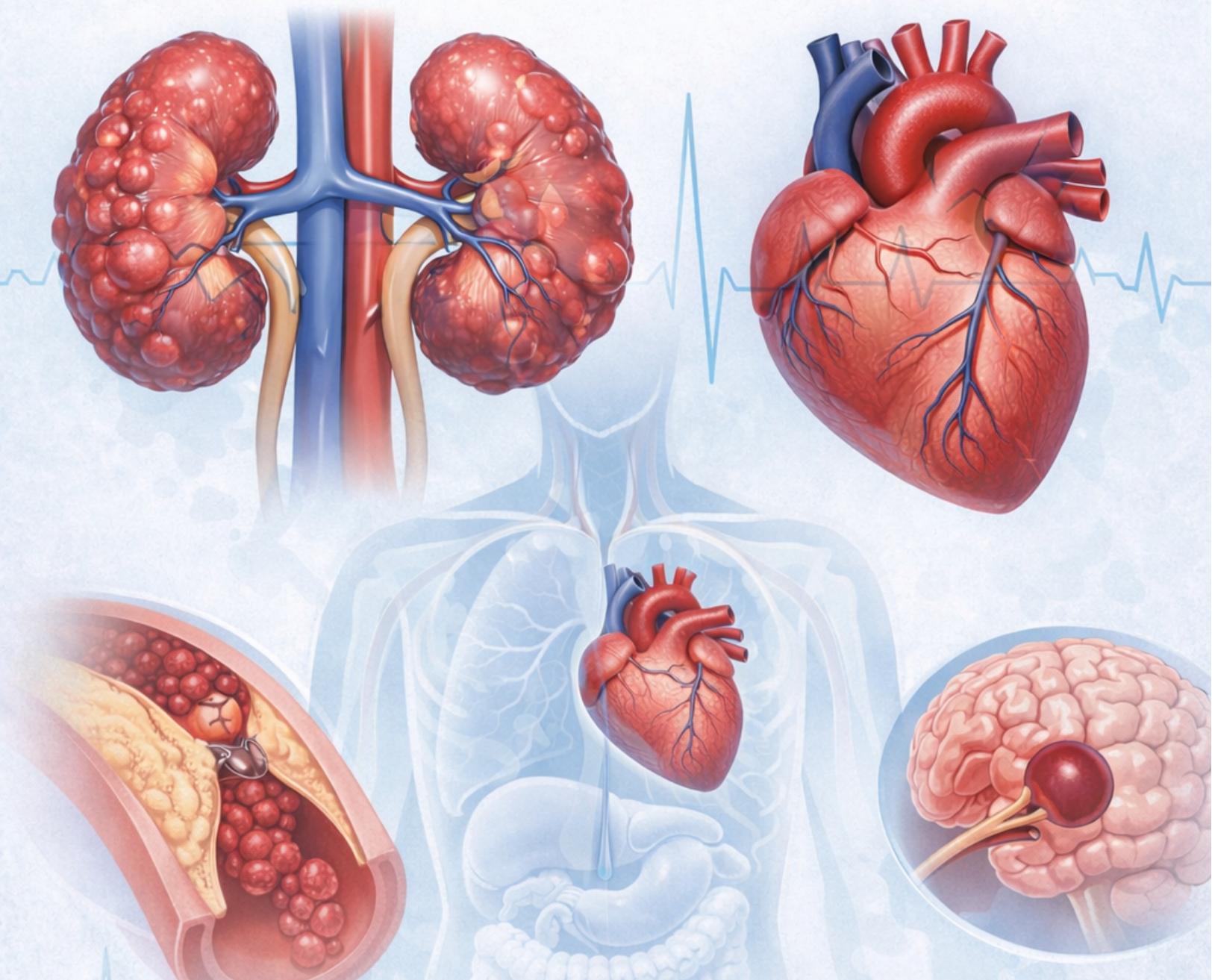


Andrew Kowalski, MD

Kidney Disease:

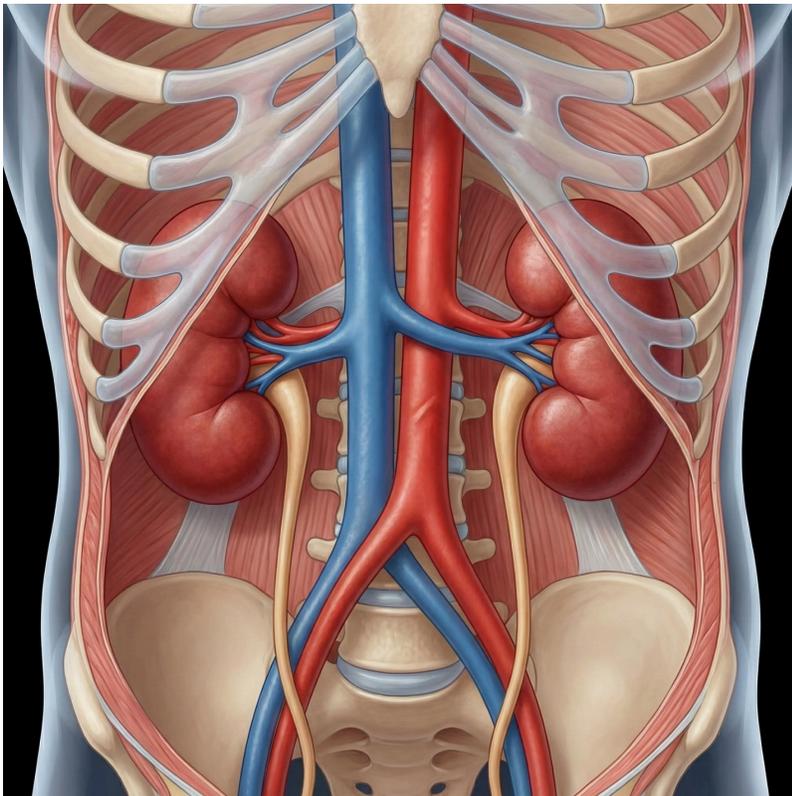
How It Affects Your
Body And Heart



Kidney Disease: How It Affects Your Body And Heart

The Silent Guardian: Know Your Kidneys

Deep in the middle of your body, hidden underneath your ribcage on either side of your spine, sit two bean-shaped organs that are largely responsible for cleaning every last ounce of waste out of your body and regulating the fluids that are circulating within you: your kidneys. Each of your kidneys is about the size of a fist, and inside it are approximately one million teeny filtering units called nephrons that never have to rest in order to keep your blood clean and body balanced. These incredible organs filter some 200 quarts of blood every day, sifting out waste products, excess fluids and toxins while preserving the nutrients and other vital stuff your body needs to keep it healthy.



But the kidneys are much more than biological filters. They are master regulators of your body's internal environment, overseeing the balance of electrolytes like sodium and potassium and calcium and phosphorus that keep muscles contracting, nerves firing, hearts beating in a steady rhythm. They release hormones that spur red blood cell production, regulate blood pressure and keep your bones healthy. They help to correct your body's acid-base balance, so that blood continues to inhabit

just the precise pH level for cells to operate. Your kidneys essentially conduct a complicated symphony of behaviors that fine-tune nearly every aspect of your health.

When everything is going right, you hardly know they are there. They do their thing quietly and efficiently, behind the scenes, keeping just the right internal conditions you need your body to remember. But when something throws a

wrench in the delicate machinery, the effects can echo across your entire system not only your kidneys but also your heart, bones, blood and overall vibrancy.

When Things Don't Go As Planned: How the Kidney Develops Disease

Kidney disease is a gradual decline in the body's ability to carry out one or more of the kidney's normal functions. Unlike a sudden traumatic injury or infection that bursts on the scene with dramatic symptoms, chronic kidney disease creeps up insidiously over

months or years.

That slow evolution is what makes it especially dangerous — many people can live with

compromised kidney function without realizing something's wrong for years, and only learn there's a problem once major damage has been done or when the kind of routine blood work requested at most doctors' appointments shows abnormalities.

The kidneys can sustain damage from a number of factors, though some diseases carry extreme risks. High blood pressure is among the chief culprits, setting off a vicious cycle in which greater and greater pressure in the blood

How Chronic Kidney Disease (CKD) Affects the Body

CKD can be asymptomatic in early stages. As it progresses, it can cause widespread symptoms throughout the body.

Early CKD

Symptoms Rare

Kidney damage starts silently, often with no symptoms.



Symptoms Rare

Kidney damage starts silently, often with no symptoms.

CKD is often silent early. Symptoms usually appear as kidney function worsens—early detection and treatment matter.

Symptoms can vary. Talk with your clinician if you notice changes.

Late CKD

Symptoms Common

Kidney function worsens, impacting many organs.

- Brain & Nerves**
 - Fatigue, brain fog
 - Tremors, confusion,
 - Behavior changes.
- Heart & Blood**
 - Fatigue, swelling
 - Dizziness, chest discomfort
- Lungs**
 - Shortness of breath
 - Cough, chest discomfort
- Digestive & Urinary System**
 - Nausea, poor appetite,
 - Diarrhea
 - Urine changes
- Skin**
 - Itching, rash,
 - Bruising
- Muscles & Joints**
 - Cramps, twitching,
 - Bone or joint pain
- Sexual & Hormonal Health**
 - Low libido, erectile dysfunction
 - Pain with intercourse



vessels slowly injures the tiny filtering structures of the kidneys. Over time, this pressure destroys the nephrons and decreases the kidneys' ability to filter blood all while ironically making it even more difficult for blood pressure to be controlled. Another major threat is diabetes, which can damage the small blood vessels in the kidneys with high levels of sugar in the blood or diabetic nephropathy. In fact, diabetes and high blood pressure combined cause about two-thirds of all chronic kidney disease cases.

Before we even discuss these most common causes, the kidneys are being assaulted from all directions. Some medicines, especially if taken in large amounts or for a long time, can harm the kidneys. Chronic urinary tract infections, kidney stones and autoimmune conditions can inflame and scar the thin, delicate structures of the kidney. Even extended dehydration, as generally straightforward a problem as it may appear to be — drink some water! — can pressure kidneys and contribute to damage over time. Family history is also a factor, since certain genetic disorders like polycystic kidney disease can lead to cysts in the kidneys that grow and replace healthy tissue with fluid-filled sacs.

Once kidney waste filtration becomes less efficient, the organs can no longer keep chemicals in the body balanced properly. Toxins that are supposed to be removed begins to build up in the blood- a condition called uremia. Fluid that normally gets flushed out begins to collect in tissues, resulting in swollen legs, ankles and around the eyes. The precise reading of electrolytes is disrupted often causing life-threatening arrhythmias of the heart. Some people begin to notice changes in their urination—urinating more often, especially at night, or seeing foam in their urine from protein that is leaking through damaged filters. Others suffer from a chronic feeling of exhaustion, loss of appetite, nausea, inability to focus or itching that comes and goes. But early on, many people have no symptoms at all — which is why regular screening though simple blood and urine tests becomes so crucial, especially for diabetics, those with high blood pressure or a family history of kidney disease.

The Heart-Kidney Relationship: A Vital Partnership

One of the most important aspects of kidney disease that is not given enough attention can perhaps be found in its huge effect on heart health. The bond between the kidneys and heart is one of medicine's starkest examples of organ interdependence – when one fails, the other soon follows. It is well established that kidney disease substantially raises the risk of cardiovascular morbidities (e.g., myocardial infarction, heart failure, stroke and arrhythmias) (Chen et al.,

2019; Rayner et al., 2016). People with chronic kidney disease are much more likely to die of heart disease than to progress to kidney failure requiring dialysis.

This relationship is based on the fact that your kidneys and heart are partners in managing circulation and fluid within your body. Blood is pumped away from your heart to deliver oxygen and nutrients through your whole vascular system, then blood is pushed into the kidneys to be purified. The kidneys, in their turn, balance blood volume and pressure; eliminate excess fluid, while maintaining the electrolytic balance that allows your heart to keep beating evenly. They also make compounds that keep blood vessel tone in check so that vessels don't constrict too much or dilate too much. When this partnership goes well, your heart and blood vessels work smoothly together, allowing oxygen-rich blood to flow from the heart where it is pumped to organs that need it.

But as kidney function deteriorates, this careful control begins to unravel. Your kidneys lose the ability to get rid of excess sodium and water, causing more fluid in your system that makes your heart work harder. This additional volume of blood elevates the blood pressure, which means the heart has to pump harder on each beat. Eventually, the heart muscle thickens and stiffens, a condition called left ventricular hypertrophy, decreasing the efficiency of the heart and leading to eventual heart failure. The buildup of fluid, too, means that extra water spills into your lungs, causing shortness of breath and making even the most mundane tasks feel exhausting.

The issues go beyond fluid overload. As the kidneys fail waste products and toxins build up in the blood adding to inflammation which affects the heart and vessels of the cardiovascular system. This state of chronic inflammation speeds up atherosclerosis — the buildup of plaque in the arteries — and raises the risk for heart attack and stroke. The kidneys weaken in their ability to control minerals, leading to deposits of calcium in blood vessels and heart valves, which become stiffer and less resilient. Compromised hormone synthesis affects the creation of red blood cells, which in turn leads to anemia that causes the heart to beat faster in order to deliver enough oxygen to organs. The kidneys' lack of control over hormones that regulate blood pressure increases the damage high blood pressure can cause in the kidneys, leading to an even more difficult-to-control level of blood pressure.

That's why kidney disease isn't just a distant malady affecting an isolated organ — it's a systemic affliction and places the entire cardiovascular system in jeopardy. And the reason this relationship is crucial is that it means taking care of

your kidneys is also taking care of your heart, and the other way around. Blood pressure control, management of blood sugar in diabetes, a heart-healthy diet, regular exercise and no smoking all also benefit both organs. Not being proactive about the health of your kidneys, on the other hand, is synonymous with putting your heart in unnecessary danger.

Beyond the Kidneys: Wide-Ranging Complications

Though the heart-and-kidney relationship deserves particular notice, kidney disease takes a toll on many additional body systems and sets off a cascade of complications that can substantially threaten quality of life and overall health.

Hypertension and Volume Status

No organ controls BP like the kidneys. Healthy kidneys, through a intricate interplay of hormone production, sodium regulation and fluid balance work to keep blood pressure in check at that narrow zone where things are healthy. They do this in part by way of the renin-angiotensin-aldosterone system (RAAS), a hormonal chain that regulates blood vessel constriction as well as the retention of sodium based on what the body needs. As kidney function deteriorates, this regulatory system goes haywire. The kidneys can overproduce renin, setting off a cascade that narrows blood vessels and holds onto sodium in ways that raise blood pressure. At the same time, injured kidneys are unable to get rid of extra sodium and water to maintain optimal fluid balance, resulting in volume overload that increases blood pressure.

This presents a uniquely difficult scenario, since high blood pressure is both caused by kidney disease and speeds its progression. The increased pressure kills off fragile blood vessels inside the kidneys, leading to yet more scarring and loss of function, which then makes blood pressure even more difficult to control. So what can be done to break this cycle? Aggressive control of blood pressure usually with combination therapy of pharmacologic agents acting at different nodes is the answer. The fluid overload that goes along with worsening kidney function shows in more than high blood pressure, having known swelling in the legs, ankles and feet, puffiness around the eyes—particularly upon arising from bed—and occasionally accumulation of fluid in the lungs (pulmonary edema) that brings even a mild amount of air hunger.

Anemia: The Energy Drain

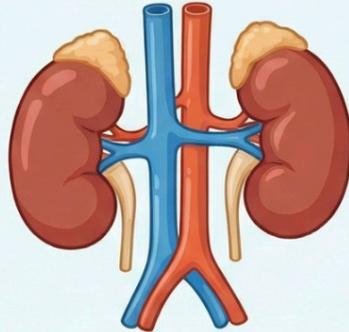
One of the kidney disease complications that can have a detrimental effect on daily life is anemia which is when you do not have enough healthy red blood cells

UNDERSTANDING KIDNEY HEALTH & CHRONIC KIDNEY DISEASE (CKD)

HEALTHY KIDNEYS



Regulate Electrolytes & Blood Pressure



CHRONIC KIDNEY DISEASE (CKD)



Often with Fluid Retention and Electrolyte Imbalance

CKD: A SILENT PROGRESSION



THE RIPPLE EFFECT OF CKD ON YOUR BODY



1. HEART HEALTH

Failing kidneys
Hypertension
Heart Failure



2. ANEMIA

Reduced Erythropoietin
Fewer Red Blood Cells
Fatigue



3. BONE HEALTH

Disrupted Calcium-Phosphate
Weakened Bones
Fractures



4. INCREASED TOXINS

Inability to Filter
Toxin Buildup
Affects Organs

to carry oxygen throughout your body. EPO: Healthy kidneys make a hormone called erythropoietin (EPO) that signals your bone marrow to make the exact number of red blood cells you need to stay healthy and replace those that naturally wear out. This cycle provides a continuous source of oxygen carriers so that the tissues and organs have sufficient to receive the necessary amount of oxygen for energy production and normal function.

EPO production will decrease in parallel with the progression of kidney disease and loss of functioning kidney tissue. Without this important signal, the bone marrow slows production of red blood cells. As you age, you may lose red blood cells and the ability of your blood to transport oxygen declines. This presents as

long-term, very severe tiredness—it's not relieved by rest and is even worse than the fatigue that comes with normal activities. Here are what some symptoms of anemia look like in patients with kidney disease: General weakness, very little exertion makes you short of breath, difficulty concentrating or thinking clearly (brain fog), feeling cold, and pale.

And anemia has consequences that go much deeper than these symptoms. Dancing with death Long-term oxygen deprivation makes the heart work harder, pounding both faster and more powerfully to supply enough oxygen to tissues that have fewer carriers of the gas. This increased demand on the heart leads to left ventricular hypertrophy and promotes the progression of heart disease. Moreover, insufficient oxygenation of muscles can exacerbate the muscle wasting (sarcopenia) that is frequently associated with chronic kidney disease, setting off a vicious cycle of weakness and impaired function.

Bone Health: The Mineral Imbalance

The close connection of kidneys and bones is another way that kidney disease affects systems far from the kidneys themselves. Healthy kidneys are crucial for bone health, as they help regulate the balance of calcium, phosphorus and vitamin D - three nutrients that combine to build and maintain strong bones.

The kidneys are responsible for activating vitamin D, converting it from its inactive oral form that we get through diet and sunlight to an active hormone (called calcitriol) that helps the intestine to absorb calcium from the diet effectively. This activated vitamin D also helps your body control the production of PTH (parathyroid hormone), which maintains calcium and phosphorus blood levels. The kidneys are also a means of filtering and ridding the body of extra phosphorus, keeping it in check. When this process is working correctly, bones get the calcium they need to be strong and phosphorous levels stay in balance.

As kidney disease progresses, this fine balance of mineral metabolism breaks down in numerous ways. Reduced activation of vitamin D by the kidneys can also contribute to poor calcium absorption. This insufficiency results in decreased calcium absorption from the intestine, and a reduction of blood calcium. This low calcium is sensed by the parathyroid glands, which release more PTH in response. This hormone helps to leach more calcium from bones so that it can be put back into blood - but it also weakens a person's skeleton. At the same time, kidneys that aren't working properly cannot flush out phosphorus well and it builds up in your blood. Increased levels of phosphorus also depress calcium

levels which in turn promotes additional PTH production, resulting in secondary hyperparathyroidism.

This interplay of mineral and hormone imbalances results in a collective syndrome known as chronic kidney disease-mineral and bone disorder (CKD-MBD) [formerly renal osteodystrophy]. The bones are weakened and fragile on account of this, that they may break with very slight injury. Excess phosphorus and calcium-phosphate crystals are deposited in soft tissues such as blood vessels and heart valves, leading to cardiovascular diseases. In some individuals there may be bone pain, while others don't have any symptoms until a break happens. Without proper management, the condition can stunt growth and cause skeletal deformities in children with kidney disease.

Empowerment Through Health Literacy

Recognizing these widespread ramifications also emphasizes the importance of health literacy (the ability to access, understand and act on health information in order to make informed choices for your health), a priority for anyone living with or at risk of developing kidney disease. It has been said that knowledge is power and nowhere does that make more sense than when dealing with chronic disease, especially here at the center of kidney disease!

Health literacy as it relates to kidney disease is about more than knowing what the kidneys do. It means understanding how the kidneys are connected to overall health; recognizing symptoms that indicate kidney disease is present; what the laboratory tests are for and what results tell about kidney function; which medications and lifestyle choices can harm or shield the kidneys, and feeling prepared to take an active role in medical decisions and care.

Programs dedicated to education around kidney disease have exhibited highly successful results in raising patient outcome levels. Community workshops that open a dialogue on kidney disease in layman's terms, academic tools available for free which teach complicated medical jargon into digestible information, patient groups that share experiences and tactics with one another and by healthcare professionals who take the time to explain diagnosis' and treatment options all factor in to improved health literacy. If people see that they need to control their blood pressure not just because of some numbers on a monitor, but to protect their heart and kidneys against progressive damage, then they are highly motivated over time to be more adherent to taking those medications and making those lifestyle changes. Once they understand that the fatigue they experience may be associated with anemia related to their kidney disease and

that treatments are available, they are likely to report symptoms and seek care rather than assume a loss of energy is inevitable.

Education Studies continue to show that patients who are educated and have high health literacy do better in terms of health. They're also more likely to notice subtle changes in their condition that should be brought to the attention of a doctor, prompting earlier intervention before complications progress. They're more likely to stick with medicine schedules because they get why each medication is important and what it's guarding. They eat with more purpose, knowing how sodium influences water retention and blood pressure, how phosphorus affects bone health and the way protein demands shift as kidney disease becomes more severe. They engage more in their care, asking questions they understand and becoming part of the team that cares for them versus sitting back and following directions without even knowing why.

This Loop, of proactive involvement, becomes a 'virtuous circle' as aware patients feel increasingly empowered and their ability to manage their illness with more confidence is reinforced. This confidence flows into self-care practices, and better outcomes build upon themselves to validate their hard work. Communities that are health literate regarding kidney disease foster a preventive environment where screening is part of routine care, risk factors are identified and managed early, and the interwoven importance of kidney health in general well-being is appreciated.

The Way Forward: Inclusion and Engagement

In fact the whole picture that comes from saving kidney disease and attenuating its multifaceted effects is one of deep connectedness. Your kidneys don't exist in a vacuum they are deeply connected with your cardiovascular system, bone health, energy levels, blood chemistry and more and ultimately all aspects of life. When the kidneys fail, a cascade of health complications can follow that radiate out to affect almost every aspect of your health.

That's a daunting but also an empowering realization. It means that protecting kidney health protects other systems, too. "This confirms the benefit of blood pressure control in both kidneys and heart." Keeping blood sugar under control in diabetes staves off kidney damage and cardiovascular disease. Good nutrition helps keep your kidneys in good shape and can also help reduce the buildup of harmful waste products by supplying all the important elements that are needed to build strong bones and make healthy blood. Being active regularly prevents

kidney problems, lets the heart muscle be stronger and assists in retaining both muscle mass and bone density.

From the clinical standpoint, this systems view of kidney disease requires that healthcare professionals take a comprehensive approach to the management of kidney disease, balancing considerations focused specifically on kidney function with attention to the full spectrum of cardiovascular, metabolic, mineral and hematologic comorbidities. For patients and their loved ones, it underscores the evident need of holistic care, regular surveillance, adherence to treatment and lifestyle changes beneficial to overall health rather than just for a single organ system.

The more we know about our bodies and how they work as a system, with complex connections between organs and systems, the more empowered we are to get in control of this ride that is called health. Kidney disease may be a highly significant and permanent condition, but informed by knowledge, buttressed by health care providers and empowered by health literacy, people can play an active role in maintaining kidney health - not to mention their overall well-being. Every good move you make to protect your kidneys -- whether it's keeping your blood pressure under control or being sure you're super hydrated, going for those check-ups or getting that lab result explained to you properly -- is an investment in whole-body health that pays dividends throughout the systems and throughout the years.

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