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A REVIEW ON DIABETIC NEPHROPATHY

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Abstract:
Diabetic nephropathy (DN) is a serious complication of type 1 diabetes and type 2 diabetes. It's also called diabetic kidney disease. It is one of the most feared diabetic chronic microvascular complications and the major cause of end-stage renal disease (ESRD). The classical presentation of DN is characterized by hyperfiltration and albuminuria in the early phases which is then followed by a progressive renal function decline. Diabetic nephropathy or diabetic kidney disease is a syndrome characterized by the presence of pathological quantities of urine albumin excretion, diabetic glomerular lesions, and loss of glomerular filtration rate (GFR) in diabetics.

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INTRODUCTION:

Diabetic nephropathy is a serious complication of type 1 diabetes and type 2 diabetes. It's also called diabetic kidney disease. Diabetic nephropathy affects the kidneys' ability to do their usual work of removing waste products and extra fluid from our body. The best way to prevent or delay diabetic nephropathy is by maintaining a healthy lifestyle and adequately managing your diabetes and high blood pressure. Over many years, the condition slowly damages your kidneys' delicate filtering system. Early treatment may prevent or slow the disease's progress and reduce the chance of complications. Kidney disease may progress to kidney failure, also called end-stage kidney disease. Kidney failure is a life-threatening condition. Treatment options are dialysis or a kidney transplant.

Diabetic nephropathy (DN) is one of the most feared diabetic chronic microvascular complications and the major cause of end-stage renal disease (ESRD). The classical presentation of DN is characterized by hyperfiltration and albuminuria in the early phases which is then followed by a progressive renal function decline. Diabetic nephropathy (DN) or diabetic kidney disease is a syndrome characterized by the presence of pathological quantities of urine albumin excretion, diabetic glomerular lesions, and loss of glomerular filtration rate (GFR) in diabetics. Diabetes may be classified as type 1 (autoimmune β-cell destruction and absolute insulin deficiency), type 2 (relative insulin deficiency and resistance), and other types(e.g., pancreatic disease).

Hypertension, or high blood pressure, is a complication of diabetes that is believed to contribute most directly to diabetic nephropathy. Hypertension is believed to be both a cause of diabetic nephropathy, as well as a result of the damage that is created by the disease. As kidney disease progresses, physical changes in the kidneys often lead to increased blood pressure. Uncontrolled hypertension can make the progress toward stage five diabetic nephropathy occur more rapidly. The high blood sugar associated with diabetes also causes damage to the kidney through many different and complicated pathways. Most of this damageis directed toward the blood vessels that filter the blood to make urine.

DIABETES MELLITUS

Diabetes Mellites is defined as a heterogeneous metabolic disorder characterized by common feature of chronic hyperglycemia with disturbance of carbohydrate, fat and protein metabolism. [(1)]

EPIDEMOLOGY:

Diabetes Mellites is a leading cause of morbidity and mortality world over. It is estimated that approximately 1% of population suffers from DM. Among this, 5 to 10% of the diagnose diabetic population have type 1 diabetes. The incidence of type 1 diabetes peaks during puberty between 10 and 14 years of age, although the age at onset ranges from 9 monthsto 28 years of age. Approximately 7.4% of adults who are diagnosed with diabetes between 30 and 75 years of age have type 1 diabetes. [(2).] The incidence is rising in the development countries of the world at the rate of about 10% per year, especially of type 2 DM, due to rising incidence of obesity and reduced activity levels. [(3)] The worldwide prevalence of diabetes has continued to increase dramatically. Globally, as of 2011, an estimated 366 million people had DM, with type 2 making up about 90% of the cases. The number of people with type 2 DM is increasing in every country with 80% of people with DM living in low-and middle- income countries. [(4)]

India is one of the epicentres of the global diabetes mellitus pandemic. Rapid socio- economic development and demographic changes along with increased susceptibility for Indiaindividuals, have led to the explosive increase in the prevalence of diabetic mellites in India over the past four decades. The burden of diabetes is high and increasing globally, and in developing economies like India, mainly fueled by the increasing prevalence of overweight/obesity and unhealthy lifestyles. The estimates in 2019 showed that 77 million individuals had diabetes in India, which is expected to rise to over 134 million by 2045.

Kerala is the diabetes capital of India with a prevalence of diabetes as high as 20% ─ double the national average of 8%. 1, 2 In a large multi-centre study involving nearly 20,000 subjects, the prevalence of diabetes in Thiruvananthapuram was 17% compared to 15% in Hyderabad and New Delhi.

ETIOLOGY:

In all the cases of diabetes symptoms are: polyuria (frequent urination), polydipsia (increased thirst and consequently increased fluid intake) and polyphagia (increased appetite). These symptoms develop fast in type 1, particularly in children but may be absent or developing slowly in type 2. In type 1 there may also be weight loss and irreducible fatigue.

When the glucose concentration in the blood is high (above the renal threshold), reabsorption of glucose in the proximal renal tubule is incomplete, and part of the glucose remain in the urine cause glycosuria. This increases the osmotic pressure of urine and inhibitsthe

reabsorption of water, resulting in an increased urine production (polyuria) and an increased fluid loss from the blood. The lost blood volume will be replaced by the water held in the body cells, causing dehydration and increase thirst.

Prolonged high blood glucose produces changes in the shape of the lens of the eyes leading to vision changes. Blurred vison is a common complaint leading to a diagnosis of type

1. In type 1 diabetes there is a smell of acetone in breath due to a diabetic ketoacidosis, a rapid, deep breathing, polyuria, nausea, vomiting and abdominal pain, altered state of consciousness or as usual. In severe DKA (Diabetic Ketoacidosis), coma which leads to death. A rarer condition such as hyperosmolar non ketotic state is more common type 2 diabetes which is the result of dehydration due to the polyuria. (5)

CLINICAL MANIFESTATIONS:

SIGNS AND SYMPTOMS:

Diabetes symptoms depend on how high your blood sugar. Some people, especially if they have prediabetes or type 2 diabetes, may not have symptoms. In type 1 diabetes symptoms tend to cone on quickly and be more severe.

Some of the symptoms of type 1 diabetes and type 2 diabetes are:

* Frequent urination
* Excessive thirst
* Unexplained weight loss
* Extreme hunger
* Sudden vision changes
* Tingling or numbness in the hands or feet
* Feeling very tired much of the time
* Very dry skin
* Have sores that heal slowly
* Have more infections than usual

Type 1 diabetes can start at any age. But it often starts during childhood or teen years. Type 2 diabetes, the more common type, can develop at any age. Type 2 diabetes is more common in people older than 40.

DIAGNOSIS:

Hyperglycaemia remains the fundamental basis for the diagnosis of diabetes mellitus. In symptomatic cases, the diagnosis is not a problem and can be confirmed by finding glucosuria and a random plasma glucose concentration above 200 mg/dl.

1.A fasting plasma glucose test measures your blood glucose after you have gone at least 8 hours without eating. This test is used to detect diabetes or prediabetes.

2. An oral glucose tolerance test measures your blood sugar after you have gone at least eight hours without eating and two hours after you drink a glucose-containing beverage. This test can be used to diagnose diabetes or prediabetes.

3. In a random plasma glucose test, your doctor checks your blood sugar without regard to when you ate your last meal. This test, along with an assessment of symptoms, is used to diagnose diabetes, but not prediabetes.

4. A haemoglobin A1c (HbA1c) test can be done without fasting, and can be used to diagnose or confirm either prediabetes or diabetes.

Positive test results should be confirmed by repeating the fasting plasma glucose test or the oral glucose tolerance test on a different day. When first diagnosed with diabetes, your doctor may suggest a zinc transporter 8 autoantibody (ZnT8Ab) test. This blood test -- along with other information and test results -- can help determine if a person has type 1 diabetes and not another type. The goal of having the ZnT8Ab test is a prompt and accurate diagnosis and that can lead to timely treatment.

5. Fasting Plasma Glucose (FPG) Test:

The FPG (Fasting plasma Glucose) is most reliable when done in the morning. Results and their meaning are shown in table 1. If your fasting glucose level is 100 to 125 mg/dL, you have a form of prediabetes called impaired fasting glucose (IFG), meaning that you are more likely to develop type 2 diabetes but do not have it yet. A level of 126 mg/dL or above, confirmed by repeating the test on another day, means that you have diabetes.

Table 1. Fasting Plasma Glucose Test Confirmed by repeating the test on a different day

Plasma Glucose Result (mg/dL)	Diagnosis
99 and below	Normal
100 to 125	Prediabetes (impaired fasting glucose)
126 and above	Diabetes

6. Gestational diabetes:

It is also diagnosed based on plasma glucose values measured during the OGTT (Oral Glucose Tolerance Test). Blood sugar levels are checked four times during the test. If your blood sugar levels are above normal at least twice during the test, you have gestational diabetes. Table 3 shows the above-normal results for the OGTT

for gestational diabetes.[6]

Table 2. Gestational Diabetes: Above-Normal Results for the Oral Glucose Tolerance Test

When	Plasma Glucose Result (mg/dL)
Fasting	95 or higher
At 1 hour	180 or higher
At 2 hours	155 or higher
At 3 hours	140 or higher

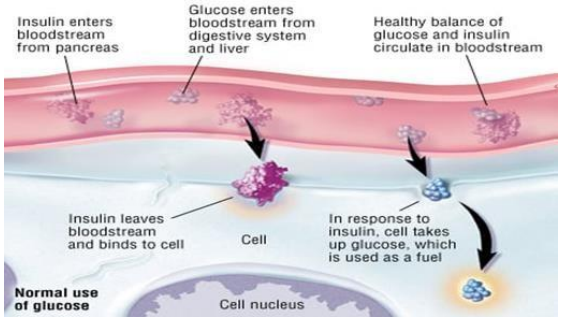
PATHOPHYSIOLOGY:

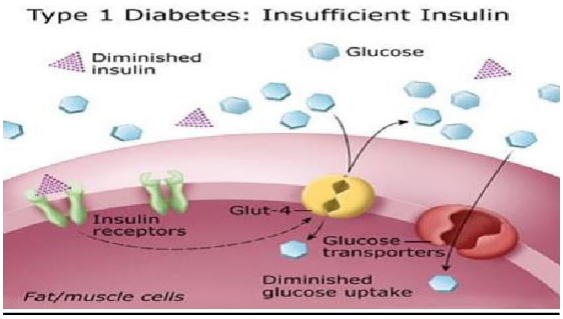
The pathophysiology of all types of diabetes is related to the hormone insulin, which is secreted by the beta cells of the pancreas. In a healthy person, insulin is produced in response to the increased level of glucose in the bloodstream, and its major role is to control glucose concentration in the blood. What insulin does is, allowing the body cells and tissues to use glucose as a main energy source. Also, this hormone is responsible for conversion of glucose to glycogen for storage in the muscles and liver cells. This way, sugar level is maintained at a near stable amount.

In a diabetic person, there is an abnormal metabolism of insulin hormone. The actual reason for this malfunction differs according to the type of diabetes. Whatever the cause is, the body cells and tissues do not make use of glucose from the blood, resulting in elevated blood glucose (a typical symptom of diabetes called hyperglycaemia). This condition is also exacerbated by the conversion of stored glycogen to glucose, i.e., increased hepatic glucose production. Over a period of time, high glucose level in the bloodstream can lead to severe complications, such as eye disorders, cardiovascular diseases, kidney damage, and nerve problems.

In Type 1 diabetes, the pancreas cannot synthesize enough amounts of insulin as required by the body. The pathophysiology of Type 1 diabetes mellitus suggests that it is an autoimmune disease, wherein the body's own immune system generates secretion of substances that attack the beta cells of the pancreas. Consequently, the pancreas secretes little or no insulin. Type 1 diabetes is more common among children and young adults (around 20 years). Since it is common among young individuals and insulin hormone is used for treatment, Type 1 diabetes is also referred to as Juvenile Diabetes or Insulin Dependent Diabetes Mellitus(IDDM).

In case of Type 2 diabetes mellitus, the insulin hormone secreted by the beta cells is normal or slightly lower than the ideal amount. However, the body cells are not responding to insulin as they do in a healthy person. Since the body cells and tissues are resistant to insulin, they do not absorb glucose, instead it remains in the bloodstream. Thus, the Type 2 diabetes is also characterized by elevated blood sugar. It is commonly manifested by middle-aged adults (above 40 years). As insulin is not necessary for treatment of Type 2 diabetes, it is known as Non-insulin Dependent Diabetes Mellitus (NIIDM) or Adult-Onset Diabetes. [7]





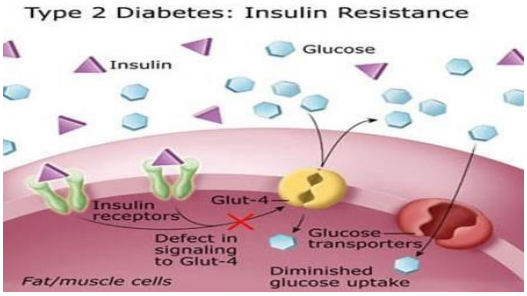


Figure 1: Pathophysiology of Diabetes Mellitus

TREATMENT:

Treatment for diabetes mellitus is aimed at reducing blood glucose concentrations to normal levels. Achieving this is important in promoting well-being and in minimizing the developmentand progression of the long-term complications of diabetes. Measurements of HbA1c (HaemoglobinA1C) can be used to assess whether an individual's treatment for diabetes is effective. Target values of HbA1c levels should be close to normal.

1. DIET AND EXERCISE:

All diabetes patients are put on diets designed to help them reach and maintain normal body weight, and they often are encouraged to exercise regularly, which enhances the movement of glucose into muscle cells and blunts the rise in blood glucose that follows carbohydrate ingestion. Patients are encouraged to follow a diet that is relatively low in fat and contains adequate amounts of protein. In practice about 30 percent of calories should come from fat, 20 percent from protein, and the remainder from carbohydrates, preferably from complex carbohydrates rather than simple sugars.

The total caloric content should be based on the patient's nutritional requirements for growth or for weight loss if the patient is obese. In overweight or obese patients with type 2 diabetes, caloric restriction for even just a few days may result in considerable improvement in hyperglycaemia. In addition, weight loss, preferably combined with exercise, can lead to improved insulin sensitivity and even restoration of normal glucose metabolism.

2. INSULIN TERAPIES:

Diabetics who are unable to produce insulin in their bodies require insulin therapy. Traditional insulin therapy entails regular injections of the hormone, which are often customized according to individual and variable requirements. Beef or pork insulin, made from the pancreatic extracts of cattle or pigs, can be used to treat humans with diabetes. However, in the United States, beef and pork forms of insulin are no longer manufactured, having been discontinued in favour of human insulin production. Modern human insulin treatments are based on recombinant DNA technology. Human insulin may be given as a form that is identical to the natural form found in the body, which acts quickly but transiently (short-acting insulin), or as a form that has been biochemically modified so as to prolong its action for up to 24 hours (long-acting insulin). Another type of insulin acts rapidly, with the hormone beginning to lower blood glucose within 10 to 30 minutes of administration; such rapid-acting insulin was made available in an inhalable form in 2014.

The optimal regimen is one that most closely mimics the normal pattern of insulin secretion, which is a constant low level of insulin secretion plus a pulse of secretion after each meal. This can be achieved by administration of a long-acting insulin preparation once daily plus administration of a rapid-acting insulin preparation with or just before each meal. Patients alsohave the option of using an insulin pump, which allows them to control variations in the rate of insulin administration. A satisfactory compromise for some patients is twice-daily administration of mixtures of intermediate-acting and short-acting insulin. Patients taking insulin also may need to vary food intake from meal to meal, according to their level of activity; as exercise frequency and intensity increase, less insulin and more food intake may be necessary.

3. DRUGS USED TO CONTROL GLUCOSE LEVEL:

There are several classes of oral drugs used to control blood glucose levels, including sulfonylureas, biguanides, and thiazolidinediones. Sulfonylureas, such as glipizide and glimepiride, are considered hypoglycaemic agents because they stimulate the release of insulin from beta cells in the pancreas, thus reducing blood glucose levels. The most commonside effect associated with sulfonylureas is hypoglycaemia (abnormally low blood glucose levels), which occurs most often in elderly patients who have impaired liver or kidney function.

Biguanides, of which metformin is the primary member, are considered antihyperglycemic agents because they work by decreasing the production of glucose in the liver and by increasing the action of insulin on muscle and adipose tissues. A potentially fatal side effect of metformin is the accumulation of lactic acid in blood and tissues, often causing vague symptoms such asnausea and weakness.

Thiazolidinediones, such as rosiglitazone and pioglitazone, act by reducing insulin resistance of muscle and adipose cells and by increasing glucose transport into these tissues. These agents can cause oedema (fluid accumulation in tissues), liver toxicity, and adverse cardiovascular events in certain patients. Furthermore, oral hypoglycaemic agents lower mean blood glucoseconcentrations by only about 50–80 mg per 100 ml (2.8–4.4 mmol per litre), and sensitivity to these drugs tends to decrease with time.

There are several other agents that can be highly effective in the treatment of diabetes. Pramlintide is

an injectable synthetic hormone (based on the human hormone amylin) that regulates blood glucose levels by slowing the absorption of food in the stomach and by inhibiting glucagon, which normally stimulates liver glucose production. Exenatide is an injectable antihyperglycemic drug that works similarly to incretins, or gastrointestinal hormones, such as gastric inhibitory polypeptide, that stimulate insulin release from the pancreas. Exenatide has a longer duration of action than incretins produced by the body becauseit is less susceptible to degradation by an enzyme called dipeptidyl peptidase-4 (DPP-4). A drug called sitagliptin specifically inhibits DPP-4, thereby increasing levels of naturally produced incretins. Side effects associated with these drugs are often mild, although pramlintide can cause profound hypoglycaemia in patients with type 1 diabetes. [9]

COMPLICATIONS:

1. cardiovascular disease**:** Affects the heart and blood vessels and may cause fatal complications such as coronary artery disease (leading to heart attack) and stroke. Cardiovascular disease is the most common cause of death in people with diabetes. High blood pressure, high cholesterol, high blood glucose and other risk factors contribute to increasing the risk of cardiovascular complications.

2. kidney disease (diabetic nephropathy)**:** Caused by damage to small blood vessels in the kidneys leading to the kidneys becoming less efficient or to fail altogether. Kidney disease is much more common in people with diabetes than in those without diabetes. Maintaining near normal levels of blood glucose and blood pressure can greatly reduce the risk of kidney disease.

3. Nerve disease (diabetic neuropathy**)**: Diabetes can cause damage to the nerves throughout thebody when blood glucose and blood pressure are too high. This can lead to problems with digestion, erectile dysfunction, and many other functions. Among the most commonly affected areas are the extremities, in particular the feet. Nerve damage in these areas is called peripheral neuropathy, and can lead to pain, tingling, and loss of feeling.

4. Eye disease (diabetic retinopathy)**:** Most people with diabetes will develop some form of eye disease (retinopathy) causing reduced vision or blindness. Consistently high levels of blood glucose, together with high blood pressure and high cholesterol, are the main causes of retinopathy. It can be managed through regular eye checks and keeping glucose and lipid levelsat or close to normal.

5. Pregnancy complications**:** Women with any type of diabetes during pregnancy risk a number of complications if they do not carefully monitor and manage their condition. To prevent possible organ damage to the foetus, women with type 1 diabetes or type 2 diabetes should achieve target glucose levels before conception. All women with diabetes during pregnancy, type 1, type 2 or gestational should strive for target blood glucose levels throughout to minimize complications. High blood glucose during pregnancy can lead to the foetus putting on excess weight. [12]

DIABETIC NEPHROPATHY

Diabetic nephropathy is a common complication of type 1and type2 diabetics. Over time, poorly controlled diabetes can cause damage to blood vessel clusters in your kidney that filter waste from your blood. This can lead to kidney damage and cause high blood pressure.

EPIDEMOLOGY:

Western literature suggests approximately 35% of patients with IDDM (Insulin dependent Diabetes Mellitus) develop this complication. The prevalence in patients with NIDDM (Non- Insulin dependent diabetes mellitus) depends on the ethnic background varying from 15-60%. It is highest in pina Indians while Europeans have the lowest.

Studies in India found the complication in NIDDM to be varying from 19.7-28.5% while in IDDM it was 7.9%. The average age at presentation was 53.01-55.9% years. [13, 14]

About 21% of patients of diabetic nephropathy (DN) reach the end stage an average of 11.85 years after the onset of disease. The manifestation of DN occur earlier in those patients who reach the end stage.

Five-year survival rates for renal grafts are only 44%in diabetics compared to 72% in non- diabetics. The most common cause of death are myocardial infraction and septicaemia.

Diabetic nephropathy is one of the leading causes of chronic renal failure in India. It has been reported that among 4837 patients with chronic renal failure seen over a period of 10 years, the prevalence of diabetic nephropathy was 30.3% followed by chronic interstitial nephritis (23.0%) and chronic glomerulonephritis (17.7%). [13,14]

ETIOLOGY:

Damage to the kidneys puts stress on these vital

organs and prevents them from workingproperly. When this happens:

- the body starts to lose protein through the urine
- the kidneys cannot remove waste products from the blood
- the kidneys cannot maintain healthy fluid levels in the body

Diabetic nephropathy develops slowly. Also, if a person has no clinical signs of nephropathy 20–25 years after diabetes starts, they have a low chance of developing it thereafter. Diabetic nephropathy is less likely if a person with diabetes manages their glucose levels effectively. High blood glucose levels increase the risk of high blood pressure because of the damage to blood vessels. Having high blood pressure, or hypertension, may contribute to kidney disease. (15)

CLINICAL MANIFESTATIONS:

SIGNS & SYMTOMS:

In the early stages of diabetic nephropathy, you would most likely not notice any signsor symptoms. In later stages, signs and symptoms may include:

- Worsening blood pressure control
- Protein in the urine
- Swelling of feet, ankles, hands or eyes
- Increased need to urinate
- Reduced need for insulin or diabetes medicine
- Confusion or difficulty concentrating
- Shortness of breath
- Loss of appetite
- Nausea and vomiting
- Persistent itching
- Fatigue

DIAGNOSIS:

Diabetic nephropathy is usually diagnosed during routine testing that's a part of your diabetes management. If you're living with type 1 diabetes, screening for diabetic nephropathy is recommended beginning five years after your diagnosis. If you are diagnosed with type 2 diabetes, screening will begin at the time of diagnosis.

Routine screening tests may include:

- Urinary albumin test: This test can detect the blood protein albumin in your urine. Typically, the kidneys don't filter albumin out of the blood. Too much of the protein in your urine can indicate poor kidney function.
- Albumin/creatinine ratio: Creatinine is a chemical waste product that healthy kidneys filter out of the blood. The albumin/creatinine ratio — a measure of howmuch albumin is in a urine sample relative to how much creatinine there is provides another indication of kidney function.
- Glomerular filtration rate (GFR): The measure of creatinine in a blood sample may be used to estimate how quickly the kidneys filter blood (glomerular filtration rate). A low filtration rate indicates poor kidney function. (16)

Other diagnostic tests may include the following:

- Imaging tests: Your doctor may use X-rays and ultrasound to assess your kidneys' structure and size. You may also undergo CT scanning and magnetic resonance imaging (MRI) to determine how well blood is circulating within your kidneys. Other imaging tests may be used in some cases.
- Kidney biopsy: Your doctor may recommend a kidney biopsy to take a sample of kidney tissue. You'll be given a numbing medication (local anaesthetic). Then your doctor will use a thin needle to remove small pieces of kidney tissue for examination under a microscope. (17)

PATHOPHYSIOLOGY:

The pathophysiology of diabetic nephropathy involves a multifactorial interaction between metabolic and hemodynamic factors. Metabolic factors involve glucose-dependent pathways, such as advanced glycation end-products and their receptors. (18) The pathogenesis of diabetic nephropathy is likely to be as a result of metabolic and hemodynamic abnormalities, as seen in diabetes, interacting with each other and with various reactive oxygen species-dependent pathways. Both gene regulation and activation of transcription factors are influencedby the interactions between metabolic stimuli, hemodynamic factors and reactive oxygen species generation in diabetes. The consequences of molecular activation and inhibition of the various pathways lead to functional and structural changes that clinically become manifest as diabetic nephropathy, characterized by increasing albuminuria and declining renal function. (19,20) AGE, advanced glycation end-products; ECM, extracellular matrix; ESRF, end-stage renal failure; ET, endothelin; GFR, glomerular filtration rate.

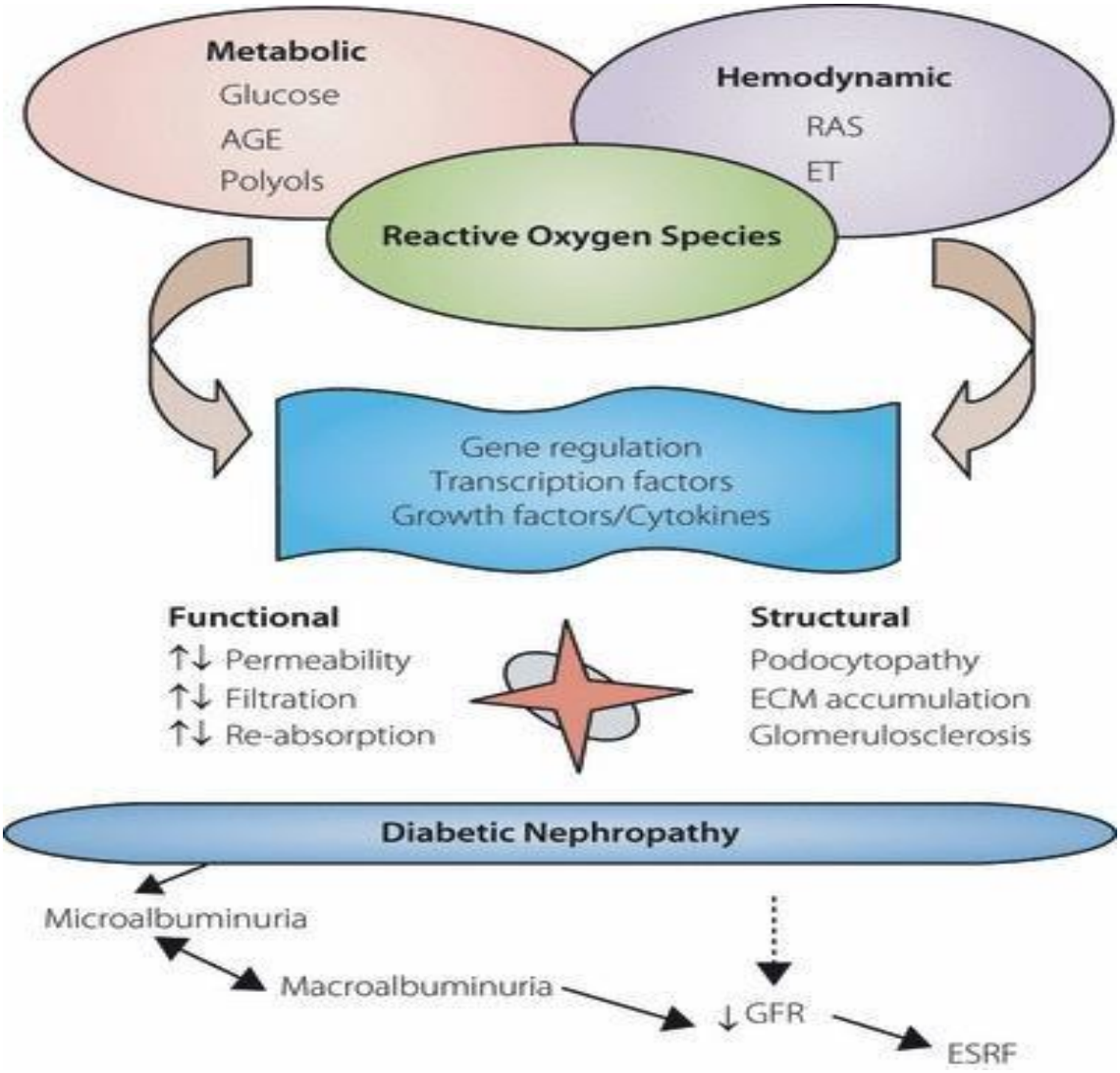


Figure 2: Pathophysiology of Diabetic Nephropathy

TREATMENT:

Early treatment can delay or prevent the onset of diabetic nephropathy. The main aim of treatment is to maintain and control blood glucose levels and blood pressure. This may involvethe use of medication. [19]

DRUG TREATMENT:

Angiotensin converting enzyme (ACE) inhibitors or angiotensin receptor blockers (ARBs) can help lower Trusted Source blood pressure, protect kidney function, and prevent further damage. A doctor may also prescribe vitamin D, as people with kidney disease often have low vitamin D levels, or a statin to reduce cholesterol levels.

DIETARY CHANGES:

If a person has kidney disease, their doctor may ask them to keep track of the following nutrients Trusted Source:

Water: Although essential, too much water or fluid may increase the risk of swelling and high blood pressure

Sodium: This can raise blood pressure as it is a constituent of salt.

Protein: For a person with kidney disease, protein can cause waste to build up in the blood, putting extra pressure on the kidneys.

Phosphorus: This occurs in many protein and dairy foods. Too much phosphorus can weaken the bones and put pressure on the kidneys.
Potassium: People with kidney disease can have higher levels of potassium than is healthful, which can affect nerve cells.[20]

MANAGING BLOOD SUGAR LEVEL:
This is crucial for lowering the risk of diabetes complications, such as kidney disease, cardiovascular disease, and diabetic neuropathy, which affects the nervous system. These conditions, too, can lead to further complications. Managing blood sugar levels can also help prevent these from developing.

LATE-STAGE TREATMENT:
If diabetic nephropathy progresses to ESRD, a person will need either dialysis or a kidney transplant. They will usually need dialysis for the rest of their life or until a kidney transplant is available.

DIALYSIS:
There are different types of dialysis:
Haemodialysis: Blood leaves the body through a needle in the forearm and passes through a tube to a dialysis machine. The machine filters the blood outside the body, and the blood returns through another tube and needle. A person may need to do this from three to seven times a week and spend from 2 to 10 hours Trusted Source in a session, depending on the option theychoose.

Peritoneal dialysis: This uses the lining of the abdomen Trusted Source, or peritoneum, to filter blood inside the body.

- In continuous ambulatory peritoneal dialysis (CAPD), dialysis fluid enters the abdomenthrough a catheter. The fluid stays inside for several hours, filtering waste products before draining out. Draining takes 30–40 minutes.
- In continuous cycler-assisted peritoneal dialysis (CCPD), or automated peritoneal dialysis, a person spends 8–10 hours overnight connected to a dialysis machine, whilethey sleep. The machine controls the drainage of the fluid. [21]

PATIENT COUNSELLING:
Diabetic nephropathy is a serious disorder with lifelong repercussions and a high mortality rate. There is no cure for the disorder, and all treatments have limitations. The key today is to prevent nephropathy from developing. Thus, an interprofessional clinical team is crucial in reducing cardiovascular risk factors, glycaemic control, and decreased risk of complications across multiple countries. [22]

The current recommendation is that the patient also is included as a member of this interprofessional treatment team for optimal outcomes. The nurse should educate the patient on the importance of glucose control, exercise, follow up, and a healthy diet, whereas the pharmacist should educate the patient on medication compliance and blood pressure control. A dietary consult should be made to educate the patient on low protein foods, and a social worker should ensure that the patient has the support and financial resources for treatment. Thenephrologist and dialysis nurses should educate the patient on renal replacement options, and the transplant nurse should educate the patient on the indications and benefits of atransplant.
(23)

Further, these patients should be taught how to monitor and treat their blood glucose levels at home. Studies show that patients who remain compliant with home monitoring of blood glucose tend to have a delay in renal dysfunction. [24]

COMPLICATIONS:
If nephropathy is left untreated, it can progress to kidney failure. Kidney failure is a serious condition that can be life-threatening. Symptoms nephropathy include:

- Fluid retention, which can cause swelling in your feet, legs, and ankles
- High blood pressure
- Fluid in the lungs which is also called pulmonary oedema
- Cardiovascular disease or heart disease that can cause cardiovascular events like a heart attack or stroke
- Diabetic retinopathy, which is damage to your eye tissue
- Anaemia which is a low level of red blood cells
- Erectile dysfunction
- Foot sores, which are also called foot ulcers
- Diarrhoea

PATIENT COUNSELLING OF DIABETES MELLITUS
PATIENT EDUCATION:
General dietary advices
- Try to Cut down on fat, particularly animal fat, sugar & sugary food.
- Eat regular meals based on starchy foods such as bread, potatoes, rice & cereals.

- Try to eat at least five portions of fruit & vegetables every day.
- Use cereals, mixed coarse grains, whole pulses, salads, fruits & vegetables, brown bread, foods containing dietary fibres (oats, pulses).
- Avoid sugar, honey, jaggery, sweets, white rice, white bread.
- Saturated fat (ghee, butter): <7% of total caloric intake.
- Dietary cholesterol intake: <300mg/day.
- Take regular aerobic exercise
- Wear well-fitting, protective foot wear.
- Drink adequate liquids before, during and after exercise to prevent dehydration.
- Keep rapidly absorbed carbohydrates on hand.
- Eat a snack 15 - 30 m before exercise and again every 30mts during exercise.
- Regular exercise is essential.
- Specially for patients with Type 2 DM.
- Brisk walk 30-60min/day & 5days/week.
- Exercise schedule must be suited for each individual according to his/herphysical strength
- Patients with nephropathy should avoid strenuous exercise.
- Foot care
- Regular foot examination should be done.
- Type 2 DM once per year.
- Avoid activities that can injure the feet.
- Wash & check the feet daily use lukewarm water and mild soap to clean feet.
- Gently pat your feet dry and apply a moisturising cream or lotion. (11)

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