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Original Article

Punarnava: A Natural Remedy for Management of Chronic Kidney Disease

Megha Patel[*], Ms. Purvi Ramanuj[1], Dr. Pragnesh Patani[2]

[1]Associate Professor, Department of Pharmaceutical Chemistry & QA, Khyati College of Pharmacy, Palodia, Ahmedabad
[2]Principal, Khyati College of Pharmacy, Palodia, Ahmedabad

***Corresponding Author:** Megha Patel
*Khyati College of Pharmacy, Palodia, Ahmedabad, Email: patelmegha1808@gmail.com

Abstract
This abstract reviews the pharmacological actions of Punarnava *(Boerhavia diffusa)*, a traditional Ayurvedic herb, has gained attention for its potential in managing chronic kidney disease (CKD). Known for its diuretic, anti-inflammatory, and nephroprotective properties, Punarnava may help in reducing fluid retention, managing blood pressure, and supporting kidney function. Research suggests that the bioactive compounds in Punarnava can reduce oxidative stress and inflammation, which are critical factors in CKD progression. As a natural remedy, it offers a complementary approach to conventional treatments, potentially improving quality of life for CKD patients by slowing disease progression and mitigating symptoms.

Keywords: Punarnava, Chronic Kidney Disease, Diuretic Properties, Ayurvedic Medicines, Herbal Treatment, Renal function

1. Introduction To Chronic Kidney Disease

The kidneys play a crucial role in eliminating waste and toxins from the blood while also regulating other essential functions, such as maintaining the body's fluid balance. This makes them vital organs. When the kidneys are damaged, the body cannot effectively remove excess urine and waste, leading to elevated levels of blood electrolytes like potassium and magnesium.(1)

Chronic kidney disease (CKD) is characterized by ongoing urine abnormalities, structural kidney issues, or reduced renal function, indicating a decline in functional nephrons. Many individuals with CKD face an increased risk of accelerated cardiovascular disease and mortality. For those who advance to end-stage renal disease, limited access to renal replacement therapy poses a significant. India has limited infrastructure for renal care, with most facilities concentrated in major cities. The government allocates minimal funds to healthcare each year, and patients are expected to visit primary health centers, which many avoid due to the loss of a day's wages. The high cost of treatment for chronic kidney disease (CKD) is unaffordable for the average person in India. Even for those who can manage the expense, it is a lifelong financial burden that places immense strain on patients and their families. This financial pressure is a key reason why only 2-3% of kidney failure patients in India receive treatment, with many opting for an early death to alleviate the financial burden on their loved ones. The conventional treatment methods, Hemoglobin including dialysis and renal transplantation, are neither affordable nor widely accepted by the Indian population.(2)

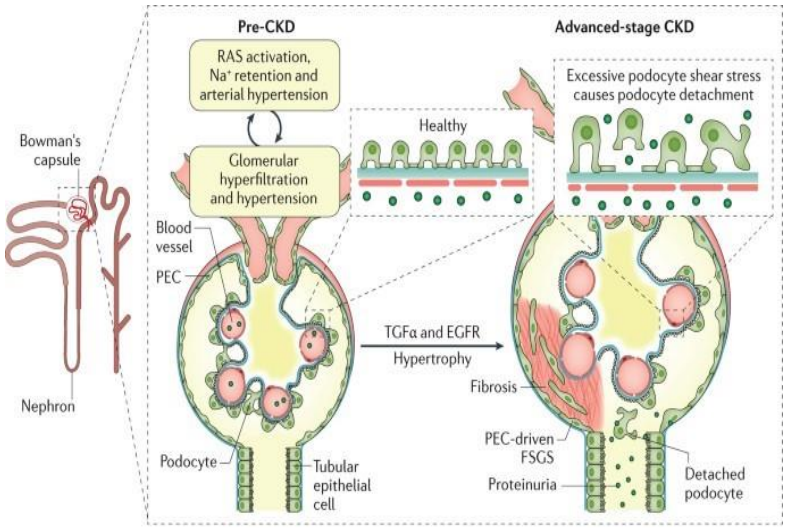


Fig. 1 Mechanism of Chronic Kidney Disease

1.1 Ayurvedic Approach For CKD

Ayurveda, a traditional system of medicine that originated in India thousands of years ago, is founded on the principles of balance and harmony between the body, mind, and spirit. In Ayurveda, Chronic Kidney Disease (CKD) is associated with the Mutravaha Srotas, the channels responsible for urine elimination. Ayurvedic treatment for CKD typically involves a combination of dietary adjustments, herbal remedies, and lifestyle changes. The aim is to enhance kidney function, alleviate symptoms, and prevent complications. This approach significantly addresses uremia, a key feature of CKD, and improves renal function, as evidenced by reductions in serum creatinine and blood urea pirit. Additionally, Ayurvedic treatment enhances the overall well-being of the patient.

Ayurveda, which means “the science of life”, emphasizes a holistic approach to health and wellness, focusing on the balance of the body ,mind, and spirit. According to Ayurvedic principles,

CKD is viewed not just as a physical aliment but as a disorder rooted in the imbalance of the body’s doshas (Vata, Pitta, and Kapha) and the improper functioning of the body’s waste removal system, or “mutravaha srotas”. In ayurveda, the management of CKD is not just about addressing symptoms but about restoring balance to the body and mind , there by showing disease prodression and improve in quality of life. However, It’s important to note that Ayurvedic treatments should be pursued under the guideline of qualified practitioner and in cinjuction with conventional medical care.[3]

1.2 Conceptual model and Outcomes

Depicts a conceptual model for the onset, progression, and consequences of chronic kidney disease.[4,5] The model incorporates antecedents linked with greater risk, illness stages, and consequences, including mortality. Risks are classified as either vulnerability to kidney disease due to sociodemographic and genetic variables, or exposure to disease-causing causes. Early stages of illness are frequently asymptomatic, detectable during the evaluation of concomitant conditions, and potentially reversible. Rapidly progressive illnesses can cause kidney failure in months; however, most diseases develop over decades, and some patients do not advance after years of follow-up.[6]

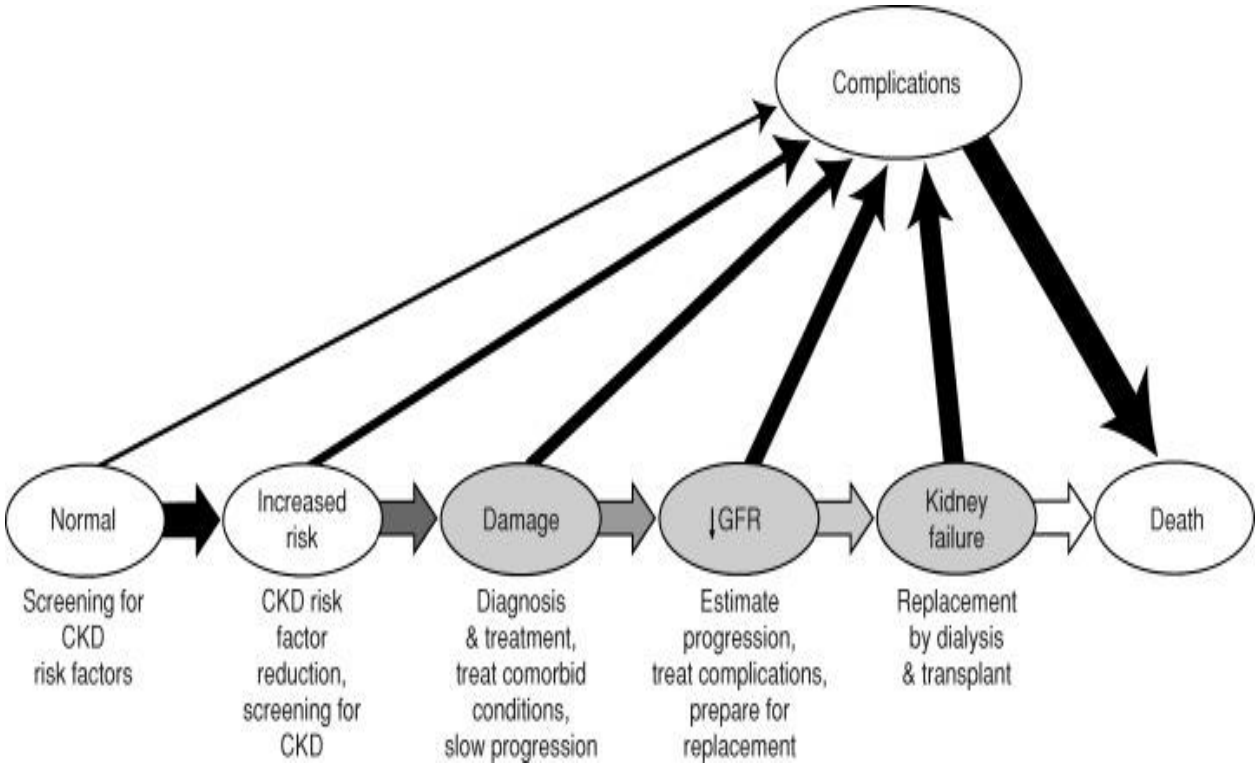


Fig: 2 Conceptual Model for CKD

Kidney failure is historically viewed as the most dangerous result of chronic kidney disease, with symptoms typically induced by complications of impaired kidney function. When symptoms are severe, only dialysis and transplantation may be used to treat kidney failure; this is referred to as end-stage renal disease.Kidney failure is defined as having a GFR of less than 15 mL/min per 1.73 m or requiring dialysis or transplantation. Other consequences of low GFR include an increased risk of cardiovascular disease, acute renal damage, infection, cognitive impairment, and decreased physical function.[7-11] Complications can develop at any point, which typically lead to mortality with little progression to renal failure, and can come from unfavorable effects of therapies.[12]

2. Medicinal Herb - Punarnava

Punarnava (a well-known medicinal plant) is used to cure a wide range of ailments, according to Ayurveda. The plant was called *Boerhaavia diffusa* after Hermann Boerhaave, a well-known Dutch physician from the 18th century.[13] Punarnava appears in Charaka Samhita's Vayahsthapana Mahakashaya and Rasayana Prakrana. In Sushruta Samhita it is explained in Vidarigandhadi gana.and Raktha/red (Boerhavia verticillata Poir.) variety of Punarnava.[14]


Fig.- 3 Punarnava Leaves and Roots

2.1 Pharmacognosy[15]

Scientific Name :*Boerhaavia diffusa Linn*.
Kingdom: :Plantae Division
Order: :Caryophyllales
Family :Nyctaginace
Group: :Dicotyledons
Phylum: :Angiosperms.

Vernacular names

Sanskrit: Punarnava, Raktakanda, Shothaghni, Varshabhu Telugu: Galigeru, Atikamamidi, Punarnava, English: Spreading Hog weed (Red), horse purslane (White) Hindi: Snathikari Gujarati: Dholia saturdo, Moto-satoda, Tamil: Mukaratee-Kirei, Kannada: Kommegida Tambadivasu Bengali: Punurnava.

Morphology[15-17]

Roots:
Type: The plant has a taproot system.
Appearance: Roots are thick, tuberous, and fusiform, often with a woody texture.
Color: The roots are typically brownish or yellowish on the outside and white or pale internally.

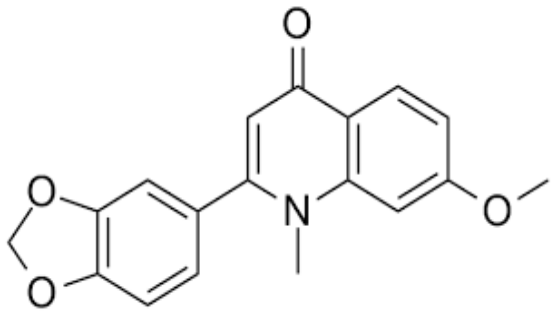
Stem:
Type: The stem is prostrate, spreading, or ascending.
Structure: It is slender, branched, and somewhat woody at the base.
Color: The stem is usually green but may turn reddish as it matures.
Surface: The stem is often hairy or pubescent.

Leaves:
Arrangement: Leaves are opposite and decussate.
Shape: They are simple, ovate to oblong, with a rounded or slightly cordate base and a blunt or rounded apex.
Size: Leaves are generally small, ranging from 2 to 6 cm in length.
Texture: The leaves are slightly succulent and have a smooth margin.
Surface: The upper surface is glabrous or slightly hairy, while the lower surface is pubescent.

Flowers:
Inflorescence: The flowers are small, clustered in axillary or terminal racemes, or panicles.
Type: They are usually bisexual, actinomorphic (radially symmetrical), and small.
Color: The flowers are pink or white.[15-17]

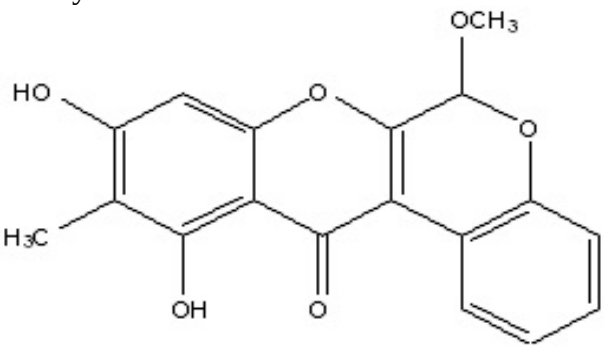
Geographical Distribution and Habitat[18]
The genus Boerhavia, which includes 40 species, is found in tropical and subtropical countries with warm climates. It is found in Ceylon, Australia, Sudan, and the Malay Peninsula, with extensions to China, Africa, America, and the Pacific Islands. Six of the 40 species of Boerhavia are present in India: B. diffusa, B. erecta, B. rependa, B. chinensis, B. hirsute, and B. rubicunda.[18]

Chemical Constitute of Punarnava
Alkaloid : Punarnavine, Punarnavine is one of the major alkaloids present in Punarvava. It has been found to possess significant anti-inflammatory, immunomodulatory, and diuretic properties. These properties help in reducing inflammation and swelling, which are common symptoms in CKD. The diuretic effect of punarnavine aids in flushing out excess fluids and toxins from the body, thus reducing the burden on the kidneys. [19-20]



Punarnavine

Phenolic compound : Boeravinone B, A specific group of rotenoids found in Punarvava, boeravinones have shown significant anti-inflammatory and nephroprotective effects. These compounds help in reducing inflammation and preventing fibrosis in the kidneys, thus preserving kidney function. [21]



Boeravinone

Retenoid : Boeravinone A-F , Hypoxanthine 9-L-arabinofuranoside , Hentriacontane, B-sitosterol and ursolic acid[22-25]
Glycoside : Punarnavoside C-methylflavone 5,7-dihydroxy-34-dimethoxy- 6,8-dimethylflavone B-ecdysone, triacontane B-sitosterol- B-D-glucoside[26-28]
Flavonoids : Quercetin, Kaempferol[29-30]
Steroids : Ecdysteroids[31]

Acids : Tetracosanoic, hexacosonoic, stearic, palmitic, arachidic acids, Boerhavin and boerhavic

acid[32]

3. Punarnava in Chronic Kidney Disease

Punarnava has a long history of use by indigenous and tribal people in India, as well as in Ayurvedic (natural/herbal) treatment.[33] The roots are used for a variety of functions, including liver, gallbladder, kidney, renal, and urinary diseases. Bitter, stomachic, laxative, diuretic, expectorant, rejuvenating, diaphoretic, emetic Root purgative, antihelmintic, febrifuge, white laxative, and diaphoretic.[34]

It works extremely effectively on the urinary system and directly targets the injured nephrons (the kidney's fundamental functional unit), which are destroyed especially in instances of high blood sugar levels, such as in diabetics. Punarnava speeds up kidney filtration and flushes away extra fluids and waste materials.[35]

Punarnava has been traditionally used for kidney and liver ailments in various cultures. Given the regenerative capacity of these organs, the traditional use of Punarnava in such contexts might suggest a supportive role in cell regeneration.[36]

3.1Pharmacological Action of Punarnava in CKD

- **Diuretic Action**: Punarnava is known for its diuretic properties, which help in the removal of excess fluids and waste products from the body. This reduces the burden on the kidneys and helps in managing edema, a common symptom in CKD patients.
- **Anti-inflammatory and Antioxidant Effects**: Chronic kidney disease is often associated with inflammation and oxidative stress. Punarnava contains bioactive compounds like flavonoids, alkaloids, and steroids that exhibit significant anti-inflammatory and antioxidant activities. These properties help in reducing renal inflammation and protecting kidney tissues from oxidative damage.
- **Nephroprotective Action**: Punarnava has been reported to have nephroprotective effects, possibly due to its ability to modulate pro-inflammatory cytokines and reduce renal cell injury. It also helps in preserving the structure and function of nephrons, the functional units of the kidneys.
- **Improvement of Renal Function**: Clinical studies suggest that Punarnava may improve renal function by decreasing serum creatinine and blood urea levels, which are critical indicators of kidney health. The herb’s ability to enhance glomerular filtration rate (GFR) and promote the excretion of waste products contributes to better overall kidney function.[37-39]

A study investigated the effect of an aqueous ethanolic extract on E. coli-induced acute pyelonephritis in rats. When Boerhaavia diffusa extract (50 mg/kg p.o.) was administered orally twice, it resulted in a 42.85% reduction in the number of affected animals and exhibited signs of renal changes. This treatment led to a 99.09% decrease in bacterial count per mL of urine in rats.[40] Additionally, the ethanolic extract of Boerhaavia diffusa Linn roots has been shown to possess significant diuretic and natriuretic properties, likely due to its chemical constituents such as amino acids and alkaloids. The extract also demonstrates adaptogenic and immunomodulatory activities.[41,42]

Conclusion

Punarnava (Boerhaavia diffusa) has shown significant potential as a natural remedy for managing chronic kidney disease. Traditional use and recent studies highlight its effectiveness in improving renal function, particularly through its diuretic properties that help in flushing out excess fluids and waste from the body. Punarnava targets damaged nephrons, which are crucial in CKD, and assists in the regeneration of renal tissues. Additionally, its use in Ayurvedic medicine, combined with other herbal formulations, has been associated with reductions in serum creatinine, urea, and uric acid levels, suggesting an overall improvement in kidney function and the management of CKD symptoms. The herb's broad pharmacological profile, including its anti-inflammatory, diuretic, and nephroprotective properties. Its ability to address anemia, a common complication in CKD, by

improving hemoglobin levels further supports its therapeutic role. Punarnava offers a promising, cost-effective alternative that aligns with the holistic approach of Ayurveda.
Further research and clinical trials are warranted to fully establish its efficacy and safety, but the existing evidence underscores its potential as part of a comprehensive strategy for CKD management.

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