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RESEARCH ARTICLE

SUSHRUTA'S APPROACH FOR HAEMOSTASIS

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ABSTRACT

Rakta, which is an essential component of our body, has been given much importance in *Ayurveda*. It serves many functions in our body and is even considered the fourth Dosh by *Acharya Sushruta* (Shastri, 2020). *Rakta* is considered *Prana*, and that is why it is very important to save or preserve this priceless entity, as *Raktasrava* (haemorrhage) can lead to many morbid conditions and even death (Sashtri, 2020; Gupta, 1951). Loss of *Rakta* from the body can be due to *Shashtra Karma* (surgical procedures), some *Vyadhis* (diseases) like *Raktapitta*, any *Aghata* (trauma), or during *Raktamokshan* (*Therapeutic Bloodletting*). For this purpose, *Acharya Sushruta* described four *Raktastambhanopayas* (haemostatic measures), which are *Skandana*, *Sandhana*, *Pachana*, and *Dahana* (Shastri, 2020). This review focuses on the four haemostatic measures used in *Ayurveda*, their probable mode of action, and modern correlations.

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INTRODUCTION

According to *Ayurveda*, *Dosha*, *Dhatu*, and *Mala* are the *Moola* (Basis) of the human body (Shastri, 2020). *Rakta*, or *Raktadhatu*, i.e., blood, is one of the most important entities essential for the survival of any human being on this planet. In *Ayurveda*, the science of life, it is given utmost importance in various texts. By explaining its importance, *Acharya Sushruta* says that *Rakta* is the *Moola* of the body, and it is *Rakta* that maintains vitality. *Rakta* is life; hence, it should be preserved with utmost care (Shastri, 2020). He also considers it equally important as the *Vatadi Doshas* reside in the body during *Sambhav* (origin), *Sthiti* (preservation), and *Pralaya* (dissolution) (Shastri, 2020). A good surgeon should know the importance of *Rakta* and, at the same time, the complications arising from its loss. *Raktasrava* can occur in many forms, may lead to many morbid conditions, and can even cause death (Sashtri, 2020). Therefore, a surgeon must know the methods to stop the haemorrhage as quickly as possible to reduce the complications arising due to haemorrhage. *Acharya Sushruta*, the father of surgery, had a good understanding of this concept and therefore advocated four main methods for controlling *Raktasrava*, which are *Skandana*, *Sandhana*, *Pachana*, and *Dahana* (Shastri, 2020). These methods are explained in increasing order of their effectiveness.

Rakta: *Rakta* is one of the most essential components of our body, which is one of the *Saptadhatu*s (Gupta, 2020). It is formed from *Rasa Dhatu* by the action of *Ranjak Pitta* (Sashtri, 2020). It serves many functions in our body, such as giving life, forming organs, and nourishing its successor *Dhatu*s (Gupta, 2020) (Sashtri, 2020) (Sashtri, 2020). It is also one of the *Dashapranaayatana* (ten seats of *Prana*) and *Pitta Dosh Sthana* (Shastri, 1979; Shastri, 1979). *Kshaya* and *Vridhhi* of *Dhatu*s also depend on *Rakta* (14). It has five main properties, viz., *Visrata*, *Dravata*, *Raga*, *Spandana*, and *Laghuta*, which are given by *Prithvi*, *Jala*, *Teja*, *Vayu*, and *Aakash Mahabhoota*, respectively (Sashtri, 2020). According to contemporary medicine, blood is connective tissue in fluid form. It is considered the fluid of life, the fluid of growth, and the fluid of health because it transports oxygen and nutrients, protects the body from diseases, and eliminates waste products (Sembulingam, 2020).

Raktasrava: *Raktasrava* means discharge of blood or loss of blood from the body. *Raktasrava* can occur by *Shashtra* during *Shastrakarma*, as a complication of *Shastrakarma*, due to *Aghata*, due to any systemic illness, or during *Raktamokshana* (bloodletting therapy). *Raktasrava* increases during *Ushna* (hot) conditions or *Ushna Ritu* (hot climate), after excessive *Swedana*, after excessive *Vedhana* or *Vedhana* by *Agya*

(inexperienced surgeon) (Sashtri, 2020). According to modern medicine, haemorrhage is the escape of blood from a blood vessel. Haemorrhage is mainly arterial, venous, and capillary. Arterial haemorrhage is bright red and ejects in spurts. Venous haemorrhage is dark red and flows steadily. Capillary haemorrhage blood is bright red and oozes out rather than flowing. It may also be classified as internal, which is not seen outside, and external, which is seen externally (Das, 2020).

Need for preserving Rakta: *Rakta Dhatu* is an essential component responsible for life, the formation of organs, *Dhatuposhana*, and other important functions, and it needs to be preserved at any cost. By explaining its importance, *Acharya Sushruta* says that *Rakta* is the *Moola* of the body, and it is *Rakta* that maintains vitality. *Rakta* is life; hence, it should be preserved with utmost care (Shastri, 2020). Excess *Raktasrava* causes *Dhatukshaya* and aggravates *Vata* dosha. It can cause *Shiroroga* (disease of the head), *Andhya* (blindness), *Adhimanth* (glaucoma), *Timira* (loss of sight), *Dhatukshaya*, *Aakshepaka* (convulsions), *Pakshaghata* (hemiplegia), *Ekangaroga* (paralysis), *Trishna* (thirst), *Daha* (burningsensation), *Hikka* (hiccups), *Kasa* (cough), *Shwasa* (asthma), *Panduroga* (anemia), and even death (Sashtri, 2020). To avoid these complications, there was a need for methods to stop *Raktasrava* and preserve *Rakta*, for which *Acharya Sushruta* described *Raktastambhanopayas*.

Raktastambhana: The word *Rakta* means blood, and *Stambhan* means to prevent mobility. The word *Raktastambhana* means to stop the mobility or excess flow of *Rakta*. *Acharya Sushruta* described four *Stambhanopayas* to arrest *Rakta Srava-Skandana*, *Sandhana*, *Pachana*, and *Dahana*, in increasing order of their effectiveness. If one method fails to achieve *Raktastambhana*, a successive method is adopted until *Raktasrava* is stopped. *Skandana* is done by *Hima Dravyas* (cold substances), *Sandhana* by *Kashaya Dravyas*, *Pachana* with *Bhasma*, and *Dahana* by *Shalaka* (Thakral, 2020; Sashtri, 2020). Haemostasis refers to the arrest or cessation of bleeding. It occurs in three stages.

Vasoconstriction: When the endothelium is damaged and collagen is exposed, platelets adhere to this collagen, get activated, and secrete serotonin and other vasoconstrictor substances that cause constriction of blood vessels. Adherence of platelets to collagen is accelerated by the Von Willebrand factor.

Platelet plug formation: Platelets adhere to the collagen and secrete adenosine diphosphate and thromboxane A_2 . These substances attract more and more platelets and activate them. All platelets clump together to form a loose, temporary haemostatic plug that seals off the ruptured vessel. It is accelerated by platelet-activating factor.

Coagulation of blood: Fibrinogen is converted to fibrin. Fibrin threads get attached to the loose platelet plug, which blocks the ruptured part of the vessels (Sembulingam, 2012).

The haemostasis can be achieved by

1. Rest
2. Applying pressure bandages and packing
3. Using operative measures, which include haemostats and clips, ligation of vessels, coagulation with diathermy,

transfixation sutures, oxygel or gelatine sponge, gauze soaked in adrenaline, bone wax, etc (Das, 2020).

Skandana: *Skandana* means making the blood thick (*Styanikarana*). This can be achieved through the application of *Hima Dravyas* (Thakral, 2020). *Hima* causes *Stambhan*, thus stopping the *Rakta* at its source (Shastri, 1979). Cold water application is done to control *Raktasrava* after *Jalaukavacharana*, *Sheetal Padartha Aachhadana*, *Sheeta* place for *Shayan* and *Sheetal Aushadhi Lepa*, and *Sinchan* with their *Kashaya* has also been advised after *Raktamokshan* (Sashtri, 2020). Application of cold substances like ice constricts the vessels, reducing blood loss. It basically helps in achieving the first step of haemostasis, which is vasoconstriction (<https://www.sciencedirect.com/science/article/abs/pii/S0306362383900642?via%3Dihub>). It can be applied over visible bleeding and contusions.

Sandhana: *Sandhana* means to unite the *Vrana* or *Shastrapada*. *Sandhana* is done with the help of *Kashaya Dravyas* (Thakral, 2020). These *Dravyas* have *Sheeta* (cold), *Ropana* (healing), and *Twakmamsasthirikaran* properties, which help them do *Sandhana Karma* (Shastri, 1979). However, its application is not limited to the use of *Kashaya Dravyas*; it can also be understood as procedures such as pressure bandaging, vessel ligation, suturing, and so on. *Lodhra* (*Symplocos racemosa*), *Madhuka* (*Madhuka indica*), *Priyangu* (*Callicarpa microphylla*), *Patanga* (*Caesalpinia sappan*), *Sarjarasa* (*Shorea robusta*), *Rasanjan* (Extract of *Berberia aristata*), *Salmalipushpa* (*Salmalia malbarica*), *Masa* (*Vigna mungo*), *Yava* (*Alhagi camelorum*), *Haritakyadi* and *Panchavalkala Dravyas* are used in the form of *Choorna* for local application to stop *Raktasrava* followed by bandaging (Sashtri, 2020).

Astringents are substances that precipitate proteins but do not penetrate cells, thus affecting only the superficial layer. They toughen the surface, making it mechanically stronger, and decrease exudation. Tannic acid and tannins are examples of astringents. They denature proteins, forming the protein tannate, and are used in bleeding gums and bleeding piles. Alcohol and alum are other examples of astringents (Tripathi, 2019). Gauze soaked in Adrenaline and bone wax may also be considered as *Sandhanakaraka Dravyas*. By considering the points above, this method can be adopted in topical haemorrhage and during surgery for ligation of vessels.

Pachana: *Pachana* means suppuration or metabolic transformation by the action of *Agni*. For *Pachana*, *Kshoum Vastra Bhasma* or *Kshar* is used (Gupta, 1951). *Kshar* has *Pachana* and *Stambhana* properties, which enhance the process of coagulation (Sashtri, 2020). *Kshar* are basically alkalies, and alkalosis induces platelet aggregation, platelet, calcium, and serotonin release, as well as Platelet factor III availability (<https://pubmed.ncbi.nlm.nih.gov/28678/>). (Online). In modern science, local haemostatics like fibrin (prepared from human plasma and dried as a sheet or foam), gelatin foam, and oxidised cellulose (as strips that can be cut and placed in the wound) are used. It acts as a meshwork to activate the clotting mechanism and prevent bleeding (Tripathi, 2019). This can be used in capillary haemorrhage and in submucosal haemorrhage.

Dahana: If all other methods of *Raktastambhana* fail to achieve haemostasis, then *Dahana* is used. *Dahana* means to

apply heat or thermal energy i.e. to cauterize. It is done with *Shalaka* or by other means of *Agnikarma*, as advised by *Acharya Sushruta* while explaining *Agnikarmavidhi*. *Kshoudra*, *Guda*, and *Sneha* have been specifically told for *Agnikarma* in *Sira*, i.e., veins (Shastri, 2020). In *Kadar Chikitsa* after *Shastra Karma*, *Daha* by *Sneha* is advised (Shastri, 2020). *Dahana* karma does *Sankochan* for *Sira*, leading to the stoppage of *Raktasrava*. At present, *Dahana Karma* can be correlated with electric cauterization. This technique raises the local temperature, which coagulates tissue proteins and results in blood vessels to constrict. Furthermore, it aids in blood coagulation. This is used to stop bleeding from small vessels and during surgery (Gayathri, 2022).

DISCUSSION

Despite the fact that these methods of stopping *Raktasrava* were described thousands of years ago, they are very similar to current more scientifically advanced tools of achieving haemostasis. *Skandana* is stopping the haemorrhage by the application of cold items like ice, which arrests the bleeding by vasoconstriction and can be used mainly in topical haemorrhage. The second method is *Sandhana*, which involves the use of primarily *Kashaya Dravyas*, which have an astringent property that toughens the skin, denatures the proteins, and precipitates them, thereby preventing further bleeding. The next procedure is *Pachana*, which involves the use of *Bhasma* of *Kshoum Vastra* and *Kshar*, which may cause platelet aggregation and enhance coagulation due to its alkaline nature. The last method is *Dahana*, which causes hemostasis by thermal coagulation and vasoconstriction of the tissues. These methods are explained in a specific order, which is *Skandana*, *Sandhana*, *Pachana*, and *Dahana*. When one method fails to achieve hemostasis, the next method is applied, making *Dahana* the ultimate method for *Raktastambhana*.

CONCLUSION

Surgeons have to deal with *Raktasrava* on a daily basis. A good knowledge of the haemostatic measures and their applicability helps a surgeon to act promptly in an emergency. Modern haemostatic measures are modifications of *Acharya Sushruta's* four basic *Stambhanopayas*. Although with the modern advancement and discovery of new techniques, one must adopt these new techniques in order to provide better health facilities to the patients, one must at the same time remember the basic *Stambhanopayas*—*Skandana*, *Sandhana*, *Pachana*, and *Dahana* which can be applied effectively wherever there is a scarcity of resources.

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