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Rakta dhatu, bleeding time and clotting time- a correlation study

Kuber Asmita*[1], Phadke Supriya[2], Dumbre Satish[3]

1. H. O. D. Dept. of *Rognidan* and Research Methodology
2. Asst. Prof. Dept. of Research Methodology,
3. Principal, HOD Dept. of *Kayachikitsa*,

Ashtang Ayurveda Mahavidyalaya, *Pune*, Maharashtra- 411030

***Corresponding Author:** Ph. No: 9822458351; Email id: asmitakuber@yahoo.com

Abstract:

Rakta Blood and *Rakta dushti* Blood disorders have more importance since ancient time. As *Rakta* blood is the main component of human body, the normal and anomalous condition has great impact on the health of an individual. *Rakta dushti lakshanas* mentioned in *ayurvedic* texts are difficult to assess in modern times. Hence, the study was conducted to understand if there is any correlation between *Rakta dushta lakshanas* and modern pathological parameters. 100 participants were selected for the study. The mean age of the sample was 46.18 ± 14.83. High bleeding and clotting time were observed in *pitta dushta Rakta* (153.18 ± 31.24; 355.45 ± 12.12), while low bleeding and clotting time was seen in *kapha dushta Rakta* (131.94 ± 25.35; 221.84 ± 39.90). No statistical difference in bleeding time was observed between males and females ($p<0.80$), while high statistical difference in clotting time ($p<0.02$) was observed between males and females.

The study suggests that there is a correlation between *Rakta dushti lakshanas* and bleeding and clotting time. These tests can be used for primary evaluation of *Rakta dushti* by *doshas*. The confirmation of *dushti* will be based more on clinical symptoms of the patients. A large group study is needed to confirm the observations from this study.

Keywords: *Rakta dushti*, bleeding time, clotting time, blood viscosity, haemostasis.

Introduction:

Ayurveda, a science of life has a unique way of describing the human body and its components. As per *Ayurvedic* text the human body comprises of three *doshas*, seven *dhatus* and three *malas* [1, 2, 3]. When all these elements are in their natural state results in health, on the other hand any

deterioration in these elements is the root cause of various ailments.

Among all these elements *Vata* and *Rakta* are of extreme importance. Vitiation in *Vata* and *Rakta* are the causative factors for many disorders. *Rakta* or blood is essential component of circulatory system. It carries the nutrients as well the waste elements to and from every part of the body. Blood by nature is liquid but the protein, nutrients and other cells that blood carry makes it more viscous than water. To carry these nutrients smoothly the thickness i.e., viscosity of blood should be normal. The resistance of fluid to deform at a specific rate is called viscosity. In other terms we can say that viscosity is an internal force that arises between the layer of the fluid when in relative motion [4].

Increase in blood viscosity causes many disorders like rheumatoid arthritis, cardiovascular diseases, sickle cell anaemia, etc. [5]. *Rakta dhatu dushti* mentioned in *Ayurvedic* texts also states that when *Rakta* gets vitiated by *Vata*, *pitta* or *kapha* causes various diseases [6]. In *Rakta dushti* to indicate the change in viscosity of blood the *granthakaras* have mentioned specific *lakshanas*. In *Vata dushta Rakta*, the blood is said to be *vishad* (clear), tanu (less viscous), *fenil* (foamy) and *shigrhagami* (fast flowing). *Pitta dushta Rakta* is askandi (does not clot easily) while *Kapha dushta Rakta* is *pichchil* (sticky/ viscous), *tantumadh* (contains clots) and *snigdha* (unctuous)[6]. The above-mentioned parameters are subjective and need to evaluated on modern pathological aspects.

For this study to evaluate blood viscosity at primary level bleeding time and clotting time are considered to compare with *Ayurvedic* parameters mentioned above. The bleeding time test was the initially done to understand platelet function [7]. In 1912 Duke was first to characterize bleeding time which in 1941 was modified by Ivy [8]. The bleeding time is an indirect measure of platelet number and a more direct measure of platelet function, vascular integrity, and platelet interaction with the vascular sub-endothelium [9].

Clotting time in simple terms means the time required for the blood to form a clot. Any malfunction in coagulation factors lead to abnormalities in clotting time [10]. The primary phase of *hemostasis*, which involves platelet adhesion to injured capillaries and then platelet activation and aggregation, is measured using a bleeding time evaluation. When the platelet count is low or the platelets are damaged, the bleeding time can be abnormal. An inherited or acquired cause of irregular bleeding time can exist.

Aim of the study:

The aim of the study is to correlate *ayurvedic* parameters of *Rakta dushti* with modern pathological parameters like bleeding time and clotting time.

Objectives of the study:

1. To study the *Rakta dushti* and its effect on bleeding time.
2. To study the *Rakta dushti* and its effect on clotting time.
3. To study the difference between male and female bleeding time

4. To study the difference between male and female clotting time

Material and Methods:

Patients from Out Patient Department of *Kayachikitsa* department of *Ashtang Ayurveda Mahavidyalaya, Pune* were selected for the study. These patients were diagnosed clinically for *Rakta dushti* and referred to *Rognidaan* department for further blood investigations and *Raktamokshan*. Selection of patients was done as per the inclusion and exclusion criteria. The patients with bleeding disorders, on anticoagulants, auto-immune disorders, etc. were excluded from the study.

Procedure for Bleeding time:

Requirements: Sterile lancet, alcohol swab, filter paper and stopwatch.

The bleeding time procedure was done as per the Duke method. The patient was asked to sit in comfortable position. The ring finger tip of left hand was considered to make the prick. 70% alcohol swab was applied at the tip, then with sterile lancet a prick 3-4 mm deep was made. Stopwatch was started simultaneously and at every 15 *Seconds* the blood was wiped with the help Assessment Parameters: of filter paper. This procedure was repeated till the bleeding stopped and the time was recorded [11].

Procedure for Clotting time:

Requirements: 10 mm glass capillary tubes, sterile lancet, alcohol swab and stopwatch.

Clotting time procedure was followed as per capillary method. A deep prick with sterile lancet needle was made at the tip of ring finger of left hand under sterile conditions. One end of the capillary tube was touched at the fingertip slightly tilted downwards in position. The tube was easily filled with blood due to the capillary action. The stopwatch was started simultaneously to measure the time length. The capillary was kept idle for 2 *minutes* and the it was broken in to small parts one by one after every 15 *Seconds*. The procedure was repeated till the fibrin thread was formed and the time was noted [11].

Normal range:

- Bleeding time (Duke method): less than 3 *minutes* [12].
- Clotting time (Capillary method): 3-6 *minutes* [13].

***Ayurvedic* Parameters**	**Modern parameters**	**Remarks**
Askandi (*pitta dushti*)	Bleeding time Clotting time	Bleeding time of 2 *minutes* and more than 2 *minutes* was considered Clotting time of 5 *minutes* or more than 5 *minutes* was considered for *askandi*
Pichchil, tantumadh (*kapha dushti*)	Clotting time	Clotting time of 3 *minutes* and less than 3 *minutes* was considered. Bleeding time between 1-2 *minutes* was considered.

Data Analysis:

z- test for two sample mean was used to analyze the data.

Results:

Total 100 patients were selected for the study as per the inclusion and exclusion criteria. There were 69% males and 31% females. The average age of the sample was 46.18 ± 14.83 (Mean ± SD). Average age of females was 47.82 ± 12.14 and males was 45.13 ± 16.33 respectively. The *Rakta dushti* by *dosha* was observed as 31% *kapha dushti*, 33% *pitta dushti* and 36% *Vata dushti* respectively.

Bleeding time and Clotting time:

Average bleeding time and clotting time of the sample was 143.03 ± 28.01 and 286.4 ± 60.56 respectively. There was no statistical difference observed for bleeding time between male and female ($p<0.80$), while highly statistical difference was observed for clotting time between male and female ($p<0.02$). The maximum and minimum bleeding time in females was 3 *minutes* 48 *Seconds* and 1 min 42 *Seconds* respectively. The maximum and minimum bleeding time in males was 3 *minutes* 10 *Seconds* and 1 min 10 *Seconds* respectively.

The maximum and minimum clotting time in females was 6 *minutes* 10 *Seconds* and 2 *minutes* 40 *Seconds* respectively. The maximum and minimum clotting time in males was 6 *minutes* 20 *Seconds* and 2 *minutes* 58 *Seconds* respectively.

Table 1: Male and Female comparison for bleeding and clotting time

Parameter	Male	Female	P value
Bleeding time (in seconds)	142.46 ± 28.38	143.92 ± 27.77	p < 0.80
Clotting time (in seconds)	297.57 ± 62.94	268.92 ± 52.79	p < 0.02

Figure 1: Gender wise Bleeding time

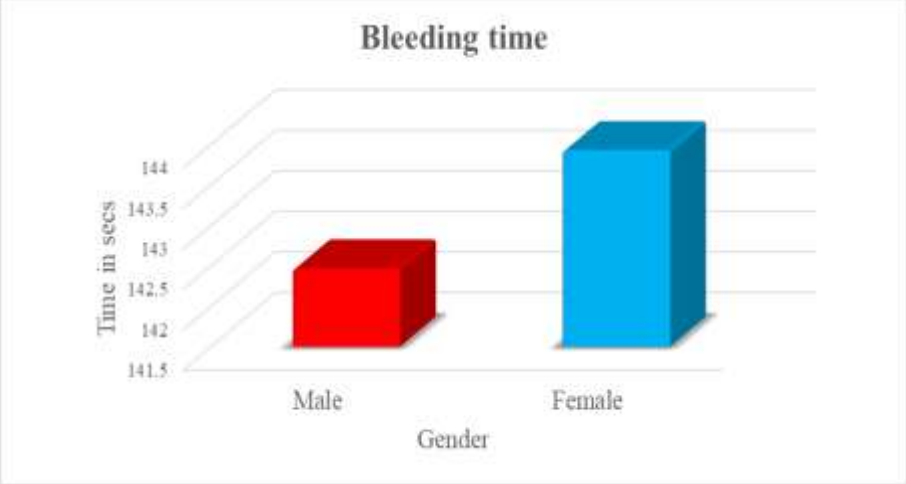
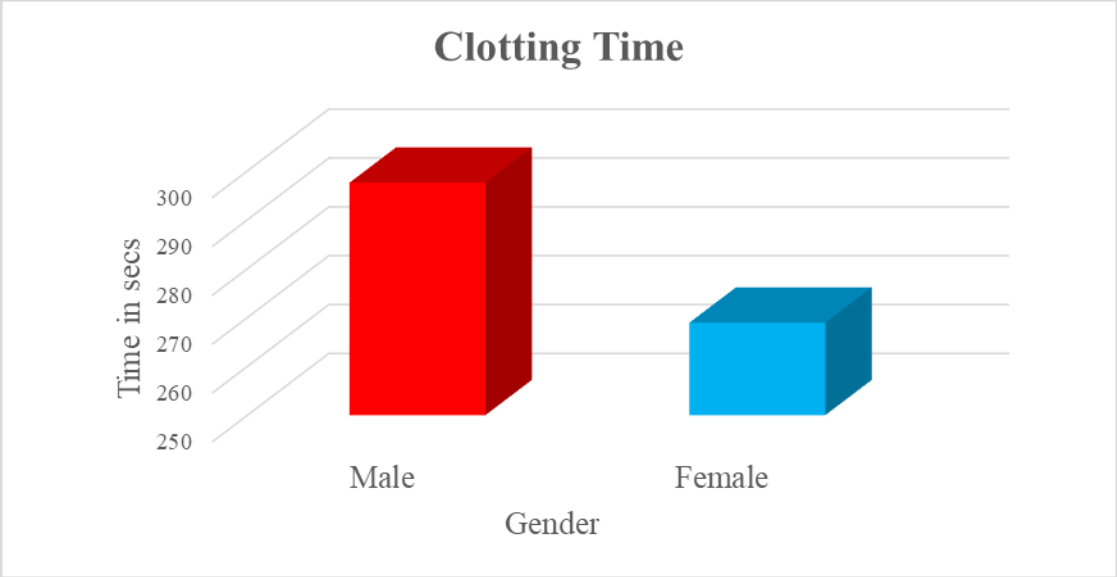


Figure 2: Gender wise Clotting time



It was observed that the bleeding time and clotting time was higher in *pitta dushta Rakta* in comparison to *Vata dushti* and *kapha dushti*.

Table 2: *Dosha dushti* wise bleeding and clotting time

Parameter	*Vata dushti*	*Pitta dushti*	*Kapha dushti*
Bleeding time (in seconds)	143.28 ± 23.86	153.18 ± 31.24	131.94 ± 25.35
Clotting time (in seconds)	278.69 ± 24.67	355.45 ± 12.12	221.84 ± 39.90

Figure: 3 *Dosha dushti* wise bleeding time

Figure 4: *Dosha dushti* wise Clotting Time

The minimum and maximum bleeding time and clotting time in *kapha dushti*, *pitta dushti* and *Vata dushti* is as follows:

Table 3: *Dosha dushti* wise minimum and maximum bleeding and clotting time

Parameter		*Vata dushti*	*Pitta dushti*	*Kapha dushti*
Bleeding time	Minimum	1 min 20 *Seconds*	1 min 26 *Seconds*	1 min 10 sec
	Maximum	3 *minutes* 2 sec	3 *minutes* 48 *Seconds*	2 *minutes* 54 *Seconds*
Clotting time	Minimum	3 *minutes* 15 *Seconds*	5 *minutes* 30 *Seconds*	2 *minutes* 40 *Seconds*
	Maximum	5 *minutes* 20 *Seconds*	6 *minutes* 20 *Seconds*	4 *minutes* 20 *Seconds*

Discussion:

Rakta or blood is the vital element of the body. In *Ayurveda Rakta* is called as '*Jeeva'* [14]. Blood carries the nutrients, oxygen and all essential elements throughout the body to keep it healthy. Many diseases or disorders can be reflected through various blood examinations. Thus, when blood gets affected or *dushta* it is causative factors for various ailments. In *ayurvedic* texts various reasons of *Rakta dushti* are mentioned. When the *Rakta* gets *dushta* by *Vata*, *pitta* or *kapha* it shows different *lakshanas* accordingly. To identify the *dosha-dushti granthkaras* have mentioned *Rakta dushti lakshanas* in details [6]. All these parameters are subjective and perspective in nature. In today's era it is difficult to assess these parameters and confirm the *dushti*

lakshanas. In this study an attempt is made to correlate these symptoms with modern pathological parameters. For assessing the viscosity and flow tendency of blood bleeding time and clotting time was considered for comparison.

The primary phase of *hemostasis*, which comprises platelet adhesion to wounded capillaries and then platelet activation and aggregation, is measured using a bleeding time evaluation[15]. Clotting time is also referred as time taken to form clot or fibrin thread. The *patho*-physiology behind bleeding and clotting time is related to *haemostasis*. *Hemostasis* is a series of events that result in the creation of a fibrin-platelet *hemostatic* plug, which stops bleeding [16]. Increased bleeding and clotting time are suggestive of blood related disorders.

Pitta dushta Rakta is said to *askandi* i.e., does not clot easily or has increased bleeding time. In this study it was observed that both bleeding and clotting time is higher. Though the time ranges within the given normal range, here the *dosha dushta lakshanas* are not related to any specific blood disorders. Here the upper limit of normal reference range for bleeding as well as clotting time was considered to understand the askandi nature of *pitta dushta Rakta*.

Kapha dushta Rakta is said to be *pichchil* (viscous) and *tantumadh* (contains clot). In the study it was observed that the bleeding time and clotting time referred to the lower limit of normal reference range of bleeding and clotting time respectively.

Vata dushta Rakta is *tanu* i.e., less viscous in comparison to *kapha*. It was observed that the bleeding time and clotting time for *Vata dushta Rakta* was slightly higher than *kapha dushta* but less than *pitta dushta Rakta* respectively.

It was also observed that the bleeding time and clotting time is higher in females than males. But no statistical difference was observed in bleeding time between males and females this may be due to the sample size variation of both the gender. High statistical difference was seen in clotting time between males and females this may be due the presence of estrogen hormone [17].

Clinical Significance of Bleeding time and clotting time:

Although the bleeding time appears to be the most obvious fit, it has been shown to be a poor predictor of clinical bleeding. It also has surprisingly low diagnostic sensitivity and specificity. "A broad number of disorders, medicines, physiologic factors, test circumstances, and therapeutic actions, not all of which are platelet-related, alter bleeding time" [18].

Though bleeding time and clotting time have lost their diagnostic value, still as primary level of evaluation there are beneficial. To assess the *Rakta dushti lakshanas* bleeding and clotting time can be considered as a guideline.

Conclusion:

The study suggests that there is a correlation between the *dosha dushta Rakta lakshanas* and bleeding time and clotting time. Though these parameters are not used for any diagnostic purpose but still from the reference ranges we can identify the *dosha*

dushti to some extent. In the above study difference between male and female bleeding time was statistically non-significant, this may be due to the dissimilarity of the sample size. A further large sample size study is needed to confirm the observations.

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