# Vcheck
Cardiac Biomarker

NT-proBNP & Troponin I

BIONOTE

Vcheck kit demonstrates excellent performance in SCI-level paper

A number of papers have been published covering the superior performance of NT-proBNP test kits measurable using the fluorescent immunoassay analyzer, Vcheck. One such paper [1], published in the international journal 'Veterinary Clinical Pathology' (SCI), evaluated the performance of Vcheck Canine NT-proBNP kit. The study, which involved Texas A&M University and Washington State University, confirmed the excellent performance of the Vcheck kit in terms of accuracy and reproducibility.

Scan the code to
see the paper
(Veterinary Clinical Pathology paper)
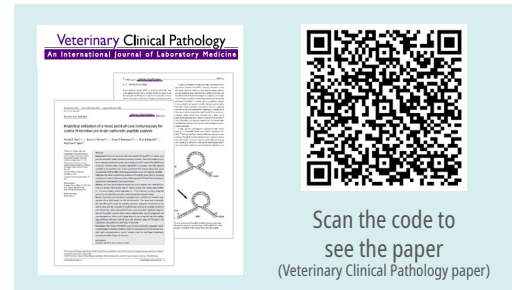
Excellent precision

The kit's results showed a 9-12% Coefficient of Variation (CV) for samples with medium to high concentration, which is within the acceptable range, confirming its high precision.

Excellent accuracy compared to the reference method

The comparison of the Vcheck assay with the lab NT-proBNP assay revealed an excellent correlation with minimal bias (y=0.9x + 37, R^2=0.9), when preanalytical factors were controlled.

Minimized interference from interfering substances

When samples of various concentrations were measured after spiking with hemoglobin (35 mg/dL) and intralipid (1,000 mg/dL), the measured concentrations were found to be unaffected by the interfering substances.

Cardiac biomarker testing is most accurate when performed in-house.

Cardiac biomarkers, such as NT-proBNP and Troponin I, have low sample stability due to the fact that they can be broken down by proteases in the blood. Therefore, if a sample is stored at room temperature or refrigerated conditions, the concentration of the biomarkers may decrease rapidly within a short period of time, resulting in lower measurements than the actual concentrations.

To obtain accurate results, it is recommended to conduct an in-house test using a POC (Point-of-Care) analyzer immediately after collecting the sample (serum). In a clinical study [1] conducted using the Vcheck analyzer, the author emphasized that "Onsite testing can minimize variability related to preanalytical error and provide clinically useful contemporaneous results."
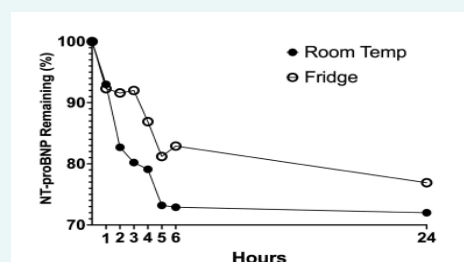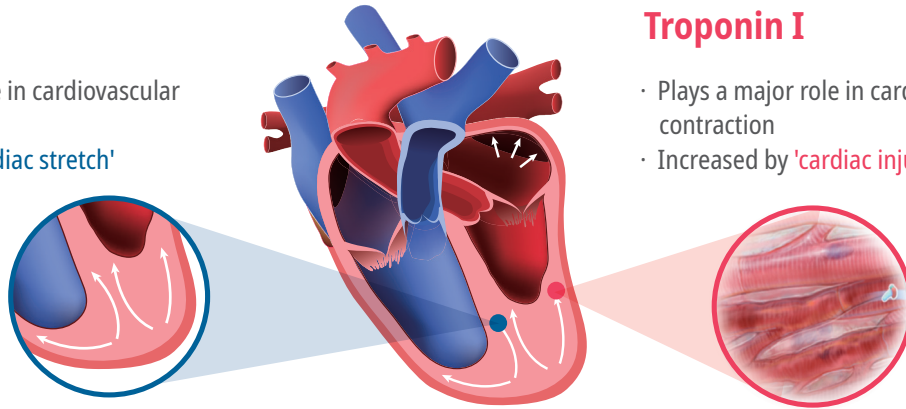
Stability changes in NT-proBNP in blood when
stored at room temperature or refrigerated [2]

Cardiac Biomarker Category

NT-proBNP

· Plays a major role in cardiovascular homeostasis
· Increased by 'cardiac stretch'

Troponin I

· Plays a major role in cardiomyocyte contraction
· Increased by 'cardiac injury'

What is NT-proBNP?

proBNP, which is produced in the cardiac myocytes, is secreted into the blood as BNP and NT-proBNP (N-terminal pro-B type natriuretic peptide).

The secretion of NT-proBNP increases with excessive stretching of the myocardial wall, which reflects the severity of heart disease [3]. Due to its stability in blood and long half-life, NT-proBNP is widely used as a useful cardiac biomarker in both canines and felines.
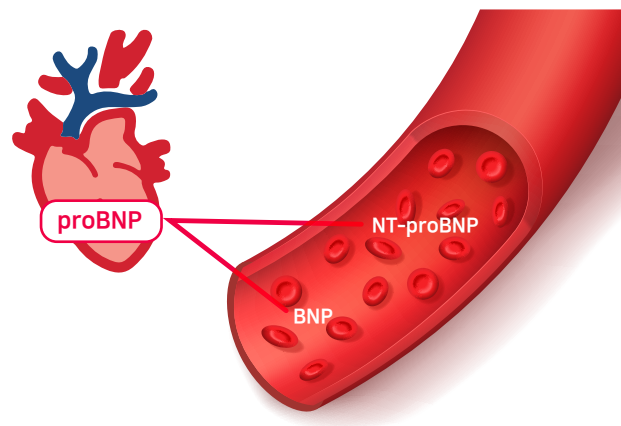
What is Troponin I?

Troponin consists of 3 subunits (troponin I, T, and C) which together function as the molecular switch of cardiomyocyte contraction. Among them, cardiac Troponin I (TnI) is a sensitive and specific circulating marker of cardiac injury for dogs and cats.
Cardiac injury causes the release of TnI into circulation, where its concentration is correlated to the severity of the damage.


Actin   Troponin Complex   Tropomyosin
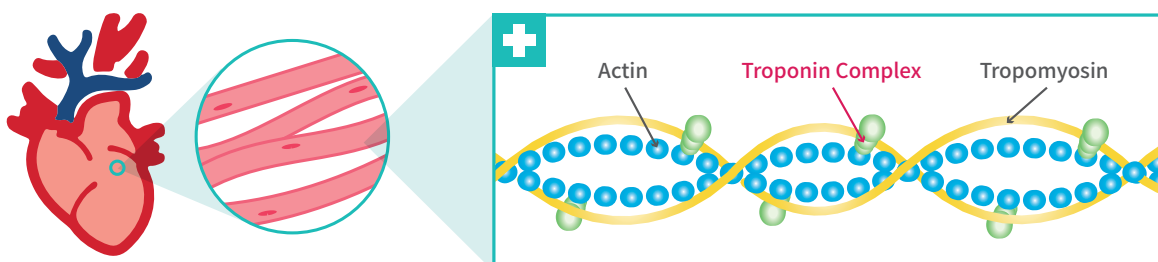
Canine Cardiac Biomarker

What is Canine MMVD?

Myxomatous mitral valve disease (MMVD) is the most common heart disease in dogs which causes blood reflux due to valve degeneration.

The prevalence of MMVD increases with advancing age. According to one study [4], it occurs in approximately 10% of dogs aged 5 to 8, 20% to 25% of dogs aged 9 to 12, and 30% to 35% of dogs aged 13 or older. In other words, as many as one in three older dogs may have MMVD.

30~35%

20~25%

10%

Increasing prevalence of MMVD

5 to 8 years old

9 to 12 years old

over 13 years old
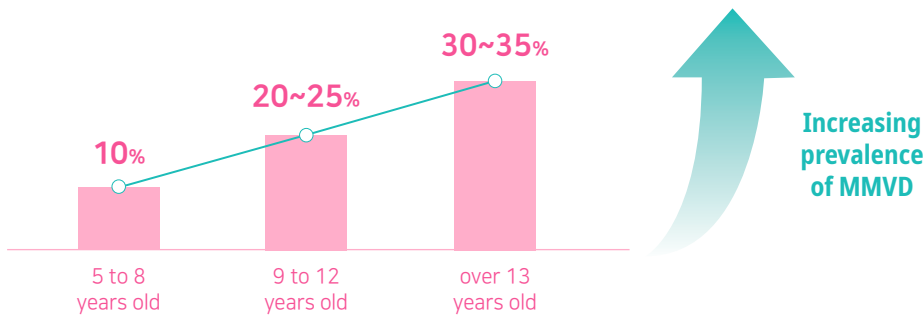
The prevalence of MMVD increases with the advancing age of canines [4]

What is Canine DCM?

Dilated cardiomyopathy (DCM) is a primary disease of the cardiac muscle that reduces the heart's ability to generate pressure for pumping blood through the vascular system. This condition mainly affects medium and large dog breeds.

NT-proBNP and Troponin I concentrations start to rise in the early phases of DCM. Therefore, cardiac biomarkers can be useful for screening asymptomatic high-risk dogs [5,6].

For screening heart disease in elderly dogs or dogs at high risk of developing the disease

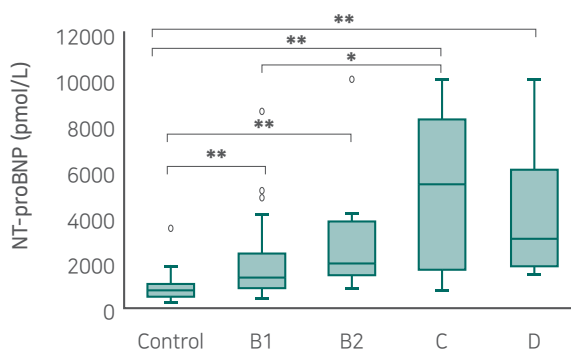For differentiating cardiac and respiratory causes in dogs with respiratory signs

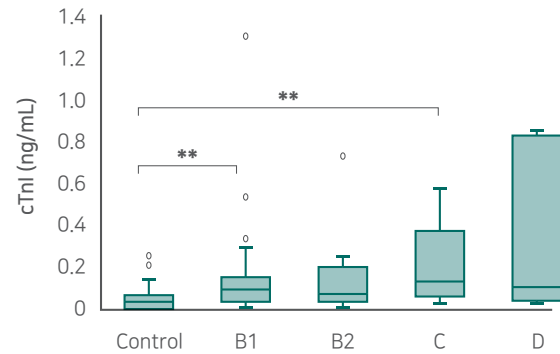For monitoring the severity of heart disease in dogs with heart disease

Evaluate overall heart function using NT-proBNP + TnI markers!

Changes in biomarker concentration according to the severity of heart disease

As MMVD ACVIM Stage increases, the blood concentration of NT-proBNP increased [7]

As MMVD ACVIM Stage increases, the blood concentration of Troponin I increased [7]

Clinical Use of Cardiac Biomarkers

Monitoring useful cardiac biomarkers, such as NT-proBNP and TnI, in dogs can help assess the severity of heart disease. In particular, Troponin I provides prognostic information in patients with heart disease as well as non-cardiac disease [8].

Evaluates the severity of MMVD [9, 10]

....

Ongoing monitoring in dogs diagnosed with MMVD and identification of congestive heart failure (CHF)

Detects early phases of DCM [5, 6]

....

Recommended as a screening test in large breed dogs at high risk

Determines the cause of respiratory symptoms [11]

....

Distinguishes between cardiac and respiratory conditions based on respiratory signs, using NT-proBNP as a diagnostic marker.

Useful in assessing the prognosis in critically ill patients [8]

....

Evaluating the prognosis of patients with cardiac or non-cardiac medical conditions that could lead to myocardial damage (Troponin I)

Reference: 1. *Vet Clin Pathol.* 2022;51:398–407. **2.** Evaluation data from the College of Veterinary Medicine, University of Illinois at Urbana-Champaign **3.** *J Vet Intern Med* 2017;31:678–684. **4.** Sisson D. Valvular heart disease in dogs. Proceedings from the WSAVA 2002 **5.** *Am J Vet Res* 2011;72:642–649. **6.** *J Vet Intern Med.* 2019;33:54–63. **7.** *J. Vet. Med. Sci* 2021;83(4): 705–715. **8.** *J Vet Intern Med.* 2016;30:36–50. **9.** *J Vet Cardiol.* 2017 Apr;19(2):124-131. **10.** *Journal of Small Animal Practice.* 2005;46:139–145. **11.** *J Am Vet Med Assoc* 2009;235:1319–1325. **12.** *J Vet Cardiol.* 2015;Dec;17 Suppl 1:S244-57. **13.** *J Vet Intern Med.* 2019;May;33(3):1242-1250. **14.** *Vet Clin Pathol.* 2011 Jun;40(2):237-44. **15.** *J Vet Cardiol.* 2009;11(Suppl 1):S51-S61. **16.** *J Am Vet Med Assoc.* 2008;233:1261-1264. **17.** *J Vet Intern Med.* 2014;28:1731-1737. **18.** *J Vet Intern Med.* 2018;32:922-929

Canine Cardiac Biomarker

Vcheck Canine Biomarker Category

Sample	: Serum 100 μl	
Testing Time	: 15 minutes	
Measurement Range	: 500 - 10,000 pmol/L	

< 900 pmol/L	900 – 1,800 pmol/L	> 1,800 pmol/L
Normal	Suspected	Abnormal (Cardiac stretch)

Sample	: Serum 100 μl	
Testing Time	: 10 minutes	
Measurement Range	: 0.01 - 20 ng/ml	

< 0.1 ng/ml	0.1 - 0.2 ng/ml	> 0.2 ng/ml
Normal	Suspected	Abnormal (Cardiac injury)

Guidelines for the Utilization of Biomarkers

The combination of NT-proBNP and TnI biomarkers can be used to evaluate the severity of heart disease in dogs. Utilizing these biomarkers for a thorough evaluation of heart disease in high-risk dogs is recommended.

**Heart disease screening test in apparently healthy dogs**
NT-proBNP + TnI test

When both markers show normal values	When either of the two markers shows an abnormal value
NT-proBNP < 900 pmol/L and TnI < 0.1 ng/ml	NT-proBNP ≥ 900 pmol/L or TnI ≥ 0.1 ng/ml
There is a low possibility of heart disease	There is a possibility of heart disease
Normal or possible early phase of heart disease Comprehensive evaluation of auscultation/X-ray	A close examination of heart status is recommended. Comprehensive evaluation of auscultation/X-ray/(echocardiography)

Point Evaluate the severity of heart disease in dogs by monitoring periodically, using biomarkers

- ☑ Elevated levels of NT-proBNP (≥ 900 pmol/L) indicate **increased wall stress** in the myocardium, which is associated with progressive stages of heart disease.
- ☑ Elevated levels of Troponin I (≥ 0.1 ng/ml) indicate **increased cardiac injury** in the myocardium, which is associated with progressive stages of heart disease.
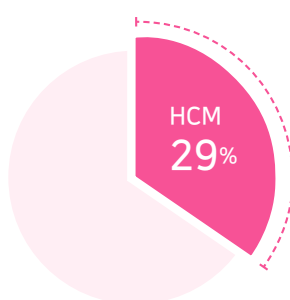
Feline Cardiac Biomarker

What is Feline HCM?

Hypertrophic cardiomyopathy (HCM) is the most common heart disease and one of the 10 most common causes of death in cats. According to a study [12] that examined the prevalence of HCM in 780 cats with no apparent clinical symptoms, 14.7% of cats had HCM. The prevalence of HCM is even higher in senior cats over 9 years old, with up to 29% affected.

HCM
15%

HCM
29%
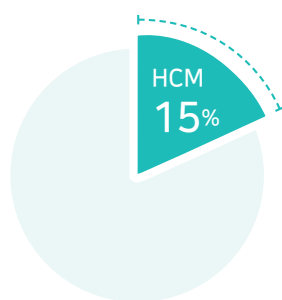
In the general cat population

In senior cats (≥ 9 years old)

Clinical Use of Cardiac Biomarkers

Useful heart biomarkers in cats, such as NT-proBNP and TnI, can screen for the likelihood of heart disease, assess its severity, and even evaluate the patient's prognosis. Using both markers together can further improve diagnostic accuracy.

Screens for HCM in asymptomatic cats [13, 14]

Can be used in all situations where heart disease screening is required, including annual check-up, prior to anesthesia, etc

Determines the cause of respiratory symptoms [15, 16]

Distinguishes between cardiac and respiratory conditions based on respiratory signs in cats

Evaluates the severity and prognostics of heart disease [17, 18]

Monitoring and prognosis assessment of cats with heart disease

Feline Cardiac Biomarker

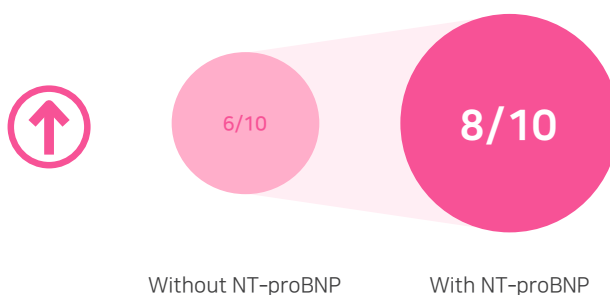## Why cardiac biomarkers should be applied in clinical practice

Echocardiography is the gold standard test for diagnosing heart disease, but it is not easy to perform in hospitals due to several limitations, which includes high costs.

Using cardiac biomarkers during the heart disease screening stage before an echocardiogram can help in clinical diagnosis. They can be used not only for medical examination purposes in asymptomatic cats, but also for identifying the cause of respiratory symptoms in cats.
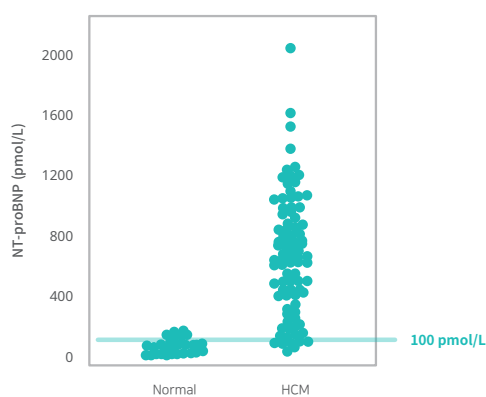
Improved accuracy
of diagnosis [15]

69.2%   **87%**

Without NT-proBNP   With NT-proBNP
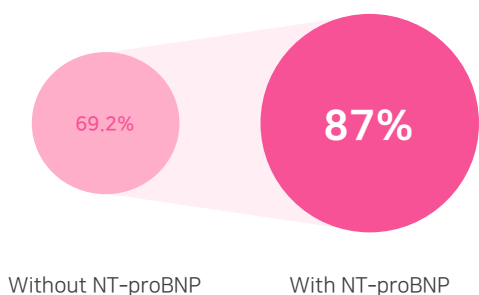
Improved confidence
in diagnosis [15]

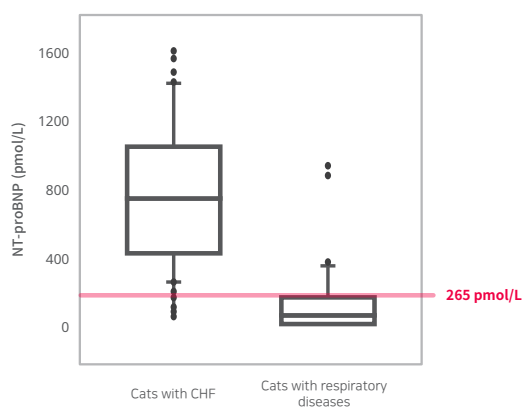6/10   **8/10**

Without NT-proBNP   With NT-proBNP

Changes in biomarker concentration according to the severity of heart disease

In asymptomatic cats

NT-proBNP test could screen the presence of HCM with 92% sensitivity and 94% specificity [14]
(Cut-off: 100 pmol/L)

In patients with respiratory symptoms

If NT-proBNP is high, it is 92% likely that the cause is heart failure [15]
(Cut-off: 265 pmol/L)

Feline Cardiac Biomarker

Vcheck Feline Biomarkers Category

Sample	: Serum 100 µl
Testing Time	: 10 minutes
Measurement Range	: 50 - 1,500 pmol/L

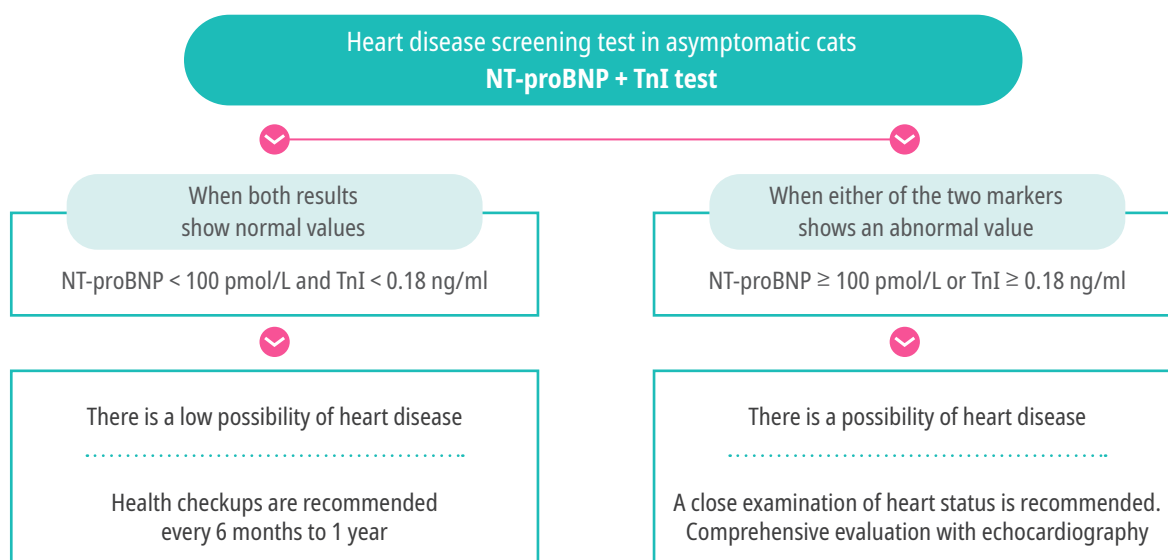| < 100 pmol/L	≥ 100 pmol/L
Normal	Abnormal (Cardiac stretching)

* In cats with respiratory signs, if the NT-proBNP is >270 pmol/L, CHF is the most likely cause of the clinical signs.

Sample	: Serum 100 µl
Testing Time	: 10 minutes
Measurement Range	: 0.01 - 20 ng/ml

< 0.18 ng/ml	0.18 - 0.28 ng/ml	> 0.28 ng/ml
Normal	Suspected	Abnormal (Cardiac injury)

Guidelines for the Utilization of Biomarkers

The combination of NT-proBNP and TnI biomarkers can be used to evaluate the likelihood of heart disease and can further improve HCM diagnostic accuracy.
Utilize these biomarkers for a thorough evaluation of heart disease in cats without any apparent clinical symptoms.

Heart disease screening test in asymptomatic cats
NT-proBNP + TnI test

When both results show normal values	When either of the two markers shows an abnormal value
NT-proBNP < 100 pmol/L and TnI < 0.18 ng/ml	NT-proBNP ≥ 100 pmol/L or TnI ≥ 0.18 ng/ml

There is a low possibility of heart disease	There is a possibility of heart disease
Health checkups are recommended every 6 months to 1 year	A close examination of heart status is recommended. Comprehensive evaluation with echocardiography

Point — **Early phases of HCM or RCM : TnI levels may increase while NT-proBNP levels are normal, if no significant increase in wall stress within the myocardium is present.**

- Increased NT-proBNP (≥ 100 pmol/L) indicates **increased wall stress** in myocardium with progressive stages of heart disease.
- Increased Troponin I (≥ 0.18 ng/ml) indicates **increased cardiac injury** in myocardium with progressive stages of heart disease.

Vcheck Cardiac Biomarkers

Key Features

Quantitative measurement
Accurately assess the severity of heart disease through quantitative results

A user-friendly procedure
Improved user convenience by having a simple, 3-step procedure

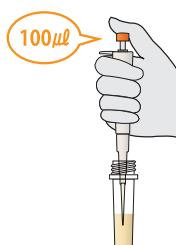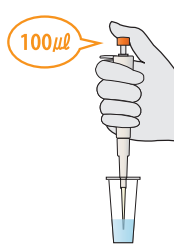| High correlation with reference laboratories |
|---|
| Strong correlations with the reference method ($R^2 > 0.95$) |

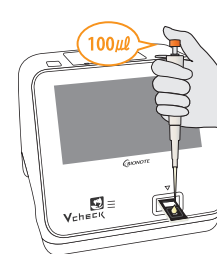| Fast results in-house |
|---|
| Results in less than 15 minutes, without the need to request for a lab service |

Test Procedure

1 Add 100 μl of serum to the assay diluent tube

2 Mix well 5-6 times by using a 100 μl pipette

3 Add the mixed sample 100 μl into the test device

Samples should be tested immediately after collection.
Degradation of NT-proBNP/TnI may occur if stored at room temperature or refrigerated, leading to false negative results.

Ordering Information

Product No.	Product Name	Storage temperature	Packing Unit
VCF132DC	Vcheck Canine NT-proBNP	2 ~ 8 °C	5 Tests/Kit
VCF130DC	Vcheck Feline NT-proBNP	1 ~ 30 °C	5 Tests/Kit
VCF137DC	Vcheck Canine TnI	1 ~ 30 °C	5 Tests/Kit
VCF139DC	Vcheck Feline TnI	1 ~ 30 °C	5 Tests/Kit

Vcheck
Cardiac Biomarker

NT-proBNP & Troponin I

Rev.0