ZOETIS DIAGNOSTICS

InCoag

Hospital Resource Guide

Coagulation Analyser

zoetis

Welcome

to the InCoag Point-of-Care Coagulation Analyser Hospital Resource Guide.

This guide is designed to help make the InCoag Coagulation Analyser indispensable for your veterinary clinic by addressing the most common issues of secondary haemostasis and coagulation that are likely to arise in your practice. Throughout the chapters listed here, you will find links and references to supplemental resources to help address any questions you may have.

We hope you find this guide useful, and as always, contact Zoetis Diagnostic Technical Support for further assistance at:

1800 270 727

dxsupport.au@zoetis.com

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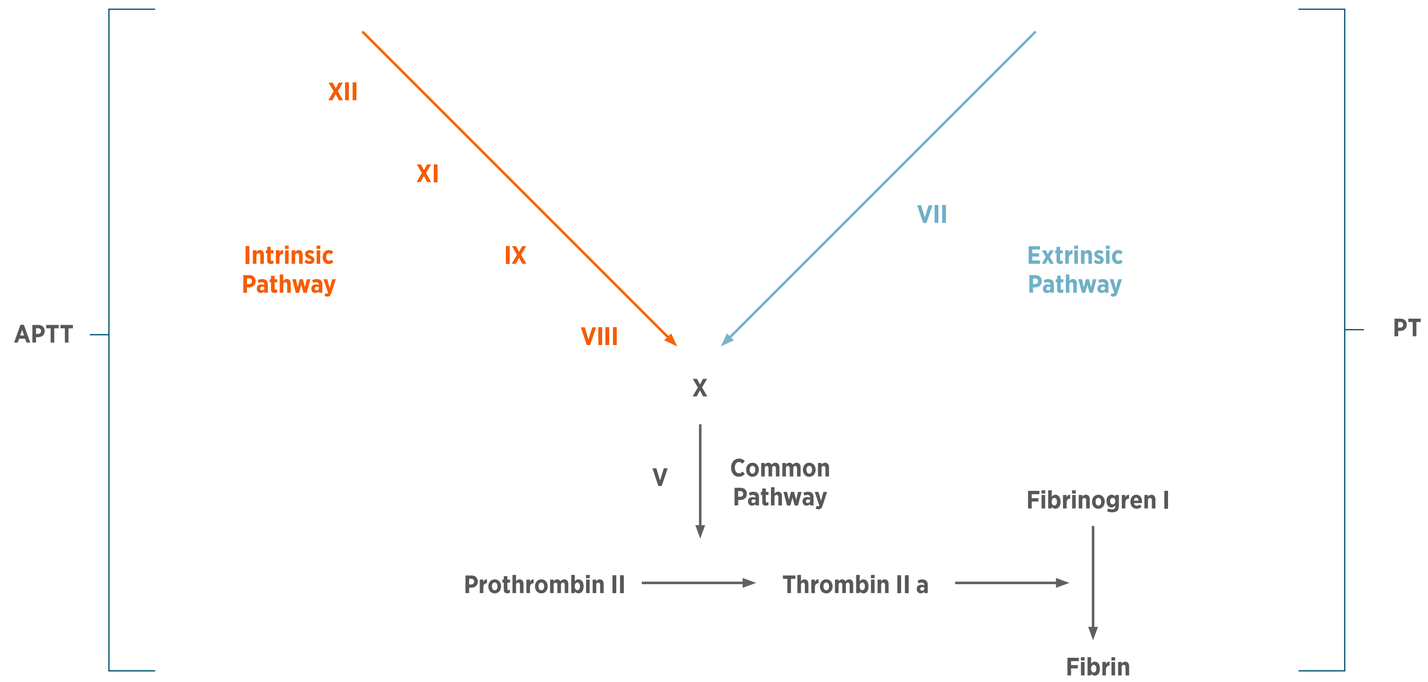
How the InCoag Works

The InCoag Coagulation Analyser is a state-of-the-art point of care analyser that delivers accurate performance.[1]
By using 100 µL citrated whole blood, the analyser's proprietary technology and algorithms provide rapid, dependable[1,2] results during each cartridge run.

InCoag Profiles

- Coagulation testing includes the evaluation of both prothrombin time (PT) and activated partial thromboplastin time (aPTT).
- Testing determines if a significant coagulation factor deficiency exists, and if so, which factor(s) are affected.
- PT is used to evaluate the extrinsic and common pathways, while aPTT is used to evaluate the intrinsic and common pathways.

The Coagulation Cascade



Sample Collection – Tubes

- The test cartridge pack contains 12 ready to use, manufacturer-validated citrated tubes, which are the only citrated collection tube validated for use with the InCoag Analyser.
- These citrated tubes **must be used** to ensure validated results.
- These tubes, provided with your test cartridges, eliminate the need to maintain a separate supply of citrated collection tubes and alleviate any concerns over having properly validated tubes readily available.

Reference: 1. Data on File, Study No. TI-11906, 2025, Zoetis, Inc. **2.** Data on file, Study No. DHX6Z-US-24-278, 2024, Zoetis Inc.

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How the InCoag Works

Sample Collection – Running an InCoag Cartridge

- After sample transfer from the manufacturer-provided citrated tube to the test cartridge sample port, the sample is divided into several reagent coated microfluidic channels.
- An air pump circulates and oscillates the sample in the reagent channels ensuring proper sample mixing and reagent contact.
- The pressure and oscillation frequency in each channel is then measured until a precalibrated point is reached and the coagulation test values are calculated and reported.

Required Components

A. InCoag Analyser

B. Test Cartridge Pack

C. Test Cartridge

D. Manufacturer–Validated Citrated Tubes

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Sample Collection, Handling and Testing

The quality of the sample analysed is directly related to the quality of the result. Proper sample collection and handling is essential to ensure valid results in coagulation testing.[1]

Patient Preparation

Minimise any excitement/fear during the appointment, as excessive activity may lead to inadvertent activation of various aspects of the coagulation system.

Sample Collection Guidelines

Avoid vein collapse when drawing samples	• Minimise suction on the syringe and do not draw back too quickly
Prevent haemolysis	• Use the largest vein and needle appropriate for blood collection • Avoid using 23 gauge or smaller needles • Use minimal alcohol on fur/skin; contamination from alcohol or other fluids will interfere with the coagulation assay • Remove the needle or butterfly catheter from the syringe before dispensing into the blood tube
Ensure the correct ratio of anticoagulant to blood	• Fill manufacturer-provided citrated tube to the sample fill line to 0.3 ml (300 µL) • Immediately after filling the blood tube, replace the cap and invert gently 10 times to sufficiently mix with the anticoagulant
Ensure appropriate tube use	• Unless blood cultures are being performed, coagulation testing samples should be collected first • Only use the manufacturer-validated citrated whole blood collection tubes • Ensure the blood tubes have not expired • If improper tube filling occurs, the sample should be discarded and a new sample should be drawn
Prevent unwanted blood clotting	• Do not hold off or apply pressure for more than a few seconds before venipuncture • For feline samples collected from the hind leg, a butterfly catheter system is recommended instead of a syringe
Do not allow samples to degrade	• Run the sample as soon as possible after drawing • Never place the sample in contact with ice prior to testing • Samples in the manufacturer-validated citrated tube may be held at room temperature and run within 1 hour of collection • Samples chilled to 2 – 8 °C may be run within 4 hours of collection, but must be allowed to come to room temperature prior to running

Reference: 1. Gosselin RC. Preanalytical Variables in Hemostasis Testing. Methods Mol Biol. 2023;2663:39-50. doi: 10.1007/978-1-0716-3175-1_2. PMID: 37204702.

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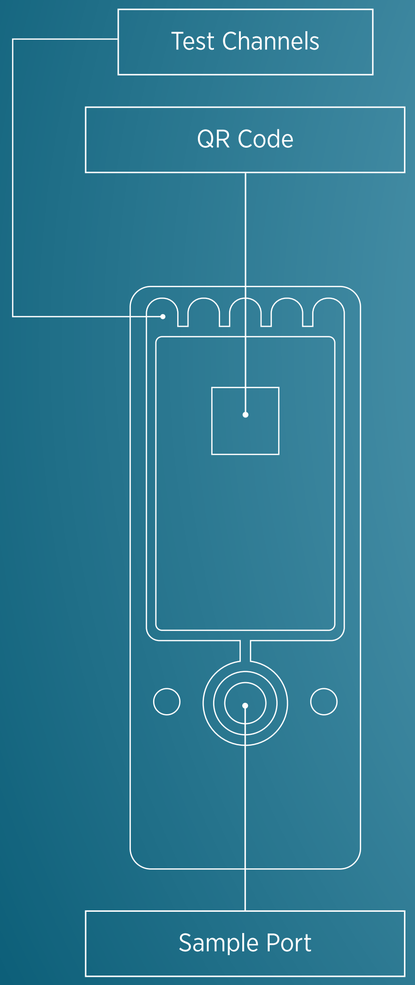
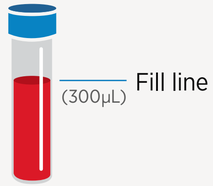
Test Cartridge



Sample Handling

Sample Collection and Testing[1]

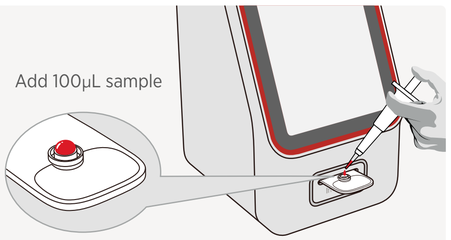


Step 1
Collect and transfer the sample to the citrated tube

1. Collect blood with a regular syringe or syringe with butterfly catheter.
2. Remove the needle or butterfly.
3. Transfer the sample to the manufacturer-provided citrated tube.

Step 2
Mix sample with anticoagulant

1. Gently invert the sodium citrate tube 10 times immediately after filling to ensure a good mixture with the anticoagulant.



Step 3
Insert test cartridge and transfer sample to cartridge

1. Insert test cartridge, QR code facing up, into the test cartridge slot below the interactive touch screen.
2. The instrument will warm the cartridge and indicate when it is ready for sample transfer (may take up to 1 minute).
3. Transfer 100 µL of sample from the manufacturer-validated citrated tube to the sample port on the cartridge.

Reference: 1. Gosselin RC. Preanalytical Variables in Hemostasis Testing. Methods Mol Biol. 2023;2663:39-50. doi: 10.1007/978-1-0716-3175-1_2. PMID: 37204702.

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Sample Handling

Sample Collection and Testing[1]

Do

Material/Components

- Use a fixed 100 µL volume pipette to transfer the sample from the citrated tube to the test cartridge sample port
- Always use citrated tube provided with test cartridges

Proper Filling and Handling

- Always fill the tube with 0.3 mL (300 µL) of whole blood immediately after collection
- Use a 100 µL pipette such as the the Vetscan VS2® pipette
- Remove cartridge from pouch immediately before testing
- Keep cartridge in a level position when loading and inserting

Temperature: Cartridge and Sample

- Test cartridges should be stored in their unopened foil pouch at room temperature
- The instrument will warm the cartridge and indicate when it is ready for sample transfer (may take up to 1 minute).

Timing

- Run samples at room temperature within 1 hour of collection
- Samples chilled or refrigerated between 2 – 8 °C, never on ice or frozen, may be stored then run within 4 hours of collection
- Samples chilled must be allowed to come to room temperature prior to testing
- If the testing is delayed, gently invert 5-10 times just prior to testing.

Sample Types

- Use citrated whole blood samples transferred from the manufacturer-provided tubes

Reference: 1. Gosselin RC. Preanalytical Variables in Hemostasis Testing. Methods Mol Biol. 2023;2663:39-50. doi: 10.1007/978-1-0716-3175-1_2. PMID: 37204702.

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Sample Handling

Sample Collection and Testing[1]

Do not

Material/Components

- Use samples from EDTA tubes or from any other tube than that provided with the test cartridges

Proper Filling and Handling

- Underfill or overfill citrate tubes as this may alter results due to the improper anticoagulant to sample ratio, leading to inconsistent and unreliable results
- Overfill the sample port or allow air bubbles in the sample — both may result in test errors necessitating discarding the cartridge and retesting
- Remove a sample from the cartridge and try to reintroduce it in the cartridge
- Hold or handle the cartridge by the sample port
- Touch or contaminate the pipette tip
- Spill blood on, deface or otherwise mark the cartridge QR code

Temperature: Cartridge and Sample

- Store cartridges in the freezer
- Freeze or place the sample in the citrated tube in contact with ice

Sample Types

- Run sample types other than citrated whole blood — no other sample types are supported for use on the InCoag
- Use samples with visible blood clots

Timing

- Test room temperature samples greater than 1 hour after collection
- Test chilled samples greater than 4 hours after collection

Troubleshooting

If a cartridge run fails and leads to an error code, please consult the troubleshooting recommendations in your InCoag User Manual, or call Zoetis Diagnostic Technical Support 1800 270 727 or dxsupport.au@zoetis.com. Further examination of sample run details will indicate the next best course of action and next steps.

Reference: 1. Gosselin RC. Preanalytical Variables in Hemostasis Testing. Methods Mol Biol. 2023;2663:39-50. doi: 10.1007/978-1-0716-3175-1_2. PMID: 37204702.

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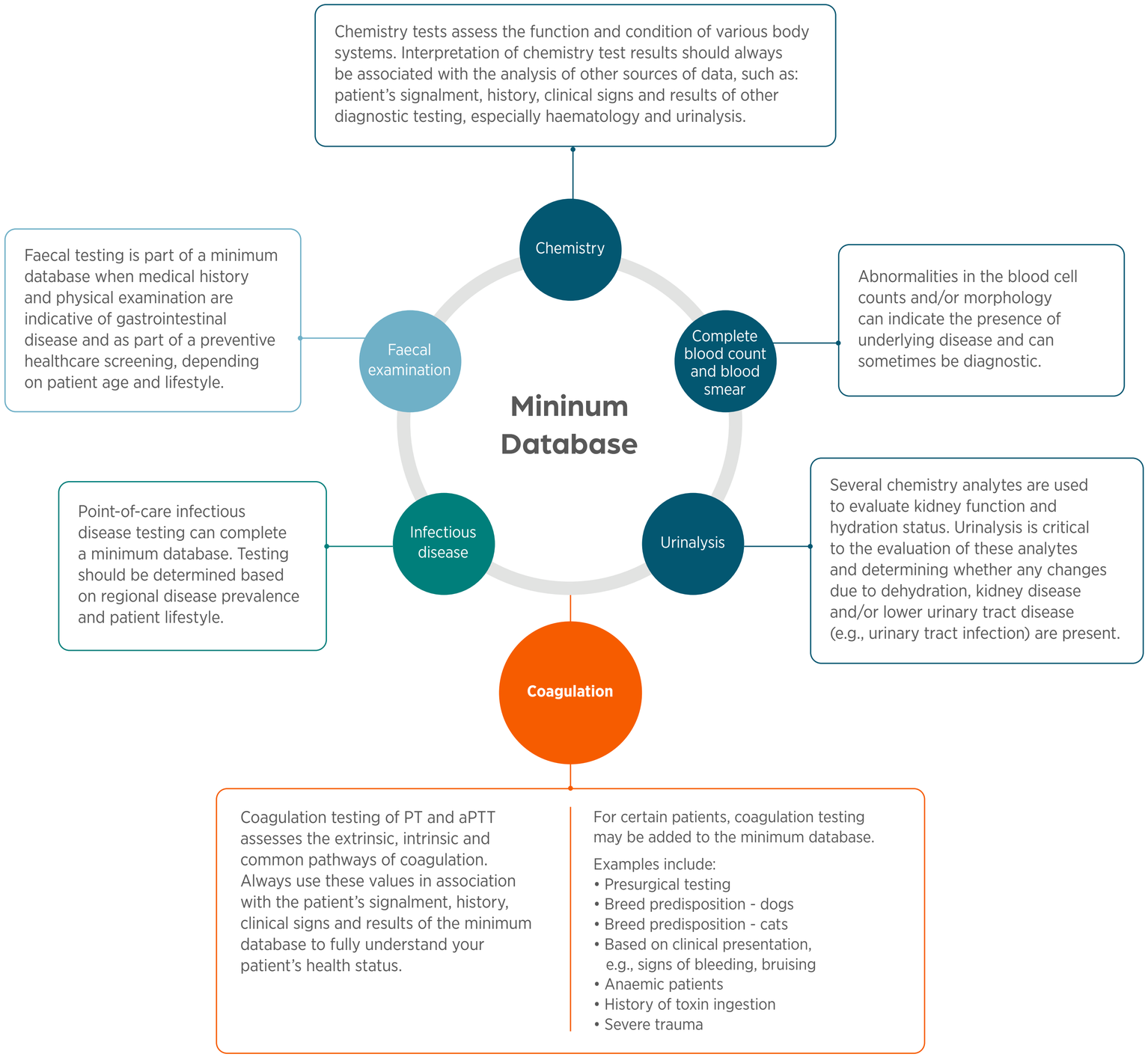
Minimum Database

The InCoag coagulation test results can be used in combination with the minimum patient database to further assess the overall health status of your patient, or more specifically, to assess and address any coagulation system concerns.



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Suggested Test Uses and Clinical Presentations

Preventive care

Baseline values are important to establish due to inherited or congenital abnormalities. In addition, minimum database screening may produce results that lead to coagulation testing as a next step.

- Pre-surgical testing should be considered for any patient regardless of age, because some coagulopathies may present with only mild or inapparent clinical signs.
- Inherited or congenital haemophilia may not be observed on physical examination and present with mild or inapparent clinical signs.[1,2]
- Haemophilia A, or factor VIII deficiency, is the most common inherited coagulopathy of animals.[1,2]
- Haemophilia A is observed in dog breeds such as the German Shepherd and Labrador Retriever.[1,2]
- Haemophilia B, or factor IX, deficiency affects cats and dogs.[1,2]
- Other less common coagulation deficiencies have been recorded in animals as well.

Hepatic disease[3,4]

Any patient with increased liver enzymes, possible hepatic dysfunction, or confirmed hepatopathy will benefit from coagulation testing. This becomes imperative should the patient require invasive surgery or biopsy/aspirate of the liver or other organ.

Liver disease can affect the coagulation cascade in multiple ways, as the liver produces most of the coagulation factors. Consider that:

- Many of the clotting factors are synthesised and cleared by the liver.
- Vitamin K is fat soluble, so its absorption depends on adequate bile production and flow.

Any disease state that affects the liver can lead to a coagulation abnormality including:

- Inflammation (hepatitis, cholangiohepatitis)
- Neoplasia
- Biliary stasis
- Use of chronic medications (NSAIDs, anaesthetics, chemotherapeutics, etc.)
- Hepatotoxins

References: 1. Baldwin, CJ, Cowell, RL. Inherited Coagulopathies. Consultations in Feline Internal Medicine 3. John R. August, ed. 1997. **2.** Brooks M. A review of canine inherited bleeding disorders: biochemical and molecular strategies for disease characterization and carrier detection. J Hered. 1999 Jan-Feb;90(1):112-8. doi: 10.1093/jhered/90.1.112. PMID: 9987916. **3.** Kavanagh C, Shaw S, Webster CR. Coagulation in hepatobiliary disease. J Vet Emerg Crit Care (San Antonio). 2011 Dec;21(6):589-604. doi: 10.1111/j.1476-4431.20110691.x. PMID: 22316251. **4.** Webster CR. Hemostatic Disorders Associated with Hepatobiliary Disease. Vet Clin North Am Small Anim Pract. 2017 May;47(3):601-615. doi: 10.1016/j.cvsm.2016.1109. Epub 2016 Dec 27. PMID: 28034472.

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Suggested Test Utilisation (cont'd)

Vitamin K deficiency or antagonism[1]

Vitamin K is an essential cofactor for coagulation factors II, VII, IX and X. Factor VII has the shortest half-life and will deplete the earliest, therefore, PT is often prolonged first. Some causes of Vitamin K deficiency are:

- Rodenticide toxicity
- Cholestatic liver disease (reduced bile flow reduces absorption)
- Liver failure
- Malabsorption disorders
- Medications

Other disease states where coagulation testing is indicated[2]:

- Any patient with unexplained bleeding, bruising or petechial haemorrhage
- Snake bite/envenomation
- Infectious disease
- Immune-mediated disease
- Shock or severe systemic disease; potential for DIC (disseminated intravascular coagulopathy)
- Actively bleeding patients
- Heat stroke

References: 1. Parry BW. Laboratory evaluation of hemorrhagic coagulopathies in small animal practice. Vet Clin North Am Small Anim Pract. 1989 Jul;19(4):729-42. doi: 10.1016/s0195-5616(89)50081-0. PMID: 2672537. **2.** Brainard BM, Brown AJ. Defects in coagulation encountered in small animal critical care. Vet Clin North Am Small Anim Pract. 2011 Jul;41(4):783-803, vii. doi: 10.1016/j.cvsm.2011401. Epub 2011 May 23. PMID: 21757093.

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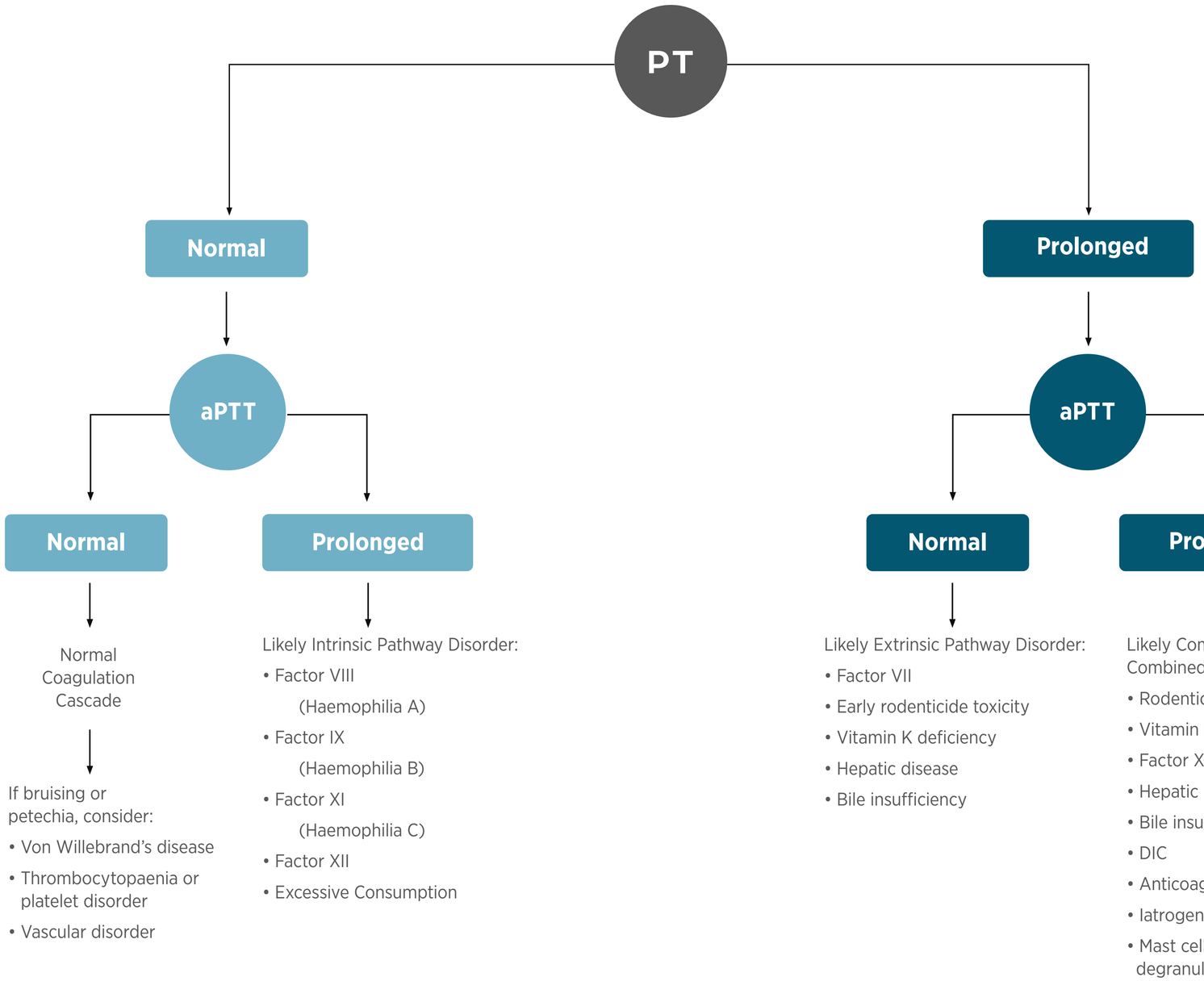
Test Interpretation

PT (Prothrombin Time):
Measures the Extrinsic and Common Pathways

aPTT (Activated Partial Thromboplastin Time):
Measures the Intrinsic and Common Pathways



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Canine and Feline Breed Inherited Coagulopathy Predispositions

Canine Hereditary Secondary System Coagulopathies	
Breed*	**Bleeding Disorders****
1. Labrador Retriever	Haemophilia A / Haemophilia B / vWD
2. Rottweiler	Haemophilia A / Haemophilia B
3. German Shepherd	Haemophilia A / Haemophilia B / vWD
4. Golden Retriever	Haemophilia A / Haemophilia B
5. Beagle	Haemophilia A / Haemophilia B / fVII def.
6. Poodle	Haemophilia A / Haemophilia B / fXII def.
7. Dachshund	Haemophilia A / vWD
8. American Cocker Spaniel	Haemophilia A / Haemophilia B / vWD / f II, X def. / plat. dysfct.
9. Yorkshire Terrier	Haemophilia A
10. Pomeranian	vWD
11. Shih Tzu	Haemophilia A / Haemophilia B / vWD
12. Chihuahua	Haemophilia A
13. Boxer	Haemophilia A / fII def.
14. Shetland Sheepdog	Haemophilia A / vWD
15. Dalmatian	Haemophilia A
16. Miniature Schnauzer	Haemophilia A / vWD
17. Siberian Husky	Haemophilia A
18. Miniature Pinscher	vWD
19. Pug	Haemophilia A
20. Doberman Pinscher	Haemophilia B / vWD

*Rank listing in descending order by number of total AKC registered individuals for 1996

**Bleeding disorders referenced in Tables 2–6: hem A = factor VIII deficiency; hem B = factor IX deficiency; vWD = von Willebrand disease; fII def. = factor II (prothrombin deficiency; fVII def.= factor VII deficiency; fX def. = factor X deficiency; fXII def. = factor XII deficiency; plat dysfct. = platelet dysfunction

Adapted from Brooks M. A review of canine inherited bleeding disorders: biochemical and molecular strategies for disease characterization and carrier detection. J Hered. 1999 Jan-Feb;90(1):112-8. doi: 10.1093/ jhered/90.1.112. PMID: 9987916.

Feline Hereditary Secondary System Coagulopathies		
Breed	**Disease**	**Factors**
Mixed Breed Domestic	Haemophilia A	VIII:C
Mixed Breed Domestic British Shorthair Siamese	Haemophilia B / Christmas disease	IX
Mixed Breed Domestic	Hageman factor deficiency	XII
Mixed Breed Domestic	Combined Haemophilia A and Hageman factor deficiency	VIII:C and XII
Mixed Breed Domestic Siamese	Combined Haemophilia B and Hageman factor deficiency	IX and XII
Devon Rex	Vitamin K-dependent multifactor coagulopathy	II, VII, IX, X

Adapted from Baldwin, CJ, Cowell, RL. Inherited Coagulopathies. Consultations in Feline Internal Medicine 3. John R. August, ed. 1997

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Reference Intervals

Reference intervals (ranges) have been validated only for canine and feline patients using the manufacturer-validated citrated tubes.

Test Interval[1,2]		
Canine	**Reference Intervals (sec)**	**System Reportable Range (sec)**
PT	15 – 34	7 – 90
APTT	21 – 59	7 – 120
Feline		
PT	15 – 34	7 – 90
APTT	21 – 59	7 – 120

References: 1. Data on File, Study No. TI-11906, 2025, Zoetis, Inc. **2.** Data on File, Study No. DHX6Z-US-24-278, 2024, Zoetis, Inc.

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