Big insights from a small test.

Every SNAP* test puts reference lab technology in the palm of your hand.

IDEXX

CREATING CLARITY

Highly accurate results are just one piece of the puzzle.

Reference-laboratory quality, innovative education and endless support come with every SNAP* test.

Automatic analysis.

The SNAP Pro* Analyzer makes testing, interpreting and storing results fast and simple. For every SNAP test, every day.

+ View interpreted results at a glance for quick and accurate health assessments.
+ Reduce missed charges and automatically include results in patients' medical records with common compatible practice management software.
+ Analyze current results alongside historical data within VetConnect* PLUS for the most up-to-date picture of your patient's health.

Faster decision-making.

VetConnect PLUS offers a holistic view of all IDEXX diagnostics for every patient. So you can spot trends and abnormalities earlier.

+ Determine next steps with differential diagnoses and expert guidance.
+ View real-time test order status in the reference laboratory for every patient – anytime, anywhere.

Reference laboratory support.

IDEXX Reference Laboratories offer the most complete and advanced menu of diagnostic tests to keep you at the forefront of patient care.

+ Gain further insights with innovative IDEXX tests, including RealPCR* testing, pathology services and microbiology services.
+ In the event of a positive test result, get support from IDEXX Reference Laboratories with any follow-up testing required.
+ Access a dedicated team of technical and medical professionals to support you in your practice and on the phone every day.

Personalized tools.

IDEXX offers unparalleled support. Including a global network of experts who are ready to help – both virtually and in-person.

+ Train your team, optimize your workflow and get personalized support from Veterinary Diagnostic Consultants, Professional Service Veterinarians, Field Support Representatives and Reference Laboratory Specialists.
+ Talk with medical consultants, pathologists and customer support representatives who are just a phone call away.
+ Send personalized client-friendly test result summaries.

Continuing education.

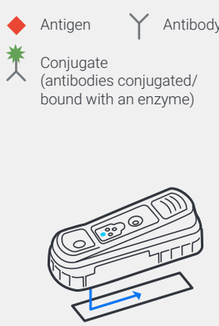
The IDEXX Learning Center provides all the latest learning resources to keep you up to speed and help you get ahead.

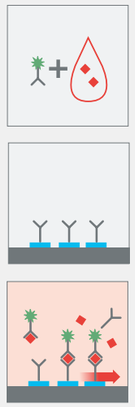
+ Get unfettered access to a variety of educational materials, all offered free of charge as part of your partnership with IDEXX.
+ Attend webinars, live seminars and courses, in-person and online.
+ Access learning plans and white papers to help you stay ahead of veterinary trends.

ELISA technology: What sets SNAP tests apart

The entire range of SNAP* tests for in-house diagnostics is based on ELISA technology (enzyme-linked immunosorbent assay). This technology conforms to the quality of the methods used at IDEXX Reference Laboratories and is considered the gold standard for in-house diagnostics.

The SNAP tests detect antigens and/or antibodies using anticoagulated whole blood, serum, plasma or fecal samples. Each SNAP test is characterised by three unique features that ensure an optimal interpretation of test results: bidirectional flow, the wash process and signal amplification through the enzyme substrate reaction.





1 The antigen is bound when the enzyme-bound antibody from the conjugate is mixed with the patient sample.

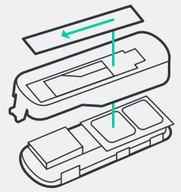
2 The matrix is coated with antigen-specific antibodies.

3 The conjugate and the antigen bind to the matrix-bound antibodies and form a so-called 'sandwich'.

4 The SNAP rapid test is activated by pressing down.

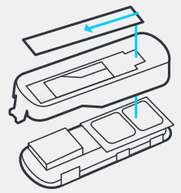
Example: Antigen SNAP* test

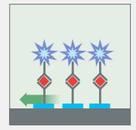
Wash process = higher specificity
bidirectional flow = higher sensitivity



5 The wash step removes non-specific, unbound conjugate and blood components from the matrix and prepares for the next step. The antigen flows across the matrix again and, therefore, has two opportunities to bind due to this bidirectional flow.

Signal amplification = higher sensitivity





6 The substrate flows over the washed matrix and reacts with the enzyme in the conjugate to amplify the antigen colour signal.

This results in an unambiguously readable, clearly stained spot.

Summary

- Gold standard ELISA technology = IDEXX reference lab technology
- High specificity and sensitivity through wash step with bidirectional flow and signal amplification
- Four SNAP tests, the SNAP* 4Dx* Plus, the SNAP* FIV/FeLV Combo Plus, SNAP* Feline Triple* and SNAP* Leish 4Dx* tests, offer the opportunity for multiple determinations: with only three drops of blood, multiple pathogens can be tested for in a single analytical run

Overview of all in-house tests

	Page	Pathogen/Parameter	Test	Species
Feline retroviruses/ vector-borne diseases	6	Feline leukaemia virus	SNAP* **Feline Triple* Test** SNAP* **FIV/FeLV Combo Plus Test** SNAP* **FeLV Test**	Cat
	7	Feline immunodeficiency virus	SNAP* **Feline Triple* Test** SNAP* **FIV/FeLV Combo Plus Test**	Cat
	8	Feline *Dirofilaria immitis*	SNAP* **Feline Triple* Test** SNAP* **Heartworm RT Test**	Cat
Vector-borne diseases	9	*Leishmania infantum*	SNAP* ***Leishmania* Test** SNAP* **Leish 4Dx* Test**	Dog
	10	Canine *Dirofilaria immitis*	SNAP* **4Dx* Plus Test** SNAP* **Leish 4Dx* Test** SNAP* **Heartworm RT Test**	Dog
	11	*Anaplasma* spp.	SNAP* **4Dx* Plus Test** SNAP* **Leish 4Dx* Test**	Dog
	12	*Ehrlichia* spp.	SNAP* **4Dx* Plus Test** SNAP* **Leish 4Dx* Test**	Dog
	13	*Borrelia burgdorferi*	SNAP* **4Dx* Plus Test**	Dog
Gastrointestinal pathogens	14	*Giardia* spp.	SNAP* ***Giardia* Test**	Dog Cat
	15	Canine parvovirus	SNAP* **Parvo Test**	Dog
Internal diseases Heart and pancreas	16	NT-proBNP	SNAP* **Feline proBNP Test**	Cat
	17	Canine pancreas-specific lipase	SNAP* **cPL* Test**	Dog
	18	Feline pancreas-specific lipase	SNAP* **fPL* Test**	Cat
Other	19	*Angiostrongylus vasorum*	IDEXX **Angio Detect* Test**	Dog
	20	All pathogenic *Leptospira* serovars	SNAP* **Lepto Test**	Dog
Horse	21	Immunoglobulin G (IgG)	SNAP* **Foal IgG Test**	Horse

Note

All algorithms within this document are provided as a reference resource only for use by, or under the supervision of, a licensed veterinarian.

Feline leukaemia virus

SNAP® Feline Triple®, SNAP® FIV/FeLV Combo Plus and SNAP® FeLV tests

Disease
Feline leukaemia virus

Pathogen
Felines leukaemia virus (FeLV;
fam. Retroviridae/Gamma-retrovirus)

Pathogenesis
There are several stages of FeLV infection. Abortive infection occurs when the cat's immune system eliminates the virus prior to proviral DNA integration in dividing lymphocytes. These cats do not pose an infection risk to other cats.

Regressive infection occurs when a cat has controlled the spread of infection prior to a secondary viraemia. These cats are at reduced risk of shedding the virus and developing FeLV-related disease.

Progressive infection occurs when the virus infects the bone marrow and a secondary viraemia occurs. These cats are at increased risk of shedding the virus and developing FeLV-related disease.

Focal (localized or atypical) infection occurs when the immune response controls viral replication prior to bone marrow infection, thereby limiting viral replication to certain tissues, such as the spleen, lymph nodes, small intestine or mammary glands.

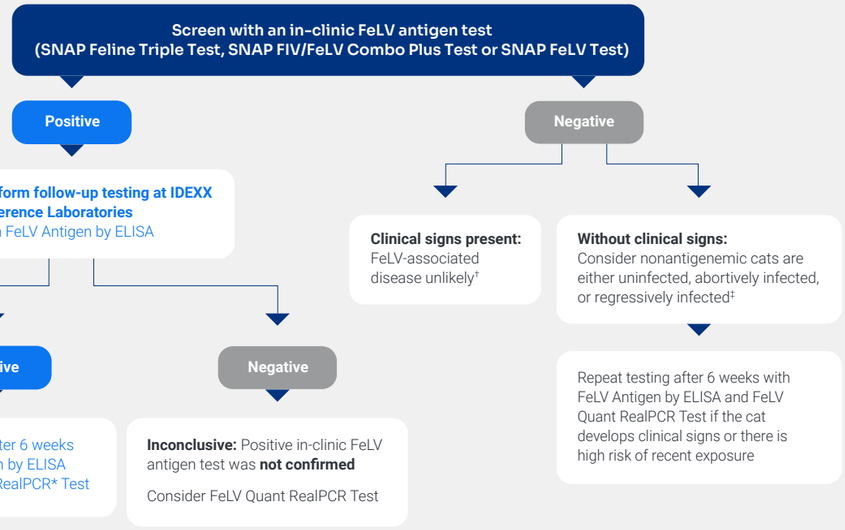
Transmission
Primarily oronasal, less often via bite wounds. A large amount of virus is shed in the saliva, less in other secretions and excretions; also transmitted from queens to kittens during pregnancy or through ingestion of milk.

Symptoms
In the acute phase, mostly non-specific with fever, anorexia, poor general condition, lymphadenopathy, icterus; later neoplasms, immune-suppression, gingivitis/stomatitis and other secondary infections, anorexia and other clinical signs derived from various cytopenias and immune-mediated disease, reproductive or neurological disorders.

Laboratory diagnostics
Acute phase: Leukopenia
Persistent viraemia: depending on the disease severity. Non-regenerative anaemia, leukopenia, thrombocytopenia, pancytopenia, hyperproteinemia, hyperbilirubinema and proteinuria is possible. Some cats will develop leukaemia.

Prophylaxis
Vaccination

When to test:
+ At the time of adoption
+ Before initial vaccination for the virus
+ After potential exposure to the virus
+ If clinical signs are present
+ Prior to breeding or blood donation



†Lymphoma and bone marrow suppression has been described occasionally in recessively infected cats. The FeLV Quant RealPCR Test can be considered.
‡Early infection can lead to a negative result for both the in-clinic and reference laboratory FeLV antigen testing options; recheck in 6 weeks if cat recently acquired or at risk of recent exposure.

Product	SNAP Feline Triple, SNAP FIV/FeLV Combo Plus, SNAP FeLV tests
Detection of	FeLV p27 antigen
Package size	5/15/30 tests (SNAP Feline Triple, SNAP FIV/FeLV Combo Plus tests) 15/30 tests (SNAP FeLV Test)
Storage	2–8˚C
Sample material	Anticoagulated whole blood/serum/plasma
Duration of test	10 minutes

- Positive control
- FeLV antigen
- FIV antibody
- Feline heartworm antigen (SNAP Feline Triple Test only)

Feline immunodeficiency syndrome

SNAP® Feline Triple® and SNAP® FIV/FeLV Combo Plus tests

Disease
Feline immunodeficiency syndrome

Pathogen
Feline immundeficiency virus
(FIV; fam. Retroviridae/Lentivirus)

Pathogenesis
The virus is T-cell-tropic, especially in relation to CD4⁺, but also other immune cells. The viral genome is integrated into the host genome after cell entry.

Transmission
The virus is transmitted pirmarily via saliva from bite wounds. Therefore, free-roaming unneutered male cats are especially at risk.

Other more rare transmission pathways are: transplacental, with lactogenic and during mating (both venereally and through a bite from an infected male).

Symptoms
Acute phase: Fever, lymphadenopathy, anorexia (may go unnoticed by owner as signs are mild)

Latent phase: Subclinical

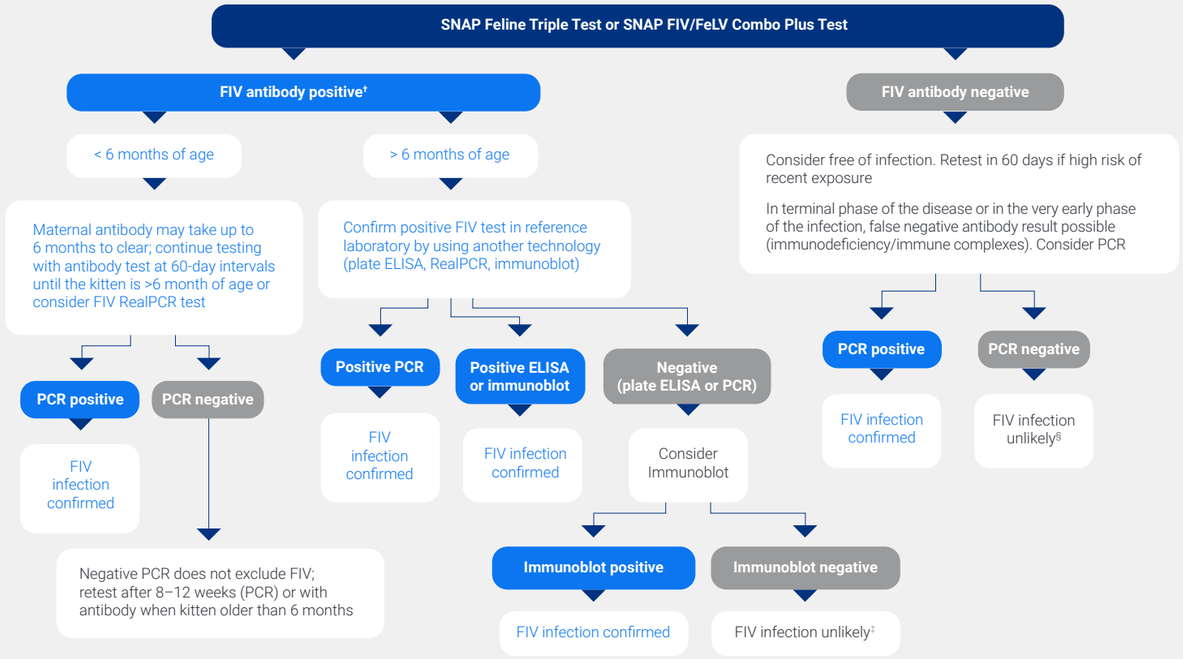
Non-specific symptom phase: Anorexia, weight loss, stomatitis, organ-specific symptoms, depending on the organ system involved.

Terminal phase: FIV itself is responsible for immunodeficiency with susceptibility for secondary infections and neoplasia or immune stimulation (potentially resulting in immune-mediated disease); immunodeficiency and/or immunostimulation can lead to chronic gingivitis/stomatitis, chronic rhinitis, lymphadenopathy, glomerulonephritis, cachexia or neurological disorders.

Laboratory diagnostics
Acute phase: Neutropenia, lymphopenia, clinical chemistry unremarkable

Terminal phase: Anaemia, leukopenia, thrombocytopenia; serum biochemistry profile occasionally shows hypergammaglobulinaemia (polyconal), other abnormalities depending on organ system involved, e.g., proteinuria, azotaemia, hyperglycaemia, hypercholesterolaemia

Prophylaxis
Neuter male cats, prevent contact of FIV-negative cats with potentially FIV-positive cats.



†Vaccination against FIV induces FIV-specific antibodies which lead to a positive test result. PCR is recommended for these cats; there is currently no registered FIV vaccination in Europe.
‡FIV infection status unclear; test again after 6 months (serology, PCR)
§Cats with clinical suspicion for FIV: retest in 3–6 weeks with immunoblot (for a wider range of antibodies) and PCR.

Product	SNAP Feline Triple, SNAP FIV/FeLV Combo Plus tests
Detection of	Antibodies to FIV
Package size	5/15/30 tests
Storage	2–8˚C
Sample material	Anticoagulated whole blood/serum/plasma
Duration of test	10 minutes

- Positive control
- FeLV antigen
- FIV antibody
- Feline heartworm antigen (SNAP Feline Triple Test only)

Feline dirofilariasis | SNAP® Feline Triple® and SNAP® Heartworm RT tests

Disease
Dirofilariasis is a parasitic disease of the pulmonary arteries and heart. Cats are more resistant to adult heartworm infection than dogs and often have very low worm burdens. In cats, larvae often die during migration from the subcutis to the pulmonary arteries and heart. When adult heartworm infection is present, the low worm burden and potential for a mono-sex infection make observation of circulating microfilaria rare. Due to the small body size of the cat, even infection with a small number of worms is considered a heavy burden. Studies have estimated the prevalence of adult heartworm infection in cats to be between 5%–15% of that of unprotected dogs in the same geography. Dirofilariasis is endemic in the Mediterranean region, and because of expansion of the vector habitat and lengthening of the warm season due to climate change, the distribution of the disease is spreading into other areas in Europe.

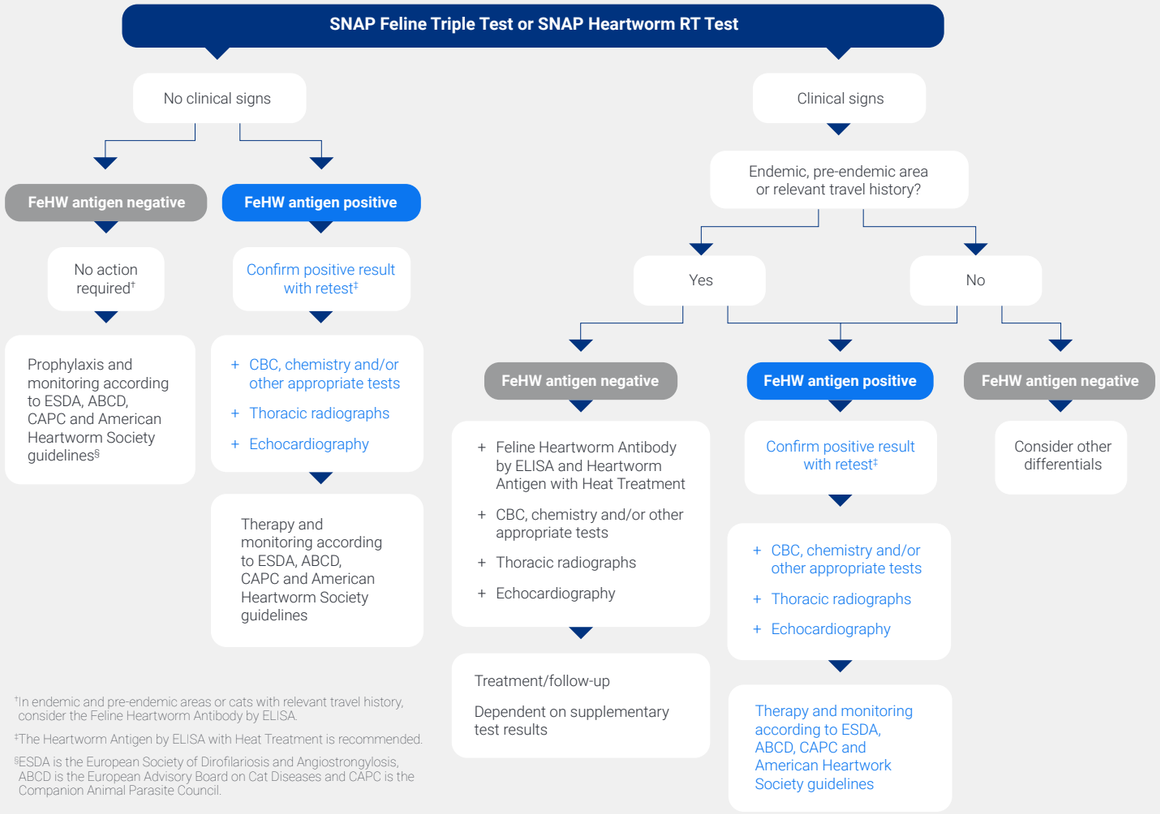
Pathogen
Dirofilaria immitus

Vector
Mosquito (*Culex, Aedes, Anopheles*)

Which cats should be tested?
Test cats living or visiting endemic or pre-endemic areas, cats with clinical signs of the disease and infected cats to monitor disease status.

Clinical signs
Cats may be asymptomatic or transiently symptomatic. Acute onset of dyspnea, hemoptysis, sudden death can occur as well as chronic respiratory signs, vomiting, malaise, anorexia and weight loss.

Laboratory diagnostics
Diagnosis of dirofilariasis can be difficult due to the complex life cycle. Heartworm antigen tests are nearly 100% specific for adult heartworm infections consisting of at least one adult female worm. Heartworm antibody tests can detect exposure to heartworm larvae as early as two months after exposure but do not prove active infection. It is often helpful to use these tests in combination to obtain the most complete clinical picture.

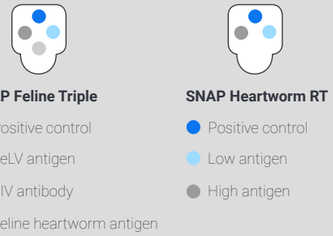


†In endemic and pre-endemic areas or cats with relevant travel history, consider the Feline Heartworm Antibody by ELISA.

‡The Heartworm Antigen by ELISA with Heat Treatment is recommended.

§ESDA is the European Society of Dirofilariosis and Angiostrongylosis, ABCD is the European Advisory Board on Cat Diseases and CAPC is the Companion Animal Parasite Council.

Product	SNAP Feline Triple, SNAP Heartworm RT tests
Detection of	*Dirofilaria immitus* antigen
Package size	5/15/30 tests
Storage	SNAP Feline Triple Test at 2–30°C; SNAP Heartworm RT Test at room temperature
Sample material	Anticoagulated whole blood/serum/plasma
Duration of test	SNAP Feline Triple Test at 10 minutes, SNAP Heartworm RT Test at 8 minutes



Leishmaniosis | SNAP® *Leishmania* and SNAP® Leish 4Dx® tests

Disease
Leishmaniosis in Europe is endemic to the Mediterranean region. Diagnosis is difficult due to the diverse and non-specific symptoms. Many infected dogs show no or only mild clinical symptoms (peripheral lymphadenopathy/dermatitis) and only a low or even no antibody titre at all, which can make further testing necessary.

Pathogen
Leishmania infantum

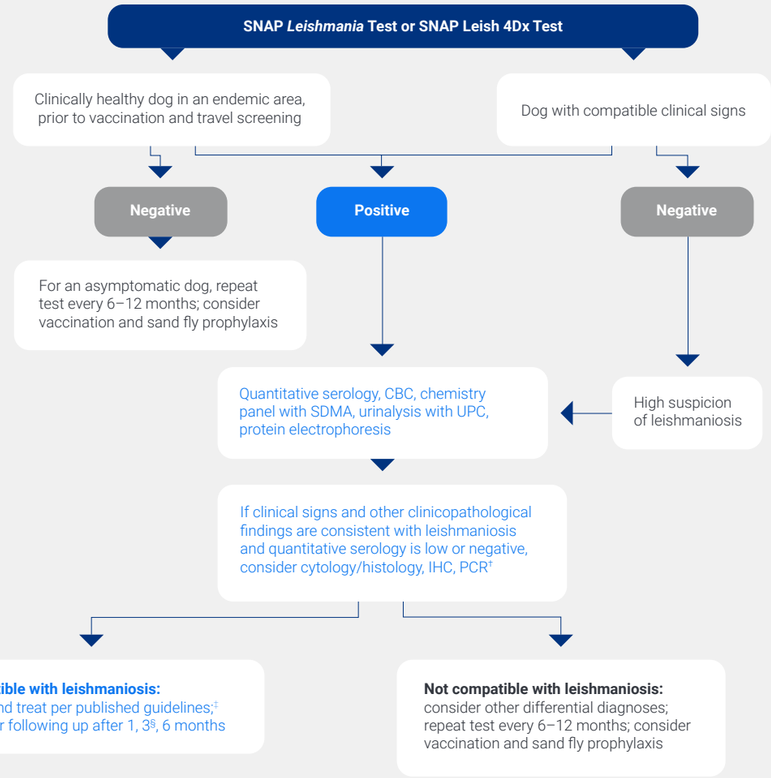
Vector
Phlebotomus spp. (sand flies)

Symptoms
In 50%–90% of cases, skin changes occur. Typical skin symptoms include symmetrical hair loss without itching, hyperkeratosis, exfoliative dermatitis and inflammation of the claw bed with long growth of the claws. A large number of dogs have a generalised lymphadenopathy. The direct harm to the animal caused by the parasites leads to granulomatous, non-purulent inflammatory reactions in the tissues of the host.

The deposition of immune complexes can lead to polyarthritis, vasculitis, glomerulonephritis and uveitis. Furthermore, weight loss, muscular atrophy, fever, lethargy, anorexia, spleno- and hepatomegaly, and more rarely epistaxis, may occur. The typical gastrointestinal symptoms include diarrhoea, vomiting and melaena.

Laboratory diagnostics
Increased total protein with hyperglobulinaemia, usually polyclonal gammopathy, monoclonal changes are also possible and hypoalbuminaemia; also increased CRP or liver values; proteinuria is extremely important; later also azotaemia (kidney failure is the most common cause of death); anaemia; thrombocytopenia; leukocytosis or leukopenia.

Which animals should be tested?
Dogs that have been in endemic regions should be tested once again 6–12 months after potential exposure or for diagnosis if corresponding clinical symptoms are present. Dogs in endemic areas should be tested annually prior to vaccination to assess potential risks and infection. As antibody titres may be low, additional testing methods may be used to establish a diagnosis when clinical signs are present.

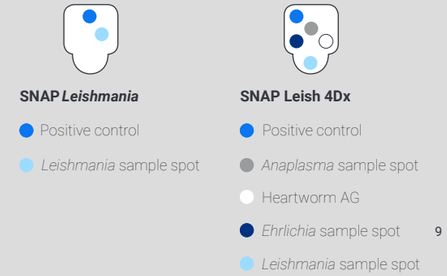


†Recommended sample types: bone marrow, lymph node, spleen, skin or conjunctival swabs.

‡For more information on the clinical staging, treatment and prognosis of leishmaniosis, visit the LeishVet website: leishvet.org/fact-sheet/clinical-staging.

§Quantitative serology recommended 3 months after initial therapy and then every 6–12 months.

Product	SNAP *Leishmania*, SNAP Leish 4Dx tests
Detection of	*Leishmania infantum* antibodies
Package size	10/30 tests (SNAP *Leishmania* Test) 5/15/30 tests (SNAP Leish 4Dx Test)
Storage	2–8°C (improved versions can be stored up to 6 months at room temperature [18–25°C])
Sample material	Anticoagulated whole blood/serum/plasma
Duration of test	8 minutes



Canine dirofilariasis | SNAP® 4Dx® Plus, SNAP® Leish 4Dx® and SNAP® Heartworm RT tests

Disease
Dirofilariasis is a parasitic disease of the large pulmonary vessels and the heart. The parasites are found preferentially in the pulmonary arteries, but they can also enter the right heart and even the vena cava when present in sufficient numbers. In Europe, the parasite is endemic to the Mediterranean region.

Pathogen
Dirofilaria immitis

Vector
Mosquitoes *(Culex, Aedes, Anopheles)*

Symptoms
The disease initially progresses subclinically. Symptoms develop with increasing damage to the vessels and depend on the number of heartworms.

The clinical course is divided into three stages:

Stage I
Asymptomatic

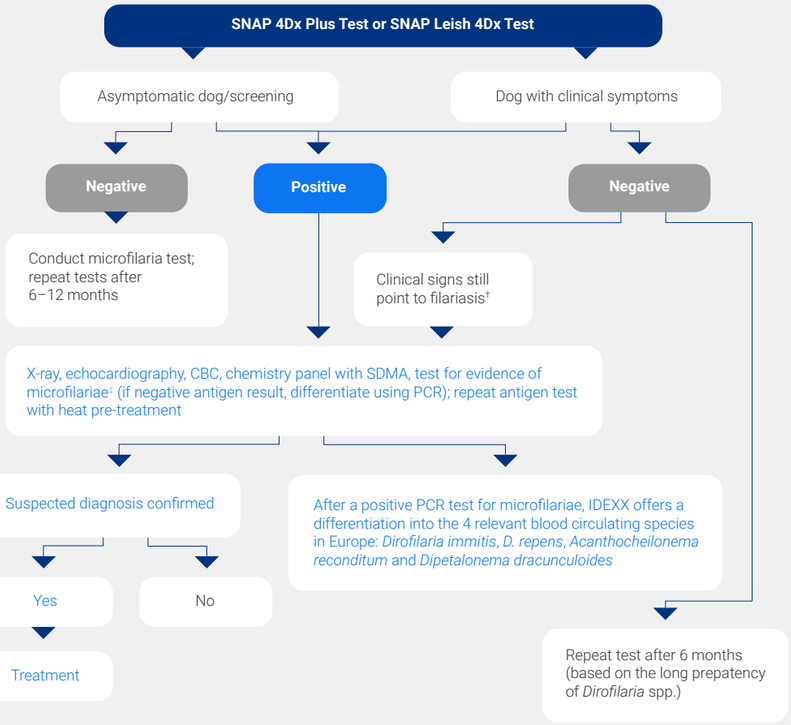
Stage II
Deterioration of performance, sporadic coughing, anaemia

Stage III
Lethargy, anorexia, weight loss; chronic cough, sometimes with bloody sputum; dyspnoea and tachypnoea; syncope; inspiratory lung sounds; jugular pulse, peripheral venous congestion, ascites, hepatomegaly; heart murmurs; glomerulopathy, renal insufficiency.

Laboratory diagnostics
Non-pathognomonic; anaemia (absent, mild or moderate, depending on chronicity and severity of disease); eosinophilia and basophilia (variable); inflammatory leukogram and thrombocytopenia (associated with thromboembolism); hyperglobulinaemia (uncertain); proteinuria (common in chronic and severe disease); possibly a CRP increase.

Which animals should be tested?
Dogs that come from endemic regions. Also, dogs that have been in endemic regions, 6 months after potential exposure or for diagnosis if corresponding clinical symptoms are present.

If the time of infection is unknown, repeat if necessary. The test also allows a diagnosis of occult infections without circulating microfilariae. For comprehensive diagnostics, the SNAP* test should always be conducted with a test for microfilariae.†



†If immune complexes are suspected, perform heat protocol at the reference laboratory.

‡To screen for a filarial infection, the antigen test for adult worms should be always combined with a microfilariae-based test (e.g., filtration or PCR) as both tests detect different stages and are thus complementary.

Anaplasmosis | SNAP® 4Dx® Plus and SNAP® Leish 4Dx® tests

Canine granulocytic anaplasmosis

Pathogen
Anaplasma phagocytophilum
Widespread in central and northern Europe.

Vector in Europe
Ixodes ricinus

Pathogenesis
The pathogen predominantly attacks neutrophils and is disseminated by them.

Symptoms
Often subclinical course. Symptoms may occur suddenly after a 1–2 week incubation period (seasonal peaks correlating with tick activity) and are non-specific: fever, listlessness, anorexia, splenomegaly, musculoskeletal pain (rarely joint pain). Less commonly, gastrointestinal, neurological, respiratory and dermatological symptoms, such as a tendency to bleed, hepatomegaly and lymphadenopathy, occur.

Laboratory diagnostics
Thrombocytopenia, normochromic anaemia, lymphopenia, monocytosis, hypoalbuminaemia, liver enzyme and CRP elevation†; rarely proteinuria.

Infectious canine cyclic thrombocytopenia

Pathogen
Anaplasma platys
In Europe, found in the Mediterranean region.

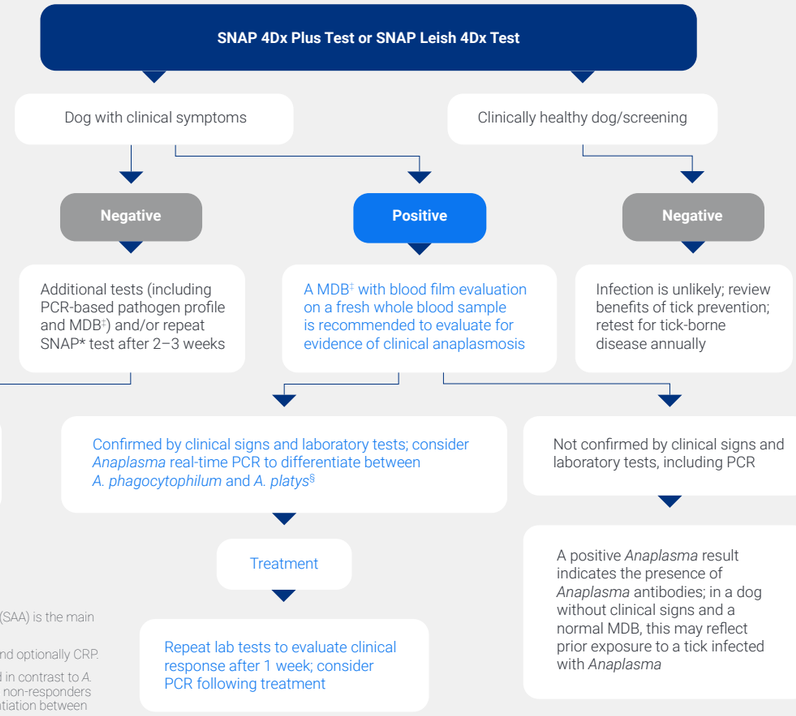
Vector
Rhipicephalus sanguineus

Pathogenesis
Thrombocytopenia (subsequently cyclic) within 10 days post infection (incubation period of 8–15 days).

Symptoms
Non-specific and mild clinical manifestation, including anorexia, lethargy, generalised enlargement of lymph nodes, pale mucous membranes and fever; more severe course possible with petechial and ecchymotic haemorrhages as well as uveitis.

Laboratory diagnostics
Thrombocytopenia, potentially also CRP elevation. Co-infections (primarily *Ehrlichia canis*, but also *Babesia* and *Hepatozoon canis*) may cause other changes in laboratory values.

Co-infection with *Borrelia*
In the event of a co-infection with *Borrelia* and *A. phagocytophilum*, the risk that an animal will develop clinical symptoms of one of the diseases is approximately twice as high as with a monoinfection.[1] With the SNAP 4Dx Plus Test, you can detect both infections in one test and initiate timely therapeutic intervention.

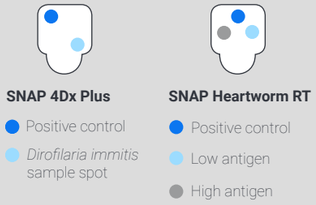


†CRP is specific for dogs; in cats and horses, serum amyloid A (SAA) is the main acute phase protein to be tested.

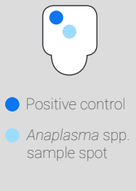
‡MDB = minimal database with urine analysis, including UPC, and optionally CRP.

§As *A. platys* can cause a severe disease in European dogs, and in contrast to *A. phagocytophilum*, a high proportion of dogs are considered as non-responders to treatment (co-infections are one possible reason), a differentiation between these two *Anaplasma* species is important.

Product	SNAP 4Dx Plus, SNAP Heartworm RT, SNAP Leish 4Dx tests
Detection of	*Dirofilaria immitis* antigen
Package size	5/15/30 tests (SNAP 4Dx Plus Test, SNAP Heartworm RT Test) 5/10/30 tests (SNAP Leish 4Dx Test)
Storage	SNAP 4Dx Plus and SNAP Leish 4Dx tests: 2–8°C or room temperature (improved versions can be stored up to 6 months at room temperature [18–25°C]) SNAP Heartworm RT Test: at room temperature
Sample material	Anticoagulated whole blood/serum/plasma
Duration of test	8 minutes



Product	SNAP 4Dx Plus, SNAP Leish 4Dx tests
Detection of	*Anaplasma* spp. antibodies
Package size	5/15/30 tests (SNAP 4Dx Plus Test) 5/10/30 tests (SNAP Leish 4Dx test)
Storage	2–8°C or room temperature (improved versions can be stored up to 6 months at room temperature [18–25°C])
Sample material	Anticoagulated whole blood/serum/plasma
Duration of test	8 minutes



Ehrlichiosis | SNAP® 4Dx® Plus and SNAP® Leish 4Dx® tests

Disease
In canine monocytic ehrlichiosis (CME), the pathogen invades monocytes, where it forms what are called morulae, and in rare cases, the pathogen is also visible microscopically. Monocytes spread the pathogen to the spleen, lymph nodes and bone marrow. *Ehrlichia canis* is called a 'silent killer' (long incubation period and non-specific clinical signs).

Pathogen in Europe
Ehrlichia canis

Vector
Rhipicephalus sanguineus
In Europe, found in the Mediterranean region.

Symptoms
A distinction is made between three stages of CME: acute, subclinical and chronic. After an incubation period of 8–20 days, the acute phase starts (2–4 weeks), which progresses without symptoms or with only mild symptoms and often transitions into a subclinical stage.

Acute:
Fever, lethargy, dyspnoea, anorexia and splenomegaly

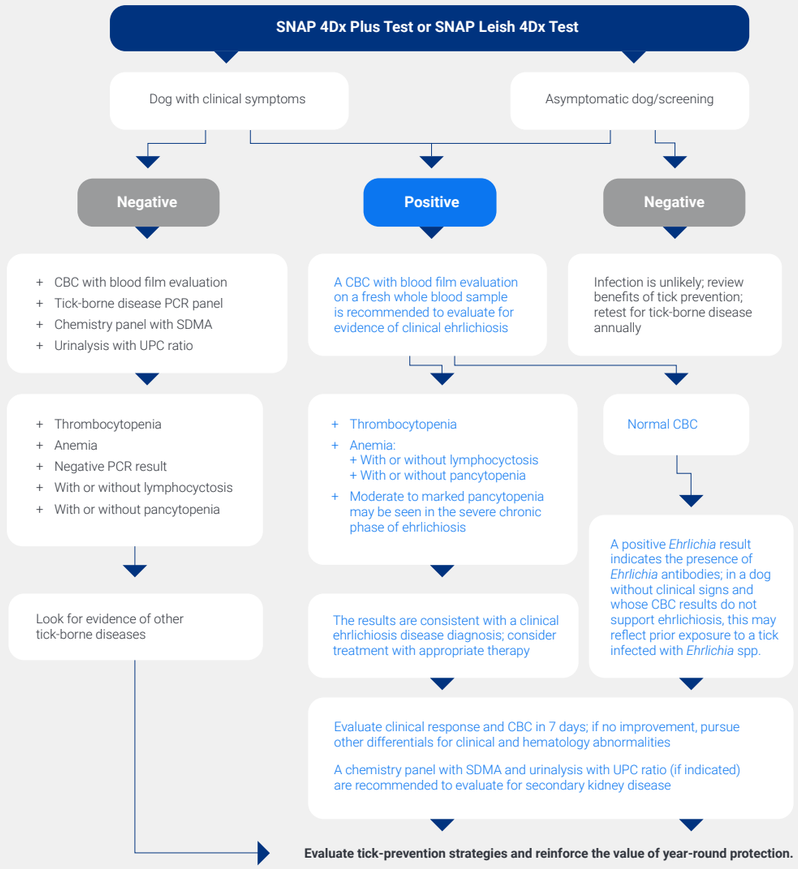
Chronic:
Petechial haemorrhages, ecchymoses; fever with apathy, anorexia, weight loss; generalised lymphadenopathy, splenomegaly, bone marrow hypoplasia; central nervous system (CNS) disorders (meningitis), polymyositis, polyarthritis, ocular symptoms (uveitis, retinal lesions), cough, dyspnoea (pneumonia), cardiac enlargement.

Laboratory diagnostics
Thrombocytopenia, anaemia, leukopenia, leukocytosis and monocytosis (if chronic), elevated liver enzymes, hyperglobulinaemia (also monoclonal gammopathies within the beta or gamma region possible), hypoalbuminaemia, proteinuria, possibly CRP elevation; in advanced stages, also pancytopenia and neutropenia (both associated with poor prognosis), azotaemia.

Co-infection with *Leishmania*
In the event of co-infection with *Leishmania* and *Ehrlichia*, the risk of clinical disease and a poor response to treatment is significantly higher, and there is the risk of a higher incidence of immune-mediated and bone marrow disease.[2]

Therapeutic options
In the acute and subclinical stages, the disease is still easily treatable, while in the chronic stage it is more difficult. Therefore, early detection of infected dogs is important. Dogs that come from endemic areas, or have been in such areas, should always be checked for the presence of an *Ehrlichia canis* infection.

The SNAP 4Dx Plus Test detects antibodies to *E. ewingii* and *E. chaffeensis*; however, these are only of significance in North America.



†PCR from blood can be false negative; potentially higher sensitivity with spleen or bone marrow samples.

Product	SNAP 4Dx Plus, SNAP Leish 4Dx tests
Detection of	*Ehrlichia* spp. antibodies
Package size	5/15/30 tests
Storage	2–8°C or room temperature (improved versions can be stored up to 6 months at room temperature [18–25°C])
Sample material	Anticoagulated whole blood/serum/plasma
Duration of test	8 minutes

Borreliosis | SNAP® 4Dx® Plus Test

Disease
Lyme borreliosis (LB) is a multi-systemic, often subclinical disease of companion animals, such as the dog, cat or horse, but also in humans.

Pathogen
Borrelia burgdorferi sensu stricto†

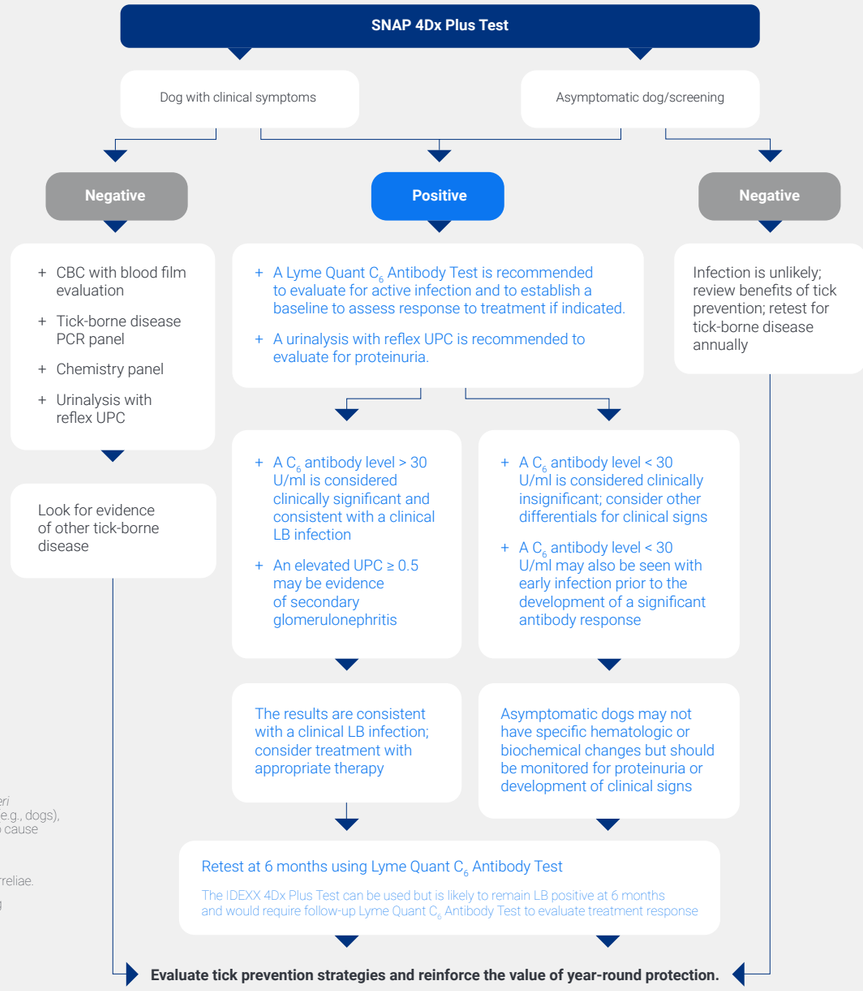
Vector in Europe
Ixodes ricinus‡

Symptoms
LB shows different clinical courses depending on species. In contrast to humans, the bull's-eye rash (erythema migrans) is not observed in the dog.

After an incubation period of 2–5 months, approximately 5% of dogs show lameness (with histopathological changes in the synovial membrane). A small percentage of patients show kidney disease (in the sense of a sterile membranoproliferative immune complex glomerulonephritis). Very few patients show symptoms involving the heart or neurological symptoms.

Laboratory diagnostics§
Mostly unremarkable. Only in chronic cases do differences occur, depending on the organ system involved. Non-regenerative anaemia occurs in glomerulonephritis and renal insufficiency (possibly also thrombocytopenia), increased CRP values, hypoalbuminaemia, proteinuria and azotaemia. Increased neutrophils can be detected in the synovial fluid.

C_6-peptide ELISA
The detection of antibodies to the C_6 peptide (one of six non-variable regions of the immunomodulatory surface protein VlsE) offers advantages over previous tests (whole cell ELISA/IFAT). Positive result indicates an active infection. There is no cross-reaction with Lyme vaccines and antibodies induced by other spirochetes (e.g., leptospires). The Lyme Quant C_6* Antibody Test, which can be requested from IDEXX Reference Laboratories, offers the option of precise quantification of the antibodies, which has been shown to to correlate with the amount of immune complexes.[3] Anti-C_6 antibodies can often already be detected 3 weeks post-infection.



†In humans, some species of the *Borrelia burgdorferi* sensu lato complex can cause LB, but in animals (e.g., dogs), so far only *B. burgdorferi* sensu stricto is proven to cause clinical disease.

‡There is evidence that other *Ixodes* spp., such as *I. hexagonus* may also act as vectors for Lyme borreliae.

§Recommendations and differentials are according to Pantchev et al.[4]

Product	SNAP 4Dx Plus Test
Detection of	*Borrelia burgdorferi* C_6 antibodies
Package size	5/15/30 tests
Storage	2–8°C or room temperature
Sample material	Anticoagulated whole blood/serum/plasma
Duration of test	8 minutes

Giardiasis | SNAP* *Giardia* Test

Disease
Giardiasis is a parasitic infection of the intestine caused by protozoa. Young and senior animals, as well as immunosuppressed animals and those with co-infections/ co-morbidities, are especially likely to show clinical symptoms. Dysbiosis may also play an as yet underestimated role. It is considered a potentially zoonotic disease, albeit an overestimated one, particularly in dogs and cats. Asymptomatic shedders in an animal group may act as reservoirs.

Pathogen
Giardia duodenalis (synonyms *G. intestinalis, G. lamblia*) Cysts are excreted in the faeces and are the infectious form. Trophozoites are motile, attach to the microvilli of the small intestine, can reduce the absorption surface and damage enterocytes.

Transmission
Ingestion of food or water that is contaminated with cysts. Also possible via contamination of the environment or of the coat, through close contact with sniffing and licking, drinking from puddles, and coprophagy in dogs, among others.

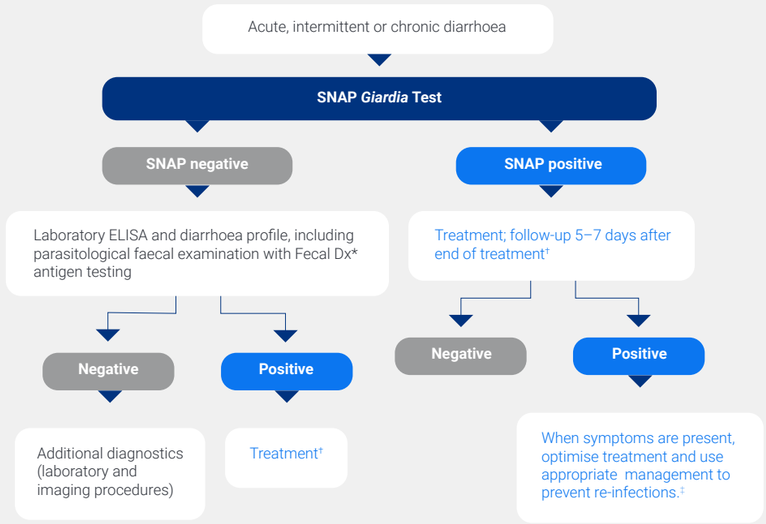
Symptoms
The prepatent period is approximately one week. Due to epithelial damage, there may be recurrent or chronic diarrhoea with light-coloured, foul-smelling, mucous-greasy faeces, possibly with admixed blood and vomitus.

Further symptoms arising due to malabsorption are anorexia, listlessness, weight loss and a reduction in weight gain in puppies.

Laboratory diagnostics
Laboratory findings, including CBC, are typically unremarkable. Mild leukoctyosis and anaemia may sometimes occur.

Prophylaxis
The risk of re-infection can be minimised by thorough cleaning of the environment and washing of the coat, as well as identification and concomitant treatment of asymptomatic carriers in groups, where necessary. The most common reason for refractory infection is re-infection; despite all hygiene measures, this cannot be reliably prevented in the dog.

Prevalence of *Giardia*
One dissertation showed that 22.8% of canine and 15.4% of feline faecal samples sent to the IDEXX Reference Laboratories for analysis were positive (a total of approximately 80,000 samples). In animals aged under 12 months, the proportion increases to 62.5% and 53.5%, respectively. Co-infections with cryptosporidia/coccidia (dog/cat), nematodes (dog) or *Tritrichomonas foetus* (cat) were detected significantly more frequently.[5] In large dog and cat populations (kennels, animal shelters), the entire population can be infected if the pathogen is introduced. A European study carried out by the University of Veterinary Medicine Hannover and IDEXX (2010) with the SNAP* test revealed that 24.8% of dogs and 20.3% of cats with diarrhoea were infected with *Giardia*.[6] This shows an increased relevance of *Giardia* in enteropathies in dogs and cats, particularly in young animals with co-infections.



†According to new scientific data, metronidazole can cause dysbiosis in dogs; retesting longer than 1 week after treatment can show re-infection.[7]

‡According to ESCCAP, treatment of healthy *Giardia*-positive animals is generally not recommended; e.g., treatment could be an option in high-risk environments like kennels, catteries or with breeders, particularly with a high incidence of diarrhoea in puppies, or where there are small children or immunocompromised humans.[8]

Product	SNAP *Giardia* Test
Detection of	*Giardia* antigen
Package size	5/15 tests
Storage	2–8°C
Sample material	Faeces
Duration of test	8 minutes

Positive control
Giardia antigen

Parvovirus | SNAP* Parvo Test

Disease
Canine parvovirus is a severe infectious disease. Puppies in the first months of life are especially prone to contracting the disease with a high mortality rate. Parvovirus takes two clinical forms. Neonates and puppies develop the intestinal form. The cardiac form is rare and only affects neonates lacking maternal antibodies.

Pathogen
Canine parvovirus (CPV)
Primarily CPV-2 is relevant, with the variants CPV-2a, CPV-2b and CPV-2c (all 3 are detected by the SNAP Parvo Test)[9]

Transmission
The virus is transmitted by direct contact with the excreta of infected animals in the environment (primarily faeces). Transmission via contaminated objects or food is also possible.

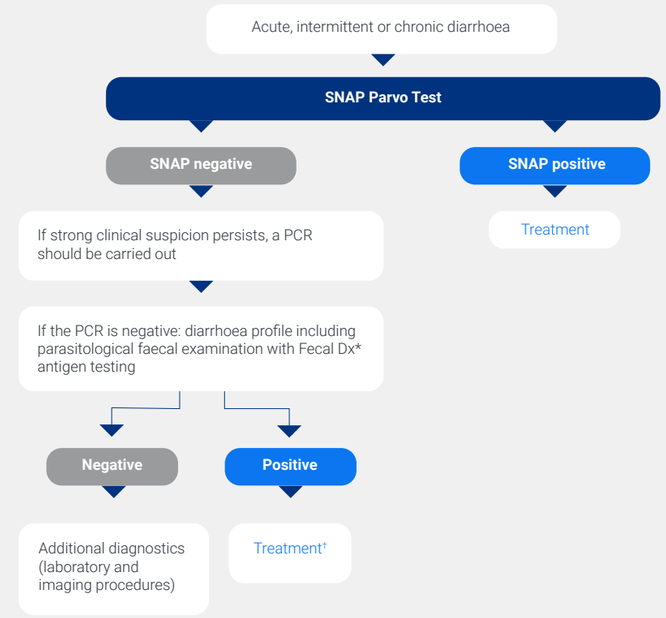
Symptoms
Intestinal form: Infected animals show fever, listlessness, anorexia, vomiting, bloody diarrhoea, tense abdomen.

Cardiac form: Affected puppies develop non-purulent myocarditis. They may die suddenly or after preceding symptoms.

These include dyspnoea, nausea, pulmonary oedema and ascites.

Laboratory diagnostics
Thrombocytopenia, anaemia, transient leukopenia, lymphopenia

Prophylaxis
Vaccination with the customary parvovirus vaccines in the form of primary vaccination and boosters. Unvaccinated puppies should not come into contact with other dogs or potentially contaminated objects.



†Examinations confirm 100% specificity of the test. The test should not interfere with a vaccination. This can be ruled out if necessary using PCR.

Product	SNAP Parvo Test
Detection of	CPV-2a,b,c/FPV antigen
Package size	5 tests
Storage	2–25°C
Sample material	Faeces
Duration of test	8 minutes

Positive control
Parvovirus antigen

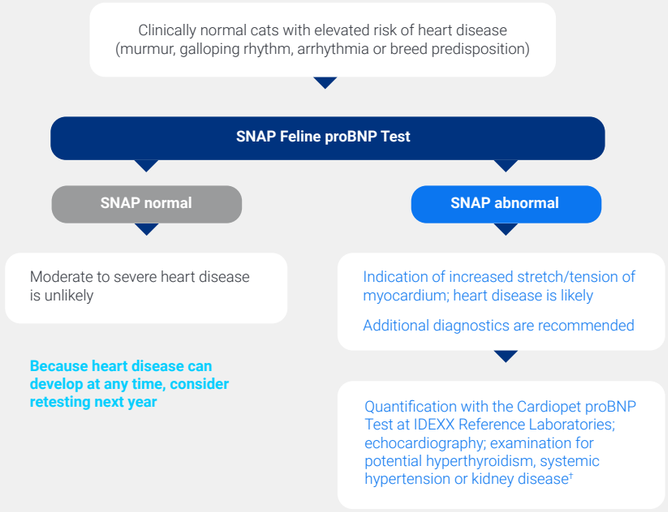
Hypertrophic cardiomyopathy | SNAP* Feline proBNP Test

Parameter
NT-proBNP

Disease
Cardiomyopathies, especially hypertrophic cardiomyopathy (HCM), are the most common heart diseases in cats. HCM typically occurs in young to middle-aged males, but any cat can be affected. A breed predisposition is described for Bengal, Himalayan, Persian and Maine coon cats. HCM is characterised by concentric hypertrophy of the left ventricle and associated diastolic dysfunction (impaired ventricular relaxation). With progression of the disease, there is ultimately an enlargement of the left atrium as well as an increase in left atrial pressure and a resultant elevated risk for development of congestive heart failure. Cats with enlarged left atrium also are at risk of developing a thromboembolism (aortic thrombosis/saddle thrombus).

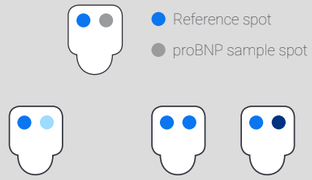
Symptoms
Cats with cardiomyopathies may appear outwardly healthy, even though moderate to severe changes are evident on echocardiography. On auscultation, a systolic murmur with or without a galloping rhythm or arrhythmia may be noted sternally or parasternally. Not every cat with cardiomyopathy has a heart murmur and, at the same time, non-pathological heart murmurs may occur in cats without heart disease, particularly older cats.

BNP and NTproBNP – physiology and pathophysiology
The natriuretic peptide BNP (B-type or brain natriuretic peptide) is a neuroendocrine hormone, which forms as a prohormone (proBNP) in the cardiac muscle cells of the atria. When the atria are physiologically stretched, proBNP is broken down and released in the form of two smaller peptides: the inactive N-terminal peptide (NT-proBNP) and the biologically active C-terminal peptide (C-BNP). C-BNP counteracts myocardial stretch by binding to receptors in the blood vessels and kidneys and inducing vasodilation as well as diuresis. In the course of heart disease, BNP is additionally produced and released by the cells of the ventricular myocardium. **The quantity released is proportional to the severity of the disease.** It is therefore a marker of enlargement of the atria and ventricles, as well as strain on the cardiac wall. Both the **SNAP* Feline proBNP Test and the Cardiopet* proBNP Test** measure the concentration of NTproBNP in the bloodstream.



†Elevated NT-proBNP concentrations in cats may also arise secondary to the cardiac effects of hyperthyroidism or hypertension, or as a result of reduced renal excretion due to severe azotaemia.

Product	SNAP Feline proBNP Test
Detection of	NTproBNP
Package size	5/10 tests
Storage	2–8˚C
Sample material	Serum/EDTA plasma
Duration of test	10 minutes



Canine pancreatitis | SNAP* cPL* Test

Parameter
Canine pancreas-specific lipase (cPL)

Disease
Pancreatitis occurs frequently in dogs. Diagnosis is made more difficult, however, due to non-specific clinical symptoms and the limited explanatory power of non-invasive diagnostic testing options. The disease mainly affects middle-aged and older dogs.

Pancreatitis results in an intrapancreatic activation of proteolytic and lipolytic digestive processes, which can lead to autodigestion of tissues of the pancreas and adjacent organs with systemic complications, even through to the death of the dog. Local inflammation and potentially necrosis, and in severe cases of acute pancreatitis, systemic complications (e.g., SIRS and MODS), can occur.

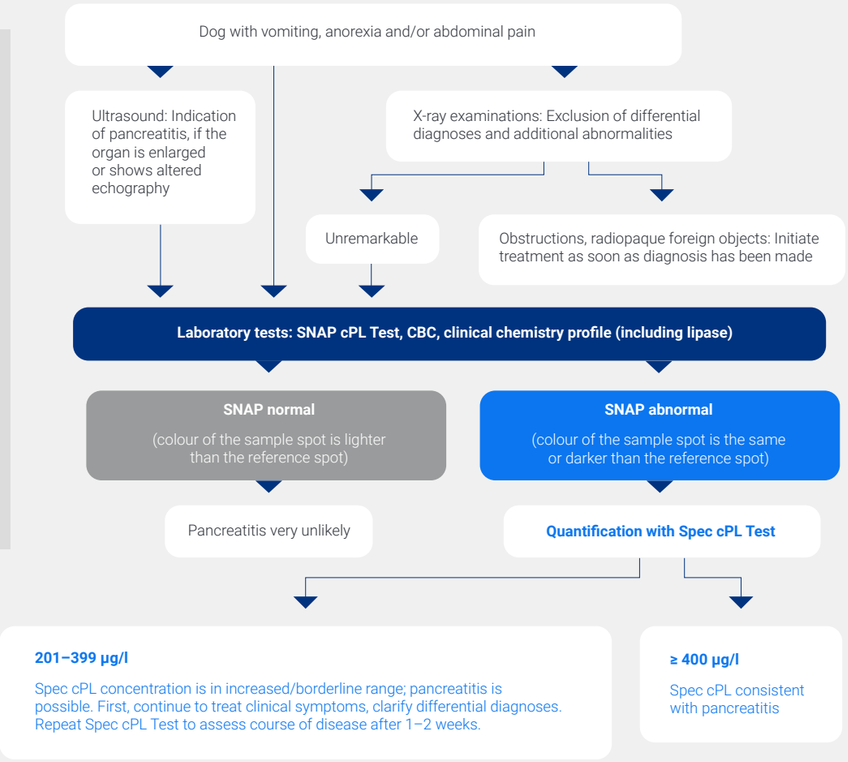
Symptoms
Clinical symptoms are mostly non-specific. For example, the animals affected show vomiting, abdominal pain, anorexia, weakness, dehydration and diarrhoea. Dogs are more likely to have acute pancreatitis (pathohistological diagnosis), which is often accompanied by severe clinical symptoms. However, mild and even subclinical courses are also possible. The changes due to acute pancreatitis are generally reversible. The chronic form occurs more rarely in dogs and mostly progresses subclinically or is associated only with mild symptoms. However, the pathohistological changes are irreversible and may repeatedly occur in recurrent episodes with marked clinical symptoms in the course of activated chronic pancreatitis.

Laboratory diagnostics
Thrombocytopenia, neutrophilia with left shift with toxic changes, and increased CRP, anaemia, elevated liver enzymes, azotaemia, electrolyte imbalances (e.g., hypocalcaemia), hyperbilirubinaemia, hypoalbuminaemia, hypercholesterolaemia, hypo- or hyperglycaemia; urine analysis with increased urine specific gravity (USG), possibly bacteriuria and proteinuria.

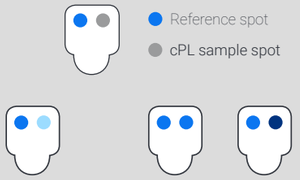
Spec cPL* Test (IDEXX Reference Laboratories)
In contrast to conventional testing methods, the Spec cPL Test exclusively determines canine pancreas-specific lipase (cPL) immunologically and provides a reliable, minimally invasive diagnostic method for the detection of pancreatitis.

The Spec cPL Test should be conducted for quantification in the event of a positive SNAP cPL Test.

Moreover, it allows monitoring of the success of treatment and the course of disease, especially in chronic cases.



Product	SNAP cPL Test
Detection of	Canine pancreas-specific lipase
Package size	5/10 tests
Storage	2–8˚C
Sample material	Serum
Duration of test	10 minutes



Feline Pancreatitis | SNAP* fPL* Test

Parameter
Feline pancreas-specific lipase (fPL)

Disease
Feline pancreatitis is a multifactorial disease with variable clinical courses and diverse outcomes. It is much more common than many vets assume and the diagnostic work-up can be challenging.

In cats, the acute form is rare; most animals show chronic pancreatitis.

Symptoms
Chronic pancreatitis (pathohistological diagnosis) can progress subclinically or be associated with only mild symptoms.

However, the changes are irreversible and recurrent acute episodes are possible; often then occurring with sudden onset and pronounced clinical signs. Common reasons for presentation are lethargy, reduced appetite and dehydration.

In comparison to the dogs that are affected, cats more rarely exhibit vomiting or abdominal pain.

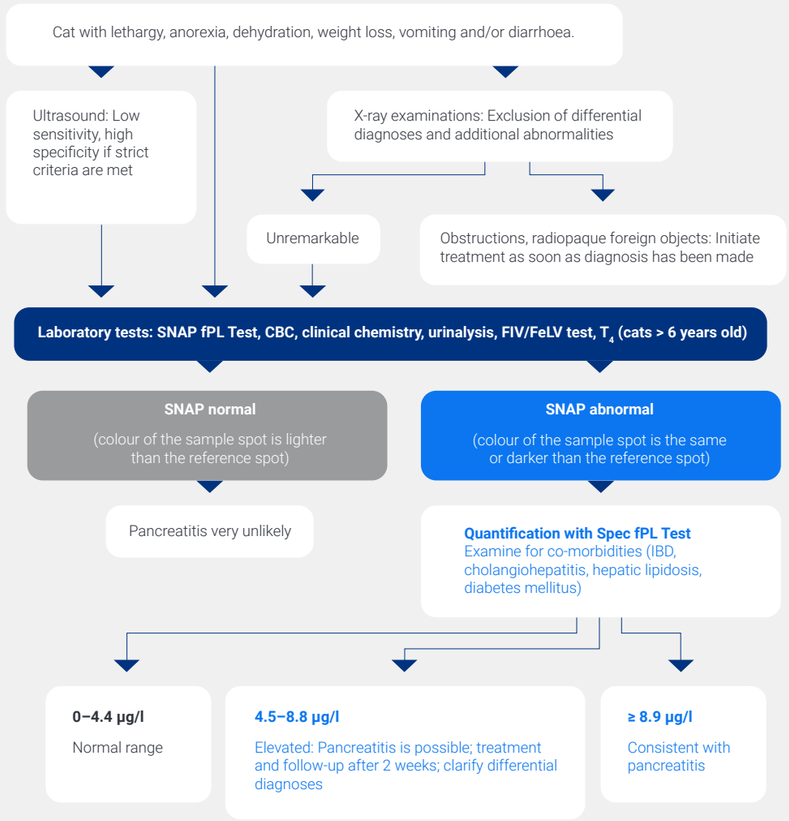
Diarrhoea can be triggered by pancreatitis itself or be caused by other gastrointestinal co-morbidities (inflammatory bowel disease, cholangiohepatitis, hepatic lipidosis). 'Triaditis' is a term applied to feline inflammatory gastrointestinal (GI) disease, describing concurrent inflammation of the small intestines, pancreas and hepatobiliary system.†

Other possible clinical signs are icterus, fever and a palpable abdominal mass.

Laboratory diagnostics
Commonly unremarkable or a manifestation of co-morbidities. The following may occur: non-regenerative anaemia, leukocytosis or leukopenia, increased SAA values, elevated liver enzymes, hyperbilirubinaemia, hyperglycaemia, azotaemia, electrolyte imbalances, hypocalcaemia. Serum amylase and lipase are not suitable for diagnostic purposes in cats.

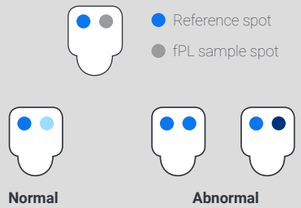
Spec fPL* Test (IDEXX Reference Laboratories)
The Spec fPL Test should be conducted for quantification in the event of a positive SNAP fPL Test. It detects the concentration of pancreas-specific lipase in the blood and provides information about the feline patient's pancreatic status.

Moreover, it allows monitoring of the success of treatment and course of disease, especially in chronic cases.



†A definitive diagnosis of triaditis requires histological confirmation of inflammation in each organ, but this is frequently difficult because of financial or patient-related constraints. Evidence-based data indicates that histological lesions of triaditis are present in 30% to 50% of cats diagnosed with pancreatitis and cholangitis/inflammatory liver disease.[10]

Product	SNAP fPL Test
Detection of	Feline pancreas-specific lipase
Package size	5/10 tests
Storage	2–8˚C
Sample material	Serum
Duration of test	10 minutes



Angiostrongylosis | Angio Detect* Test

Disease
Canine pulmonary angiostrongylosis (CAG)

Pathogen
Angiostrongylus vasorum

Intermediate host
Snails

Transport host
In experimental models, dogs can be infected by ingesting frogs or chickens that are infected with L3 larvae that they acquired from snails.

Life cycle
After the dog has ingested an L3-infected intermediate host, the larvae migrate through the intestinal wall into the mesenterial lymph nodes. They develop into L4 larvae there and arrive in the right ventricle and pulmonary arteries via the blood vessels 10 days post-infection. They undergo further development there; after approximately 6–8 weeks, the adult females begin to lay eggs. The L1 larvae migrate into the upper airways via the alveoli, are coughed up, swallowed, shed with faeces and taken up again by an intermediate host. Excretion of the L1 larvae occurs intermittently, with alternating periods of high and absent pathogen shedding. Therefore, a single faecal examination can be negative despite the presence of adult worms.

Symptoms
CAG represents an important differential diagnosis in dogs with respiratory, haemorrhagic and neurological symptoms, as well as syncope (frequently associated with pulmonary hypertension). Clinical symptoms are variable and non-specific (weight loss, occasional coughing, as well as intermittent lameness, loss of coordination, reluctance to move, listlessness and deterioration of performance). Dramatic changes have also been described, however, such as severe dyspnoea, coagulopathy, neurological symptoms, up to acute heart failure.

Echocardiography can sometimes detect right ventricular hypertrophy and dilatation, as well as pulmonary hypertension. Pulmonary oedema is also possible. On the other hand, the disease can remain subclinical for months to years.

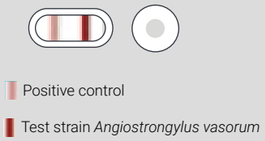
Laboratory diagnostics
Neutrophilia (more rarely eosinophilia), anaemia, rarely also altered coagulation parameters and thrombocytopenia. Elevated CRP levels and alterations in serum protein electrophoresis are also possible.

Angio Detect Test
The test allows a statement to be made on the presence of an *Angiostrongylus vasorum* infestation within 15 minutes. It has shown a very high sensitivity† and specificity‡ compared to the Baermann method. Parasite detection is also possible in periods when larval shedding is absent.

The test exhibits no cross-reactions with other nematodes.

†Higher sensitivity compared to Baermann funnel from a single sample due to intermittent larval shedding in faeces.
‡The specificity of microscopic examination according to the Baermann method depends strongly on the examiner skills.

Product	Angio Detect Test
Detection of	*Angiostrongylus vasorum* antigen
Package size	5/20 tests
Storage	4–30˚C
Sample material	Serum/plasma
Duration of test	15 minutes



Leptospirosis | SNAP* Lepto Test

Disease
Leptospirosis

Pathogen
Leptospirosis in the dog is primarily caused by serovars of *Leptospira interrogans*, *Leptospira kirschneri* and *Leptospira borgpetersenii*.

Pathogenesis
Bacteraemia after penetration via the mucous membranes. The production of specific antibodies leads to the disappearance of leptospires from the blood and most organs. They may, however, persist in the liver and kidneys. Contact with dogs is a risk factor for zoonotic transmission. Pathogenesis includes haemolysin production with haemolytic disease, leptospiral toxins, organ damage because of bacterial replicating and induced cytokine production, and organ damage by direct invasion of inflammatory cells, among others. After approximately 10 days of infection, leptospires enter the tubular lumen and are eliminated in the urine over a period of days to months.

Transmission
Leptospires are excreted in the urine and contaminate the environment. Infection occurs primarily through contaminated water, soil and food. Rodents are common reservoir animals.

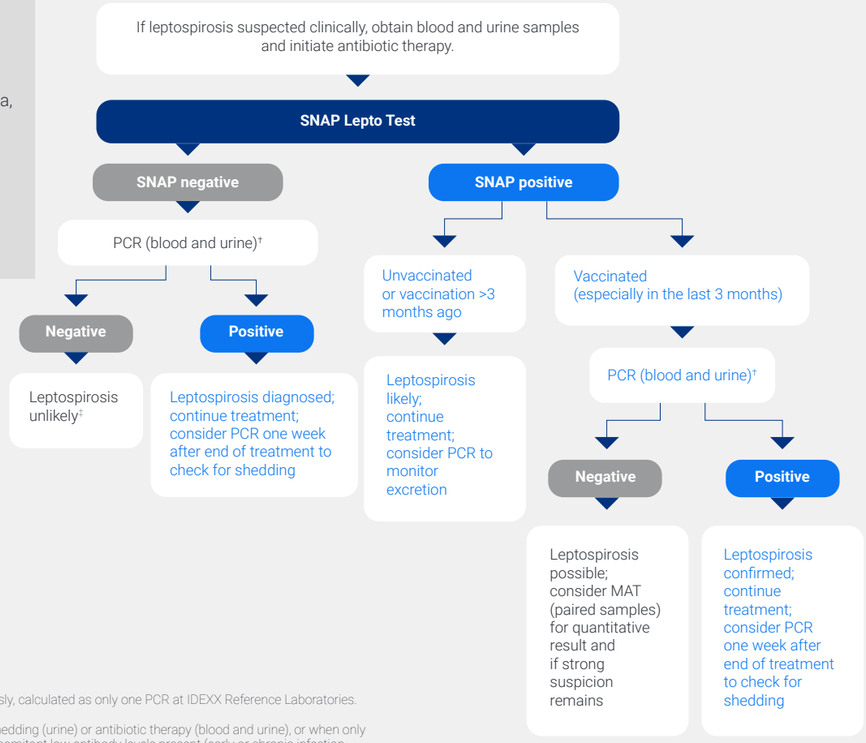
Symptoms
Commonly leading to acute kidney injury, followed by liver diseases; recently, commonly also pulmonary or atypical forms; frequently anorexia, listlessness, gastrointestinal symptoms, as well as polydipsia/polyuria. In addition, jaundice, fever, painful abdomen, muscle pain (stiff gait), uveitis, dyspnoea, coagulopathies.

Laboratory diagnostics
Anaemia, leukocytosis with neutrophilia, thrombocytopenia.

Azotaemia, elevated liver enzymes, hyperbilirubinaemia and increased creatine kinase activity, electrolyte imbalances. Increase in prothrombin and thromboplastin time.

Decreased urine specific gravity, glucosuria, granular casts, low-grade proteinuria.

Diagnostic range
The SNAP Lepto Test detects antibodies to pathogenic *Leptospira* serovars, including Icterohaemorrhagiae, Grippotyphosa, Canicola, Pomona, Bratislava and Autumnalis. The test is based on reliable ELISA technology and also efficiently detects IgM antibodies, in addition to IgG.



†When blood and urine submitted simulataneously, calculated as only one PCR at IDEXX Reference Laboratories.

‡PCR can be negative because of intermittent shedding (urine) or antibiotic therapy (blood and urine), or when only one material (blood or urine) is tested, with concomitant low antibody levels present (early or chronic infection in carriers with or without clinical signs). Therefore, a serum pair using MAT in the reference laboratory can be advisable to rule out leptospirosis.

Product	SNAP Lepto Test
Detection of	*Leptospira* antibodies
Package size	5/10 tests
Storage	2–8°C
Sample material	Serum
Duration of test	10 minutes

- Positive control
- *Leptospira* sample spot

Immunoglobulin deficiency in the neonatal foal | SNAP* Foal IgG Test

Parameter
Immunoglobulin G (IgG)

Importance of IgG
Transfer of IgG via the colostrum is crucial to foal health. Absorption of IgG is only possible in the first 18–24 hours of a foal's life. If there is no or only inadequate IgG absorption, the foal is at risk of severe and potentially fatal infections.

Studies show that up to 30% of foals suffer from deficiencies in the transfer of IgG.[11–18] Checking the foal's IgG level in the first 8–12 hours of life allows timely administration of additional colostrum. A transfusion after the first 24 hours of life requires considerably more effort, is more expensive and poses a higher risk to the foal.

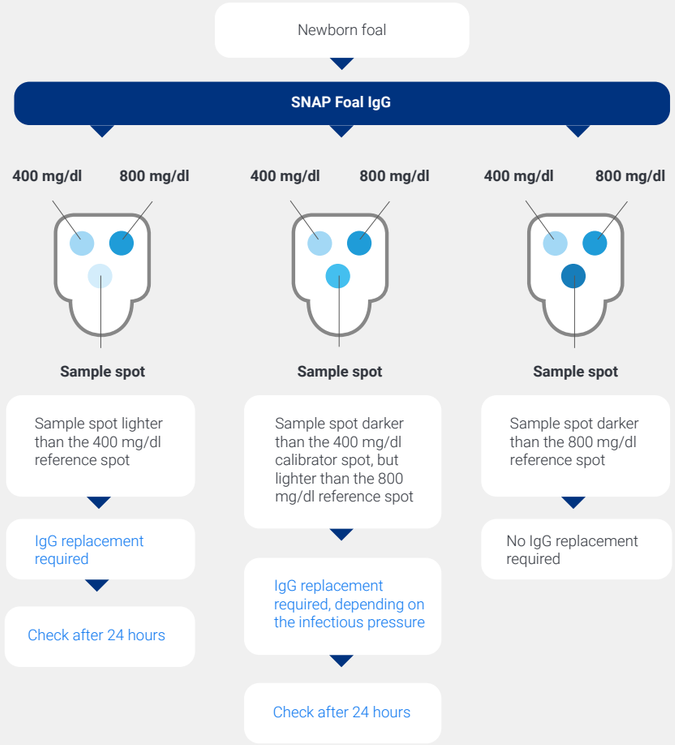
Aetiology
Various factors can lead to deficiencies in the transfer of IgG. In addition to clear causes, such as the death of the mare or the rejection of the newborn, premature births and premature lactation do not ensure sufficient transfer of maternal IgG to the foal. The colostrum of some mares contains insufficient levels of IgG. If the foal is weak, it may absorb too little IgG as well as in the event of malabsorption in the intestine.

Diagnostics
A routine check of the IgG status of all foals allows prompt identification of animals that are at risk. With a rapid test conducted directly in the stable, diagnosis can be made immediately and therapeutic intervention undertaken when necessary. To be on the safe side, the IgG value should be checked again 24 hours after treatment.

The foal profile offered by IDEXX Reference Laboratories
Over the course of the first year of life, different disease complexes predominate in the individual developmental stages. In addition to dysfunction of the organ systems (particularly the respiratory tract, digestive tract, urogenital tract), umbilical diseases and injuries are especially common.

Diseases of the respiratory and digestive tract are the most common reason for a visit by the veterinarian during the foal's further development into a young horse.

As foals often deteriorate very quickly with non-specific clinical symptoms and without advance external signs, the IDEXX foal profile offers a comprehensive overview of the haematological and organ-specific changes, including the IgG status (CBC, blood urea nitrogen (BUN), creatinine, total bilirubin, ALP, GGT, AST, glucose, CK, triglycerides, Na, K, Ca, Mg, Fe, Se, total protein, IgG).



Product	SNAP Foal IgG Test
Detection of	Immunoglobulin G (semiquantitative)
Package size	10 tests
Storage	2–8°C
Sample material	Anticoagulated whole blood/serum/plasma
Duration of test	7 minutes

- Reference spot 400 mg/dl
- Reference spot 800 mg/dl
- Sample spot

You do less. The SNAP Pro Analyser does more.

With the SNAP Pro* Analyser, all you do is prepare your sample, pour it into the SNAP* test device and insert the device into the SNAP Pro Analyser. 3 simple steps, saving you time so you can focus on your patients.

How's this for easy?

Step 1 Step 2 Step 3

+ View interpretive results at a glance for quick and accurate health assessments.
+ No more timer—the analyser times the test for you so you don't have to stand by and wait.
+ Color-coded, easy-to-read results take the guesswork out of interpretation, which gives you and your staff more confidence along with improved efficiency.
+ Reduce missed charges and automatically include results in your patient's medical record with common compatible practice management software.

References

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