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Invited Article

### SHATKRIYAKALA - A MODERN PERSPECTIVE.

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Acharya Sushruta has described the concept of Kriyakala which seeks to explain the incidence of vranas, in terms of dosha disturbances. Vrana in modern parlance may be described as inflammatory processes, which may lead on to suppuration and ulceration. The inflammatory processes are stated to follow a distinct pattern of evolutive phases which are described as Kriyakala.

Sanchaya, Prakopa, Prasara, Sthanasanshraya, Vyakti and Bheda are the six kriyakala. All the diseases undergo this process of evolutionary changes. The utility of the same may be understood in context of fever.

**Sanchaya:** It is the inceptive phase of disease when dosha are stated to have accumulated and stagnated in its own place. In case of fever it is the pyrogen which may be exogenous (bacterial substance lipopolysaccharide (LPS) present on bacterial cell wall) or endogenous (cytokines, Interleukin-1 and Interleukin-6 etc). These pyrogens enter the body and activate the immune cells (antigen presenting cell) for the formation of cytokines and other factors or due to endogenous cause too activation of immune system takes place.

**Prakopa:** It is phase wherein accumulated and stagnated dosha tend to become swollen and excited in its own place. Exogenous factors contain immunological protein called lipo-polysaccharide binding protein (LBP) which binds to LPS. The LBP-LPS complex then binds to the CD14 receptors of a nearby macrophage. It causes synthesis and release of various endogenous cytokines factors such as IL-1, IL-6, Tumour Necrosing Factor alpha (TNF $\alpha$ ).

**Prasara:** It means to spread which generally takes place with help of vata and rakta. The excited and swollen dosha are stated to spread over and extend to other parts of the body. These cytokine factors are released into general circulation, where they migrate to the circumventricular organs of the brain due to easier absorption caused by the blood-brain barrier's reduced filtration action there. The cytokine factors then bind with endothelial receptors on vessel walls, or interact with local microglial cells. When these cytokine factors bind, the arachidonic acid pathway is then activated. Prostaglandin E2 (PGE2) is released which is mediated by the enzymes phospholipase A2 (PLA2), cyclooxygenase-2 (COX-2), and prostaglandin E2 synthase.

**Sthanasansraya:** It is prodromal phase or the phase of purvarupa wherein disease is yet to be manifested fully. The excited dosha having extended to other parts of the body become localized and it marks the beginning of specific diseases pertaining to those sthan/ structures. PGE2 is the ultimate mediator of the febrile response. PGE2 acts on neurons in the preoptic area (POA) through the prostaglandin E receptor 3 (EP3). EP3-expressing neurons in the POA innervate the dorsomedial hypothalamus (DMH), the rostral raphe pallidus nucleus in the medulla oblongata (rRPa), and the paraventricular nucleus (PVN) of the hypothalamus. Fever signals sent to the DMH and rRPa lead to stimulation of the sympathetic output system, which evokes non-shivering thermogenesis to produce body heat and skin vasoconstriction to decrease heat loss from the body surface. It is presumed that the innervation

from the POA to the PVN mediates the neuroendocrine effects of fever through the pathway involving pituitary gland and various endocrine organs.

**Vyakti:** This stage may be stated to be that of manifestation of the fully developed disease- the resultant dosha dushya samurchana. In case of fever the brain ultimately orchestrates heat effector mechanisms via the autonomic nervous system. It causes increased heat production by increased muscle tone, shivering and hormones like epinephrine (adrenaline) and also prevents heat loss by way of vasoconstriction.

**Bheda:** It is the stage in which the disease may become sub-acute and chronic or incurable. Different types or variant of disease gets manifested. Signs like increased blood pressure, neck stiffness, headache, giddiness, unconsciousness etc are seen in this phase.

The utility of this shatkriyakala is to enable the treating physician to recognize the disturbances in its early formative stages and to enable to take necessary steps in time, to correct and eliminate the offending factors before they have caused sufficient damage.

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