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Review Article

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Review study on anatomical consideration of *Dhamnis* and related diseases

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ABSTRACT

Ayurveda is a life science that is a combination of four factors sharir, *indriya*, *satva*, and *atma*. The *dhamni* is a pulsatile structure and works under the direct influence of *vyaan vaayu*. The artery is a blood vessel that takes blood away from the heart. The prevalence of PAD arterial disease is 29% but it also is a byproduct of modern lifestyle. The prevalence is also directly related to the other existing diseases. This study aims to highlight the importance of *dhamni* and diseases. There are many Ayurvedic texts, literature, articles, books which enlighten us on this topic like *Brihattrayee* with their commentaries, especially from *Sushruta Samhita Sharirsthana.* The ayurvedic concept of *dhamni* - origin and distribution is explained in this literature. Arterial diseases like Abdominal Aortic Aneurysm, Thoracic Aortic Aneurysm, Coronary Artery Disease, PAD is described. This all information will be helpful for young readers. The *dhamni* is a duct with thick walls equivalent to an artery. It is a tubular vessel of the human body starting from the heart or from the naval to carry the rasa. Any abnormalities like embolism, plaque formation, anatomical defects in the artery will lead to disease. Our acharya's elaborately explained the concept of *dhamni* in their respective books.

Keywords: Aneurysm, D*hamni*, Pulsatile.

INTRODUCTION

Ayurveda is a life science that is a combination of four factors *sharir, indriya, satva, and atma*. The term dhamni is derived from the root *'Dhma' (Dhamni + Va Digha). Dhamnis* are tube-like structures that originate from the heart or from the naval to carry the *rasa dhatu*. According to *Charak 'Dhamanadhamanyah'*: thus, *dhamnis are the structures that being pulsatile produce sound.* According to *Sushruta, sira & dhamni* is the pathway for the movement of fluid in the body.

Ancient Greeks believed that the arteries were held by air because without a heartbeat the arteries of the dead were empty. In middle age, it was believed that arteries carried vital spirits which were separate from the blood. It became more clear after William Harvey described the circulatory system. Modern science explains three types of blood vessels, they are arteries, veins, and capillaries. Also, the lymphatics and nerves are the other two important channels for the maintaining of the body.

The prevalence of PAD rises with age and affects a substantial proportion of the elderly population (>20% in >80-year-old individuals).[1] The prevalence is 29%(>70years) without additional risk factors, 50-69 years with a history of smoking and diabetes.[2] If a person is having any of the risk factors, then the occurrence of having the disease is more. We will go thorough knowledge of *dhamnis*, its origin, and development, and types in this topic. We will also come across the diseases involving the arteries, their risk factors, and different sites of diseases.

MATERIALS AND METHODS

There are many Ayurvedic texts, literature, articles, books which enlighten this topic like *Brihattrayee* with their commentaries, particularly the *Sushruta Samhita Sharirsthana.*

Development of *Dhamnis*

Sushruta has described that the direction of vessels is around the umbilicus but there is no elaboration of the name of the vessels in his chapters, so the theory is not acceptable, although Acharya *Sushruta* has used the word "*Nabhiprabhava*". This is because in the intrauterine period the arteries and the vein start from the fetal umbilicus, thus the word *nabhiprabhava* came into being. Sometimes the word *nabhi* is used in the sense of heart but *Charak, Ashtansangrah, Ashtanghridaya* have shifted their view about the origin of *dhamnis* from *nabhi* to *hridaya*.[3][4]

Charak has also mentioned in his 30th chapter of *sutrasthan*a that dhamnis arise from the heart.[5] *Sushruta* safely commented that the *dhamnis* are vessels that originate from *nabhi* only during fetal life, post-birth, the *dhamnis* are directly connected to the heart. The blood vessels develop between the endoderm and the mesoderm of the yolk sac.[6][7]

Urdhwaga dhamni:

These Dhamnis spread in an upward direction of the body. After reaching the *hridaya* each one divides into three, thus becoming thirty. Out of these, two each carry *vata, pitta, kapha, shonita*, and *rasa* - thus become ten. Two each carry the sensation of *shabda* (sound), *rupa* (sight), *rasa* (taste), and *gandha* (smell) thus become eight. Two each for actions like *kathita* (speaking), *ghoshita* (shouting), *swapiti* (sleep), *pratibudhi* (waking), *ashru* (tears in eyes), *stanya* (breast milk ejaculation), *shukra* (semen ejaculation).

These arteries supply to the abdomen above the umbilicus, flanks, back, chest, shoulders, neck, and arms.[8] Phrenic and intercostal arteries are related to the diaphragm which helps in respiratory movement. The carotid artery is divided into the external carotid artery and internal carotid artery which supply blood to the exterior of the head, neck, and cranial and orbital cavities respectively.[9] So *urdhvaga dhamnis* can be correlated to the arteries supplying blood to the head, neck, upper limb and thorax.[10]

Table 1: Nomenclature of *Urdhwaga Dhamni*

Name of *Dhamni*	Name A/c to Pandit Gangadhar Shastri	Name A/c to Dr. Ghanekar	Name A/c to Modern
Sabdavaha Dhamni	Auditory Nerves	Internal auditory artery	Internal auditory artery (acoustic nerve)
Rupavaha Dhamni	Optic Nerves	Central retinal artery	Central retinal artery (optic nerve)
Rasavaha Dhamni	Glossopharyngeal and Lingual Nerves	Lingual artery	Lingual artery (nerves of taste that branches from glossopharyngeal)
Gandhavaha Dhamni	Olfactory Nerves	Sphenopalatine branch of the internal	Sphenopalatine branch of the internal maxillary artery (olfactory nerve)
Ghoshakar Dhamni	Hypoglossal Nerves	Laryngeal arteries	Laryngeal arteries (inferior laryngeal nerve)
Bhashan Dhamni	Inferior Laryngeal Nerves	Sublingual artery	Sublingual artery (hypoglossal nerve)
Ashruvahi Dhamni	Lacrimal Nerves	Lacrimal artery	Lacrimal artery (lacrimal nerve)
Stanyavahi Dhamni		Mammary artery	Mammary artery

***Adhogami Dham*ani:** spreading downward purvey flatus, feaces, semen, and menstrual blood in the downward direction. The *adhogami dhamni* divide into three *dhamni*s near *amashaya* and *pakvashaya*. *Sara* and *kitta*

divide in this place. It nourishes the body by assimilating nutrients present in the essence of food and supply that to the *dhamni* spreading in an upward and transverse direction, fill the seat of *rasa (hridaya)*, and separate urine, feces, and sweat.

The *adhogami dhamni* divides into 30 other *dhamni*s near *amasaya* and *pakvasaya*.There are two *dhamnis* each for *vata, pitta, kapha, shonita, and rasa* respectively. Two are present in the intestine, two carry *toya* (water produced during digestion), two presents in the bladder carry urine, two for production of *shukra* in the testis, and two for its elimination; two are attached to the large intestine for expelling the faces- thus total comes to twelve. Another eight *dhamni* supply sweat to those spreading transversely. These *dhamnis supply blood to organs* such as *pakwashaya* (large intestines), *kati* (pelvis), *mutrashaya* (urinary bladder), *purishashaya* (organs of feces i.e. rectum), *guda* (anus), *vasti* (bladder), *medhra* (penis), and *sakthi* (legs).

Vata, mutra, purish, shukra and artava are formed in the abdomen and they move downwards.[11] These substances are formed in their respective organs after getting blood supply from their arteries and then they move downwards and pass out from the body. *In pittadhara kala* food is digested and absorbed to form *annarasa*, which helps in providing nourishment. These functions of the intestine are possible only when *adhogami dhamnis* supply blood to the intestine. So, this *dhamni* is called *vivechak* (differentiator) and *abhivahak* (supplier). With the help of *adhogami dhamnis*, ingested food is digested to form *rasa*, which moves upward to reach the heart through *sira* (veins) and *rasayani* (lymphatic vessels) to nourish the *urdhvaga* and *tiryaga dhamnis*. It means that *urdhvaga dhamnis* are indirectly nourished by the *adhogami dhamnis.* After digestion of food *satmya* part of digested food is absorbed by *rasa prapa* (cisterna chili) and *rasa kulya* (thoracic duct) to carry it to the heart.

Mutra, *purisha* and *sweda* are malas of *pakwa anna*. These *malas* are differentiated in *udar vibhag*. *Swedasravan* is the function of *tiryaggami dhamni*, but blood supply to *tiryaggami dhamni* is the job of *adhogami dhamni*. Each *adhogami dhamni is* divided into three branches between the space of *amashaya* and *pakwashaya*. The arteries which supply to *amashaya* and *kshudrantra* are capable of moving digested food in the downward direction i.e. celiac artery and superior mesenteric artery are capable to do it.

***Mutravahi dhamni*:** It is related to the artery where urine formation takes place. In Ayurveda principal site of urine is *the basti*. Following modern science, we could consider renal arteries (and also the nerves from the renal plexus, spermatic, ovarian, inferior mesenteric plexus, and hypogastric plexus) as *mutravahi dhamni*.

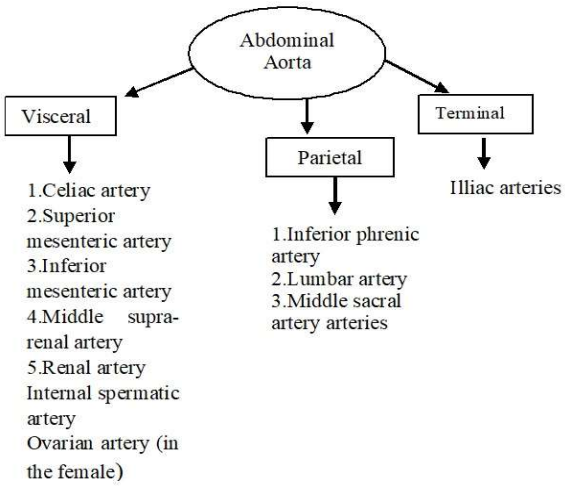
***Sukravahi dhamni*:** It is related to the artery where sperm formation takes place.
***Sukra-visarjini dhamni*:** During coitus (maithuna), sperms produced by testis move to the epididymis, vas deference, and prostate. By contraction of urethra, sperm ejaculation occurs.

***Varcho-nirashni dhamni*:** The function of the large intestine is to move fecal matter downwards and defecate it outside the body. So, the arteries which help to do this job are called *varcho-nirashni dhamni*s i.e. inferior mesenteric artery, middle colic, and right colic arteries (also pelvic visceral nerve).[12]

The abdominal aorta begins at the hiatus of the diaphragm which is in front of the lower border of the body of the twelfth thoracic vertebra, from there it goes to the fourth lumbar vertebra. It divides into two common iliac arteries. (Figure 1)

Following modern science *adhogami dhamnis* could be considered as abdominal aorta and branches. In the lower limb, there is no mention of special functions by the arteries. So, arteries of lower limbs are not described in this context, their names are given as *swedamarpayanti*.[13]

Figure 1 – Abdominal Aorta



Tiryaggami dhamnis:

Each one of the four *dhamni* spreading sidewards divide into hundreds and thousands of branches further and thus become innumerable. By these, the entire body appears to be *gavaksita* (full of windows); these unite together broadly, their ends are joined to *romakupa*; these purvey *sweda* and *rasa* both inside and outside. Only through these dhamanis the potency of medicines used for *abhyanga parisheka* and *lepa*, get assimilated in the skin and enter inside the body. The sensation of both comfortable and uncomfortable touch is perceived in these only.[14]

Abdominal Aortic Aneurysm

An enlarged abdominal aorta is typically greater than 3 cm. The exact cause of an aortic aneurysm is unclear but risk factor like smoking, hypertension increases the disease. In this disease, with the increase in the size of the aneurysm, the abdominal and back pain may increase, may radiate to the groin, and there may be a feeling of pulsatile mass in the abdomen.

Thoracic Aortic Aneurysm

There is a presence of bulging in the upper part of the aorta. This can cause aortic rupture. They are of two types, ascending thoracic aneurysm and descending thoracic aneurysm. The symptoms are chest pain, backache, cough, hoarseness, dyspnea. The risk factor includes genetic variants like Marfan, Loeys-Dietz and Ehlers-Danlos syndrome, family history of thoracic aortic aneurysm, bicuspid aortic valve, hypertension, age, smoking.

Coronary Artery Disease

It is a condition caused by plaque buildup along the inner walls of coronary arteries. The plaque deposits are of fatty materials like cholesterol, calcium. Over time the plaque residue narrows the coronary arteries and decreases the circulation to the heart and causes chest pain, dyspnea, or other coronary artery disease signs and symptoms. The risk factor includes high cholesterol level, high blood pressure, smoking, alcohol consumption and lack of exercise. An individual having CAD has a risk for blood clots that can cause myocardial infarction.

Renal Vascular Disease

Also called renal artery stenosis. By the plaque formation in the renal arteries, there is a lack of blood flow in the kidney, by this the overall blood pressure becomes low and hence an enzyme called renin is released in the bloodstream which causes the constriction of small vessels. Thus sodium is retained in the body causing damage to the kidney. The causes are arteriosclerosis, fibromuscular dysplasia, renal artery aneurysm.

Thoracic Outlet Syndrome

This disorder involves compression of the nerves, blood vessels, between the muscles of the neck and shoulder or between the first rib and collar bone. This area is called the thoracic outlet. The symptoms are nerve compression, arterial compression, venous compression.

Popliteal Artery Entrapment Syndrome

It occurs when the popliteal artery becomes compressed by a muscle, tendon, or band behind the knees. This compression restricts blood flow to the lower leg and can cause damage to the artery over time. The symptoms include aching pain, numbness or cramping in one or both calves, changes in skin color around the calf muscle, numbness, tingling and pigmentation of the feet, aching in the feet at rest.

Peripheral Arterial Disease

This causes blockage in the arteries to the legs due to the buildup of plaque. In some PAD patients, the vascular system may compensate for the reduced blood flow by forming alternative routes called collateral vessels, which bypass the affected vasculature. The common symptoms are Persistent or intermittent leg pain, cramping, numbness, unhealing sores, discoloration of limbs or warmth, decreased hair and nail growth on the affected limb, foot ache at rest.

Vertebrobasilar Disease

It is a disease affecting blood flow to the posterior side of the brain via the vertebral and basilar arteries. Atherosclerosis is the main cause of vertebrobasilar disease. The risk factor includes diabetes, hypertension, obesity, high cholesterol, smoking, advanced age, inactive lifestyle. The common symptoms include vertigo, visual disturbance, sudden falls, numbness or tingling, slurred or lost speech, confusion, issue with swallowing.

Subclavian Steal Syndrome

It is a disease of reversed blood flow in a branch of the subclavian artery that is the result of an ipsilateral hemodynamically significant tension of the proximal subclavian artery. The causes are Atherosclerosis, large artery vasculitis, thoracic outlet syndrome, congenital abnormalities like a right-sided aortic arch with an isolated left subclavian artery.

Aortoiliac Occlusive Disease

It is the blockage in the aorta or the iliac arteries. This blockage is caused by plaque formation within the walls of the vessels. The symptoms are persistent or intermittent leg/ thigh/ buttocks pain; cramping, numbness, unhealing sores, pigmentation, unsteady growth of hair and nail on the affected limb, foot ache at rest, erectile dysfunction.[15][16]

RESULT

The *dhamnis* arise from the heart states *Acharya Charaka; dhamnis* originated from nabhi during fetal life,post-birth it is related to the heart states *Acharya Sushruta.* There are 10 *urdhvagami dhamni,10 adhogami dhamni*, and 4 *tiryaggami dhamni.* They are further divided into different *dhamnis* which are described in table 2.

Table 2: Table showing division of d*hamni's*

Urdhavgami Dhamni	***Adhogami Dhamni***	***Tiryaggami Dhamni***
10 Divide near heart 3 branch- 10x3 (each 2-2 artery)	10 Divide near *Amashaya* & *Pakvashya* in 3 branch- 10x3	*4*
Tridoshas + Rasa + Rakta- 5x2=10	*Tridosha + Rasa + Rakta* 5x2=10	They are subdivided into various branches & spread throughout the body.
Shabda, Rupa, Rasa, Gandha- 4x2=8 *Bhashyakar-2* *Ghoshkara-2* *Nidrakara-2* *Jagrutikar-2* *Ashruvaha-2* *Stanvah-2* *Or sukravah*-2	*In Antra* *Annavahan-2* *Jalavahan-2* *Mutravahan-2* *Shukrotpatti-2* *Shukravisarjan-2 (in male)* *Artavvahan-2* *Malavisarjan-2* *For sweda-8*	

The *Vata dosha* is vitiated by intake of alcoholic drinks, food, improper lifestyle, working under a lot of pressure, worries, and emotional stress. When dosha becomes imbalanced it creates a circulatory imbalance, hypertension, insomnia, cold intolerance.[19]

The peripheral arterial disease is described in *uttana vatarakta*. When *kapha* and *pitta* dosha starts accumulating in blood channels, it causes blockages (*avarana*). Due to this circulatory vata gets affected which causes *vegapratibadha* leading to *vatarakta*. CAD is considered as *krimija hrida* roga. If a person is suffering from cardiac disease due to an imbalance of dosha and he consumes oily food, milk, and dairy products, sugar products, avoids physical activities; he would certainly lead to changes in the artery which would result in CAD. Atherosclerosis is caused due to altered vata dosha in the heart and organs around it resulting in the disease. Vitiated vata dosha in the Mutravaha Srotas leads to plaque formation in the renal artery causing renal vascular disease. The thoracic outlet syndrome falls under *vata vyadhi* as mentioned in *Charaka Sushrutsthana,* chapter twenty, and *Madhav Nidana*, chapter twenty-two. In aneurysm *vata kapha* dominating *tridoshas* are involved like in the pathogenesis of *Granthi Roga.* As we know that vata dosha is related to the artery, hence any imbalance in the Vata dosha will lead to arterial diseases.

CONCLUSION

The *dhamnis* are tube or cord-like structures filled with vata dosha having pulsation. The *dhamni* term is taken from the root '*Dhma*'. According to *Acharya Charak 'Dhamanadhamanyah*', hence dhamni is the vessel that produces sound[17] *Acharya Sushruta states that sira* and *dhamni* are the channels other than srotas.[18]

Any abnormalities like embolism, plaque formation, anatomical disturbance in its structure in arteries lead to life-threatening diseases as described above. So if we maintain a proper balance of dosha, dhatu, and mala, we can holistically manage the diseases and bring well-being to life

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