AYURVEDIC APPROACHES FOR KIDNEY'S DISEASES

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Abstract:-

Renal system/ Urinary system consists of kidney's, Ureters, Urinary bladder & Urethra, which is one of the important system for normal functioning of body. Kidney's (a: or Vrikka) is one of the most important organs of the body. Kidney's are present in pairs (left & right). These bean-shaped organs regulate blood pressure, maintain blood and electrolyte balance such as potassium, sodium, calcium, and other essential ions. Kidney's role is to filter blood and remove toxic substances. Urine is waste and excess fluid that flows via the ureters into the basti (bladder).

The current modern sophisticated lifestyle that people are living is causing serious dysfunction of regular body functions. According to Ayurveda, the human body is a combination of three factors: Doshas, Dhatu, Malas. Imbalance in these can be caused due to external or internal factors which may lead to various renal diseases or disorders. Some of the most common are Kidney's Stones, Urinary tract infection,Diabetes Insipidus, etc. Ayurvedic therapy has been proved to be quite beneficial in treating renal disease & enhancement of kidney's function. It works sympathetically to relieve renal issues and helps in the healing of injured kidney's cells. In Ayurveda the kidney's treatment is in the following order: 1)Ahara (Diet) 2)Vihara (Lifestyle) 3)Aushadha (Medicines).

In this review we are focusing on the preventive measures/ remedies of herbal origin that cause less adverse/side effects & beneficial in all aspects. It also provides information on herbal remedies that can cause and treat renal damage.

Keywords – *Kidney, Kidney's Stones, Urinary tract infection, Diabetes Insipidus, Acute Kidney Injury (AKI), Cronic Kidney Disease (CKD).*

1.Introduction

According to Ayurveda, the main reference for kidneys is Mutravaha srotas. These are the channels that oversee urine formation. These eliminate the body's waste materials. However, there is no mention of the Vrikka in this context. So, we need to hunt for a reference for the urine production process. According to Ayurveda, this is the large intestine, which is responsible for urine generation [1]. The pathophysiology of many of these kidney illnesses is complicated, including the interaction of hereditary and environmental variables. Typically, kidney histology, a restricted collection of serologic markers, and clinical symptoms of the illness are used to make diagnostic and therapeutic judgments [2].

The most common causes of chronic kidney disease are diabetes and hypertension. Evidence shows that reducing blood sugar levels and blood pressure, as well as addressing proteinuria, can postpone or prevent the progression to renal failure. Unfortunately, chronic kidney disease is frequently missed in its most curable phases [3]. kidney disease, which is characterised as a decreased glomerular filtration rate, increased excretion of albumin through urine, or both, is becoming a growing public health concern. The global prevalence is estimated to be 8-16 % [4].

Diabetes is the primary cause of kidney failure globally, and the majority of diabetes-related kidney failure occurrences occur in people with type 2 diabetes. Although its importance in kidney failure is now well acknowledged, type 2 diabetes was formerly thought to be linked with a benign renal prognosis, and progressive diabetic kidney disease (DKD) was mostly attributable to type 1 diabetes [5].

2.Acute kidney injury and chronic kidney diseases:

Acute kidney Injury:

A sudden decline in excretory kidney function is the hallmark of acute kidney injury (AKI). Acute kidney diseases and disorders (AKD), which include AKI, are a group of conditions characterized by a slow decline in kidney function or a persistent kidney dysfunction as well as an irreversible loss of kidney cells and nephrons. Chronic kidney Disease (CKD) can result from these conditions [6].

Example: - kidney stones (nephrolithiasis) can cause post-renal acute kidney injury (AKI) via obstruction of urinary outflow, often associated with rapid deterioration in renal function. Kidney stone is a small risk factor that could contribute to CKD [7].

Chronic kidney Disease:

A persistent abnormality in the urine, anatomical abnormalities, or reduced excretory renal function that is suggestive of the loss of functional nephrons are all indicators of chronic kidney disease (CKD). Most CKD patients run the risk of developing accelerated cardiovascular disease and dying.

Low nephron numbers at birth, nephron loss due to ageing, and acute or chronic kidney damage brought on by toxic exposures or illnesses are risk factors for the development and progression of chronic kidney disease (CKD) [8].

Example: - Hypertensive nephrosclerosis (HN) is defined as chronic kidney disease caused by non-malignant hypertension [9].

2.1 Relationship between AKI, AKD, CKD and NKD:

I. Acute kidney injury (AKI), a condition that belongs to a group of acute kidney diseases and disorders, is identified by kidney function markers (serum creatinine and urine output levels) and a duration of less than seven days (AKD). Acute kidney injury (AKI) and Acute kidney diseases (AKD) can Occur in patients with or without a history of chronic kidney disease (CKD), which is defined as a persistent (>3 months) alteration of kidney function. No overlap exists between any of these entities and patients without kidney disease (NKD).

II. Acute kidney injury (AKI) and chronic kidney disease (CKD) are recognised as important but separate pathology. A sudden decline in excretory kidney function is the hallmark of acute kidney injury (AKI). Acute kidney diseases and disorders (AKD), which include acute kidney injury (AKI), are a group of ailments characterised by a slow decline in kidney function or a persistent kidney dysfunction as well as an irreversible loss of kidney cells and nephrons that may progress to chronic kidney disease (CKD) [6].

3.KIDNEY STONES

Kidney stones (calculi) are mineral concretions that can be found free or adhering to the renal papillae in the renal calyces and pelvis (Fig.1.1). Nephrocalcinosis, on the other hand, refers to diffuse renal parenchymal calcification. Stones in the urinary tract (also known as nephrolithiasis or urolithiasis) arise when urine gets overly supersaturated with a mineral, resulting in crystal formation, growth, aggregation, and retention inside the kidneys. Approximately 80% of kidney stones worldwide are made up of calcium oxalate (CaC_2O_4) combined with calcium phosphate [$Ca_3(PO_4)_2$]. Uric acid, struvite, and cystine stones are also frequent, accounting for around 9%, 10%, and 1% of all stones, respectively. Stone formation is a prevalent condition with a 50% recurrence rate after 5 years. The occurrence of stones has steadily increased over the last 50 years, and future increases are projected as a result of altering lifestyle and dietary choices. Obesity, diabetes, hypertension, and metabolic syndrome are all risk factors for stone formation; stone formers, on the other hand, are at risk of hypertension [10].

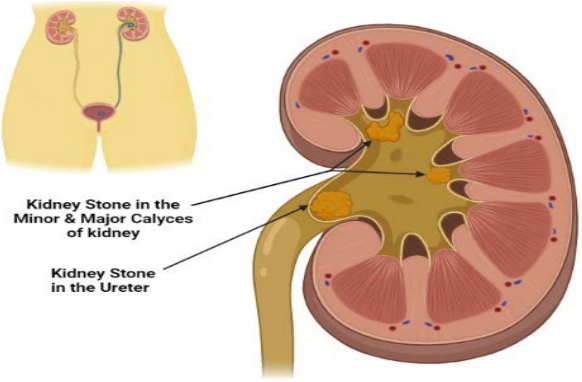

Fig.3.1 Kidney Stones

Stones in the urinary tract can be found in the kidneys, ureters, or bladder. Kidney stones are classified as staghorn (filling a large number of main and minor calices) or non-staghorn. Non-staghorn stones are classified as calyceal or pelvic, whereas ureteral stones are classified as proximal, intermediate, or distal. Kidney stones with diameters less than 5 mm have a strong probability of passing, those with diameters 5-7 mm have a 50% chance, and those with diameters greater than 7 mm

nearly certainly require urological intervention. Theories of fixed and free particles Kidney stone formation is assumed to involve crystal formation in tubular fluid, followed by crystal retention and build-up in the kidney [11].

3.1 Types of kidney stones

The four principal forms of stones that deposit in the kidneys is calcium (75 to 85%), struvite (2 to 15%), uric acid (6 to 10%), and cystine (1 to 2%). The geographical location of the living being, and population investigated influences the distribution and frequency of these stones. Long-term drug usage produces kidney stones in approximately 1% of cases.

- **Calcium deposits:** Hypercalciuria produced by hyperparathyroidism is related with calcium oxalate, calcium urate, and calcium phosphate stones. Increased calcium absorption from the intestine produces renal calcium or phosphate leak, hyperuricosuria, hyperoxaluria, hypocitraturia, and hypomagnesuria in people with illness.
- **Struvite crystals:** Struvite is made up of magnesium ammonium phosphate stones that are formed throughout the collecting system (partial or complete staghorn calculi). Chronic urinary tract infections caused by Gram-negative urea-splitting rods such as Proteus, Pseudomonas, and Klebsiella species lead to this stage.
- **Uric acid crystals:** The production of uric acid stones is dependent on high purine consumption medications or high cell turnover (e.g., malignancy), both of which are common in gout patients. Uric acid stones are most commonly formed in mildly acidic urine (pH 5.5). They can be seen in the wild and are normally radiolucent on X-ray imaging.
- **Cystine crystals:** Cystine stones form as a result of a genetic intrinsic metabolic condition termed cystinuria, in which cystine re-absorption in the renal tubule is impeded. Because of their high sulphur content, these stones may be difficult to detect on X-rays. Several medicines can contribute to the production of renal stones in drug-induced stones.
- **Drug-related stones:** Some medicines also contribute to the production of renal stones, which can be utilised to treat another condition. Indinavir, atazanavir, guaifenesin, triamterene, silicate (antacids), and sulfa medicines are among them. These stones are extremely uncommon and are always visible on X-Rays (radiolucent).

Kidney stones are more common in white males in their 30s and 40s. However, kidney stones can occur in anyone. Kidney stones can be caused by a number of circumstances [12].

Table3.1 Symptoms and risk factors of kidney stones [12]

Symptoms of a kidney stone include:	**What are the risk factors?**
Feeling pain in your lower back or side of your body	Not drinking enough liquids
Having nausea and/or vomiting with the pain	Hypercalciuria (high calcium levels in your urine)
Seeing blood in your urine	Having a family history of kidney stones
Feeling pain when urinating	Having a blockage in your urinary tract
Being unable to urinate	High blood pressure, Obesity.
Feeling the need to urinate more often	Gout and cystic fibrosis, Kidney cysts.
Fever or chills	Diabetes, Osteoporosis
Having urine that smells bad and seems Cloudy	Inflammatory bowel disease and chronic diarrhoea

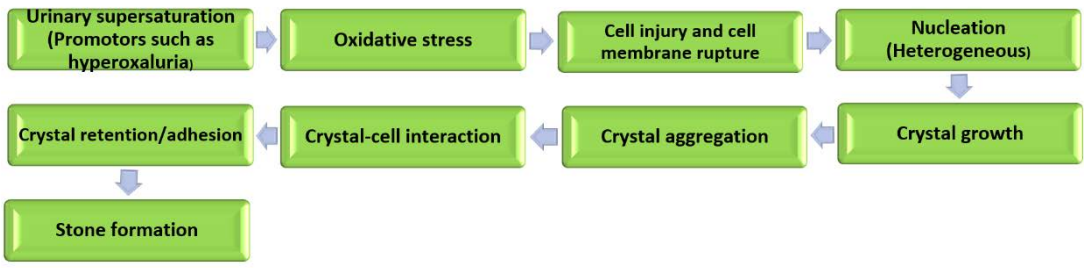

Fig.3.2 Schematic representation of the various events of kidney stone formation [14]

Table3.2 Medications that increase risk of developing kidney stone [13].

Drug	**Primary Stone Composition**	**Status on Plain Radiography**
Loop diuretics	Calcium oxalate	Radiopaque
Acetazolamide	Calcium phosphate	Radiopaque
Topiramate	Calcium phosphate	Radiopaque
Zonisamide	Calcium phosphate	Radiopaque
Laxatives (when abused)	Ammonium acid urate	Radiolucent
Magnesium trisilicate	Silica	Poorly radiopaque
Ciprofloxacin	Ciprofloxacin	Radiolucent
Sulfa medications	Sulfa	Radiolucent
Triamterene	Triamterene	Poorly radiopaque
Indinavir	Indinavir	Radiolucent
Guaifenesin/ephedrine	Guaifenesin/ephedrine	Radiolucent

3.2 Categories of stone former

Patients with kidney stones are categorised into several groups based on the makeup of the stones and the history of past stone episodes. This categorization has an impact on diagnostic workup and preventative care. Both of these qualities, however, have restrictions. For example, categorization based on stone composition bears the provison that chemical techniques are inaccurate and do not discriminate between crystalline forms, recommended approaches are infrared spectroscopy or X-ray diffraction.

Table3.3 Difference between non-calcium and calcium stones [10]

Non-calcium stones	**Calcium stones**
Struvite stones	Single and sporadic stone formers who are not at risk of chronic kidney disease and/or metabolic bone disease
Other purine stones (such as xanthine and 2,8-dihydroxyadenine)	Single and sporadic stone formers who are at risk of chronic kidney disease and/or metabolic bone disease
Uric acid stones	Recurrent stone formers
Matrix stones	
Cystine stones	
Drug stones	

3.3 Ayurvedic Approaches of kidney/urinary stones

- **Small stones:** small stones do not require much therapy; they are removed from the body by drinking a specific amount of water. Drinking sufficient amount of water (around 4-5 lit/day) aids in the removal of stones from the body via urine. The movement of stones causes pain, which can be managed with pain medications [15].
- **Kidney stone:** medical treatment: Alpha blockers are commonly prescribed by doctors; they relax the muscles in the ureters, allowing the kidney stone to pass more quickly. Diuretics can also help with stone removal by increasing urine flow [16].
- **Large stones:** large stones are difficult to eliminate even with plenty of water because they become caught in the renal tube. These stones can be hazardous to the body because they can damage the kidneys and cause internal bleeding, Nephron loss, or make it easier to become infected with certain urinary tract infections. Because of their size and the possibility of breaking down, bigger stones cannot pass past the kidneys. They also cause bleeding, UTIs, and renal damage [17].
- **Extracorporeal shock wave lithotripsy (ESWL):** Large kidney stones are broken into small bits in this method by using sound waves or shock waves to induce significant vibrations. Small fragments of fractured stones can be washed out of the body via urine [18].
- **Nephrolithotomy:** is one of the alternatives if doctors discover big stones in or near the kidneys. The patient is under general anesthesia during this procedure. The device includes a thin telescopic instrument that removes kidney stones larger than 2 cm in size. This tool is most suited for stones in the pelvic region [19].
- **Ureteroscopy:** is a treatment used to remove stones that have become lodged in the ureters or bladder. Upper urinary tract stones can be checked with ureteroscopy. This uncomfortable technique includes a short wire that links to a camera at the end. The wire is placed into the urethra and passed into the bladder to remove stones, and it is attached to a cage [20].

3.4 Herbal Approach of kidney stone

Herbs and natural medications can help with kidney stone treatment. These medications have piqued people's curiosity due to clinically demonstrated benefits such as immunomodulation, adaptogenicity, and antimutagenicity. Furthermore, the overuse of synthetic pharmaceuticals, which leads to a higher prevalence of unpleasant drug reactions, has prompted humans to resort to the usage of natural therapies [12].

- **Viratarvadigana (*Celosia argental*):** The Indian medical system is thought to be unique in its treatment of urinary stones. Its aqueous decoction is used to dissolve and excrete stones. Didymocarpus pedicellata, also known as Patharphodi or Shila pushp, is beneficial [21].
- **Fenugreek seed (*Trigonella foenum-graecum*):** The seeds of this herb are extensively used to prevent and treat kidney stones in northern Africa. Fenugreek seed was proven to considerably reduce calcification in the kidney and help avoid kidney stones in animal research [22].
- **Shatavari root (*Asparagus racehorses*):** In test animals, a major Ayurvedic Ramayana (rejuvenative cure) was reported to inhibit the production of calcium oxalate stones [23].
- **Chanca piedra/Stonebreaker (*Phyllanthus niruri*):** The Chanca stone breaker has a long history of use for preventing and passing kidney stones. This herb has been shown in several in vitro and animal experiments to help in prevention of kidney stones [24].
- **Origanum vulgare:** This plant is commonly used as a spice and medicine; it functions as a lithotripter, diuretic, and antispasmodic. The crude aqueous metabolic extract of O. vulgare aerial portion inhibited the nucleation and aggregation of calcium oxalate crystals in vitro and also reduced the quantity of crystals generated in calcium oxalate detestable solutions [25].
- **Barberry root bark (*Berberis vulgaris*):** Barberry has been shown to decrease calcium oxalate crystallization and protect the kidney from oxidative stress. The most successful preparation was the water extract [26].
- **Punarnava herb (*Boerhaavia diffusa*):** This widespread Indian weed is used as a kidney tonic and to aid in the elimination of kidney stones. It was able to suppress the production of struvite stones in an in vitro investigation; whether it can do so *in vivo* is uncertain [27].
- **Varuna bark (*Crataeva nurvala*):** Taking this Ayurvedic herb on a daily basis lowered urine calcium excretion and kidney stone formation. This Ayurvedic herb is used to help avoid kidney stones and is also used to successfully treat kidney stones when combined with banana stem (Muse paradisiacal). According to the authors of a recent human study, this formula "aided in the dissolution of renal calculi, simplified their passage, and reduced pain" [28].
- **Evening primrose seed oil (*Oenothera biennis*):** In a human research, regular administration of EPO (1000 mg per day) raised citraturia (urine citrate levels) while decreasing urinary

oxalate, calcium, and the Tiselius risk index, which is a risk factor for kidney stone formation [29].

- **Rupture wort herb (*Herniaria hirsuta*):** In animal trials, this plant prevented Calcium Oxalate crystalline formation [30].
- **Ammi visnaga**: Various types of tea made from the fruits of Ammi visnaga have long been used by patients with kidney stones in Egypt and around the world. This fruit's aqueous extract aided in the breakdown of cystine stones in the kidneys. The fruit and its two principal ingredients, khellin and visnagin, were found to be effective in the treatment of kidney stone disease caused by hyperoxaluria [31].
- **Hibiscus sabdariffa:** In Thai traditional medicine, Hibiscus sabdariffa is used for urinary stone prevention and therapy. A 15-day clinical trial of a cup of tea brewed from 1.5 g of dried H. sabdariffa taken twice daily on 18 patients indicated uricosuric impact and considerable increase in uric acid excretion and clearance from kidneys by urine [32].
- **Black cumin seed (*Nigella sativa*):** In animal trials, this plant significantly prevented testing animals against experimentally induced calcium oxalate stone formation [33].
- **Gokshura fruit/root (*Tribulus terrestris*):** This herb is an Ayurvedic rasayana and nephroprotective agent that is extensively used to treat urinary tract disorders in India and China. It prevented the production of kidney stones in animal trials and may have even helped to reverse early-stage Urolithiasis. Tibullus appears to protect against calcium oxalate-induced kidney injury in vitro, which supports animal observations [34].

4.DIABETES INSIPIDUS

Diabetes Insipidus (DI) is a condition characterised by a liquid imbalance throughout the body. DI is distinguished by continuous thirst and a desire to drink water despite having earlier consumed water. DI also promotes frequent urination. Colourless and odourless is what insipid means. Diabetes insipidus is so named because it causes your body to produce a lot of insipid urine [35].

4.1 Types of Diabetes Insipidus

- **Central Diabetes Insipidus:** Central diabetes insipidus is caused by injury to the hypothalamus or pituitary gland, which interferes with the normal creation, storage, and release of appropriate amounts of ADH. As with hereditary neurohypophyseal diabetes insipidus, the syndrome can also be transmitted owing to a deficiency in the vasopressin-producing gene.
- **Nephrogenic Diabetes Insipidus:** When the kidneys are unable to resorb water despite the presence of the Vasopressin hormone, this is known as nephrogenic diabetes insipidus.It is caused by inherited gene defects or mutations that cause the kidneys to become unresponsive to vasopressin. As a result, excessive fluid loss from a person's bloodstream is possible
  - Among the other acquired causes of nephrogenic diabetic insipidus are:
    1. Chronic kidney disease and polycystic kidney disease are two examples of kidney illnesses.
    2. Inflammatory granulomas in the kidney, such as sarcoidosis.
    3. Imbalances in blood electrolyte levels, such as high calcium (hypercalcemia) or low potassium levels (hypokalemia).
    4. Urinary tract obstruction
    5. Lithium, ofloxacin, demeclocyline, aminoglycosides, and a few more medicines.
- **Dipsogenic Diabetes Insipidus:** Dipsogenic diabetes insipidus, like central diabetes insipidus, has a source in the upper centres of the thirst mechanism, the hypothalamus. Any impairment of the thirst system contributes to decreased vasopressin secretion and increased urine output.
- **Gestational Diabetes Insipidus:** Diabetes insipidus that happens in the course of pregnancy is called gestational diabetes insipidus. During being pregnant, the placenta (a transient connecting organ among the mom and baby) produces an enzyme that breaks down the mom's vasopressin and contributes to the condition [36].

4.2 Home Remedies and Lifestyle Changes

Dehydration prevention entails having access to water and medicines at all times. Take them with you everywhere you go. This will help to avoid significant complications such as dehydration.

- **Medical alert devices:** Carrying a medical alert card or wearing a medical alert bracelet will assist in informing a health care practitioner in the event of a health-related emergency.
- **Prameha:** An Ayurvedic Solution to Preventing Urinary Problems Diabetes insipidus is difficult or impossible to prevent since it is caused by genetic abnormalities or other disorders. It is frequently a lifelong condition. However, the disease's symptoms can be properly

controlled. When therapy is started as soon as possible, the disease's prognosis improves.

- Diabetes Insipidus cannot be avoided in any manner. In contrast hand, certain preventative measures may aid in preventing severe diseases consequences These are the measurements
- Urine output should be carefully monitored, especially if the individual has had brain tumours or renal illness. Low salt - should be consumed on a daily basis. Dehydration symptoms should be monitored on a frequent basis by self-monitoring.
- **Yoga** should be practised on a regular basis to preserve general wellness.

4.2.1 Natural Remedies

- **Dietary changes:** Your diet must be nutrient-dense. It should also contain water-rich veggies and fruits.
- **Consume water:** based hydrating foods on a daily basis - Such as -Watermelon, cucumber, spinach, and kale Blueberries, red cabbage, red pepper, Strawberries with citrus fruits, Pineapples and kiwis. Potatoes, bananas, avocados, squash, and other starchy veggies Coconut Water - aids in bodily hydration. It also helps to keep your electrolytes in check.
- **Processed foods:** Rich in salt and other chemicals / preservatives should be avoided. Caffeine Carbonated beverages Maintain consistent hydration. Drink plenty of fluids. This will compensate for and replenish the fluid loss. It will also assist to quench your thirst. Make certain that you rapidly compensate for fluid loss caused by strenuous work and exercise, when you are unwell, or whenever your body is losing a lot of fluids. Take water with you everywhere you go. Wear a medical alert bracelet as well to alert specialists who can assist you in dealing with the problem.
- **Balance of Electrolytes:** The primary electrolytes present in the body are calcium, magnesium, sodium, potassium, chloride, and phosphate. Their equilibrium is essential. They not only serve to balance your body's fluid levels, but they also activate your nerves. Sodium is important in the retention and release of water in the body. More water is excreted from the kidneys if your diet is high in salt. Maintain a moist mouth. always Suck on some ice chips or sour candies. This moistens your mouth, increases saliva flow, and decreases your need to drink water. Keep track of your prescriptions. Electrolyte imbalances can be caused by diuretics, hormone tablets, antibiotics, cancer therapies, and blood pressure drugs. Those undergoing chemotherapy as part of cancer treatment suffer from severe electrolyte abnormalities. Diuretics and laxatives alter sodium and potassium levels in the blood and urine as well. Electrolyte imbalances can be caused by hormone interactions from antidiuretic hormone drugs, aldosterone, and thyroid hormones. When the hormones are influenced by excessive amounts of psychological stress, fluid and electrolyte levels might become unbalanced. Check to see whether a new medication or supplement is producing electrolyte or fluid imbalances, especially if you have diabetes insipidus symptoms.

4.3 Therapy for central diabetes insipidus

If you have a lesser version of this type of diabetes insipidus, you will need to increase your water consumption. If this issue is caused by an anomaly such as a pituitary or hypothalamic tumour, your doctor will deal with the underlying disorder. Desmopressin, a synthetic hormone, is used to treat this illness. This replaces ADH and hence reduces urine. It is administered orally, intravenously, or by nasal spray. Other medications, such as indomethacin, chlorpropamide, and others that can make ADH accessible in the body, may also be administered.

Diabetes insipidus will not induce your kidneys to collapse or result in the need for dialysis. The kidneys nearly typically filter your blood. However, you will be susceptible to dehydration. Keep something to drink nearby to stay hydrated. This is especially important when the weather is hot or you are exercising. Workout Timing, Physical and Psychological Advantages.

4.4 Principles of treatment in Ayurveda

Diabetes insipidus should be treated according to the principles of "Prameha treatment", especially Kaphaja Prameha. The main principles of Kapha treatment/Type of Prameha includes Vamana, i.e.- therapeutic vomiting, and Langhana, i.e., therapies that bring lightness to the body. These therapies should be administered with caution after analysing the patient's strength and disease.

4.4.1 Other Principles Diabetes insipidus can also be treated along the lines of -

- **Trishna Chikitsa:** Treatment of Thirst, since thirst is one of the main complaints of diabetes insipidus. This helps not only with thirst but also with dehydration associated with excessive fluid loss.
- **Dushti Treatment:** Excessive thirst is the result of dehydration caused by excessive fluid loss Urinate. If this continues over a long period of time and the pathogenesis is deeply

embedded, it contaminates the water transport channels in the body. The principles of treatment should be to eliminate this contamination.

- **Treatment of Medovaha Sroto Dushti:** In Prameha it is said that the channels of formation and transport of adipose tissue are mainly polluted. Fat belongs to the kapha category of tissues. Treatment should be aimed at correcting this contamination and balancing lipid metabolism in the body. Correcting Pachaka Pitta and Apana Vata imbalances – Pachaka-Pitta, with the help of Samana Vata - the gut doshas - is responsible for the formation of urine from the food and drink we consume [35].

5.Urinary tract infection

UTI's are among the most common bacterial infections, affecting 150 million people worldwide each year. Although both men and women can be infected, UTIs are usually considered to be a female disease, with 50% of women suffering over their lifetime. Approximately 25% of women who present with bacterial cystitis for the first time have recurrent UTI (rUTI) within 6 months, with some having six or more infections in the year after the original episode. Infection of the urinary tract occurs when UPEC enters and ascends the urethra by an unclear method after colonisation of the periurethral region by gastrointestinal tract flora. UPEC binds superficial epithelial (facet) cells in the urine bladder in a type 1 pilus-dependent way. Recent research indicates that Uro Pathogenic Escherichia Coli (UPEC) can neutralise the lysosome and that this neutralisation is recognized by a lysosomal membrane protein known as mucolipin TRP channel 3 (TRPML3), triggering pathways that guide exocytosis of UPEC-containing lysosomes. Some of these bacteria will infect young bladder epithelium exposed following exfoliation, eventually creating quiescent intracellular reservoirs that elude immune clearance and resist systemic antibiotic therapy. Survival and development of UPEC during infection may be dependent on significantly varied metabolic sources at various spatiotemporal locations. Intracellular survival apparently necessitates a distinct set of metabolic capacities [37].

It is critical to distinguish between recurrence and reinfection in order to define the diagnostic-therapeutic strategy. Recurrences account for 20% of UTIs and are caused by the persistence or return of the initial strain, which usually occurs 2 or 3 weeks after the completion of antibiotic therapy. The most common reasons are insufficient antibiotic therapy or the existence of underlying urological illness (nephrolithiasis, urinary catheter, or chronic prostatitis), which would allow bacteria to remain in the quiescent phase and at the intracellular level. Reinfections account for 80% of UTIs and are caused by strains other than the original one, however they can sometimes be caused by the same strain that persists in the digestive system [38].

5.1 Remedy:

In Sutra sthan shadvirechan shata shritiya adhaya, Charak samhita explained several herbal plants such as Gokshur, Vidarikand, Kamal, Neel kamal punarnava. Paniya ksharas are also recommended for urinary problems. Under mutraghat chikitsa, Ashtang Hridaya discussed medications effective in UTI.

- **Neem (*Azadirachta indica*):** It belongs to the subfamily Meloideae, family Meliaceae, and is often known as 'India Lilac' or 'Margosa.' Various elements of the neem plant (bark, leaves, blossoms, seed, fruits, oil, neem cake, and gum) are used in traditional Ayurvedic medicine in India. Neem oil, bark, and leaf extracts are used in traditional medicine to treat intestinal helminthiasis, leprosy, constipation, and respiratory diseases.
- **Parijat (*Nyctanthes arbortristis*):** Nyctanthes arbor-tristis Linn. is a well-known medicinal plant in traditional medicine that belongs to the Oleaceae family. Its leaves include sitosterol, D-mannitol, flavonol, astragalin, glycosides, sitosterolnicotiflorin, nyctanthic acid, oleanolic acid, tannic acid, methyl salicylate, ascorbic acid, an amorphous resin, an amorphous glycoside, friedeline, carotene, lupeol, mannitol, glucose, iridoid glycosides, fructose as well as benzoic acid.
- **Tulsi (*Occimum sanctum*):** Ocimum sanctum stands as a medicinal herb containing antibacterial property against numerous microbes with antibiotic resistance. The components of Ocimum class possess antibacterial, antifungal, antioxidant as well as radio protective effects.
- **Turmeric (*Curcuma longa L.*):** Alkaloids, tannin, flavonoid, glycoside, and carbohydrate are all found in Curcuma longa extract. Plants' antibacterial properties are attributed to alkaloids and flavonoids.
- **Chebulic Myrobalan (*Terminalia chebula*):** The presence of chemical elements such as saponins, alkaloids, tannins, tannic acid, glycosides, cardiac glycosides, and simple phenolic compounds contributes to the antibacterial action [39].

6. POLYCYSTIC KIDNEY DISEASE

Polycystic Kidney Disease (PKD) is a genetic disorder in which a cyst forms on the surface of the kidney, causing the kidney to grow in size. These cysts are fluid-filled. If the number of cysts increases or the size of the cysts increases, the kidneys may be more damaged than before. This disease is passed down from grandparents to parents to children. The average number of people affected by this disease varies depending on the type of disease [40].

6.1 Types of Polycystic Kidney Disease

Though both types of Polycystic kidney disease are non-curable, they can be managed by Ayurveda treatment. As Ayurveda Polycystic Kidney Disease Treatment in Ayurveda is very effective and painless.

- Autosomal Dominant Polycystic Kidney Disease (ADPKD); It passes from the parents means if the one parent has PKD, then here are the chances to get into their child too that called ADPKD.
- Autosomal Recessive Polycystic Kidney Disease (ARPKD); In this disease, both parents are needed to carry a gene for this disorder to pass it to their child. The chances of getting this disease in the child is 25% [41].

6.2 Symptoms of Polycystic Kidney Disease

- High blood pressure
- Back or side pain
- Swollen abdomen
- Kidney failure
- Blood in your urine
- A feeling of fullness in your abdomen
- Increased size of your abdomen due to enlarged kidneys
- Headaches
- Kidney stones [41].

6.3 The underlying mechanisms of herbal medicine in ADPKD

Based on the pathogenesis of ADPKD, several drugs are currently under investigation, including vasopressin antagonists, somatostatin analogs and mTOR inhibitors.

- However, these drugs have some drawbacks, including severe liver toxicity and unstable activity. As a result, finding effective, stable, and safe medicines for ADPKD is critical.
- Natural products extracted from herbal medicines, have been drawing extensive attention due to their good efficacy against ADPKD progression and safety *in vivo* studies, such as triptolide, curcumin, ginkolide B, steviol.

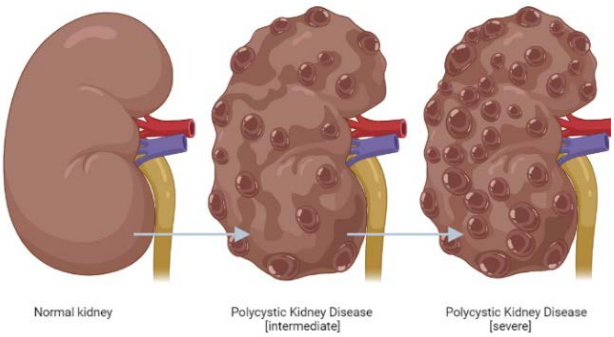

Fig6.1 Polycystic Kidney Disease

- Although some herbal medications have a limited therapeutic window that restricts their use in clinical settings, using them still calls for caution. While herbal remedies are generally safe, a relatively high dose may cause them to exhibit a potential toxic effect.
- For instance, triptolide's primary side effects include liver and kidney damage, as well as the loss of reproductive and hematopoietic system functions. Additionally, some herbal medicines with complex ingredients lack appropriate standards to assess their pharmacological effects, which restricts their clinical use and necessitates additional study to determine whether the main ingredients are safe or toxic.
- To sum up, both *in vivo* and *in vitro* experiments show that herbal medicines have significant therapeutic effects on ADPKD. Additional research is needed to transform herbal remedies into therapeutic drugs that effectively treat ADPKD [42].

6.4 Applications of Herbal Medicine to Treat Autosomal Dominant Polycystic Kidney Disease:

Autosomal dominant polycystic kidney disease (ADPKD) is a common hereditary kidney disease, which is featured by progressively enlarged bilateral fluid-filled cysts. Enlarging cysts destroy the structure of nephrons, ultimately resulting in the loss of renal function. Eventually, ADPKD develops into end-stage renal disease.

Currently, there is no effective drug therapy that can be safely used clinically. Patients progressed into ESRD usually require haemodialysis and kidney transplant, which is a heavy burden on both patients and society. Therefore, looking for effective therapeutic drugs is important for treating ADPKD.

In previous studies, herbal medicines showed their great effects in multiple diseases, such as cancer, diabetes and mental disorders, which also might play a role in ADPKD treatment.

Currently, several studies have reported that the compounds from herbal medicines, such as triptolide, curcumin, ginkgolide B, steviol, G. lucidum triterpenoids, Celastrol contribute to the inhibition of the development of renal cysts and the progression of ADPKD, which function by similar or different mechanisms [42].

- **Triptolide**
  1. Triptolide is a diterpene triepoxide that was discovered in 1972 after being Extracted from the medicinal plant Tripterygium wilfordii Hook F (TWHF).
  2. It has the chemical formula $C_{20}H_{24}O_6$ and a molecular mass of 360 [43].
  3. Triptolide has been proven in clinical and experimental investigations to have Anti-inflammatory and immunosuppressive properties in bone marrow, heart, Kidney, and skin transplantation, and can successfully lengthen graft lifetime. As a result, triptolide is commonly utilised in inflammatory and autoimmune Illnesses, Including rheumatoid arthritis (RA), immune-complex nephritis, systemic lupus Erythematosus (SLE), and organ transplantation [44].
  4. Roscovitine, a cycle-dependent kinase inhibitor, has been shown to inhibit the Formation of renal cysts in animal models indicating that the cell cycle may be One of the targets in the inhibition of ADPKD Given triptolide's cell cycle arrest Effect in colon cancer, cell cycle regulation may be involved in triptolide's inhibition of renal cyst formation in animal models. In the Pkd1/ mouse renal epithelial cell Line, triptolide inhibited cell growth [45].
  5. Cyclin p21 expression was found to be increased. Furthermore, triptolide inhibited Cell cycle in smooth muscle cells induced by platelet-derived growth factor (PDGF) And renal cell carcinoma cells via G0/G1 cell cycle arrest, indicating that triptolide May induce cell cycle arrest in the ADPKD model [46].
- **Curcumin**
  1. Curcumin, a polyphenol diferuloylmethane extracted from the rhizome of the Curcuma longa plant, has been shown to have antioxidant, anti-inflammatory, and Anti-proliferative properties.
  2. Curcumin has shown potential therapeutic effects on a variety of diseases, including Neurodegenerative disorders, inflammatory diseases, fibrosis, and cancers, by Regulating the NF-B, Wnt/-catenin, MAPK, and mTOR signalling pathways, all of Which are involved in the pathogenesis of ADPKD [47].
  3. Previous studies have demonstrated the inhibitory effect of curcumin on cyst Growth by inhibiting cell proliferation and promoting epithelial cell. Differentiation in Pkd1 deletion mouse models, suggesting its potential to be Natural candidate drug for ADPKD.
  4. The average length of the longest tubules derived from each MDCK cyst treated by Curcumin was longer than those in control group. Consequently, curcumin can Promote MDCK cell differentiation, subsequnently inhibiting cyst development [48].
- **Ginkolide B**
  1. Ginkgolide B, a major terpene lactone, is a Ginkgo biloba active component. Ginkgolide B is used in traditional medicine because of its anti-inflammatory, Antioxidant, anti-tumor, and anti-apoptotic properties [49].
  2. Ginkgolide B was found to inhibit cyst growth in the MDCK cyst model as Well as in Pkd1 knockout mice. Ginkgolide B inhibited cyst formation and Growth in a dose-dependent manner by downregulating the Ras/MAPK Pathway, and the inhibitory effect was reversible [50].
  3. Stevioside and Its Derivative; Stevioside is a high-sweet, low-calorie sweetener derived from the leaves and stems of the herbaceous plant Stevia Rebuadiana, which belongs to the composite family. It is degraded by intestinal microflora to its aglycone, steviol, and then absorbed into the bloodstream.
  4. Stevioside has been reported to have properties including anti-hypertension, anti-Hyperglycemia, anti-inflammation, anti-tumor, anti-diarrhea and immunity Regulation [51].
  5. ADPKD progression contains two key processes, cell proliferation and fluid Secretion,

involving multiple signaling pathways.

6. Stevioside is metabolised by gut bacteria into steviol, which is easily absorbed by the Gut and can also reach the kidney [52].
7. Steviol enhanced the expression of lysosomal enzyme marker LAMP2, indicating,The increase of lysosomal degradation of β-catenin, which involves in cell Proliferation.

In general, stevioside and its derivative, steviol, could regulate pathways of cell Proliferation to slow down progression of cysts [53].

CONCLUSION:

Effectively these Ayurvedic drugs have capacity to normalize associated medical symptoms and laboratorial parameters pertaining to CKD & AKD patients. It provides leads for further studies primarily based totally on clinical parameters.

There are various active components in herbal medicine that have been identified as possible candidates for future medication development. As a result, this topic can give useful evidence to boost the development of herbal medicine as a therapeutic application to treat CKD, and therefore aid to prolong patient lives and alleviate the burden of CKD.

AKD represents an important transition period for patients who have suffered an episode of AKI. Considerable advances have been made in our collective understanding of AKI and CKD; however, the relationship between these two conditions is vitally important because these two syndromes are interconnected. One of the most significant risk factors for AKI is pre-existing CKD, and AKI is a significant risk factor for the development of CKD as well as the progression of pre-existing CKD. A critical period of vulnerability for patients who develop AKI is in the immediate period following development of AKI — a period previously labelled AKD.

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Abbreviation Table

Sr.No.	Abbreviation	Full Form
1	ARPKD	Autosomal Recessive Polycystic Kidney Disease
2	ADH	Anti-Diuretic Hormone
3	ADPKD	Autosomal Dominant Polycystic Kidney Disease
4	AKD	Acute Kidney Diseases And Disorders
5	AKI	Acute Kidney Injury
6	CKD	Chronic Kidney Disease
7	DI	Diabetes Insipidus
8	EPO	Evening Primrose Seed Oil
9	ESWL	Extracorporeal Shock Wave Lithotripsy
10	NKD	No Kidney Disease
11	PDGF	Platelet-Derived Growth Factor
12	PKD	Polycystic Kidney Disease
13	RA	Rheumatoid Arthritis
14	rUTI	Recurrent Urinary Tract Infection
15	SLE	Systemic Lupus Erythematosus
16	TRP	Transient Receptor Potential
17	TRPML3	Transient Receptor Potential Mucolipin Channel 3

18	TWHF	Tripterygium Wilfordii Hook F
19	UTI	Urinary Tract Infection
20	UPEC	Uro Pathogenic Escherichia Coli

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