FRONTLINE MEDICAL SCIENCES AND PHARMACEUTICAL JOURNAL 1(8): 35-51, December 2021
DOI: https://doi.org/10.37547/medical-fmspj-01-08-04
ISSN- 2752-6712
*Accepted 20th December, 2021 & Published 30th December, 2021*

# THE ROLE OF BRAIN NATRIURETIC PEPTIDE IN THE DIAGNOSIS OF CHRONIC HEART FAILURE IN PATIENTS WITH TYPE 2 DIABETES MELLITUS

**Yusupova Sh.K.**

**Docent Ph.D., Head Of Department Of Hospital Therapy And Endocrinology Andijan State Medical Institute, Uzbekistan**

**ABSTRACT**

The aim of the study was to study the role of brain sodium uretic peptide in the diagnosis of chronic heart failure in patients with type 2 diabetes mellitus. For the period 2019-2021, we identified and selected 185 patients as an object of research based on the materials of their appeal to medical institutions in Andijan aged 30 and older. The patients underwent general clinical, biochemical, hormonal, genetic blood tests, as well as ECG, Echo-ECG and other instrumental studies. The mean values of NT proBNP significantly differed in all groups and, at the same time, they were significantly higher in the group of patients with diabetes mellitus + CHF compared to those in patients with isolated CHF. We selected median NT-proBNP levels in increasing NT-proBNP tertiles in the range from 125 to 250 pg / ml, from 250 to 500 pg / ml, and above 500 pg / ml. The dynamics of their concentration, mainly NT-proBNP, can help in assessing the effectiveness of the therapy and the need for dose titration of drugs.

**KEYWORDS:-** Type 2 Diabetes Mellitus, Chronic Heart Failure, Hormones.

## INTRODUCTION

Currently, various biological markers are widely studied and discussed, which are used as monitoring indicators for diseases of any genesis, including chronic heart failure (CHF). Among these markers, natriuretic peptides (NT-PROBNP), soluble ST 2 receptor, copeptin, galectin-3 are generally recognized in the diagnosis of CHF. These recommendations are included in the modern protocols of the European Society of

FRONTLINE MEDICAL SCIENCES AND PHARMACEUTICAL JOURNAL 1(8): 35-51, December 2021
DOI: https://doi.org/10.37547/medical-fmspj-01-08-04
ISSN- 2752-6712
*Accepted 20th December, 2021 & Published 30th December, 2021*

Cardiology, which, if CHF is suspected, refer patients to determine NT-PROBNP in the blood. They recommend interpreting its increase as one of the effective markers and criteria for the diagnosis of CHF with intermediate (medium) and preserved left ventricular ejection fraction (LV). In addition, it is believed that the decrease in NT-PROBNP levels is a reflection of the effectiveness of the therapy. Moreover, the dynamics of NT-PROBNP levels can serve as an indicator of the effectiveness of the therapy. At the same time, it is most often recommended to determine the level of NT-proBNP – a brain natriuretic peptide [1]. As is known, NT-PROBNP is a family of related peptides, including atrial natriuretic peptide (A—type, ANP, PNT-PROBNP), brain natriuretic peptide ( B-type NT-PROBNP, BNP, MNT-PROBNP), as well as C-type NT-PROBNP ( CNP) and D-type NT-PROBNP (DNP). According to researchers, the main reason for the increased synthesis of NT-PROBNP is the volume overload of the heart cavities [2, 3]. Modern reviews confirm that it is now widely recommended to determine the levels of BNP and NT-proBNP in order to diagnose and assess the severity of CHF [4].

Despite the fact that modern laboratory technologies allow the determination of all three NT-PROBNPS, the definition of BNP and its predecessor NT-proBNP has a number of advantages. So, the negative effects of ANP is that it is dependent on factors such as physical activity, changes in body position, and has a shorter half-life, which in active ANP is only 3-4 minutes. Along with this, CNP can be considered as a marker, mainly, of endothelial dysfunction. NT-PROBNP receptors are found in the brain, vascular bed, kidneys, adrenal glands and lungs [5, 6, 7].

According to the authors, for patients with CHF compensation, the upper limit of normal values for BNP in the blood is on average 35 pg/ml, and for NT-proBNP corresponds to 125 pg/ml. In acute decompensation of CHF, the maximum permissible values are 100 pg/ml and 300 pg/ml, respectively. It should be noted that these diagnostic values are used both for CHF with reduced LVEF (CHF), and for CHF with preserved (CHF) and

FRONTLINE MEDICAL SCIENCES AND PHARMACEUTICAL JOURNAL 1(8): 35-51, December 2021
DOI: https://doi.org/10.37547/medical-fmspj-01-08-04
ISSN- 2752-6712
*Accepted 20th December, 2021 & Published 30th December, 2021*

intermediate (CHF) LVEF [8, 9]. At the same time, normal values of NT-PROBNP in an untreated patient completely exclude significant CHF, making it unnecessary to perform additional research methods, the authors point out [10].

Back in 193, Morwani J. et al were the first to show that the level of BNP is statistically significantly different in groups of patients with postinfarction cardiosclerosis (PICS) with reduced LV LV and patients with reduced and normal LV LV in comparison with people without heart pathology [11].The same data were obtained in the study by Davidson N. et al. [12]. In further studies, the inverse correlation between the NT-proBNP level and LVEF was also confirmed [4, 10].

Fattah E. et al. established a statistically significant positive relationship between the level of BNP and the severity of mitral insufficiency based on echocardiography (Echo-KG) data [13]. The literature also discusses the determination of the level of BNP and NT-proBNP in order to assess the prognosis and effectiveness of therapy in patients with CHF. Thus, an increased BNP level is associated with a poor prognosis, while a decrease in its level correlates with the best prognosis [15]. At the same time, a number of large studies evaluating the effectiveness of therapy enhancement in order to reduce the BNP level, unfortunately, gave ambiguous results, which does not currently make it possible to widely recommend treatment correction based on the dynamics of the BNP level [14].

The SAVE and CONSENSUS II studies established that the BNP level is a significant prognosis factor indicating the risk of recurrence of acute MI (myocardial infarction), CHF and death not only in patients with MI, but also in patients with unstable angina pectoris [16].

In a study by Daniels L. et al. it was shown that an increase in NT-proBNP concentration over 300 pg / ml in combination with moderate or severe LV diastolic dysfunction, or an isolated increase in NT-proBNP over 600 pg / ml, or an increase in BNP over 100 pg / ml statistically significantly worsened the

FRONTLINE MEDICAL SCIENCES AND PHARMACEUTICAL JOURNAL 1(8): 35-51, December 2021
DOI: https://doi.org/10.37547/medical-fmspj-01-08-04
ISSN- 2752-6712
Crossref doi Google Scholar
*Accepted 20th December, 2021 & Published 30th December, 2021*

prognosis [17 ].

A study of the role of NT-proBNP on the possibility of developing CHF was shown in a large-scale population-based study, the Cardiovascular Health Study. It involved 5,447 patients of the older age category, in whom 289 cases of CHF were registered over an average follow-up time of more than 12 years. It was found that an increased level of NT-proBNP was statistically significantly correlated with mortality, regardless of other risk factors [8]. In the well-known large-scale study IMPRESS (Inhibition of Metalloproteinase in a Randomized Exercise and Symptoms Study in Heart Failure), a statistically significant decrease in NT-PROBNP was found against the background of clinically effective doses of angiotensin converting enzyme (ACE) inhibitors and angiotensin II receptor antagonists (ARA) a year and two after the start of drug therapy [9].

Thus, NT-PROBNP are currently recognized markers of CHF, their undeniably high value in determining the prognosis and risk stratification of CHF patients has been repeatedly proven in numerous randomized clinical trials. Their diagnosis should become part of the diagnosis of CHF, especially with preserved and intermediate LVEF [20, 21]. The dynamics of their concentration, mainly NT-proBNP, makes it possible to judge the effectiveness of the therapy and the need to titrate the dose of drugs. However, due to the wide variability of NT-PROBNP values, depending on age and gender, and comorbidities (may increase in acute coronary syndrome, pulmonary embolism, heart contusions, after cardioversion, in stroke, renal dysfunction, liver cirrhosis, paraneoplastic syndrome, COPD, anemia, severe infections, burns, thyrotoxicosis, diabetic ketoacidosis, etc.), they are not “ideal” markers of heart failure.All of the above was the reason for this study.

The aim of the study was to study the role of brain sodium uretic peptide in the diagnosis of chronic heart failure in patients with type 2 diabetes mellitus.

## MATERIAL AND RESEARCH METHODS

FRONTLINE MEDICAL SCIENCES AND PHARMACEUTICAL JOURNAL 1(8): 35-51, December 2021
DOI: https://doi.org/10.37547/medical-fmspj-01-08-04
ISSN- 2752-6712
*Accepted 20th December, 2021 & Published 30th December, 2021*

For the period 2015-2021, we identified and selected 185 patients as an object of research based on the materials of their appeal to medical institutions in Andijan aged 30 and older. Of the 185 patients, there were 115 men and 70 women (table 1)

The patients were divided into 3 groups:

Group 1 - patients with type 2 diabetes mellitus + CHF - 65 patients,

Group 2 - patients with type 2 diabetes without CHF - 60 patients,

Group 3 - patients with CHF without type 2 diabetes - 60 patients

The control group consisted of 20 healthy individuals of the corresponding middle age (10 men and 10 women). ...

CHF screening, examination algorithm, diagnosis of CHF disease and treatment were performed based on the Clinical Guidelines for CHF, Russia, 2016 [Klimontov, V.V., Myakina N.E. Glycemic variability in diabetes mellitus // Novosibirsk: IPC NSU, 2016. - S. 197-198.]. In these recommendations, we used the classification of CHF, according to which CHF is distinguished by LV ejection fraction, CHF by stages, by functional class.

The first stage was screening, during which clinical and biochemical studies were used.

At the second stage, a more in-depth examination was carried out to identify type 2 diabetes with CHF and the main non-communicable diseases and their risk factors (instrumental, special and functional) in the surveyed population.

At the third stage, a special study was carried out, according to a comparative assessment of the degree of association of type 2 diabetes with CHF with a risk factor (hyperglycemia, insulin resistance and hyperinsulinemia, dyslipidemia, hyperuricemia, hypertension, obesity, physical inactivity, smoking, alcohol consumption, stress, low consumption of vegetables and fruits, decreased adherence to treatment, microalbuminuria, levels of nat-uretic peptide NT-pro-BNP, renin-angiotensin system (PAAC) and vasopressin, structural and functional changes in the heart), fatal outcomes, specific (diabetic polyneuropathy, diabetic retinopathy) and chronic kidney disease and macrovascular

FRONTLINE MEDICAL SCIENCES AND PHARMACEUTICAL JOURNAL 1(8): 35-51, December 2021
DOI: https://doi.org/10.37547/medical-fmspj-01-08-04
ISSN- 2752-6712
*Accepted 20th December, 2021 & Published 30th December, 2021*

complications of type 2 diabetes with CHF (acute cerebrovascular accident, acute coronary syndrome

Statistical calculations were carried out in the Microsoft Windows software environment using the Microsoft Excel-2007 and Statistica version 6.0, 2003 software packages. The data obtained are reflected in the thesis as M ± m, where M is the mean value of the variation series, m is the standard error of the mean. The significance of differences between independent samples was determined using the Mann-Whitney and Student method.

## RESULTS AND ITS DISCUSSION

Table 1 shows the distribution of patients by sex and age.

As can be seen from Table 1, patients in the age category from 45 to 74 years old prevailed both among men and women - 18/20 cases, respectively. At the same time, the number of men significantly dominated - 115/70.

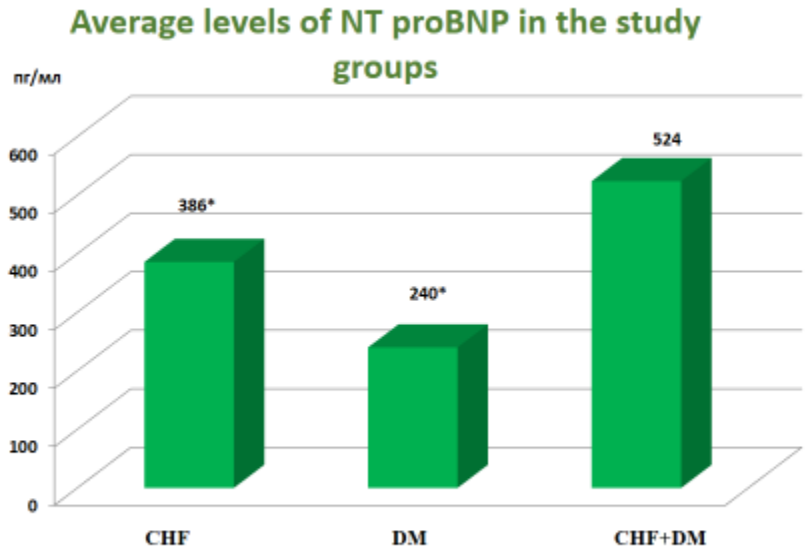
Table 1

**Distribution of patients by gender and age.**

| Age periods | Average of men | Average of women |
|---|---|---|
| 18-44 (young age) | 11 (9,6%) | 10 (14,3%) |
| 45-59 (middle age) | 43 (37,4%) | 26(37,1%) |
| 60-74 (old age) | 46 (40,0%) | 28(40,0%) |
| 75 and older (senile age) | 15 (13,0%) | 6 (8,5%) |
| Over all: n = 185 | 115 (62,2%) | 70(37,8%) |

Picture 1 shows the average levels of NT proBNP in the study groups

FRONTLINE MEDICAL SCIENCES AND PHARMACEUTICAL JOURNAL 1(8): 35-51, December 2021
DOI: https://doi.org/10.37547/medical-fmspj-01-08-04
ISSN- 2752-6712
*Accepted 20th December, 2021 & Published 30th December, 2021*




Picture 1 shows the average levels of NT proBNP in the study groups

**Here * is the reliability of the differences, where p < 0.05**

One of the important signs of CHF is an increase in the concentration of natriuretic peptides in the peripheral blood plasma. As seen from Fig. 1, the average values of the N-terminal precursor NT-PROBNP significantly differed in all our study groups and, at the same time, they were significantly higher in the group of patients with diabetes mellitus + CHF compared to those in patients with isolated CHF.

Thus, we found an increase in the mean values of NT proBNP indicators in all groups. They were significantly increased in the group of patients with diabetes mellitus in combination with CHF: These patients had the highest indicators, significantly differing from those in patients with diabetes and not significantly compared with the CHF group.

The next step was to carry out a comparative analysis of the baseline characteristics of the

FRONTLINE MEDICAL SCIENCES AND PHARMACEUTICAL JOURNAL 1(8): 35-51, December 2021
DOI: https://doi.org/10.37547/medical-fmspj-01-08-04
ISSN- 2752-6712
*Accepted 20th December, 2021 & Published 30th December, 2021*

patients, which is presented in Tables 2, 3 and 4. At the same time, we selected the median NT-proBNP levels in increasing NT-proBNP tertiles in the range from 125 to 250 pg / ml, from 250 to 500 pg / ml and above 500 pg / ml.

As can be seen from Table 2, in patients of group 1 - these are patients with type 2 diabetes + CHF - the number of patients with an average NT-proBNP level of more than 500 pg / ml dominated - 48 patients out of 65 (73.8%). Significant differences were established in comparison with the control in all tertiles with respect to SBP, DBP, BMI, HbA1c, decrease in HDL, GFR. . ($p < 0.05$).

**Table 2**

**Comparative analysis of baseline characteristics in group 1 , n = 65**

| Indicators | Patient groups | | |
|---|---|---|---|
| | 1 tertil<br>n = 8<br>125 to 250 | 2 tertil<br>n = 9<br>250 to 500 | 3 tertil<br>n = 48<br>More than 500 |
| NT-proBNP, pg/l | 199.7 ± 12.9 * | 423.8 ± 2.3 * | 556.8 ± 11.8 * |
| SBP, mm Hg | 143.3 ± 2.3 * | 158.4 ± 8.7 * | 162.9 ± 7.9 * |
| DBP, mm Hg | 92.1 ± 3.4 * | 103.1 ± 3.8 * | 110.6 ± 5.6 * |
| BMI, kg / m2 | 29.5 ± 2.1 * | 29.9 ± 1.2 * | 29.6 ± 1.3 * |
| HbA1c, (%) | 8.7 ± 0.4 * | 9.8 ± 0.8 * | 10.4 ± 0.6 * |
| HDL cholesterol, (mmol/l) | 1.18 ± 0.30 * | 1.22 ± 0.34 * | 1.19 ± 0.29 * |
| LDL cholesterol, (mmol/l) | 2.64 ± 0.94 | 2.54 ± 0.26 | 2.57 ± 0.56 |
| Triglycerides, (mmol/l) | 5.68 ± 1.1 * | 4.56 ± 1.2 * | 5.23 ± 1.6 * |
| GFR , ml/min $^{2}$ | 67.2 ± 3.4 * | 56.2 ± 2.8 * | 50.4 ± 3.8 * |
| History of CVD, n (%) | 8 (100%) | 9 (100%) | 48 (100%) |
| Diabetic retinopathy, n (%) | 5 (62.5%) | 7 (77.7%) | 31 (64.5%) |

Note: NT-proBNP - brain sodium uretic peptide, normal up to 125 pg / ml , SBP - systolic blood pressure, DBP -

FRONTLINE MEDICAL SCIENCES AND PHARMACEUTICAL JOURNAL 1(8): 35-51, December 2021
DOI: https://doi.org/10.37547/medical-fmspj-01-08-04
ISSN- 2752-6712
*Accepted 20th December, 2021 & Published 30th December, 2021*

diastolic blood pressure, BMI - body mass index, HbA1c - glycated hemoglobin, HDL - high density lipoproteins, in normal > 1.6 mmol / l, LDL - low density lipoproteins, normal 2.4-5.4 mmol / l, triglycerds - up to 1.7 mmol / l, * - significance of differences from control, where p <0.05

**Table 3**

**Comparative analysis of baseline characteristics in group 2 , n = 60**

| Indicators | Patient groups | | |
|---|---|---|---|
| | **1 tertil** n = 47 125 to 250 | **2 tertil** n = 11 250 to 500 | **3 tertil** n = 2 More than 500 |
| NT-proBNP, pg/l | 240.7 ± 8.5 * | 348.5 ± 9.4 * | 512.3 ± 7.6 * |
| SBP, mm Hg | 137.4 ± 1.9 | 147.9 ± 3.2 * | 166.2 ± 2.1 * |
| DBP, mm Hg | 88.5 ± 1.5 | 98.2 ± 4.2 * | 107.9 ± 2.9 * |
| BMI, kg/m2 | 28.7 ± 1.1 * | 29.4 ± 1.7 * | 29.9 ± 1.4 * |
| HbA1c , (%) | 9.8 ± 0.7 * | 10.8 ± 0.3 * | 11.2 ± 0.9 * |
| HDL cholesterol , (mmol/l) | 1.20 ± 0.31 * | 1.24 ± 0.28 * | 1.25 ± 0.21 * |
| LDL cholesterol, (mmol/l) | 2.36 ± 0.89 | 2.61 ± 0.78 | 2.61 ± 0.88 |
| Triglycerides, (mmol/l) | 4.34 ± 0.9 * | 4.18 ± 0.8 * | 5.12 ± 0.4 * |
| GFR , ml/min $^{2}$ | 69.7 ± 2.9 * | 58.6 ± 2.5 * | 49.6 ± 4.2 * |
| History of CVD, n (%) | - | - | - |
| Diabetic retinopathy, n (%) | 34 (72.3%) | 6 (54.5%) | 2 (100%) |

Note: NTproBNP - brain sodium uretic peptide, normal up to 125 pg / ml , SBP - systolic blood pressure, DBP - diastolic blood pressure, BMI - body mass index, HbA1c - glycated hemoglobin, HDL - high density lipoproteins, LDL - low density lipoproteins, * - significance of differences from control, where p <0.05

As can be seen from Table 3, in patients of group 2 - these are patients with type 2

FRONTLINE MEDICAL SCIENCES AND PHARMACEUTICAL JOURNAL 1(8): 35-51, December 2021
DOI: https://doi.org/10.37547/medical-fmspj-01-08-04
ISSN- 2752-6712
*Accepted 20th December, 2021 & Published 30th December, 2021*

diabetes without CHF - the number of patients with an average level of NT-proBNP from 125 to 250 pg / ml dominated - 47 patients out of 60 (78.3%). Significant differences were established in comparison with the control in all tertiles regarding SBP, DBP, BMI, HbA1c , decrease in HDL, GFR. ( P <0.05)

**Table 4**

**Comparative analysis of baseline characteristics in group 3, n = 60**

| Indicators | Patient groups | | |
|---|---|---|---|
| | 1 tertil<br>n = 12<br>125 to 250 | 2 tertil<br>n = 42<br>250 to 500 | 3 tertil<br>n = 6<br>More than 500 |
| NT-proBNP, pg / l | 187.3 ± 7.8 * | 386.3 ± 7.9 * | 545.7 ± 11.8 * |
| SBP, mm Hg | 133.3 ± 1.8 | 152.9 ± 5.2 * | 164.6 ± 3.5 * |
| DBP, mm Hg | 96.7 ± 2.9 * | 112.4 ± 4.2 * | 113.4 ± 4.8 * |
| BMI, kg / m2 | 29.3 ± 1.8 * | 29.8 ± 1.2 * | 29.2 ± 1.9 * |
| HbA1c , mmol / mol | 4.7 ± 0.1 | 4.8 ± 0.7 | 4.4 ± 0.6 |
| HDL cholesterol , (mmol / l) | 1.22 ± 0.26 * | 1.27 ± 0.29 * | 1.23 ± 0.22 * |
| LDL cholesterol , (mmol / l) | 2.59 ± 0.87 | 2.57 ± 0.88 | 2.53 ± 0.75 |
| Triglycerides, (mmol / l) | 5.23 ± 1.7 * | 4.78 ± 1.3 * | 5.89 ± 1.8 * |
| GFR , ml / min $^2$ | 63.8 ± 2.6 * | 58.6 ± 2.7 * | 51.4 ± 2.82 * |
| History of CVD, n (%) | 12 (100%) | 42 (100%) | 6 (100%) |
| Diabetic retinopathy, n (%) | - | - | - |

Note: NT-proBNP - brain sodium uretic peptide, normal up to 125 pg / ml , SBP - systolic blood pressure, DBP - diastolic blood pressure, BMI - body mass index, HbA1c - glycated hemoglobin, HDL - high density lipoproteins, LDL - low density lipoproteins, * - significance of differences from control, where p <0.05

FRONTLINE MEDICAL SCIENCES AND PHARMACEUTICAL JOURNAL 1(8): 35-51, December 2021
DOI: https://doi.org/10.37547/medical-fmspj-01-08-04
ISSN- 2752-6712
*Accepted 20th December, 2021 & Published 30th December, 2021*

As can be seen from Table 4, in group 3 patients - these are patients with CHF without type 2 diabetes - the number of patients with an average NT-proBNP level from 250 to 500 pg / ml dominated - 42 out of 60 patients (70.0%). Significant differences were established in comparison with the control in all tertiles regarding SBP, DBP, BMI, HbA1c , decrease in HDL, GFR. ( P <0.05)

Based on the analysis performed, we developed an algorithm for predicting CHF in patients with type 2 diabetes mellitus using NT proBNP (Fig. 2).

In 2020, the results of a multi-country study were published . The authors studied 5509 patients (with complete data) out of 8561 patients with type 2 diabetes, cardiovascular and / or chronic kidney disease who were included in the ALTITUDE study (Aliskiren for type 2 diabetes using cardiorenal endpoints). As a result, it was shown that in patients at high risk of T2DM, NT-proBNP itself demonstrated discriminatory ability similar to the multivariate model in predicting both death and cardiovascular events and should be considered for risk stratification. [22].

As shown by the results of another multicenter study in the United States, published in 2020, among patients with diabetes type 2 after a recent acute coronary syndrome, the use of biomarkers, such as the N-terminal natriuretic peptide pro-B-type and clinical variables, allows risk stratification for enhanced outcomes in heart failure [23].

Recently, the European Society of Cardiology (ESC) and the European Association for Diabetes Society (EASD) introduced a new model for cardiovascular risk stratification (CVD) to help guide future treatment decisions for people with diabetes. A comparative study performed in Austria aimed to investigate the predictive effectiveness of the ESC / EASD risk model versus the Systematic Coronary Risk Evaluation (SCORE) risk model and pro-B-type N-terminal natriuretic peptide (NT-proBNP) in a selected cohort of patients with type 2 diabetes. [4]. A total of 1,690 patients

FRONTLINE MEDICAL SCIENCES AND PHARMACEUTICAL JOURNAL 1(8): 35-51, December 2021
DOI: https://doi.org/10.37547/medical-fmspj-01-08-04
ISSN- 2752-6712
*Accepted 20th December, 2021 & Published 30th December, 2021*

with T2DM were analyzed with 10-year follow-up for fatal CVD and all-cause death and 5-year follow-up for CVD and all-cause hospitalizations. According to the ESC / EASD risk criteria, 25 (1.5%) patients were classified as moderate, 252 (14.9%) - high, 1125 (66.6%) - very high and 288 (17.0%) - not responding classification. As a result, NT-proBNP and SCORE showed significantly higher C-scores than the ESC / EASD cardiovascular death risk model [4].

The results of a multicountry study (UK, Norway, USA, Canada, Sweden) showed that patients with CHF and reduced ejection fraction with AF had a higher NT-proBNP than patients without atrial fibrillation (AF) .. However, at concentrations above 400 pg / ml (which corresponds to the majority of patients in each group) NT-proBNP had a similar predictive value for adverse cardiovascular outcomes, regardless of AF status They classified patients with AF and without AF into 5 levels (tertiles) NT- proBNP : <400, from 400 to 999, from 1000 to 1999, from 2000 to 2999, and ≥3000 pg / ml [25].

In a randomized controlled trial carried out jointly by the UK and Denmark, median NT-proBNP levels in increasing NT-proBNP tertiles were 50, 157 and 534 ng / L, respectively. Participants with lower NT-proBNP tertile were younger, had lower SBP, higher eGFR, less frequent history of cardiovascular disease, and less frequent use of β-blockers or diuretics [26]. Brain N-terminal natriuretic peptide (NT-proBNP) is secreted by the ventricular myocardium in response to increased myocyte stress and volume overload. The authors hypothesized that high levels of NT-proBNP may be a marker of excess volume overload in patients without overt heart failure and may be an indicator of response to RAAS intervention. [26].

Thus, as can be seen from the discussion of the literature, at present, the study of the prognostic value of NT-proBNP in the development of CHF in patients with type 2 diabetes is a widely and actively discussed topic. In this regard, the development of reference values of this marker in the Uzbek population is no less urgent work, being

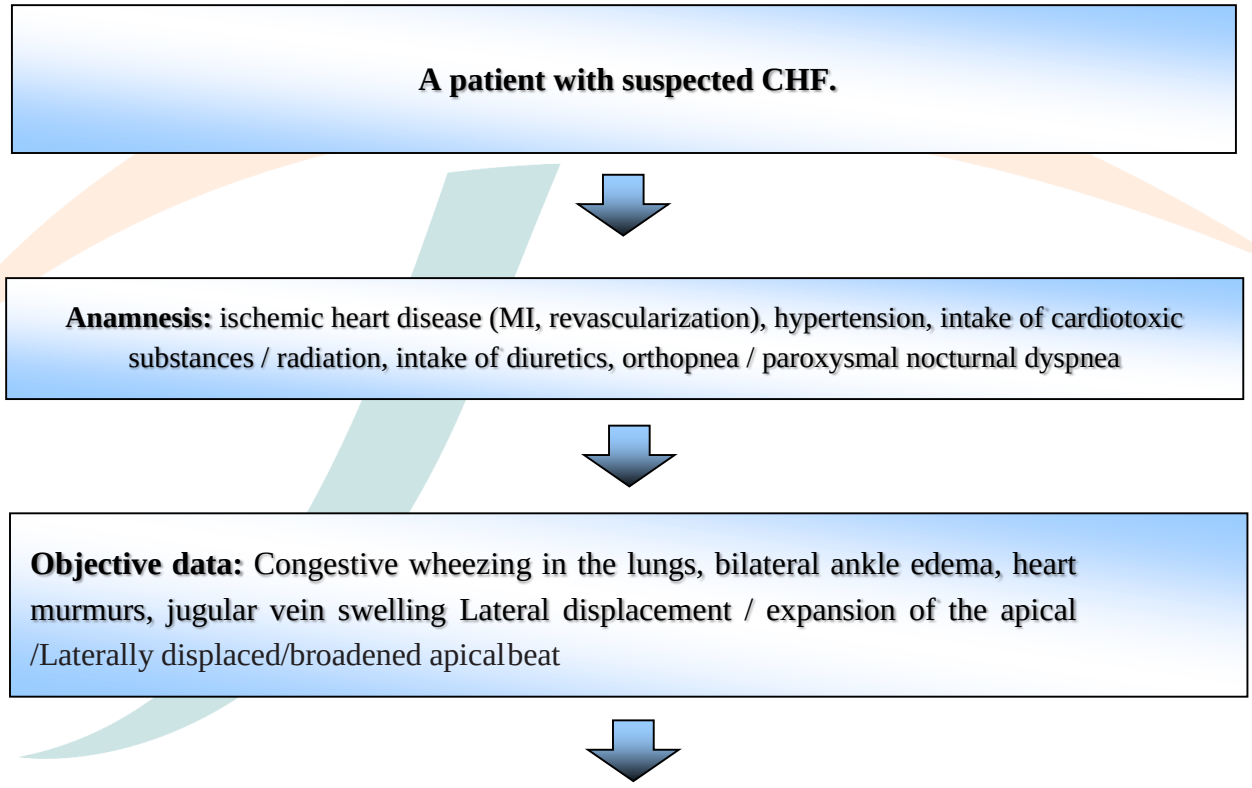
FRONTLINE MEDICAL SCIENCES AND PHARMACEUTICAL JOURNAL 1(8): 35-51, December 2021
DOI: https://doi.org/10.37547/medical-fmspj-01-08-04
ISSN- 2752-6712
*Accepted 20th December, 2021 & Published 30th December, 2021*

performed for the first time in our country.

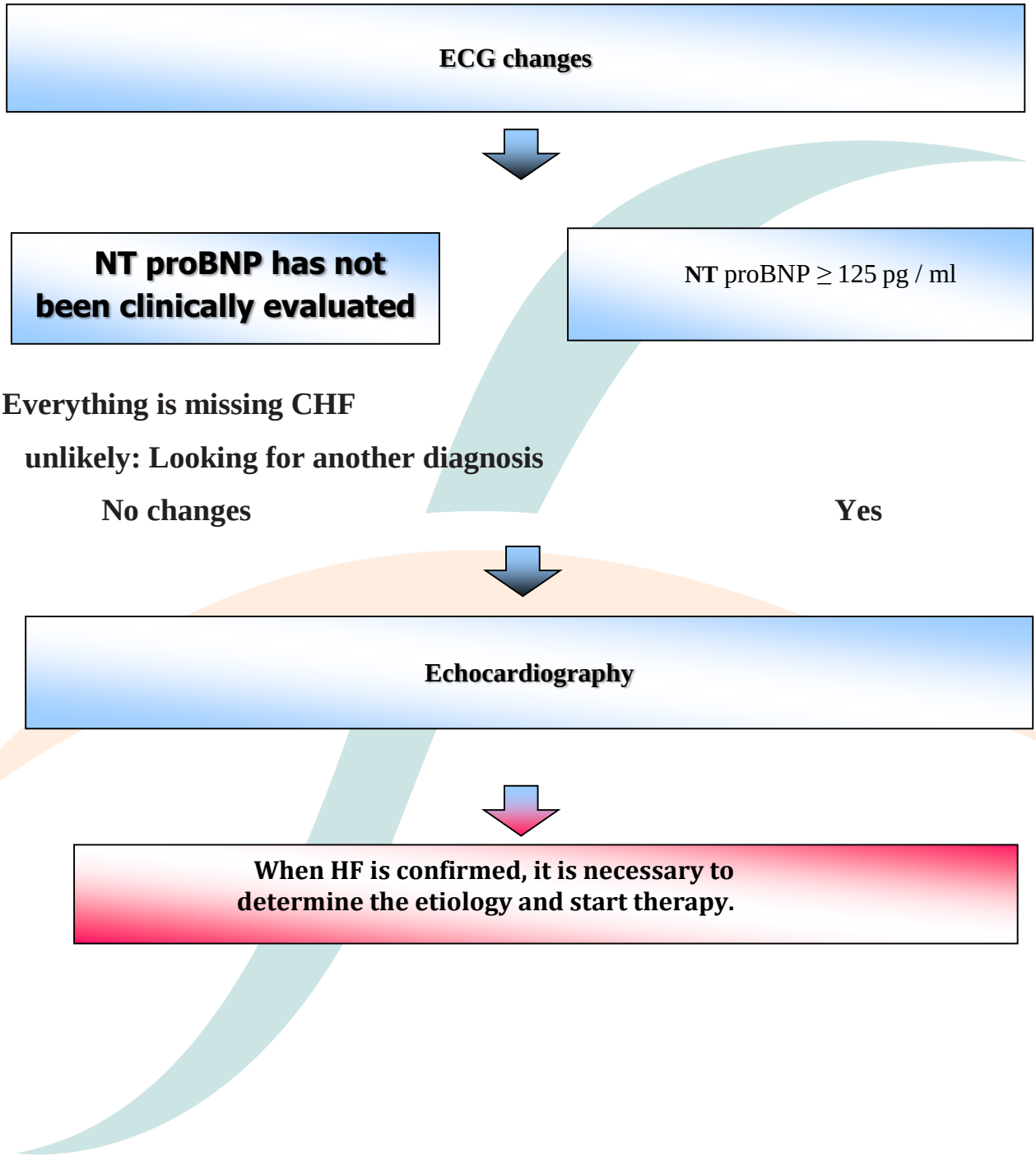
## CONCLUSIONS

1) Increasing concentrations of NT - proBNP in all patients with type 2 diabetes - the first type with concomitant heart failure, as well as high sensitivity and specificity of the test dock - is called the value of this marker for the diagnosis of CHF in patients with type 2 diabetes - the first type. The dynamics of their concentration, mainly NT-proBNP, can help in assessing the effectiveness of the therapy and the need for dose titration of drugs.
2) We selected median NT-proBNP levels in increasing NT-proBNP tertiles in the range from 125 to 250 pg / ml, from 250 to 500 pg / ml and above 500 pg / ml.

Pic. 2. Algorithm for predicting CHF in patients with type 2 diabetes mellitus using NT proBNP.



FRONTLINE MEDICAL SCIENCES AND PHARMACEUTICAL JOURNAL 1(8): 35-51, December 2021
DOI: https://doi.org/10.37547/medical-fmspj-01-08-04
ISSN- 2752-6712
*Accepted 20th December, 2021 & Published 30th December, 2021*





ISSN- 2752-6712

FRONTLINE MEDICAL SCIENCES AND PHARMACEUTICAL JOURNAL 1(8): 35-51, December 2021
DOI: https://doi.org/10.37547/medical-fmspj-01-08-04
ISSN- 2752-6712
*Accepted 20th December, 2021 & Published 30th December, 2021*

## REFERENCES

1. Gromova OI Noninvasive electrophysiological and neuro-humoral markers of arrhythmic events and zhizneugro- zhayuschih states in patients with coronary disease of the heart. Diss. on competition of a scientific degree of Cand. honey. sciences. Moscow. 2014; 172.
2. Gromova O.I. Noninvasive electrophysiological and neurohumoral markers of arrhythmic events and life-threatening conditions in pa- tients with coronary heart disease.Dis.on competition of a scientific degree Cand. of medical Sciences. Moscow. 2014; 172 [in Russian].
3. Edvinsson M., Ahnstedt H. et al. Characterization of Relaxant Responses to Natriuretic Peptides in the Human Microcirculation In Vitro and In Vivo. Microcirculation. 2016; 23 (6): 438-446. Wong LL, Wee AS, Lim JY, Ng JY et al. Natriuretic peptide receptor 3 (NPR3) is regulated by microRNA-100. J. Mol. Cell Cardiol. 2015; (82): 13-21.
4. Working group on the diagnosis and treatment of acute and chronic heart failure of the European society of cardiology (ESC) with the Participation of the Association of heart failure (ACH) in the ESC. ESC guidelines for the diagnosis and treatment of acute and chronic heart failure 2016. Russian cardiology journal. 2017; 1 (141): 7-81 [in Russian].
5. De Vito P .. Atrial natriuretic peptide: an old hormone or a new cytokine. Peptides. 2014; (58): 108-116.
6. Moghtadaei M., Polina I., Rose R.A. Electrophysiological effects of natriuretic peptides in the heart are mediated by multiple receptor subtypes. Prog Biophys Mol Biol. 2016; 120 (1-3): 37-49.
7. Yandle T.G., Richards A.M. B-type

FRONTLINE MEDICAL SCIENCES AND PHARMACEUTICAL JOURNAL 1(8): 35-51, December 2021
DOI: https://doi.org/10.37547/medical-fmspj-01-08-04
ISSN- 2752-6712
*Accepted 20th December, 2021 & Published 30th December, 2021*

natriuretic peptide circulating forms: analytical and bioactivity issues. Clin Chim Acta. 2015; 448: 195-205.

8. Richards A.M. The relationship of plasma NT-proBNP to age and outcomes in heart failure. JACC Heart Fail. 2016; 4 (9): 746-748.

9. Koegelenberg A.S., Smith W. et al. IGF-1 and NT-proBNP in a black and white population: the SABPA Study. Eur J Clin Invest 2016; 46 (9): 795-803.

10. Osipova O.A., Vlasenko O.A., Humoral mechanisms of chronic heart failure in patients with postinfarction cardiosclerosis. Scientific statements of the Belgorod state University. Series: Medicine.Pharmacy. 2011; 14 (10): 77-80 [in Russian].

11. Morwani J. G., McAlfine H. et al. Plasma brain natriuretic peptide as an indicator for angiotensin-converting-enzyme inhibition after myocardial infarction. Lancet. 1993; 341 (8853): 1109-1113.

12. Davidson N.C., Naas A.A., Hanson J.K. et al. Comparison of atrial natriuretic peptide, B-type natriuretic peptide, and N-terminal proatrial natriuretic peptide as indicators of left ventricular systolic dysfunction. Am J Cardiol. 1996; 77 (10): 828-831.

13. Abdel Fattah EM, Girgis HY, El Khashab K. et al. B-type natriuretic peptide as an index of symptoms and severity of chronic rheumatic mitral regurgitation. Heart Views. 2016; 17 (1): 7-12.

14. Alieva AM, Nikitin IG, Starodubova AV et al. Diagnostic and prognostic significance of natriuretic peptides in cardiac patients. Therapeutics. 2016; 3: 78-84 [in Russian].

15. Wang X, Wang P, Li HF et al. The correlation between brain natriuretic peptide and invasive hemodynamic parameters and their value in prognosis of patients with noncardiac shock.

16. Goreva L.A. Acute myocardial

FRONTLINE MEDICAL SCIENCES AND PHARMACEUTICAL
JOURNAL 1(8): 35-51, December 2021
DOI: https://doi.org/10.37547/medical-fmspj-01-08-04
ISSN- 2752-6712
Crossref doi Google Scholar
*Accepted 20th December, 2021 & Published 30th December, 2021*

infarction in patients with diabetes mellitus type 2: efficacy and safety of zofenopril and perindopril, including the effect on condition of oxidative stress and endothelial function: Dis the candidate of medical Sciences. M. 2012; 104 [in Russian].

17. Daniels L.B., Maisel A.S. Natriuretic peptides. J Am Coll Cardiol. 2007; 50 (25): 2357-2368.

18. Patton KK, Sotoodehnia N., De Filippi C., Siscovick DS, Gottdiener J.S., Kronmal R.A. N-terminal pro-B-type natriuretic peptide is associated with sudden cardiac death risk: the Cardiovascular Health Study. Heart Rhythm. 2011; 8 (2): 228-233.