

CRITICAL STUDY OF *MUTRAVAHA SROTAS* AND URINE FORMATION WITH MODERN REVIEW

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❖ **ABSTRACT**

Ayurveda is the ancient advanced medical system, a branch of *Atharva Veda* which provides *mantra* for human health and cure. Ayurveda also engrid several theories and concepts related to the human anatomy and physiology. In this regards Ayurveda has mentioned anatomical and physiological perspectives related to the various system and *Mutravaha srotas* is one of them. The *Mutravaha Srotas* described in many Samhitas and vedas for collection and excretion of *Mutra* (urine). To understand the physiology of *mutravaha srotas* and various organs related to *mutra nirmiti* (formation) and *uthsarjana* (excretion) with ayurvedicand contemporary view. Though there was no technical advancement, still vision of aptajana about *mutra nirmiti* is highly commendable. *Ahara* is a key of *Prana dharana*, after *aharapaak* it transformed into *saar* (nutritive part) and *kitta* (less nutritive part). *Saar bhag* nutures the *dhatu*s (body tissues) and *kitta bhag* transformed in *mutra* and *purisha* (faeces).The process of urine formation in ayurveda is contradictory with contemporary view, hence in attending article the author has tried to prove the scientific significance of ayurveda concept of *mutra nirmiti* with reference of different samhitas, vedas and modern literature.

KEYWORDS: *Ayurveda, Moolsthana, Mutra, Mutra nirmiti, vedas.*

❖ **INTRODUCTION**

The acharya's have explained various body systems in relation to their anatomy and physiology. Ayurveda the ancient system of India described many considerations related to the anatomical and physiological perspective of human body. The physiological knowledge of various system helps to understand their pathological state therefore ayurveda science elaborated anatomical and physiological functionality of different system and *mutravaha srotas* is one of them.

According to modern prospective urine formation process takes place at kidney in nephrons as a filtration, reabsorption and secretion process at that region but absorption of fluid and nutrients takes place at small and large intestine. Similarly, acharyas says after *aharapaak* with action of *jataragniahara* divides into *saarbhag* and *kittabhag*. *Kittabhag* goes to *pakvashaya*(large intestine) where it divides into *mutra bhag*(liquid part) and *purisha bhag* (fecal part). *Mutra bhag* absorbed from *pakvashaya* and transport to *basti* (bladder)with numerous *mutravahi nadi* (urine carrying tubules).(1)

Urine formation is one of the important physiological activities of human body in which *Mutravaha srotas* and *kitta bhag* of *Aahar Rasa* (nutrient essence) contributes significantly. *Pakwashaya, Mutravaha Sira* (vein of urinary system), *Mutravaha Dhamanis* (arteries of urinary system), *Vrikka* (kidney), *Mutravaha Nadis, basti* and *medra* etc. are major body parts which play particular role in the process of urine production and excretion. While modern science described kidney, nephrons, ureters, urinary bladder and urethra etc. essential parts of urine production and excretion.

❖ **Organ involved in *mutravaha srotas*:- According to Ayurveda and Veda**

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|--|---|
| 1. <i>Basti</i> (Urinary bladder) | 2. <i>Vrikka</i> (Kidney) |
| 3. <i>Gavini</i> (Ureters) | 4. <i>Mutrapraseka</i> (Urethra) |
| 5. <i>Mutravaha Nadi</i> (tubular system of urinary) | 6. <i>Mutravaha Dhamanis</i> (Arteries of urinary system) |
| 7. <i>Mutravaha Sira</i> (Veins of urinary system) | 8. <i>Pakwashaya</i> (large intestine) |

1. *Basti* (Urinary bladder):

In Shabdakosha- "*Vas Acchadane*"(to cover, base, store house and reservoir).

In amarkosha - *basti* and *adhonabhi*.

Utpatti - *saar bhaag* of *rakta* (blood) and *shleshma* (mucous) get digested by action of *pitta* and *Vaayu* follow it. (Acharaya Shusruta) (2)

Site - Acharya Shusruta states it is surrounded by *Nabhi* (Umbilicus), *Kati* (Waist), *Mushka* (Scrotum), *Guda* (Rectum), *Vakshanas* (Inguinal region) and *Sepha* (Penis). (3)

Ashaya - *mutrashaya* (store house of urine).

Acharya shusruta and acharya charak has mentioned *basti* in *mutravaha srotas*.

2. *Vrikka* (Kidney):

In amarkosha - "*vrishasechene*" means irrigation. (4)

utapatti - *prasad bhag* of *rakta* and *meda* (Acharya shusruta). (5)

Features - *mamsa pinda* and round in shape. (Acharya shusruta)

Number - two.

Site - are situated in the lumbar regions on either side in the posterior abdominal wall. (Acharya shusrut) (6)

Acharya shusrut and acharya charak has mentioned *vrikka* in *medovahasrotas*.

3. *Gavini* (Ureters): In Athurveda it is described *mutra* which is formed in *antra* is transported through two *nadis* called *gavini*, which is situated in either side of lumbar region into *mutrashaya* (urinary bladder). (7)

4. *Mutrapraseka* (Urethra): Acharya shusruta has told, *Mutrapraseka* is one of the eight important organs, which are to be protected from any injury while performing surgery for *Mutrashmari* (Bladder calculus). It is the outfall of the *Basti* (Bladder), Which is two *Angulas* (A type of length measurement) in females and Twelve *Angulas* in males. In

male it exit path for both *Mutra* (Urine) and *Shukra* (Semen), while in female only *Mutra* (Urine).(8)

In Arundatta commentary it is said *mehan* is *nishkraman dwara* (outway) of urine. (9)

5. *Mutravaha Nadis* (tubular system): Acharya shusruta has told that thousands numbers of *nadis* are situated in *Pakwashaya* (Large intestine) always carry urine towards bladder like river always carry water to the sea. These *Nadis* (channels) by *Nishyandana* process (Filtration of urine) fills the bladder in state of awakening or sleep. These thousand *nadis* (channels) are invisible so exact location and structures are not mentioned. (10)
6. *MutravahiDhamanis* (Arteries of urinary system): According acharya Charak heart is the *mool* of 10 *dhamanis* which circulate oja in the body and nourishes it.(11)
Shadhangdhar told that *dhamanis* carry *rasadhātu* all over the body and fills it with air.(12)
Acharya Susruta has told about 24 *Dhamanis* (Arteries) of which one of the type of *Dhamani*, termed as *Adhogami Dhamani* (Arteries which move downwards) which carry *vata*, *mutra*, *mala*, *shukra* and *arthav*. When it reaches near *pittashya* (pancreas/gallbladder) carries nutrients from digested food through which it nourishes the body, *udhravgami dhamanis* and *triyakgami dhamanis*. It also provides *rasa* to *rasasthana* and separates *mutra*, *purisha* (fecal matter) and *sweda* (sweat) from digested food. Between *amashya* and *pakwashya* it further gets divided into 30 *dhamanis* of which 10 are *vata*, *pitta*, *kapha*, *rakta* and *rasa*. Rest enters into *antra* where it 2 are for carrying food, 2 are for carrying *jal*(water), 2 *mutravaha dhamani*, 2 for formation and 2 for dispersion of *sukra* (in females for menstrual blood).(13)
7. *Mutravaha Siras* (Veins of urinary system): In Charaka and Shusruta Samhita, description of *sira* is there but not particular about *Mutravaha Sira* is available. Ashtanga Hridaya has first time described concept of *Mutravaha sira*. *Mutravaha Sira's* are considered as minute channels carrying *Mutra* (Urine) to *Basti* (Bladder). This *Mutravahi Sira* opens in the lateral side of *Basti* (Bladder) and fills the *Basti* (Bladder) with *Mutra* (Urine) continuously by the process of *Nishyandana* (Filtration). (14)
Acharaya Shadangdhar told that *sira* binds the parts together and transport the doshas and dhatus. (15)
Acharya Shusruta told that *sira* is a big *jalhariniya* (blood vessels) through which garden and small *kulyas* (channels) through which fields gets nourishes. He also define 40 *mool siras* (main vessels) i.e *vata*, *pitta*, *kapha* and *raktavaha siras*. (16)
8. *Pakwashaya* (large intestine): Anatomical and physiological important organ for the digestion of food and formation of urine. (17)
Site - exists above *shroni* (pelvis), *guda* (anus) and below *nabhi* (Acharya shusruta) (18)
kala - *purishadhara kala*. (Acharya shusruta)
Acharya shusruta and acharya charak has mentioned *pakwashaya* in *purishavaha srotas*.

❖ Physiology of *mutra nirmiti* in ayurveda

Description of *mutra nirmiti* is mentioned in various places. Very first description about *mutra nirmiti* is mentioned in ‘Atharveda’ in (2000BC). According to *Atharveda* two *nadis* (tubes) termed as *gavini*, resembles to ureter receiving *mutra* from *antras* transport *mutra* into *basti*.(19)

In ayurveda urine formation is related to *aharapaak* (food digestion). Different acharyas has different *Siddhant* of *dhatu poshak*. considering all the facts of *Siddhant* we can summarize the process of *dhatu poshan* and *mala* like *mutra*, *purisha*, *vayu* and *mala* formation.

According to dalhana commentary, after intake of food it get digested with the action of *jataragni* and get separated in *prasad bhaga* and *kitta bhag*. *Prasad bhag* (*ahara rasa*) absorbed and goes to heart. Action of *dhatu agni* on *ahara rasa*, it converted into *sthula prasad rasa dhatu* and *prasad rakta dhatu*. Further action of *dhatuagni* on *rakta dhatu* further process will happen and next *dhatu* will form. (20)

According to Chakrapani commentary whole *rasa dhatu* do not convert completely, only *shonita* part of *rasa dhatu* convert into *rakta dhatu* left over part goes to place of *rakta dhatu* that is *yakrit* (liver), *pleeha* (spleen) and *sarakta meda*. Further *dhatu* formation process is same as of *rakta dhatu*. *Mutra* is the liquid part of *kitta*. (21)

Inshusrut Samhita it is described that between *amashya* and *pakwashya* situated *paachka pitta* divide digested food in *rasa* and *mala*. Other than *vayu mala* get divided into *mutra* and *purisha*. (22)

Now in other place it is mentioned that rivers always connect sea in same way *mutravaha nadis*(channels passing urine) of *pakwashya*, they fill the *mutrasaya* (bladder). These *nadis* are in invisible due to thousands of openings. *Nadis* inside from *pakwashya* carry urine and through *nishayandan* (filtration) fills bladder day and night. Like new water pitcher dipped in water till neck get filled by small thousands minute pores same way bladder gets filled by thousands small openings of *srotas*(channels) around it. (23)

Sarangdhara describes that *rasa dhatu* is the nutrient part of digested food while without nutrient part is called as the *Maladrava* (Liquid part of stool) from digested food. From this *maladrav* liquid part is absorbed from *antras*. This *shonita* liquid travel through *sira* towards *basti* then it is called *mutra*. Left over part is called as *kitta* which remain in *pakwashya* or *malashya*.(24)

In Asthanghridya digested food get divided into *saar* and *kitta*. Clean *kitta* is *mutra* and concentrated form is *mala*. Food *saar* is further digested by *jataragni* and from *saar rasaraktadi* seven *dhatu poshak* (nutritive) part develop. From there seven *datus* digested from their own *dhatuagni*, divide into *saar* and *kitta*. *Rasa* formed divided into to parts i.e *sukshma* part and *sthula* part. *Sthula* part form its own *dhatu* and *sukshma* part forms next *dhatu*. *Kitta* part form *mala*. (25)

❖ Urine formation in modern view

Urine formation process starts with the digestion of food and turning it into nutrients, which the body uses for energy, growth and cell repair. The digestion process also involves creating waste to be eliminated. Digestive tract (or gastrointestinal tract) is a long twisting tube that starts from mouth and ends at anus. (26) Food digestion starts from mouth and after reaching the small intestine chyle get absorbed into lymphatic system. (27) Then leftover (feces) moves into the large intestine where water and some minerals are reabsorbed back into bloodstream. (28) These all nutrients and toxins extracted from digested contents goes into portal vein through inferior mesenteric vein and superior mesenteric vein. Portal vein supply 80% to liver where nutrients get metabolized. Main functions of liver are bile production, fat soluble vitamin storage and/or metabolism, drug metabolism and bilirubin metabolism. After metabolism by-products are excreted into bile or blood. Bile by-products enter the intestine and leave the body in stool. Blood by-products are filtered out by the kidneys and leave the body as urine. (29)

In kidney urine production and excretion occurs mainly in three steps:-

1. Glomerular Filtration - It is the initial process in urine production. Blood entered through renal artery in kidney. Main process of filtration starts from glomerular capillaries in which plasma filtered out through a three layers of filtration membrane. The plasma proteins are retained while excess fluid and waste products reached to Bowman's capsule to form ultrafiltrate with rate of 120-125ml/min.

2. Tubular Reabsorption – In this process water and other substances are transported from renal tubules back to the blood. Four different segments have each unique absorptive properties.

(i) Proximal convoluted tubule – reabsorbs all the glucose and amino acids as well as 65% of sodium, potassium, calcium, bicarbonates, chlorides, phosphate, urea, uric acid and water.

(ii) Descending limb of Loop of henel – reabsorb water.

Ascending limb of Loop of henel – reabsorb sodium, potassium and chlorides

(iii) Distal convoluted tubule – reabsorb sodium, calcium, bicarbonate and water.

(iv) Collecting tubule – reabsorb active sodium and calcium .

3. Tubular Secretion – dipose of drugs, metabolites, excess potassium and hydrogen ions. Secretion of creatinine, ammonia and many other organic acids and basics occur. (30)

Storage of urine – Ureter on each side transport urine in bladder. In urinary bladder urine get stored.

Urethra – It drain out urine from bladder.

❖ DISCUSSION

Comprehensive study of all samhitas, vedas and modern literature many important reference are highlighted. *Mutravaha Srotas* (capillary system) according to Acharya Charaka, 'Sraavanat Srotamsi.' which means, from where something flows on. (31) *Mutravaha Srotas* has its *mool* (root) from *Basti* (Bladder) and two *Vankshana* (Inguinal region). (32) Whereas according to acharaya shusruta *srotas* are hollow structures different from *sira* and *dhamani*. (33) They originate from *mool* (root) opening and spread in whole body carrying *rasadi* contents. Susruta mentioned *basti* and *Medhra* as the roots of *Mutravaha Srotas*. (34) It means that *srotas* are the channels transporting many contents like *rasadi dhatus*, *dosha* and *mala* absorbed after food digestion.

After digestion of food it divided into *saarbhag* and *kitta bhag*. That *saar* which look like *jaltatva* absorbs from small intestine and first goes to *yakrit* (liver) and *pleeha* (spleen) (both are *moolstana* of *raktavaha srotas*) and forms *rakta dhatu*. (35) Some acharyas also told that heart is the place of *ahara rasa* from where through 24 *dhamanis* it spread to whole body. It means that absorption from small intestine goesto blood stream as well as lymphatic system has similarity with modern view. *Kitta bhag* reaches to *pakwashya* where it get divide into *mutra bhag* and *mala bhag*. *Mutra bhag* get absorbed from *pakwashya* and from there it goes to blood stream. Through *raktavaha sira* which give nutrients to *dhatus* (36) enter in liver as it is place of *rakta dhatu* and from their blood carrying *kitta* and *saar bhag* get metabolized. After that it goes to heart from where it get into circulation from their *mutra bhag* enter into thousands of *mutravaha nadis* through *mutravaha dhamanis* which resembles renal artery supplying blood to nephron from there *mutra bhag* through *nishayandan* (filtration) process goes to *basti* through two *gavinis*. *Basti* holds that urine for some time then excrete it out through *medra* (urethra).

❖ CONCLUSION

Studying thoroughly the concept of urine production and excretion from ayurvedic and modern literatures conclusion drawn is that acharayas has defined urine formation and secretion process similar to modern explanation. In atharveda it is mentioned that structure process the urine formation and excretion look like *antra*. It means that thousands *nadis* which are invisible carrying urine look like *antra*. In modern aspect it resembles to the structure of nephron which is convoluted tubules. Due to lack of technical advancement they did not came to know about the microscopic structures present inside kidney. They made a assumption of thousand *nadis* carrying *mutra* and did not clearly define kidney function they just add it in *medovaha srotas*. Ayurvedic concept has similarities with the modern concept but in ayurveda role of kidney is not clearly define.

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