Conceptual Study of Shatkriyakala w.s.r to Cell Injury

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ABSTRACT
Health may be defined as the ability to adapt and manage physical, mental and social challenges throughout life¹⁵. Ayurveda is mainly concerned with preventive aspect of health. The goals of medicine are to promote health, to preserve health, to restore health when it is impaired and to minimize suffering and distress¹⁴. In Ayurveda, aetiopathogenesis of disease i.e progression of disease is explained in six stages termed as shatkriyakal and those are Sanchaya, Prakopa, Prasara, Sthanasamshraya, Vyakat, Bheda. A clear understanding about the stages of Kriyakala is an essential factor for early diagnosis, prognosis and for adopting preventing and curative measurement. Sanchaya and the other five stages develop one after the other successively and become stage of evolution of disease process known as Rogasamprapti (pathogenesis). During these stages the Doshas gets aggravated, brings about abnormalities in Doshas, Dhatus, Malas and Ojas. The number and severity of the symptoms and the curability or incurability of the disease depends upon severity of such vitiation. So in present era Shatkriyakala can be understood as cellular injury, which is the common representation in almost all the diseases. Cell injury is defined as an alteration in cell structures or biochemical functioning resulting from stress that exceeds the ability of the cell to compensate through normal physiological adaptive mechanism². Hence a great emphasis has been laid on a clear understanding of these six progressive stages of disease.

KEYWORDS
Shatkriyakal, Cell injury
INTRODUCTION

When the vital energies of human body are imbalanced with physical makeup for a longer period, there is an origin and spread of disease. The disease begins in the smaller form and then progresses, thus disease is demonstrated in different stages and these steps are called as Kriyakala. The disease being deep rooted decreases the Bala (strength) and Ayu (life span) of a person.

The concept of Kriyakala describes the mode and stages of development of a disease, a very good understanding of a disease and its prognosis is essential for preventive and curative measures.

Acharya Sushruta in Sutra Sthana Vranaprashna adhyaya has enumerated these Shatkriyakala as Sanchya, Prakopa, Prasara, Sthana Samshraya, Vyakta, Bheda and has beautifully furnished the details of each.

1. Sanchaya
Accumulation of Dosha in its own Sthana and Dosha Vriddhi occurs in both qualitative and quantitative manner. This is the first stage for commencement of treatment.

2. Prakopa
Expansion of Dosha in Vilayana (liquid form).

Accumulated Vatadi Dosha start moving to the other sites from their own places but doesn’t spread in all body parts.

3. Prasara
The word Prasara means to spread. In this stage aggrevated Dosha are in the state of spreading, the Dosha are spreaded to other parts of body by a means of any Srotas.

4. Sthana Samshraya
The aggrevated Dosha’s goes on spreading in the body through Srotas and once such excited Dosha gets obstructed at any part of the body, will produce disease respective to the body parts.

5. Vyakta
Stage of manifestation of fully developed disease and it is represented by its characteristic symptoms.

6. Bheda
Stage of differentiation, specific sign and symptoms are observed in this stage.

Cells are the basic structural and functional unit of any living thing, which combines to form tissues and in turn organs and organ system in human body. In health, the cell remain in accord with each other. In 1859 Virchow first published cellular theory of disease, bringing in the concept that disease occurs due to abnormalities at cellular level.

Most forms of disease begin with cell injury followed by consequent loss of cellular function.
Cell injury is defined as variety of stress, a cell encounters as a result of changes in internal and external environment\(^\text{10}\). The cause can be any like physical, chemical, infectious biological, nutritional, immunological and idiopathic factors\(^\text{10}\). The goals of *Ayurveda* are to promote health, to preserve health to restore health when it is impaired and to minimize suffering and distress. Hence a good understanding of *Kriyakala* is very essential for preventive and curative measurements.

**MATERIALS AND METHODS**

**Sources of data**
- Relevant *Ayurvedic* text book
- Various national and international journals
- Modern Medical books.

**Method**
A review article on *shatkriyakala* and its correlation with cell injury for an easy understanding of pathogenesis and diagnosis of a disease from a minutest level of its origin.

**DISCUSSION**

Cell injury is defined as the effect of variety of stress due to etiologic agents a cell encounters resulting in changes in its internal and external environment\(^\text{2}\). The cellular response to stress may vary and depend upon following two variables:
- Host factor i.e the type of cell and tissue involved.
- Factors pertaining to injurious agent i.e extent and type of cell injury\(^\text{2}\).

In *Ayurveda* aetiologypathology of disease i.e progression of disease is explained in six stages termed as *Shatkriyakal* and those are *Sanchaya*, *Prakopa*, *Prasara*, *Sthanasamshraya*, *Vyakat* & *Bheda*. A detailed study on *Kriyakala* is very essential for early diagnosis, prognosis and for adopting preventing and curative measurement.

**Sanchaya** (Stage of accumulation)

First stage of *Kriyakala* is known as *Sanchaya* which means collection or putting together i.e. the accumulation of *Dosha* due to various *Nidana* or causative factors. In this stage, *Doshas* get accumulated but they do not leave their own place and this state of *Dosha* is known a *Sanchaya*. In *Vata Sanchaya* *Stabdhpurnakoshtha* (fullness of abdomen), in *Pitta Sanchaya* *Mandoshmata* (decreased digestive fire), *Pita-Avabhasata* (yellowish discoloration) and in *Kapha Sanchaya*—*Gaurava* (heaviness), *Alasya* (laziness) are observed. *Samhati- Rupa Vridhdi* (gradual
accumulation) of Dosha in respective places is seen in the first stage of Shatkriyakal\(^1\). Foremost stage for the commencement of disease. When there is increased functional demand, the cell may adapt to the changes which are expressed morphologically and then revert back to normal after the stress is removed (cellular adaptation)\(^2\). For the sake of survival on the exposure to stress, the cell make adjustments with changes in their environment (i.e adapt) to the physiological needs (physiological adaptation) and to non-lethal pathological injuries (pathological adaptation), an such adaptation occur by following processes those are\(^2\):

- Decreasing or increasing their size i.e atrophy and hypertrophy respectively, or by increasing their number i.e. hyperplasia.
- Changing the pathway of phenotypic differentiation of cells i.e metaplasia and dysplasia\(^2\).

In general, the adaptive response are reversible on withdrawal of stimulus\(^2\).

Normal cell  
\[ \text{Altered functional Demand} \]
\[ \text{Adaptation} \]
- Atrophy, hypertrophy, hyperplasia  
- metaplasia, dysplasia  
\[ \text{Stress removed} \]
\[ \text{Normal cell restored} \]

**Prakopa** (Stage of aggravation)

This is the second stage of Kriyakala i.e stage of Vilayan Rupa Vriddhhi of Dosha means the expansion of Dosha in Vilayana form. This Prakopit Dosha will exhibit its particular Lakshana’s and the probability of disease manifestation (Rogautpatti) will increase\(^{13}\).

When the Doshas are in Sanchaya condition, if Nidana intake persists, Dosha Prakopa stage follows. Prakopa stage is limited to the state of readiness of Dosha to move from its own place. This means that Dosha increases in quantity and is ready to move. Specific symptoms and signs are seen in this stage such as Koshtha- Toda (pricking kind of pain in abdomen), Sancharana (gurgling sounds in abdomen) of Vayu in Koshtha in Vata Prakopa. Amlika(sour belching), Pipasa (thirst), Paridah(burning sensation) in Pitta prakopa and Annadvesha(aversion to food), Hridayotklesh (nausea) in Kapha Prakopa. Vilayan- Rupa Vriddhi of Doshas is observed in Prakopa stage as per Acharya Dalhana\(^{13}\).
Repair and healing
The residual effect of reversible cell injury may persist in the cell as evidence of cell injury at subcellular level (sub cellular changes) or metabolites may accumulates within the cell (intracellular accumulation). Intracellular accumulation of substances in abnormal amounts can occur within the cytoplasm (especially cytoplasm) or nucleus of the cell. This phenomenon is referred as infiltration, meaning thereby that something unusual has infiltrated the cell from outside which is not always the case. Intracellular accumulation of the substance in mild degree causes reversible cell injury while more severe damage results in irreversible cell injury.

Prasara
It is the third stage of Kriyakala. If Nidana-Sevan (indulgence in causes of disease) is continued and Prakopavastha is not encountered, the dosha will move to the stage of prasara. In Prakopa state, Doshas get excited and are ready to move, whereas in Prasara they overflow or spread or will move to other parts of the body. Prasara of Doshas is of fifteen types including prasara of Rakta. Here it is important to note that the Acharya Sushruta has given weight age to Rakta, equivalent to Doshas viz Vata, Pitta and Kapha. It may be because of his association with school of surgery. But, he has discussed the symptoms of Prasara-Avastha, according to the Doshas only. In the Vata PrasaraVimargagamana, Atopa, in Pitta prasaraavastha Osha, Chosha, Paridah, Dhumayan and in Kapha prasaraavastha- Arochaka, Avipaka, Angasada, Chardi are observed. Heto, Linga chikitsa of dosha is advised up to Prasara –Avastha, after which Vyadhichikitsa is followed.

Pathogenesis of cell injury
Common underlying mechanism, following are the intracellular biochemical phenomenon underlie all forms of cell injury:
- Mitochondrial damage
- Cell membrane damage disturbing the metabolic and transmembrane exchanges
- Release of toxic free radicals.

Sthana samshraya(Stage of disease relocation or augmentation)
Localisation of Doshas which are aggrevated and spreading out, now become localize at certain places and produce disease in such places. The agitated Doshas spread to different places and struck some where because of obstruction in Srotas due to abnormality (kha vaigunya) in Srotas. The aggrevated and expanded Doshas, thus firmly take shelter in the different parts of the body, exhibit the premonitory symptoms of disease.
For example when they become localized in the abdomen, they produce tumors of the abdomen, abscess, enlargement of the abdomen, gastroenteritis diarrhea and such other diseases.

When localized in the urinary bladder, produces diabetes, urinary calculus, retention of urine etc.

_Purvarupa_ produced (premonitory symptoms of disease) gets produced. This stage of appearance of premonitory symptoms is 4th _Kriyakala_. In this stage treatment should be employed to correct _Dosha Dushya_ or both. This is the stage which can invite some degenerative disorders or infective diseases.

Biochemical and molecular changes underlying cell injury from various agents become apparent first, and are associated with appearance of ultra structural changes in the injured cell. However eventually gross and light microscopic changed in morphology of cell appears²,⁴.

**Concept of Sthana Samshraya and Kha Vaigunya**

a) Fatty changes (steatosis)/fatty metamorphosis

The accumulated intracellular lipid neutral fat within parenchyma cell, wherever gets a proper place to reside (i.e khavaigunya) will stop and will do the manifestation in that tissue, organs results in a specific sign and symptoms of a particular disease.

Eg: _Sthana Samshray_ – lipid/fat

_Kha Vaigunya_ - liver

_Vyakt_ - fatty changes in the liver , depending on the intensity of the damage.

_Bheda-_ the complication which will arrive if treatment is given properly.

b) Cholestrol deposit

_Sthana Samshraya_ of – cholestrol (may be due to hypercholesterolaemia)

_Kha Vaigunya_ - macrophage

_Vyakta_ - macrophages turned into foam cells

Eg . Fibro fatty plaque (atherosclerosis)

Clusters of foam cells in tumor like masses like xanthomas and xanthelasma.

c) Accumulation of protein

_Sthana samshraya_ of – protein in the cytoplasm of cell

_Kha vaigunya_ - in renal tubules

_Vyakta_ - in proteinurea, there is excessive renal tubular reabsorption of protein by the proximal tubular epithelial cells.

d) Accumulation of glycogen

Excessive accumulation of intracellular glucogen

_Kha Vaigunya_ intra cellular accumulation of glycogen in different tissues because cellular uptake of glucose impaires².

Places of deposition

- Epithelium of distal potion of PCT
- Descending loop of henle
- Hepatocytes
- B cells of pancreatic islets
- Cardiac muscles².

**Vyakta** (which can be visualized)/ (stage of symptoms manifestation)

The progression of disease overpowers the capability of the human body to maintain homeostasis and immunity. At this juncture, structural and functional dysfunction progress to such an extent where the illness has actually started. It is clear manifestation of the symptoms in disease like swelling, malignant, tumor, benign tumor, in fever, diarrhea and many other internal diseases. In this stage **Vyadhi Prayatnika Chikitsa** may be adopted. Eventually cell injury affects cellular function adversely which has bearing on the body. Consequently, clinical features in the form of symptoms and sign would appear. Further course or prognosis will depend upon the response to the treatment versus the biological behavior of the disease². In this stage **Vyadhipratanika Chikitsa** may be adopted.

**Bheda** (stage of updrava or complication)

This stage is a last stage of **Shatkriyakal**, characterized by severe depletion of the tissue function, serious depletion to the channels of circulation or **srotas**, and the **updrava** which involves the related tissue¹⁷. This is the stage of bursting / tearing of the swelling and formation of the wound and disease such as fever, diarrhea etc. becoming chronic. If the disease are not treated in this stage they will become Incurable.

Complication stage in **medicine**, is an unfavorable evolution or consequence of a disease, a **health** condition or a therapy. The disease can become worse in its severity or show a higher number of signs, **symptoms** or, new **pathological** changes, become widespread throughout the body or affect other organ systems. A new disease may also appear as a complication to a previous existing disease¹⁸.

The cellular response to an injurious stimulus depends on the severity, duration and nature of the injury. To explain this, if a small amount of a toxin is injected into an individual, the cells may be injured and undergo reversible injury, but since the toxin levels are low, the cell is able to recover once the toxin is cleared away. If the levels of toxins persist at a very high level, the cells will undergo very critical injuries, and may eventually die, resulting in irreversible cell injury and cell death¹⁰.

**CONCLUSION**

In the manifestation of disease it is necessary to rely upon the **Shatkriyakala**, if we are able to understand the concept of **Shatkriyakala** properly the pathology can
be judged and in its initial stage only it can be treated easily. Though Acharya Sushruta has mentioned Kriyakala in Vranaprashniya Adhyaya in respect with Vrana Shopha and Vrana, but it has to be understood as the universal phenomenon. Hence I have tried to set a correlation between the Shatriyakal and cell injury for a better understanding of a pathogenesis of a disease and also about its early diagnosis, prognosis, and for adopting prevention and curative measurement.
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