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REVIEW ARTICLE

A REVIEW ARTICLE ON DIFFERENT TYPES OF DISEASES AFFECTED ON KIDNEY

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ABSTRACT
Acute kidney injury (AKI) is a seriouscondition marked by a sudden decline in kidney function. It can cause waste products toaccumulate, disturb electrolyte levels, and disrupt fluid balance. Kidney dysfunction is often associated with other organ disorders because the kidneys, heart, lungs, and liver work together to maintain normal body function. This interaction is known as organ crosstalk. Injury may spread between organs through reduced blood flow, fluid imbalance, inflammation, oxidative stress, and hormonal changes. Cardiovascular disease can reduce blood supply to the kidneys, while kidney dysfunction can increase blood pressure, fluid retention, and cardiac workload. Severe lung disease may affect kidney function through low oxygen levels and inflammation. Advanced liver disease can reduce effective circulation and cause complications such as hepatorenal syndrome. Diabetes, hypertension, sepsis, dehydration, older age, and nephrotoxic medicines increase the risk of kidney injury. Early diagnosis, regular monitoring, appropriate fluid management, avoidance of unnecessary kidney-toxic medicines, and treatment of underlying diseases are important for preventing complications. Healthy lifestyle choices, including a balanced diet, physical activity, smoking cessation, and control of blood pressure and blood glucose, can support kidney health. This review summarizes kidney interactions with the heart, lungs, and liver, and highlights prevention and management strategies.

Keywords: *Acute kidney injury; chronic kidney disease; cardiorenal syndrome; hepatorenal syndrome; organ crosstalk; lifestyle modification.*

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1. INTRODUCTION

The kidneys are essential organs that filter blood, remove metabolic waste, regulate fluid and electrolyte balance, maintain acid–base equilibrium, help control blood pressure, and support red blood cell production. When kidney function declines, these processes become disturbed and may affect several other organs. Kidney injury may occur because of reduced renal blood flow, direct tissue damage, urinary obstruction, severe infection, dehydration, or exposure to nephrotoxic medicines. Acute kidney injury develops over a short period, whereas chronic kidney disease involves persistent abnormalities in kidney structure or function. Both conditions can lead to serious complications, particularly in hospitalized and critically ill patients. Kidney-associated organ dysfunction may involve hemodynamic changes, inflammatory mediators, endothelial injury, reactive oxygen species, mitochondrial dysfunction, and metabolic disturbances. Understanding these interactions helps clinicians recognize complications early and provide coordinated treatment [1].

2. KIDNEY–HEART INTERACTION

2.1 Relationship between the Heart and Kidneys

The heart and kidneys work together to maintain circulation, blood pressure, fluid balance, and electrolyte levels. Dysfunction in either organ can worsen the other, producing a condition known as cardiorenal syndrome (CRS). When cardiac output falls or venous pressure rises, kidney perfusion may decline, and acute kidney injury may develop. In the opposite direction, kidney dysfunction can cause sodium and water retention, hypertension, electrolyte abnormalities, and increased workload on the heart [2].

2.2 Types of Cardiorenal Syndrome

- **Type 1 – Acute cardiorenal syndrome:** Sudden worsening of cardiac function causes acute kidney injury; examples include acute decompensated heart failure.
- **Type 2 – Chronic cardiorenal syndrome:** Chronic heart disease contributes to progressive kidney dysfunction.
- **Type 3 – Acute renocardiac syndrome:** Sudden kidney injury contributes to acute cardiac dysfunction.
- **Type 4 – Chronic renocardiac syndrome:** Chronic kidney disease contributes to cardiac hypertrophy, fibrosis, and cardiovascular risk.
- **Type 5 – Secondary cardiorenal syndrome:** A systemic illness, such as sepsis, affects both the heart and kidneys.

2.3 Complications, Prevention, and Management

Complications may include acute or chronic kidney disease, hypertension, heart failure, arrhythmias, recurrent cardiovascular events, prolonged hospitalization, and increased mortality. Prevention and management include early recognition, regular assessment of kidney and heart function, blood pressure and glucose control, individualized fluid management, appropriate medicines, a balanced diet, physical activity, and smoking cessation. Treatment should be guided by the underlying condition and the patient's clinical status [2, 3-4].

3. KIDNEY–LUNG INTERACTION

3.1 Relationship and Impact of Lung Disease

The kidneys and lungs help maintain fluid balance, electrolyte levels, acid–base equilibrium, and waste removal. Acute kidney injury may cause sodium and water retention, leading to pulmonary congestion or edema. Conversely, pneumonia, acute respiratory distress syndrome (ARDS), chronic obstructive pulmonary disease (COPD), and severe respiratory failure may contribute to kidney injury. Hypoxemia reduces oxygen delivery to renal tissues, while carbon dioxide retention can worsen acid–base disturbances. Changes in blood pressure and cardiac output may further reduce kidney perfusion.

3.2 Mechanisms and Management

Systemic inflammation can release cytokines that contribute to endothelial dysfunction, oxidative stress, and renal tubular injury. Fluid and electrolyte imbalance, acid–base disturbances, impaired alveolar fluid clearance, and venous congestion can also affect both organs. Combined lung and kidney dysfunction is associated with a greater need for intensive care and poorer outcomes.

Management focuses on treating the underlying disease and carefully balancing fluids: excessive fluid may worsen pulmonary edema, whereas inadequate fluid replacement can compromise kidney perfusion. Decisions must be individualized and medically supervised [1,3, 5-6].

4. RELATIONSHIP BETWEEN THE LIVER AND KIDNEYS

The liver performs metabolism, detoxification, protein synthesis, and bile production, while the kidneys regulate fluid and electrolyte balance, blood pressure, acid–base status, and waste excretion. These organs influence one another through circulation, hormonal regulation, inflammation, and the handling of metabolic substances. Advanced liver disease, especially cirrhosis and acute liver failure, can substantially impair kidney function. Kidney injury may also contribute to liver inflammation, oxidative stress, and altered metabolism.

4.1 Impact of Liver Disease on Kidney Function

Cirrhosis, hepatitis, acute liver failure, and fatty liver disease may affect kidney function. Advanced liver disease can cause portal hypertension and widening of blood vessels in the splanchnic circulation, reducing effective arterial blood volume. The body responds by activating the renin–angiotensin–aldosterone system, the sympathetic nervous system, and antidiuretic hormone. These responses promote sodium and water retention and constrict renal blood vessels, potentially reducing kidney perfusion.

4.2 Main Mechanisms

- **Hepatorenal syndrome (HRS):** Kidney dysfunction associated with advanced liver disease, often involving altered circulation and reduced renal perfusion.
- **Acute kidney injury:** May develop due to dehydration, infection, sepsis, gastrointestinal bleeding, excessive diuretic use, or reduced renal blood flow.
- **Chronic kidney disease:** May be associated with metabolic abnormalities, diabetes, hypertension, inflammation, or repeated episodes of acute kidney injury.
- **Bile cast nephropathy:** Severe elevation of bilirubin and bile acids may cause bile casts, tubular obstruction, and direct renal tubular injury.
- **Inflammation and oxidative stress:** Inflammatory mediators can contribute to endothelial dysfunction and cellular damage in the kidneys.
- **Fluid and electrolyte imbalance:** Ascites, edema, low sodium, potassium abnormalities, and acid–base disturbances may complicate care.

4.3 Clinical Complications

Liver and kidney dysfunction together can lead to hepatorenal syndrome, acute kidney injury, fluid retention, ascites, electrolyte disturbances, altered drug handling, increased infection risk, longer hospitalization, and higher mortality. Reduced kidney clearance and altered liver metabolism may also increase the risk of medicine accumulation and toxicity.

4.4 Prevention and Management

Early recognition and monitoring are important. Assessment may include serum creatinine, estimated glomerular filtration rate (eGFR), urine output, electrolytes, bilirubin, albumin, and liver enzymes. Fluid balance should be managed carefully, and diuretics should be used cautiously when clinically indicated. Treatment targets the underlying liver disease and its complications. Selected patients with hepatorenal syndrome may require specialist-directed vasoconstrictor therapy with albumin. Liver transplantation or kidney replacement therapy may be considered in selected severe cases [5,6, 7,8].

5. LIFESTYLE MODIFICATIONS

Lifestyle measures can help protect kidney function and reduce the risk or progression of chronic kidney disease. They do not replace medical treatment, and people with established kidney disease may need individualized advice based on kidney function, laboratory results, and other health conditions.

5.1 Healthy and Balanced Diet

Eat a balanced diet that includes vegetables, fruits, whole grains, and appropriate amounts of protein. Reducing excessive salt intake can help control blood pressure and fluid retention. People with advanced kidney disease may need individualized limits on sodium, potassium, phosphorus, protein, or other nutrients.

5.2 Appropriate Fluid Intake

Adequate hydration supports normal body function and helps prevent dehydration-related kidney injury. However, fluid needs differ among individuals. Excessive fluid may cause swelling or breathing difficulties in people with advanced kidney disease or heart failure, while insufficient fluid can reduce kidney perfusion. Follow the fluid advice provided by a healthcare professional.

5.3 Physical Activity and Healthy Body Weight

Regular activity, such as walking, cycling, or other suitable exercise, can support a healthy weight, improve cardiovascular fitness, and help control blood pressure and blood glucose. Exercise should be adapted to a person's health and physical capacity. Maintaining a healthy body weight can reduce the risk of diabetes, hypertension, and cardiovascular disease.

5.4 Control of Blood Pressure and Blood Glucose

Diabetes and hypertension are major risk factors for kidney disease because they can damage the kidney's blood vessels and filtering units. Regular monitoring, taking prescribed medicines as directed, and attending medical appointments can help prevent or slow kidney damage.

5.5 Avoid Smoking and Alcohol Misuse

Smoking damages blood vessels and increases cardiovascular risk, which may contribute to kidney disease progression. Avoiding smoking and avoiding or limiting alcohol according to individual medical advice can support overall health.

5.6 Avoid Unnecessary Nephrotoxic Medicines

Some medicines, particularly non-steroidal anti-inflammatory drugs (NSAIDs) such as ibuprofen and diclofenac, may cause kidney injury in susceptible people, especially during dehydration or in the presence of existing kidney disease. Prescription medicines, over-the-counter products, and herbal supplements should be reviewed with a healthcare professional.

5.7 Sleep, Infection Prevention, and Check-Ups

Adequate sleep, stress management, personal hygiene, recommended vaccinations, and prompt treatment of urinary tract infections support general health. Regular check-ups may include blood pressure, blood glucose, serum creatinine, eGFR, and urine albumin testing, especially for people with diabetes, hypertension, cardiovascular disease, or a family history of kidney disease [3,6,9,10].

6. CONCLUSION

Kidney diseases are complex conditions influenced by interactions between the kidneys and other organ systems. Cardiovascular disease can reduce kidney perfusion, while kidney dysfunction can cause fluid overload, hypertension, and electrolyte disturbances that increase cardiac strain. Lung disease may affect kidney function through hypoxemia, inflammation, and circulatory changes, while kidney dysfunction can contribute to pulmonary edema and acid–base disturbances. Advanced liver disease can impair renal circulation and cause hepatorenal syndrome. These relationships demonstrate that kidney injury is not always an isolated problem and may contribute to multiple-organ dysfunction.

Early diagnosis, regular monitoring, treatment of underlying conditions, appropriate fluid and electrolyte management, and avoidance of unnecessary nephrotoxic medicines are important for reducing complications. Healthy eating, suitable physical activity, control of blood pressure and blood glucose, smoking cessation, and regular medical check-ups can support kidney health. Lifestyle changes should be individualized, particularly for patients with advanced kidney, heart,

or liver disease. A coordinated approach involving preventive care, appropriate medical treatment, and patient education can help slow disease progression and improve quality of life.

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10. INFORM CONSENT AND ETHICAL CONSIDERATION
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