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**DIABETIC- RETINOPATHY IN AYURVEDIC PERSPECTIVES -A LITERARY REVIEW**PRIYANKA RANI<sup>1</sup>, GYANENDRA DATTA SHUKLA<sup>2</sup>, K S DHIMAN<sup>3</sup>, DEEPAK PAWAR<sup>4</sup>

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**ABSTRACT:**

*In the medical field there are tremendous changes occurring day by day due to advance technologies and bio-chemistry; so life span of patients suffering from incurable diseases like Diabetes Mellitus is also increasing. However with these advances some new problems related with health are also approaching and Diabetic Retinopathy is one of them. 'Madhumeha' a disease described in Ayurveda under the classification of Prameha realistically correlates with Diabetes mellitus in modern science. But it is not possible to compare 'Diabetic Retinopathy' - a complication of Diabetes mellitus, exactly to any particular disease in Ayurveda; other than we find direct reference of eye disorders due to Prameha in "Netra Prakashika" written by Poojyapada Mahamuni. However there are some other references also available in Ayurveda. Blurring of vision or complete loss of vision is explained under the heading of Drishtigata Rogas as Timira. The present study was done with an aim to analyze pathogenesis of Diabetic Retinopathy based on Dosha-Dushya involvement as per Ayurveda, so that the plan for proper Ayurvedic management can be established. For fulfilling this purpose a detailed study of literatures of both sciences was done. After a thorough study of literatures it was concluded that there are many similarities in different stages of pathogenesis of the disease; on the basis of which an alternative treatment modality with less side effects in Ayurveda can be established.*

**Key Words:** Diabetic Retinopathy, Madhumeha, Srotodushti, Timira

## INTRODUCTION

### **CORRESPONDANT:**

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Diabetes Mellitus (DM) affects almost every system in the body. It is associated with long term complications involving eyes, kidneys, nerves and blood vessels. Eyes are specially subjected to diabetic disturbances because of their peculiar structure and metabolism. Diabetic retinopathy (DR) is one of the major vascular complications of DM. It is estimated that DM affects 4% of world population. Nearly all people of type 1 DM (IDDM) and 75% of type 2 DM (NIDDM) will develop Diabetic Retinopathy after 15 years duration of DM and 18 % will develop Diabetic Retinopathy in less than 15 years duration of DM India being diabetic capital of world (according to W.H.O.) is feared to end up with an alarming 11.4 million of type 2 DM individuals developing Diabetic Retinopathy by 2025. About 20 years ago, Diabetic Retinopathy was 17<sup>th</sup> cause of blindness. Now it has become 6<sup>th</sup> cause of blindness. As far as the working class or industrial areas are concerned Diabetic Retinopathy is 2<sup>nd</sup> leading cause of

blindness in working age group (<55 years old) in industrial countries<sup>1</sup>.

Once the sight-threatening DR has been detected, treatment options are limited. Management of DR includes Diet Restriction, Control of systemic risk factors, Pharmacological modulation, Intravitreal steroids, Laser Photocoagulation and Vitrectomy. Laser photocoagulation therapy has been proven effective in reducing DR progression, and Vitrectomy can in many cases prevent severe vision loss in patients with advanced stages of DR. Both Laser photocoagulation and Vitrectomy improve quality of life for patients with DR and are cost-effective. Unfortunately, both treatments carry a risk of additional vision loss, and neither is effective at reversing loss of VA (visual acuity). Vitrectomy can accelerate cataract formation and includes risks of retinal detachment and endophthalmitis. In some patients treated with photocoagulation, DR continues to progress and ongoing treatment is necessary. DME (Diabetic Macular Edema) can also recur. Further with One large study has shown that even a proportion of people who have very well controlled glucose levels still develop DR in the future<sup>2</sup>.

Thus a patient desires for a reliable treatment to save his/her vision at any cost and is moving towards alternate and effective medical therapy. In recent era

*Ayurveda* has regained its fame and popularity because of our ancient revered scholars. *Acharya Puhyapada Mahamuni* described DR under *Prameha Janya Netra Roga*; moreover Ayurvedic descriptions on *Madhumeha* (a type of *Vataja Prameha*) find very much resemblance with DM in aetiopathogenesis and management. According to modern science DM is a multifactorial disease. In the same way *Prameha* is explained under a *Tridoshaja Vyadhi* with involvement of ten *Dushya*. Changes seen in stages of DR are quite similar to pathogenesis of *Prameha*. However patient complaints primarily related with vision which come under *Timira* in *Ayurveda*. The clinical features described for *Timira* are having broad applications and can be used to explain a number of ophthalmic problems ranging from refractive errors, posterior segment pathologies like retinal degenerations and even systemic ophthalmopathies like Diabetic and Hypertensive retinopathies; but without proper knowledge of *Dosha-Dushya Samurcchana* (pathogenesis of disease) it is difficult to treat the root of the disease, that's why for better management it's important to rule out the pathogenesis of *Pramehaja Timira* in the context of DR.

#### AIM AND OBJECTIVE

To study Diabetic Retinopathy in *Ayurvedic* perspective so that a proper

*Ayurvedic* treatment protocol can be established.

#### MATERIAL AND METHODS:

Classical texts of *Ayurveda* and modern texts including internet, dictionaries regarding the subject were used as source material in this study.

#### REVIEW OF LITERATURES

It is necessary to put in front of the abundant information which is available in Modern literature.

#### MODERN LITERATURE REVIEW<sup>3,4</sup>

Diabetic Retinopathy is the most common micro vascular complication of DM and remains a major cause of new-onset visual loss. Chronic hyperglycemia triggers a cascade of molecular events that leads to micro vascular damage. When a carbohydrate rich food is consumed, blood sugar level rises. Immediately pancreas secretes insulin into the blood, based upon the blood sugar level. Now the insulin facilitates the transport of glucose from the blood into the cells by increasing the permeability of cell membrane to glucose. Sometimes, the body stops making insulin (for example, in type 1 DM), or the insulin does not work properly (as in type 2 DM). In diabetic patients, glucose does not enter the cells sufficiently, thus staying in the blood and creating high blood sugar levels. Blood glucose levels vary widely

throughout the day and night in people with diabetes. When blood sugar levels remain high for several hours, dehydration and more serious complications can develop. Moreover, even mild hyperglycemia (a fasting blood sugar over 109 mg/dl in adolescents/adults or over 100 mg/dl in children before puberty) -when unrecognized or inadequately treated for several years -can damage multiple tissues in the brain, kidneys, and arteries. A high sugar in diabetes weakens these blood vessels and punctures them at certain sites. This leads to leakage of blood and damage to retina. This weakening, leaking and damage caused by diabetes to the retina is called as "Diabetic Retinopathy".

Ultimately Diabetic Retinopathy is an ocular microangiopathy. Vascular alterations can progress to retinal capillary nonperfusion, resulting in a clinical picture characterized by increased numbers of hemorrhages, venous abnormalities, and intraretinal micro vascular abnormalities (Non-Proliferative Diabetic Retinopathy (NPDR)/ Background Diabetic Retinopathy (BDR)). A later stage includes closure of arterioles and venules and proliferation of new vessels on the disc, retina, iris, and filtration angle. Increased vasopermeability results in retinal thickening (edema) during the course of Diabetic Retinopathy (Proliferative Diabetic Retinopathy (PDR)). Visual loss

results mainly from macular edema, macular capillary nonperfusion, vitreous hemorrhage, and distortion or tractional detachment of the retina (Diabetic maculopathy, Advanced diabetic eye disease) - (Figure-1, 2, 3)

### Pathogenesis of DR

Essentially, it is a microangiopathy affecting retinal precapillary arterioles, capillaries and venules. (Flow chart-1, Figure-4)

### Mechanism of Damage in DR

There are three basic components of this damaging process.

- The blood vessels can leak.
- They can make a special growth substance that makes other vessels grow. (VEGF = vascular endothelial growth factor)
- The vessels may eventually close and block.

First, tissues become short of oxygen (hypoxia). Retinal function becomes reduced at this point; this is Background or mild Non-proliferative Retinopathy. At around this time, white blood cells (leucocytes) stick to the capillary blood vessel walls, and the capillaries block. This causes more shortage of oxygen in the tissues (hypoxia and ischemia). The retina responds to this by increasing blood flow through the larger blood vessels. This is Pre-proliferative or moderate Non-proliferative Retinopathy. At around this

time, the cells in the capillary walls develop a thicker basement membrane (a thicker cell wall). Pericytes are cells supporting the blood vessel wall, and these start to die at this stage. The endothelial cells release the growth chemical VEGF, and start to leak fluid (macula edema). Later, the endothelial cells die as the capillaries block, and too little oxygen

reaches the retinal cells, causing ischemia (Figure-5)

**AYURVEDIC LITERATURE REVIEW:**

In Ayurvedic classics, *Acharyas* have classified *Prameha* in following ways:

	According to Dominance of <i>Dosha</i>	According to <i>Sadhyasadhyata</i> (prognosis)	According to etiology (causes)	According to body constitution:	According to Pathogenesis ( <i>Madhumeha</i> )
1	<i>Kaphaja Prameha</i>	<i>Sadhya</i> (curable)	<i>Sahaja</i> (By birth or by genetic defect)	<i>Sthoola pramehi</i>	<i>Aavaranjanya</i>
2	<i>Pittaja Prameha</i>	<i>Yapya</i> (requires lifelong treatment)	<i>Apathyanimittaja</i> (Aquired)	<i>Krishna pramehi</i>	<i>Dhatu kshayajanya</i>
3	<i>Vataja Prameha</i>	<i>Asadhya</i> (Incurable)			

According to dominant *Dosha*, eventually develop into *Madhumeha*. *Aacharya Vagbhitta* described that there are 20 forms of *Prameha*: 4 are due to *Vata*, 6 results from *Pitta* & 10 are caused by *Kapha*. Even though the disease starts with *Kapha Dosha* predominance,

gradually it passes through all the three *Dosha* dominant stages. Moreover there are a good number of *Dushyas* involved in the *Samprapti* (pathogenesis) of *Prameha* making it so difficult to cure. All types of *Prameha* when remain untreated

*Madhumeha* is a subtype of *Vataja Prameha*. *Madhumeha* has got two different types of pathogenesis- *Dhatukshaya janya* and *Avarana janya*<sup>5</sup>. It is true that there is no direct reference for *Prameha* causing eye diseases in any of our treatises but we find direct reference in “*NetraPrakashika*” written by *Poojyapada Mahamuni* (available in manuscripts form (*Pandulipi*) at *Tanjor Maharaja Sarfoji saraswati mahala* library & also published by CCRAS) clearly mentioning that *Netra Roga* are caused due

to *Prameha*<sup>6</sup>. There are also many other references which indirectly point out that *Prameha* can cause eye diseases as its complications-

- In *Prameha* major *Samprapti Ghataka* (pathological factor) is *Kleda* (increased fluidity) which contributes much to the *Upadrava roga* (complications)<sup>7</sup>. The presence of this increased fluidity in *Rakta* (blood) and in *Raktavahasrotas* (blood vessels) is mainly responsible for the complications. This *Vikruta Kleda* (morbid fluid content of body) when combined with *Tridoshas* initiates *Vikriti* (deformity) in all the three important *Marmas* (Vitals part of body). The *Trimarmas* namely *Shiras* (Head), *Hridaya* (Heart) and *vasti* (Kidneys) are seriously affected, if the *Prameha* is not properly treated<sup>8</sup>. The involvement of *Trimarmas* (Head, Heart and Kidneys) in complication stage is the important hallmark event in the progression of *Prameha*. Moreover a serious fact mentioned in classics is "Upadeha in *Hridaya*, *Netra*, *Jihwa* and *Shravana*"<sup>9</sup>, even in the prodromal stage of *Prameha*; which gives direct clue regarding slow involvement of vital organs like eye since early stages of *Prameha* which become more evident in later stages.
- In *Sushruta samhita* while describing *Upadrava* (complications) of *Prameha*, *Pratishyaya* (rhinosinusitis) is described as one of the complications<sup>10</sup>. *Pratishyaya* in complication stage is said to cause serious ocular problems in classics<sup>11</sup>. Along with these another complication mentioned

there is *Pandu* (Anemia). *Pandu* also leads to *Hatendriya lakshana* (damage to sense organs) in its progression stage as described by *Acharya Charaka*<sup>12</sup>. Also under complications according to *Doshika* predominance of *Prameha*, *Peeta vinamutranetrata* (yellow discoloration of stool, urine and eyes) is categorized under complication of *Pittaja Prameha* by *Acharya Sushruta*. Thus all these references give a clue towards involvement of eyes as a complication of *Prameha*.

- In *Sushruta samhita* while describing treatment of *Madhumeha* in *Madhumeha chikitsa* chapter, there is description of *Tuvarakadya Anjana* containing *Tuvaraka Majja*, *Saindhava*, *Anjana* and *Tuvaraka Taila*, which is said to be useful in many eye diseases like *Timira* etc. So it may be an indirect reference of *Timira* occurring due to *Madhumeha*<sup>13</sup>.

#### **Nidana (Etiology) Of Pramehaja Timira-**

*Prameha* etiology includes both *Beeja Dosh* (congenital) and *Ahara-Vihara* (Acquired).

The main etiological factor for *Prameha* is *Kapha dosha*<sup>14</sup>. *Netra* also very easily gets afflicted by *Kapha Dosh*. Moreover certain etiological factors in *Prameha* are *Achakshusya* (not beneficial for eyes). This shows the relation between *Prameha* and *Netra Roga*<sup>15</sup>. These etiological factors are discussed below-

1. **Madhur Rasa** if taken in excess amount causes both *Prameha* as well as *Netra roga*<sup>16</sup>.

2. **Amla Rasa**

*Kleda Vriddhi, Drava Vriddhi, Adya Dhatu Shaitilya-Prameha*<sup>17</sup>. *Kapha-Pitta Prakopaka, Rakta Vidaha- Netra roga*<sup>18</sup>

3. **Shuktaaranala-** *Drava-Kleda Vriddhi--Prameha Amla Vipaka, Kapha-Pitta Prakopa—Netraroga*<sup>18</sup>

4. **Masha-** *Guru-Snigda, Madhura Rasa/Vipaka—Prameha*<sup>19</sup>

*Usna Virya- Netra roga*<sup>20</sup>

4. **Vega Vinigraha** (Delaying time of natural urges)- *Mutra Vega, Apana Vayu Dushti—Prameha*

*Nidra-Ashru Vega— Netra roga*<sup>21</sup>

**Samprapti (Pathogenesis) Of Pramehaja Timira**

In *Samprapti* (pathogenesis) of *Prameha* all three vitiated *Doshas* are integrated but it's mainly *Kapha* dominant disorder because of particular pathway of pathogenesis taking place in *Prameha*. When *Kapha* gets vitiated due to etiological factors, it is signified as *Bahudrava Shleshma Doshavishesha* (increased *Kapha Dosh* in body) by *Acharya Charaka*; which affects *Kapha* preponderance *Dushya* in the body like *Meda, Rakta, Shukra, Ambu, Vasa, Lasika,*

*Majja, Rasa, Oja and Mamsa* which all are *Drava Dhatus*. Increased *Drava* property leads to *Agnimandyata* (decreased digestive power) resulting in invention of inappropriate *Kapha* i.e. *Kledaka Kapha* in body. All the systems in the body get affected due to increased proportion of *Kledaka Kapha* and this can be perceived by increased body stickiness (*Sharirantargata Klinnata*). At this level if proper treatment or management is not adapted or the pathogenesis of *Prameha* is prolonged, the nourishment/ nutritious quality of *Kapha* is hampered due to augmented proportion of *Kledaka Kapha* with *Dushta* (vitiated) *Pachaka Pitta, Samaan Vayu* and affected *Dushya*; ultimately leading to improper/impure production of *Dhatus* i.e. *Dhatwagnimandya*. *Dhatwagnimandya* leads to *Mamsopachaya* i.e. accumulation of improper body tissues resulting in *Shaitilyata*. In eyes, symptoms like feeling of stickiness inside the lids, sticky discharge from eyes are seen where it is clear that improper *Mamsopachaya* leads to raise its *mala* i.e. sticky discharge from eyes. If it is remained untreated then there is declining i.e. *Kshaya* of *Prakruta* (normal) *Kapha & Kaphaja Drava Dhatu*. *Prakruta Pitta* shows increased level as compared to level of *Prakruta Kapha*. Aggravating factors like *Pittaj Ahara* and *Vihara* vitiates *Pitta* and *Rakta* with *Mutra*, which's sum up in *Pittaja Prameha*. At this stage of *Prameha*,



*Peetanetratva* (yellowness/muddiness of bulbar conjunctiva) is seen as a sign in eye.

After *Dosha Dushya Sammurchhana* (development of pathogenesis) when it remains untreated, it can lead to diffuse *Kshaya* of *Dhatus*. In this stage additional with *Dhatu Kshaya*, consumption of *Vata Dosha* aggravating factors result in converting *Pittaja Prameha* into *Vataja Prameha* which further leads to *Daurbalya* of *Rasayani*<sup>22</sup> (weakness of lymphatic channels, blood vessels and microcapillaries) in the whole body affecting various organs. Here augmented proportion of *Kledaka Kapha* leads to increased viscosity of body fluid due to its *Parthiva Guna* (solid elements properties) and consequences are seen on *Adhosharira* (lower body i.e. lower limbs) in the form of *Pidika* (Diabetic lesions). There is less of *Parthivata* in body fluid which circulates in superior area of body due to gravity; so the consequences are not seen externally in upper part of body but upper body organs are also affected equivalently. In present era, with the help of advancing technologies the changes in eye from early state of diabetes can be visualized. So as prior said, the involvement of *Trimarmas* (Head, Heart and Kidneys) in *Upadrava* state of *Prameha* is comprehensible here.

**Chikitsa (Treatment) Of Pramehaja Timira**

Management of *Timira* can be broadly classified into three ways-

**Based on Nidana (Etiology)** - *Nidana Parivarjana* (Prevention) should be the first line of treatment.

**Based on Samprapti (Pathogenesis)** - *Kledahara*, *Raktavahasrothodustiharana* (Blood purifier), *Vatanulomana*, *Shophahara* (Antiinflammatory), *Rasayana Chikitsa* (Immunomodulators).

**As An Upadrava (Complication)** - *Charaka* has explained that complications are produced when the disease continues for a long time, and the produced complication is more severe because the body becomes weak after a long duration of disease. For treatment of complication, it is said to treat the basic disease first, by this the complication itself get treated<sup>23</sup>.

## DISCUSSION ON LITERARY REVIEW (AYURVEDIC AND MODERN)

### • Etiological Factors

*Ayurvedic* and modern medical sciences agree to the same etiological factors i.e. genetic preponderance, faulty life style like high caloric diet intake & lack of exercise as well as stress.

*Acharya Charaka* in *Sutrasthana* says that *Prameha* is having hereditary nature<sup>24</sup> Even the risk of occurrence for DR is highest in patients having the family history.

## PATHOGENESIS

In *Sushruta Samhita* while describing *Prameha Pidika* (Diabetic lesions), it is said that in *Purvarupa Avastha* (prodromal stage of *Prameha Pidika*), *Apatarpana* (weight lowering diet and life style), *Vanaspati kashaya* (decoction of herbal medicines) and *Basta mutra* (urine of goat) should be used as preventive measures. If these measures are not used, there is increased *Maadhurya* (sweetness) in *Mutra, Sweda* and *Shleshma* (body fluids); which leads to development of *Rupa Avastha* (development) of *Prameha Pidika*. At this stage, *Ubhaya Samshodhana* (purification procedures) should be done otherwise the *Doshas* vitiate more and affect *Mamsa* (muscle mass) and *Rakta Dhatus*, due to which *Shopha* (inflammation) and other complications of *Prameha* occur<sup>25 1</sup>. On the other hand the *Drava Dhatus* involved in *Prameha* lead to vitiation of *Vyana* and *Apana Vata*, causing *Rasayani Daurbalya* in whole the body. *Rasayani* are the microcapillaries responsible for nourishment of tissues. When there is no proper nutrition, many vascular complications may occur. Here Diabetic Retinopathy can be considered under the umbrella of vascular complications. (Flow chart-2) According to modern science also the pathology of DR starts with microvascular occlusion due to vascular changes like endothelial cell damage,

thickening of basement membrane and loss of capillary pericytes, further leading to formation of microaneurysms, haemorrhages and exudates in the retina. When the microcapillaries of eyes are affected, there is loss of pericyte and endothelial cell death which is the main pathogenesis involved in DR. As a result of this, there is outpouching of vascular walls (microaneurysms), bursting of capillaries (haemorrhages) and leaking (exudates). If the DR pathology is analysed properly according to both sciences, it possesses all the four features of *Srotovaigunya* (deformities in nourishing channels) *i.e.*, *Atipravritti* (Increased formation of substances), *Sanga* (occlusion), *Siragranthi* (deformities in anatomical structure) and *Vimarga Gamana* (Fluctuation or deflection). Thus a perfect similarity is seen in pathogenesis according to both sciences. *Atipravritti* can be correlated to the neovascularization where new vessels are formed. *Sanga* is manifested by the retinal vessels occlusion leading to hypoxia/ischaemia. *Siragranthi* is nothing other than development of microaneurysms and *Vimarga Gamana* can be correlated with haemorrhages in the retina.

## TREATMENT

Acharya Charaka has explained that for treatment of any disease we have to treat the basic disease first, by this the complication itself gets treated. In the

same way modern science quotes that the first step towards treatment of DR is to control blood sugar level.

As far as the main treatment part is concerned, like modern medicines, Ayurvedic medicines and procedures also act on micro-angiopathies and correct the

health of capillaries. They also help in establishing blood retinal barrier reducing the edema. Nevertheless the gradual control reduces the chances of production of hemorrhages which is associated with the rapid lowering of blood glucose.

CONCLUSION

This study shows that disease Diabetic Retinopathy and *Pramehaja Timira* are same conceptually. There is not much difference found in pathogenesis of the disease according to Ayurvedic and modern sciences. The need is of proper analysis of pathogenesis and involvement of *Dosha Dushyas*; so that proper management of the disease can be done. The judicious use of detoxification procedures in Ayurveda such as *Virechana*/purgation, *Nasya*/nasal drops;

ial eye '*Kriya kalpas*' /ocular therapeutic procedures may be helpful in stopping the bleeding from retina and revitalizes the retina reducing the chances of recurrence. The therapeutic measures also include gradual and greater lowering of blood sugar levels as it probably helps in the increased insulin sensitivity. In this way Ayurveda can be an alternative treatment modality for Diabetic Retinopathy.

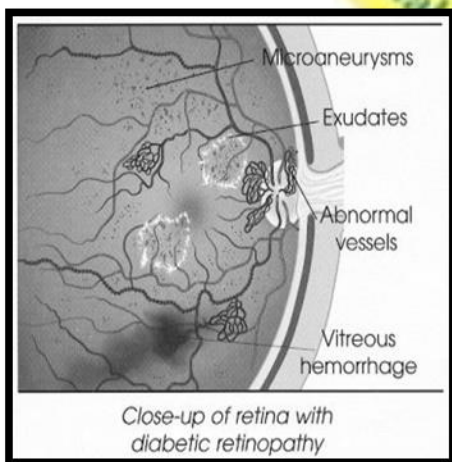


Fig 1- DR changes in fundus



Fig 2- DR changes in fundus

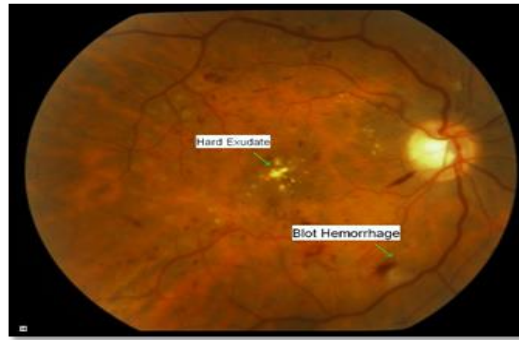


Fig 3- DR changes in fundus

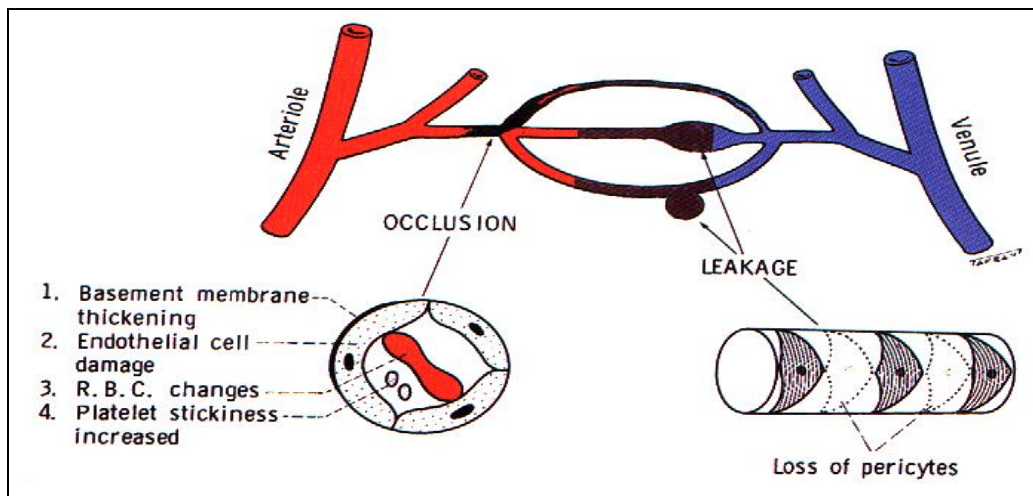


Fig 4-Pathogenesis of DR

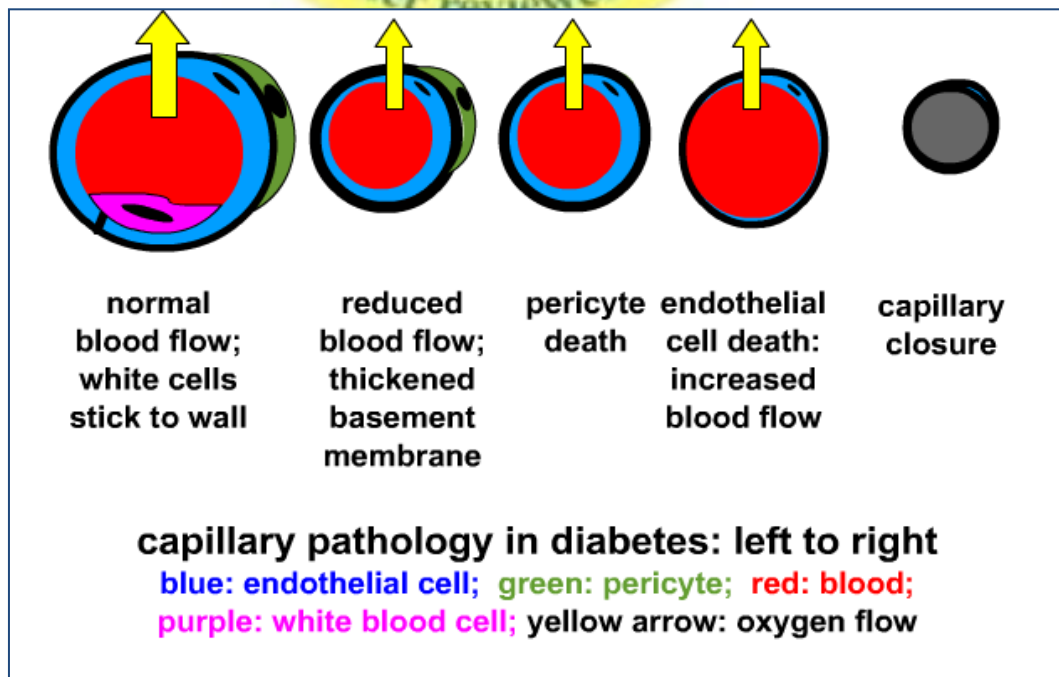
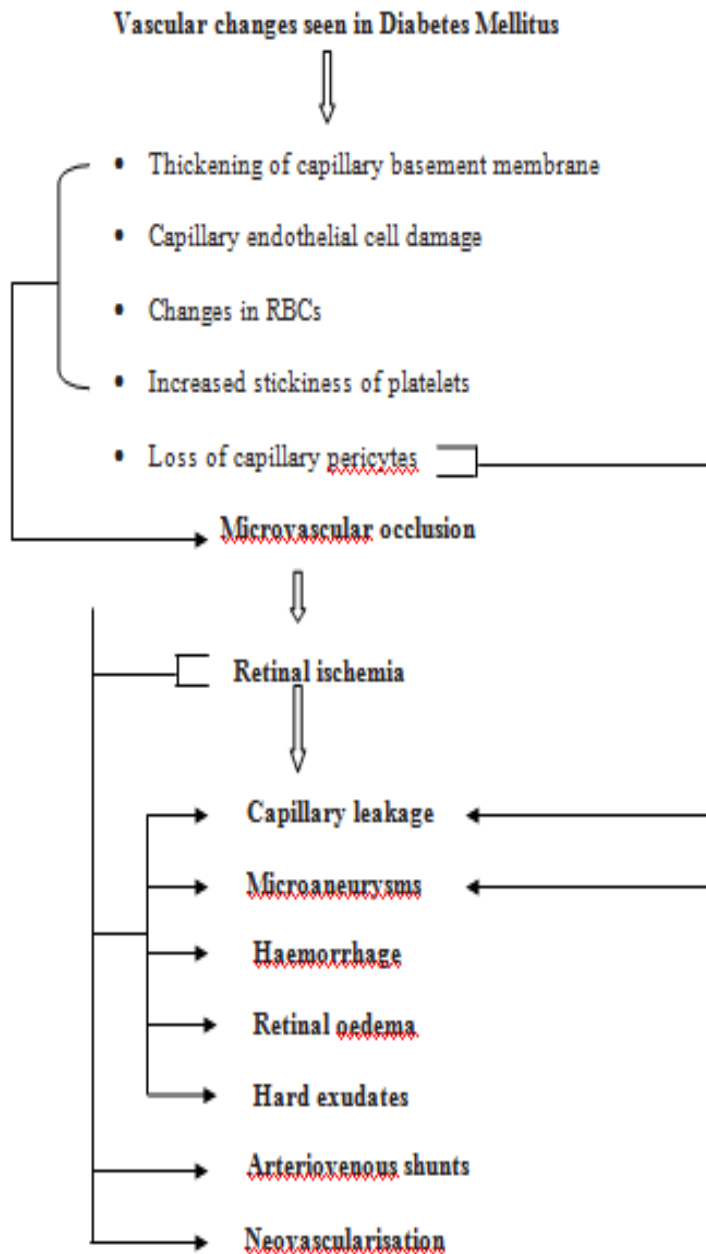
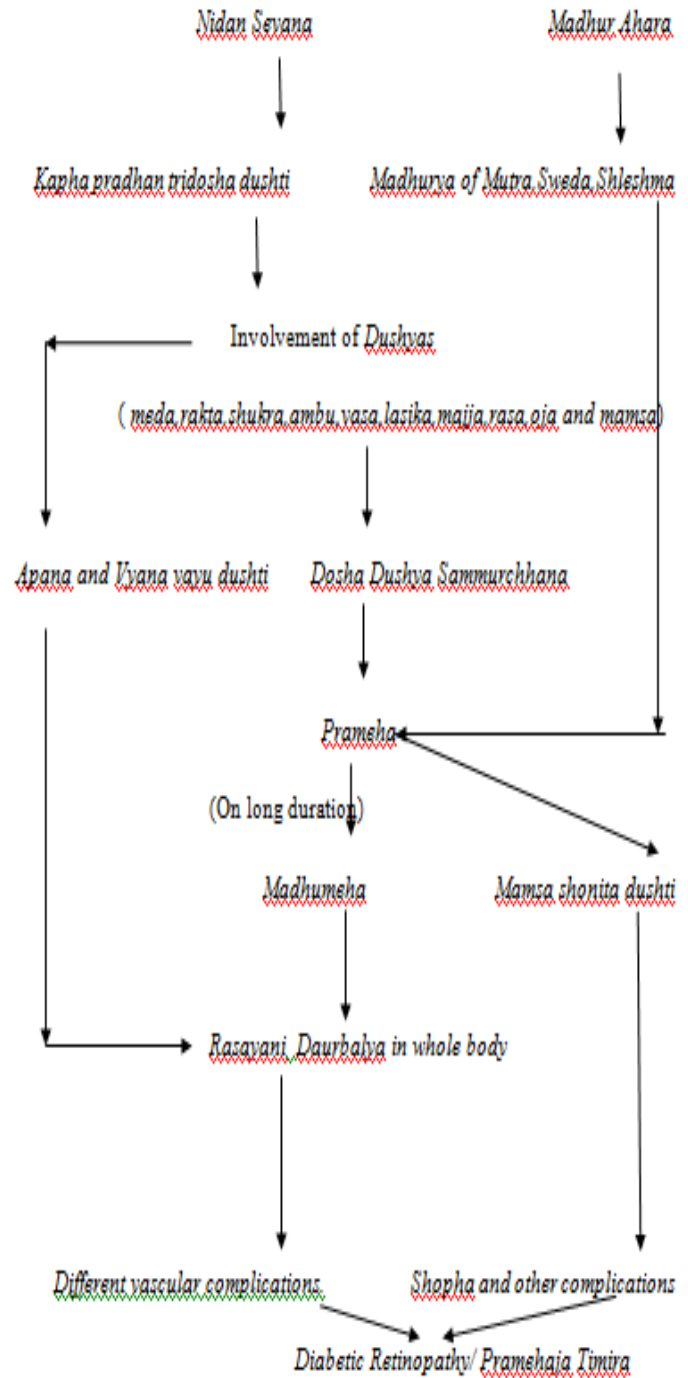


Fig 5- Mechanism of Damage at Microvascular level in DR



Flow chart 1- Pathogenesis of Diabetic Retinopathy in Modern Perspective



Flow chart 2- Pathogenesis of Diabetic Retinopathy in Ayurvedic perspective

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