# Assessment of Progression of Chronic Kidney Disease in Patients with Type 2 Diabetes

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**Annotation:** Predicting the progression of kidney disease in patients with diabetes mellitus is an important clinical and public health challenge. Currently, in many regions, diabetes is the leading cause of end-stage renal failure. Diabetic nephropathy is a significant contributor to diabetes-related healthcare costs and is also considered a leading cause of mortality. Indeed, the majority of deaths from cardiovascular diseases aimed at a comprehensive study of the factors of progression of chronic kidney disease among patients with diabetes mellitus.

**Keywords:** hyperlipidemia, arterial hypertension, diabetes mellitus, diabetic nephropathy, diabetic chronic kidney disease.

Diabetes mellitus (DM) is a chronic disease with an annual increase of 1.2%. Despite the fact that a huge amount of work is being done around the world to study the development of diabetes and its complications, it is of interest to many researchers to this day. According to the International Diabetes Federation (IDF), in 2021, 538 million people in the world suffer from DM. Of these, 98% are type 2 DM [8,9].

The danger of diabetes is certainly associated with the occurrence of various types of complications that develop as a result of the violation of the integrity of the endothelial layer of blood vessels. Among them, the leading place is occupied by diabetic nephropathy. Early morphologic signs of renal injury include nephromegaly, the extent of injury being best determined by proteinuria and glomerular filtration rate (GFR)[6,7]. The average incidence of diabetic nephropathy is high (3% per year) during the first 10 to 20 years after the onset of diabetes. Typically, it takes 15 years for small blood vessels in organs such as the kidneys, eyes, and nerves to become affected. However, according to observations, more than 20% of patients with type 1 diabetes and 40% of patients with type 2 diabetes develop chronic kidney disease (CKD) in the first 5 years in the absence of carbohydrate metabolism compensation. According to WHO, between 2000 and 2019, mortality from diabetes in the world increased by 70%, with 80% of this increase occurring among men. In the Eastern Mediterranean countries, mortality from diabetes has almost doubled, and in percentage terms, the increase in mortality from this disease in this region is the highest [1,3,4].

To date, a number of achievements have been made in the world in the field of treatment of patients with type 2 diabetes mellitus, studying the peculiarities of its course. In particular, multifaceted therapy has been developed for patients complicated by diabetic nephropathy. However, there are a number of problems concerning the principles of management of patients with diabetic nephropathy and chronic renal failure. Therefore, prevention of complications of diabetes mellitus and prevention of their development remain one of the most pressing problems [10,11, 12].

**The aim** of the study was to identify the most significant risk factors for the progression of chronic kidney disease to the stage of end-stage renal failure.

**Research methods.** The work used general clinical, biochemical, serological (creatinine, urea, glucose, SCF, total protein, albumin, calcium, potassium, phosphorus, magnesium, vitamin D, parathyroid hormone), instrumental (ECG, ultrasound, radiological) and statistical methods. The study was conducted at the Bukhara Regional Multidisciplinary Center in the Department of Nephrology and Hemodialysis during 2020-2022. The study involved 175 patients with type 2 diabetes mellitus and chronic kidney disease. The patients were divided into 4 groups:

The first group included 60 patients with CKD stage 3(a, b).

The second group consisted of 35 patients with CKD stage 4.

The third group consisted of 50 patients with CKD stage 5 with ESRD.

Inclusion criteria:

1. Type 2 diabetes

2. at least one year of active follow-up;

3. persistent proteinuria for one year;

4. SCF <60 ml/min/1.73 m2 at last visit.

One of the methods of mathematical and statistical analysis is systemic forecasting, which can be used to determine the degree of risk of progression of diabetic nephropathy and end-stage renal failure by comparing prognostic tables.

We used the method of normalization of intensive indicators (NIP) of E.N. Shigan (1977-1983), based on the probable Bayes method. The indicators of development and progression of DN in the groups of patients studied were adopted as the normalizing value (M).

Based on this analysis, the following most significant risk factors were identified: gender, age, duration of the disease, degree of compensation (HbA1c), systolic and diastolic blood pressure, Hb levels, triglycerides, LDL, vitamin D, the presence of complications such as stroke, PICS, smoking, alcohol and late complications of diabetes (stages of retinopathy).

An integrated assessment of progression factors was carried out differentially, taking into account the decrease in glomerular filtration rate at all stages of CKD, starting from the third.
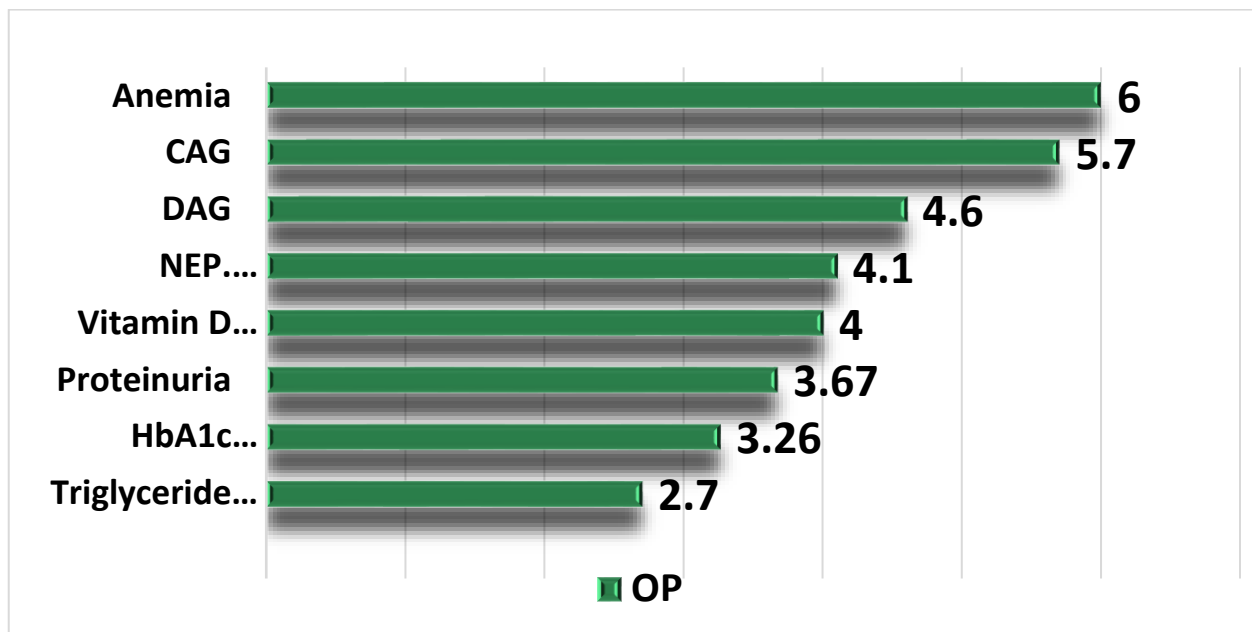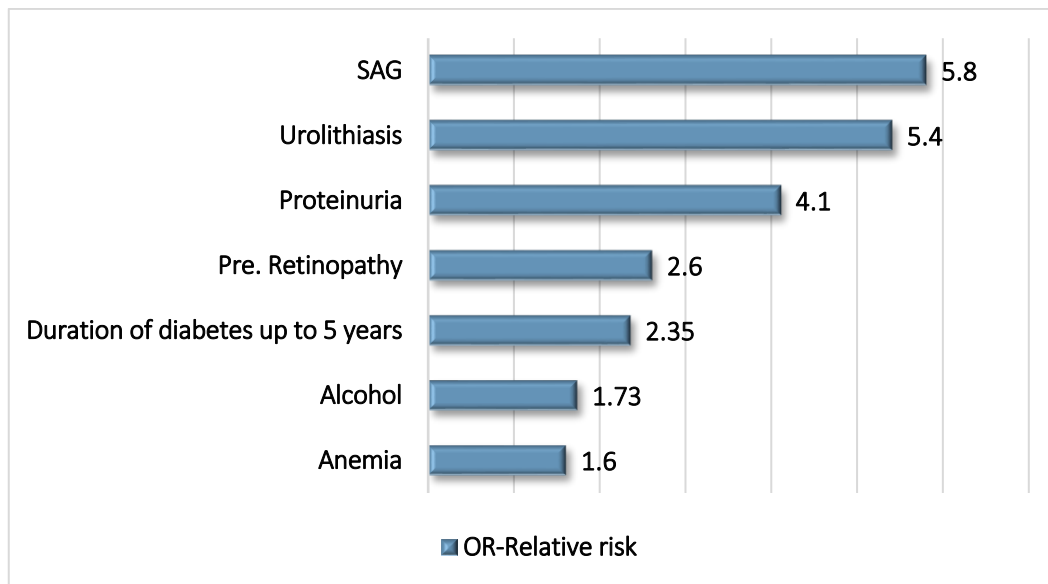


*SAH – systolic arterial hypertension*

*DAH – diastolic arterial hypertension*

**Figure 1. Assessment of factors for the progression of CKD stage 3a.**

Chronic renal failure stage 3a is the phase of the first clinical manifestations of a decrease in SCF. The main factors that prevail in the development of renal dysfunction according to the study data are the following: anemia (OR=6), even a slight increase in systolic (OR=5.7) and diastolic (OR=4.6) pressure, the presence of initial manifestations of retinopathy (OR=4.1), vitamin D deficiency (OR=4),

decompensation of diabetes (OR=3.26) and a history of myocardial infarction (OR=2.47). Such indicators as triglycerides (OR=2.6) are also important.
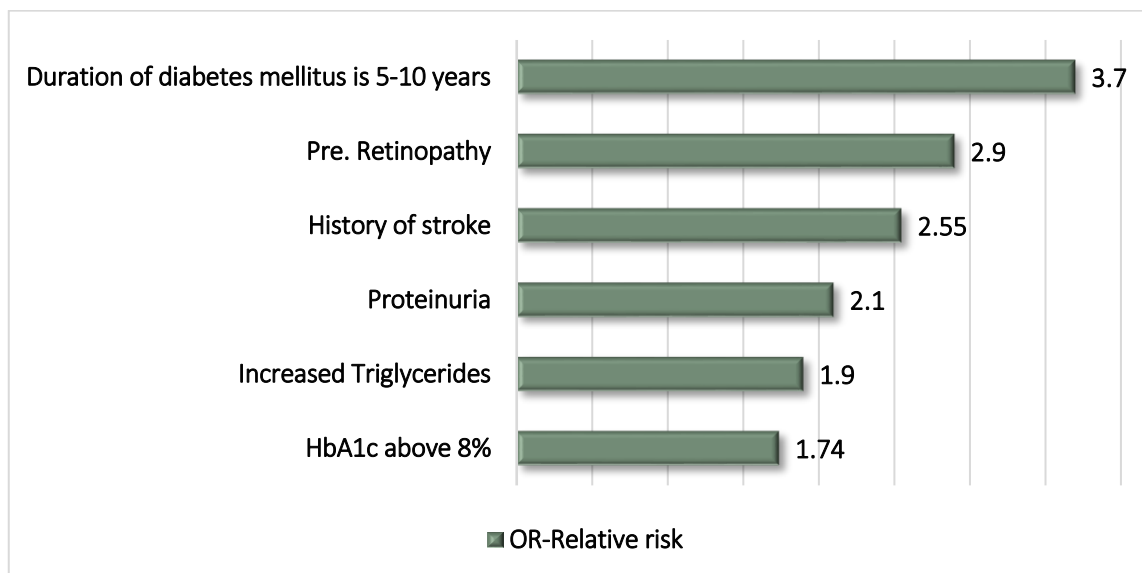


*SAG – systolic arterial hypertension*

*UCD – urolithiasis*

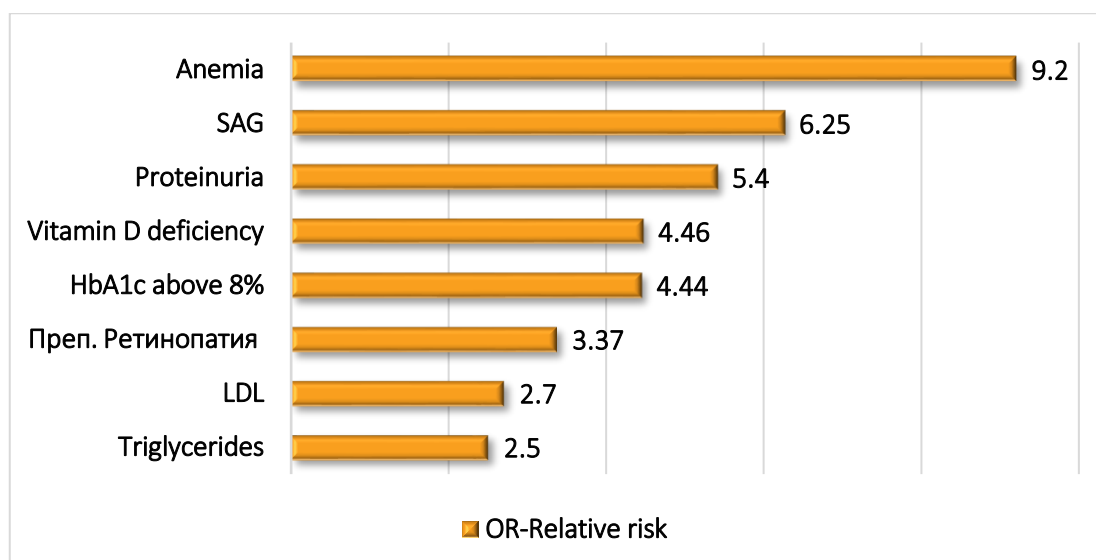**Figure 2. Evaluation of factors for the progression of CKD stage 3b**

At stage CKD C3b, the leading risk factors for progression were identified: a marked increase in systolic blood pressure (OR=5.8), corresponding to stage II hypertension, concomitant urolithiasis (OR=5.4), proteinuria (OR=4.1), the presence of retinopathy (OR=2.6), the duration of diabetes up to 5 years (OR=2.58) (which indirectly indicates a late diagnosis of diabetes), alcohol consumption (OR=1.73), and anemia (OR=1.6).



*ACMC – acute cerebrovascular accident*

**Figure 3. Evaluation of factors for the progression of CKD stage 4**

When studying the factors prevalent in the development of CKD stage C4, the following parameters were identified: duration of diabetes from 5 to 10 years (OR=3.7), preproliferative stage of retinopathy (OR=2.9), history of stroke (OR=2.55), proteinuria (OR=2.1), increased triglyceride levels (OR=1.9), and decompensation of diabetes (OR=1.74).

*SAH – systolic arterial hypertension*

*UCD – urolithiasis*

*LDL – low-density lipoproteins*

**Figure 4. Evaluation of factors for the progression of CKD stage 5**

In the study of the factors of ESRD progression, the following indicators were identified: severe anemia (Hb 70 g/l) (OR=9.2), high systolic blood pressure (OR=6.25), concomitant proteinuria (OR=5.4), vitamin D deficiency (OR=4.46), decompensation of diabetes (HbA1c more than 8%) (OR=4.44), proliferative retinopathy (OR=3.37), increased LDL (OR=2.7) and triglycerides (OR=2.5).

**Conclusion.** An integrated assessment of the factors of chronic kidney disease progression depending on the previous stage showed that the most significant parameters do not differ significantly at each stage of CKD, but the priority of the sequence of leading factors changes**.** These indicators lead to microvascular disorders, hemodynamic and metabolic changes, and a sharp deterioration in the microcirculation of the glomerular apparatus. Most of the identified parameters are modifiable factors, the timely correction of which can significantly reduce the risk of developing ESRD and the need for RRT.

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