



REVIEW ARTICLE

A review on pathophysiology and pharmacotherapeutic approach in the vitiation of *rakthavahasrotas*

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Abstract

The science of *Ayurveda* is supported by means of strong principles. One among those pillar principles on which the entire science is buttressed is the concept and principle of *srotas* (channels of circulation). The entire human body is nothing but a network of *srotas* (channels of circulation). The concept of *swasthya* in a human can be enabled only if these channels function in its natural manner. Any vitiation to their natural environment can result in a diseased condition. *Rakthavahasrotas* (channels of blood circulation) holds an uncanny position among the *antarmukha srotas*. Being the carrier of the elixir of life, its relevance is unbeatable. Any vitiation to the *raktha dhatu* (blood) it carries, can in turn result in the vitiation of the *srotas* (channels of circulation) and can trigger the origin of diseases in the areas they circulate. It is necessary to understand the entire physiology and pathology involved in the *rakthavahasrotas* (channels of blood circulation) and its vitiation, only then can a proper therapeutic approach to rectify it be made.

Introduction

The entire science of *Ayurveda* is strongly buttressed by specific principles which includes the *tri dosha, sapta dhatu, tri mala, ama, agni, srotas* and *ojas*. The *srotas* (channels of circulation) plays a paramount role in circulating the principles like the *doshas, dhatus* and *mala*. These can be considered as the channels of circulation, controlling the movement of these principles to specific sites in the body. They actively participate in the conversion, transportation, absorption and excretion of the materials bore by them. It has been mentioned in *Charaka Samhita* that the *samprapthi* (pathogenesis) of any disease involves *srotodushti* (vitiation of the channels) in its progression.^[1] The mechanism of action of each *srotas* (channels of circulation) varies in accordance with substances transported by them. The *roga* (disease) arise due to vitiation of these *srotas* (channels of circulation) hence a pathophysiological and pharmacotherapeutic approach to understand the mechanism of each *srotas* (channels of circulation) becomes a sheer necessity. *Charaka Samhita* has enlisted thirteen *srotas*^[2] (channels of circulation) while *Susrutha Samhita* has mentioned eleven.^[3] *Rakthavahasrotas* (channels of blood circulation) is one among the *srotas* (channels of circulation) and its

importance and utility has a major role concerning with the circulatory system carrying the elixir of life, the blood. The *vikaras* (diseases) arising out of the vitiation of *rakthava-hasrotas* (channels of blood circulation) has prime importance in today's world. On closely observing the diseases arising out of the *raktavahasrotodushthi* (vitiation of channels of blood circulation), known as *rakthapradoshajavikaras*,^[4] it is observed that it leaves a heavy impact on the integumentary and the circulatory system. The aim of this review is to understand the pathophysiology of *rakthava-hasrotas* (channels of blood circulation) and to provide an insight into the pharmacotherapeutic measures that can be adopted to rectify the diseases arising out of its vitiation and to make a conceptual compilation on *rakthavaha srotas* (channels of blood circulation).

Materials and Methods

Literary review of the conceptual research was done by referring various *Ayurvedic* classical texts to extract information regarding the main concept of *rakthavaha srotas* (channels of blood circulation), its pathophysiology and pharmacotherapeutics. Also, the review has been done following various research journals, scientific papers and internet sources.

1. Etymology and derivation of *srotas* (channels of circulation)

The word *srotas* (channels of circulation) is derived from the root word *susravano* meaning to ooze, permeate, filter or infuse.^[5] The word "*sravanat srotamsi*" gives an insight into the meaning of *srotas* (channels of circulation) which means a body structure through which the *sravana* karma takes place. *Chakrapani* has explained that *sravana* here implies to the flow of the *rasadi poshya dhatu* (nutrients).^[6]

2. Definition of *srotas* (channels of circulation)

Charaka Samhita has defined *srotas* as channels of circulation, which carries the *dhatu*s undergoing transformation to their destination.^[7] *Susrutha Samhita* has defined *srotas* (channels of circulation) to be empty spaces that spread throughout the body, which has its origin from root spaces except for *sira* (veins) and *dhamani* (nerves).^[8]

3. Synonyms of *srotas* (channels of circulation)

The synonyms of *srotas* (channels of circulation) include *sira* (vein), *dhamani* (arteries), *rasayani* (lymphatics), *rasavahini* (capillaries), *nadi* (tubular conduits), *pantha* (passages), *sthana* (sites), *ashaya* (repository), *niketa* (resorts), *marga* (pathways), *samvrita-asamvrita* (open or blind passages)

and *sharira chidra* (body orifices). These synonyms implies that *srotas* (channels of circulation) is nothing, but a collective term reflecting all the macro and micro channels of circulation and internal pathways functioning in the human body.^[9]

4. Classification of *srotas* (channels of circulation)

The science of *Ayurveda* describes that, generally there are two types of *srotas* (channels of circulation), *bahirmukha* and *antarmukha srotas*. *Bahirmukha srotas* are 9 in male and 12 in female.^{[10],[11]} *Charaka Samhita* mentions that there are 13 *antarmukha srotas* which are *pranavaha*, *udakavaha*, *annavaha*, *rasavaha*, *rudhiravaha*, *mamsavaha*, *medovaha*, *asthivaha*, *majjavaha*, *sukravaha*, *mutravaha*, *purishavaha* and *svedavaha srotas*.^[12] *Susrutha Samhita* has described 11 pairs of *srotas* (channels of circulation) and has excluded *asthivaha*, *majjavaha* and *svedavaha srotas*. In addition, he included the *artavavaha srotas*.^[13]

5. Physiology of *rakthavahasrotas* (channels of blood circulation)

The physiological aspects related to the *rakthavahasrotas* (channels of blood circulation) is discussed below.

5.1. *Utpathi* (origin) of the *rakthavahasrotas* (channels of blood circulation)

Rakthavaha srotas (channels of blood circulation) are channels carrying the *raktha dhatu* (blood). The *utpathi* or *moola sthana* (site of origin) of the *srotas* (channels of circulation) is *yakrit* and *pleeha* according to *Charaka Samhita*^[14] and *Susrutha Samhita*. *Rakthavahini dhamani* (artery) has also been included as *sthana* (site) by *Susrutha Samhita*.^[13] Commentary of *Charaka Samhita* by *Chakrapani* described that the *utpathi sthana* or *moola sthana* actually refers to the anatomical seat of respective *srotas* (channels of circulation), and these *utpathi sthanas* are those which undergo pathological changes and hence has a key role in diagnostic and therapeutic measures.^[14]

5.2. Importance of *rakthavahasrotas* (channels of blood circulation)

Rakthavahasrotas (channels of blood circulation) carries the ambrosia of life, the blood. *Raktha* (blood) is responsible for providing *bala* (strength), *varna* (complexion), *sukhayu* (longevity of life).^[15] *Raktha* (blood) is the *moola* or regarded as the root cause by which body functions. There is nothing other than *raktha* (blood) that can influence the longevity of life and hence it ought to be protected at any cost. The *rakthavahasrotas* (channels of blood circulation) is responsible for circulating the normal blood and any vitiation in the *srotas* (channels of circulation) in turn vitiates *raktha* (blood) and results in the formation of disease.^[16]

5.3. *Dhatu* involved with *rakthavaha srotas* (channels of blood circulation)

The *antarmukha srotas* carries the physiological principles like *dhatu*, *mala*, *prana*, *anna* and *udaka*. Each *srotas* (channels of circulation) is differentiated in its function by means of these materials they circulate or carry. *Rakthavaha srotas* (channels of blood circulation) carries the second *dhatu* in the process of *dhatu parinama* which is the *raktha dhatu* (blood).^{[10], [11], [12]}

5.4. Etymology and derivation of *raktha dhatu* (blood)

The word *raktha* is originated from the Sanskrit word '*raj ranjane*' meaning that which adds stain or colour.^[17] Since the *dhatu* is red coloured it is known as *raktha dhatu* (blood).

5.5. Synonyms of *raktha dhatu* (blood)

Rudhira, *asruk*, *lohita*, *asra*, *kshataja* and *shonitam* are the synonyms of *raktha*.^[18]

5.6. Formation of *raktha dhatu* (blood)

Susrutha Samhita describes that the first formed *dhatu*, *rasa*, though *apya* (possessing properties and liquidity similar to water) after reaching *yakrit* (liver) and *pleeha* (spleen) attains red colour by action of the *tejas* in the body and becomes *avyapanna* (unvitiated) and *prasanna* (clear) to be termed as *raktha dhatu* (blood).^[19] *Charaka Samhita* describes that the *tejas* portion of *ahara rasa* when acted upon by *pitha* and *ushma* attains redness to be termed as *raktha dhatu* (blood).^[20]

5.7. Importance of *raktha dhatu* (blood)

Susrutha Samhita describes that *raktha dhatu* (blood) is the sole factor responsible for improving the longevity of life and must be protected at all costs.^[15] It has been included as one among the *dashapranayatana* (ten repositories of life).^[21] *Susrutha Samhita* has regarded the *raktha dhatu* (blood) to be the fourth *dosha*. Also states that, the body cannot survive without *vata*, *pitha*, *kapha* and *shonitha* and thus establishes the importance of *shonitha* in the human body.^[27]

5.8. Function of *raktha dhatu* (blood)

Charaka Samhita describes that *raktha dhatu* (blood) is responsible for imparting *bala* (strength), *varna* (complexion), *sukha* (happiness) and *ayu* (longevity) and also plays a vital role in maintaining *prana*.^[23] *Ashtanga Hridaya* regards *jeevana* (enlivening) as the main karma of *raktha dhatu* (blood).^[24]

5.9. *Panchamahabhuta* composition of *raktha dhatu* (blood)

All the substance in the universe is composed of *panchama-*

habhuta and so is *raktha dhatu* (blood). *Jivaraktha* (blood present in a living body) is composed of the following qualities of *visrata* (bad smell), *dravata* (liquidity), *raga* (red colour), *spandanam* (throbbing nature) and *laghuta* (levity) which are due to *prithwi*, *ap*, *tejas*, *vayu* and *akasha mahabhutas* respectively.^[25]

5.10. *Pramana* (quantity) of *raktha dhatu* (blood)

Raktha dhatu (blood) has a *pramana* (quantity) of eight *anjali*.^[26]

5.11. *Upadhatu* of *raktha dhatu* (blood)

Upadhatu of *rakthadhatu* (blood) are *kandara* (tendons) and *sira* (veins).^[27]

5.12. *Mala* of *raktha dhatu* (blood)

Pitha is considered as the *mala* (metabolic by-product) of *raktha dhatu*.^[26]

5.13. Relationship of *raktha dhatu* with *dosha*

Pitha dosha is related to *raktha dhatu* (blood) and *sveda*.^[28] Due to a reciprocal relationship, medicine which brings about an increase or decrease of one factor automatically brings about the very same state to the other related factor too.

5.14. *Sudha Raktha Lakshana* (Features of pure blood)

Pure blood is comparable to gold purified with fire, *indragopa* (fire fly), red lotus, lac and to the fruit of *gunja*, which may vary according to individual constitution.^[29]

6. Pathophysiological approach to *rakthvahasrotas* (channels of blood circulation)

The pathophysiological approach to *rakthvahasrotas* (channels of blood circulation) has been discussed below.

6.1. Pathophysiological importance of *srotas* (channels of circulation)

The *srotas* (channels of circulation) are structural features within the body, responsible for conducting the important factors like *prana* (air), *anna* (food) and *udaka* (water) which are necessary for the survival of man. *Charaka Samhita*, owing to the importance of the *srotas* (channels of circulation) has regarded the human body as nothing but the conglomeration of *srotas* (channels of circulation).^[30] By conducting factors like *prana* (air), *anna* (food) and *udaka* (water), the *srotas* (channels of circulation) carries the *poshana* (nutrition) required by the body, thereby maintaining the normalcy of *dhatu*s which is necessary for the proper functioning of the body and *srotas* (channels of circulation) also helps in excretion of metabolic products. Physiologically, in order to maintain the healthy status of the body, the

healthy maintenance of the *srotas* (channels of circulation) is absolutely necessary. On analysing pathologically, we can understand that the vitiation of the *doshas* lead to the vitiation of the *dhatu*s, which in turn vitiates the *srotas* (channels of circulation) which carry them. These *srotas* (channels of circulation) on vitiation can create havoc inside the body since they carry the vitiated *dhatu*s throughout the body further vitiating the healthy sites too. Even if the *dhatu*s are healthy, as it reaches a deranged *srotas* (channels of circulation) it can lead to the formation of a disease.

6.2. Rogamarga (disease pathway) and its relation to rakthavahasrotas (channels of blood circulation)

Rogamarga (disease pathway) are divided into three, *bahyarogamarga* (external pathway of diseases), *abhyantara rogamarga* (internal pathway of diseases) and *madhyama rogamarga*.^[31] *Rogamarga* (disease pathway) are crucial in understanding the pathology of a disease. In the *sthanasamshraya* (localization of the disease) state of a disease *khavaigunya* (vitiating of the channels) occurs in the *rogamarga* (disease pathway).^[32] The *khavaigunya* (vitiating of the channels) in the particular *rogamarga* (disease pathway) determines the pathway of progression of the disease. The *rakthavaha srotas* (channels of blood circulation) circulates the *raktha dhatu* (blood), and *raktha dhatu* (blood) is one of the six constituents of *bahyarogamarga* (external pathway of diseases).^{[33],[34]}

6.3. Rakthavaha srotodushti karana (Causes of vitiation of the channels of blood circulation)

Ahara (food) and *vihara* (regimen) that are similar to the qualities of *doshas* and opposite to the qualities of *dhatu*s are responsible for vitiating the *srotas* (channels of circulation) in general.^[35] The factors involved in vitiating the *rakthavahasrotas* (channels of blood circulation) are of two categories, *aharaja* (food) and *viharaja* (regimen). The con-

sumption of foods and drinks which are *vidahi* (irritant), *snigdha* (unctuous), *ushna* (hot) and *drava* (liquid) comes under the category of the *aharaja* factors responsible for vitiating the *rakthavaha srotas* (channels of blood circulation). The *viharaja* factors involved in vitiating the *rakthavahasrotas* (channels of blood circulation) includes exposure to *atapa* (sun) and *anala* (fire). It is to be noted that no mental factors are mentioned in *Charaka Samhita* while explaining the factors which pave way to *rakthavahasrotodushti*.^[36]

6.4. Rakthavahasrotodushtilakshana (Signs and symptoms of vitiated channels of blood circulation)

Charaka Samhita describes that *atipravriti* (increase), *sanga* (obstruction), *siragranthi* (nodules) and *vimargagamana* (diversion of the original flow) are the possible types of *srotodushti* (vitiating of *srotas*).^[37] *Charaka Samhita* has explained the *rakthavahasrotodushti lakshana*, specifically coining them under the term *rakthapradoshajavikara*. These include *kushta* (skin diseases including leprosy), *visarpa* (erysipelas), *pidaka* (eruptions or pimples), *raktha pitha* (haemolytic disease), *asrigdhara* (menorrhagia), *guda paka* (inflammation of rectum), *medrapaka* (inflammation of phallus), *asya paka* (inflammation of mouth), *pleeha roga* (splenomegaly), *gulma* (abdominal tumour), *vidhradhi* (abscess), *nilika* (bluish coloured mole), *kamala* (jaundice), *vyanga* (freckles), *piplava* (port wine mark), *tilakalaka* (black mole), *dadru* (ringworm infestation), *charamadalam* (dermatitis), *shwitram* (leukoderma), *pama* (papules), *kota* (urticaria), *asramandalam* (red circular patches).^[4] Types of pathological changes involved in *rakthapradoshaja vikara* in enlisted in the table 1.

7. Pharmacotherapeutic approach in Rakthavahasrotodushtivikara

Table 1. Types of pathological changes in the *rakthapradoshaja vikara*

Disease	Charaka Samhita	Susrutha Samhita	Ashtanga hridaya
<i>Kushta</i>	<i>Rakthadushya</i> ^[38]	-	<i>Raktha dushya</i> ^[39]
<i>Visarpa</i>	<i>Raktha dushya</i> ^[40]	<i>Raktha dushya</i> ^[41]	<i>Raktha dushya</i> ^[42]
<i>Pitaka</i>	-	-	<i>Raktha dushya</i> ^[43]
<i>Rakthapitha</i>	<i>Lohitapramanavardhana</i> ^[44]	-	<i>Raktha kopa</i> ^[45]
<i>Asrigdhara</i>	Increase in <i>raktha pramana</i> ^[46]	<i>Atiprasanga of raktha</i> ^[47]	-
<i>Gudapaka</i>	-	-	-
<i>Medrapaka</i>	-	-	-
<i>Asyapaka</i>	-	<i>Rakthadushya</i> ^[48]	<i>Rakthadushya</i> ^[49]
<i>Pleeharoga</i>	<i>Shonita vardhana</i> ^[50]	<i>Asruk dushti</i> ^[51]	<i>Shonita vridhi</i> ^[52]

Gulma	-	-	Rakthakopa ^[53]
Vidradhi	Atimatra dushtarakta ^[54]	Raktha dushya ^[55]	Rakthadushya ^[56]
Nilika	-	-	Rakthadushya ^[57]
Kamala	Asruk dagdham ^[58]	-	Asruk dagdham ^[59]
Vyanga	-	-	Rakthadushya ^[60]
Piplava	-	-	-
Tilakalaka	-	-	-
Dadru	Rakthadushya ^[36]	-	Rakthadushya ^[37]
Charmadala	Rakthadushya ^[36]	-	Rakthadushya ^[37]
Shwitra	Rakthadushya ^[61]	-	Rakthadushya ^[62]
Pama	Rakthadushya ^[36]	-	Rakthadushya ^[37]
Kota	-	-	-
Asramandala	Rakthadushya ^[36]	-	Rakthadushya ^[37]

The treatment protocol for *rakthavaha srotodushti* (causes of vitiation of the channels of blood circulation) consists of *shodhana* (purification) and *shamana* (pacifying) therapies which has been detailed in *Charaka Samhita*. *Rakthapitha chikitsa* consisting of *virechana*, *upavasa*, and *rakthamoksha* can be adopted to treat *rakthavaha srotodushti* (causes of vitiation of the channels of blood circulation). Commentary on *Charaka Samhita* by *Gangadhara* clarifies that, in case of *rakthavaha srotodushti chikitsa*, the *vamana karma* (emesis) can be excluded from the *shodhana kriya* (purificatory therapies) specified for *raktha pitha chikitsa*.^[63] The treatment protocol as a whole should not be employed in a disease. The pathology of the disease and the mode of involvement of *raktha* in that disease must be closely analysed and then the suitable treatment modalities can be employed.

Virechana

The *shodhana* procedure i.e., the *virechana karma* (purgation) is the first treatment modality advised in *rakthavahasrotodushti* (causes of vitiation of the channels of blood circulation), which involves the expulsion of vitiated doshas through *gudamarga*. This is employed to pacify the vitiated *pitha dosha*, or else, it can vitiate the dhatus which will finally vitiate the *srotas* (channels of circulation) involved. The *dravya* used here must be *ushna* (hot), *teekshna* (sharp), *sukshma* (subtle), *vyavayi* (pervading the entire body) and *vikashi* (causing looseness of joints) in *guna*.^[64]

Upavasa

The second treatment modality employed is *upavasa*, which comes under the *shamana* therapy and is employed when *alpadosha* is vitiated. *Upavasa* is nothing but *langhana*, one among the *shadupakrama*. That which brings *laghava*

(lightness) to the body is *langhana*. The qualities of *dravyas* employed in *upavasa* are *laghu* (light), *tikshna* (sharp), *ushna* (hot), *visada* (non-slimy), *ruksha* (dry), *sukshma* (subtle), *khara* (rough), *sara* (fluid) and *katina* (hard).^[65]

Rakthamoksha

The next step advocated in *rakthavaha srotodushti* (causes of vitiation of the channels of blood circulation) is *shonitamoksha* (blood-letting), which is the nothing but the removal of impure blood out of the body. *Susrutha Samhita* explains that it is generally of two categories *prachanam* (scratching) and *siravyadha* (vein puncturing).^[66]

Charaka Samhita describes *sonithasthapana dasaimani*, which includes *madhu* (honey), *madhuka* (*Glycyrrhiza glabra* Linn.), *rudhira* (*Crocus sativa* Linn.), *mocarasa* (resin of *Salmalia malabarica* Schott & Endl.), *mritkapala* (earthen pot pieces), *lodhra* (*Symplocos racemosa* Roxb.), *gairika* (Ferrum haematite), *priyangu* (*Callicarpa macrophylla* Vahl.), *sarkara* (sugar) and *laja* (fried paddy).^[67] These ten drugs can be used either alone or in combination in order to rectify the vitiation of blood or to prevent its *atipravriti* or bring it back to normalcy or to maintain the normal function of blood.

Rakthavahasrotas (channels of blood circulation) may be related to the haemopoetic system and circulatory system through which blood, the elixir of life is circulated. Being the carrier of blood its relevance in the body is impeccable. On keen observation of diseases caused due to *rakthavahasrotodushti* (causes of vitiation of the channels of blood circulation), it can be concluded that, most diseases have direct involvement of *raktha dhatu* (blood) in the form of *raktha dushya* (vitiation of blood), *raktha kopa* (aggravation of blood), *dagdha* of *raktha* (burning action on

blood) and *raktha pramana vardhana* (increase in quantity of blood). Even though most diseases mentioned in *rakthapradoshaja vikaras* have direct involvement of *raktha dhatu* (blood) in the pathology, there are some others in which *raktha* is not directly involved. But these diseases have involvement of *pitha dosha* which in turn may subject *raktha dhatu* (blood) to vitiate, on account of the *ashrayaa ashrayi bandha* of *pitha dosha* and *raktha dhatu* (blood). It is noteworthy that most of the diseases of the *rakthava-hasrotodushti* has manifestation in the *twak* (skin) this may be due to the fact that *rakthavahasrotas* (channels of blood circulation) is related to the *bahyrogamarga* (external pathway of diseases).

On examining the treatment protocol suggested, it can be assessed that the entire treatment modalities cannot be advocated in all *raktha pradoshaja vikaras*. A crucial examination regarding the kind of vitiation involved in *raktha dhatu* (blood) and the type of vitiation involved in the *rakthavahasrotas* (channels of blood circulation) must be understood and employed. It is to be noted that *langhana* (fasting) plays a crucial role as the pathologies that involve the vitiated *pitha dosha* and *raktha dhatu* (blood) in turn involves the participation of *ama*. Hence *langhana* must be specifically employed to bring back the normalcy. The *shonithasthapana mahakashaya dravyas* having mainly *thiktha, kashaya and madhura rasa* can be thoughtfully used. Drugs having *kashaya, madhura* and *thiktha rasa* can be employed here, as they rectify *pitha dosha*, which in turn can pacify the vitiated *raktha dhatu* (blood) due to its *ashraya ashrayi bandha*, and thus finally clears away the *rakthavaha srotodushti* (causes of vitiation of the channels of blood circulation).^[68] Drugs having *guru, shita, manda, sthira* and *sandra guna* must be used since these are opposite to the qualities of *pitha dosha* and thus prevents its vitiation.^[69] *Shita virya dravya* can be included in the treatment protocol since they bring about *prasadana* of *raktha dhatu* (blood) and *pitha dosha*.^[70] *Madhura vipaka dravya* are *pitha shamaka*, hence can be administered in this condition.^[71] All therapies employed in the vitiation must be selected with due concern, by focusing on the pathology of the diseases and the property of the *dravya* employed.

Conclusion

Ayurveda is a science based on, and sustained by definite principles and *srotas* (channels of circulation) has been advocated to be the supreme among these principles. *Srotas* (channels of circulation) is an important structural component of the human body. Maintenance of the proper and

healthy functioning of each and every *srotas* (channels of circulation) is necessary for the sustenance of human health. It can be advocated that most of the diseases which a man faced in ancient or till date is a result of vitiation of these *srotas* (channels of circulation). Human body is wrecked without the proper functioning and circulation of blood and hence *rakthavahasrotas* (channels of blood circulation) stands tall among them. Understanding of the basic structure, function of the *srotas* (channels of circulation) as well as the specific pathology involved in the formation of the *rakthapradoshaja rogas* are very important. The importance of *raktha dhatu* (blood), its healthy status, pharmacotherapeutic principle and approach are detailed here. As per the principle *shodhana* and *shamana* modalities can be employed. *Shonitha sthapana dasaimani* can also be employed for the well-being of the *srotas* (channels of circulation). After understanding the definite pathology, the most suitable *dravya* must be employed to get a clear result which would bring back the body to normalcy, which is in fact the basic and the only aim of any treatment.

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