CRITICAL STUDY OF MUTRAVAVAHA 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 ayurvedic and 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* natures the *dhatus* (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 acharyas 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 *jataragni avara* 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. *Pakvashaya, 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

1. **Basti** (Urinary bladder)
   - In Shabdakosha- "Vas Acchadane" (to cover, base, store house and reservoir).
   - In amarkosha - basti and adhonaabh. 
   - Utpatti - saar bhaag of rakta (blood) and shleshma (mucous) get digested by action of pitta and vaayu follow it. (acharya 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 shrusrut and acharya charak has mentioned vrikka in medovahasrotas.

3. **Gavini** (Ureters): In Athraveda it is described mutra which is formed in antra is transported through two nadiis 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 nadi's are situated in Pakwashaya (Large intestine) always carry urine towards bladder like river always carry water to the sea. These Nadi's (channels) by Nishyandana process (Filtration of urine) fills the bladder in state of awakening or sleep. These thousand nadi's (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 rasadhatu 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, udhragami 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 Shusrusna 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 - purishadharaka 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 toaharapaak (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 rakt 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 maladray 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 dhatus 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, 'Sravanat 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 acharyaya 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 rakra 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 pakhwasya where it get divide into mutra bhag and mala bhag. Mutra bhag get absorbed from pakhwashya and from there it goes to blood stream. Through raktavaha sira which give nutrients to dhatu (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.
REFERENCES


