4. Reference Ranges for NT-proBNP (N-Terminal Pro-B-Type Natriuretic Peptide) and Risk Factors for Higher NT-proBNP Concentrations in a Large General Population Cohort Paul Welsh,Ross T. Campbell,Leanne Mooney,Dorien M. Kimenai,Caroline Hayward,Archie Campbell,David Porteous,Nicholas L. Mills,Ninian N. Lang,Mark C. Petrie,James L. Januzzi,John J.V. McMurray and Naveed Sattar Originally published13 Sep 2022 https://doi.org/10.1161 CIRCHEARTFAILURE.121.009427Circulation: Heart Failure. 2022;15

5. NTproBNP: an important biomarker in cardiac diseases; Vasiliki Panagopoulou [1], Spyridon Deftereos, Charalampos Kossyvakis, Konstantinos Raisakis, Georgios Giannopoulos, Georgios Bouras, Vlasios Pyrgakis, Michael W Cleman

18. TROUBLE SHOOTING CHART

PROBLEM	POSSIBLE CAUSE	SOLUTION
1. Controls out of validation limit	a) Controls/ calibrator deterioration due to improper storage or used	Use controls/ calibrator within 30 days once opened and Check storage after expiry. temp. It should be 2-8^{0}C.
	b) Cross contamination	Pipette carefully and do not of Controls interchange caps.
	c) Reagents deterioration due to improper storage or used after expiry.	Use reagents within 30 days once opened and Check storage temp. It should be 2-8^{0}C.
	d) Magnetic microsphere are not properly mixed before loading in the analyzer.	Ensure proper mixing of bottle containing microspheres by gentle shaking/ inversion before use.
2) High NT-proBNP test results	a) Use of turbid, lipaemic or hemolyzed sample.	Use clear fresh sample. Refer specimen collection, handling and processing for more details.
	b) Sample position is wrongly defined while loading the sample details in analyzer.	check the sample position and run the test meticulously.
	c) Magnetic microsphere are not properly mixed before loading in the analyzer.	Ensure proper mixing of bottle containing microspheres by gentle shaking/ inversion before use.
	d) Wrong Sample identification	Make sample I.D. at the time of sample Collection.
3) Low NT-proBNP test results	a)Sample deterioration due to improper Storage or microbially contaminated sample.	Use clear fresh sample immediately after collection. Refer Specimen collection, and handling processing for more details.
	b) Sample position is wrongly defined while loading the sample details in analyzer.	check the sample position and run the test meticulously.
	c) Magnetic microsphere are not properly mixed before loading in the analyzer.	Ensure proper mixing of bottle containing microspheres by gentle shaking/ inversion before use.
	d) Wrong Sample identification	Make sample I.D. at the time of sample Collection.

in vitro diagnostic Reagent, not for medicinal use

VER-01 R-00

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NT-proBNP *i*Clia

Chemiluminesence Immunoassay for the Quantitative measurement of NT-pro-BNP in Human Serum/**Plasma**

1. INTRODUCTION

NT-proBNP is mainly produced by enzyme digestion of B-type Natriuretic Peptide Precursor (proBNP) secreted by ventricular myocytes. Its function is to maintain the steady state of the capacity, osmotic pressure and pressure regulation of the circulatory system. NT-proBNP has a longer half-life (60-120 minutes) and strong in vitro stability. The concentration in patients with heart failure is higher than that of BNP, and in some cases it is more Conducive to the diagnosis of heart failure 2. The concentration of NT-proBNP in serum and plasma is related to the prognosis of left ventricular insufficiency. NT-proBNP is the most powerful predictor that can independently predict the mortality of patients with acute coronary syndrome within one year. Natriuretic peptide testing (including NTproBNP) plays an important role in the management of heart failure from diagnosis to monitoring. The level of NTproBNP increases with the increase in the number of stages, reflecting the severity of heart damage.

2. INTENDED USE

NT-proBNP iCLIA Diagnostic Kit is intended for the *in vitro* quantitative measurement of NT-proBNP in human serum/plasma as an aid in the diagnosis of Cardiac Failure in conjunction with other laboratory and clinical findings. This kit is only operational in conjuction with J. Mitra CLIA Analyzer.

3. PRINCIPLE

NT-proBNP iClia is chemiluminescent immunoassay based on the "Sandwich" principle. The magnetic microspheres are coated with Anti-NT-proBNP antibodies.

The samples are added in the assay cup containing assay buffer and anti-NT-proBNP antibodies coated microspheres followed by addition of AE conjugate (Anti-NT-proBNP antibodies linked to acridinium ester) to assay cup . A sandwich complex is formed wherein NT-proBNP (from serum sample) is "trapped" or "sandwiched" between the microspheres coated antibody and antibody labelled with AE conjugate. Unbound conjugate is then washed off with wash buffer. The amount of bound AE conjugate is proportional to the concentration of NT-proBNP present in the sample. Finally pre-trigger and trigger solution containing hydrogen peroxide and sodium hydroxide solution is added to the reaction mixture. The resulting chemiluminescent reaction is measured as relative Light units (RLUs). There is a direct relationship between the amount of NT-proBNP present in the sample and the RLUs detected by the optical system. Results are calculated automatically based on the established calibration curve.

4. DESCRIPTION OF SYMBOLS USED

The following are graphical symbols used in or found on J. Mitra diagnostic products and packing. These symbols are the most common ones appearing on medical devices and their packing. They are explained in more detail in the European Standard EN ISO 15223-1:2021.

	Manufactured By	IVD	*In vitro* diagnostic medical device
Σ	No. of tests		Instruction for use
LOT	Lot Number Batch Number	2°C 8°C	Temperature Limitation
	Manufacturing Date		Caution - See instruction for use
	Expiry Date	REF	Catalogue Number
	Do not use if package is damaged		Keep away from sunlight
BIO	Contains biological Material of Human Origin	BIO	Contains biological Material of Animal Origin
IN	Country of Manufacture		Keep Dry

5. KIT PRESENTATION

- 50 Test Pack

6. KIT & ITS COMPONENTS

COMPONENT	DESCRIPTION
Microparticles Buffer	Magnetic microparticle buffer coated with anti-NT-proBNP antibodies with preservatives.
AE Conjugate	Anti-NT-proBNP antibodies linked to acridinium ester with protein stabilizers.
Assay Buffer	Tris Buffer containing BSA with stabilizer.
Calibrator-1 (C0)	Low concentration of NT-proBNP in Human Serum containing preservatives.
Calibrator-2 (C1)	High concentration of NT-proBNP in Human Serum containing preservatives.
Control-1 (Q1)	Low concentration of NT-proBNP in Human Serum containing preservatives.
Control-1 (Q2)	High concentration of NT-proBNP in Human Serum containing preservatives.
Reagent Plugs	Silicon caps to cover the opened reagents.

7. STORAGE AND STABILITY

The shelf-life of the kit is 12 months from the date of manufacturing, when stored at 2-8^{0}C. **Once the kit is opened, onboard stability of reagents, calibrator and control is 30 days at 2-8^{0}C.**

8. ADDITIONAL MATERIAL AND INSTRUMENTS REQUIRED

- **Pre-Trigger Solution:** Hydrogen peroxide solution.
- **Trigger Solution:** Sodium hydroxide solution.
- **Wash Buffer:** Phosphate buffered saline solution with surfactant.
- **Assay Cup**
- **J. Mitra CLIA Analyzer**

All materials and analyzer to be used for running the NT-proBNP *iClia shall be from J. Mitra & Co. Pvt. Ltd.*

9. SPECIMEN COLLECTION & HANDLING

1. Only human serum or plasma samples should be used for the test.
2. For serum collection use serum vacutainer. While preparing serum samples, remove the serum from the clot as soon as possible to avoid hemolysis. Fresh serum/plasma samples are preferred.
3. For plasma collection: use Dipotassium EDTA, Tripotassium EDTA, Sodium heparin and lithium heparin gel vacutainer.
4. Specimens should be free of microbial contamination and may be stored at 2-8^{0}C for one week, or frozen at -20^{0}C or lower. Avoid repeated freezing and thawing.
5. Do not use heat inactivated samples as their use may give false results. Hemolyzed and Icteric hyperlipemic samples may give erroneous results.
6. Serum specimens from patients receiving anticoagulant or thrombolytic therapy may contain fibrin due to incomplete clot formation.
7. Always use clear specimens. Centrifuge viscus/ thick or turbid specimen at 10,000 RPM for 15 minutes prior to use to avoid inconsistent result.
8. Use of disposable pipettes or pipette tips is recommended to prevent cross contamination.

10. SPECIMEN PROCESSING

(A) FROZEN SAMPLE

NT-proBNP iClia test is best used with fresh samples that have not been frozen and thawed. However most frozen samples will perform well if the procedure suggested below is followed.

Allow the frozen sample to thaw in a vertical position in the rack. Do not shake the sample. This allows particles to settle to the bottom. Centrifuge the sample at 10,000 rpm for 15 minutes.

(B) TRANSPORTATION

If the specimen is to be transported, it should be packed in compliance with the current Government regulations regarding transport of aetiologic agents.

11. WARNING & PRECAUTION

⚠ **CAUTION:** THIS KIT CONTAINS MATERIALS OF HUMAN ORIGIN. NO TEST METHOD CAN OFFER COMPLETE ASSURANCE THAT HUMAN BLOOD PRODUCTS WILL NOT TRANSMIT INFECTION. NEGATIVE CONTROL, POSITIVE CONTROL & ALL THE SAMPLES TO BE TESTED SHOULD BE HANDLED AS THOUGH CAPABLE OF TRANSMITTING INFECTION.

1. The use of disposable gloves and proper biohazardous clothing is STRONGLY RECOMMENDED while running the test.
2. In case there is a cut or wound in hand, DO NOT PERFORM THE TEST.
3. Do not smoke, drink or eat in areas where specimens or kit reagents are being handled.
4. Tests are for *in vitro* diagnostic use only and should be run by competent person only.
5. Do not pipette by mouth.
6. All materials used in the assay and samples should be decontaminated in 5% sodium hypochlorite solution for 30-60 min. before disposal or by autoclaving at 121°C at 15psi for 60 minutes. Do not autoclave materials or solution containing sodium hypochlorite. They should be disposed off in accordance with established safety procedures.
7. Wash hands thoroughly with soap or any suitable detergent, after the use of the kit. Consult a physician immediately in case of accident or contact with eyes, in the event that contaminated material are ingested or come in contact with skin puncture or wounds.
8. Spills should be decontaminated promptly with Sodium Hypochlorite or any other suitable disinfectant.

12. PRECAUTIONS FOR USE & REAGENT HANDLING

1. Do not use kit components beyond the expiration date which is printed on the kit.
2. Store the reagents & samples at 2-8°C.
3. Do not pool reagents from within a batch or between different batches, as they are optimised for individual batch to give best results.
4. Before loading the reagent kit in the clia analyzer for the first time, ensure proper mixing of microparticle bottle to resuspend microspheres that may have settled during transport or storage.
5 Once reagents are opened, reagent plug must be used to prevent reagent evaporation and contamination and to ensure reagent integrity. Reliability of assay results cannot be guaranteed if reagent plugs are not used according to the instructions given.
6. Mark the test specimen with patient's name or identification number. Improper identification may lead to wrong result reporting.
7 To avoid contamination, wear clean gloves when placing a reagent plug on an uncapped reagent bottle.
8. Once a reagent plug has been placed on an open reagent bottle,do not invert the bottle as this will result in reagent leakage and may compromise assay results.
9. Reagents may be stored on or off the Chemiluminescence immunoassay analyzer. If reagents are removed from the analyzer, store them at 2-8°C (with Reagent plugs) in an upright position. For reagents stored off the system, it is recommended that they should be stored in their original trays and boxes to ensure they remain upright. If the microparticle bottle does not remain upright (with a Reagent plug placed) while in refrigerated storage off the system, the reagent kit must be discarded.
10. Run control-1 & control-2 in each assay to evaluate validity of the kit.
11. Distilled or deionised water must be used for wash buffer preparation.
12. Avoid strong light exposure during the assay.
13. In case of any doubt the run should be repeated.

13. TEST PROCEDURE

Assay Procedure

1. Refer to the Clia user manual for detailed information on preparing the analyzer.
2. Before loading the NT-proBNP iClia reagent kit on the analyzer for the first time, mix contents of the microparticle bottle to resuspend microspheres that may have settled during transporation/ storage. Once the microspheres have been loaded, no further mixing is required.

   Important Note: Swirl the microparticle (RA) bottle 30 times. Visually inspect the bottle to ensure microspheres are resuspended. If microspheres are still adhered to the bottle, continue to Swirl the bottle until the microspheres have been completely resuspended. If the microspheres do not resuspend, DO NOT USE. Once the microspheres have been resuspended, remove the cap and place the the reagent plug on the bottle to make it ready to use. Remove the cap of (RA), (RB) and (RD) bottles and place the reagent plugs before use as follow:

   (RA) & (RB) : Natural color plug
   (RD) : Brown color plug
3. Load the NT-proBNP iClia reagent kit on the Chemiluminescence immunoassay analyzer.
4. Verify that all necessary reagents are available in the reagent tray.
5. Ensure that adequate sample volume (not less than 250 μL) is present in sample tube prior to running the test.
6. Sample volume required for each additional test from same sample tube is 50 μL.
7. Ensure sample positons are properly define at the time of loading in the analyzer.
8. The NT-proBNP iClia test-specific parameters are stored in barcode placed on the reagent tray and read through barcode reader. In cases, the barcode cannot be read, contact customer support at: 011-47130300, 500 or write us at: jmitra@jmitra.co.in.
9. Mix NT-proBNP iClia calibrator and controls by gentle inversion before use. Open the cap and place the calibrators and control-1 & control-2 vials into each respective sample positions. Read the barcode for calibrator and controls provided with the kit.
10. Run calibration as mentioned in heading **calibration** below.
11. Press Run. The test result for first sample will be obtained at 15 minutes.
12. The Chemiluminescence immunoassay analyzer performs all the functions automatically and calculates the results.

Calibration

1. Every NT-proBNP iClia kit has a two-dimension code label containing the predefined master curve of the particular reagent lot.
2. Test both the Calibrators in triplicate. Both control-1 and control-2 must be tested in each run to evaluate the assay calibration. Ensure that controls values are within the validity range specified in the NT-proBNP iClia QC data sheet.
3. Once calibration is accepted (within range) and stored, all subsequent samples may be tested without further calibration unless:
4. Recalibrate the analyzer in following conditions:

a) After each exchange/use of new lot (Test reagent and pritrigger/ Trigger solution/wash buffer).
b) Every 15 days and/or at the time of any component to be changed.
c) Controls are out of validation range.
d) Required by pertinent regulations.
e) After specified service procedures have been performed or maintenance to critical part or subsystems that might influence the performance of the NT-proBNP iClia.

RESULT CALCULATION:

The analyzer calculates cut off values based on the RLUs of calibrator and the results are calculate automatically and given in pg/ml.

INTERPRETATION OF TEST RESULTS

If sample concentration is lower than the lower limit of the linear range, report the result < 30 pg/ml, while > 30000.00 pg/ml when it is higher than the upper limit of linear range.

DETERMINATION OF REFERENCE INTERVAL

Reference Interval of NT-proBNP iCLIA is <125 pg/mL for healthy people, which is established referring to literatures, based on the rest results of more than 60 clinical samples.

Each laboratory should establish its own range of normal value. The values given above are only indicative. Due to the differences in geography, race, gender or age, it is suggested that each laboratory establish its own reference interval or conduct verification of the existing reference interval

14. PERFORMANCE CHARACTERISTICS

- Assay results obtained in individual laboratories may vary from data presented in this product insert.

Limit of Blank (LoB)

- The Limit of Blank was determined in accordance with the CLSI (Clinical and Laboratory Standards Institute) EP17-A requirements.
- The Limit of Blank is the 95th percentile value from n >20 measurements of analyte free samples over several independent series. The Limit of Blank corresponds to the concentration below which analyte-free samples are found with a probability of 95%.
- The observed LoB value was ≤ 25 pg/ml.

Accuracy: The accuracy of NT-proBNP iClia was detected with 60 clinical specimen and compared with Roche CLIA. The co-relation co-efficient is ≥0.990.

Precision

Intra Assay Variation

Within run variation was determined by 10 replicate measurements of two different NT-proBNP control sera(Low) and (High) in one assay in 3 different lots. The within assay variability is <10.0 %.

Inter Assay Variation

Between run variation was determined by 10 replicate measurements in 10 sequential days of two different control sera(Low) and (High)in 3 different lots.The between assay variability is <10%.

Intra-Assay, n=10			Inter-Assay, n=10×3		
Control	Mean (pg/ml)	CV	Sample	Mean (pg/ml)	CV
1	198.16	5.95%	1	194.33	9.44%
2	2484.62	5.79%	2	2511.05	9.20%

Inter machine(CLIA-181 Analyzer) Variation

Between machine variation was determined by 3 replicate measurements of two different NT-proBNP control sera(Low) and (High)in 3 different lots in 3 different CLIA-181 Analyzer. The between machine variability is <10 %.

Linearity

The linearity was determined in accordance with the CLSI (Clinical and Laboratory Standards Institute) EP6-A requirements.

The linearity range was verified by more than 6 concentration levels which encompass or be equal to the minimum and the maximum values of linearity range and duplicate assays in triplicate in single run for each lot at all 6 levels.

The NT-proBNP iClia kit has been demonstrated to be linear from 30 pg/ml to 30000 pg/ml, regression (R^2) of more than >0.990.

Specificity

Interference

A study was performed based on guidance from CLSI EP7-A2.

Potentially interfering substances were evaluated to determine whether NT-proBNP concentrations were affected when using the NT-proBNP iClia (Follide-stimulating Hormone assay) kit. Samples containing the potential interferents were prepared at two NT-proBNP concentrations. The samples were assayed, and the NT-proBNP concentrations of the spiked samples were compared to the reference samples.

Potential Interferent	Interferent Concentration	% Interferent Bias
Bilirubin	≤ 20 mg/dL	<10%
Hb	≤ 500 mg/dL	<10%
Total Protein	≤ 10 g/dL	<10%
HAMA	≤ 600 ng/ml	<10%
ANA	≤ 400 Ang/ml	<10%

15. LIMITATION OF THE TEST

- Results should be used in conjunction with other data; e.g., symptoms, results of other tests, and clinical impressions.
- If the NT-proBNP results are inconsistent with clinical evidence, additional testing is recommended.
- Specimens from patients who have received preparations of mouse monoclonal antibodies for diagnosis or therapy may contain human anti-mouse antibodies (HAMA). Such specimens may show either falsely elevated or depressed values when tested with assay kits that employ mouse monoclonal antibodies. Additional information may be required for diagnosis.

16. LIMITED EXPRESSED WARRANTY DISCLAIMER

The manufacturer limits the warranty to the test kit, as much as that the test kit will function as an *in vitro* diagnostic assay within the limitations and specifications as described in the product instruction-manual, when used strictly in accordance with the instructions contained therein. The manufacturer disclaims any warranty expressed or implied including such expressed or implied warranty with respect to merchantability, fitness for use or implied utility for any purpose. The manufacture's liability is limited to either replacement of the product or refund of the purchase price of the product and in no case liable to for claim of any kind for an amount greater than the purchase price of the goods in respect of which damages are likely to be claimed.

The manufacturer shall not be liable to the purchaser or third parties for any injury, damage or economic loss, howsoever caused by the product in the use or in the application there of.

17. REFERENCES

1. Ultrasensitive and Rapid Detection of N-Terminal Pro-B-Type Natriuretic Peptide (NT-proBNP) Using Fiber Optic Nanogold-Linked Immunosorbent Assay; Han-Long Liu,[1,2,†] Yen-Ta Tseng,[1,2,†] Mei-Chu Lai,[3,†] and Lai-Kwan Chau[1,2,4,*]; Author information Article notes Copyright and License information PMC Disclaimer
2. Role of Btype natriuretic peptide (BNP) and NTproBNP in clinical routine; Michael Weber and Christian Hamm
3. Heart failure biomarkers BNP and NT-proBNP detection using optical labels; Author links open overlay panelOlga A. Goryacheva [a], Tatiana D. Ponomaryova [a], Daniil D. Drozd [a], Alina A. Kokorina [a], Tatiana Yu Rusanova [a], Pradyumna K. Mishra [b], Irina Yu Goryacheva [a]