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AYURVEDIC UNDERSTANDING OF URINARY SYSTEM-A REVIEW

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ABSTRACT

Ayurveda is considered as upanga of Atharvaveda which provides ways of healthy living has given prime importance to Mutravaha srotas (urinary system) and its srothogatha vikaras (urinary disorders). Being a system responsible for homeostasis of fluids in the body, it also detoxifies the body by eliminating certain waste products through urine. When diseased, people produce symptoms such as increased or decreased urine production, painful micturition, formation of stones, and thereby obstructed micturition, increased frequency of micturition. The concept of urinary system is explained under mutravaha srotas in Ayurvedic classics and it is one among the abhyantara srotas explained by Charaka and Susrutha. Mutra is the drava roopi mala which is formed in pakwashaya and expels the kleda from shareera regulated by samana vayu and apana vayu. Any derangement in the physiology of the system leads to kleda vridhi which can be observed by the increased bio chemical parameters such as urea, creatinine, Serum electrolytes.

KEYWORDS: Mutravaha srotas, Vasthi, Vrikka.

INTRODUCTION

The urinary system consists of Kidneys, ureters, bladder and urethra, It plays vital role in the regulation of volume and composition of blood, pH, BP along with regulatory functions secretion of hormones such as Erythropoetin. Autoregulation is a process within many biological systems resulting from an internal adaptive mechanism that work to adjust that system's response to stimuli and is clearly observed in kidney, heart and brain. Regulation of

renal blood flow is important to maintaining a stable glomerular filtration rate despite changes in systemic blood pressure. In Ayurvedic classics we will get scattered references of mutravaha srotas along with structures and functions related to it with a much similarity to the urinary system.

URINARY SYSTEM

The definitive human kidney arises from two distinct sources.The excretory tubules(nephrons) are derived from the metanephros – the lowest part of nephrogenic cord which is derived from intermediate mesoderm.[1] The collecting part of the kidney is derived from a diverticulum called the ureteric bud which arises from the lower part of the mesonephric duct. The kidneys lie on either side of the spine in the retroperitoneal space between the parietal peritoneum and the posterior abdominal wall, well protected by muscle, fat, and ribs. They are roughly the size of your fist, and the male kidney is typically a bit larger than the female kidney. The kidneys are well vascularised, receiving about 25 percent of the cardiac output at rest. The left kidney is located at about the T12 to L3 vertebrae, whereas the right is lower due to slight displacement by the liver. Upper portions of the kidneys are somewhat protected by the eleventh and twelfth ribs.[2]

Each kidney weighs about 125–175gm in males and 115–155gm in females. They are about 11–14 cm in length, 6 cm wide, 4 cm thick, and are directly covered by a fibrous capsule composed of dense, irregular connective tissue that helps to hold their shape and protect them. This capsule is covered by a shock-absorbing layer of adipose tissue called the renal fat pad, which in turn is encompassed by a tough renal fascia. The fascia and, to a lesser extent, the overlying peritoneum serve to firmly anchor the kidneys to the posterior abdominal wall in a retroperitoneal position. On the superior aspect of each kidney is the adrenal gland. The adrenal cortex directly influences renal function through the production of the hormone aldosterone to stimulate sodium reabsorption.[3]

A frontal section through the kidney reveals an outer region called the renal cortex and an inner region called the medulla. The renal columns are connective tissue extensions that radiate downward from the cortex through the medulla to separate the most characteristic features of the medulla, the renal pyramids and renal papillae. The papillae are bundles of collecting ducts that transport urine made by nephrons to the calyces of the kidney for excretion. The renal columns also serve to divide the kidney into 6–8 lobes and provide a supportive framework for vessels that enter and exit the cortex. The pyramids and renal

columns taken together constitute the kidney lobes. Podocytes[4] are the cells in the Bowman's capsule in kidneys that wrap around the capillaries of the glomerulus. Podocytes cells make up the epithelial lining of the Bowman's capsule the third layer through which filtration of blood takes place. Bowman's capsule filters the blood retaining large molecules such as proteins while smaller molecules such as water,salt,sugar are filtered as the first step in the formation of urine.

The purpose of the urinary system is to eliminate waste from the body, regulate blood pressure and control levels of electrolytes and metabolites. Each kidney consists of functional units called nephrons. The circulating metabolic end products pass along with blood to the glomerulus through the afferent arteriole and then leave through the efferent arteriole. The glomerulus is a network of up to 50 parallel branching and anastomosing capillaries covered by epithelial cells and enclosed into the "Bowman's Capsule".[5] The pressure of the blood in the glomerulus cause the fluid to filter in Bowman's capsule and from here the fluid flows in to the proximal tubule that lies in cortex of the kidneys along with glomerulus. The fluid filtering through the glomerulus into the Bowman's capsule is called "Glomerular filtrate" and the membrane of glomerular capillaries is called glomerular membrane. The permeability of these membranes is 100-105 times as great as usual capillaries. The tremendous permeability of the glomerular membrane is caused by the special structure viz. thousands of small holes called "Fenestration". The 99% of its water and varying amount of its solutes are normally reabsorbed into the vascular system and small amount of some substances are also secreted into the tubules, the remaining tubular water and dissolved substances to become urine.

Tubular reabsorption[6] is the process by which water and other substances are transported from renal tubules back to the blood. When the glomerular filtrate flows through the tubular portion of nephron, both qualitative and quantitative changes occur. Large quantity of water, electrolytes and other substances are reabsorbed by the tubular epithelial cells. The reabsorbed substances move into the interstitial fluid of renal medulla and from here substances move into the blood in peritubular capillaries. Since the substances are taken back into the blood from the glomerular filtrate, the entire process is called Tubular reabsorption.

MUTHRAVAHA SROTAS

Among srotases explained by Susruta and Charaka Mutravaha Srotas[7] plays its own role in body function as mutra utpatti and mutra sanchaya. Organs of the Mutravaha srotas are

kidney, ureter, bladder and urethra. In these the urinary bladder is much helpful part anatomically, physiologically. According to charaka, the definition of the word srotas is "sravanath srotamsi"[8] which means, "from where something oozes out". The channels which carry muthra can be considered as muthravaha srotas.

Moolasthana

According to Charaka vasthi and two vankshanas are the moolasthana[9] of mutravaha srotas, But according to Susruta it is vasthi and medra.[10] Intake of food and drinks and doing sexual intercourse while having the urge of micturition and the suppression of urge of micturition are the main causes of vitiation of muthravaha srotas. It also gets vitiated in patients who are debilitated and those with injury of urinary tract. Symptoms of vitiation are voiding of too much of urine or complete suppression of urine, impairment of composition of urine, occasional or frequent passing of thick urine associated with pain. Any trauma to this muthravaha srotas leads to acute retention of urine, distension of urinary bladder and stiffness of the penis.

VRIKKA

The description of anatomy and physiology of excretory system in Ayurvedic literature is very crude and miniature. Term Vrikka has been derived from vrikkadane, which means 'to take'. In veda the meaning of vrikka is explained as "vyadhe varjayathi ithi vrikka" The organ which helps to ward off diseases is known as vrikka, While explaining the urinary system, Sushruta has not mentioned the vrikka in relation to the basti. There is description that mutravaha nadis or dhamanis carry drava mala from pakwashaya to basti where it percolates in drops in a pool of urine[11] i.e. basti. The relation of vrikka and mutrashaya has been mentioned while describing seven ashayas and the organs related to the ashayas. Most of the ancient acharyas described vrikka as a koshtanga[12], which means vrikka is situated in koshta, one in vama and other in dakshina parswa. Symptoms of vrikka vidrathi include prishta kateegraha and parswa sankocha, from this we assume the site vrikka is near prishtta vamsha, in parswa and posteriorly. The symptoms of vrikka vidradhi suggest that vrikkas are situated in the back part of the abdomen in the koshtha in the lumbar region. The vrikkas have been told to be the root of medovaha srotas.It is derived from essence of rakta and medas. The shape of the vrikkas has been mentioned to be near round.

VASTHI

The word vasthi has been derived from the root "Vas" after adding suffix "Tich" According to Sabdakosha, meaning of the root " Vas" is used as "vas achadane " or "vas nivase". Its different meanings are to cover, base, storehouse and reservoir. According to Stomamahanidhi - "Vasthre avrunoti mutram", "Nabheradhobhage mutradhare sthane". It means the organ, which act as receptacle or reservoir of urine and is situated in the lower part of the nabhi. During foetal development, the essence of raktha and kapha are undergoing the process of pakavastha with the help of pitha. At that time the vata enters into it and results in the formation of a hollow organ called vasthi. It is derived from the maternal contribution (Matrujabhava). The vasthi is an alabu shaped organ and is fixed on all sides by siras and snayus according to susrutha. He further adds that vasthi is thin walled and has a single outlet directed downwards. Internally vasthi is related to vasthisira, pourusha grandi, vrishana and guda. And it also mentioned that it is situated in the pelvic cavity. Vagbhata has mentioned the shape of vasthi as dhanurvakra that is curve like a bow, with a downward opening. Further he has also mentioned that vasthi is composed of raktha and mamsa dhathu and its opening is surrounded by sushira snayu. Vasthi has been accounted as one of the vital parts, marmas of the body. It is of snayu marma type having swapanithala pramana and It is sadya pranahara.[13] Charaka mentions it as one among the thrimarmas.[14]

MUTRA PRASEKA

Mutrapraseka[15] is one among the eight important organs, which should be protected from injury at the time of surgical procedure of mutrashmari. According to Dalhana and Arunadatta an injury to this leads to continuous leakage of urine. Acharya Dalhana says that it is situated at the outlet of vasthi, through which the urine passed out. In case of female, it is two angula in length, whereas it is approximately four angulas in males. Its length may be much smaller in female child. In males, it carries both Mutra and Sukra and only Mutra in female.

GAVINI

In Atharvaveda, we can see the reference of Gaveeni. It is described as the conducting channel connected to vasthi and situated near anthram. They carry muthra (Urine) into the vasthi. Sayanacharya, the bhashyakara of Adharvaveda, explains it as nadi situated on either side of parswa(flanks).And it is the structure which conducts the urine to mutrashaya.

Mutravaha Dhamanis

Susruta while describing the Dhamanis (Arteries) has narrated one variety of Dhamani, termed as Adhogami Dhamani (Arteries which move downwards)' which are meant for Sara-Kitta Vibhajana (Dividation between essence and fecal matter of food) and to transport Mutra (Urine), Purisha (Feaces), Shukra (Semen), Artava (Ova/Menses), Apana Vata (Flatulence) etc. downwards. Adhogami Dhamani (ten in numbers) are further subdivided into three parts, thus total number becomes 30. These same Dhamanis (Arteries) taking part in the Sara-Kitta Vibhajana (Dividation between essence and fecal matter of food) process, out of which two are said to be the Mutravaha dhamanis (Arteries of urinary system) going to the Mutrabasti (Urinary bladder), the functions of which stated are Dharana (Holding) and Yapan (Nourishing) of Mutra (Urine) and Basti (Bladder). Dalhan further says that these are further divided into countless branches.

URINE

The volume of urine eliminated per day in a normal adult is about 1-2 Litres. Urine volume is influenced by fluid intake, blood pressure, blood osmotic pressure, diet, Temperature, diuretics, mental state and general health. Low BP triggers the renin – Angiotensin pathway, which increases reabsorption of water and salts in the renal tubules and decreases urine volume. Likewise when blood osmotic pressure decreases, secretion of ADH is inhibited and and a larger volume of urine is excreted. Water accounts for about 95% of the total volume of urine. The remaining 5% consists of solutes derived from cellular metabolism and outside sources such as drugs. Normally most abundant solute is urea, followed by Sodium, Chloride, Potasssium and lesser amount of creatinine, Uric acid, Phosphates sulphates and traces of calcium magnesium and sometimes bicarbonate. Organic:Urea, Creatinine, Uricacid, Urobilinogen, Inorganic:Na+,K+,Cl,Mg2+,NH4+,Ca2+,Sulphur,Phosphate.

MUTRA

Mutra is a dravaroopa mala through which excess kleda formed in the body is eliminated.Acharya susrutha clearly mentioned boundaries of vasthi,Upper boundary is Nabhiprushta (till upper lumbar area on the posterior abdominal wall) Lower is kati (pelvis) surrounded by mushka, guda, vamkshana and shepha. Related structures include pourusha vrishana and guda and lies in Gudasthi vivarasritha. This structure having shape of Alabu, characteristics like ekadwara (one external opening) and adhomukha (facing downwards) showing similarity towards bladder. There are two mutravaha nadi reaching to pakwashaya of

basthi can be considered as the ureter. Muthrashaya is one among the eight ashaya mentioned by acharyas. Kidney and urinary bladder together can be considered where mutra is formed and collected before voiding.

Mutra formation

According to all Ayurvedic texts, the general concept of formation of urine is that the ingested food converts in to sara and kitta portion by the action of samana vayu after the completion of digestive process. The sara portion is absorbed and utilized for nourishment. Ghana part converts to pureesha and drava part forms mutra. According to Acharya susrutha, the process of formation of urine begins in pakwashaya. From the pakwashaya urine is transported into vasthi constantly during the time of sleep and arousal. Urine carrying channels existing in the abdominal cavity saturate the bladder with urine constantly as rivers do for the sea.

Vasthi purana that is the drainage of urine in to vasthi is a continuous process and can be compared with a new earthen pot which is immersed in water. When earthen pot is new, it is very porous and it allows the transudation of water through these pores, similarly the vasthi is filled with urine through these minute channels. As per the opinion of Dalhanacharya, mutra is formed from the kleda. Here the word kleda means ardra bhava of ahara. The ardra bhava of ahara is separated during the process of digestion from the pakwashaya and result in the formation of urine. The next step that is the transportation of urine from pakwashaya to vasthi is seen in the vyakhyana of ashmari nidana. Mutravaha nadis are present in pakwashaya, these nadis helps in the tarpana that means vivardhana of mutra like a river fills sea with water.

Mutra karma- mutra fills the Urinary bladder and eliminates the excess kleda from the food.[16] The function of Urinary system is removal of waste products mainly Urea and Uric acid, regulation of electrolyte balance, acid-base homeostasis, controlling blood volume and maintaining Blood pressure.

DISCUSSION

Anatomical aspects of urinary system are well explained in Ayurveda in different contexts like vasthi, vrikka, mutravaha srotas etc. Urine formation and excretion is one among the basic physiological activity of the body which is regulated by urinary system. After considering all the physiological aspects vasthi one among the tri marma can be understood

as the reservoir of urine. Mutra is the drava roopi mala which is formed in pakwashaya and expels the kleda from shareera regulated by samana vayu and apana vayu. Any derangement in the physiology of the system leads to kleda vridhi which can be observed by the increased bio chemical parameters such as urea, creatinine, Serum electrolytes.

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