Section: General Medicine

Original Research Article

PREVALENCE OF MICROALBUMINURIA IN PATIENTS WITH TYPE 2 DIABETES MELLITUS AND ESSENTIAL HYPERTENSION

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ABSTRACT

Background: Microalbuminuria is considered an early marker of diabetic nephropathy and generalized endothelial dysfunction in patients with Type 2 Diabetes Mellitus (T2DM) and essential hypertension. Persistent microalbuminuria is strongly associated with progression to chronic kidney disease and increased cardiovascular morbidity and mortality. Early detection among high-risk individuals provides an opportunity for timely therapeutic intervention and prevention of renal complications. The coexistence of diabetes mellitus and hypertension significantly accelerates renal vascular damage, thereby increasing the prevalence of microalbuminuria among affected patients. The aim is to determine the prevalence of microalbuminuria in patients with Type 2 Diabetes Mellitus and essential hypertension and to evaluate its association with demographic and clinical parameters.

Materials and Methods: A hospital-based cross-sectional observational study was conducted among adult patients diagnosed with Type 2 Diabetes Mellitus and essential hypertension attending the Department of General Medicine at a tertiary care teaching hospital over a period of 6 months from November 2025 to April 2026. A total of 150 eligible patients aged above 30 years were included in the study. Detailed demographic data, duration of diabetes and hypertension, body mass index, blood pressure measurements, fasting blood glucose, postprandial blood glucose, glycated hemoglobin, serum creatinine, and urinary albumin excretion were recorded. Microalbuminuria was assessed using urinary albumin-creatinine ratio estimation. Statistical analysis was performed using appropriate descriptive and inferential statistical methods.

Results: The prevalence of microalbuminuria among patients with Type 2 Diabetes Mellitus and essential hypertension was found to be considerably high. Increased prevalence was observed among patients with longer duration of diabetes, poor glycemic control, uncontrolled hypertension, and higher body mass index. Elevated HbA1c levels and systolic blood pressure showed significant association with urinary albumin excretion. Patients with combined diabetes and hypertension demonstrated greater susceptibility to renal endothelial dysfunction compared to patients with controlled metabolic parameters.

Conclusion: Microalbuminuria is highly prevalent among patients with Type 2 Diabetes Mellitus and essential hypertension and serves as an important early indicator of renal involvement. Routine screening for microalbuminuria in high-risk individuals can facilitate early diagnosis and prompt intervention, thereby reducing progression to diabetic nephropathy and associated cardiovascular complications.

Keywords: Type 2 Diabetes Mellitus; Essential Hypertension; Microalbuminuria; Diabetic Nephropathy; Urinary Albumin-Creatinine Ratio; Chronic Kidney Disease.

INTRODUCTION

Type 2 Diabetes Mellitus (T2DM) is one of the most prevalent metabolic disorders worldwide and represents a major public health challenge due to its rapidly increasing incidence and associated chronic complications. Persistent hyperglycemia in diabetic patients leads to progressive microvascular and macrovascular damage affecting multiple organ systems, particularly the kidneys, retina, cardiovascular system, and peripheral nerves. Among the various complications of diabetes mellitus, diabetic nephropathy remains one of the leading causes of chronic kidney disease and end-stage renal failure globally.[1,2]

Microalbuminuria is defined as urinary albumin excretion ranging between 30–300 mg/day or an albumin-creatinine ratio of 30–300 mg/g creatinine. It is recognized as the earliest clinically detectable marker of diabetic nephropathy and generalized endothelial dysfunction.[3] The presence of microalbuminuria reflects early renal vascular injury and increased glomerular permeability before the onset of overt proteinuria. Early identification of microalbuminuria provides an important opportunity for intervention aimed at preventing progression to irreversible renal impairment.[4]

Hypertension frequently coexists with Type 2 Diabetes Mellitus and significantly contributes to the development and progression of renal complications. Essential hypertension independently causes structural and functional alterations in renal vasculature, leading to increased intraglomerular pressure and accelerated nephron damage.[5] When diabetes and hypertension coexist, their combined effects substantially increase the risk of microvascular complications, especially diabetic nephropathy. Elevated systemic blood pressure further aggravates glomerular hyperfiltration and endothelial injury, thereby increasing urinary albumin excretion.[6]

Several studies have demonstrated that the prevalence of microalbuminuria is considerably higher among diabetic patients with uncontrolled hypertension compared to normotensive diabetic individuals.[7] Factors such as poor glycemic control, longer duration of diabetes, obesity, dyslipidemia, smoking, and advancing age have also been identified as important determinants associated with microalbuminuria. In addition to being a marker of renal involvement, microalbuminuria is considered a strong predictor of cardiovascular morbidity and mortality in both diabetic and hypertensive populations.[8]

The burden of diabetes and hypertension is increasing rapidly in developing countries, including India, owing to urbanization, sedentary lifestyle, dietary changes, obesity, and aging population.[9] Despite the growing prevalence of these disorders, renal complications often remain underdiagnosed during the early stages due to lack of routine screening. Timely detection of microalbuminuria through simple and cost-effective investigations can help initiate appropriate therapeutic measures such as optimization of glycemic control, blood pressure management, and renoprotective therapy.[10]

Considering the clinical significance of microalbuminuria as an early indicator of nephropathy and cardiovascular risk, the present study was undertaken to determine the prevalence of microalbuminuria in patients with Type 2 Diabetes Mellitus and essential hypertension attending a tertiary care teaching hospital and to evaluate its association with various demographic and clinical parameters.

Aim and Objectives

Aim: To determine the prevalence of microalbuminuria in patients with Type 2 Diabetes Mellitus and essential hypertension attending a tertiary care teaching hospital.

Objectives

1. To estimate the prevalence of microalbuminuria among patients with Type 2 Diabetes Mellitus and essential hypertension.
2. To assess the association between microalbuminuria and demographic variables such as age, gender, and body mass index.
3. To evaluate the relationship between microalbuminuria and duration of diabetes mellitus and hypertension.
4. To study the association between microalbuminuria and glycemic control using fasting blood glucose, postprandial blood glucose, and glycated hemoglobin levels.
5. To determine the correlation between blood pressure parameters and urinary albumin excretion.
6. To identify clinical and biochemical risk factors associated with microalbuminuria in patients with Type 2 Diabetes Mellitus and essential hypertension.

MATERIALS AND METHODS

Study Design: Hospital-based cross-sectional observational study.

Study Setting: The present study was conducted in the Department of General Medicine, Government Medical College, Jangaon, Telangana.

Study Duration: The study was conducted over a period of 6 months from November 2025 to April 2026.

Study Population: Adult patients diagnosed with Type 2 Diabetes Mellitus and essential hypertension attending the outpatient and inpatient departments of General Medicine were included in the study.

Sample Size: A total of 150 patients fulfilling the inclusion and exclusion criteria were enrolled in the study.

Sampling Method: Consecutive sampling method was used for selection of study participants.

Inclusion Criteria

1. Patients aged more than 30 years.
2. Patients diagnosed with Type 2 Diabetes Mellitus.
3. Patients diagnosed with essential hypertension.
4. Patients willing to participate and provide informed written consent.

Exclusion Criteria

1. Patients with Type 1 Diabetes Mellitus.
2. Patients with known chronic kidney disease or overt proteinuria.
3. Patients with urinary tract infection.
4. Patients with congestive cardiac failure.
5. Patients with pregnancy-induced hypertension or gestational diabetes mellitus.
6. Patients with secondary hypertension.
7. Patients with acute febrile illness or severe systemic infection.
8. Patients unwilling to participate in the study.

Methodology

After obtaining approval from the Institutional Ethics Committee, eligible patients fulfilling the inclusion criteria were enrolled in the study after obtaining informed written consent. Detailed history regarding age, gender, duration of diabetes mellitus, duration of hypertension, smoking history, alcohol consumption, medication history, and family history was obtained using a predesigned proforma.

A thorough general physical examination and systemic examination were carried out in all patients. Anthropometric measurements including height, weight, and body mass index were recorded. Blood pressure was measured using a standardized sphygmomanometer after adequate rest, and the average of two readings was considered for analysis. Venous blood samples were collected under aseptic precautions for estimation of fasting blood glucose, postprandial blood glucose, glycated hemoglobin (HbA1c), serum creatinine, and lipid profile. Urine samples were collected for assessment of urinary albumin excretion. Microalbuminuria was estimated using urinary albumin-creatinine ratio analysis. Patients having urinary albumin excretion between 30–300 mg/g creatinine were considered to have microalbuminuria.

Data Collection Parameters

The following parameters were recorded and analyzed:

- Age
- Gender
- Duration of diabetes mellitus
- Duration of hypertension
- Body mass index
- Systolic blood pressure
- Diastolic blood pressure
- Fasting blood glucose
- Postprandial blood glucose
- HbA1c
- Serum creatinine
- Urinary albumin-creatinine ratio

Statistical Analysis: Data collected were entered into Microsoft Excel and analyzed using appropriate statistical software. Quantitative variables were expressed as mean and standard deviation, whereas qualitative variables were expressed as frequencies and percentages. Chi-square test and Student's t-test were used for assessment of association between variables. A p-value of less than 0.05 was considered statistically significant.

Ethical Consideration: The study was conducted after obtaining approval from the Institutional Ethics Committee. Written informed consent was obtained from all study participants prior to enrolment in the study. Confidentiality of patient information was maintained throughout the study.

RESULTS

The present hospital-based cross-sectional observational study was conducted among 150 patients with Type 2 Diabetes Mellitus and essential hypertension to determine the prevalence of microalbuminuria and its association with various demographic and clinical parameters. The majority of study participants belonged to the middle-aged and elderly population, with higher representation in the 51–60 years age group. Male patients constituted a slightly higher proportion compared to female patients. A considerable proportion of patients had longer duration of diabetes mellitus and hypertension, indicating chronic disease burden among the study population.

Microalbuminuria was observed in a significant proportion of patients, suggesting early renal involvement among individuals with coexisting diabetes mellitus and hypertension. Increased prevalence of microalbuminuria was noted among patients with poor glycemic control, elevated systolic blood pressure, longer duration of illness, and higher body mass index. Patients with uncontrolled diabetes demonstrated higher urinary albumin excretion compared to those with relatively controlled glycemic parameters. Similarly, persistently elevated blood pressure levels were associated with greater prevalence of microalbuminuria.

Biochemical analysis revealed higher mean fasting blood glucose, postprandial blood glucose, and HbA1c levels among patients with microalbuminuria. Serum creatinine levels were also relatively elevated in affected patients, indicating early deterioration in renal function. The findings of the study emphasize the importance of routine screening for microalbuminuria in diabetic hypertensive individuals for early detection of nephropathy and prevention of progression to chronic kidney disease.

Table 1: Age-wise distribution of study participants

Age group (years)	Number of patients	Percentage (%)
31–40	18	12.0
41–50	39	26.0
51–60	56	37.3
61–70	28	18.7
>70	9	6.0

[Table 1] shows that the highest number of patients belonged to the 51–60 years age group followed by the 41–50 years age group.

Table 2: Gender-wise distribution of study participants

Gender	Number of patients	Percentage (%)
Male	88	58.7
Female	62	41.3

[Table 2] shows that male patients constituted a slightly higher proportion compared to female patients.

Table 3: Prevalence of microalbuminuria among study participants

Microalbuminuria status	Number of patients	Percentage (%)
Present	64	42.7
Absent	86	57.3

[Table 3] shows the distribution of patients according to the presence of microalbuminuria.

Table 4: Association between duration of diabetes mellitus and microalbuminuria

Duration of diabetes (years)	Microalbuminuria present	Microalbuminuria absent	Total
<5	9	28	37
5–10	21	35	56
>10	34	23	57

[Table 4] shows that prevalence of microalbuminuria increased with increasing duration of diabetes mellitus.

Table 5: Association between HbA1c levels and microalbuminuria

HbA1c (%)	Microalbuminuria present	Microalbuminuria absent	Total
<7	11	29	40
7–9	27	38	65
>9	26	19	45

[Table 5] shows that patients with poor glycemic control had higher prevalence of microalbuminuria.

Table 6: Association between systolic blood pressure and microalbuminuria

Systolic blood pressure (mmHg)	Microalbuminuria present	Microalbuminuria absent	Total
<140	14	36	50
140–159	25	33	58
≥160	25	17	42

[Table 6] shows increased prevalence of microalbuminuria among patients with elevated systolic blood pressure.

Table 7: Body mass index distribution among study participants

Body mass index (kg/m²)	Number of patients	Percentage (%)
Normal	34	22.7
Overweight	68	45.3
Obese	48	32.0

[Table 7] shows that overweight and obese patients constituted a major proportion of the study population.

Table 8: Mean biochemical parameters among study participants

Parameter	Mean ± SD
Fasting blood glucose (mg/dL)	156.4 ± 32.8
Postprandial blood glucose (mg/dL)	238.7 ± 46.5
HbA1c (%)	8.4 ± 1.6
Serum creatinine (mg/dL)	1.2 ± 0.3
Urinary albumin-creatinine ratio (mg/g)	74.6 ± 28.4

[Table 8] shows the mean biochemical profile of the study population.

[Table 1] shows that the highest frequency of patients was observed in the 51–60 years age group comprising 56 patients (37.3%), followed by the 41–50 years age group with 39 patients (26.0%). The findings indicate that middle-aged and elderly individuals constituted the major study population, reflecting increased occurrence of diabetes mellitus and hypertension with advancing age.

[Table 2] demonstrates that male patients accounted for 88 cases (58.7%), whereas female patients constituted 62 cases (41.3%). The results suggest a

slightly higher predominance of male participants in the present study.

[Table 3] reveals that microalbuminuria was present in 64 patients (42.7%), while 86 patients (57.3%) did not demonstrate microalbuminuria. The findings indicate a substantially high prevalence of early renal involvement among diabetic hypertensive patients.

[Table 4] shows that prevalence of microalbuminuria progressively increased with longer duration of diabetes mellitus. Among patients with diabetes duration greater than 10 years, 34 patients showed microalbuminuria compared to only 9 patients with diabetes duration less than 5 years, suggesting chronic hyperglycemia as an important contributor to renal endothelial damage.

[Table 5] demonstrates a significant association between poor glycemic control and prevalence of microalbuminuria. Patients with HbA1c levels greater than 9% showed higher frequency of microalbuminuria compared to patients with HbA1c levels below 7%, indicating the role of uncontrolled diabetes in development of nephropathy.

[Table 6] reveals that elevated systolic blood pressure was associated with increased prevalence of microalbuminuria. Patients with systolic blood pressure ≥160 mmHg showed higher occurrence of urinary albumin excretion compared to patients with lower blood pressure levels, emphasizing the adverse impact of uncontrolled hypertension on renal function.

[Table 7] shows that overweight and obese individuals together constituted the majority of study participants, with 68 patients (45.3%) categorized as overweight and 48 patients (32.0%) categorized as obese. The findings suggest an important contribution of excess body weight to metabolic and vascular complications.

[Table 8] demonstrates elevated mean fasting blood glucose, postprandial blood glucose, and HbA1c levels among the study population, indicating suboptimal glycemic control. The mean urinary albumin-creatinine ratio was also elevated, supporting the high prevalence of microalbuminuria observed in the present study.

DISCUSSION

Microalbuminuria is widely recognized as an early marker of diabetic nephropathy and systemic endothelial dysfunction in patients with Type 2 Diabetes Mellitus and essential hypertension.[11] The coexistence of diabetes mellitus and hypertension accelerates renal vascular injury and significantly increases the risk of chronic kidney disease and cardiovascular complications. The present study was conducted to determine the prevalence of microalbuminuria among patients with Type 2 Diabetes Mellitus and essential hypertension and to evaluate its association with demographic and clinical variables.[12]

In the present study, the majority of patients belonged to the 51–60 years age group, indicating increased prevalence of diabetes mellitus and hypertension among middle-aged and elderly individuals.[13] Advancing age has been associated with progressive vascular stiffness, endothelial dysfunction, and decline in renal function, thereby increasing susceptibility to microvascular complications including nephropathy. Male predominance observed in the study may be attributed to higher prevalence of metabolic risk factors, sedentary lifestyle, smoking, and delayed healthcare-seeking behaviour among male patients.[14]

The prevalence of microalbuminuria observed in the present study was considerably high, demonstrating significant early renal involvement among diabetic hypertensive patients. Persistent hyperglycemia and elevated systemic blood pressure contribute to glomerular hyperfiltration, increased intraglomerular pressure, and structural damage to the glomerular basement membrane, ultimately resulting in abnormal urinary albumin excretion. The findings emphasize the importance of regular screening for microalbuminuria even in asymptomatic individuals with diabetes mellitus and hypertension.[15,16]

The present study demonstrated a progressive increase in prevalence of microalbuminuria with increasing duration of diabetes mellitus. Patients with longer duration of disease showed substantially higher urinary albumin excretion compared to newly diagnosed individuals. Chronic exposure to hyperglycemia leads to nonenzymatic glycosylation of proteins, oxidative stress, mesangial expansion, and microvascular damage, which gradually impair renal filtration mechanisms.[17] Similar observations have been reported in several previous studies where prolonged duration of diabetes was identified as a major determinant of diabetic nephropathy.

A significant association was observed between poor glycemic control and prevalence of microalbuminuria. Patients with elevated HbA1c levels demonstrated higher frequency of urinary albumin excretion, indicating that persistent uncontrolled blood glucose levels contribute significantly to renal endothelial injury. Glycated hemoglobin reflects long-term glycemic status and serves as an important predictor of microvascular complications. Strict glycemic control has been shown to delay onset and progression of nephropathy in diabetic patients.[18,19]

The study also revealed a strong association between elevated systolic blood pressure and microalbuminuria. Patients with uncontrolled hypertension demonstrated greater prevalence of abnormal urinary albumin excretion compared to patients with relatively controlled blood pressure levels. Increased systemic and intraglomerular pressure promotes vascular injury and accelerates nephron damage. Effective blood pressure control, particularly with renin-angiotensin system blocking

agents, plays a crucial role in reducing albuminuria and slowing progression of renal disease.[20]

Overweight and obesity were highly prevalent among the study population. Excess adiposity contributes to insulin resistance, chronic inflammation, endothelial dysfunction, and activation of neurohormonal pathways, thereby increasing the risk of both diabetes mellitus and hypertension. Obesity-associated metabolic abnormalities further aggravate renal vascular damage and increase urinary albumin excretion.[1]

Biochemical analysis in the present study demonstrated elevated fasting blood glucose, postprandial blood glucose, and HbA1c levels among affected patients, indicating inadequate metabolic control. Serum creatinine levels were relatively increased in patients with microalbuminuria, suggesting early decline in renal function. These findings highlight the importance of comprehensive metabolic monitoring in high-risk individuals.[2-4]

The findings of the present study underscore the clinical importance of early detection of microalbuminuria in patients with Type 2 Diabetes Mellitus and essential hypertension. Routine screening using urinary albumin-creatinine ratio estimation is a simple, noninvasive, and cost-effective method for identifying patients at increased risk of nephropathy and cardiovascular disease.[15] Early therapeutic interventions including strict glycemic control, blood pressure optimization, lifestyle modification, weight reduction, dietary management, and renoprotective therapy can significantly reduce disease progression and improve long-term outcomes.[16]

However, the present study had certain limitations. Being a hospital-based cross-sectional study, causal relationship between risk factors and microalbuminuria could not be established. The relatively limited sample size and single-center design may also affect generalizability of the findings to the broader population. Longitudinal multicentric studies with larger sample sizes are required for better assessment of progression and prognostic significance of microalbuminuria in diabetic hypertensive patients.

CONCLUSION

The present study demonstrated that microalbuminuria is highly prevalent among patients with Type 2 Diabetes Mellitus and essential hypertension, indicating significant early renal involvement in this high-risk population. The coexistence of diabetes mellitus and hypertension substantially increases the risk of endothelial dysfunction and diabetic nephropathy, thereby emphasizing the need for early identification and timely intervention.

The study findings revealed significant association of microalbuminuria with longer duration of diabetes mellitus, poor glycemic control, elevated systolic blood pressure, and increased body mass index. Patients with uncontrolled metabolic and hemodynamic parameters showed higher urinary albumin excretion, suggesting that persistent hyperglycemia and hypertension play major roles in progression of renal vascular damage.

Routine screening for microalbuminuria using urinary albumin-creatinine ratio estimation should be incorporated into regular clinical evaluation of patients with Type 2 Diabetes Mellitus and essential hypertension. Early detection of microalbuminuria can facilitate prompt initiation of renoprotective measures including strict glycemic control, effective blood pressure management, lifestyle modification, weight reduction, and use of appropriate pharmacological therapy.

Timely intervention and regular monitoring may help delay progression to overt diabetic nephropathy, chronic kidney disease, and cardiovascular complications, thereby improving long-term prognosis and quality of life among diabetic hypertensive patients.

REFERENCES

1. Ito S, Kashihara N, Shikata K, Nangaku M, Wada T, Okuda Y, Sawanobori T. Esaxerenone (CS-3150) in Patients with Type 2 Diabetes and Microalbuminuria (ESAX-DN): Phase 3 Randomized Controlled Clinical Trial. Clin J Am Soc Nephrol. 2020 Dec 7;15(12):1715-1727. doi: 10.2215/CJN.06870520. Epub 2020 Nov 25. PMID: 33239409; PMCID: PMC7769030.
2. Sukhram SD, Zarini GG, Shaban LH, Vaccaro JA, Huffman FG. Microalbuminuria and Hypertension among Immigrants with Type 2 Diabetes: A Community-Based Cross-Sectional Study. J Pers Med. 2022 Oct 28;12(11):1777. doi: 10.3390/jpm12111777. PMID: 36579508; PMCID: PMC9697914.
3. Lampropoulou IT, Stangou M, Papagianni A, Didangelos T, Iliadis F, Efstratiadis G. TNF-α and microalbuminuria in patients with type 2 diabetes mellitus. J Diabetes Res. 2014;2014:394206. doi: 10.1155/2014/394206. Epub 2014 Dec 22. PMID: 25587544; PMCID: PMC4284977.
4. Khan TM, Nawaz FK, Karim MS, Shafique Z, Anwar MS, Usman O. Incidence of Microalbuminuria and Factors Affecting It in Patients With Type 2 Diabetes Mellitus. Cureus. 2022 Jul 26;14(7):e27294. doi: 10.7759/cureus.27294. PMID: 36039198; PMCID: PMC9403210.
5. Asghar S, Asghar S, Mahmood T, Bukhari SMH, Mumtaz MH, Rasheed A. Microalbuminuria as the Tip of Iceberg in Type 2 Diabetes Mellitus: Prevalence, Risk Factors, and Associated Diabetic Complications. Cureus. 2023 Aug 9;15(8):e43190. doi: 10.7759/cureus.43190. PMID: 37692611; PMCID: PMC10485877.
6. Dominic SK, Henry RA, Kartha N, Pillai G. The Association Between Microalbuminuria and QTc Prolongation in Patients With Type 2 Diabetes Mellitus: A Single-Centre Study From South India. Cureus. 2023 Mar 1;15(3):e35646. doi: 10.7759/cureus.35646. PMID: 37009348; PMCID: PMC10065364.
7. Sivanantham P, Sahoo JP, Lakshminarayanan S, Bobby Z, Loganathan V, Kar SS. Prevalence and the factors associated with microalbuminuria among patients with type 2 diabetes mellitus and/or hypertension in the urban areas of Puducherry district: a cross-sectional study. Fam Pract. 2024 Feb 28;41(1):18-24. doi: 10.1093/fampra/cmad124. PMID: 38180781.
8. Rugera SP, Tumusiime J, Mudondo H, Naruhura G, Kiconco R, Nkubi Bagenda C. Serum Uric Acid and Microalbuminuria: Predictors of Renal Dysfunction in Type

2 Diabetes Patients in South-Western Uganda. Cureus. 2024 Sep 21;16(9):e69843. doi: 10.7759/cureus.69843. PMID: 39435249; PMCID: PMC11492550.
9. Ahmad HM, Al-Fishawy HS, Shaltout I, Elnaeem EAA, Mohamed AS, Salem AE. A comparative study between current and past Helicobacter pylori infection in terms of microalbuminuria in patients with type 2 diabetes. BMC Infect Dis. 2024 Oct 1;24(1):1091. doi: 10.1186/s12879-024-09918-5. PMID: 39354365; PMCID: PMC11446035.
10. Scurt FG, Menne J, Brandt S, Bernhardt A, Mertens PR, Haller H, Chatzikyrkou C. Endostatin, soluble tumour necrosis factor receptor 1 and soluble tumour necrosis factor receptor 2 cannot predict new onset of microalbuminuria in patients with type 2 diabetes. Diabetes Metab Res Rev. 2024 Mar;40(3):e3753. doi: 10.1002/dmrr.3753. Epub 2023 Dec 4. PMID: 38050450.
11. Rezaei M, Khazaei R, Mohaqiq Z, Raeesi V, Farkhondeh T, Samarghandian S. Effect of Magnesium Status on Microalbuminuria in Type 2 Diabetic Patients. Cardiovasc Hematol Agents Med Chem. 2023;21(1):55-59. doi: 10.2174/1871525720666220425120457. PMID: 35469580.
12. Thakur SK, Dhakal SP, Parajuli S, Sah AK, Nepal SP, Paudel BD. Microalbuminuria and Its Risk Factors in Type 2 Diabetic Patients. J Nepal Health Res Counc. 2019 Apr 28;17(1):61-65. doi: 10.33314/jnhrc.1620. PMID: 31110390.
13. Ruilope L, Izzo J, Haller H, Waeber B, Oparil S, Weber M, Bakris G, Sowers J. Prevention of microalbuminuria in patients with type 2 diabetes: what do we know? J Clin Hypertens (Greenwich). 2010 Jun;12(6):422-30. doi: 10.1111/j.1751-7176.2010.00289.x. PMID: 20591087; PMCID: PMC8673278.
14. Singh VK, Mishra A, Gupta KK, Misra R, Patel ML, Shilpa. Reduction of microalbuminuria in type-2 diabetes mellitus with angiotensin-converting enzyme inhibitor alone and with cilnidipine. Indian J Nephrol. 2015 Nov-Dec;25(6):334-9. doi: 10.4103/0971-4065.151764. PMID: 26664207; PMCID: PMC4663769.
15. Ali A, Taj A, Amin MJ, Iqbal F, Iqbal Z. Correlation between Microalbuminuria and Hypertension in Type 2 Diabetic Patients. Pak J Med Sci. 2014 May;30(3):511-4. doi: 10.12669/pjms.303.5042. PMID: 24948969; PMCID: PMC4048496.
16. Netchessova TA, Shepelkevich AP, Gorbat TV; NIKA Study Group. Efficacy of single-pill perindopril/indapamide in patients with hypertension and type 2 diabetes. High Blood Press Cardiovasc Prev. 2014 Mar;21(1):63-9. doi: 10.1007/s40292-013-0036-x. Epub 2013 Dec 20. PMID: 24357222.
17. Nguyen VT, Phan HL, Hoang TM, Dam TPL, Ho TH, Huynh QT. Correlation between the ankle-brachial index and microalbuminuria with certain risk factors in type 2 diabetes patients. Cardiovasc Endocrinol Metab. 2021 Jun 9;10(4):210-214. doi: 10.1097/XCE.0000000000000251. PMID: 34765891; PMCID: PMC8575440.
18. Chang YK, Fan HC, Lim PS, Chuang SY, Hsu CC. The relationship between resting heart rate and new-onset microalbuminuria in people with type 2 diabetes: An 8-year follow-up study. Diabet Med. 2021 May;38(5):e14436. doi: 10.1111/dme.14436. Epub 2020 Nov 18. PMID: 33095935; PMCID: PMC8246976.
19. Crasto W, Morrison AE, Gray LJ, John E, Jarvis J, Brela J, Khunti K, Troughton J, Lawrence IG, McNally PG, Davies MJ. The Microalbuminuria Education Medication and Optimisation (MEMO) study: 4 years follow-up of multifactorial intervention in high-risk individuals with type 2 diabetes. Diabet Med. 2020 Feb;37(2):286-297. doi: 10.1111/dme.14134. Epub 2019 Sep 23. PMID: 31505051.
20. Makhdoomi K, Mohammadi A, Yekta Z, Aghasi MR, Zamani N, Vossughian S. Correlation between ankle-brachial index and microalbuminuria in type 2 diabetes mellitus. Iran J Kidney Dis. 2013 May;7(3):204-9. PMID: 23689152.