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## “REVIEW ON KIDNEY FAILURE: CLASSIFICATION, STAGES, SIGNS AND SYMPTOMS, DIAGNOSTIC APPROACH, MANAGEMENT”

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### ABSTRACT :

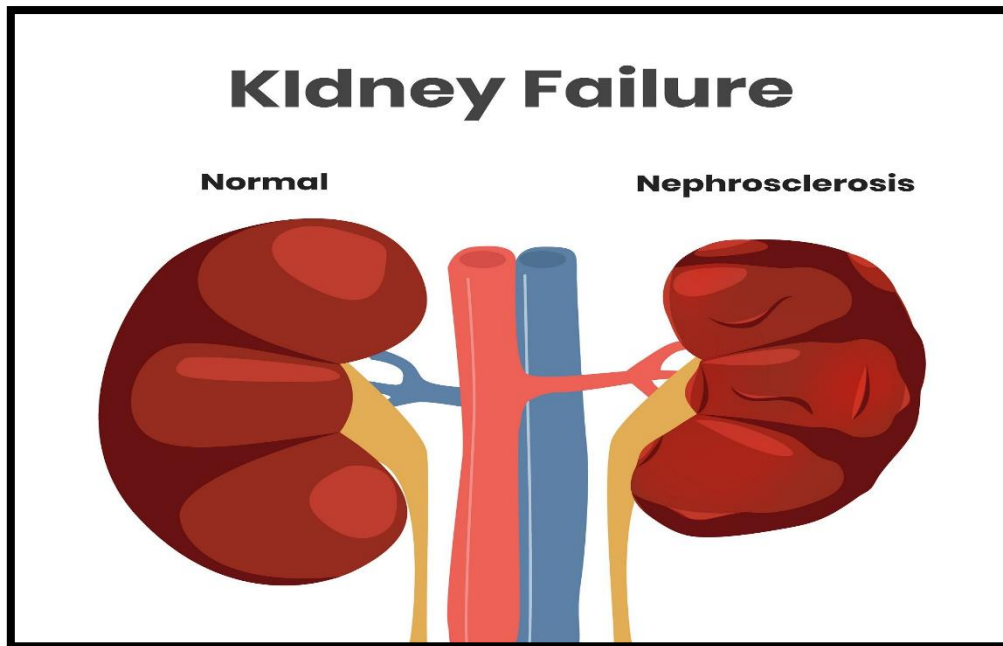
We examined dose-response relationships, gender-specific effects, and whether quitting smoking lowered the risk of smoking-related kidney failure in the future in order to investigate the role of smoking in renal damage. Of the 65,589 Norwegian individuals in the HUNT II research, 124 advanced to stage 5 chronic renal disease over a median follow-up of 10.3 years. Comparing individuals who had never smoked to those who were younger than 70 years old at inclusion, there were notable multi-adjusted hazard ratios for kidney failure of 3.32 and 4.01. For men, the risk rose in proportion to a significantly greater trend in cumulative smoking (pack-years); on the other hand, the risk fell significantly in proportion to an increase in the number of passed years since quitting smoking. While there was no difference in the prevalence of current smoking across genders, women had smoked 10.2 pack-years less than men had, and there were 46 fewer occurrences of renal failure among women than among men (78 vs. 15.8). Smoking had a comparable effect on the risk of kidney failure (hazard ratios for men and women who were currently smokers were 2.94 and 4.30, respectively), although it did not achieve statistical significance in women. Thus, we discovered that smoking is a substantial risk factor for developing renal failure in the future in this sizable population-based cohort. This risk was reduced, at least in men, by quitting smoking.

**KEYWORDS:** chronic kidney disease, kidney failure, risk factors.

### INTRODUCTION :

A progressive loss of kidney function is a feature of chronic kidney disease, commonly known as chronic kidney failure. Urine is the result of your kidneys filtering wastes and extra fluid from your blood. Your body may accumulate hazardous amounts of fluid, electrolytes, and waste products if you have advanced chronic renal disease. You may not have many symptoms or indicators when chronic kidney disease is first developing. It's possible that renal illness won't become apparent to you until it's well advanced. The goal of treatment for chronic kidney disease is to limit the damage to the kidneys' progression, usually by addressing its underlying cause. However, if the underlying cause is not addressed, kidney disease may still worsen. End-stage kidney failure, which is lethal in the absence of artificial filtering (dialysis) or a kidney transplant, can develop from chronic renal disease. Your kidneys can no longer function properly enough to sustain your life, which is known as kidney failure. 85–90% of renal function is lost in kidney failure. Stage 5 CKD, sometimes referred to as end-stage kidney disease or ESKD, is present in patients with renal failure<sup>[1]</sup>

Acute failure treatment is contingent upon the underlying cause. Chronic failure treatment options include hemodialysis, peritoneal dialysis, and kidney transplantation. Hemodialysis involves the use of a machine to filter blood outside the body. Peritoneal dialysis involves the placement of a specific fluid into the abdominal cavity and subsequent draining, repeated several times a day. Kidney transplantation involves the surgical placement of a kidney from a donor and the administration of immunosuppressive medication to prevent rejection<sup>[2]</sup> Other recommended measures from chronic disease include maintaining an active lifestyle and making specific dietary adjustments<sup>[3]</sup> Patients with kidney failure also frequently experience depression, which is linked to unfavorable outcomes such as an increased risk of hospitalization, death, and deterioration in renal function. In a recent study supported by PCORI, individuals undergoing outpatient hemodialysis for renal failure showed comparable efficacy from pharmaceutical and nonpharmacological depression treatments<sup>[4]</sup>



## Classification

There are two types of kidney failure: acute renal failure and chronic kidney failure. The trend in serum creatinine indicates the kind of renal failure; anemia and the size of the kidneys on sonography can also be used to distinguish acute from chronic kidney failure, as chronic kidney disease typically results in anemia and small kidneys.

### *Acute kidney failure*

Previously known as acute renal failure (ARF), acute kidney injury (AKI) is a rapidly progressive loss of renal function. It is typically characterized by fluid and electrolyte imbalance, as well as oliguria, or decreased urine production, which is defined as less than 400 mL per day in adults, less than 0.5 mL/kg/h in children, or less than 1 mL/kg/h in infants. Numerous factors, broadly categorized as prerenal, intrinsic, and postrenal, can lead to AKI. Hemodialysis may be necessary in certain cases of AKI experienced by individuals with paraquat poisoning.[Reference required] Dialysis could be required to fill the time gap while the underlying cause is being treated in order to stop the progression. The reason must be found and addressed<sup>[5]</sup>

### *Chronic kidney failure*

Additionally, chronic kidney disease (CKD) may appear slowly at first and have minimal symptoms.[15] CKD may occur as a part of a disease's course or as a long-term effect of an acute, irreversible illness.[Reference required] Based on the estimated glomerular filtration rate, CKD is classified into five stages, namely 1 through 5. (eGFR). eGFR is normal in CKD1, but it has dropped to fewer than 15 ml/min in CKD5<sup>[6]</sup>

### *Acute-on-chronic kidney failure*

Acute-on-chronic kidney failure (AoCRF) is a situation in which acute kidney injury can coexist with chronic kidney disease. Similar to AKI, the aim of treatment for AoCRF is to restore the patient's baseline kidney function, which is usually assessed by serum creatinine. The acute phase of the condition may be reversible. Similar to AKI, if a patient has not had medical supervision and there is no historical blood work available for comparison, it may be challenging to differentiate AoCRF from chronic renal disease<sup>[7]</sup>

## Stages of kidney failure

The five stages of chronic kidney disease (CKD) are as follows. The stages are determined by the eGFR test result and the efficiency with which your kidneys remove excess fluid and waste from your blood. Your kidneys function poorer and the disease worsens as the stages increase. It is critical to take action at every stage to lessen kidney injury.

### **- STAGE 1**

If you have minor kidney impairment and a normal eGFR of 90 or more, you are considered to have stage 1 CKD. You may not be experiencing any symptoms because your kidneys are still functioning properly. Additional indicators of renal impairment could include the presence of protein in your urine.

### **-STAGE 2**

When you have stage 2 chronic kidney disease (CKD), your eGFR has dropped to 60–89 and your kidney damage is moderate. Your kidneys are still functioning normally most of the time, so you might not be experiencing any symptoms. Additional indicators of kidney impairment could include bodily harm or protein in your urine.

**-STAGE 3**

If your eGFR falls between 30 and 59 and you have mild to moderate renal impairment, you are considered to have stage 3 CKD. Your kidneys' ability to filter waste and excess fluid from your blood is compromised. Your body may get overloaded with this waste, which could lead to other health issues like high blood pressure and bone damage. Symptoms like fatigue and weakness or edema in your hands or feet may start to appear.

**-STAGE 4**

If you have moderate to severe kidney impairment and an eGFR between 15 and 29, you are considered to have stage 4 CKD. The ability of your kidneys to filter waste from your blood is compromised. Your body may accumulate this waste, which could lead to many health issues like high blood pressure, heart disease, and bone disease. Your hands and feet may swell, and you may experience lower back ache as symptoms. This is the final phase prior to renal failure. To prevent kidney damage and prepare for potential kidney failure treatments, it's critical to schedule routine check-ups with a nephrologist, or kidney doctor.

**-STAGE 5**

You have substantial kidney damage and an eGFR of less than 15 if you have stage 5 CKD. Your kidneys have failed (ceased to function) or are very near to failing. Waste products accumulate in your body as a result of your kidneys' failure to filter waste from your blood, which can lead to various health issues as well as severe illness. Dialysis or a kidney transplant are two therapy options available to you if your kidneys fail<sup>[8]</sup>

STAGES	eGFR Result	What it means
<b>STAGE 1</b>	90 OR higher	Mild kidney damage
<b>STAGE 2</b>	60-80	Mild kidney damage
<b>STAGE 3</b>	45-59	Mild to moderate kidney damage
<b>STAGE 4</b>	15-29	Severe kidney damage
<b>STAGE 5</b>	Less than 15	Most severe kidney damage

**Table 1: Stages of kidney failure .**

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## Signs and symptoms

A progressive decline of kidney function leads to renal failure. Before they have renal failure, some patients are unaware that they have kidney disease. Those who have renal disease in its early stages might not have any symptoms, which is why. Advanced illness symptoms typically appear later and can include:

- Shortness of breath
- Nausea and/or vomiting
- Loss of appetite
- Trouble sleeping

Your body's excess fluid and waste are eliminated by healthy kidneys. They maintain your blood's mineral and salt balance. They also support healthy bones, red blood cell production, and blood pressure regulation. Kidneys cannot function as well as they should when they are in renal failure. Consequently, waste products and extra fluid may accumulate in your body, leading to illness.<sup>[9]</sup>

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## Causes

When a sickness or ailment affects kidney function, kidney damage worsens over a period of months or years, leading to chronic kidney disease. The following illnesses and ailments can result in chronic kidney disease:

- Type 1 or type 2 diabetes
- High blood pressure
- Glomerulonephritis
- Interstitial nephritis

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## Diagnostic approach

### *1. Stages of kidney failure*

The glomerular filtration rate, or GFR, of the patient is used to calculate the five stages of chronic kidney failure. Mildly reduced renal function and few obvious symptoms characterize stage 1 CKD. In order to slow down and treat their renal failure, patients in stages two and three require higher amounts

of supportive care from their physicians. To survive, people with kidney failure in stages 4 and 5 typically need to get ready for active therapy. Dialysis or a kidney transplant are the only options for treating stage 5 CKD, which is regarded as a serious condition<sup>[10]</sup>

## **2. Renal failure index**

The renal failure index (RFI) and the fractional sodium excretion (FENa) index are two additional urine measures. Urine sodium times plasma creatinine divided by urine creatinine is the renal failure index. Confirmation of acute renal failure can be aided by a FENa score of more than 3% or a renal failure index (RFI) of more than 3.

## **3. Use of the term uremia**

Renal failure was frequently referred to as uremic poisoning before to the development of contemporary medicine. The word used to describe the urea-contaminated blood was uremia. It is the blood's overabundance of urea content. This included decreased pee production beginning about 1847, which was believed to be the result of the urine combining with the blood rather than passing through the urethra. These days, the condition that coexists with renal failure is referred to as uremia<sup>[11]</sup>

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## **Management of kidney failure**

A dangerous disorder that is frequently associated with diabetes and high blood pressure is chronic kidney disease (CKD). Although there is no known cure, medication and lifestyle modifications can help reduce the disease's course. This could include taking blood pressure and sugar medications, eating a diet high in plants and low in sodium and protein, and maybe even trying some of the newer anti-inflammatory treatments. Infection control, stopping further kidney damage, and heart disease risk management may also be top priorities for medical professionals. Even though dialysis might be required in the future, a gradual switch can help protect the kidneys' remaining function. There is still more research to be done to enhance patient outcomes and CKD care<sup>[12]</sup>

### **1. Blood pressure**

It has been discovered that angiotensin converting enzyme inhibitors (ACEIs) or angiotensin II receptor antagonists (ARBs) decrease the decline of kidney function compared to a more rapid decline in people who are not taking one of these medicines, making them recommended as first-line treatments<sup>[16]</sup> When compared to a placebo, they have also been shown to lower the risk of significant cardiovascular events in people with CKD, including myocardial infarction, stroke, heart failure, and cardiovascular disease-related death<sup>[17]</sup> When it comes to preventing kidney failure and death from all causes in individuals with chronic kidney disease (CKD), ACEIs may be more effective than ARBs<sup>[18]</sup> People's chance of death is lowered by aggressively decreasing blood pressure<sup>[13]</sup>

### **2. Dietary salt intake**

An excessive consumption of sodium in the diet may raise the risk of cardiovascular disease and hypertension. People with chronic renal disease have had the impact of dietary salt limitation studied. Reduced salt consumption may assist to lower both systolic and diastolic blood pressure, as well as albuminuria, according to high-certainty evidence reported in a 2021 Cochrane review of controlled trials in persons with CKD at any stage, including those on dialysis<sup>[19]</sup> Nonetheless, there was also evidence with a moderate degree of certainty that some individuals might have hypotensive symptoms, such lightheadedness, after abruptly cutting back on sodium. It was unclear how salt restriction affected oedema, extracellular fluid, and the loss of total body weight<sup>[14]</sup>

### **3. Iron supplementation**

Low-certainty evidence indicated that recipients of intravenous (IV) iron therapy were 1.71 times more likely to meet their goal hemoglobin levels, according to a Cochrane review of controlled studies comparing IV iron therapy with oral iron supplements.<sup>[79]</sup> Hemoglobin was generally 0.71 g/dl higher in individuals who received oral iron supplementation. Serum ferritin measurements of the liver's iron reserves revealed a 224.84 µg/L increase in individuals undergoing IV iron therapy.<sup>[79]</sup> Low-certainty data did, however, also suggest that allergic responses were more likely to occur after IV iron therapy. It was unknown how iron therapy was administered and whether this would change the number of patients who could need dialysis or blood transfusions, or if it would affect the risk of death from any cause, including cardiovascular disease<sup>[15]</sup>

### **4. Renal replacement therapy**

Kidney replacement therapy, such as dialysis or a kidney transplant, is typically necessary at stage 5 CKD. Many uremic poisons build up in the blood in CKD. Dialysis is not a very effective treatment for ESKD (which is mostly synonymous with CKD5), therefore the toxin levels do not return to normal after dialysis. In a similar vein, levels following a kidney transplant might not return to normal since the new kidney might not function perfectly. In most cases, the creatinine level is normal if it does. The toxins have varying molecular weights, exhibit a range of cytotoxic actions in the serum, and some are associated to other proteins, mostly albumin. Three categories—small water-soluble solutes, medium molecular weight solutes, and protein-bound solutes—are used to categorize uremic toxins. Water-soluble small molecular weight uremic toxins have been better removed by hemodialysis using a high-flux dialysis membrane, prolonged or frequent treatment, and enhanced blood/dialysate flow.<sup>[20]</sup> With hemodialysis, middle molecular weight molecules are eliminated more successfully by utilizing hemodiafiltration, hemofiltration, and a high-flux membrane. Nevertheless, the elimination of protein-bound uremic toxins is a limitation of traditional dialysis treatment<sup>[21]</sup>

**CONCLUSION :**

Kidneys are not the only organs affected by acute renal failure. Its effects may be felt by several organs. On the other hand, acute renal failure can be efficiently managed by controlling blood pressure, sugar, and cholesterol levels, as well as maintaining healthy levels. Supportive therapy that maintain electrolyte and fluid balances aid in the condition's subsequent improvement. With extensive treatment, kidney function can be restored to almost normal.

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