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Microalbuminuria in Ayurveda

Review Article

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Abstract

Microalbuminuria is the first stage of Nephropathy; pathology will progress with uncontrolled diabetes and hypertension. It is a complication of diabetes so according to Ayurveda it can be considered under the *Santarpanjanya* disease, where *Kleda* (waste) is main causative factor. Albuminuria is nothing but the excess loss of *Dhatu Saramsa* (finest tissue) due to weakness of *Ayanadourbalya* (system). The progress of this structural damage gradually leads to a condition in which function of the *Srotas* (system) is totally get impaired (*Sanga*). This is actually happening in glomerulosclerotic stage of diabetic nephropathy. As function of membrane of *Mootradharakala* (urinary tract) becomes fully impaired, there is failure in the removal of *Kledamsa* (waste) and *Udaka Bhava*s (ions), which leads to their accumulation in the body. This will lead the further progression. As per Charaka quotation, physician need not to name the disease, he should investigate the *Sthana* (location), *Samsthana* (cause) and *Samutthana* (symptoms). So here humble attempt is done to through light on microalbuminuria in Ayurvedic view to understand the disease and plan out the treatment.

Key words: Ayurveda, Diabetes mellitus, *Madhumeha*, Microalbuminuria, Nephropathy

Introduction

In Ayurvedic texts, the disease *Prameha* is defined to be characterized with excessive urination and turbidity.(1) The turbidity may vary in colour and concentration, variety etc depending upon the involvement of *Dosha* and *Dushya*. With the review of etiopathology it will be clear that it is a metabolic disorder, not localized to the urinary tract pathology alone. However, the environment of the urinary tract is associated frequently in this disease or almost in every case in the advanced stage. Thus, the manifestations of metabolic abnormality as well as of the urinary tract pathology are included.

A long list of *Upadrava* (complications) is mentioned by various Acharya for every type of *Prameha*. Acharya Charaka has mentioned common complications of *Prameha*.(2) Sushruta narrates that all types of *Prameha*, if not treated properly, may ultimately develop into *Madhumeha*. (3)

Regarding the concept of *Upadrava* it is necessary to remember its association with a disease and its manifestation after that of the main disease. It is the latter which is predominant and the ailment that appears as a complication is of secondary nature which may be a major or minor illness. The complication generally gets subsided

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when the main disease is cured. However, the complication is more painful because it is manifested in the body of the patient which is already very weak due to its earlier affliction by the main disease. Therefore, the treatment of such complications should be undertaken carefully. (4) Here the manifestation of Diabetic Nephropathy occurs as *Nidanartakara Roga* after *Madhumeha* manifestation. (5)

Anatomical consideration:

As diabetic nephropathy is a disorder afflicting the kidneys, in the form of damage to the Glomerular Basement Membrane, Mesangial cell proliferation and Glomerulosclerosis, to understand the pathogenesis of the disease, the knowledge of anatomy and physiology of urinary system in particular is very important. In Ayurveda, the formation and excretion of *Mootra* (urine) falls under the functions of *Mootravaha Samasthana* (urinary system).

The explanation about this has been done by Acharya in a very elaborate manner. The following is a short comparative description of *Mootravaha Samsthana* given in ancient classics:

1. *Basti* (to the whole urinary system including bladder)
2. *Vrikka* (as Kidneys and Suprarenal gland)
3. *Gavini* (to the ureters and also the nephron)
4. *Mootrapraseka* (as urethra)

1. *Basti*:

The word *Basti* has been derived from the root "*Vas*" after adding the suffix "*Tich*" which means to cover, base, store house and reservoir.

Synonyms:

Mootrashaya, *Mootra Basti*, *Bastisheersha*, *Mootradhara*, and *Mootraputaka*(6)

Definition

Basti can be defined as '*Basti Pooranakrut Va Kledakrut Mootram*'. It signifies that *Basti* is responsible for the maintenance of Homeostasis of body fluid. A careful probe into the various references of classical Ayurvedic literature reveals that the term *Basti* not only indicates urinary bladder, but in some contexts it proves to be the whole urinary system.

Embryological development:

Embryologically *Basti* is a hollow structure developed by the essence of *Rakta, Sleshma, Pitta* and *Vayu* and liquid waste products.(7) It has been said by all the *Acharya*s that *Basti* is derived from *Matrija Bhava*- the maternal constituents.(7,8)

The *Mootrashaya* is one among the *Koshtaangas* and it is said to be the *Uttama Ayatana* (abode) for *Prana* (i.e. for the existence of life) and one among the *Trimarmas*.(9) *Basti* is one among the *Snayu Marma* covering an area of four fingers(10) and it is also a type of *Sadyopranahara Marma*, i.e. one which leads to death immediately, but if *Anteviddam* (i.e. *Sameepe* or *Madhya Viddam*) then it can lead to death in a delayed way. This can be supported by references suggesting the attainment of *Sadyopranahara Marma*(11) to a state of *Kaalantara Pranahara Marma* if the cause of *Marmabhighata* is not competent enough (*Karanavaikalyaat*). By this we can come to know that *Doshabhighata* to *Basti* never causes immediate death. This explanation holds good in context of manifestation of *Doshakrita Bastimarmabhigata* (Glomerular Injury) in due course of *Madhumehajanya Upadrava*.

Structure:

Basti is a thin walled structure. It resembles a stretched bow (*Danurvakra*) being situated internally in *Katipradesha*(12) and has a single outlet

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directed downwards which could be compared with bladder having a single outlet downwards, the urethra.(13)

2. *Vrikka*:

The word *Vrikka* or *Vukka* are the derivatives of the root *Vukadaane* meaning to take.

Synonyms: *Vikka, Vrikka*

Definition:

Vrikka are defined as *Maamsa Pinda Dwaya*. They are two in number and are situated one in each (*Dakshina* and *Vaama*) *Parshwa*.(14)

Embryology:

Embryologically, *Vrikka* are said to be the maternal contribution and *Prasada Bhaga* (essence) of *Rakta* and *Meda*(15,16)

Structure:

Vrikka is a pair organ situated in *Koshtha* or the trunk, specifically in the posterior wall of the abdomen in the lumbar region each one in the respective *Dakshina* and *Vaama Parshwa* (right and left lumbar region). *Dalhana* described *Vrikka* as a pair of fleshy rounded bodies. (17)

These explanation points to the description of kidneys which are a bean-shaped (*Dhanurvakra*) paired excretory organs situated on the posterior abdominal wall, in each side of the vertebral column between T12 to L3 vertebrae, measuring 10-12cm long, 5-7cm wide and 3 cm thick and weighing 135-150gm. They have an indentation along the medial border called the Renal Hilus which consists of Renal vein, Renal Artery, and Renal Pelvis (from anterior to Posterior side). Its longitudinal section reveals two distinct regions: Outer Cortex and Inner Medulla.

Medulla consists of 8-18 cone shaped renal pyramids. The narrow apex of each pyramid is called Papilla which is fitted to minor calyx. Several minor calyx join to form 3 to 4 major calyx, 3 to 4 of which join to form renal pelvis and then ureters which finally empty into the urinary bladder. In between two adjacent pyramids, there are narrow masses of cortical tissue -Column of Bertin. Medulla secretes PGA2, PGE2, PGF2, α prostaglandins and thereby regulates blood pressure.

Kidneys do the production of urine, homeostatic functions and regulation of electrolytes, acid-base balance and blood pressure. In producing urine, the kidneys excrete wastes such as urea and ammonium. They are also responsible for the reabsorption of glucose and amino acids. Finally, the kidneys are important in the production of hormones including vitamin D, renin and erythropoietin. The kidneys receive blood from the paired renal arteries, and drain into the paired renal veins.(18)

Function:

Sharangadhara describes embryologically and functionally *Vrikka* related to fat metabolism, nourishment of the *Jatharastha Meda*(16) and even *Vrikka*(19) is considered as *Moola* of *Medo Vaha Srotas.*

3. *Gavini* / Ureters and Nephrons:

They are two in number, situated on each side of *Basti*, receiving *Mootra* from the *Antras* and sending it further to the *Mootrashaya*. (i.e. to imply the Renal pelvis).(20) In Sushruta the *Moola* of *Mootravahini Srotas* is told as *Basti* and *Medhra*(19) Dalhana comments as the *Moola Dhamanis* of *Mootravahinis* are two, which further branches into 10,000 and 1000 in number.

The formation of *Sira* occurs from the *Mridupaka* of the *Snehamsa* of *Medas*, due to the *Nirantara Rasa Sambrutatvat.*(21) This could explain the possibility of arterial changes in Diabetic nephropathy, as *Madhumeha* being a *Santarpanotta Vikara* with involvement of *Meda*, *Kapha* and *Vata*, the *Shoshana* of

Kapha and *Meda* by aggravated *Vata*, could bring about deposition at arteries. The *Siras* are *Ashuddha Raktavahinis* and *Dhamani* are *Rasayanees*. The *Siras* could be compared to Renal Artery receiving blood from all over the body and the Renal veins, which carry blood to inferior vena cava can be compared to that of *Dhamani* which carry the blood to Inferior Venacava.

Gavini are concerned with the passage of formed urine. The innumerable constituent functioning units in the kidney which filter the urine is more clearly described as the *Saaraheena Pureesha Nisruta Drava* which are percolated from the *Pakwashaya*, enters the *Mootrasya Pakwashaya* (Renal Medulla) like the rivers fill the ocean with water.(22) These are finally carried by the *Mootravaha Srotas* to the *Mootra Praseka* to be expelled out. This could be compared to ureters, which carry the urine up to urethra to be expelled out. The *Mootravaha Srotas* branching into thousands of minute branches could be compared to millions of nephrons and collecting tubules which help in Ultra filtration and urine formation. The nephrons constitutes the secretory part and the collecting tubules constitutes the non secretory part. Many tubules unite and form Duct of Belini which opens into minor calyx.

4. *Mootrapraseka* / Urethra:

Synonyms:- *Mootrapatha*, *Mootramarga*, *Mootrasrota*.

It refers to urethra. It is one among the eight important organs, which are to be protected from any injury at the time of performing surgery for *Mootrashmari*.(23) It is the outlet of the *Basti*. It is two *Angula* (4cm) in females and Twelve *Angula* (15 to 20 cm) in males. In male it carries both *Mootra* and *Shukra*, while in female only *Mootra*.

Formation of Urine:

Ayurvedic idea of urine formation is very much related to the process of digestion. Urine is the liquid portion derived from food and drinks after digestion. (24) It is separated from the *Sara* portions by the *Maladharakala*, with the help of *Pachakapitha* and *Samana Vayu*. After that, it is taken to the bladder by innumerable vessels.(25) In Dr. B. G. Ghaneker's book, an interesting table is furnished comparing the ancient and modern concept of urine formation.

Table no. 1: Comparison of ancient and modern concept of urine formation -

Sr. No.	Particulars	*Ayurvedic* concept	Modern concept
1.	Origin of urine formation	From food and drinks taken into the stomach	Blood from general circulation
2.	Organ of formation	Intestine	Kidneys
3.	Responsible part of the organ	*Maladharakala*	Glomerulus of the kidneys
4.	Other factors responsible	*Pachakagni*, *Samana Vayu*	Blood pressure, cells of tubules
5.	Urine carrying vessels	Small innumerable	Two vessels (not that small)
6.	Place of collection of urine	*Basti*	Bladder

Here it is seen that the urine formation starts from the site of digestion. But intestines cannot be taken as the organ of urine formation as given in the above table. It is said clearly in Sharngadhara Samhita that *Mootra* formation is completed only as the concerned substances reaches the *Basti*.(26) Also as

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per the definition of Charaka, the *Srotasas* carry substances that are continuously transforming(27) i.e. the precursor of *Mootra* is undergoing continuous transformation in different parts of the *Mootrvaha Strotas.* Part of the functions of *Mootra*, is the elimination of *Kleda*.(28) The main precursor, as seen from above descriptions, comes from the liquid portion of the *Mala*. But there are equal chances that excess *Kleda* formed in different levels i.e. at the level of *Dhatu* and still *Sukshma* levels, during the metabolism, also contribute to it. The division of *Kitta* and *Sara* happens at this level also.

***Moothravaha Srotas* and *Doshas*:**

The structure of specific *Srotas* are modulated so that a specific function is executed well. Even if the specificity of the *Srotas* is attributed to its structure, their functions are integrated and regulated by *Tridoshas*. The role of *Vata* is maintaining the integrity of the whole body.(29) *Vata* is responsible for small and big movements. So *Mootravivechana*, *Abhivahana* and *Visarjana* (excretion) need the normal functioning of *Vata*.

Being the regulator of *Agni*, *Samana Vayu* is working at the level of *Mootravivechana*. In *Charaka Samhitha Vata Vyadhi chikitsa*, *Samana* is said to be situated in *Sweda*, *Dosha* and all *Udaka* carrying *Srotas*.(30) This shows the control executed by *Samana* in the functioning of *Mootravaha Srotas*. *Vyana* is responsible for *Gati*. So for carrying the factors, which are getting transformed into *Mootra* (may be through *Rasa* or *Rakta*) to the *Mootravivechanakala,* etc the functioning of *Vyana* is necessary. *Apana* is responsible for all excretory functions, which is one of the main functions of *Mootravaha Srotas*. When these *Vata* are in normal equilibrium, in their normal position, in *Anuloma* state they bring support the body as well as the integrity of *Mootravaha Srotas*. When any of these *Vata* is deranged it will either cause some pathology related to its place and action or it will result in death or similar conditions.(26)

Ayurvedic idea of *Mootra* formation is very much related to the process of digestion. *Mootra* is the liquid portion derived from food and drinks after digestion.(31) It is separated from the *Sara* portion by *Maladharakala*, with the help of *Pachaka Pitta* and *Samana Vayu. Kleda*, being an *Apya Bhava* produced in the body is very much related to *Kapha*. Here, the derangement of *Avalambaka Kapha* which has the function of *Udakakarma*(32) and of *Kledaka Kapha* which has the function of *Annasanghata* is seen.(33) *Kledana* will produce more *Kleda Bhava* from the digestion. So *Avalambaka* and *Kledaka Kapha* have a great role in *Mootravaha Srotas*.

***Kleda*:**

While *Mootravaha Srotas* ensures proper formation, carrying and elimination of *Mootra*, indirectly it is also doing the function of *Kledavahanam*. Hence, a review of *Kleda* will reveal the functional importance of *Mootra* in the maintenance of body. *Kleda* is described in the classics as the *Bhava* or representation of *Jala Mahabhoota* in the body. The term is used to describe such elements in the body, which are *Jala* predominant and causing softening and loosening of solid materials on an account of its *Drava*, *Snigdha* and *Mridu* properties. So, *Kleda* is nothing but *Udaka* with some modification. Dalhana also opines that *Kleda* is *Ardra Bhava*. The definition is apt for *Kleda* when we consider the function of *Mootra* as *Kledavahana* ie. *Kleda* is *Ardrata* in excess, attaining the form of *Mala*. So whenever the normal liquid portion (*Ardrata*) increases in *Dhatus* as a result of metabolism or in some pathological

conditions, it is to be eliminated mainly through *Mootra*. *Sweda* also helps in the elimination, but it is mainly done by *Mootra* as its function is mainly said as *Kledavahana*. *Kleda*, being *Apya* is more related to *Kapha* among the *Tridoshas*. But formation of *Kleda* needs the involvement of *Pitta* also. The function of *Pitta* is said to be *Swedana*, *Kledasruti*, etc and *Pitta* by *Ashrayashrayi Bandha* relates to *Rakta*. So, we may say that excess *Drava Bhava* of the body is carried in the form of *Kleda* through *Rakta*. The *Kleda* is also found to be defined as *Krishnata*, *Dourgandhya* and *Tanutwa* of *Rakta*.(34) The discolouration and odour suggest *Malarupata* while *Tanutwa* or thinning indicates excess quantity of water content. This shows the possibility of *Kleda* formation in all *Dhatus*. So we can come to the conclusion that *Kleda* is used in Ayurveda in two senses; one as a normal constituent needed for the body, helping in digestion, existing in all *Dhatu*s, softening them in normal amount. When this *Dravata* exceeds a particular limit, attaining *Malarupata*, it is to be eliminated through *Mootra*, *Sweda* and *Lasika* with *Purisha* as *Atisara*. Here *Kleda* is used as a *Mala* or constituent that is to be eliminated from the body. This is the main function of *Mootra*. So *Kleda* in this sense is the precussor of *Mootra* and when this is not properly converted to *Mootra* and eliminated from the body, it will result in *Malasanchayam* in all *Dhatus*.

Pathology of Microalbuminuria:

By the favourable combination of all the three specific factors, viz.etiology, dosas and dhatus, kapha gets immediately aggravated and because of its excessive quantity it initiates the process of manifestation of prameha. The aggravated kapha spreads all over the body because of the looseness developed in the dhatus. While spreading in the body, first it gets mixed with medas (fat) because there is an increase in the quantity and decrease in the viscosity of medas and also because kapha and medas share identical qualities. In other words, as kapha itself is vitiated, it vitiates medas while getting mixed with the latter. The vitiated kapha along with the vitiated medas gets mixed with the muscle tissues and liquid dhatus of the body, in as much as these two are supposed to have already exceeded their quantity. Vitiation of the muscle tissues provides a congenial atmosphere for the manifestation of putrified carbuncles like saravika and kacchapika in the muscle. The liquid *Dhatus* are further vitiated and transformed into urine. Kidneys and bladder are the root (controlling organs) of the channels carrying urine and the openings of these channels are obstructed. So, the result is the manifestation of *Prameha* which becomes chronic or incurable due to the affectation of all the qualities of *Kapha* and also due to the simultaneous vitiation of homogenous and heterogenous *Dhatus*.(35)

The other factors promoting Diabetic Nephropathy -

Based on *Rasa*: *Madhura*, *Amla*, *Lavana*.
Based on *Guna*: *Guru*, *Snigdha*, *Picchila*
Based on *Dravya*: *Navanna*, *Dadhi*, *Ksheera*, *Anoopa Mamsa*, *Masha*, etc.
Based on *Vihara*: *Madhyanitya*, smoking, *Divaswapna*, *Avyayama*, *Adhyasana*, etc.

All these factors cause the *Kapha – Medo, Rakta Dushti* and overuse of this will promote the complication of *Madhumeha*. There is also a familial propensity to nephropathy in both Type I and Type II diabetes, although the precise genetic factors responsible have not been identified. According to Ayurveda, *Prameha* is a ***Kulaja Vikara***.

***Poorvaroopa* (premonitory signs) of microalbuminuria:**

There is no external clinical sign and symptoms present in the *Poorvaroopavastha*. According to modern

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concept, the *Poorvaroopavastha* is the stage of hyperfiltration. This stage is associated with increased glomerular size and kidney volume, increased Glomerular Filtration Rate (GFR). This stage can be detected only by imaging techniques and by lab techniques.

***Roopa* (Signs and Symptoms) of Microalbuminuria:**

This incipient Nephropathy is not associated with significant clinical signs or any changes other than a very small increase in blood pressure. But symptoms like frothy urine (*Avilamootrata*) can be seen in some patients with incipient nephropathy in OPD. As Microalbuminuria is a complication of diabetes so presenting complaints of diabetes will be present with microalbuminuria in early stage; this can be taken for assessment. The albumin excretion can be detected by laboratory methods. We can also see that there is hyperlipidaemia in patients with microalbuminuria. But when this stage is progressed to other stages, the blood pressure rises progressively and oedema (*Shopha*) and breathlessness (*Shwasa*) develop. Anaemia (*Pandu*) often occurs and patient also shows uremic symptoms (*Vrikkamaya*). Then the disease tends to become *Asadhya*.

***Samprapti* (Pathogenesis):**

Diabetes patients who are over indulged in *Guru*, *Snigdha*, *Madhura*, *Lavana* and *Picchila*, etc. diet are prone to *Agnimandya* since they are *Prithvi-Apya Guna Bhuyishtha*. Hence they will cause *Agnidushti*. This *Agnidushti* will be the cause for *Ama* formation. *Ama* is nothing but undigested food due to *Jatharagnimandya*[36]and it can be understood as the toxic metabolites which are not needed for the body. Due to *Jatharagnimandya*, *Dhathwagnimandya* occurs and by this, proper nutrients are not formed for *Dhathus*. This A*ma* and *Mandagni* vitiate the *Pachaka Pitta* which has the function of digestion and *Annavivechana* and also vitiate the *Samana Vayu* situated at *Antaragni Sameepasthana* which has the function of promotion of *Pachakagni*. The *Ama* and *Agni Dushti* also vitiate *Avalambaka* and *Kledaka Kapha*. This will cause the increased production of *Dravamsha* in *Kapha* (which will translate into excess formation of Bahudrva Kapha in the conditioin of Prameha. This *Bahudrava Kapha*, *Ama*, *Pitta,* etc will cause the over production of *Kleda* in the body. These *Kleda* and *Dushita Doshas* produce further *Shithilata* and *Dushti* of *Meda*, *Mamsa, Rasa, Raktadi Dhathus*. The *Kapha* and *Kaphabhava Dushyas* especially *Meda* causes the *Avarana* of *Vata*. The *Gati Nirodha* of *Vata* at *Vrikka* by *Meda* and *Kapha* can happen by means of three interlinked phenomena:

1. *Vatakara Nidana* directly causing *Vata Prakopa*.
2. The *Gatinirodha* by excess *Meda* and other *Dushyas*.
3. *Kapha* causing *Dhamani Pratichaya* i.e. *Dhamani Upalepa* which represents glomerular atherosclerosis and reduced oxygenation and degenerative changes. The already existing ROS in DM further damages the functioning of kidneys. Here the renal damage is minimal but the *Prakupita Vata* does displacement (*Ashayapakarsha*) of essential factors and excretes it along with metabolic waste. The *Prakupita Vata* manifests its signs earliest at its abode i.e. *Pakwashaya*.(37) Since it is the *Moola* of *Mootravaha Srotas*,(26) the *Srotas* is also dragged into the *Samprapti*.

Samana Vayu and *Pachaka Pitta* by their proper functioning separate *Mala Bhava*s from *Saramsha*. *Mootra* is the *Dravarupa Mala* formed in the *Mootradharakala* situated in *Vrikka*. *Sthanasamsraya*, *Kleda*, *Bahudrava Kapha*, *Samana Vayu*, *Pachaka Pitta*, and the other *Dhatus* derangements cause

Ayanadourbalya of *Moothradharakala* due to the *Shithila* and *Dushita Dushyas*.

This *Ayanadourbalya* contributes to the excessive loss of *Dhathu Saramsha* along with *Kleda Bhava*s because of the loss of ability to hold them together before separating from *Mala Bhava*s. This also causes *Atipravritti* of *Srotas*. *Atipravritti* of *Srotas* cause *Vata Prakopa* and structural damage of the organs. Some of *Meda* and *Kledamsha* gradually get accumulated within the *Ayanamukhas* leading to their occlusion. This is the underlying pathology in glomerular basement thickening and mesangial expansion in microalbuminuria.

Albuminuria is nothing but the excess loss of *Dhathu Saramsa* due to *Ayanadourbalya*. The progress of this structural damage gradually leads to a condition in which function of the *Srotas* is totally impaired (*Sanga*). This is actually happening in glomerulosclerotic stage of diabetic nephropathy. As function of *Mootradharakala* becomes fully impaired, there is failure in the removal of *Kledamsa* and *Udaka Bhava*s, which leads to their accumulation in the body. These *Mala*s may take *Sthanasamshraya* thereby producing different symptoms like *Shopha*, uraemia etc. This is what is happening in end stage nephropathy and the disease becomes *Asadhya*.

***Sadhyasadhyata* (Prognosis):**

The *Sadhyasadhyata* depends upon the factors like *Dosha*, *Dushya*, chronicity of *Vyadhi*, *Vayah* and other factors like *Prakriti*, *Kala*, *Bala* of *Samprapti Ghatakas* etc. In early stages of nephropathy i.e. in the stage of microalbuminuria, the condition is reversible with good diabetic control. This phase is also managed by hypotensive treatment that aims at a sustrained blood pressure of < 130/80 mm of Hg. As the stage advances, it will become *Asadhya* due to severe *Dhathukshaya* and *Mala* accumulation. In earlier stage, i.e. the stage of *Ayanadaurbalya*, we can reverse it but in the later stages *Vata Kopa* and structural damage occurs. In this stage, the disease becomes *Prathyakhyaya*.

Conclusion:

Microalbuminuria is the condition of *Kledavridhi* in *Mutravaha Strotas*, as there is no direct correlation in Ayurveda. It can be consider as *Kapha-Vata Dushti* with *Ayandaurbalya*. *Kledaharana* and *Shodhana* (*Mutravirechana*) will be the line of treatment.

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