point of the opposite LR group.
MCP-1: monocyte chemoattractant protein

Results & Discussions

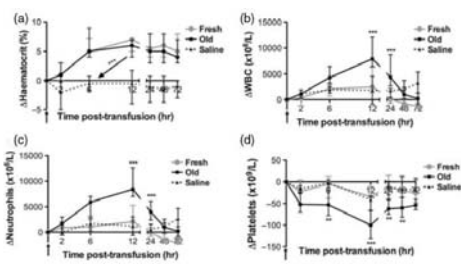


Fig. 1 Transfusions of old RBCs result in neutrophilia and decreased platelet counts. Data are median ± interquartile range for increases in (a) haematocrit, (b) WBC count, (c) neutrophil count and (d) platelet count from baseline levels up to 72 h after fresh (grey circles; $n = 20$) or old (black squares; $n = 20$) RBC transfusions or saline infusions (dotted line; $n = 8$). *$P < 0{\cdot}01$, **$P < 0{\cdot}001$ comparing only the fresh and old RBC transfusions at each time-point.

LR did not affect the responses of leukocytosis, increased neutrophils, and decreased platelet counts

No differences between LR and non-LR groups were observed on complete blood cell counts *in vivo*

Conslusions

- Old RBC transfusions induce an MCP-1 response, accompanied by increased neutrophils and decreased platelets
- Both fresh and old stored blood induce extravascular hemolysis

Figure 1 Two physicians transfusing blood from a dog into a man. Reproduced with permission from Bibliothèque Interuniversitaire de Médecine, Paris, Scultetus J, 1671

Review

Xenotransfusion with canine blood in the feline species: review of the literature

Journal of Feline Medicine and Surgery
15(2) 62-67
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Catherine Bovens and Tim Gruffydd-Jones

First study (1962)
Forth study (1969)
Second study (1963)
Fifth study (2004)
Third study (1968)

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Forth study (1969)
Second study (1963)
Fifth study (2004)
Third study (1968)

Second study (1963)	7 cats 11 ml/kg (Cr^{51}) Lifespan 3.6 days (longest 5.4 day)
Third study (1968)	4 cats Autoagglutination(+) & in vitro hemolysis (+): 6-7 days 2nd transfusion: 1 cat in 4 days, 2 cats in 1 and 2 days (survive) 1 cat in 7 days (died)
Forth study (1969)	8 cats Autoagglutination (+): 6 days 2nd transfusion: < 6 days: survive > 7 days: died

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Case report

Questions!?