Journal of the
Bahrain Medical Society

Alkaabi, J Bahrain Med Soc. 2024;36(4):1-12

ORIGINAL ARTICLE

Screening And Management of Renal Impairment In Adults With Type 2 Diabetes Mellitus In Primary Health Care Of Royal Medical Services: A Clinical Audit

Dr. H. H. Alkaabi

M.D, Arab board of family medicine, Irish board of family medicine, Consultant of family medicine in primary care of Royal Medical Service; E-Mail: drhessaalkaabi@gmail.com

Received date: June 28, 2024; **Accepted date:** November 12, 2024; **Published date:** December 31, 2024

Abstract

Background: This study evaluates screening and management of renal impairment in adults with type 2 diabetes at the Royal Medical Services in Bahrain. Type 2 diabetes is a significant risk factor for chronic kidney disease, underscoring the importance of early identification and proper management in primary healthcare.

Methods: This retrospective study analyzed data from primary healthcare clinics' electronic medical records of 292 patients with type 2 diabetes. The study included 160 males (54.8%) and 132 females (45.2%), ranging from 32 to 94 years old. It focused on sociodemographic details, diabetic history, albuminuria screening, eGFR, and medication management for those with renal impairment.

Results: Among 292 patients, 57.9% had detectable albumin creatinine levels. In the albuminuria group, 31.5% were morbidly obese, while 27.3% were moderately obese. For patients with albuminuria, 39% had good HbA1c control (<7%), with a mean HbA1c of 7.5 ± 1.4. Both groups had a high prevalence of stage 2 hypertension cases. 9.4% of the albuminuria group were referred to nephrology for evaluation. Re-testing rates were 85.8% for albuminuria patients and 87.7% for non-albuminuria patients.

Discussion: Addressing compliance issues with regular urinary monitoring is crucial to improving diabetic kidney disease screening. The study underscores connections between albuminuria, obesity, and glycemic control, emphasizing the necessity for more research on renal risk factors for CKD progression. Results show good screening rates for T2DM complications in primary care, with a considerable number of patients having undetected renal issues. Implementing evidence-based strategies and guideline-driven assessments can enhance early T2DM detection and optimize diabetic kidney disorder management in this population.

Conclusion: The study on screening and managing diabetic kidney disease (DKD) in adults with type 2 diabetes. It focuses on early detection, high-risk populations, and intervention to prevent DKD progression. The study emphasizes the role of primary care physicians in identifying and managing DKD in type 2 diabetes patients to ensure effective care and prevent disease advancement.

Keywords: Chronic kidney disease, Type 2 diabetes mellitus, Albumin creatinine levels

Introduction

Diabetes is a major health issue in Bahrain, causing a significant number of deaths, with 276,000 attributed to the disease. It is the leading cause of chronic kidney disease (CKD) requiring renal replacement therapy.[1] About 40% of people with

type 2 diabetes need CKD care. Early screening for CKD is vital, with primary care providers playing a key role in disease management and collaboration with healthcare professionals.

The population at risk of renal impairment from type 2 diabetes often misses crucial diagnostic assessments that could intervene early to halt disease progression. Identifying these individuals is vital for health promotion, risk assessment, and tailored follow-up care based on current guidelines. Regrettably, current data in Bahrain predominantly concentrate on end-stage disease and CKD management in tertiary or specialized care settings.

Data from the International Diabetes Federation (IDF) indicates that roughly 537 million adults worldwide have diabetes, affecting about one in ten adults. Projections anticipate this number to rise to 643 million by 2030 and 783 million by 2045.[1]

Diabetes carries various complications leading to significant morbidity and mortality, categorized into microvascular (neuropathy, nephropathy, retinopathy) and macrovascular (cardiovascular disease, stroke, peripheral artery disease) complications.[2] Primary care physicians handle a large volume of diabetic patients, tasked with adhering to international guidelines for effective management and complication screening.[3]

Internationally, Diabetes Mellitus (DM) is the primary cause of chronic kidney disease (CKD) and End-Stage Renal Disease, with the IDF reporting a 40% risk of diabetic patients developing end-stage renal failure. In Bahrain, microalbuminuria (MA) prevalence among Type 2 diabetic patients is 22%, and macroalbuminuria stands at 5.8%.[4] A retrospective study across 6 health centers involving 2,125 diabetic patients revealed that 16.3% suffered from CKD stages 3, 4, and 5.[5]

A literature review of the available data across Gulf Cooperative Council countries showed that at Al-Sabah Hospital in Kuwait, 43.5% of Type 2 diabetic patients exhibited proteinuria, with 27.3% having MA and 16.2% showing macroalbuminuria. In the Al-Ain district of the UAE, 61.2% of individuals with diabetes had MA. In Oman, the prevalence of MA among Type 2 diabetic patients at Sultan Qaboos University Hospital's clinic was 27%, with a 42% prevalence of diabetic nephropathy (DN).[5]

In Saudi Arabia, studies have shown that 45.6% of Type 2 diabetic patients at King Abdul-Aziz University Hospital had microalbuminuria (MA), and 54.3% in Abha City exhibited proteinuria. A cross-sectional study involving 54,670 Saudi Type 2 diabetic patients reported a diabetic nephropathy (DN) prevalence of 10.8%, with 1.2% having MA, 8.1% having macroalbuminuria, and 1.5% having end-stage renal disease (ESRD).[5]

Diabetes and hypertension, either individually or combined, account for about 80% of end-stage kidney failure.[6] Risk factors for diabetic nephropathy include modifiable factors like hypertension, glycemic control, dyslipidemia, metabolic syndrome, cardiovascular disease, lifestyle habits, obesity, and non-modifiable factors like race, age, genetics, and family history.[5,6]

KDIGO guidelines advise screening for diabetic nephropathy using the Albumin-to-Creatinine Ratio (ACR) and estimated Glomerular Filtration Rate (eGFR) at diagnosis and annually thereafter if normal or as needed.[5,7] The progression of diabetic nephropathy begins with albuminuria, advancing from micro to macroalbuminuria. Microalbuminuria serves as an early DN marker and a predictor for cardiovascular disease, with early detection crucial for reducing morbidity and mortality.[4]

Diabetic nephropathy is more common in certain ethnic groups.[8] The American Diabetes Association recommends screening type 2 diabetes at diagnosis via a spot urine sample for albumin, as it is accurate and convenient compared to cumbersome and error-prone 24-hour or timed urine collections. Spot urine collections for albumin measurements can be expressed as urinary albumin concentration (mg/l) or albumin-to-creatinine ratio (mg/g or mg/mmol). Despite potential sample dilution/concentration effects, this method remains accurate and cost-effective. A threshold of 17 mg/l in random urine samples shows high sensitivity (100%) and good specificity (80%) for diagnosing microalbuminuria, aligning with the European recommendation of 20 mg/l.

To validate abnormal results, it's advised to analyze at least two out of three samples collected over 3-6 months due to urinary albumin excretion fluctuations. Screening should exclude conditions elevating albumin excretion like infections, hematuria, hyperglycemia, and vigorous exercise. Proper sample storage is crucial, allowing refrigeration for same or next-day use and a single freeze before testing.

This study assesses screening and management practices for renal issues in adults with type 2 diabetes at primary healthcare centers in the Royal Medical Services, Bahrain. It aims to establish a baseline compliance rate for CKD screening, diagnosis, and prevention, focusing on referral criteria to nephrology clinics. The study evaluates screening implementation for diabetic nephropathy at a military hospital's diabetic clinic, emphasizing timely retesting, appropriate nephrology referrals, and control of modifiable risk factors.

Methodology

The setting of the study was the primary healthcare clinic in the Bahrain Defence Hospital under the Royal Medical Service, Bahrain. The targeted population entailed all registered diabetic patients in the primary care diabetic clinic in Bahrain Defense Force Hospital during the audit period -from 8 May to 31 June 2023. Thus, in furtherance to applying the inclusion and exclusion criteria for sampling, diabetic patients who were registered in the primary care diabetic clinic in Bahrain Defense Force Hospital during the audit period, from May 2023 to June 2023, formed the sample of the study. The sample size was calculated using the sample size calculator. The total number of diabetic patients in 2022 was 2123 patients and the size of the sample was 326 estimated to give a 95% chance of being within 5% of the true result. This number represented all diabetic patients who were registered in May and June and those who repeated the appointment whereas the patients who canceled or missed the appointment were excluded. Thus, the total number of patients in the sample was set to 292.

This study is a retrospective chart review that collected data from an electronic medical record database of patients with type 2 diabetes who were successfully reviewed in primary healthcare clinics. As stated, all patients who were registered in the clinic for the 2-month audit period were included (exclusion criteria); only the patients who repeated or missed their visits post-registration were excluded (inclusion criteria). The patient population consisted of 160 males (54.8%) and 132 females (45.2%), aged between 32 and 94 years. Data was collected through consented accessibility to the medical records' electronic database of these registered patients. Data about sociodemographic, diabetic history, screening for albuminuria and estimated goal, glomerular filtration rate, (eGFR), and medication management for respective populations with renal impairment were collected and collated. A high degree of confidentiality in terms of patient identity was maintained.

The checklist, using an Excel document, was formulated concerning a study conducted in Bahrain, 5 However, due to the smaller size of our study sample, we were unable to include all the variables from the referenced study. Continuous variables are represented as Mean ± standard deviation whereas categorical variables are represented as frequencies and percentages. SPSS (version 26.0) software was used to conduct all analyses.

Results

Patient characteristics

The result of this study indicates that from a total of 292 patients, albumin-creatinine was detected in 169. There were 160 males (54.8%) and 132 females (45.2%). The patients' ages ranged from 32 to 94 years old, with a mean age and standard deviation of 59.8 ± 9.759 years. Patients' baseline characteristics are represented in Table 1 as frequencies and percentages or mean ± standard deviation.

The analysis of gender differences in this study yielded a p-value of 0.116, indicating that there does not exist any statistically significant difference between the groups at the conventional significance level of 0.05. Similarly, the examination of nationality and its relationship with diabetic nephropathy yielded a p-value of 0.114, indicating the absence of any statistically significant association. This result implies that nationality does not significantly

influence the risk of diabetic nephropathy, leading us to fail to reject the null hypothesis in both cases. Together, these findings suggest that neither gender nor nationality are determining factors in the development of diabetic nephropathy within our study population, emphasizing the need to explore other contributing variables. This p-value suggests that the observed differences in outcomes related to gender and nationality are likely due to random variation rather than a true effect.

Table 1: Baseline characteristics

Parameters	N	Albumin creatinine detected (N = 169)	Albumin creatinine not detected (N = 123)	P-value
Gender				
Male	160	86 (50.9)	74 (60.2)	0.116
Female	132	83 (49.1)	49 (39.8)	
BMI¥				
Normal	41	26 (15.8)	15 (12.4)	< 0.01**
Overweight	97	42 (25.5)	55 (45.5)	
Obesity	81	45 (27.3)	36 (29.8)	
Morbid obese	67	52 (31.5)	15 (12.4)	
Nationality				
Bahraini	240	144 (85.2)	96 (78.0)	0.114
Non-Bahraini	52	25 (14.8)	27 (22.0)	
Biomarkers of metabolic and cardiovascular health				
HbA1c control:				
Good	116	66 (39.1)	50 (40.7)	0.556
Inadequate	83	52 (30.8)	31 (25.2)	
Poor	93	51 (30.2)	42 (34.1)	
Estimated glomerular filtration rateΨ				
Early-stage kidney disease	266	151 (89.3)	115 (94.3)	0.140
kidney disease	25	18 (10.7)	7 (5.7)	
Thyroid function				
Euthyroid	257	149 (88.2)	108 (87.8)	0.937
Hypothyroid	32	18 (10.7)	14 (11.4)	
Subclinical hypothyroid	3	2 (1.2)	1 (0.8)	
Blood pressure€				
Normal	81	47 (28.3)	34 (27.9)	0.235
Elevated	47	21 (12.7)	26 (21.3)	
Stage 1	60	38 (22.9)	22 (18.0)	
Stage 2	100	60 (36.1)	40 (32.8)	

**Significant p-value <0.01

The P-value was calculated using Chi-square, and Fisher's exact test as appropriate. ¥ In terms of BMI, 4 cases from the detected albumin patients and 2 from the undetected albumin patients were not applicable. Ψ One case from the undetected albumin cases was not applicable. € 3 cases were not applicable from the detected albumin patients, and one from the undetected albumin cases. 5, 10

Table 2: Total number of cases stratified under the Risk category for chronic kidney disease progression, represented as N (%).

		Albuminuria categories (mg/mmol)		
		A1 < 3	A2 3 - 29	A3 ≥ 30
Estimated Glomerular Filtration Rate (mL/min/1.73m^2)	Early-stage kidney disease 60 - 89	83 (55.0)	56 (37.1)	12 (7.9)
	Kidney disease	10 (55.6)	6 (33.3)	2 (11.1)

145 (85.8%) patients from the albumin-detected group underwent re-testing, and within the albumin-not-detected group, a total of 100 (87.7%) patients were re-tested, as shown in Figure 1. The total number of cases stratified under the risk category for CKD progression is represented in Table 2.

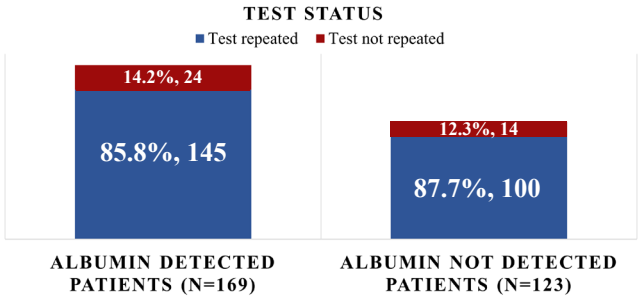

Figure 2: Total number of patients who got re-tested from both groups, represented as frequencies and percentages N (%). Nine patients from the albumin not detected group were missing.

Renal function

Among patients diagnosed with early-stage kidney disease, the findings showed that 83 (55%) of them had a low risk of chronic kidney progression, while only 12 (7.9%) indicated a very high risk. A total number of 18 patients suffered from kidney disease, with 10 (55.6%) of them having type A1 albuminuria and 2 (11.1%) having type A3, as represented in Table 2.

Obesity

Among the patients with albuminuria, a total of 52 (31.5%) were classified as morbidly obese, and 45 (27.3%) were categorized as obese. In contrast, among the group of patients where albumin was not detected, 55 (45.5%) were classified as overweight, while only 15 (12.4%) were categorized as morbidly obese. In our study, the analysis revealed a statistically significant association between overweight status and the prevalence of diabetic nephropathy, with a p-value of 0.01.

Hba1c control

According to the study, in the group where albumin was detected, 39% of patients demonstrated good control of their HbA1c levels, with values below 7. Additionally, 30.8% of patients showed inadequate control (7-8) while 30.2% had weak control above 8. The mean value of HbA1c in this group was 7.5, with a standard deviation of 1.4.

On the other hand, in the group where albumin was not detected, 40.7% of patients possessed good control of their HbA1c levels, below 7%. Among this group, 25.2% had inadequate control, and 34.1% showed poor control. The mean value of HbA1c in this group was 7.6, with a standard deviation of 1.5. Additionally, the mean values of HbA1c are similar between the two groups, indicating comparable overall glycemic control. 11 The p-value of 0.556 indicates that there is no statistically significant association between HbA1c levels and the prevalence of diabetic nephropathy.

Blood pressure control

Patients with and without albumin creatinine ratio both had the highest number of cases with stage 2 blood pressure, 60 (36.1%) and 40 (32.8%), respectively. The relationship between high blood pressure and diabetic nephropathy was not statistically significant, as indicated by a p-value of 0.235.

Nephrology referral

Out of 169 patients with detected albumin, 16 patients (9.4%) were referred to nephrology. The cases referred included stages 3a, 3b, and Figure 4

of diabetic nephropathy. In the non-albumin detected group, only 2 out of 123 patients (1.6%) were referred to nephrology. The patients referred were diagnosed with stage 3a nephropathy.9 patients with A3 albuminuria and normal estimated glomerular filtration rate (eGFR) were not referred to nephrology. Notably, 5 of these patients were closely monitored at the diabetic clinic within the primary care setting and showed improvement in their albuminuria levels. Among these, two patients exhibited low eGFR due to uncontrolled blood sugar levels, suggesting poor glycemic control in their diabetes management.

Table 3: Comorbidity prevalence among patients, represented as frequencies and percentages N (%): Some patients had more than one comorbidity.

	Albumin creatinine detected (N = 169)	Albumin creatinine not detected (N = 123)
Comorbidities		
Diabetes	167 (98.8)	122 (99.2)
HTN	113 (66.9)	62 (50.4)
Hyperlipidemia	118 (69.8)	86 (69.9)
Gout	3 (1.8)	1 (0.8)
Hypothyroid	14 (8.3)	14 (11.4)
Smoking	5 (3.0)	2 (1.6)
Asthma	5 (3.0)	3 (2.4)
IHD	15 (8.9)	12 (9.8)
Glaucoma	0 (0.0)	1 (0.8)
Myeloma	2 (1.2)	0 (0.0)
Psoriasis	2 (1.2)	0 (0.0)
Breast cancer	1 (0.6)	0 (0.0)
Atrial fibrillation	2 (1.2)	0 (0.0)
Thrombocytopenia	1 (0.6)	0 (0.0)
Sarcoidosis	1 (0.6)	0 (0.0)
Ulcerative colitis	1 (0.6)	0 (0.0)

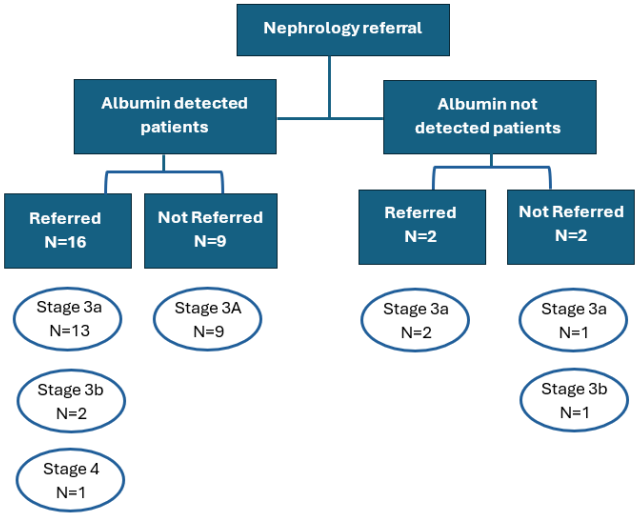

Figure 4: Nephrology referral patient distribution

Discussion

In our diverse population, genetic, demographic, and lifestyle-related factors contribute to the development of diabetic nephropathy. It is crucial to understand and address these factors to prevent and manage diabetic nephropathy effectively. In the primary care setting, diabetic clinics focus on providing comprehensive care for diabetic patients by closely managing their condition and screening for complications such as retinopathy, nephropathy, and diabetic foot, following established clinical guidelines. Patient satisfaction and well-being are important considerations, and strategies and interventions are implemented to align with the principles outlined in the 2001 Institute of Medicine report, "Crossing the Quality Chasm." This report emphasizes the importance of delivering consistent, effective, and patient-centered care, with a focus on safety, effectiveness, patient-centeredness, timeliness, efficiency, and equity. By incorporating these principles into diabetic clinics, healthcare providers can strive to enhance the quality of care and outcomes for patients with diabetic nephropathy.[12]

The audit focused on diabetic patients and specifically examined the screening for diabetic nephropathy as a measure to prevent complications. The audit conducted between May and June 2023 involved 292 patients who were managed by a primary care diabetic clinic in the Royal Medical Services Military Hospital, Bahrain. Among them, 169 patients had albumin-creatinine ratio detected,

while the remaining patients did not exhibit albumin-creatinine ratio or their total protein levels remained within the normal range.

Diabetic nephropathy in the Arab Gulf countries is linked to specific factors, including being male, having a high body mass index (BMI), poor control of diabetes, and the presence of diabetic retinopathy and/or neuropathy. These factors have been observed in studies conducted in the region.[13]

Additionally, a considerable percentage of the Bahraini population demonstrates similar factors linked to diabetic nephropathy, with 85% in the albuminuria-detected group and 96% in the group without albuminuria. This indicates that these factors are common among Bahraini residents and may play a role in the development of the condition even though nationality results did not show a statistically significant association. A more detailed examination of ethnicity may yield more informative insights into these relationships.

Genetic susceptibility is also identified as a crucial factor in both the incidence and severity of diabetic nephropathy. Having a diabetic sibling or parent with diabetic nephropathy significantly increases the risk. Given the common practice of marriage among relatives in these countries, which can enhance genetic predisposition, it is important to thoroughly investigate this factor.[13]

Additionally, older age, hypertension, and obesity 9 are recognized as other risk factors associated with the development of diabetic nephropathy. These factors have been observed in populations outside the Arab Gulf countries as well. The mean age of the current study population in the albumin-detected group is 60.5 and in the non-detected group is 58.8. The non-albuminuria CKD phenotype is more prevalent in women with diabetes while men with diabetes demonstrate albuminuria CKD phenotype. In terms of progression toward end-stage renal disease (ESRD), women with diabetes tend to experience faster progression and poorer outcomes, especially those with type 2 diabetes in the later stages of life. Hormonal and genetic factors have been identified to play significant roles in explaining these differences in DKD. Experimental studies have shown that estrogens and progesterone have a protective effect on DKD although gender differences in this study indicate otherwise.[14]

Our study revealed that males comprised 50.9% of the albumin-detected group, while females accounted for 49.1%. This finding contradicts the expectation that females would have a lower tendency to develop nephropathy due to their physiological characteristics. The calculated p-value of 0.116 indicates that there does not exist any statistically significant difference between genders in this context, probably due to the equal numbers.

Among the population with a positive albumin ratio, 89% exhibited an early stage to normal estimated glomerular filtration rate (eGFR) between 60 and 89, according to international guidelines. An investigation into the hospital laboratory revealed that the testing machine adhered to these guidelines; however, an issue was found in the electronic data system concerning laboratory result calculations. This issue was addressed in collaboration with the laboratory and technology departments, leading to a resolution that accounted for the error in the implementation of the new system. The p-value of 0.140 was not statistically significant, which may be attributed to limitations within the system that impacted the actual values for the patients.[15] The HbA1c control levels were found to be 7.5, with a standard deviation of 1.4 in the albumin-detected group, and 7.6, with a standard deviation of 1.5 in the non-albumin-detected group. These mean values are consistent with findings from other studies conducted in different regions. The p-value of 0.556 indicates that there is no statistically significant association between HbA1c levels and the prevalence of diabetic nephropathy. This high p-value suggests that any observed differences in diabetic nephropathy outcomes are likely due to the well-monitored follow-up of patients and the control of HbA1c levels rather than a direct effect. Consequently, it is indicated that effective management through regular follow-up and HbA1c control does have a measurable impact on the risk of developing diabetic nephropathy in our study population.

These findings also suggest that the Hba1c control has no significant impact on the presence of proteinuria. In both groups, there is a similar distribution of patients with good, inadequate, and poor control of HbA1c levels. The mean values of HbA1c are also similar between the two groups, indicating comparable overall glycemic control.[11]

Significantly, a clinical audit at the Bahrain Defense Force Hospital in 2010 within the endocrine clinic reported a mean HbA1c of 8.2. The subsequent attainment of mean HbA1c values of 7.5 and 7.6 indicates a significant improvement in diabetes management within our population.[16] A study conducted in a rural health clinic in Montana reported a mean HbA1c value of 7.43% among diabetic patients, and another study conducted in community health centers in Chicago reported a higher mean value of 8.6%. A study in Riyadh, Saudi Arabia, showed better indicators of HbA1c control in a primary healthcare center (PHCC), with mean values ranging between 7.65% and 7.84%. Similarly, in the primary healthcare centers of the Ministry of National Guard-Health Affairs in the Makkah region of Saudi Arabia, the mean values ranged from 8.09% to 8.32% in 2017 and from 7.87% to 8.34% in 2018.[17]

Comparing these findings to our study, it can be concluded that the HbA1c mean values in our population indicate good control. However, it is important to consider that HbA1c targets may vary depending on individual patient characteristics and guidelines from different healthcare organizations.

The fact that both groups had a high prevalence of stage 2 blood pressure suggests that hypertension may be a contributing factor to proteinuria in these cases.

Among the patients with albuminuria, 31.5% were classified as morbidly obese, and 27.3% were categorized as obese. This suggests a relatively higher prevalence of higher weight categories in this group compared to the general population. On the other hand, in the group of patients where albumin was not detected (no albuminuria), 45.5% were classified as overweight while only 12.4% were categorized as morbidly obese. This indicates a higher prevalence of overweight individuals in this group compared to the albuminuria group.

These findings indicate a possible association between higher weight categories and the presence of albuminuria. Obesity and morbid obesity are recognized risk factors for numerous health issues, including cardiovascular diseases and kidney dysfunction. Excess weight can lead to chronic inflammation, insulin resistance, and elevated blood pressure, all of which may adversely affect kidney function and contribute to the development of albuminuria. The audit results revealed a statistically significant relationship between obesity and diabetic nephropathy, with a p-value of 0.01.

In this study, the population demonstrates a high prevalence of hyperlipidemia on treatment. In the group with albumin detection, 69.8% of individuals have hyperlipidemia, and 8.9% have ischemic heart disease (IHD). In the non-albumin detected group, 69.9% have hyperlipidemia, and 9.8% have IHD.

Another study suggests that the administration of statin medications to treat abnormal lipid levels (dyslipidemia) may have benefits for individuals with diabetic nephropathy and can reduce the risk of cardiovascular events. The study emphasizes the importance of early detection and aggressive treatment of dyslipidemia in all diabetic patients, except those with contraindications or end-stage renal disease. This highlights the potential benefits of promptly and effectively managing dyslipidemia to prevent complications and reduce cardiovascular risks in individuals with diabetes.[18]

A research study conducted at Vanderbilt University Medical Center (VUMC) in Nashville, Tennessee focused on the frequency of albuminuria testing for patients with diabetes mellitus (DM). The study found that, on average, 69.0% of the 2860 visits over 12 months involved albuminuria testing.

To improve the testing rate, the researchers implemented an intervention using a checklist with the triage nurse. After six months, the rate of testing increased to 81.7%, representing a 12.7% improvement compared to the initial figure of 69.0%.[19]

When examining test compliance in our study, the study revealed that among the group where albumin was detected, 85.8% of patients underwent yearly

testing. In the group where albumin was not detected, the compliance rate was 87.7%. These compliance rates are considered favorable, suggesting that the patients who were not subjected to annual screening either refused to take the test, were unaware of it, or missed it due to the oversight of their doctors. This lack of awareness could be attributed to insufficient communication or explanation regarding the significance and purpose of the test. Some patients may ignore or neglect the test, possibly due to various reasons or personal preferences.

Out of 169 patients with detected albumin, 16 patients (9.4%) were referred to nephrology. The cases referred included stages 3a, 3b, and 4 of diabetic nephropathy. This indicates that these patients showed signs of kidney damage and were directed to specialists for further evaluation and management. In the non-albumin detected group, only 2 out of 123 patients (1.6%) were referred to nephrology. The patients referred were diagnosed with stage 3a nephropathy. 9 patients with A3 albuminuria and normal estimated glomerular filtration rate (eGFR) were not referred to nephrology. Notably, 5 of these patients were closely monitored at the diabetic clinic within the primary care setting and showed improvement in their albuminuria levels. Initially classified as having A3 albuminuria, which indicates significant albumin presence in their urine, these patients benefited from diligent management. This included the introduction of Sodium-Glucose Transport Protin 2(SGLT-2) inhibitors and Renin- Angiotensin-aldosterone system (RAAS) inhibitors Angiotensin-converting enzyme inhibitors and Angiotensin receptor blockers (ACE and ARB), alongside strict blood sugar control. As a result, their albuminuria levels improved, leading to a decrease in albumin excretion and a change in classification from A3 to A2 and A1 categories.

Overall, the study demonstrates a positive trend in retesting rates compared to the previous study, indicating an improvement in the screening process for albuminuria among patients with diabetes. Implementing a similar diabetic triage nurse checklist in our nurse triage system as the previous study has the potential to further improve the outcomes and reduce the likelihood of missing tests. Further, by incorporating a checklist, it can be ensured that the necessary tests, including albuminuria testing, are essentially and consistently administered and not overlooked.

The checklist can serve as a reminder for nurses to discuss the test with patients, explain its importance, and address any concerns or questions they may have. This proactive approach can increase patient awareness and engagement, reducing the number of uninformed patients.

Furthermore, the checklist can also help healthcare providers track and document the completion of tests, ensuring that patients receive the information and opportunity. It acts as a systematic tool to ensure that all necessary procedures are followed and that important tests are not missed.[18]

In our population, the patients were referred properly and followed by the doctor. Only 9.4% of the detected group was referred to the nephrology and 1.6 % from the non-detected group. Out of 169 patients with detected albumin, 16 patients (9.4%) were referred to nephrology. The cases referred included stages 3a, 3b, and 4 of diabetic nephropathy. This indicates that these patients showed signs of kidney damage and were directed to specialists for further evaluation and management. In the non-albumin detected group, only 2 out of 123 patients (1.6%) were referred to nephrology. The patients referred were diagnosed with stage 3a nephropathy.

Nine patients with A3 albuminuria and normal estimated glomerular filtration rate (eGFR) were not referred to nephrology. In this study, the patients were closely followed by doctors and referred according to clinical guidelines. Close monitoring and adherence to established guidelines are essential for ensuring optimal patient care and accurate data collection in research studies.

Limitation

The audit encountered a few limitations in the course of its conduct. The major ones were the following: the new change in the pressure guidelines of the day and the change of patient categorization from stage one to stage two of hypertension. Yet another key concern was the discrepancy between

the estimated glomerular filtration rate calculated using the previous in-house system versus the values obtained using the updated methodology aligned with international guidelines, which had implications for patient management. The new change in blood pressure guidelines, tight control change of patient's categorization from stage 1 to stage 2 of hypertension and the discrepancy found in the patient's estimated GFR subsequently affected the patients' stage classification of diabetic nephropathy. Lack of communication between the following laboratory guidelines and primary health care/diabetic clinic physicians related to the albumin creatinine ratio invariably is found to be the cause for this discrepancy.

Recommendations

The audit entails six recommendations. Firstly, implementing a diabetic triage nurse checklist in the computer system of the diabetic clinic can help avoid missing tests for the patients. By integrating the checklist into the clinic's electronic medical record (EMR) system, healthcare providers can ensure that all necessary tests and screenings are ordered for diabetic patients. The checklist could include items such as blood glucose monitoring, HbA1c tests, lipid profiles, kidney function tests, eye exams, and foot examinations. The computer system can generate reminders or alerts for healthcare providers to ensure that all tests are completed for each patient, reducing the risk of missing important screenings. Secondly, continuing to monitor the results of estimated GFR in the new modified lab automated system and to compare the outcome with previous patient results could evaluate the degree of improvement if any.

Thirdly, strengthening health education and referring obese or overweight patients to the obesity clinic can significantly improve their management and overall health outcomes. Next in line is to improve the current establishment of the clinic by proper utilization of currently available diabetic nurses (two specialized nurses who are assigned are not available to the diabetic clinic as one of them is assigned to the 19-care clinic till date, and the other one covers the primary care clinic's nursing staff shortage). Further, by monitoring the effectiveness of the proposed diabetic nurse's clinic assessment checklist within one year of implementation. Lastly, a summary of recommendations for including criteria such as duration of diabetes, specific age group, and type of diabetes to enhance the precision of results in future audits of diabetic patients.

Conclusion

This study was conducted to evaluate the clinical documentation of primary health care physicians in assessing the diabetic clinic patients of primary health care, and set a baseline compliance rate, to achieve prevention, screening, and diagnosis of chronic kidney disease among diabetic patients in primary care clinics and to ensure effective resource utilization in terms of defining criteria for referring patients to nephrology clinics. The result proved the yearly retesting rate compared with other studies in other countries with 85.8 in the albumin-detected group and 87.7 in the non-albumin-detected group.

The study demonstrates that close follow-up and adherence to guidelines have resulted in an effective referral system to the nephrology clinic, with referral rates of 9.4% in the albumin-detected group and 1.6% in the non-albumin-detected group. It also shows that our population exhibits good control of modifiable risk factors, with average HbA1c levels of 7.5 in the albumin-detected group and 7.6 in the non-albumin-detected group, which are favorable compared to other studies. However, blood pressure was primarily classified as grade 2, likely due to updated guidelines emphasizing tighter control, which differs according to national standards.

The study highlights the negative impact of obesity on diabetic patients and consequent nephropathy, revealing that 31.5% of those in the albumin-detected group were morbidly obese and while % were morbidly obese. Additionally, 69.8% of patients in the albumin-detected group and 69.9% in the non-detected group were on medication for hyperlipidemia. This suggests that statins may provide a protective effect, as the incidence of nephropathy is lower in these patient groups.

Overall, the results indicate that the primary care clinic at the Royal Medical Services Military Hospital in Bahrain has established and implemented

effective clinical protocols and patient management systems to control diabetes and ensure high-quality care.

Conflict of interest

The authors do not have any conflict of interest.

References

1. International Diabetes Federation [Internet]. Home; 2024 [cited 2024 Aug 26]. Available from: https://idf.org/.
2. Papatheodorou K, Banach M, Bekiari E, et al. Complications of Diabetes 2017. J Diabetes Res. 2018;2018:3086167.
3. National Institute for Health and Care Excellence. Type 2 diabetes in adults: management [Internet]. London: NICE; 2015. Available from: http://www.nice.org.uk/guidance/ng28.
4. Aldukheil A. Prevalence of diabetic nephropathy among Type 2 diabetic patients in some of the Arab countries. Int J Health Sci. 2017;11(1):1.
5. AlSaweer A, Qambar F, Humaidan H, et al. Prevalence and Management of Renal Impairment in Adults with Type 2 Diabetes Mellitus in specialized diabetes clinics in Primary Care in the Kingdom of Bahrain. J Health Sci. 2022;2(11):485.
6. Natesan V, Kim SJ. Diabetic Nephropathy - a Review of Risk Factors, Progression, Mechanism, and Dietary Management. Biomol Ther. 2021;29(4):365-72.
7. Kidney Disease: Improving Global Outcomes. Clinical Practice Guideline for Diabetes Management in Chronic Kidney Disease. Kidney Int. 2020;98(4S).
8. Gross JL, De Azevedo MJ, Silveiro SP, et al. Diabetic Nephropathy: Diagnosis, Prevention, and Treatment. Diabetes Care. 2005;28.
9. Centers for Disease Control and Prevention. Defining Adult Overweight & Obesity [Internet]. [cited 2024]. Available from: https://www.cdc.gov/obesity/basics/adult-defining.html.
10. American Heart Association. Understanding Blood Pressure Readings [Internet]. [cited 2024]. Available from: https://www.heart.org/en/health-topics/high-blood-pressure/understanding-blood-pressure-readings.
11. Abera RG, Demesse ES, Boko WD. Evaluation of glycemic control and related factors among outpatients with type 2 diabetes at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia: A cross-sectional study. BMC Endocr Disord. 2022;22(1).
12. Institute of Medicine. Crossing the Quality Chasm: A New Health System for the 21st Century. Washington, DC: National Academies Press; 2001.
13. Farag YMK, Al Wakeel JS. Diabetic Nephropathy in the Arab Gulf Countries. Nephron Clin Pract. 2011;119:c317-23.
14. Giandalia A, Giuffrida AE, Gembillo G, et al. Gender differences in diabetic kidney disease: Focus on hormonal, genetic and clinical factors. Int J Mol Sci. 2021;22(11):5808.
15. Grill AK, Brimble S. Approach to the detection and management of chronic kidney disease: What primary care providers need to know. Can Fam Physician. 2018;64.
16. Al-Baharna MM, Whitford DL. Clinical audit of diabetes care in the Bahrain Defence Forces Hospital. Sultan Qaboos Univ Med J. 2013;13(4):520-6.
17. AlZahrani A, BinDajam O, AlGhamdi S, et al. Quality of care provided to diabetic patients attending primary health care centers in the National Guard in Makkah Region, Saudi Arabia. J Family Med Prim Care. 2022;11(6):2900.
18. Chen S, Tseng CH. Dyslipidemia, kidney disease, and cardiovascular disease in diabetic patients. Rev Diabet Stud. 2013;10(2-3):88-100.
19. Kam S, Angaramo S, Antoun J, et al. Improving annual albuminuria testing for individuals with diabetes. BMJ Open Qual. 2022;11(1).

Appendix

Definitions Five stages of kidney disease are identified based on eGFR:

- Stage 1: normal or high eGFR of ≥90 mL/min/1.73m^2
- Stage 2: mildly decreased eGFR of 60-89 mL/min/1.73m^2
- Stage 3a: mildly to moderately decreased eGFR of 45- 59 mL/min/1.73m^2
- Stage 3b: moderately to severely decreased eGFR of 30-44 mL/min/1.73m^2
- Stage 4: severely decreased eGFR of 15-29 mL/min/1.73m^2
- Stage 5: kidney failure at eGFR off less than 15 ml/min/1.73 m^2.[5]

The body mass index was classified according to the CDC as:

- If your BMI is 18.5 to <25, it falls within the healthy weight range.
- If your BMI is 25.0 to <30, it falls within the overweight range.
- If your BMI is 30.0 or higher, it falls within the obesity range.[9]
- HbA1c targets less than 7 % good control.
- HbA1c from 7-8% was defined as inadequate control
- Above 8 % defined as poor control.
- As recommended by the American diabetic Association.[11]

BLOOD PRESSURE CATEGORY	SYSTOLIC mm Hg (upper number)	and/or	DIASTOLIC mm Hg (lower number)
NORMAL	LESS THAN 120	and	LESS THAN 80
ELEVATED	120 – 129	and	LESS THAN 80
HIGH BLOOD PRESSURE (HYPERTENSION) STAGE 1	130 – 139	or	80 – 89
HIGH BLOOD PRESSURE (HYPERTENSION) STAGE 2	140 OR HIGHER	or	90 OR HIGHER
HYPERTENSIVE CRISIS (consult your doctor immediately)	HIGHER THAN 180	and/or	HIGHER THAN 120

Current Care Gaps