# *Diabetic patients on hemodialysis*

***Msc. Kujtim MULGECI***
Faculty Of Medical Technical Sciences
European University Of Tirana

## Abstract

***Introduction:*** *Diabetes Mellitus is one of the leading causes of end-stage renal disease (ESRD) worldwide. Good glycemic control plays a key role in reducing the progression of macro and microvascular damage in patients on hemodialysis.*

***Aim of the study:*** *To investigate the prevalence of Diabetes Mellitus in patients with chronic hemodialysis. Evaluation of the prevalence of comorbidities such as Arterial Hypertension, Chronic Heart Failure and Neuropathy in patients with diabetes mellitus undergoing chronic hemodialysis.*

***Methodology:*** *This is a cross-sectional study involving 70 adult patients (age > 18 years) who underwent hemodialysis for at least three months, three times a week and who consented to participate in the study. The study was conducted for a period of one month, January-February 2021, at the Mother Teresa Hospital Center, Tirana, hemodialysis ward. Demographic data (gender, age), good quality HD, height, weight before and after dialysis, causes of kidney failure, other diseases such as Diabetes Mellitus, cardiovascular disease and neuropathy were obtained using medical records of patient records.*
***Results:*** *The study included 70 patients. Of them 65.7% were male. The mean age of patients treated with chronic HD was 52 ± 15. The prevalence of Diabetic nephropathy in our study was 15.7%. In the group of patients where the primary disease for ESRD was Diabetes, the percentage of concomitant diseases was: Hypertension 10%, Chronic Heart Failure 10% and Neuropathy 5.7%. In the rest of the patients the percentage of concomitant diseases was: Hypertension 55.7%, Chronic Heart Failure 45.7% and Neuropathy 7.1%. Patients with DM had 6 months to 10 years of HD treatment time.*
***Conclusions:*** *We do not have a statistically significant relationship between the*

*occurrence of diseases such as Arterial Hypertension, Chronic Heart Failure and Neuropathy and patients with DM treated with chronic hemodialysis.*

***Keywords:*** *diabetes mellitus, hemodialysis, hypertension, chronic heart failure, neuropathy.*

## Introduction

There are two main types of dialysis:

1 – Hemodialysis
2 – Peritoneal dialysis

Hemodialysis is the purification of blood from metabolic products which are filtered and removed through a semi-permeable artificial membrane which is located outside the body. The word 'hemodialysis' comes from the Greek language and consists of the words 'hemo' which means 'blood' and 'dialysis', which means 'release from something'. The process of hemodialysis replaces some of the functions of the kidneys. This process helps remove the end products of protein metabolism (urea and creatinine, etc.), also regulates the amount of electrolytes and acidity in the body. Through this process can not be replaced kidney function which is responsible for the secretion of the hormone responsible for the normal functioning of the bone marrow (erythropoietin), regulates blood pressure by (renin, bradykinin, kallikrein, prostaglandin) and vitamin D3 activation. Peritoneal dialysis is the exchange of fluids and dissolved substances between the peritoneal capillaries of the blood and the peritoneal cavity through the 'membrane' which consists of a vascular wall, interstitium, mesothelioma. The movements of matter follow the physical laws of diffusion and connective transport, while the movements of fluids are related to osmosis. The transfer of dissolved substances across the peritoneal membrane occurs through two major mechanisms, diffusion and convection. The rate of transport of diffuse dissolved substances is proportional to the difference in concentration between blood in the peritoneal capillaries and fluid in the PD. Substances pass from the blood into the peritoneal capillaries, into the filled cavity of peritoneal dialysis, where they must pass at least three structures that can provide resistance: the capillary wall, interstitial tissue, and cellular mesothelial layers. Diffusion and ultrafiltration occur in two directions throughout this resistance. Diabetes Mellitus is a metabolic syndrome with multiple etiologies. It is characterized by chronic hyperglycemia associated with a disorder of

carbohydrate metabolism that results from a defect in the secretion or action of insulin, or as a combination of both factors together. It is also characterized by specific microvascular complications, macrovascular complications due to accelerated atherosclerosis, and various other complications, including neuropathy, pregnancy with complications, and an increased chance of infections. Regarding the diagnostic criteria of diabetes, it is accepted as diabetes if the sober (venous) glycemia is 126 mg / dl (7.0 mmol / l), or if the occasional plasma glycemia is 200 mg / dl (11.1 mmol / l) ) two hours after taking 75 g of glucose by mouth. In asymptomatic persons, performing the test in only one case is not sufficient to establish the diagnosis (e.g. to begin treatment of Diabetes). This should be confirmed after at least one more test is performed the following day.

## Epidemiology & etiology

Diabetes (mainly type 2) is an increasingly common cause of end-stage renal disease (ESRD) in all countries, and accounts for almost 40% of dialysis patients in the US and 20% in Europe. Patient survival is much worse compared to patients without diabetes, with a high number of patients dying within the first 3 months of dialysis. The leading cause of death is cardiovascular disease. The prognosis is better for patients who have had a transplant.
Most non-renal complications of diabetes will continue to progress after starting dialysis, including:

- arterio-coronary disease
- retinopathy
- cataracts
- cerebrovascular disease
- peripheral vascular disease
- peripheral neuropathy
- sexual dysfunction
- depression

The increasing prevalence of diabetic neuropathy among patients with end-stage renal disease (ESRD) occurs mainly from the increasing prevalence of type 2 diabetes in the general population. The incidence of end-stage renal disease (ESRD) among patients with type 1 diabetes is decreasing as a result of better management of blood pressure, blood glucose levels, and the use of ACEI / ARBs. Diabetic patients on dialysis have higher vascular comorbidity than non-diabetic patients.

## Study

### *Objective*

- Evaluation of the prevalence of Diabetes Mellitus in patients with chronic hemodialysis.
- Evaluation of demographic and laboratory data in diabetic patients with chronic hemodialysis.
- Evaluation of the prevalence of comorbidities and complications in diabetic patients with chronic hemodialysis.
- Nursing care and development of plans for the education and management of diabetic patients with chronic hemodialysis.

### *Methodology*

The cross-sectional study was conducted within the period January-February 2021. Our study included 70 patients who were presented at the Mother Teresa Hospital Center in Tirana.

Demographic data (gender, age), good quality hemodialysis, weight before and after dialysis, causes of kidney failure, concomitant diseases such as Diabetes Mellitus, cardiovascular disease and neuropathy were obtained using medical records of patients.

Routine laboratory data evaluated monthly for each patient using standard automated techniques were also obtained using medical data.

### *Criteria*

Inclusion criteria : adult patients (age > 18 years), who performed hemodialysis for at least 3 months, 3 times a week and who gave consent to participate in the study. Exclusion criteria : patients with acute kidney injury, malignant diseases, major surgery, septic condition.

## Results

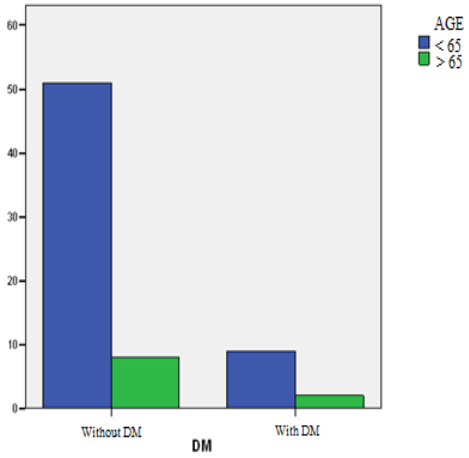
### *1. Prevalence ratio between diabetes mellitus and age*

| | | | AGE | | Total |
|---|---|---|---|---|---|
| | | | < 65 | ≥ 65 | |
| DM | No | Number | 51 | 8 | 59 |

| | | | | | |
|---|---|---|---|---|---|
| | | % of total | 72.9% | 11.4% | 84.3% |
| | Yes | Number | 9 | 2 | 11 |
| | | % of total | 12.9% | 2.9% | 15.7% |
| Total | | Number | 60 | 10 | 70 |
| | | % of total | 85.7% | 14.3% | 100.0% |

**TABLE 1**

The mean age of patients undergoing chronic hemodialysis treatment was 52 ± 15, male/female ratio 46/24 (65.7% / 34.3%). The prevalence of Diabetes Mellitus in the group of patients taken in the study was 11 patients (15.7%). In the whole group 10 (14.3%) patients were ≥ 65 years old and only (2.9%) of them were diabetic.



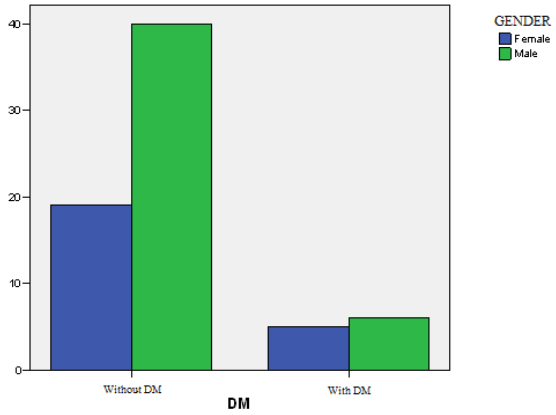

## Prevalence ratio between diabetes mellitus and gender

The male/female ratio in the group of diabetic patients with chronic hemodialysis was 6 (8.6%) / 5 (7.1%) but had no statistical significance.

| | | | Gender | | Total |
|---|---|---|---|---|---|
| | | Female | Male | | |
| DM | No | Number | 19 | 40 | 59 |
| | | % of total | 27.1% | 57.1% | 84.3% |
| | Yes | Number | 5 | 6 | 11 |
| | | % of total | 7.1% | 8.6% | 15.7% |

| | | | | |
|---|---|---|---|---|
| Total | Number | 24 | 46 | 70 |
| % of total | 34.3% | 65.7% | 100.0% | |

**TABLE 2**

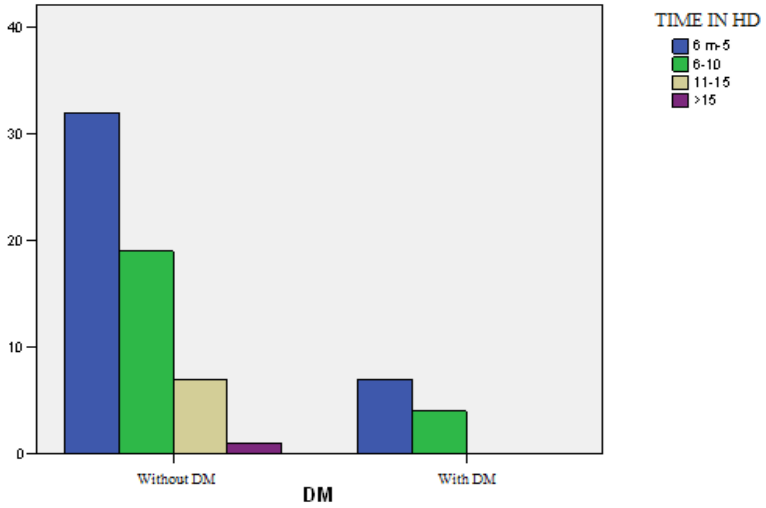



## 3. Prevalence of diabetes mellitus and time of treatment with hemodialysis

Patients with diabetes mellitus had 6 months to 10 years being treated with hemodialysis.

| | | | TIME IN HEMODIALYSIS TREATMENT | | | | Total |
|---|---|---|---|---|---|---|---|
| | | | 6 M-5 YEARS | 6-10 YEARS | 11-15 YEARS | >15 YEARS | |
| DM | No | Number | 32 | 19 | 7 | 1 | 59 |
| | | % of total | 45.7% | 27.1% | 10.0% | 1.4% | 84.3% |
| | Yes | Number | 7 | 4 | 0 | 0 | 11 |
| | | % of total | 10.0% | 5.7% | .0% | .0% | 15.7% |
| Total | | Number | 39 | 23 | 7 | 1 | 70 |
| | | % of total | 55.7% | 32.9% | 10.0% | 1.4% | 100.0% |

**TABLE 3**




## 4. Prevalence of diabetes mellitus and hypertension in patients with chronic hemodialysis

Hypertension was present in 65.7% of the group of patients treated with chronic hemodialysis. 10% of patients with diabetes mellitus also had arterial hypertension for which they were treated with medications of several classes.

| | | | HTA | | Total |
|---|---|---|---|---|---|
| | | | Without HTA | With HTA | |
| DM | No | Number | 20 | 39 | 59 |
| | | % of total | 28.6% | 55.7% | 84.3% |
| | Yes | Number | 4 | 7 | 11 |
| | | % of total | 5.7% | 10.0% | 15.7% |
| Total | | Number | 24% | 46 | 70 |
| | | % of total | 34.3% | 65.7% | 100.0% |

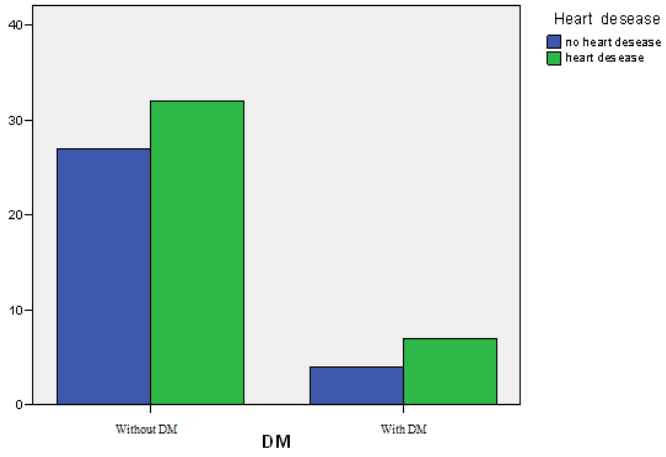
**TABLE 4**

## 5. Prevalence of diabetes mellitus and chronic heart failure in patients with chronic hemodialysis

Chronic Heart Failure (CHI) was present in 55.7% of the group of patients on chronic hemodialysis treatment. 10% of patients with diabetes mellitus also had CHI.

| | | | CHI | | Total |
|---|---|---|---|---|---|
| | | | Without CHI | With CHI | |
| DM | No | Number | 27 | 32 | 59 |
| | | % of total | 38.6% | 45.7% | 84.3% |
| | Yes | Number | 4 | 7 | 11 |
| | | % of total | 5.7% | 10.0% | 15.7% |
| Total | | Number | 31 | 39 | 70 |
| | | % of total | 44.3% | 55.7% | 100.0% |

**TABLE 5**



## 6. Prevalence of diabetes mellitus and neuropathy in patients with chronic hemodialysis

Neuropathy is a significant complication in diabetic patients and in patients with chronic hemodialysis.

| | | | NEUROPATHY | | Total |
|---|---|---|---|---|---|
| | | | Without NEUROPATHY | With NEUROPATHY | |
| DM | No | Number | 54 | 5 | 59 |
| | | % of total | 77.1% | 7.1% | 84.3% |
| | Yes | Number | 7 | 4 | 11 |
| | | % of total | 10.0% | 5.7% | 15.7% |
| Total | | Number | 61 | 9 | 70 |
| | | % of total | 87.1% | 12.9% | 100.0% |

**TABLE 6**

## 7. Differences between patients with DM and without DM in hemodialysis

| | DM | N | Mean | Std. Deviation |
|---|---|---|---|---|
| Age | No | 59 | 53.32 | 12.331 |
| | Yes | 11 | 53.82 | 14.247 |
| Weight at the end | No | 59 | 67.6271 | 14.41162 |
| | Yes | 11 | 69.4545 | 16.71145 |
| BMI | No | 59 | 23.7758 | 3.84643 |
| | Yes | 11 | 25.5127 | 5.35973 |
| Years of hemodialysis | No | 59 | 6.051 | 3.6338 |
| | Yes | 11 | 4.909 | 3.0068 |
| HgB | No | 59 | 10.671 | 1.5063 |
| | Yes | 11 | 10.600 | 1.5944 |
| AST | No | 58 | 24.95 | 19.805 |
| | Yes | 11 | 26.45 | 20.978 |
| ALT | No | 58 | 33.60 | 37.845 |

| | | | | |
|---|---|---|---|---|
| | Yes | 11 | 30.27 | 28.886 |
| Serum iron | No | 59 | 78.74 | 53.625 |
| | Yes | 11 | 59.91 | 42.677 |
| Cholesterolemia | No | 59 | 167.58 | 38.675 |
| | Yes | 11 | 180.82 | 37.727 |
| Triglyceridemia | No | 59 | 152.10 | 70.990 |
| | Yes | 11 | 205.09 | 142.168 |
| Uremia | No | 59 | 159.88 | 36.264 |
| | Yes | 11 | 149.18 | 37.032 |
| Creatinemia | No | 59 | 9.778 | 1.9012 |
| | Yes | 11 | 8.227 | 1.5938 |
| Na | No | 59 | 135.08 | 2.615 |
| | Yes | 11 | 133.18 | 2.272 |
| K | No | 59 | 5.475 | .8130 |
| | Yes | 11 | 5.300 | .8379 |

**TABLE 7**

## Disscusion

This study included 70 patients who were presented at the Mother Teresa Hospital Center in Tirana. Patients were adults (age >18 years), who underwent hemodialysis for at least 3 months, 3 times a week. Patients with acute illness, malignancy, major surgery and septic condition were not included in the study. The mean age of patients undergoing chronic hemodialysis treatment was 52 ± 15. We note that the average age of patients treated with chronic hemodialysis in our country is lower compared to data from studies in America where the average age is 56 ± 15.

The male / female ratio was 46/24 (65.7% / 34.3%). So we have approximately the same percentage with the data of other studies which show that men are more at risk than women to be affected by chronic kidney disease, consequently to be treated with hemodialysis.

The prevalence of diabetes mellitus in the group of patients taken in the study was 11 patients (15.7%). We note that the prevalence of diabetes mellitus in our country is lower compared to the prevalence in America. In the whole group 10 (14.3%) patients were ≥ 65 years old and only 2 (2.9%) of them were diabetic. The male/female ratio in the group of patients with diabetes mellitus and treated with chronic hemodialysis was 6 (8.6%)/5 (7.1%), but there was no statistical significance.

Hypertension was present in 65.7% of the group of patients treated with chronic hemodialysis. 10% of patients with diabetes mellitus also had arterial hypertension for which they were treated with medications of several classes. Chronic Heart Failure (CHI) was present in 55.7% of the group of patients on chronic hemodialysis treatment. 10% of patients with diabetes mellitus also had CHI. It was concluded that only 5.7% of the patients in the study group treated with chronic hemodialysis were positive for both diabetes mellitus and neuropathy. Since the number of patients taken in the study represents a small percentage of the population treated with dialysis in Albania, we can say that the study is relatively limited and as such its results should be taken with reservations.

## Conclusion

Based on the collected data, we do not have a statistically significant relationship between the occurrence of diseases such as Arterial Hypertension, Chronic Heart Failure and Neuropathy and patients with DM treated with chronic hemodialysis.

## Recommendations

Most units start at higher GFR levels than for non-diabetic patients (10-15 mL / min to 20 mL / min) as uremia symptoms may appear earlier, and renal function tends to deteriorate more rapidly in patients with diabetes. This is also important to avoid malnutrition. When determining when dialysis should begin, the degree of impairment of renal function should be closely reviewed. The use of ACEIs and ARBs, reduction of proteinuria and good control of blood pressure can result in very slow rates of deterioration of renal function. However, dialysis should be started earlier in documented patients with rapidly deteriorating renal function, especially those patients with persistent severe proteinuria and poor blood pressure control.

## References


1. Bergamo Collaborative Dialysis Study Group (1991). Acute intradialytic well being. Kidney International 40 , 714–719.
2. Bonomini, V. et al . (1985). Benefits of early initiation of dialysis. Kidney International 17 (Suppl.), S57–S60.
3. Buoncristiani, U. (1998). Fifteen years of clinical experience with daily haemodialysis. Nephrology, Dialysis, Transplantation 13 (Suppl. 6), 148–151.
4. Burkart, J. M. et al . (1996). Solute clearance approach to adequacy of peritoneal dialysis. Peritoneal Dialysis International 16 , 457–470.

5. Cambi, V. et al . (1975). Short dialysis schedules (SDS)—finally ready to become routine? Proceedings European Dialysis Transplantation Association 11 , 112–120.
6. Canada-USA (CANUSA) Peritoneal Dialysis Study Group (1996). Adequacy of dialysis and nutrition in continuous peritoneal dialysis: association with clinical outcomes. Journal of the American Society of Nephrology 7 , 198–207.
7. Oliver, M. J., Edwards, L. J., and Churchill, D. N. (2001). Impact of sodium and ultrafiltration profiling on hemodialysis-related symptoms. Journal of the American Society of Nephrology 12 , 151–156.
8. Paniagua, R. et al . (2002). Effects of increased peritoneal clearances on mortality rates in peritoneal dialysis: ADEMEX, a prospective, randomized, controlled trial. Journal of the American Society of Nephrology 13 , 1307–1320.
9. Pierratos, A. and Ouwendyk, M. (1999). Nocturnal hemodialysis: five years later. Seminars in Dialysis 12 , 419–423.
10. Popovich, R. P. et al . (1976). The definition of a novel portable/wearable equilibrium dialysis technique. Transactions American Society of Artificial Internal Organs 5 , 64– 66.
11. Ismail.N.Becker, B.Strezelczyk, P. Renal disease and hypertension inin on insulin dependent diabetes mellitus 1991.
12. Gross,JL,de Azevedo,MJ Silvero,Diabetik nefropathy,diagnosis,and treatment, diabetes care 2005,28;164
13. Gaede P Vedel,P Larsen .Multifactorial intervention and cardiovascular disease in patients with type 2 diabetes.N Engl Med 2003, 348:383
14. Definition and diagnosis of diabetes mellitus and intermediate hyperglycemia-WHO. ISBN: 978-92-4-15949306. 2006.
15. Overview of clinical and compliacations of diabetes. www.umm.edu/diabetes/clinical_complications.htm.
16. Principle of diabetes mellitus - Leonid Poretsky. ISBN:978-0-387-09840-1. 2009.
17. Therapy for diabetes mellitus and related disordes - Harold E. Lebovitz. ISBN: 0-945-448-94-5. 1998.
18. The epidemiology of diabetes an international perspective- Jean M.Ekoe, Paul Zimmet, Rhy Williams, Sir Georhe Alberti, John Willey&Sons. ISBN:0-471-97448-X. 2001.
19. The Mediterranean diabetes cookbook- Amy Riolo. ISBN:978-1-58040-312-2. 2010.