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Prevalence of Diabetic Kidney Disease and Evaluation of Drugs to Stop Disease Progression

Sadav Khan[1], Dhruvi Patel[1], Sudhanshu Sen[1], S P Srinivas Nayak*[2]

[1]PharmD, Parul Institute of Pharmacy and Research, Parul University, Vadodara, Gujarat, India.

[2]Assistant Professor, Dept. of Pharmacy and Research, Parul University, Vadodara, Gujarat, India.

*** Corresponding Author:**

S P Srinivas Nayak**,** Assistant Professor, Dept. of Pharmacy Practice, Parul Institute of Pharmacy & Research, Parul University, Vadodara, Gujarat.

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KEYWORDS

Diabetic Kidney Disease, Chronic Kidney Disease, Diabetes Mellitus, Angiotensin Converting Enzyme inhibitors, SGLT-2 Inhibitors

ABSTRACT:

Background: Numerous factors, including genetic susceptibility, the duration and severity of diabetes, and lifestyle factors including smoking, obesity, and hypertension, affect the onset and progression of diabetic kidney disease. While strict glucose control and blood pressure management can halt the disease's course, current medicines are frequently insufficient to avert End Stage Renal Disease, and new therapeutics are required to enhance patient outcomes.

Objective: The study is to find the prevalence of Diabetic Kidney Disease and evaluate drugs to stop the disease progression, determine the incidence and prevalence of the disease, evaluate the effectiveness of existing treatments, and develop new treatments to improve patient outcomes and prevent End-stage renal disease.

Materials and Methods: This retrospective study aimed to determine the prevalence of Diabetic kidney disease and analyze the drugs used in its treatment among patients with diabetes who visited a tertiary care hospital for six months. Data was collected from electronic medical records, validated by two independent reviewers, and analyzed using Statistical Package for the Social Sciences.

Conclusion: Diabetes represents a significant risk factor for Chronic Kidney Disease, with as many as one in three individuals with diabetes facing the possibility of developing Chronic kidney disease during their lifetime.

Introduction

II. Kidney Illness

Any condition that affects the kidneys' function or structure is known as renal disease, sometimes known as kidney disease. The kidneys are important organs in the body because they control blood pressure, make hormones that govern various bodily functions, and filter waste and excess fluid from circulation[1].

Some of the most prevalent renal diseases are listed here:-

1. Chronic kidney disease: The illness known as chronic kidney disease (CKD) gradually impairs the kidneys' capacity for normal function. This can cause the body to retain more fluids and waste products, which could have a variety of harmful repercussions. Diabetes, hypertension, and glomerulonephritis are common causes of CKD[2].

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2. Acute kidney injury: Acute kidney damage (AKI) is a quick, often severe loss of kidney function that can be brought on by exposure to chemicals, drugs, infections, and other situations. AKI can result in lethargy, bad breath, and decreased urine output[3].

III. Chronic Kidney Disease

The hallmark of CKD is a steadily declining kidney function that causes the body to accumulate waste and fluid[4]. CKD, which has been connected to a higher risk of cardiovascular disease, infections, and mortality, affects millions of individuals globally[5].

1. The prevalence of chronic kidney disease

A major global health issue that impacts millions of individuals globally is CKD. A comprehensive study and meta-analysis published in PLOS One estimates that 750 million individuals, or 13.4% of the global population, suffer from CKD. A different study that was published in The Lancet claims that CKD is the tenth greatest cause of death worldwide, killing about 1.2 million people annually[6].

Pathophysiology of Chronic kidney disease

Pathophysiology of CKD includes activating the renin-angiotensin-aldosterone system (RAAS), which is essential. The effects of angiotensin II and aldosterone through RAAS activation bring hypertension, renal fibrosis, and inflammation in the kidney tissue[7]. People with diabetes and/or hypertension are often prescribed RAAS inhibitors, such as ACE inhibitors or angiotensin receptor blockers (ARBs), to delay the progression of CKD[8].

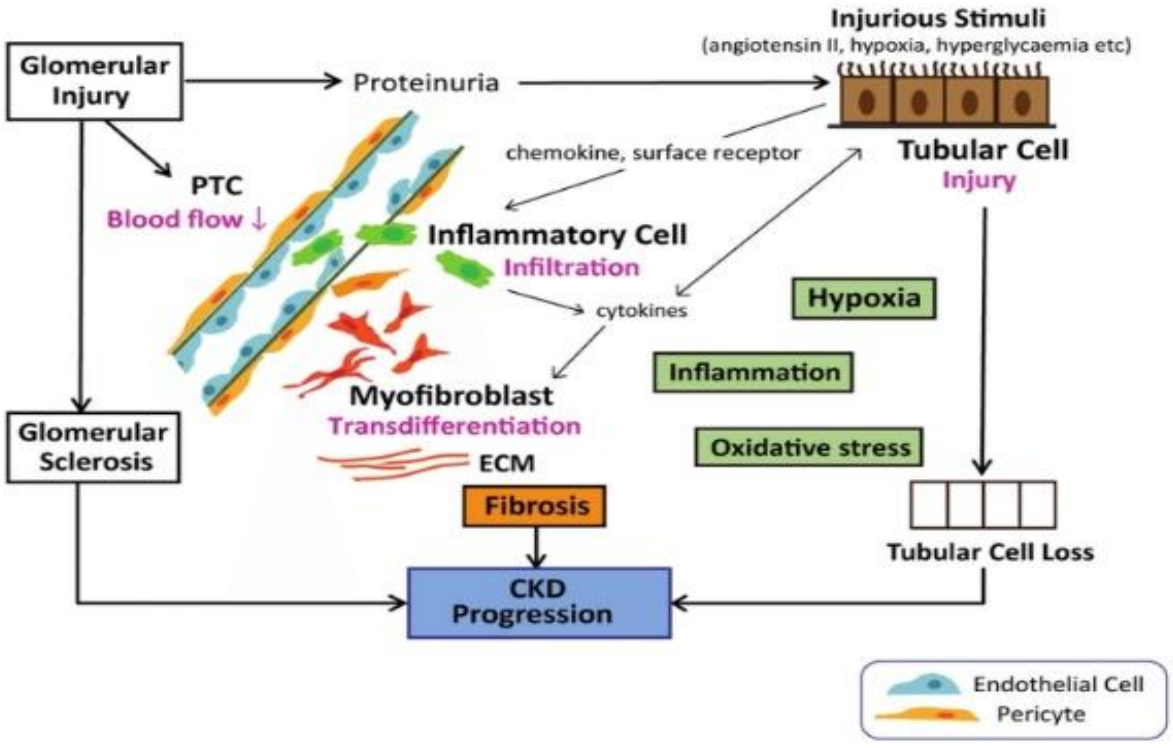

Fig.1. Pathophysiology of CKD

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4. Treatment of Chronic kidney disease

Treatment for CKD aims to control symptoms, avoid complications, and delay the progression of the condition. The treatment strategy is influenced by the patient's overall health, the underlying cause of the problem, and the stage of the disease.

4.1. Medication: Medication is administered based on the patient's symptoms as well as the underlying cause of their CKD. The following medications are regularly used to treat CKD:

I. High blood pressure is treated with ACE inhibitors and ARBs because it is a common complication of CKD. These medications also help to stop further kidney damage[9].

ii. Diuretics: Fluid retention, a typical CKD symptom, is treated with diuretics.

iii. Erythropoietin-stimulating medicines are prescribed to treat anemia, a frequent CKD consequence[10].

4.3. Dialysis: People with advanced CKD or ESRD may choose dialysis as a kind of treatment. Dialysis removes waste products and surplus fluids from the blood and can be performed in a hospital or at home. Hemodialysis and peritoneal dialysis are the two fundamental types of dialysis[11].

4.4. Kidney transplant: The recommended course of treatment for patients with ESRD is a kidney transplant. The patient's body receives a healthy donor kidney to replace their damaged kidney. Patients can continue their regular lives after a kidney transplant with a high success rate[12].

V. Definition of kidney disease caused by diabetes

In the developed world, DKD is the main cause of ESRD. It can manifest as a result of DM-1 and DM-2, among other kinds of diabetic mellitus (DM). Pancreatic islets die cellular and antibody-mediated deaths in type 1 diabetes, an autoimmune disease. Although DM-1 can occur at any age, it usually shows up before the age of 30. Insulin insufficiency and resistance are hallmarks of DM-2. DM-2 usually occurs after insulin resistance, visceral obesity, hypertension, hyperuricemia, and dyslipidemia in the metabolic syndrome. Long-term compensation for insulin resistance takes the form of increased insulin production, however, people with DM-2 may require insulin therapy as their pancreatic beta-cell function gradually declines and results in hyperglycemia even though it is now well-acknowledged to be a significant risk factor for both diabetes-related mortality and cardiovascular disease. To characterize the combined impact of albuminuria and GFR on the prognosis of kidney illnesses, including DKD, a two-dimensional composite ranking system based on cardiovascular and renal risk has been created[13]. DN is frequently accompanied by elevated proteinuria, hypertension, and a steady deterioration in renal function. DM-1 or DM-2 patients are susceptible to developing DN[14, 15].

1. Epidemiology of Diabetic Kidney Disease

Diabetes frequently causes DKD, which is the primary global cause of ESRD[16]. The prevalence and incidence of DKD vary significantly depending on the population studied, the duration of diabetes, and the diagnostic criteria used[17]. In a 2019 study that was published in Diabetes Care, the prevalence of DKD was investigated in a cohort of 1,179,801 adults with DM-2 in the US. The study found that the incidence of ESRD was 2.5 per 1000 person-years and that of DKD was 17.7 per 1000 person-years[18]. Not to add, the start and course of DKD were examined in a 2018 Diabetologia study that tracked 1,305 Finnish individuals with type 1 diabetes. According to the study, there were 3.3 cases of DKD for

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every 100 person-years and 0.4 cases of ESRD for every 100 person-years[19].

2. Diabetes-related renal disease prevalence

The population under study, the length of diabetes, and the diagnostic standards applied all affect how common DKD is globally. Lower eGFR (60 mL/min/1.73 m2) was found to be prevalent in 18.5% (95% CI 15.4-21.7) of patients with type 2 diabetes, although albuminuria (defined as urine [ACR] 30 mg/g or proteinuria [>300 mg/day]) was found to be prevalent in 28.2% (95% CI 25.8-30.6) of these patients[20]. Due to the high prevalence of diabetes in India, DKD is a common illness there. In a hospital-based population in South India, patients with DM-2 had a prevalence of CKD (including DKD) of 41.6%, according to a 2018 study published in the Indian Journal of Nephrology. Another 2020 study that was published in the Journal of Diabetes and its Complications discovered that 32.3% of Indians with DM-2 developed DKD.

3. Diabetic kidney disease pathogenesis

Numerous elements play a part in the intricate pathophysiology of DKD, including hyperglycemia, oxidative stress, inflammation, and changes in hemodynamics, among others. DKD frequently progresses in stages, beginning with hyperfiltration and microalbuminuria and ending with overt proteinuria, declining GFR, and ESRD. One of the primary mechanisms generating DKD is glomerular hyperfiltration, which shows up early in the disease and is believed to be produced by an increase in renal blood flow and pressure as a result of a combination of hemodynamic and metabolic variables(Fig. 2). The loss of albumin in the urine brought on by this hyperfiltration, which also raises glomerular permeability, is one of the distinctive features of DKD. Oxidative stress, which is brought on by a number of substances such as cytokines, advanced glycation end products (AGEs), and hyperglycemia, is another significant mechanism in diabetic kidney disease (DKD). Kidney damage is caused by oxidative stress in several ways, such as direct cellular death, the induction of inflammatory pathways, and the formation of fibrosis[21].

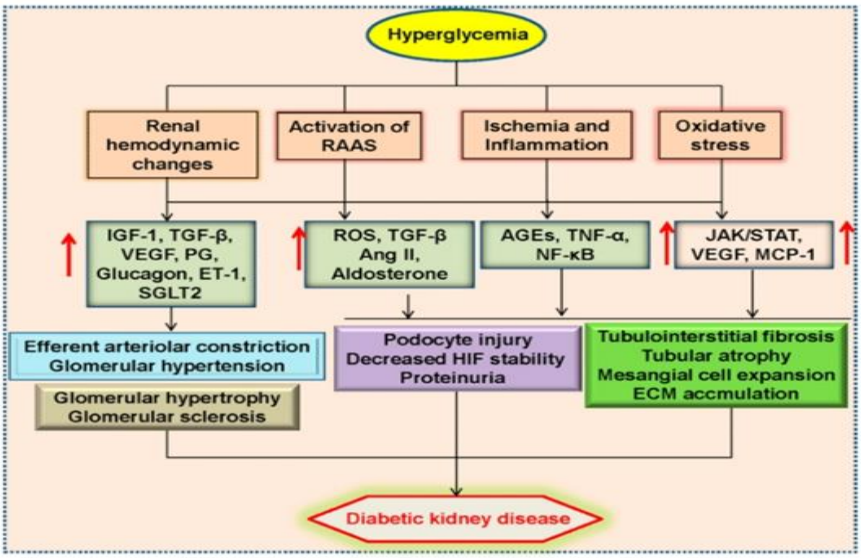

Fig.2. Pathophysiology of Diabetic Kidney Disease

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4. Factors That Lead to the Development of Diabetes-Related Kidney Disease

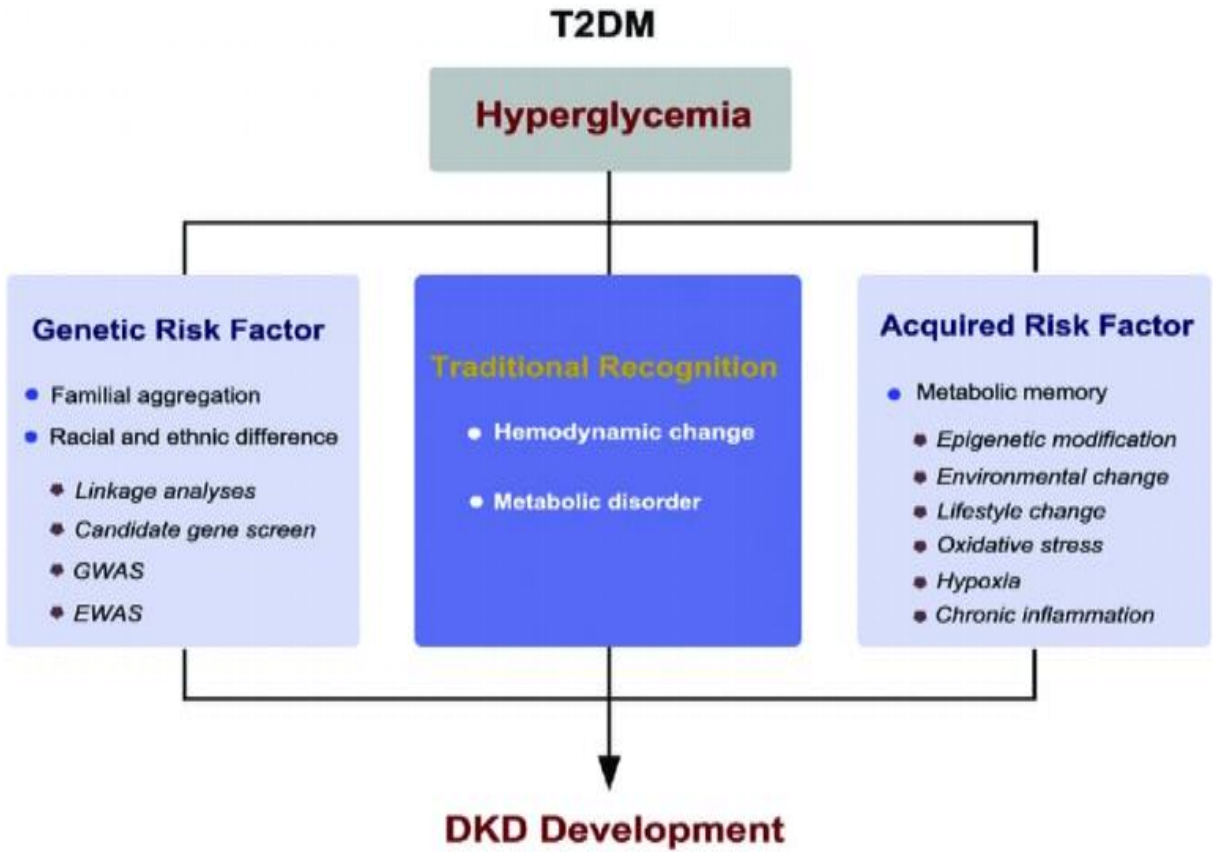

Fig.3. Factors That Lead to the Development of diabetes-related kidney disease

Criteria for experimentation:

2.1 Resources and Techniques:-

2.1.1. Make ready for study: At a tertiary care hospital, the study will assess the prevalence of diabetic kidney disease and the effectiveness of medications to halt the illness's progression.

2.1.2. Sample collection criteria:

1. Criteria for inclusion:-

18 years and above.

Patients of any age group both males and females on Kidney Disease and are diagnosed with Diabetes.

1. Requirements for exclusion:-

Women who are either pregnant or lactating.

Patient's files missing any data

2.1.3. sample size: 112

2.1.4. Data Analysis:

Data were collected from the medical record department and then statistically analyzed. The collected data were tabulated and statistically analyzed. Different types of graphs, figures, and tables are used to summarize the data visually And MS Excel sheet was used for the analysis of the data.

2.1.5. Statistical Analysis:

Categorical variables were summarized using counts and percentages. Data summaries were presented graphically. The mean was used to represent categorical data. To compare the means of three or more independent groups, an ANOVA test was performed.

Results

1. Analysis of medication utilization patterns on 112 patients: 74% used ANTI HTN drugs, while 26% used ANTIDIABETIC drugs, with higher usage of ANTIHYPERTENSIVE among CKD patients and more ANTIDIABETIC use in DKD and diabetic

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patients.

2. Diagnosis frequency assessment: 74% had CKD, 16% had diabetes, and 10% had DKD among 112 patients based on medical records.
3. Analysis of male patients: 80% suffered from CKD, 11% had diabetes, and 9% had DKD out of 66 males; 74% underwent dialysis while 26% did not; 64% used biguanides and 36% used sulfonylureas among 12 diabetic males.
4. Quantifying insulin use among males: 67% used plain insulin, 20% used glargine insulin, and 13% used other insulin types out of 15 male diabetes patients.
5. Prevalence of antihypertensive drug use among males: ACE inhibitors (31%), calcium channel blockers (27%), ARBs (24%), and centrally acting alpha-blockers (18%) were used among 55 patients.
6. Infection incidence among males: 71% had infections while 29% did not; 71% used antibiotics, and 29% did not among 65 male patients.
7. Analysis of female patients: 70% had CKD, 12% had diabetes, and 18% had DKD out of 34 females; 81% underwent dialysis while 19% did not out of 21 females; 70% used sulfonylureas, and 30% used biguanides among 10 diabetic females.
8. Prevalence of insulin use among females: 40% used plain insulin, 40% used other insulin, and 20% used glargine insulin out of 10 female diabetes patients.
9. Antihypertensive drug use prevalence among females: ACE inhibitors (37%), calcium channel blockers (33%), ARBs (25%), and centrally acting alpha-blockers (5%) were used among 29 female patients.
10. Infection incidence among females: 84% had infections while 16% did not out of 31 female patients; 84% used antibiotics while 16% did not among 28 female patients.

Category	No of Patients (n=112)	Percentage
Q 1. MEDICATION UTILIZATION PATTERNS		
- ANTI HTN	83	74%
- ANTIDIABETIC	29	26%
Q 2. DIAGNOSIS FREQUENCY		
- CKD	83	74%
- DIABETES	18	16%
- DKD	11	10%
Q 3. ANALYSIS OF MALE PATIENT		
a. DIAGNOSIS FREQUENCY		
- CKD	53	80%
- DIABETES	7	11%
- DKD	6	9%
b. DIALYSIS PATIENT COUNT		
- YES	49	74%
- NO	17	26%
c. ORAL ANTIHYPERGLYCEMIC MEDICATION		
- BIGUANIDES	9	64%
- SULFONYLUREA	3	36%

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INSULIN USE		
- GLARSIN	3	20%
- OTHER	2	13%
- PLAIN INSULIN	10	67%
d. ANTIHYPERTENSIVE DRUG USE		
- ACE INHIBITOR	17	31%
- ARB	13	24%
- CCB	15	27%
- CENTRALLY ACTING ALPHA BLOCKERS		18%
e. INCIDENCE OF INFECTIONS		
- YES	46	71%
- NO	19	29%
f. ANTIBIOTIC USE		
- YES	46	71%
- NO	19	29%
Q 4. ANALYSIS OF FEMALE PATIENT		
a. DIAGNOSIS FREQUENCY		
- CKD	24	70%
- DIABETES	4	12%
- DKD	6	18%
b. DIALYSIS PATIENT COUNT		
- YES	17	81%
- NO	4	19%
c. ORAL ANTIDIABETIC MEDICATION		
- BIGUANIDES	3	30%
- SULFONYLUREA	7	70%
- INSULIN USE		
- GLARZINE	2	20%
- OTHER	4	40%
- PLAIN INSULIN	4	40%
d. ANTIHYPERTENSIVE DRUG USE		
- ACE INHIBITORS	9	37%
- ARB	6	25%
- CCB	8	33%
- CENTRALLY ACTING ALPHA BLOCKERS		5%

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e. INCIDENCE OF INFECTIONS		
- YES	26	85%
- NO	5	16%
f. ANTIBIOTIC USE		
- YES	23	84%
- NO	5	16%

Table 1

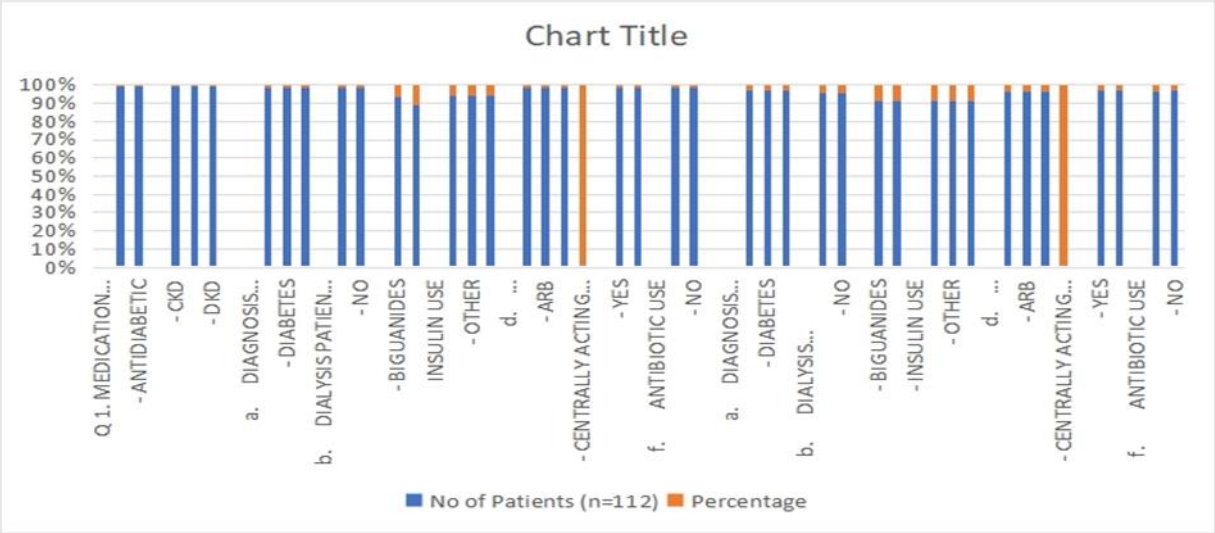

Fig 4

Discussion

In order to determine the frequency of DKD and evaluate the effectiveness of drugs in stopping the disease's progression, 112 patients all were analyzed from the collected data. The study comprised individuals who were between the ages of 0 and 20, 21 and 40, and 41 and 60. Of the total number of patients, those between the ages of 40 and 60 made up the majority (50%) followed by those between the ages of 21 and 40 (27%), and those between the ages of 0 and 20 (3%).

Male patients made up the majority (72%) of the patients in terms of gender. All patients were diagnosed with chronic kidney disease (CKD), diabetes, and DKD; it was discovered that CKD was the most common diagnosis (74%), followed by diabetes (16%), and DKD had the lowest prevalence (10%). Patients with CKD, DKD, and diabetes were additionally subjected to a medication count that included antihypertensive and anti-diabetic medications. It was found that CKD patients used antihypertensives the most (74%), whereas DKD and diabetic patients used anti-diabetic medications the most (26% each). Out of the 112 patients, 66 were men, according to further gender analysis of the data. The most common condition in male patients was CKD (80%), which was followed by diabetes (11%), and DKD (9%). The bulk of the male patients were also receiving dialysis treatment (74%) whereas the remaining patients (26%) were not receiving any dialysis treatment. The bulk of the male patients were receiving biguanides (64%), while the remaining patients were on sulfonylurea (36%). The most common antihypertensive medications taken by male patients were ACE inhibitors (31%), calcium channel blockers (27%) and ARBs (24%).

Further investigation revealed that 71% of the male patients had an infection, and 71% of them were taking antibiotics, with the remaining 29% not taking any. 34 of the 112 patients were female, with CKD accounting for

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the majority of their illnesses (70%), followed by diabetes (12%) and DKD (18%). The bulk of the female patients (81%) were also receiving dialysis treatment, while the remaining 19% were not receiving any dialysis treatment. Sulfonylurea was the most common medicine taken by female patients (70%), followed by biguanides (30%). The majority of them were also taking glarzine (20%), followed by other drugs (40%) and plain insulin (40%) in that order. The bulk of the female patients using hypertension medications were taking ACE inhibitors (37%), followed by calcium channel blockers (33%) and ARBs (25%). Further investigation revealed that 84% of the female patients had infections, 84% of them were receiving antibiotics, and the other 16% were not taking any medications.

Conclusion

The findings of this study can help doctors and other medical professionals better understand the incidence of specific disorders and the variety of available therapies. Since CKD occurs often, preventing disease development and enhancing patient outcomes depend on early detection and effective treatment. Using the data on commonly used medications as a guide, doctors can modify their treatment plans based on each patient's particular needs and responses.

The study's discovery that sick people prefer to use antibiotics more frequently emphasizes the need for doctors to use antibiotics judiciously and avoid overprescribing them.

It is essential to use antibiotics carefully to prevent the development of antibiotic-resistant bacterial strains, which can pose a major threat to the general public's health.

Generally speaking, CKD patients' quality of life can be improved and consequences can be reduced with early detection and care of the disease and related risk factors.

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