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Understanding of Thromboembolism by Ayurveda

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ABSTRACT

Thromboembolism term is used to define a type of blood pathology which involves two terms basically i.e. Thrombo + Embolism. Thromboembolism is defined as the blocking or obstruction of a blood vessel by a clot (or a part of clot, debris) that has broken off from the place where it is formed and travelled to another organ (Debris includes blood clots, cholesterol containing plaques, masses of bacteria, cancer cells, amniotic fluid, fat from the marrow of broken bones and injected substances). Thromboembolism is coagulation defect of blood which is responsible for certain life threatening conditions of human being. Ayurveda Samhita also has references regarding good as well as bad properties of the *Rakta* and *Margavarana Janya* pathological states that lead to defect of the *Kapha*, *Rakta* that produces features similar to Thromboembolism. Present article will help to understand Thromboembolism as per the Ayurveda perspective.

Key words: Thromboembolism, Ayurveda, Rakta, Kapha.

INTRODUCTION

Thromboembolism is a blood disorder which involves defective coagulation system of human blood. Thromboembolism is made up of two terms i.e. Thrombo or thrombus and Embolism.

Thrombus is the solid mass formed in circulation from the constituents of flowing blood and the process is known as Thrombosis.^[1] Embolism is the process of partial or complete obstruction of some part of the cardiovascular system by any mass carried in the circulation and the transported intravascular mass detached from its site of origin is called an embolus.^[2]

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Basic theory of coagulation

There are substances that cause or affect blood coagulation in the blood and in the tissues, some that promote coagulation are called procoagulants, and others that inhibit coagulation are called anticoagulants. Whether blood will coagulate depends on the balance between these two groups of substances. In the blood stream, the anti coagulants normally predominate, so that the blood does not coagulate while it is circulating in the blood vessels. But when a vessel is ruptured, procoagulants from the area of tissue damage become activated and override the anti coagulants, and then a clot does develop.

Thromboembolism involves various etiological factors, like for thrombosis are as,^[3]

1. Endothelial injury
2. Change in flow of blood
3. Change in composition of blood

1. Endothelial injury

Endothelial injury is the principle cause of thrombogenesis. There is increase e/o thrombus formation in arteries with atherosclerosis. Normal endothelial surface does not permit blood to clot.

Endothelial cell injury brings platelets and blood into contact with underlying connective tissue which immediately activates coagulation.

Causes of endothelial injury are as;

- a. Endotoxins
- b. Hypercholesterolemia
- c. Products absorbed from cigarette smoke
- d. Inflammatory diseases of vessel wall
- e. Radiation injury
- f. Immunologic injury

2. Alteration in blood flow dynamics

In normal laminar blood flow all cellular elements are separated from endothelium by plasma. Changes that take place in this regard are as;

- a. Stasis - common cause of venous thrombosis
- b. Eddy current formation, sometimes these occur in calf veins

Effect of these 2 changes leads to the following process;

- Disturbance of laminar blood flow
- Prevent dilatation of activated clotting factors
- Promote endothelial cell hypoxia

3. Alteration in the composition of blood

Hypercoagulability is an alteration of blood or specifically the clotting mechanism that in some way leads to thrombosis. It involves increased no. of procoagulants such as fibrinogen, prothrombin and factors 7a, 8a, 10a or increased no. of platelets or decreased no. of inhibitors such as anti-thrombin III, protein C and fibrinolytics. Examples for alteration in the composition of blood will be as:

- Deficiency of anti-thrombin III or protein C
- Nephrotic syndrome following trauma or burns.
- Post-operative
- Following child birth
- Late stage of cancer

- Severe dehydration may lead to viscous blood.

Sites of thrombus formation^[4]

1. In the arterial vessels - aorta, coronary artery, middle cerebral artery
2. In the veins - usually the calf veins
3. Heart - auricular appendages, ventricles and on heart valves
4. Capillary thrombosis

Causes of thrombosis in following sites^[5]

- a) In Arterial vessels, due to
 - Arteritis, which causes direct endothelial injury due to inflammation as well as platelet damage
 - Atheroma is commonest cause
 - Physical/chemical agents
 - In arterial aneurysms due to stasis of blood
- b) In Venous vessels, due to
 - Inflammation in and around veins (thrombophlebitis)
 - Varicose veins get thrombosed due to sluggish flow and inflammation
 - In certain cancers hypercoagulability causes migratory thrombophlebitis (Trousseau's sign)
 - Trauma and surgical wounds
- c) Cardiac thrombosis - in auricular appendages, ventricles and in heart valves due to
 - Endocarditis
 - Endocardial injury following injury in cardiac aneurysms

Mechanism of Thrombosis^[6]

Following steps are involved in thrombus formation

- Platelets adherence
- Release of thromboplastin
- Thrombin formation and fibrinogen
- Fibrin strands

- RBC's and other cells entangled in fibrin strand
- Propagating thrombosis

Fate of thrombus^[7]

If in major vessel (coronary, cerebral, pulmonary) may cause immediate death or may result in following:

1. Embolization: most dreaded complication - thrombus gets detached from vessel wall and goes into circulation
 - If in superficial veins - rarely embolizes
 - If in deep veins - pulmonary embolization
 - If in arteries - systemic embolization
2. Enzymatic digestion of thrombus i.e. it resolves - small thrombi lysed by fibrinolytic mechanism
3. Recanalization / retraction - fibrin threads contract, shrinking thrombus from all sides and opening up the vessels
4. Organization - (conversion of thrombus to a fibrous mass is organization) This may be plastered to one segment of intima. Ultimately it will become collagenised and hyalinised like any scar. It may undergo calcification and even bone with bone marrow (ossification) may develop in it. Development of fat in it converts it to atherosclerotic plaque.
5. Aneurysmal dilatation
6. Propagation
7. Infection may complicate thrombus. If gets detached gives rise to infected/ septic emboli

Embolism^[8]

An embolus is a detached intravascular solid, liquid or gaseous mass that is carried by the blood to a site distant from its site of origin.

Types of embolus

1. According to nature of embolus
 - a. Solid e.g. atheroma, tumor cells, bacterial clumps, parasites, foreign bodies

- b. Liquid e.g. amniotic fluid, fat globules
- c. Gaseous e.g. air
2. Depending upon infectivity
 - a. Bland also known as Sterile
 - b. Septic also known as Infective
3. Depending upon site of origin
 - a. Cardiac emboli
 - b. Arterial emboli
 - c. Venous emboli
 - d. Lymphatic emboli
4. Special type of emboli
 - a. Paradoxal emboli (embolus moves in same direction)
 - b. Retro grade emboli (embolus moves in opposite direction e.g. mass to spine from ca)
5. Prostate via batson's venous plexus)

Conditions resulted due to travelling of embolus

1. Embolus in artery: includes 2 entities
 - a. End artery embolus leads to
 - Obstruction of end artery
 - Dilations of collaterals
 - Stagnation of blood
 - Anoxia of tissues
 - Congested necrotic area
 - Infarction
 - b. Artery with good collateral anastomosis leads to
 - Obstruction
 - Dilation of collaterals
 - Permanent dilatation
 - Effective returning of circulation
2. Embolus in vein: includes
 - a. Obstruction or pulmonary artery occlusion
 - b. Pulmonary embolism

Sources of Thromboembolism - Includes following

- **Cardiac:** mural thrombus in the chambers, infective vegetations on the valves, ball valve thrombus etc.
- **Arterial:** atherosclerotic plaques, thrombus formed in aneurysms, paradoxal embolus etc.
- **Venous:** thrombus especially in deep vein of legs due to prolonged recumbency, oc pills, thrombus in pelvic veins etc.

Ayurveda concept of Thromboembolism

The concept of thromboembolism as per the Ayurveda understanding can be taken under

Following headings

- *Rakta Dusti*
- *Kapha Dusti*
- *Avarodhajanya* pathology

Symptoms produced by *Dosha* vitiation

In diminution of *Vata* and *Pitta*, *Kapha* blocks the channels (*Sroto Avrodha*) and produces,^[9]

1. Loss of movement (*Chesta Nasha*)
2. Fainting (*Moorcha*)
3. Difficulty in speech (*Vaaka Sanga*)

Rakta Dusti by *Kapha Dosha*

Rakta vitiated by *Kapha Dosha* is having following characteristics,^[10]

- a) *Eshat Pandu* (slight pale)
- b) *Picchila* (slimy)
- c) *Tantuvata* (fibrous)
- d) *Ghana* (viscous)

Margavaranajanya Vyadhi Vatarakta

Because of the obstruction to their course by the aggravated *Vayu* the *Medas* and *Kapha* gets provoked in excess in *Vata Rakta*.

Vata Rakta Vyadhi has *Margavaranajanya Avrodha* pathology. Understanding of *Avrodha* in *Vyadhi*

Utpatti can be better understood by the study of *Vata Rakta Vyadhi*.

Vatarakta Dusti Hetu^[11]

Vata Rakta Vyadhi Dusti Hetu are told in *Ayurveda* classics as:

Generally people of tender health (*Sukumara*) who indulge in sweet food in take (*Madhura Rasa Ahara*), leisurely eating, not doing exercise (*Avayayamasheela, Achankramanasheela*) and sedentary life style habits gets afflicted by *Vatarakta* because of following *Ahara Vihara Sevana*,

1. Excessive intake of *Lavana, Amla, Katu, Kshaara, Snigdha, Ushna* and *Ajeerna Bhojana*
2. Intake of *Klinna, Shushka, Ambuja, Anupa Prani Mamsa Sevana, Kulattha, Masha, Nishpava, Ikshu Sevana, Shaka Sevana* (leafy vegetables).
3. Excessive intake of *Dadhi, Aranala (Kanji), Sauvira* (sour preparation of dehusked barley etc.), *Sukta* (vinegar), *Takra, Sura, Asava*.
4. *Viruddha Bhojana, Adhyashana, Atyadhika Krodha, Diwaswapana, Atyadhika Ratri Jagrana*.

Mechanism of *Rakta Dusti* by means of *Vata* provoking factors^[12]

The above mentioned causative factors of *Vata Dusti* leads to *Rakta Dusti* and that *Dushita Rakta* gets aggravated due to following reasons,

1. *Abhighata* (injury), *Ashuddhi* (improper purification of body by *Vamana* and *Virechana*)
2. Excessive intake of *Kashaya, Katu, Tikta Rasa Pradhana Ahara, Alpa Matra Ahara* and *Ruksha Ahara Sevana*.
3. Riding over horse (*Hayoyana*), camel (*Ustrayana*) or on vehicles drawn by them.
4. Resorting to aquatic games (*Ambu Krida*), swimming (*Plavana*).
5. Excessive wayfaring (travelling on foot) in hot season (*Ushne Atyadhwa*) disturbs the equilibrium of *Vata*.

6. Indulgence in sexual intercourse (*Atyadhika Maithuna Karma*).
7. Suppression of the manifested natural urges (*Adharaneya Vega*)

Because of the above said reasons the *Vata* gets aggravated, being obstructed by *Rakta* thus leads to the formation of a disease named *Vatarakta*.

Concept of *Margavrodha* - *Margavarana* in Ayurvedic classics^[13]

In context to *Mahaabhishyandi Guna* of food stuff especially *Viruddha Ahara* and in reference to *Margavarodha*, it is given as *Shonita Pradooshnaye Mahaabhishyandi Margoparodhaya* (Dyslipidaemia promotes Atherosclerotic changes)

Concept of *Dhamani Pratichya* (atherosclerosis) in relation to *Margavarana Janya* pathology.

1. With *Virudhahara*^[14]

In context of *Virudhahara* and *Dhamani Pratichya* in the classics it is given that the use of *Paushkar Shaka* (*Neel Kamala*), *Rohini Shaka* or *Kapota Mamsa* if cooked in *Sarshapa Taila* and if taken with *Madhu* and *Ghruta*, causes *Abhisheyandata* in *Rakta* leading to *Raktavaha Sroto Avrodha* (obstruction), *Rakta Vahini Vispharana* (dilatation) etc.

2. As *Kaphaja Nanatmaja Vikara*^[15]

Dhamani Pratichya is included under *Kaphaja Nanatmaja Vikara* and *Chakrapani* has also commented on it by saying it as "*Dhamanyu Uplepa*" (*Uplepa* of *Kapha Vargiya Dravya* in *Dhamani*).

Dhamani Pratichya according to *Gangadhara*^[16]

Gangadhara has also quoted in relation to *Dhamani Uplepa* as "*Dhamanyu Uplepen Dhamaninanaam Pustata*" here *Dhamani Pustata* is nothing but the increase in diameter of *Dhamani* which is resulted due to deposition of *Kapha Vargiya Dravya* in inside layer of *Dhamani*. This *Dhamani Upalipata* is nothing but the atherogenesis which is responsible for the increase in diameter.

Other examples of *Margavarana Janya Vyadhi* are as;

1. *Margavarana Janya Vyadhi Vata Vyadhi* - In the classics it is discussed about the *Vata Marga Avrodha* by the *Meda*, *Kapha*, *Pitta* and *Rakta* ("*Vate Vibaddha Marge Medaha Kapha Pitta Raktana*").^[17] Here with the involvement of all the factors Atherosclerosis of the blood vessels can be understood which obstructs supply to brain due to atherosclerosis and provokes stroke or TIA frequently
2. *Margavarana Janya Vyadhi Unmada* - Here it is given about *Vata Marga Avrodha* by *Kapha* and *Meda* ("*Kuryadavruta Marge*") In context of *Vataja Unmada*.^[18]
3. *Margavarana Janya Vyadhi Hritshoola* - In context of *Hritshoola* pathology of *Margavarana* is told. *Vata* is obstructed by *Kapha* and *Pitta* respectively along with *Rasa Dusti* leads to features of *Hritshoola* ("*Kapha Pitta Avruddhastu Maruto Rasa Murchitaha*")^[19]

DISCUSSION

Thromboembolism involves coagulation defects that lead to various disorders affecting life of human being through its various manifestations. Ayurveda *Samhita* also has detailed information regarding *Kapha*, *Rakta Dusti* and *Margavarana Janya* pathology which resembles features of thromboembolism. Obstruction is seen in thromboembolism which is a main step of the disease and so is told by Ayurveda scholars. Detail about thromboembolism is given here along with its possible resemblance with *Margavarana Janya Vyadhi* is also discussed from basic to pathologic state. *Kapha Dusti*, *Rakta Dusti* Evam *Margavarana Janya Avrodha* pathology is discussed here. Disease pattern is told with various examples of references so that the present article becomes easily understandable for the reader.

CONCLUSION

Here in the conclusion part, it is understood that thromboembolism comprises a lot of etiological factors and these etiological instances lead to a lot of disorders that can be life threatening. Ayurveda *Samhita* also has also explained about this type of

pathology as told earlier in the form of *Kapha, Rakta Dusti* along with *Margavarana Janya* pathology. An effort is made by this article for the readers to understand thromboembolism as per the Ayurvedic perspective.

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