

Hypothesis of Neural Information Flow about Acupuncture

Ling Yin, xianglan Jin, Tong Li

Acupuncture, originated in China more than 3000 years ago, is an important component of Traditional Chinese Medicine and possesses a long-standing history of development. In the ancient medicine, it was originally used as an important approach for medical treatment, and later on gradually developed into a special subject with rich therapeutic experiences and profound theoretical knowledge, including multiple therapeutics such as Hao needle puncturing, moxibustion, electroAcupuncture, cupping therapeutics, etc. At the present time, Acupuncture therapeutics are used widely as treatment modalities for various clinical disorders. They are gaining widespread popularity and professional acceptance in the modern (Allopathic) medicine centres, as well as an alternative and complementary treatment for various conditions. However, the therapeutic mechanism still remains unclear, leading to its limited use in some western countries.

A great deal of ancient literature showed that the Meridian Doctrine, known as the theoretical core of Acupuncture Science, laid the theoretical foundation of Acupuncture development. Therefore most scientific research focused on the Meridian to find its characteristic and related substructure, by means of physical, chemical, optical, thermotical, electrical, and molecular biological methods. This yielded lots of experimental evidence on Acupuncture and Meridian. For example, it was found in CB-HRP and PET tracer studies that tracing signals of Acupuncture could convey upward and downward along Meridian “channels”, or pathways. Hence,

most researchers presumed the afference and efference of Acupuncture information are related to the Meridian system, but there was still no satisfactory answer for its essence. It was also found that the effect of Acupuncture disappeared when the nerve proximal to the acupoint was interrupted by a medicinal or physical method. It is thus clear that the afference of Acupuncture information -- at least parts of it -- depends on the peripheral nerve.

Much progress has been made in elucidating the mechanisms by which the Acupuncture stimulation could lead to: a) changed levels of some neurotransmitters or modulators and their receptors in the brain; b) changed levels of various enzyme proteins in intracellular signaling pathways; and c) the changed gene expressions of enkephalin or endorphin, etc. The different neurotransmitters or modulators had different biological activities and regulatory action on the related neurons, indicating that the Central Nervous System (primarily, Brain) plays an important role in the Acupuncture action mechanism. However, these researches were only able to observe the Acupuncture-induced change of some substance in some region. They were not able to combine together the changed functions in various cerebral areas, in order to find the intrinsic regulatory mechanisms and pathways from the interrelation between the local and the whole activities.

Our fMRI and PET studies showed that Stimulation of acupoint ST36 resulted in significantly increased glucose metabolism in in the left precentral and postcentral gyru, superior and middle temporal gyru, cerebellum and hypothalamus, right medial and superior frontal gyru, while decreased in the right inferior frontal, middle

occipital and temporal gyru, cingulate gyrus and cerebellum, left middle occipital gyrus, precuneus, cerebellum and lentiform nucleus. This set of areas was mostly in good agreement with early observations made by fMRI and PET experiments. This study shows the first evidence of brain metabolic modulation by Acupuncture in Human subjects. Acupuncturing ST36 seems to increase glucose metabolism in pain related Brain regions. Metabolic changes are also seen in different parts of the Autonomic Nervous System, which is correlated to gastric function. This method may provide more direct insights into the therapeutic mechanism of Acupuncture in Traditional Chinese Medicine (TCM).

According to the comprehensive analysis on the previous Acupuncture research findings, we advanced a “Hypothesis of Neural Information Flow” in 2001, meaning that: “Acupuncture signal transmits via the neural afferent pathway, and its sensing, analyzing, processing and integrating are localized at the related neurons of the Central Nervous System (Brain and Spinal Cord). Finally, the integrated signals were sent out to act on the target organs through the efferent nerve and neural-endocrine mechanism to deliver regulatory and therapeutic effects.”