



Hypothetical Approach Towards Understanding of Stages of Kriyakala with Pathogenesis of Type II DM

Aparna Singh¹, Sonam Agrawal*², Sangeeta Gehlot¹

¹Department of Kriya Sharir, Faculty of Ayurveda, Institute of Medical Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India

²Department of Kriya Sharir, Sri Sri College of Ayurveda Science and Research Hospital, Sri Sri University, Cuttack, Odisha, India

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ABSTRACT

Ayurveda believes in a holistic approach toward health and gives more emphasis to the prevention of diseases by attaining *Dhatu Samyata* via adopting the appropriate lifestyle and dietary habits. Ayurveda scholars have mentioned that exposure to etiological factors does not lead to the immediate manifestation of the disease but gets through certain stages for the full-fledged manifestation of the disease. These six consecutive stages through which the pathogenesis of the diseases accelerates to the advanced stage as well as signs and symptoms are produced in accordance to the intensity of aggravation of *Dosha* are termed as *Shatkriyakala*. These stages can be correlated with the pathogenesis of various diseases for their proper understanding as well as designing treatment protocol in accordance with stages of pathogenesis to assure a better prognosis of the disease. Thus, an approach has been made to correlate the stages of *Kriyakala* with the pathogenesis of type 2 diabetes mellitus.



*Corresponding Author

Name: Sonam Agrawal

Phone: 9616298251

Email: sonamagrwal1788@gmail.com

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INTRODUCTION

The beginning of manifestation and non-manifestation of disease in an individual is determined by the combined effects of *Nidana* (etiological factors), *Dosha*, and *Dushya*. If these factors in combination are vigorous, it will ultimately result in either immediate manifestation of a disease or will result in the expression of all the signs and symptoms of the disease. But, if these

factors are mild, it can either lead to delayed or non-manifestation of disease, or if manifested it will be expressing very few signs and symptoms [1]. This phenomenon shows that, the manifestation and non-manifestation of the diseases are not only determined by the susceptibility of a particular tissue to any antigenic attack but also by the potency of the etiological factors [2]. Exposure of an individual to disease-causing factors such as indulgence in faulty dietary habits and a sedentary lifestyle does not manifest the disease instantaneously but it takes a certain course of duration and stages for complete expression of disease. These stages of the pathogenesis of disease which take place in the body after exposure to various etiological factors till the appearance of disease are known as *Kriyakala*.

The term *Kriyakala* is composed of two words "*Kriya*" and "*Kala*". The term *Kriya* stands for *Karma* or measures taken by the physician while the term *Kala* stands for opportunities for the management during the progression of the pathogenesis of the disease. Thus, *Shatkriyakala* is the six opportuni-

ties for the physician to take the earliest appropriate measures for the management of diseases during the progression of advancement of disease pathology. It encompasses six consecutive stages denoting the successive furtherance of the disease [3]. These stages give emphasis on prompt action during the initial stage itself to assure a better prognosis of the diseases [4]. The importance of early detection and management of the disease has been explained with the idiom of an eruption of a plant from its root i.e., erupting a tiny plant from its root is easy as compared to erupting a big tree, in the same way, disease management at its earlier stage is easier, leads to complete abolition of the pathology as compared to advanced stages [5].

This idiom can also be taken to understand the pathogenesis of disease, likewise the root of a tiny plant is not rooted deeply in the soil while the roots of a big tree tend to spread deeply and lateral direction, in a similar way to the *Dosha* in the early stage of the disease is situated in superficial *Dhatu* only but once gets advanced it starts affecting the deeper structure (i.e. *Gambhira Dhatu*) [6]. Thus, the treatment in the early stage of the disease will require lifestyle modification or simple approaches such as *Deepana Pachana* or *Sanshaman* but later on it will need surgical, para-surgical, or *Panchakarma* procedure for the expulsion of vitiated *Dosha*. It also gives insights regarding the importance of early detection of diseases which makes a good prognosis but on ignorance, the disease gets advanced, and complicated that leads to poor prognosis [4].

It also emphasizes that, if the treatment has not commenced at a proper time or is inadequate or in excess due to improper knowledge of *Shatkriyakala* results in a bad prognosis of even curable diseases [7]. The Six stages of *Kriyakala* are: *Sanchaya*, *Prakopa*, *Prasara*, *Sthanasanshraya*, *Vyaktaavastha* and *Bhedavastha* [3]. These stages can be correlated with the different phases in the pathogenesis of disease. Although, previously few scholars have made an approach to correlate the pathogenesis of certain diseases such as cancer [8] with stages of *Kriyakala*, still there is no attempt to correlate these stages with pathogenesis of diabetes mellitus, which has increased the disease burden globally by affecting millions of people worldwide. Thus, this article is an attempt to understand the concept of *Shatkriyakala* in Ayurveda as well as the implementation of this concept to understand the pathology of type 2 diabetes mellitus in contemporary science. This type of approach will lead to easy understanding of the pathology of the disease as well as planning of treatment protocol in accordance with different stages.

Material and Methods

The contents related to *Shatkriyakala* were collected through Ayurveda compendia. Further, the recent description related to diabetes mellitus was scanned thoroughly from the electronic databases such as PubMed, Medline plus etc.

REVIEW AND DISCUSSION

The aggravated *Dosha* manifest different clinical symptoms during these different stages of *Kriyakala*. These stages of *Kriyakala* have been described as following

Sanchaya (The Stage of Accumulation of Dosha)

The aggravation of *Dosha* occur in their own inherent sites due to consistent indulgence in dietary and lifestyle habits having similar attributes [9, 10]. For example, intake of food substances having *Ruksha*, *Laghu*, and *Sheeta* properties, executing activities such as *Ativiyayama* (overexertion), *Ratrijagarana* (night awakening) will lead to aggravation of *Vata Dosha*, while intake of food article having *Ushna*, *Teekshna* attributes, emotional behavior such as angeriness leads to an aggravation of *Pitta Dosha* while indulgence in food having *Snigdha* (unctuous), *Sheeta* (cold), *Guru* (delayed digestibility) properties, *Divasvapna* (day time sleeping), etc. causes aggravation of *Kapha Dosha*.

In this stage, the accumulated *Dosha* gets stagnant in their own intrinsic sites rather than freely circulating in the body. This accumulated *Dosha* produces aversion towards the substances possessing similar attributes while fondness for the substances having contrary attributes [11]. For example, *Sanchaya* of *Vata Dosha* will produce aversion for food articles having *Ruksha* (dry), *Laghu* (easily digestible) properties like *Yava* (*Hordeum vulgare*), *Mudga* (*Vigna radiata*), etc. while fondness for *Snigdha*, *Guru Dravya* like milk etc.

Prakopa (The Stage of Aggravation)

If the appropriate measures are not taken during the first stage along with consistent indulgence in the faulty dietary and lifestyle factors, the accumulated *Dosha* gets more aggravated at their own sites and tends to move to other sites [12]. This *Prakopa* or aggravation of *Dosha* might occur instantaneously (*Achaya Prakopa*) or gradually (*Chaya Prakopa*) in accordance with the strength of the causative factor. It has been the most observable phenomenon that exposure to virulent toxins leads to immediate expression of signs and symptoms while non-virulent toxins lead to eventual manifestation of the disease. Many dietaries, psychological, behavioral, and temporal factors causing the aggravation of

Dosha have been narrated; the strength of the aggravation of *Dosha* will be determined by the indulgence in these factors [13].

Prasara (The Stage of Dissemination)

The aggravated *Doshas* get further aggravated, if appropriate measures are not taken and indulgence in faulty dietary and lifestyle habits are continued. In this stage, the aggravated *Dosha* start circulating with the help of *Vata* to the whole body through different *Srotas* (channels). These *Dosha* circulate differently in about fifteen manners due to the involvement of *VataDosha* i.e., individually, in amalgamation with one or two *Dosha* or *Rakta Dhatu*. An idiom of the process of fermentation has been given to explain this stage and has been compared with the phase when the fermented materials tend to move outward from the vessel [14]. The idiom of water flow in other areas due to the breaking of a bridge has been also portrayed, it shows that when *Dosha* is excessively aggravated, they leave their own place and gets mixed with the *Dosha* at other places. The aggravated *Dosha* in this stage produce abnormalities in the area depending upon where they reside i.e., either in whole body, half body or a particular part in a similar manner of rainfall do occurs on land with clouded sky and not in the area of the clear sky [15]. Again, if the *Dosha* is not too aggravated, they reside there without producing any pathology, but if encountered with favorable conditions, it results in the manifestation of the disease [16].

Signs and Symptoms Manifested During *Sanchaya*, *Prakopa* and *Prasara* Stage

The aggravated *Dosha* produces signs and symptoms in accordance with their degree of aggravation. During these stages, *Dosha* gets further progressively more aggravated and produces sign and symptoms at their own abode initially thereafter in the whole body. Table 1 shows the sign and symptoms manifested at these stages due to aggravation of *Vata*, *Pitta* and *Kapha* [17–19]. It can be seen that how the sign and symptoms of aggravated *Dosha* are getting more intense in additional stages as well as generalized rather than localized. These stages are the stages of *Dosha Vaishamyā*, which means till this stage the vitiated *Dosha* has not interacted with *Dhatu* and *Dosha-Dushya Sammurchhana* has not taken place. Thus, these three stages can be managed by adopting appropriate dietary and lifestyle habits to bring the vitiated *Dosha* in their normal stages.

***Sthanasanshraya* (The Stage of Localization)**

The aggravated *Dosha* start circulating to the

whole body through *Srotas* and gets localized to the site of *Khavaigunya* (structural or functional defect in *Srotas*) thus manifesting disease pertaining to that site [20]. For example, if *Dosha DushyaSammurchhana* occurs in *Udara*(abdominal region), it may produce symptoms pertaining to *Agnimandya* (diminished digestive strength), *Anaha* (distension of abdomen), *Visuchika* (dysentery), *Atisara* (diarrhea) but if occurs in *Basti* (bladder region) it produces symptoms pertaining to *Prameha* (genitourinary disorder), *Ashmari* (renal stones), *Mutraghata* (urinary disorders), *Mutravikara* (urinary tract related disorders) etc. [21]. This stage signifies the onset of *Vikaravastha* or *Vyadhiavastha* (specific disease) due to *Dosha Dushya Sammurchhana*. This stage also signifies the importance of abnormalities at the level of *Dushya*, without which there will be no *Dosha-Dushya Sammurchhana* and thus pathogenesis of disease will not occur. This stage also represents the prodromal phase of the disease [4].

***Vyakti* (The Stage of Manifestation)**

The *Dosha Dushya Sammurchhana* occurred during the *Sthanasanshraya Avastha* gets more progressive, producing the clinical signs and symptoms of diseases. The sign and symptoms of a disease can be categorized as general and cardinal. The general sign and symptoms are produced at the stage of *Sthanasanshraya* while the cardinal is expressed in this stage [22]. For example:- increased body temperature is observed in *Jwara*, excessive watery stool in *Atisara*, and abnormal enlargement of the abdomen in *Udara Roga* [23].

***Bheda* (The Stage of Complication)**

This is the last stage of *Shatkriyakala*. It is the most advanced stage in course of the pathogenesis of the disease. In this stage, the disease is full fledged and develops various forms of complications and disabilities. The changes occurred during this stage are irreversible thus diseases become sub-acute and chronic or incurable in nature depending upon the intensity of *Hetu*, signs and symptoms produced, *Kala Bala* and *Prakriti* of the person etc. [24].

Understanding of *Shatkriyakala* in Light of Contemporary Science

The stages of *Shatkriyakala* are the consecutive stages of the pathogenesis of the disease. Thus, the pathogenesis of various diseases in contemporary science can be understood in accordance with *Shatkriyakala*. This approach will not only facilitate an easy understanding of *Kriyakala* but also will be helpful in planning the line of treatment, and selection of drugs in the various stages of *Kriyakala*. An

Table 1: Sign and Symptoms Manifested During *Sanchaya*, *Prakopa* and *Prasara* Stage

	<i>Vata</i>	<i>Pitta</i>	<i>Kapha</i>
<i>Sanchaya</i>	<i>Stabdhapoorna Koshtata</i> (stiffness and fullness in abdomen)	<i>Pitavabhasata</i> (yellowish discoloration)	<i>Mandoshmata</i> (low body temperature) <i>Anganamgauravam</i> (heaviness of the body parts) <i>Aalasya</i> (lassitude)
<i>Prakopa</i>	<i>Koshtatoda Sancharan</i> (pricking pain and movement of <i>Vata</i> in abdominal region)	<i>Amlika</i> (sour eructation) <i>Paridaha</i> (burning sensation) <i>Pipasa</i> (excessive thirst)	<i>Annadvesha</i> (aversion to food) <i>Hridyotkleda</i> (excessive salivation in mouth)
<i>Prasara</i>	<i>Vimargagamana</i> (regurgitation) <i>Aatopa</i> (flatulence and gurgling)	<i>Osha</i> (burning sensation accompanied with sweating and restlessness) <i>Chosha</i> (painful sucking sensation) <i>Paridaha</i> (burning sensation) <i>Dhumayana</i> (feeling of movement of hot fumes inside head, neck, throat and palate)	<i>Arochaka</i> (anorexia) <i>Avipaka</i> (indigestion) <i>Angasada</i> (inertness of the limb) <i>Chhardi</i> (vomiting)

attempt has been made to explain the concept of *Shatkriyakala* by citing an example of the pathogenesis of type 2 diabetes mellitus.

Diabetes mellitus is the most common metabolic disorder, manifested either due to defective insulin production or the inability of insulin-sensitive cells to give a response. In the year 2019, approximately 463 million people were suffering from diabetes mellitus worldwide, which was 9.2% of the total population. By the year 2030, this number has been estimated to increase to 578 million, representing 10.2% of the total world adult population and further increase to 700 million by the year 2045, which represents 10.9% of the total world adult population [25].

This disease is resultant of complex interaction of multiple factors such as genetic predisposition, sedentary lifestyle, age, obesity, endocrinal factors, dysbiosis etc. It can be classified into four types, type 1 diabetes mellitus (T1DM), type 2 diabetes mellitus (T2DM), gestational diabetes mellitus (GDM), and diabetes caused or associated with certain specific conditions [26]. Among these type 2 diabetes

mellitus or non-insulin dependent diabetes mellitus is most common and accounts for approximately 90-95% of total diabetes cases. This condition is marked by a disturbed homeostatic mechanism to maintain the blood glucose level thus resulting in hyperglycemia. T2DM is characterized by insulin resistance and beta-cell dysfunction. Initially, the compensatory increase in insulin secretion maintains glucose levels in the normal range, but with the progression of the disease, insulin secretion is unable to maintain glucose homeostasis, producing hyperglycemia [27]. The insulin resistance leads to enhanced lipolysis in liver cells resulting in increased free fatty acid concentration which further enhances insulin resistance in liver and muscle cells. The sustained condition of hyperglycemia further leads to many complications like atherosclerosis, cardiovascular risk factors, nephropathy, neuropathy, retinopathy, diabetic ketoacidosis, hyperosmolar hyperglycemia, etc. [28]. The pathophysiology of type 2 diabetes mellitus can be explained in view of *Shatakriyakala*. This explanation can be helpful in the planning of treatment protocol as well as in making this topic more understandable

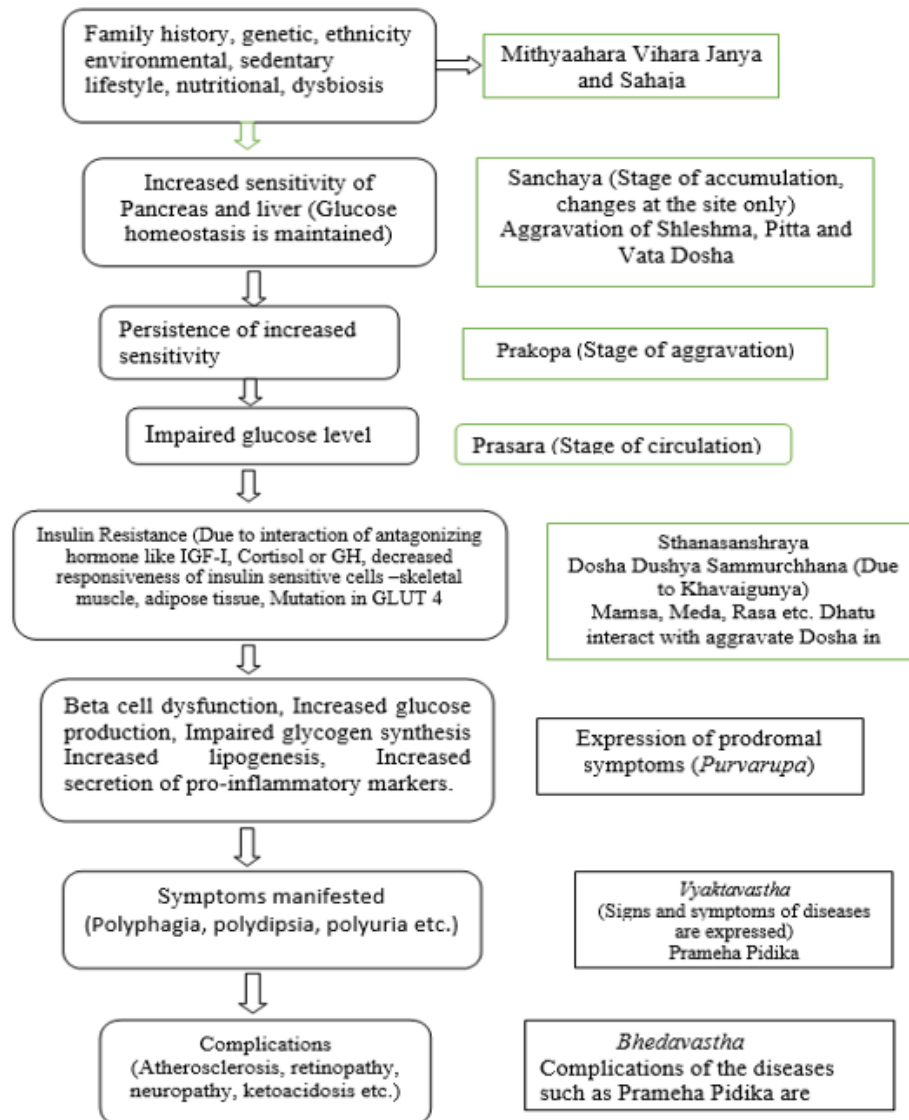


Figure 1: Pathogenesis of Type II DM in Light of Ayurveda Concept of Shatkriyakala

for the undergraduate and postgraduate scholars of Ayurveda.

The different predisposing factors mentioned can be categorized as *Mithyaaharavihara Janya* (such as sedentary lifestyle and dietary factors) and *Sahaja* or *Beejopaghatajanya* (genetic and family history). These factors have been considered as the leading cause for the onset of diabetes mellitus in contemporary science too.

The initial three phases i.e., *Sanchaya*, *Prakopa* and *Prasara*, when the sign and symptoms are not expressed can be understood with increased sensitivity of beta cells of pancreas resulting in impaired glucose level.

In these three states, there is *Agnivaishamy* and *Doshavaishamy*, thus the pathology can be reversed by correcting modifiable factors such as sedentary lifestyle and dietary factors. Further, in the stage

of *Stanasanshraya*, *Doshya Dushya Sammurchhana* takes place due to *Khavaigunya* in *Srotas* (anatomical and functional defect at the level of tissue, channels or receptor) and prodromal symptoms are expressed. The insulin resistance is developed either due to decreased sensitivity of insulin sensitive cells such as liver, skeletal muscle, adipose tissue due to mutation in glucose transporters 2 (GLUT 2) or due to presence of antagonizing hormone such as growth hormone, IGF-1, cortisol etc. The *Khavaigunya* can be related to mutation in GLUT 2 and beta cell dysfunction. The interaction between antagonizing hormone and insulin causing decreased sensitivity of tissue for insulin can be related to *Doshya Dushya Sammurchhana*. Further in *Vyaktavastha*, the sign and symptoms of the diseases are produced, thus in this stage the sign and symptoms of diabetes mellitus are manifested. The stage of *Bhedavastha* is marked by the manifestation of different complica-

tions such as cardiovascular risk factors, nephropathy, retinopathy, neuropathy, diabetic ketoacidosis, hyperosmolar hyperglycemia, etc. This has been further demonstrated in Figure 1.

CONCLUSION

Shatkriyakala provides an equal opportunity to halt the process of disease at each of its stage. Thus, the knowledge of *Kriyakala* is highly beneficial with respect to disease control and its prevention. Thus, treatment modalities of many lifestyle disorders like Hypertension, DM, and Obesity etc. according to different stages of *Shatkriyakala* should be done for the prevention along with the adoption of healthy dietary and lifestyle habits. This principle was also encouraged by Acharya *Charaka* who also emphasized that one should take care of one's own health by neglecting all other things because body is an important entity above all things. Thus, *Shatkriyakala* proves to be extremely helpful for public health professionals who are interested to check the disease progress in the community and also for the physician to halt the disease progress of an individual. *Shatkriyakala* serves as an important tool for knowing the prognosis of the disease.

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Conflict of Interest

The authors declare that there is no conflict of interest.

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