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Challenges in the management of renal dialysis in diabetic patients: a prospective study

Narayana Muthu rani*, P.Tejasree, Ch.Jaswanthi, V.Leela Krishna Vamsi, M.Ajay Prasath.

Department of Pharmacy Practice, Swathi College of Pharmacy Near Toll Plaza, Venkatachalam Mandal Nellore Dist. 524320

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Abstract

This study examines the challenges associated with managing diabetic patients undergoing renal dialysis in the nephrology department. The primary objective is to address the difficulties encountered during dialysis by improving its management, preventing the progression of chronic kidney disease to end-stage renal failure, and systematically reviewing the indications for and complications of dialysis. Managing dialysis in diabetic patients is particularly complex due to the added burden of diabetes-related issues. These patients often experience higher rates of infections, increased cardiovascular morbidity, and elevated mortality risks. Other challenges include fluid overload, complications arising from the dialysis procedure itself, psychological distress, and a diminished quality of life. These interconnected issues necessitate a comprehensive and multidisciplinary approach to improve patient outcomes. To enhance the quality of life for patients with diabetic nephropathy, it is crucial to involve a team of specialists. The multidisciplinary team should include a diabetologist, nephrologist, dietitian, microbiologist, vascular surgeon, and interventional radiologist. Each specialist contributes unique expertise to address the various complications and facets of care, ranging from infection control to vascular access and dietary management. Ultimately, overcoming the challenges of managing diabetic patients on dialysis requires collaboration, innovation, and a commitment to improving their overall health and well-being through tailored care strategies.

∗Corresponding Author
Name: Narayana Muthu rani
Phone: +91 9491676455
Email: narayanamuthurani@gmail.com

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INTRODUCTION

One of the most common and severe side effects of diabetes mellitus is diabetic nephropathy, which is linked to higher rates of morbidity and death in diabetic patients. Diabetes's link to long-term tissue problems is one of its most significant clinical characteristics. Serious clinical consequences do not arise from a brief increase in Hyperglycemia. Dietary salt reduction, starting treatment with angiotensin-converting enzyme inhibitors or angiotensin receptor blockers, and

diuretic therapy are the fundamental strategies for managing Hypertension in patients with chronic kidney disease [1]. Uncontrolled Hypertension may accelerate the development of end-stage renal disease and cause substantial cardiovascular morbidity and mortality. Intensive blood pressure control lowers the risk of poor cardiovascular outcomes and death in the CKD population, even if clinical trials have not demonstrated that it slows the course of CKD [2]. According to the 2009 Health Survey for England, the prevalence of chronic kidney disease (CKD) in adults is predicted to be 13%. As people age, their chance of developing chronic kidney disease (CKD) rises, and the condition frequently coexists with diabetes, Hypertension, and cardiovascular disease (CVD). Since there are often no distinct symptoms, it is usually undiagnosed. Late presentation for renal replacement therapy increases morbidity and mortality in the significant minority of individuals with chronic kidney disease (CKD) who will develop end-stage kidney disease [3]. According to the definition of chronic kidney disease (CKD), kidney damage or an estimated glomerular filtration rate (eGFR) of less than 60 ml/min/1.73 mt2 that lasts three months or more, regardless of the etiology, is required. Kidney injury includes urine sediment anomalies, elevated urinary albumin excretion rates, and pathologic abnormalities shown by imaging investigations or renal biopsies. Based on the glomerular filtration rate, the 2012 KDIGO CKD classification divides CKD into six groups (G1 to G5, with G3 divided into 3a and 3b) and suggests information regarding the degree of severity of the condition. The three levels of albuminuria (A1, A2, and A3) are also used for staging, and each stage of chronic kidney disease is further classified based on the urinary albumin-creatinine ratio in either mg/mmol or mg/gm from an early morning "spot" urine sample [4].

SIGNS AND SYMPTOMS:

Oedema, or swelling that initially affects your legs and feet before spreading to the rest of your body. Lack of appetite [5].

Losing weight. Weakness.

Feeling worn out or exhausted.

Vomiting or feeling queasy.

Difficulty sleeping.

High blood pressure becomes more difficult to manage.

Swelling in the hands, eyes, ankles, or feet.

Pee, that is foamy.

Confusion or trouble thinking.

Breathlessness.

Appetite loss.

Weakness and exhaustion.

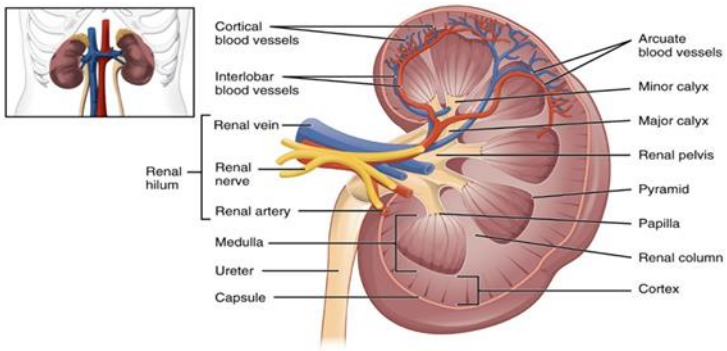

Figure 1 Anatomy of Kidney

ETIOLOGY:

The most prevalent primary disorders that lead to chronic kidney disease (CKD) and, eventually, end-stage renal disease (ESRD) are as follows [6],[7]:

Type 2 diabetes (between 30% and 50%)

Type 1 diabetes mellitus (3.9%)

High blood pressure (27.2%)

8.2% have primary glomerulonephritis.

3.6% of patients have chronic tubulointerstitial nephritis.

Cystic or hereditary illnesses (3.1%)

Vasculitis or secondary glomerulonephritis (2.1%).

Neoplasms or dyscrasias of plasma cells (2.1)

Less than 1 percent of ESRD patients in the US have sickle cell nephropathy (SCN).

PATHOGENIC MECHANISM:

Numerous routes and mediators are involved in the complicated and multifaceted pathophysiology of DN formation and progression. Traditionally, aberrant homeostasis—which

includes hemodynamic abnormalities, metabolic issues, and hormone production like Ang-II—is thought to be the cause of the developmental mechanism of DN [8]. Critical pathways to the development and progression of DN include the renin-angiotensin-aldosterone system (RAAS), the formation of advanced glycation end products (AGE), the activation of transforming growth factor-β1 (TGF-β1), connective tissue growth factor (CTGF), protein kinase C (PKC), mitogen-activated protein kinase (MAPKs), and reactive oxygen species (ROS). Every pathway interacts with other pathways or uses a variety of mediators that cause harm. Many routes and mediators overlap; for instance, oxidative stress induces injury through Ang-II, whereas RAAS causes injury through oxidative stress. TGF-β is increased by nicotinamide adenine phosphate dehydrogenase (NADPH) oxidase, while TGF-β increases ROS via NADPH oxidase activation. Because of this, the precise pathogenic mechanism and molecular incidence of DN remain unclear, and it is uncertain how much each route contributes to the development of DN [9].

DIAGNOSIS FOR DIABETIC KIDNEY DISEASE:

Since the albumin-creatinine ratio by spot urine sample has shown an outstanding connection with the 24-hour urine albumin measurements, the primary basis for the clinical diagnosis of diabetic kidney disease is the detection of albuminuria from spot urine. The estimated glomerular filtration rate, or eGFR, is an additional renal biomarker for albuminuria. Both can be used to identify those who are at risk of long-term issues and are linked to cardiovascular and renal illness in diabetics [10]. An albumin-creatinine ratio of 30-300 mg/g from a spot urine collection is considered microalbuminuria, a sign of endothelial dysfunction, and a stand-alone indicator for cardiovascular morbidity and death in people with and without diabetes. Urinary albumin excretion of 20–200 μg/min in a timed urine collection or 30-300 mg/24 hours in a 24-hour urine collection [11].

COMPLICATIONS:

Diabetic nephropathy complications may appear gradually over several months or even years. Among the complications is fluid retention, resulting in pulmonary edema, high blood pressure, or arm and leg swelling [12].

A stroke may result from heart and blood vessel disorders.

Hyperkalaemia, or elevated potassium levels

Diabetic Retinopathy is the term for damage to the blood vessels in the rear of the eye. Anaemia

Diarrhea, erectile dysfunction, foot sores, and other problems resulting from damaged blood vessels and nerves.

Pregnancy issues that might harm both the mother and the unborn child.

TREATMENT:

Complications from kidney disease can be managed to improve your comfort level. Possible treatments include:

Treatment for end-stage kidney disease

Dialysis

When your kidneys can no longer filter waste and excess fluid from your blood, dialysis is used to accomplish so artificially. A machine filters your blood during hemodialysis to remove waste and extra fluid. In peritoneal dialysis, waste and extra fluid are absorbed by a dialysis solution pumped into your abdominal cavity through a thin tube. The dialysis solution eventually leaves your body, taking the waste [13].

Kidney Transplant

A healthy kidney from a donor is surgically inserted into your body during a kidney transplant. Both living and deceased donors can provide kidney transplants. You will require lifelong medications following a transplant to prevent your body from rejecting the new organ. Dialysis is not necessary to receive a kidney transplant [14].

PREVENTION:

To lower your risk of developing diabetic nephropathy:

Control high blood pressure and other diseases. Work with your healthcare provider to manage any conditions that increase your risk of kidney disease, such as high blood pressure. Take over-the-counter drugs exactly as prescribed. Examine the labels of the medicines that are used for pain. Aspirin and nonsteroidal anti-inflammatory medications like ibuprofen (Advil,

Motrin IB, and others) and naproxen sodium (Aleve) may fall under this category. These kinds of painkillers can cause kidney damage in diabetic nephropathy patients. Maintain your ideal weight. Engage in physical activity most days of the week to maintain your healthy weight. If you need to reduce your weight, discuss the most effective weight-loss strategy with a member of your healthcare team [15].

Don't smoke. Both renal injury and worsening kidney damage might result from cigarette smoking. Consult a member of your healthcare team about quitting Smoking if you currently smoke. Some medications, counseling, and support groups may be helpful.

MATERIALS AND METHODS:

Study Site:

The study was carried out in the Department of Nephrology at Vijaya Hospital

Nellore, Andhra Pradesh.

Study Design: The study is a prospective observational study conducted at a hospital.

Study Period: The study is planned to last over 6 months, from September 2023 to February 2024.

Study Criteria:

Inclusion criteria:

The nephrology department patients with diabetic nephropathy. Patients who want to participate in the study must provide their informed consent.

Exclusion criteria:

Pregnant women and lactating women will be excluded from this study. Patients who are not willing to participate in the study will be excluded.

STUDY PROCEDURE:

A hospital-based observational study will be conducted in the Department of Nephrology at Vijaya Hospital. The study is planned over 6 months. Before initiation of the study, the institutional ethics committee's approval will be obtained. The study will include patients based on the inclusion and exclusion criteria before obtaining an informed consent form [16].

Data collection: A structured patient data collection form will collect the patient's details, such as Age, sex, medical history, Smoking, alcoholism, diet, stress, etc., as risk factors for diabetic nephropathy on renal dialysis [17].

Inclusion criteria:

Patients with diabetic nephropathy in nephrology.

Patients who were willing to give their informed consent participated in the study.

Exclusion criteria:

Pregnant women and lactating women will be excluded from this study.

Patients who are not willing to participate in the study will be excluded.

Statistical analysis:

Microsoft Excel will be used to enter the data, and analysis will be done as necessary. For categorical variables, descriptive statistics like frequency and percentages will be computed.

For visual interpretations and data analysis, graphic representations such as pie charts and bar graphs will be employed [18].

RESULTS AND DISCUSSION:

During the six-month study period from September 2023 to February 2024, we evaluated 111 patients in the Nephrology Department of Vijaya Hospital Nellore. In this study, risk factors like Age and Sex distribution, symptoms, complications, and etiology of CKD of all 111 patients were analyzed, and the following demographic details were obtained.

The study is composed of n=111 subjects. The various observations made are as follows.

1. SEX DISTRIBUTION:

Out of 111 subjects evaluated for the study, 67 (60%) were male, and the remaining 40% were female. **Table 1** shows the sex distribution of study subjects, and the same is graphically represented in **Figure 2**.

Table 1 Patient Sex Distribution

No of Subjects	Total	Percentage
Female	44	40%
Male	67	60%
Total	111	100%

Compared with earlier population-based studies on CKD, the present study shows a much higher incidence rate in males at 60% than in female

patients at 40%. This study indicates that males are more affected than females.

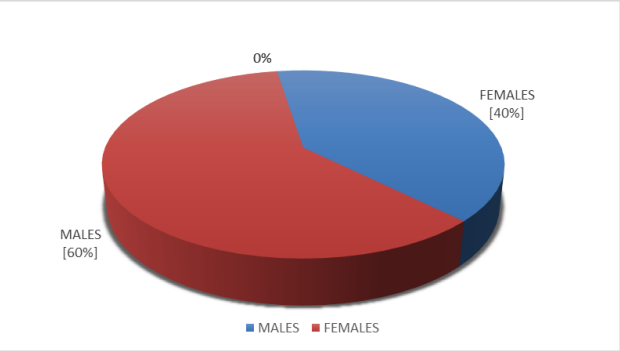

Figure 2 Graphical Representation of sex distribution of patients

2. AGE DISTRIBUTION:

Table 2 Age Distribution of Patients

Age of the Patients	No of Patients	Percentage%
11-20	2	2%
21-30	4	4%
31-40	11	10%
41-50	38	35%
51-60	44	40%
61-70	12	9%

Most everyday nonmodifiable risk factors for CKD were male sex and Age. As already mentioned above, 60% were males. Out of these patients, only 50% (n = 10) were <50 years of age and 10% of patients were > 50 years of Age. **Table 3** presents the age distribution of CKD patients with respective sex. The most prominent age groups were 41-50 and 51- 60.

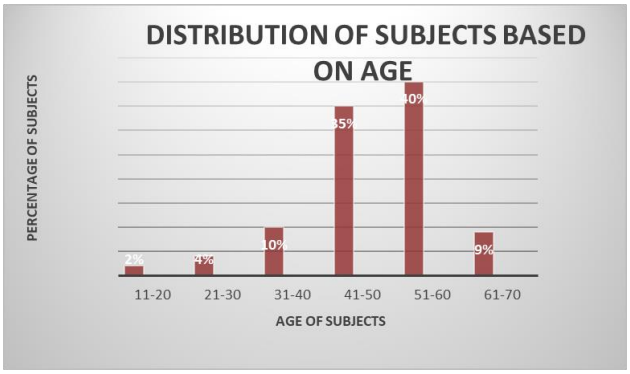

Figure 3 Age Distribution in patients

Out of 111 patients, the highest no. of patients with Diabetic nephropathy problems are in the age group of 51-60(40.13%), followed by the age group of 41-50(35.16%),31-40(10.32%),61-70(9.64%)and 11-20(2.36%),21-30(4.12%. The study reveals that the patients of age group 51-60 years are prone to Diabetic nephropathy.

3. DISTRIBUTION BASED ON SOCIAL HISTORY

Table 3 Social History of Patients

Category	Total	Percentage
Smokers	24	21%
Alcoholics	36	32%
Tobacco	11	9%
Total	71	63%

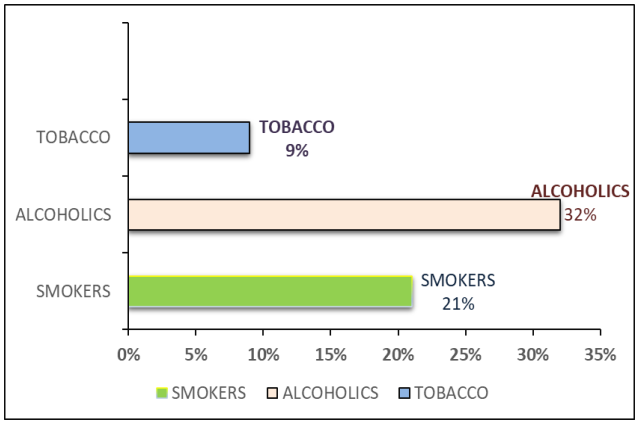

Figure 4 Graphical Representation of Social History of Patients

Out of 111 patients,21% of patients were habituated to Smoking, 32% were habituated to alcohol, and 9% were habituated to tobacco.

4. DISTRIBUTION BASED ON PRESCRIPTION MEDICATION USE

Table 4 Prescription Medication Use of Patients

Category	No of Patients	Percentage%
NSAIDs	36	33%
PPI's	23	21%
ARB's	24	22%
ACE Inhibitors	22	19%
SGLT-2 Inhibitors	7	6%

MEDICATION USE

The medications used in this study include NSAIDs like (aspirin, ibuprofen) PPIs (Pantoprazole, esomeprazole), and ARBs (Ramipril, Captopril). Among these medications, the highest prescribed drug category was NSAIDs, with 33%, and the least prescribed category was SGLT2 inhibitors, with 6%.

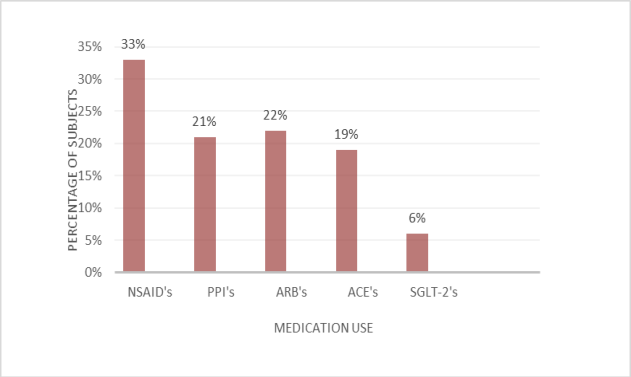

Figure 5 Graphical Representation of Prescription

5. DISTRIBUTION BASED ON TYPE OF KIDNEY DISEASES AND WITH OTHER COMORBIDITIES.

Table 5 Distribution Based On Type of Kidney Diseases And With Other Comorbidities

Comorbidities	No of Patients	Percentage%
Heart Disease	25	24%
Multiple Myeloma	1	1%
Multiple Bone Lesion	1	1%
ESRD	1	1%
Hepatic Encephalitis	1	1%
Gout	1	1%
Respiratory Disorders	5	4%
Hepatitis-C	11	10%
None	65	59%
Total	111	100%

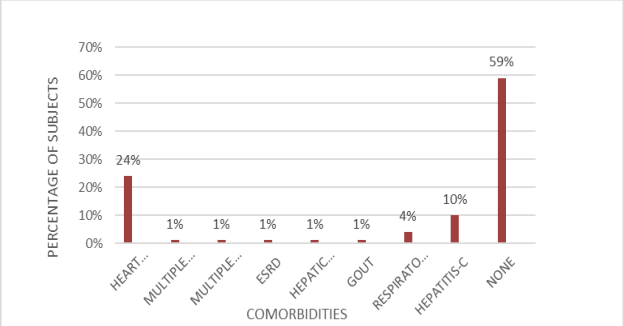

Figure 6 Graphical Representation of Type of Kidney Disease and With Other Comorbidities

Among 111 subjects, various diseased conditions were seen, along with diabetic nephropathy. The most commonly seen diseases relating to the heart with 24%, and others include hepatitis -c and other disorders

6. SUBJECT DISTRIBUTION BASED ON SYMPTOMS

In our study, out of 111 patients, 27 have Hypertension (25.16%). Among them, 18 are Males, and 07 are Females; 17 17are with Proteinuria(16.2%), 12 are Males, 4 are Females, and nine with Fatigue (9.68%). Among them, 7 are Males, and 2 are Females, and with poor appetite (5.7%), 3 are males, and 2 are females. SOB, Edema, and Nausea (7%): 14 are males, 7 are females, and they have trouble sleeping(9%): 7 are males, and 2 are females. Polyuria and vomiting (4%): Among them, 2 are males, and 2 are females. Pruritis(6%): 4 are males, and 2 are females.

Table 6 Subject distribution based on Symptoms

No of Symptoms	No of Patients	Percentage%
Proteinuria	27	25%
Swelling Of Hands	7	7 %
Fatigue	11	10%
Poor Appetite	5	5%
Shortness Of Breath	8	7%
Nausea	7	6%
Trouble To Sleeping	8	7%
Polyuria	9	9%
Vommiting	5	4%
Pruritis	7	6%
Hypertension	17	16%

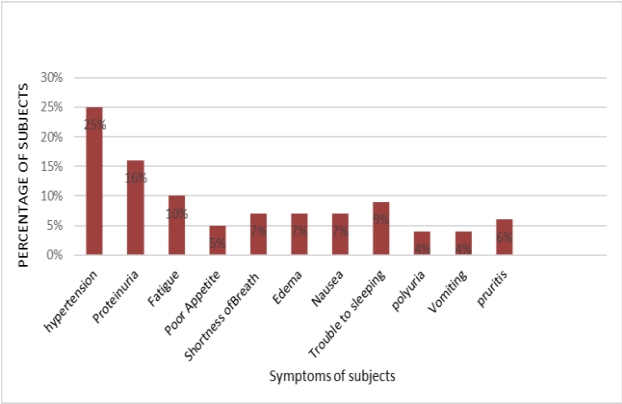

Figure 7 Graphical Representation of Symptomatic Distribution

7. SUBJECT DISTRIBUTION BASED ON RISK FACTORS

Table 7 Subject Distribution Based on Risk Factors

No of Risk Factors	No of Patients	Percentage%
Hyperglycemia	27	25%
Hypertension	14	13 %
Age	11	10%
Genetic Factors	6	5%
Retinopathy	8	7%
Dyslipidemia	10	8%
Proteinuria	8	7%
Smoking	10	9%
Dietary Factors	5	4%
Duration Of Diabetes	7	6%

In our study, Out of 111 patients, 23 are with Hyperglycemia (25.16%), 19 are Males, and 06 are Females, and 14 are with Hypertension(13.2%). Among them, 09 are Males and 05 are Females.

Ten are with Age (10.68%), among them 7 are Males, 3 are Females, and are with Genetic factors (5.7%), among them 3 are males and 2 are females, and Retinopathy (7%)among them 04 are males, and 04 are females, and dyslipidemia (8%)among them 7 are males, and 3 are females, Proteinuria and Smoking (16%)among them 10 are males, and 8 are females Dietary factors(4%)among them 3 are males.

One is female, and Duration of diabetes (6%) males are 3 and 2 are females.

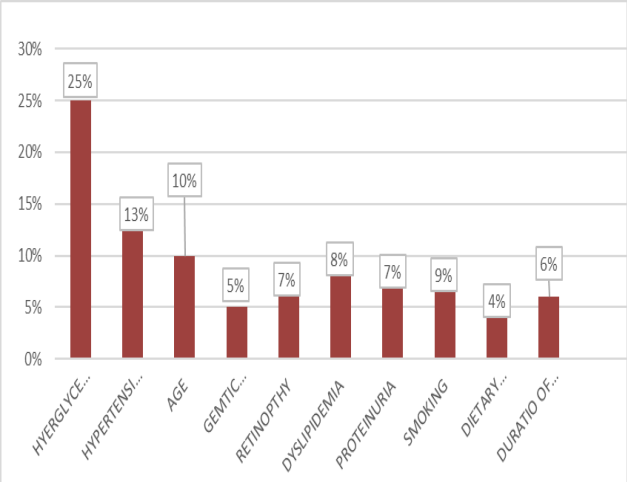

Figure 8 Graphical Representation of Subject Distribution on Risk Factors

8. PERCENTAGE OF SUBJECTS BASED ON AWARENESS

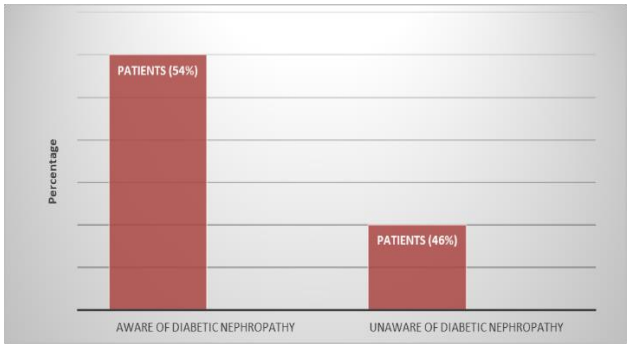

Figure 9 Graphical Representation of Awareness in Patients

LIMITATIONS OF OUR STUDY:

The accuracy of data about the Age of the senior population is questionable because there was no method to verify birth certificates.

Accurate sub-typing of the patients couldn't be performed since the imaging reports were not for sale in the majority.

Hereditary history of patients was not included.

Due to a lack of past medication history, drug-induced renal disorders were not included.

CONCLUSION:

Dialysis patient management is made more difficult by diabetes. Problems include more excellent rates of infections, cardiovascular morbidity, and mortality. Fluid overload, problems associated with dialysis, and life and psychological quality. Multiple disciplinary approaches are recommended to improve the quality of life of diabetic nephropathy patients. Because the challenges may include various complications. The numerous complexities of diabetic patient care on dialysis require the expertise of vascular surgeons, diabetologists, nephrologists, dietitians, microbiologists, and interventional radiologists.

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The Author declares that there is no conflict of interest.

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