Assessing Microalbuminuria as a Key to Diabetic Kidney Health: Review Article Ayat Khalaf Ahmed*

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ABSTRACT

Background: Microalbuminuria is prevalent in diabetic patients and is a significant early sign of diabetic nephropathy. It also predicts cardiovascular and renal problems. Prevalence rates are significantly correlated with some factors like duration of diabetes mellitus, glycemic control and body mass index (BMI). The prevalence, risk factors, significance and assessment of microalbuminuria in diabetic patients are covered in detail in this article.

Objective: This review aimed to provide a comprehensive understanding of microalbuminuria in diabetic care, emphasizing its role in enhancing patient prognosis and guiding clinical practice.

Methods: This review article on microalbuminuria in diabetic patients utilized a comprehensive literature search to gather relevant studies. Databases such as PubMed, Google Scholar, and Scopus were employed for Microalbuminuria, Diabetes mellitus and Nephropathy to identify peer-reviewed articles, clinical trials, and meta-analyses. However, only the most recent or comprehensive studies from 2010 to 2024 were included. Documents in languages other than English were disqualified due to lack of translation-related sources. Papers such as unpublished manuscripts, oral presentations, conference abstracts, and dissertations that were not part of larger scientific studies were excluded.

Conclusion: Addressing microalbuminuria should be an integral part of diabetes care, ultimately improving patient outcomes and quality of life.

Keywords: Microalbuminuria, Diabetes, Nephropathy.

INTRODUCTION

Plasma oncotic pressure is maintained by albumin, which is produced by the liver whose levels are controlled by interstitial colloidal pressure. Albumin is prevented from passing through the nephron by barriers such as the glomerular capillary wall which is negatively charged and tiny pores in the glomerular basement membrane (GBM). In the proximal convoluted tubule, the megalin-cubulin complex also breaks down albumin in order to preserve amino acids. Urine that contains albumin may be the result of GBM dysfunction ⁽¹⁾.

One of the dreaded complications of diabetes that can result in chronic kidney disease and end-stage renal failure is diabetic nephropathy. The most sensitive indicator for early detection of diabetic nephropathy is microalbuminuria. With varied reported prevalence rates, microalbuminuria is a crucial sign of this illness, highlighting the need for early detection and treatment ⁽²⁾. In order to prevent the eventuality of diabetic nephropathy, routine screening for albuminuria is crucial to diabetes care ⁽³⁾. So as to effectively prevent and manage diabetic nephropathy and ultimately alleviate the burden of microalbuminuria in this population, it is imperative to understand its epidemiology ⁽⁴⁾.

Prevalence of microalbuminuria

Patients with diabetes who had the disease for longer duration and have poorer glycemic control are more likely to have higher rates of microalbuminuria. A systematic review in Africa established that overall prevalence of 37.1% among all diabetic patients with 35.3% in type 1 and 40.2% in type 2 diabetes ⁽²⁾. A crosssectional study that was conducted in Pakistan revealed

that 30.4% of individuals with type II diabetes had microalbuminuria (3) The prevalence of microalbuminuria among Palestinians with type 2 diabetes was 29.3% ⁽⁵⁾. According to Sana et al. ⁽⁶⁾, in patients with type 2 diabetes, the prevalence of diabetic nephropathy was 30.1% and microalbuminuria was present in 25.6% of cases and 4.5% had macroalbuminuria. As reported by Ahmad et al. (7), 31.56% of diabetic patients had microalbuminuria. The prevalence of microalbuminuria as stated by Muhammad et al. ⁽⁸⁾ was 32.9%. Furthermore, study by Waheed et al. ⁽⁹⁾ found that 33% of people with type 2 diabetes had microalbuminuria. The prevalence of microalbuminuria among diabetic patients was 29.72%, according to a Bangladeshi study ⁽¹⁰⁾.

As reported by **Kanakamani** *et al.* ⁽¹¹⁾ microalbuminuria was present in 25.5% of type 2 diabetics in North India & **Thakur** *et al.* ⁽¹²⁾ found that microalbuminuria existed in 20% of diabetic patients from Nepal.

Significance of microalbuminuria

The initial clinical manifestation of diabetic nephropathy, often preceding more severe proteinuria and renal dysfunction, is microalbuminuria. Its identification enables prompt actions to stop the progression of end stage renal disease (ESRD) ⁽¹³⁾. In patients with diabetes mellitus, microalbuminuria is also an early indicator of cardiovascular disease, which is linked to an increased risk of heart failure and other problems as well as a higher all-cause mortality rate ⁽¹⁴⁾. Microalbuminuria is correlated with decreased cardiac function and a

decreased capacity to perform physical activity in diabetic patients with chronic heart failure ⁽¹⁵⁾.

Risk factors for microalbuminuria

Microalbuminuria in both type 1 and type 2 diabetes is highly correlated with poor glycemic control. Elevated fasting blood sugar and HbA1c levels are suggesting that insufficient blood sugar control raises risk ^(16, 17).

The longer diabetes has been present, particularly after more than ten years of illness, the higher the risk of microalbuminuria ^(17, 18). In diabetic patients, elevated systolic blood pressure is a considerable independent risk factor for microalbuminuria⁽¹⁶⁾.

An increased risk of microalbuminuria is associated with dyslipidemia i.e. elevated levels of total cholesterol, LDL, triglycerides, and low HDL ⁽¹⁹⁾. Obesity and higher body mass index (BMI) is linked to higher incidence of microalbuminuria ⁽²⁰⁾. Research indicates that microalbuminuria is more common in women and patients with both diabetes and hypertension ⁽²¹⁾.

Assessment of microalbuminuria

The American Diabetic Association (ADA) recommends patients with diabetes to have a microalbuminuria screening once a year in order to detect diabetic nephropathy early. Urinary albumin excretion was previously measured using а 24-hour urine collection. To screen for microalbuminuria, a spot morning urine sample for the urinary albumin: creatinine ratio (UACR) is now utilized. It is practical and closely matches the results of 24-hour collection in adults ⁽²²⁾.

A urinary albumin excretion rate (UAE) of 30-300 mg/24hours is considered microalbuminuria. Alternatively, it may be defined as 20-200 mcg/min on two of three urine collections or 30-300 mcg/mg creatinine⁽¹⁶⁾. Other variables, such as gender, race, blood pressure, time of day, muscle mass and the quantity of food, drink salt consumed can have an impact on the level of UACR. Thus, UACR might fluctuate by up to 40% every day. Aside from individual variability, one should be aware that certain cases such as those involving males, African Americans, Asians, smokers, those with greater muscle mass, and patients with urinary tract infections have a raised UACR at baselines. Three UACR measurements spaced one month apart are recommended for the reason to the significant variation ⁽²³⁾.

Treatment of microalbuminuria

The primary objective for patients with diabetes is to attain glycemic control. Patients with microalbuminuria have a number treatment options.

Due to their reno-protective effect of reducing mesangial expansion and preventing the onset of glomerulosclerosis, ACE inhibitors and ARBs are regarded as helpful drugs in diabetic individuals with

(24) even those who do not have hypertension Mineralocorticoid receptor antagonists (MRAs) have demonstrated efficacy in the treatment of proteinuria and the enhancement of renal function. Mineralocorticoid receptor antagonists, such as spironolactone or eplerenone, can be used to further decrease proteinuria in individuals with chronic renal disease if treatment with an ARB or ACE inhibitor is insufficient. MRAs, however, are linked to a higher risk of hyperkalemia. A novel nonsteroidal MRA called finerenone decreased proteinuria with lowering hyperkalemia rates ⁽²⁵⁾.

The effectiveness of sodium-glucose cotransporter 2 (SGLT2) inhibitors in lowering albuminuria has been demonstrated by recent research. They have become more effectively prescribed for managing diabetes mellitus as well as preventing the onset or exacerbation of albuminuria ⁽²⁶⁾. According to a meta-analysis combination treatment with SGLT2 inhibitors and other hypoglycemic medications reduces albuminuria ⁽²⁷⁾.

CONCLUSION

Microalbuminuria serves as a critical marker for early renal impairment in diabetic patients, highlighting the need for vigilant monitoring and management. Its presence not only indicates an increased risk for progressive kidney disease but also correlates with cardiovascular complications, highlighting its significance in the holistic management of diabetes. Early detection through routine screening can facilitate timely interventions, such as lifestyle modifications and pharmacological treatments, which are essential in preventing the deterioration of renal function and associated comorbidities. Future research should focus on refining screening protocols and exploring novel therapeutic approaches to mitigate the impact of microalbuminuria in this vulnerable population.

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