

A detailed 3D illustration of various blood cells. In the foreground, several bright red, biconcave disc-shaped red blood cells are visible. Interspersed among them are smaller, pale yellow-green cells, likely white blood cells, some of which have a distinct nucleus. The background is a dark, deep blue, with a faint, glowing grid pattern, suggesting a microscopic or digital environment. The overall lighting is dramatic, highlighting the textures and colors of the cells.

Practical Hematology Transfusion

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Practical Hematology

1. Blood Loss Anemia
2. Hemolysis
3. Non-Regenerative Anemias
4. Bone Marrow Disease
5. **Transfusion Medicine**
6. Cases
7. Polycythemia
8. Coagulopathy
9. Central IV Lines
10. Leukophilia
11. Leukopenias
12. Splenic Disease

A vertical strip on the left side of the slide shows a microscopic view of blood cells. It features several large, red, biconcave disc-shaped red blood cells and smaller, green, oval-shaped platelets. The background is a soft-focus, light-colored fluid.

Blood Units

1 canine U = amount of product collected from 450 ml whole canine blood

- **1 U whole blood** = 450 ml blood + 63 ml anticoagulant
- **1 U plasma** = 200-250 ml
- **1 U packed cells** = 200-250 ml
- **1 U cryoprecipitate** = 60-70 ml
- **1 U cryo-poor plasma** = about 100 ml
- **1 U platelet rich plasma** = 200-250 ml

1 feline U = product collected from 50-60 ml whole feline blood

- **1 U whole blood** = 50-60 ml + 5-9 ml of anticoagulant
- **1 U plasma or packed cells** = 20-30 ml



Cat Blood Types

- 3 types in the AB group – A, B and AB
- Three alleles involved – A, a and b
 - AA, Ab, Aa, aa – Type A blood
 - bb - Type B blood
 - ab – Type AB blood (very rare)
- In-practice typing cards are available
- Autoagglutinating blood will give a false AB blood type
 - Saline washing at a reference lab can give the true blood type
- Purebred Siamese are all Type A
- 95% of DSH are Type A

A vertical strip on the left side of the slide shows a microscopic view of red blood cells. The cells are depicted as red, biconcave discs of various sizes, some in sharp focus and others blurred in the background. The background is a mix of blue and green, suggesting a fluid environment.

Cat Blood Types

- Type B cats have strong naturally occurring type A antibodies
- Type AB cats never have alloantibodies
- **Never give Type A or Type AB blood to a Type B cat**
 - <5 ml can cause acute death
- Type all purebred cats prior to transfusion
 - Can offer as a wellness service to owners of purebred cats
 - Mostly likely to be Type B:
 - British Shorthair
 - Exotic Shorthair
 - Devon Rex, Cornish Rex
 - Abyssinian
 - Himalayan

Cat Blood Types

RapidVet-H (Feline A, B, AB)

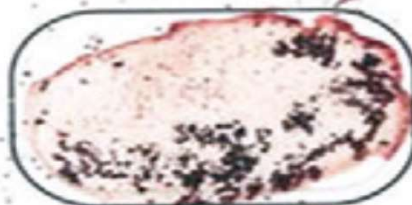
Cat Lex Date 18/12-01
96-3189

Auto-
Agglutination
Saline Screen



Type A

Patient
Test



Type B

B/ZE

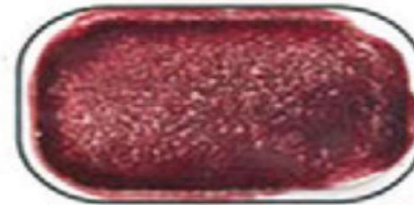
A Product of dms/agrolabo products ag
Neuhausen-am-Rheinfall, Switzerland
RapidVet is a trademark of dms laboratories, inc.

RV-HF-001

RapidVet-H (Feline A, B, AB)

Cat Git Gay Date 02/01/22

Auto-
Agglutination
Saline Screen



Type A

Patient
Test



Type B

Konkollaw
A Product of dms/agrolabo products ag
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RV-HF-001



Cat Blood Types

- ***NI (neonatal isoerythrolysis)*** occurs when a type B queen gives birth to A or AB kittens
 - Queen is bb – Type B
 - Tom is aa, Aa, AA or ab – Type A or AB
 - Type A Tom - all kittens affected
 - Type AB Tom - 50% affected
 - Type B Tom – no problem
 - Problems begin when kittens nurse

A vertical strip on the left side of the slide shows a microscopic view of red blood cells. The cells are depicted as red, biconcave discs of various sizes and orientations, set against a background of green and yellowish-green, suggesting a fluid environment. The lighting creates highlights and shadows on the cells, giving them a three-dimensional appearance.

Dog Blood Types

- More than a dozen blood group systems in dogs
- Most important is DEA 1.1 – two blood types
 - DEA 1.1 positive (40% of dogs)
 - DEA 1.1 negative (60% of dogs)
- DEA 1.2 and 7 are of secondary importance to transfusion reaction
- In-practice typing cards are available for DEA 1.1
- Autoagglutinating blood will give a false DEA 1.1 positive results
 - Saline washing at a reference lab can give the true blood type

A vertical strip on the left side of the slide shows a microscopic view of red blood cells. The cells are depicted as red, biconcave discs of various sizes and orientations, set against a background of green and yellowish fluid. Some cells are in sharp focus, while others are blurred, creating a sense of depth.

Dog Blood Types

- **Don't give positive blood to a negative dog a second time**
 - No naturally occurring ant-1.1 antibodies
- Canine RBC donors should be DEA 1.1 negative
- All 2nd canine blood transfusions should be cross-matched
 - No type cards available for DEA 1.2, DEA 7 or others
- NI not a problem in dogs unless a negative bitch has been previously transfused with positive blood

A microscopic view of blood cells, including red blood cells (erythrocytes) and white blood cells (leukocytes), set against a dark blue background with a grid pattern. The red blood cells are prominent, showing their characteristic biconcave disc shape. The white blood cells are smaller and more varied in shape, some appearing as small, round cells and others as larger, more complex structures.

Guidelines for Transfusion

Fresh Whole blood

- Premedicate with diphenhydramine 0.5-1 mg/lb IM 30 minutes prior
- 5-10 ml/lb/day
- Ideally over 2 hours or longer
- Monitor temp and RR every 10 minutes for 30 minutes, then every 30 minutes
- Stop or slow transfusion and consider dexamethasone if vomiting, tachypnea or weakness

A microscopic view of red blood cells, showing several bright red, biconcave disc-shaped cells against a dark blue background with some yellow and green highlights.

Guidelines for Transfusion

Packed Red Cells

- Premedicate with diphenhydramine 0.5-1 mg/lb IM 30 minutes prior
- 3-5 ml/lb every 12-24 hours
- Ideally over 2 hours or longer
- Can add saline to packed cells to decrease viscosity and improve flow, if extra volume will be tolerated
- Monitor temp and RR every 10 minutes for 30 minutes, then every 30 minutes
- Stop or slow transfusion and consider dexamethasone if vomiting, tachypnea or weakness
- Once collected, packed cells or whole blood must be used within 30 days

A microscopic view of red blood cells (erythrocytes) in a fluid medium. The cells are shown in various orientations and colors, ranging from bright red to dark brown, against a dark blue background with some green and yellow highlights. The cells are biconcave discs, and some are in focus while others are blurred in the background.

Guidelines for Transfusion

Oxyglobin – Hb substitute

- Purified bovine hemoglobin in LRS
- Premedicate with diphenhydramine 0.5-1 mg/lb IM 30 minutes prior
- 3-5 ml/kg added to fluids running at 0.5-2ml/lb/hr
- Or 10 ml/kg/hr for up to 3 hours
- Maximum 30 ml/kg/day
- Watch for volume overload (especially cats)
 - Stop Oxyglobin if tachypnea
- Use with care in animals with coagulopathy

A microscopic view of blood cells, showing several red blood cells (erythrocytes) and white blood cells (leukocytes) against a dark blue background. The red blood cells are biconcave discs, and the white blood cells are larger and more irregular in shape. The overall scene is illuminated with a soft, yellowish-green light, creating a sense of depth and focus on the individual cells.

Guidelines for Transfusion

Oxyglobin – Hb substitute

- Causes purple coloration of mucous membranes and urine
 - Affects colorimetric blood tests
 - Bilirubin
 - Liver enzymes
 - Creatinine
 - Glucose
 - Urine dipstick
 - Pulse ox still works fine
- Monitor by assessing Hb in RBC and plasma
 - iSTAT won't work
 - HemaVet & LaserCyte will work

A microscopic view of blood cells, including red blood cells (erythrocytes) and white blood cells (leukocytes), set against a dark blue background with a grid pattern. The red blood cells are prominent, showing their characteristic biconcave disc shape. The white blood cells are smaller and more varied in shape, some appearing as small, round cells and others as larger, more irregular cells.

Guidelines for Transfusion

Fresh Frozen Plasma

- 3-5 ml/kg every 8-12 hours
- Centrifuged within 6 hours for FFP
 - Otherwise “frozen plasma”
 - FFP better than FP for coag factors
- Once frozen, coag factors are stable for one year
- Albumin is stable for more than 5 years
- No data on how refreezing affects plasma

A microscopic view of blood cells, including red blood cells (erythrocytes) and white blood cells (leukocytes), set against a dark blue background with a grid pattern. The red blood cells are prominent, showing their characteristic biconcave disc shape. The white blood cells are smaller and more varied in shape, some appearing as small, round cells and others as larger, more complex structures.

Guidelines for Transfusion

Fresh Frozen Plasma

- Not a good source of albumin
 - 45 ml/kg needed to increase albumin 1 g/dl
 - Try hetastarch instead
- Failure of passive transfer in puppies and kittens
 - 50 ml/kg SC or IP x 3 days
 - FFP or FP equally effective

A microscopic view of blood cells, including red blood cells and platelets, set against a dark blue background with a grid pattern.

Guidelines for Transfusion

Platelet Rich Plasma

- 3-5 ml/kg every 8-12 hours

Frozen platelet concentrate

- Platelets in DMSO and plasma
- Collected by plasmapheresis
- 1 U/10 kg every 8-12 hours
- Used for IMT
- DMSO can cause bradycardia – slow rate
- 1 dose increases platelets 20,000/ul for 24 hours

A microscopic view of blood cells, including red blood cells and white blood cells, set against a dark blue background with a grid pattern.

Guidelines for Transfusion

Cryoprecipitate

- Factors 8, 13, vWF and fibrinogen
- 1 U/10 kg every 6-12 hours
- Once frozen, should be used within 1 year

Cryo-Poor Plasma

- What remains after cryoprecipitate is removed
- Good for rodenticide intoxication
 - Contains factors 2, 7, 9 and 10
- 3-5 ml/kg every 8-12 hours

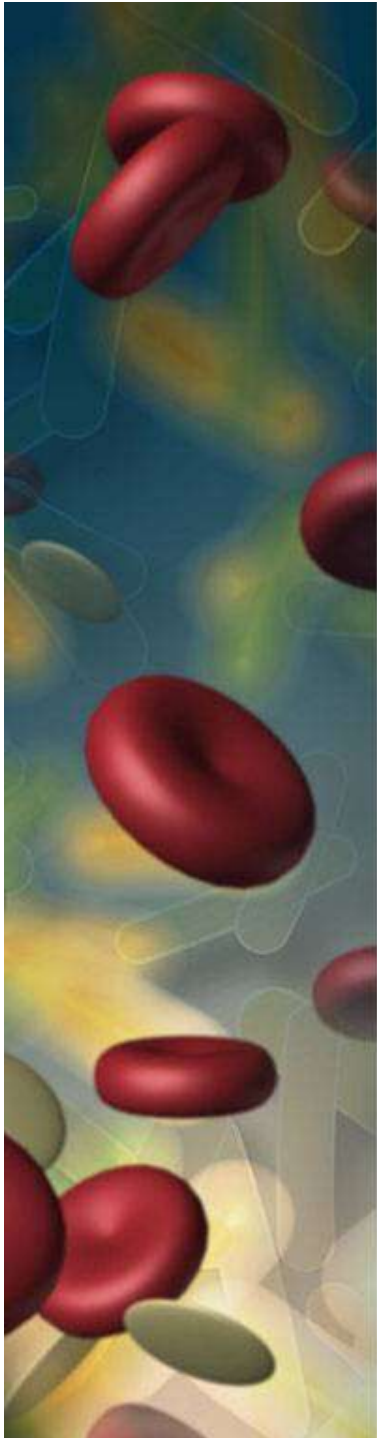
A microscopic view of blood cells, including red blood cells (RBCs) and platelets, set against a dark blue background with a grid pattern. The RBCs are shown as red, biconcave discs, while the platelets are smaller, yellowish, and disc-shaped. The background features a faint grid of light blue and yellow lines.

Guidelines for Transfusion

Human Immunoglobulin

- 1 unit produced from plasma of 1,000 donors
- Very expensive
- Has been used to treat IMHA and IMT in dogs
- Overwhelming the RBC and platelets with blocking antibodies decreases extravascular hemolysis
- Human IgG may also neutralize anti-RBC and anti-platelet antibodies
- Second infusion could theoretically produce severe anaphylaxis
- 0.5-1 g/kg IV over 6-8 hours

Melinda Luper
Houston TX



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When to Transfuse

- **There is no set HCT/PCV or Hb**
 - If HCT <12-13% in dog or <10-11% in cat, transfuse
 - But many times you still need to transfuse at higher HCT/PCV
- **Transfuse if clinical signs from anemia**
 - Lethargy and Weakness
 - Tachycardia
 - Tachypnea
 - Weak pulses, Collapse
- **Or if preparing for surgery**
 - Dogs PCV <25
 - Cats PCV <20
 - Increased risk of perioperative hemorrhage due to coagulopathy

A vertical strip on the left side of the slide shows a microscopic view of several red blood cells. The cells are depicted as biconcave discs, with a reddish-brown color and a darker center. They are set against a background of soft, out-of-focus green and yellow light, suggesting a fluid environment.

When to Transfuse

- **Transfuse sooner if**
 - Evidence of bone marrow disease or lack of marrow response
 - Simultaneous cardiopulmonary disease
 - Blood loss or hemolysis is rapid
- **More conservative with cat transfusions**
 - Increased rate of fatal reaction
 - Fewer symptoms with severe anemia
 - More susceptible to volume overload
- **Remember that with each successive transfusion, risk of reaction is higher and duration of efficacy is shorter**



Pre Transfusion Testing

- **First Cat Transfusion**
 - Typing recipient and donor should be sufficient
 - Don't give A or AB blood to a B cat
- **Subsequent Cat Transfusions**
 - Cross-match is essential
- **First Dog transfusion**
 - No testing necessary
 - Donor DEA 1.1 negative, ideally
 - Especially if breeding animal
- **Subsequent Dog Transfusions**
 - Type recipient and donor
 - Don't give DEA1.1(+) blood to (-) dog
 - Also cross match



Pre Transfusion Testing

- RapidVet-H Major crossmatch kits
- RapidVet-H Canine DEA 1.1 Type cards
- RapidVet-H Feline AB Type cards
- [Canine Typing Package Insert – with whole blood controls](#)
- [Canine Typing Package Insert – without whole blood controls](#)
- [Feline Typing Instructions](#)
- [Feline Typing Package Insert](#)
- [RapidVetH CrossMatch Kit Instructions](#)
- [CrossMatch Centrifuge List](#)
- [Major Cross-Match Instructions](#)

A vertical strip on the left side of the slide shows a microscopic view of several red blood cells. The cells are depicted as biconcave discs in various shades of red and brown, set against a background of green and yellowish fluid. The lighting creates a sense of depth and highlights the texture of the cells.

Acute Transfusion Reaction

- Fever and tachypnea are the first signs
- Hemolysis
- Anaphylaxis:
 - Vomiting, bloody diarrhea, abdominal pain in the dog
 - Pulmonary edema in the cat
 - Increased ALT within an hour
 - Coagulopathy within hours (PTT > PT)
 - Shock, pallor, weak pulses, collapse
 - Ultrasound - AFAST
 - GB edema, flat caudal vena cava, hemoabdomen
- DIC, SIRS

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Delayed Transfusion Reaction

- Shortened RBC lifespan
- Icterus
- Post-transfusion purpura
- Immune mediated joint disease

A microscopic view of blood cells, including red blood cells (RBCs) and white blood cells (WBCs), set against a dark blue background with a grid pattern. The RBCs are shown as biconcave discs, while the WBCs are larger and more irregular in shape.

Performing the Major Crossmatch

1. Take EDTA blood from donor and recipient
 - Note autoagglutination
 - Centrifuge 5 minutes
 - Separate plasma and RBC
 - Note hemolysis
2. Wash each RBC tube 3 times with 4-5 ml PBS
 - PBS – phosphate buffered saline
 - Centrifuge 1-2 minutes after each wash
 - Decant supernatant, keep RBC
3. Add a few drops PBS to each RBC tube to make a 3-5% suspension

A microscopic view of blood cells, including red blood cells (RBCs) and white blood cells (WBCs), set against a dark blue background with a grid pattern. The RBCs are shown as biconcave discs, while the WBCs are larger and more irregular in shape. The lighting creates a sense of depth and highlights the texture of the cells.

Performing the Major Crossmatch

4. Label empty tubes major, minor and recipient autocontrol

a. *Major Crossmatch:*

- 1 drop donor RBC suspension
- 2 drops recipient plasma

b. *Minor Crossmatch:*

- 1 drop recipient RBC suspension
- 2 drops donor plasma

c. *Recipient Autocontrol:*

- 1 drop recipient RBC suspension
- 2 drops recipient plasma

A microscopic view of various blood cells, including red blood cells (erythrocytes) and white blood cells (leukocytes), set against a dark blue background with a grid pattern. The red blood cells are prominent, showing their characteristic biconcave disc shape. The white blood cells are smaller and more varied in shape, some appearing as small, round cells and others as larger, more irregular cells.

Performing the Major Crossmatch

5. Mix 3 tubes gently and incubate at body temperature for 15 minutes
6. Centrifuge tubes 15 seconds
 - Note hemolysis
7. Agitate each RBC pellet by tapping over a mirror
 - Look for autoagglutination as the pellet breaks up
 - Report each as:
 - Negative - no autoagglutination
 - Mild - a few small clumps
 - Moderate – many large clumps



Acknowledgements

Chapter 2: The Complete Blood Count, Bone Marrow Examination, and Blood Banking

- Douglass Weiss and Harold Tvedten
- Small Animal Clinical Diagnosis by Laboratory Methods, eds Michael D Willard and Harold Tvedten, 5th Ed 2012

Chapter 3: Erythrocyte Disorders

- Douglass Weiss and Harold Tvedten
- Small Animal Clinical Diagnosis by Laboratory Methods, eds Michael D Willard and Harold Tvedten, 5th Ed 2012