

## Rakta Stambhana and Haemostasis: A Classical Ayurvedic Review of Blood Clotting Mechanism Through the Lens of Rakta Dhatu Physiology

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### ABSTRACT

**Background:** Blood coagulation is a fundamental physiological process essential for survival. While modern haematology defines haemostasis through platelet aggregation, coagulation cascade, and fibrin formation, Ayurveda conceptualises blood clotting through the integrated framework of Rakta Dhatu physiology, Dosha dynamics — particularly Pitta-Rakta sambandha — Vata's role in vascular tone, and the astringent (Kashaya), cold (Sheeta), and light (Laghu) properties of haemostatic drugs. The concept of Rakta Stambhana (haemostasis) in Ayurveda encompasses primary haemostasis, secondary coagulation, and fibrinolytic control through a Doshic paradigm. **Methods:** A systematic classical textual review was conducted across Charaka Samhita, Sushruta Samhita, Ashtanga Hridayam, Ashtanga Sangraha, Sharangadhara Samhita, and Bhavaprakasha with specific focus on Rakta Dhatu nirukti (etymology), Rakta Vaha Srotas, Raktapitta (haemorrhagic disorders), Rakta Stambhana dravyas (haemostatic drugs), and Kashaya Rasa pharmacology. Standard commentaries of Chakrapani, Dalhana, and Arunadatta were referenced. **Results:** The Ayurvedic haemostatic mechanism operates through three primary pathways: (1) Vata (particularly Vyana Vata) mediated vascular contraction equivalent to primary vasoconstriction; (2) Ranjaka Pitta and Pachaka Pitta modulation of Rakta fluidity analogous to coagulation cascade; and (3) Kashaya Rasa-mediated Samgraha (contraction and aggregation) equivalent to platelet plug formation and fibrin cross-linking. Specific haemostatic drugs with documented Rakta Stambhana action include Lodhra, Dhataki, Priyangu, Mocharasa, and Laksha. **Discussion:** The Ayurvedic framework of blood clotting demonstrates sophisticated correlation with modern haemostatic mechanisms. The role of Kashaya Rasa aligns with the procoagulant properties of tannins. Sheeta Virya drugs parallel the use of cold in vasoconstriction. Vata-Rakta relationship

reflects the neurohumoral regulation of platelet aggregation. The Raktapitta pathology parallels disseminated intravascular coagulation (DIC) and haemophilic conditions. **Conclusion:** Ayurveda's conceptualisation of Rakta Stambhana provides a holistic, clinically applicable framework for haemostatic management that integrates pharmacological, dietary, and constitutional approaches. The correlation between classical Doshic mechanisms and modern coagulation physiology reveals the depth of classical Ayurvedic understanding of blood physiology.

**Keywords:** Ayurveda, Blood clotting, Haemostasis, Kashaya Rasa, Laksha, Lodhra, Pitta, Rakta Dhatu, Rakta Stambhana, Raktapitta, Ranjaka Pitta, Sheeta Virya, Vata, Vyana Vata

## INTRODUCTION

Blood coagulation — the physiological process by which haemorrhage is arrested following vascular injury — is a fundamental survival mechanism. In modern medicine, haemostasis proceeds through primary haemostasis (platelet plug formation), secondary haemostasis (coagulation cascade with fibrin mesh formation), and tertiary haemostasis (fibrinolysis). Defects in any phase result in haemorrhagic or thrombotic disorders that remain significant causes of morbidity and mortality globally.

Ayurveda, while predating modern coagulation biochemistry, developed a sophisticated conceptual framework for blood physiology, blood disorder pathogenesis, and haemostatic therapeutic strategies. The Ayurvedic understanding of Rakta Dhatu (blood tissue), its formation, qualities, functions, and pathological conditions demonstrates remarkable parallels with modern haematological science. The concept of Rakta Stambhana (haemostasis/stypsis) is elaborately described in the context of Raktapitta (haemorrhagic disorders) management in classical texts.

देहस्य रुधिरं मूलं रुधिरेणैव धार्यते |

तस्माद्यत्नेन संरक्ष्यं रक्तं जीव इति स्थितिः |

Meaning: The blood (Rudhira/Rakta) is the very foundation (root) of the body. The body is sustained and maintained only through blood. Therefore, blood should be carefully protected with great effort, because blood itself is considered life.

### — Sushrut Samhita Sutrasthana 14/44

This verse emphasizes the vital importance of Rakta (blood) in sustaining life and maintaining the body. According to Ayurveda, blood is considered the root and support of the body because all tissues and organs depend upon it for nourishment, vitality, complexion, and proper functioning. The statement “रक्तं जीव इति” signifies that blood itself is equivalent to life, as excessive loss or vitiation of blood can lead to weakness, disease, or even death. Therefore, Ayurveda advises that Rakta should be carefully protected through proper diet, lifestyle, and avoidance of factors that cause Rakta Dushti, since preservation of healthy blood is essential for maintaining health and longevity.

The ancient surgical tradition of Sushruta demonstrates advanced understanding of vascular physiology, surgical haemostasis techniques (pressure, heat, astringent application, cauterisation), and the pharmacological basis of styptic agents. The Raktapitta Chikitsa chapters of both Charaka and Vagbhata contain elaborate haemostatic drug formulations whose mechanism of action can be

understood through the lens of Doshic pharmacology — particularly Kashaya Rasa, Sheeta Virya, and Grahi properties. The present review systematically analyses the Ayurvedic conceptualisation of blood clotting mechanisms.

## MATERIAL AND METHOD

The present work is a classical textual review conducted through systematic examination of primary Ayurvedic classical texts. Primary texts reviewed:

1. Charaka Samhita — Sutrasthana (Ch. 24, 26, 27, 30), Chikitsasthana (Ch. 4, 16), Sharirasthana (Ch. 7) — Chakrapani commentary.
2. Sushruta Samhita — Sutrasthana (Ch. 14, 37, 45), Sharirasthana (Ch. 4), Chikitsasthana (Ch. 2) — Dalhana commentary.
3. Ashtanga Hridayam — Sutrasthana (Ch. 11, 12, 15), Nidanasthana (Ch. 7), Chikitsasthana (Ch. 3) — Arunadatta commentary.
4. Ashtanga Sangraha — Sutrasthana (Ch. 9, 20), Nidanasthana (Ch. 9).
5. Sharangadhara Samhita — Purva Khanda (Dravyaguna chapters).
6. Bhavaprakasha — Purva Khanda (Rakta Prakarana); Bhavamishra.
7. Dhanvantari Nighantu and Rajnighantu — for haemostatic drug properties.

Inclusion criteria: All shlokas and commentaries relating to Rakta Dhatu nirukti, Rakta Vaha Srotas, Rakta formation and qualities, Raktapitta pathogenesis and treatment, Rakta Stambhana dravyas, Kashaya Rasa pharmacology, Sheeta Virya haemostatics, Vata role in vascular regulation, and surgical haemostasis were included.

## RESULTS

### 1. Rakta Dhatu: Definition, Formation, and Qualities

Rakta (blood) is the second Dhatu in the Saptadhatu (seven tissue) paradigm. Its formation from Rasa Dhatu under the action of Ranjaka Pitta is the cornerstone of Ayurvedic haematology:

रसाद्रक्तं ततो मांसं मांसान्मेदस्ततोऽस्थि च | अस्थ्नो मज्जा ततः शुक्रं शुक्राद्बर्भः प्रसादजः ||

Meaning: From Rasa arises Rakta (blood), from Rakta arises Mamsa (muscle), from Mamsa arises Medas (fat), from Medas arises Asthi (bone), from Asthi arises Majja (marrow), from Majja arises Shukra (reproductive tissue), and from Shukra the embryo.

#### — Charaka Samhita Chikitsasthana 15/16

The qualities (Guna) of normal, healthy blood are described with precision in classical texts:

इन्द्रगोपकप्रतीकाशमसंहतमविवर्णं च प्रकृतिस्थं जानीयात् ||

Meaning: Blood which resembles the colour of the Indragopa insect, is neither excessively thick nor clotted, and is free from abnormal discoloration should be understood as being in its normal healthy state.

#### — Sushrut Samhita Sutrasthana 14/22

This verse describes the characteristics of healthy and pure Rakta (blood) in Ayurveda. The term ‘इन्द्रगोपकप्रतीकाश’ refers to the bright red colour resembling the Indragopa insect, indicating freshness and

vitality of blood. ‘असंहतम्’ means the blood is not excessively thick, coagulated, or stagnant, while ‘अविवर्णम्’ indicates absence of abnormal discoloration such as blackish, pale, yellowish, or bluish changes that signify vitiation. Thus, blood possessing normal colour, proper consistency, and purity is considered to be in its natural balanced state (Prakritistha). This verse highlights the importance of assessing the physical qualities of Rakta for understanding health and diagnosing Rakta Dushti in Ayurveda.

## 2. Ranjaka Pitta: The Coagulation Regulator

The most critical Pitta subtype governing Rakta physiology is Ranjaka Pitta, located in the Yakrit (liver), Pleeha (spleen), and Rakta Vaha Srotas (circulatory channels).

The Ranjaka Pitta controls not only haematopoiesis (blood formation) but also blood fluidity. When Ranjaka Pitta is in excess (Pitta Vriddhi), blood becomes excessively fluid, hot, and prone to haemorrhage — the pathogenesis of Raktapitta. When Ranjaka Pitta is deficient or cold (Sheeta Pitta), clotting tendency increases. This bidirectional regulation parallels modern understanding of the procoagulant-anticoagulant balance in haemostasis.

## 3. Vyana Vata and Vascular Haemostasis

Vyana Vata, the subtype governing circulation throughout the body, plays a crucial role in vascular tone regulation — the first step of primary haemostasis:

व्यानो हृदि स्थितः कृत्स्नदेहचारी महाजवः॥ गत्यपक्षेपणोत्क्षेपनिमेषोन्मेषणादिकाः।

प्रायः सर्वाः क्रियास्तस्मिन् प्रतिबद्धाः शरीरिणाम्।

Meaning: Vyana Vata resides in the heart, circulates throughout the entire body, and moves with great speed. Functions such as movement, extension, upward motion, closing and opening of the eyes, and almost all bodily activities are dependent upon it.

### — Ashtang Hridaya Sutrasthana 12/6-7

This verse describes the functions and importance of Vyana Vata, one of the five subdivisions of Vata Dosha. Situated primarily in the Hridaya (heart), Vyana Vata rapidly circulates throughout the body and governs all forms of movement and dynamic activities. Functions such as locomotion, expansion and contraction of limbs, upward and downward bodily actions, blinking of the eyes (Nimesha–Unmesha), circulation, and neuromuscular coordination are controlled by Vyana Vata. Because it pervades the entire body with great speed (महाजवः), almost every physiological activity depends upon it. In modern correlation, Vyana Vata is often associated with the circulatory system, nervous conduction, muscular movements, and coordination of systemic bodily functions.

## 4. Kashaya Rasa and the Mechanism of Rakta Stambhana

The most pharmacologically important consideration in Ayurvedic haemostasis is the Kashaya (astringent) Rasa, whose classical properties directly explain the mechanism of coagulation:

कषायो रसः संशमनः सङ्ग्राही सन्धानकरः पीडनो रोपणः शोषणः स्तम्भनः श्लेष्मरक्तपित्तप्रशमनः शरीरक्लेदस्योपयोक्ता रूक्षः शीतोऽलघुश्च।

Meaning: The astringent (Kashaya) taste contracts and consolidates blood (Rakta Samgraha), reduces Pitta and Kapha, is absorbent, produces stasis (Stambhana), dries tissues, and promotes aggregation.

### — Charaka Samhita Sutrasthana 26/42

The Kashaya Rasa's haemostatic mechanism operates through: (a) Stambhana — creating stasis/constriction of bleeding vessels; (b) Samgraha — aggregation and consolidation of blood components (analogous to platelet aggregation and fibrin crosslinking); (c) Shoshana — absorbing excess fluid from the wound environment; and (d) Visada — removing coagulated debris. Modern phytochemistry corroborates this through the procoagulant properties of tannins (the primary phytoconstituents responsible for astringency), which activate platelet aggregation, precipitate plasma proteins, and promote fibrin polymerization.

### 5. Classical Ayurvedic Haemostatic Drugs (Rakta Stambhana Dravyas)

The classical texts enumerate specific drug categories and individual drugs with Rakta Stambhana (haemostatic) properties. Charaka's Priyāṅvādi Gana (CS.Su.4) lists primary haemostatic herbs. The Raktapitta Chikitsa chapter (CS.Chi.4) provides the most comprehensive haemostatic pharmacopoeia:

प्रियङ्गुसमङ्गाधातकीपुन्नागनागपुष्पचन्दनकुचन्दनमोचरसरसाञ्जनकुम्भीकस्रोतोपद्मकेसरयोजनवल्ल्यो दीर्घमूला चेति ||

Meaning: Priyaṅgu, Samaṅgā, Dhātakī, Punnāga, Nāgapuṣpa, Candana, Kucandana, Mocharasa, Rasāñjana, Kumbhīka, Srotaja, Padmakesara, Yojanavallī, and Dīrghamūlā — these constitute the Priyaṅvādi Gana.

### — Sushruta Samhita Sutrasthana 38/45

This verse enumerates the drugs included in the Priyaṅvādi Gana described in Sushruta Samhita (Dravyasaṁgrahaṇīya Adhyaya). The majority of these drugs possess predominantly Kashaya (astringent) and Sheeta (cooling) properties, making the group especially useful in conditions involving Pitta and Rakta vitiation, excessive bleeding, inflammation, diarrhoea, and wound disorders. Their pharmacological actions include Stambhana (haemostatic action), Ropana (healing), Sandhana (tissue union), and Raktaprasadana (purification and stabilization of blood). Due to their astringent and cooling nature, these drugs help constrict tissues, reduce secretions, promote coagulation, and support healing of ulcers and wounds. Hence, Priyaṅvādi Gana is widely indicated in Rakta disorders, chronic diarrhoea, burning conditions, and traumatic injuries.

The following table summarises major classical Rakta Stambhana dravyas with their Ayurvedic properties and modern pharmacological correlates:

Drug (Sanskrit)	Botanical Name	Key Rasa/Virya	Modern Haemostatic Mechanism
Lodhra	Symplocos racemosa	Kashaya, Sheeta	Loturine alkaloids — enhance platelet aggregation
Dhataki	Woodfordia fruticosa	Kashaya, Sheeta	Ellagitannins — fibrin stabilisation
Priyangu	Callicarpa macrophylla	Kashaya, Tikta, Sheeta	Flavonoids — vasoconstriction, platelet

			activation
Mocharasa	Salmalia malabarica exudate	Kashaya, Sheeta	Tannin-rich resin — protein precipitation, fibrin mesh
Laksha	Laccifer lacca	Kashaya, Madhura	Haemic components — thrombin activation
Samanga	Mimosa pudica	Kashaya, Tikta, Sheeta	Tannins + flavonoids — dual haemostatic action
Yashtimadhu	Glycyrrhiza glabra	Madhura, Sheeta	Glycyrrhizin — endothelial protection, fibrin stability

## 6. Raktapitta: Ayurvedic Model of Coagulation Failure

The Ayurvedic concept of Raktapitta represents a classical model of pathological bleeding and impaired haemostatic regulation that bears similarities to modern haemorrhagic and coagulation disorders. Charaka Samhita describes the pathogenesis as:

तैर्हेतुभिः समुत्क्लिष्टं पित्तं रक्तं प्रपद्यते | तद्योनित्वात् प्रपन्नं च वर्धते तत् प्रदूषयत् ||

तस्योष्मणा द्रवो धातुर्धातोर्धातोः प्रसिच्यते | स्वद्यतस्तेन संवृद्धिं भूयस्तदधिगच्छति ||

### — Charak Samhita Chikitsasthana 4/8

**Meaning:** Due to those causative factors, the aggravated Pitta becomes excited and enters into the Rakta Dhatu. Because Rakta is the seat and origin closely related to Pitta, the aggravated Pitta further increases there while vitiating the blood. Owing to the heat of Pitta, the fluid portion of the Dhatus begins to ooze out from one tissue to another, just as sweating occurs from excessive heat, and thus the disorder progressively increases further

This passage explains the **Samprapti (pathogenesis) of Raktapitta** in Ayurveda. Due to intake of Pitta-aggravating factors such as excessively hot, spicy, sour foods, alcohol, anger, or heat exposure, Pitta becomes excessively provoked (समुत्क्लिष्टं पित्तं). Since Rakta and Pitta possess an intimate Ashraya–Ashrayi relationship, the aggravated Pitta enters and contaminates the Rakta Dhatu, further increasing within it. The Ushna (hot) and Drava (liquefying) properties of Pitta cause abnormal fluidity and instability of blood and other body tissues. As a result, the liquid component of the Dhatus begins to seep or flow abnormally through various channels, analogous to sweating produced by excessive heat. This progressive liquefaction and overflow ultimately manifest as haemorrhagic conditions characteristic of Raktapitta. From a modern perspective, this may be correlated with pathological vascular permeability, haemorrhagic tendencies, and impaired haemostatic regulation seen in bleeding disorders.

## 7. Sheeta Virya: Cold Property in Haemostasis

The Sheeta (cold) Virya is a consistent property of classical haemostatic drugs, reflecting the known vasoconstricting and coagulation-promoting effects of cold:

Sheeta Virya (cold potency) is a characteristic feature of many classical haemostatic drugs in Ayurveda and is considered important in controlling excessive bleeding. Owing to its cooling, stabilizing, and Stambhana (arresting) properties, Sheeta helps reduce Pitta aggravation, burning sensation, and excessive fluidity of Rakta. It also promotes Sandhana (tissue union and healing), decreases local inflammation, and assists in controlling Raktasrava (haemorrhage). Classical Ayurvedic therapeutics therefore recommend both internal and external cold applications, such as cold decoctions, cold water, cooling pastes, and astringent preparations, in bleeding disorders. These principles show a close parallel with the modern physiological effects of cold-induced vasoconstriction, wherein reduced vessel diameter slows blood flow, limits blood loss, and facilitates haemostasis by enhancing platelet activity and increasing local blood viscosity.

### 8. Surgical Haemostasis in Sushruta Samhita

Sushruta Samhita Sutrasthana Chapter 14 describes four surgical haemostatic methods (Chaturvidha Rakta Stambhana Upaya):

सन्धानं स्कन्दनं चैव पाचनं दहनं तथा || व्रणं कषायः सन्धत्ते रक्तं स्कन्दयते हिमम् |

तथा सम्पाचयेद्द्रुम दाहः सङ्कोचयेत् सिराः |

Meaning: Four methods of haemostasis in surgical practice are: Sandhana (union/suturing), Skandana (coagulation/astringent application), Pachana (putrefaction/antiseptic cautery), and Dahana (thermal cauterisation).

#### — Sushruta Samhita Sutrasthana 14/39

This four-method classification demonstrates a sophisticated surgical haemostatic protocol: mechanical haemostasis (Sandhana/suturing), chemical haemostasis (Skandana/astringents), enzymatic haemostasis (Pachana/agents promoting local coagulation), and thermal haemostasis (Dahana/electrocautery equivalent). This classification predates the modern surgical haemostasis protocol by over two millennia.

### DISCUSSION

The correlation between Ayurvedic haemostatic concepts and modern coagulation physiology reveals remarkable alignment at both mechanistic and pharmacological levels.

The Pitta-Rakta relationship in Ayurveda precisely models the modern understanding of the liver's central role in coagulation. Ranjaka Pitta, located in the liver (Yakrit), is directly responsible for Rakta production and quality — paralleling the liver's role as the primary site of synthesis for virtually all coagulation factors (Factors I-XIII). Ranjaka Pitta excess (Pitta Vriddhi) causing haemorrhage parallels liver disease-induced coagulopathy, where excess thrombin activity and fibrinolysis overwhelm physiological anticoagulant mechanisms.

The Kashaya Rasa haemostatic mechanism — operating through Stambhana, Samgraha, and Shoshana — maps precisely onto the three phases of secondary haemostasis: (i) Stambhana corresponds to vascular constriction and platelet adhesion; (ii) Samgraha corresponds to platelet aggregation (platelet plug) and thrombin activation; and (iii) Shoshana corresponds to fibrin cross-linking and clot

retraction. Modern phytochemical research confirms this correlation — tannins (the primary Kashaya phytoconstituents) activate multiple platelet receptors (GPVI,  $\alpha$ IIb $\beta$ 3), stimulate thrombin generation, and promote fibrin polymerization.

The Vata-based vascular regulation (Vyana Vata) maps to the neurogenic and myogenic components of primary haemostasis. Vata Vriddhi causing vasoconstriction parallels sympathetic nervous system-mediated vasoconstriction in primary haemostasis. The concept of Vishama Vata (irregular Vata) causing both excessive clotting (thrombosis) and inadequate clotting (haemorrhage) maps to the modern understanding of Virchow's triad — stasis, hypercoagulability, and endothelial injury — as causes of pathological haemostasis.

The Sushrutan surgical haemostatic protocol (Chaturvidha Rakta Stambhana) demonstrates the highest degree of equivalence with modern surgical haemostasis. Sandhana (suturing/direct pressure) corresponds to mechanical haemostasis; Skandana (astringent application) corresponds to chemical haemostatic agents (tranexamic acid, fibrin sealants); Pachana corresponds to coagulation-promoting biological agents; and Dahana corresponds to electrocautery and laser haemostasis.

The Raktapitta model demonstrates the most comprehensive Ayurvedic understanding of coagulation failure. The upward (Urdhvaga) and downward (Adhoga) categorizations of Raktapitta, with distinct pathogeneses and prognoses, parallel the distinction between upper GI haemorrhage (associated with portal hypertension and gastric lesions) and lower GI haemorrhage (associated with colonic pathology) — both of which involve deficient haemostasis from distinct pathological mechanisms.

The differential haemostatic properties of individual Rakta Stambhana dravyas merit specific clinical attention. Lodhra (*Symplocos racemosa*) has been experimentally validated for platelet aggregation enhancement through loturine and coloturine alkaloids. Dhataki (*Woodfordia fruticosa*) demonstrates fibrin stabilisation through ellagitannin-mediated Factor XIIIa activation. Laksha (*Laccifer lacca*) contains haemic components that directly activate thrombin. These experimental validations confirm the classical Ayurvedic characterisations of these drugs.

## CONCLUSION

The Ayurvedic framework of blood clotting — operating through the Pitta-Rakta relationship, Vyana Vata vascular regulation, Kashaya Rasa pharmacology, and Sheeta Virya haemostatics — represents a comprehensive, clinically applicable haemostatic paradigm. The four-method surgical haemostatic protocol of Sushruta demonstrates a level of systematic sophistication in surgical haemostasis unprecedented in ancient medicine.

The correlation between Ayurvedic Rakta Stambhana concepts and modern coagulation biochemistry is not coincidental but reflects deep empirical observation of clinical haemostatic phenomena over millennia. The pharmacological validation of key Rakta Stambhana dravyas through modern phytochemical and pharmacological research further validates this classical framework.

Future research should focus on: (i) systematic clinical trials of classical Rakta Stambhana formulations in specific haemorrhagic conditions; (ii) phytochemical characterization of all classical Priyangvadi Gana drugs for coagulation-modulating activity; (iii) molecular docking studies of key

phytoconstituents against coagulation factors; and (iv) development of Ayurveda-based topical haemostatic preparations from validated Rakta Stambhana dravyas.

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