

# Prevalence and Correlation of Masked Hypertension with Microalbuminuria in Type 2 Diabetes Mellitus

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**Abstract:** *Early detection of microvascular and macrovascular complications in diabetes is crucial for timely intervention. This study investigated the prevalence of masked hypertension in normotensive Type 2 Diabetes Mellitus patients and assessed its correlation with microalbuminuria, an early indicator of diabetic nephropathy. Among 84 participants, 22.6% exhibited masked hypertension, and 27.4% had microalbuminuria. A significant correlation was observed between masked hypertension and increased prevalence of microalbuminuria ( $p = 0.026$ ). These findings highlight the importance of routine screening for masked hypertension and microalbuminuria in diabetic patients to mitigate the risk of kidney complications.*

**Keywords:** Masked hypertension, microalbuminuria, Type 2 Diabetes Mellitus, diabetic nephropathy, ambulatory blood pressure monitoring

## 1. Introduction

Diabetes Mellitus is a metabolic disorder associated with elevated Blood Glucose level. It is the most common Non-communicable Disease. Diabetes Mellitus leads to various acute and chronic complications. Hypertension and diabetes frequently coexist. Among Type 2 diabetics 40-50% have hypertension compared to 20% of matched non-diabetic patients.

Masked hypertension is defined by normal blood pressure levels on clinic BP (CBP) (<140/90 mm Hg) and elevated blood pressure levels at 24-hour Ambulatory BP Monitoring [1]. The prevalence of masked hypertension in Diabetic patients was found to be higher than in general population, in about 30% [2]. Patients with masked hypertension were found to have changes in the blood vessels and the left ventricle similar to that found in overt hypertensives, but in milder form [3], [4].

This study was to calculate the prevalence of masked hypertension in normotensive Type 2 Diabetes Mellitus patients, and its relation to microalbuminuria, which is an indicator of early stages of Diabetic nephropathy.

## 2. Aims and Objectives

The aims and objectives of the present study are as follows:

- 1) To determine the prevalence of Masked hypertension in patients with Type 2 Diabetes Mellitus
- 2) To assess the correlation between Masked hypertension and microalbuminuria in Type 2 Diabetes Mellitus

## 3. Materials and Methods

The study was conducted in the Dept of Cardiology, Daya general hospital and surgical speciality centre, Thrissur, between January 2022 and December 2022.

Sample size (n) for the study was calculated by the formula for single proportion

$$n = 4p(100-p)/e^2$$

p = Prevalence of diabetic patients. It was estimated to be about 4.0% [5].

e = Standard error = 5%

Applying the above formula, the value of 'n' we get is 62. A minimum of 62 patients was required for a statistically significant study.

### 3.1 Inclusion Criteria

- 1) Patients with Type 2 Diabetes Mellitus
- 2) BP at clinic evaluation (CBP) <140/90mmHg on at least two occasions

### 3.2 Exclusion Criteria

- 1) Patients with Serum creatinine level more than 1.4 mg/dl
- 2) Patients on anti-hypertensive medication for indications other than hypertension (alpha adrenergic blocker for prostatic enlargement, angiotensin converting enzyme (ACE) inhibitor for Congestive Heart Failure etc.)
- 3) Recent Urinary tract infection
- 4) Patients with self-identified substance abuse
- 5) Patients with Atrial Fibrillation or Congestive Heart Failure
- 6) Pregnant women
- 7) Patients not willing to participate

### 3.3 Study Variables

Patient demographics were noted. Patients had their clinic BP, 24 hour ambulatory BP and 24 hour urine Albumin measured. Patients were classified into normo albuminuric (<30mg/day), microalbuminuric (30-299mg/day) and macroalbuminuric (>300mg/day).

## 4. Results

The study included 84 patients with type 2 diabetes mellitus attending the OP Clinic and those patients admitted in the wards of the hospital. Age of the patients ranged from 38 years to 69 years. Mean age was  $50.36 \pm 7.98$  years. The majority of patients were females (52.4%).

**Table 1:** Age and gender distribution

Age in years	Gender		Total
	Female	Male	
<40	4	2	6
40-50	18	19	37
51-60	17	11	28
61-70	5	8	13
Total	44	40	84

Microalbuminuria was detected in 23 patients (27.4%). 12 of them were males and 11 were females. None of the patients had macroalbuminuria.

**Table 2:** Microalbuminuria distribution

24hr U. Albumin	Gender		Total
	Female	Male	
Normal	33	28	61
Microalbuminuria	11	12	23
Total	44	40	84

Masked hypertension was detected in 19 patients (22.6%) of the study population.

**Table 3:** Masked hypertension distribution

Masked Hypertension	Gender		Total
	Female	Male	
No	35	30	65
Yes	9	10	19
Total	44	40	84

Masked hypertension was compared with the 24 hour Urine albumin. 11.5% of patients of diabetes without masked hypertension was found to have microalbuminuria. However the presence of masked hypertension in diabetic patients increased the prevalence of microalbuminuria in these patients (47.4%). The relation was found to be significant ( $p=0.026$ ).

**Table 4:** Distribution masked hypertension in patients with diabetes mellitus based on 24hr Urine albumin

Masked Hypertension	24hr U. Albumin		Total
	Microalbuminuria	Microalbuminuria	
No	14	14	65
Yes	9	9	19
Total	61	23	84

## 5. Discussion

Our study aimed to determine the prevalence of masked hypertension in patients of diabetes mellitus. The prevalence of masked hypertension in general population with normotension was shown to range 9-12% in a large scale study conducted in Milan, Italy in 2001 [3]. Another study in children and young adults till the age of 25 years showed a prevalence of 11% with boys being more involved (19%) [5].

A study by Eguchi K in 2011 showed that masked hypertension was present in as much as 46.9% of the normotensive diabetics [7]. A similar value has been shown in the study conducted by Takeno K et al in 2012 in which masked hypertension was present in 47.5% of the diabetics [8]. In 2007 Leitao CB et al reported the prevalence of masked hypertension in diabetics to be 30% [2]. Similar values have been shown in the studies by Gang L et al (30.6%) and Akhili et al (28.2%) [9][10].

Our study revealed the prevalence of masked hypertension in the diabetic patients to be about 22.6%. It is in concordance with most of the other studies. Also it is found to be two times the prevalence seen in the general population, indicating the diabetic patients to be at higher risk of developing masked hypertension.

In normotensive patients the presence of microalbuminuria in diabetic patients is an early indicator for development of diabetic nephropathy. In a study on type 2 diabetes mellitus patients conducted by Wijkman et al microalbuminuria was reported in 10% of the subjects [11]. The study conducted by Alsuwaida A et al in 27 diabetic patients also revealed a higher proportion of microalbuminuria (35%) [12]. Our study on 84 diabetic normotensives revealed microalbuminuria in 23 patients (27.4%) of the study population. This shows that even many diabetic patients can be screened earlier with urine microalbumin for development of diabetic kidney disease and implement measures.

Masked hypertension was compared to the presence of microalbuminuria in the diabetic population under study. As reported in results, microalbuminuria was present in only 21.5% of diabetic patients without masked hypertension. Whereas microalbuminuria was present in 47.4% of diabetic patients with masked hypertension. This difference in microalbuminuria between the groups of patients with and without masked hypertension was statistically significant ( $p = 0.026$ ). A similar study conducted by CM Ng et al in 2008 reported significant correlation between microalbuminuria and masked hypertension in diabetes [13]. Similar finding of correlation between masked hypertension and microalbuminuria had been reported in various other studies [2][7][11][14]. This finding suggests that masked hypertension may be a significant factor contributing to early diabetic kidney disease. In addition to Urine microalbumin, 24 hour ambulatory BP should be conducted routinely in normotensive diabetics to assess the risk of development of diabetic kidney disease.

## 6. Conclusion

The study identified a significant prevalence of masked hypertension (22.6%) among Type 2 diabetes patients and established its correlation with microalbuminuria. These findings emphasize the need for regular screening of masked hypertension and microalbuminuria to prevent early diabetic nephropathy.

## References

- [1] Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL, et al. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: The JNC 7 Report. *JAMA* 2003;289(19):2560-71.
- [2] Leitao CB, Canani LH, Kramer CK, Boza JC, Pinotti AF, Gross JL. Masked hypertension, urinary albumin excretion rate, and echocardiographic parameters in putatively normotensive type 2 diabetic patients. *Diabetes Care* 2007;30(5):1255-60.
- [3] Sega R, Trocino G, Lanzarotti A, Carugo S, Cesana G, Schiavina R, et al. Alterations of cardiac structure in patients with isolated office, ambulatory, or home hypertension: data from the general population (Pressione Arteriose-Monitorate E Loro Associazioni [PAMELA] Study). *Circulation* 2001;104(1):1385-92.
- [4] Liu JE, Roman MJ, Pini R, Schwartz JE, Pickering TG, Devereux RB. Cardiac and arterial target organ damage in adults with elevated ambulatory and normal office blood pressure. *Ann Intern Med* 1999;131(8):564-72.
- [5] Singh TP, Singh AD, Singh TB. Prevalence of diabetes mellitus in Manipur. In: Shah SK, editor. *Diabetes update*, Guwahati, India: North Eastern Diabetic Society; 2001.p.13-19.
- [6] Matsuoka S, Awazu M. Masked hypertension in children and young adults. *Pediatr Nephrol* 2004;19(6):651-54.
- [7] Eguchi K. Ambulatory blood pressure monitoring in diabetes and obesity – a review. *Int J Hypertens* 2011; 2011: 954-57.
- [8] Takeno K, Tomoya Mita T, Nakayama S, Goto H, Komiya K, Abe H et al. Masked Hypertension, Endothelial Dysfunction, and Arterial Stiffness in Type 2 Diabetes Mellitus: A Pilot Study. *Am J Hypertens* 2012;25(2):165-70.
- [9] Gang L, Jian-hong T, Jia-di L. The recessive hypertension in normotensive type 2 diabetic patients and its effects on the microalbuminuria. *Medical journal of west China* 2008;20(5):996-997.
- [10] Akilli H, Kayrak M, Aribas A, Tekinalp M, Ayhan SS, Gündüz M, et al. The relationship between exercise capacity and masked hypertension in sedentary patients with diabetes mellitus. *Clin Exp Hypertens* 2013;14(5):47-53.
- [11] Wijkman M, Länne T, Engvall J, Lindström T, Ostgren CJ, Nystrom FH. Masked nocturnal hypertension--a novel marker of risk in type 2 diabetes. *Diabetologia* 2009;52(7):1258-64.
- [12] Alsuwaida A, Parkers R, So J, Feig D, Logan A. High Prevalence of Masked Hypertension in Treated Hypertensive Patients with Type 2 Diabetes Mellitus. *Saudi J Kidney Dis Transplant* 2006;17(3):326-37.
- [13] Ng CM, Yiu SF, Choi KL, Choi CH, Ng YW, Tiu SC. Prevalence and significance of white-coat hypertension and masked hypertension in type 2 diabetics. *Hong Kong Med J* 2008;14(6):437-43.
- [14] Moran A, Palmas W, Pickering TG, Schwartz JE, Field L, Weinstock RS, et al. Office and ambulatory blood pressure are independently associated with albuminuria in older subjects with type 2 diabetes. *Hypertension* 2006;47(5):955-61.