MAJ. GEN. S. L. BHATIA ORATION:

ACUPUNCTURE AND NEUROPHYSIOLOGY OF PAIN*

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Mr. Chairman, ladies and gentlemen, it is my coveted privilege today to rise and pay my homage in profound humbleness to Major General S.L. Bhatia in whose honour, I deliver this, the first oration to the XXII Annual Conference of the Association of Physiologists and Pharmacologists of India. The personality of this greatman symbolises a cultural ethos of extraordinary synthesis. He combines in himself the triple attributes of a scientist, a sage and a savant. As a sceintist his contributions to research, medical education and health problems are nationally and internationally well recognized. As a sage and a savant, one has to see him to realize what adorable radiance emanates from his gentle graciousness born of a superb moral and humane substratum of his constitution. It is no wonder therefore, that whatever he undertook to do, his performance won unqualified approbation and applause. His services to armed forces brought him rare honours. His participation in problems of medical education and that of health in general brought for him laurels from universities and the government both central and of several states. The list of his achievements and the awards conferred on him are far too many to present during the limited time at my disposal. A.V. Hill who taught him at Cambridge remarks in a forward to one of General Bhatia's books that in him i.e. General S.L. Bhatia, he found a true disciple of Hippocrates in conforming to the letter and spirit of the idealistic oath in reference to the pupil and teacher relationship. The oath enunciates "To reckon him, who taught me this art, equally dear to me as my parents, to share my substance with him and to relieve his necessities if so required". A.V. Hill continues "Two years ago, I gave a lecture to medical audience in Karachi. In it, amongst many other names, I mentioned that of Professor alias Major General Bhatia. Unexpectedly to my great pleasure his name drew a long and enthusiastic applause. At the Grant Medical College, Bombay, and on the Indian Medical Service, he had been the teacher or inspiring leader, of many of them".

I bow in admiration to this great man.

Ladies and gentlemen, I feel extremely grateful to the Association of Physiologists and Pharmacologists of India to confer on me the prestigious award to deliver the first Major General S.L. Bhatia oration. The first oration like the first born has its hazards, trials and tribulations.

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I crave your indulgence if in taking the initiative to speak before you, I fail to fulfill high expectations.

General Bhatia's abiding interest has been in the history of the growth of physiology over the millennia; a history which has been dynamic, creative and progressive and not history as it quite often is, a sequence of events in time and space, dead, burried and past. The topic of this oration is "Acupuncture and Neurophysiology of Pain" which has in it a trail of history and physiology as well. I hope and trust that the choice of this subject has your approbation.

Acupuncture is derived from the two Latin words acus = needle and punctura = puncture. It is an ancient method in the art of healing to relieve suffering and pain by puncturing the skin at an appropriate point. Acupuncture can as well be called a medical tradition dating back to the limbo of the past. Most of the historians agree that written documents on acupuncture have been first traced in China, although some authors believe that the origin of this treatment may have been in India during the time of Budha himself (12).

In China, however it is well substantiated that "The three Emperors temple' where people even now pray for the boon of good health is dedicated to Fie Hsi, Shen Nung and Huang Ti, the royalty which reigned about 3,322 B.C. (Choh-Luh Li (4). Although the Emperor Fu Hsi first promulgated the concept of Pa Kua or Yin and Yang life energies and concieved the idea of using needle made of a sharp stone to puncture skin to cure maladies, acupuncture as method of treatment was legally approved by the state during the reign of the Emperor Huang Ti popularly known as the Yellow Emperor. In one of Chinese classics going back to 2600 B.C. it is written:—

"Huang Ti speaks to Chi po (a physician and minister) I, who am chief of a great people and who should receive taxes from them, find myself afflicted by not being able to collect them because my people are sick. I desire therefore, that the employment of remedies ceases and that only needles be used. I order that this method be transmitted to all future generations and that the laws concerning it be clealy defined so that it will be easy to practice it, hard to forget it and will not be abandoned in future. Besides this, the actual modalities are to be accurately observed so that the way to research will be opened"(2). Empirical till that time, acupuncture took the rank of science only after the royal declaration. During this time i.e. about 2600 B.C., the significance of pulse abnormalities, their relation to meridians (Ching 10) and localization of disease in internal organs was hypothesized. During the reign of Shang Dynasty (1558 B.C.) the emphasis was laid on the improvement of the acupuncture needle. The sharpened stone was replaced by bamboo sticks, procellan and finally metal needles. Depending upon the shape and size of the needle, 9 varieties came into use e.g. Ch'an Chen Chisel needle, Shih Chen spoon needle, Yuan Chen round needle, Feng Chen lace needle, Pi Chen stilleto needle, Yuan Chen sharp round needle Hao Chen soft hair needle, Chang Chen long needle, and Ho Chin fire needle.

The method of use of these needles depended upon the state of abnormality of Yin and Yang. It may be quick insertion and quick removal, slow insertion followed by massage and

twisting clockwise or anticlockwise. The number of needles used at a time also varied from 1 to 42. The needle was inserted at the hoku point and such points were as many as 365 in 12 meridians. During the period when Chou Dynasty came into power (1122-403 BC) the medical profession was properly organized and books were written to expound further the theory of Pa Kua (Yin and Yang) Eight pulses and unusual meridians were also described.

Royal School of Acupuncture was established by the Emperor Hsilian Tsang about 618-960 A.D. when Tang dynasty came into power. During the period between 960-1280 AD, Wei Teh one of the emperors of Sung Dynasty ordered the construction of a bronze statue, on which all the meridians and acupuncture points were accurately depicted. This statue remains famous even today for all references, regarding the site of meridians and the acupuncture points on them. Dating from this epoch there has been many trelaties written to establish relation between 12 meridians (Ching 10) and the organs categorized as "Tsang" and 'Fu, viscera. The former consisted of heart, liver, spleen, lung and kidneys i.e. solid organs, and the latter of stomach, gall bladder, large intestine, small intestine and urinary bladder i.e. hollow organs and the function known as triheater (digestive, respiratory and sex organs). To these eleven functions, the twelfth called heart constrictor was added later on.

Anatomical dissections began in China in the years from 1102 to 1106 A.D. This revealed that the meridians had no morphological structure. During this period also the laws of cauterization were stated exactly and moxibustion became a technique in-separable from acupuncture. Today this theory on which nearly sixteen generations have laboured, has spread to all oriental and western countries of Europe and America.

The physician named Jafku in about 250 B.C. brought acupuncture to Japan. To Europe, it was brought by a German Botanist, Physician and traveller by the name of Engelbert Kampfer (1651-1716) and by the Dutch Surgeon Ten-Rhyne who learnt the method whilst in Japan. During the last two decades, a large amount of experimental work on animals and man by trained personnel has gone into giving scientific bias to this ancient therapy at medical centres in Peking, Canton and Shanghai.

The development of acupuncture in China has been deeply embedded in the oriental philosophy concerning the balance in the universe of the antagonistic forces of Yin and Yang. That the old Chinese philosphers were highly knowledgeable regarding the cosmos is clearly brought out in the "Chinese Oracle bone" which depicts human endeavour to travel in space to study and reach the various planets by extraterresterial and interplanetary flights. It was a general belief amongst the ancient physicians that these cosmic forces in the form of Yin and Yang in the living being had to be in balance to maintain normal health. It was further surmised that these opposing energies had a close dependence on the operation of the five elements i.e. Fire, Earth Metal, Water and Wood - some of which held functional sway on Yin and others on Yang viscera. These elements not only cosmic but were also part of the living system as well. These elements when they operate on each other harmoniously in normal sequence as fire on earth, earth on metal, metal on water and water on wood, disease is eliminated. If, however, they become destructive to one another, ill-health ensues because of disruption in the function of organs dependent on these elements. Thus

small intestine, heart, heart constrictor and triheater functions are upset if fire becomes destructive; spleen and stomach are deranged if earth shows aggression; lungs and colon are damaged if metal is malevolent; bladder and kidney suffer if water, and gallbladder and liver if wood begins to show abnormal influences.

Energy constituted by Yin and Yang has its primordial substratum in the elements. It is imbided from the cosmos by the living organisms through breathing and eating nutritive food. This Qi energy in the balanced Yin and Yang form which promotes health, keeps on flowing all the time in set sequence through the various internal organs for their normal functions. Its fluxes however, are well controlled according to the terresterial time. The flux remains in each organ for two hours starting with the lungs at midnight and moving through large intenstine, stomach, spleen, heart, small intestine, urinary bladder, kidney, heart constrictor, triple heater, gall bladder, liver and back in lung after 24 hours. Since each of these organs has its meridian, the flow and fluxes follow the path of these meridians. If the flow is obstructed in some meridian or if flow is deficient, the corresppnding organ shows symptoms in the form of pain or otherwise. Acupuncture at anadequate point on the proper meridian corrects the flow of the energy and relieves pain etc.Since the flow is according to a set time, the appearance of symptoms at a certain hour indicates the organ which is diseased.

Since the flow of energy is through the meridians a greater details about the meridians is very essential to understand the mechanism of maintenance of positive health or appearance of disease in the visceral component of the body.

Meridians are hypothetical channels through which Qi energy consisting of Yin and Yang flows to keep the organs functioning normally. There are several hypothesis stated regarding material constitution of these meridians. The Tibitan and Chinese medical and astronomical texts indicate that in addition to the three major circulatory systems i.e. blood, lymphatic and nerves-there is a fourth circulation system, matter-energy-light circulatory system which connects our life system to other levels of cosmic evolution (5). The work of Soviet investigators Mikhalevski and Frautov shows (quoted by Hurtak Locit) that photon energy follows the same meridian channels or acupoints as observed in Chinese acupuncture texts. James A. Hurtak in his paper on "The human system, an open-ended universe" quotes a sixteen century, Chinese acupuncture diagram which adumberates that the human physical system is basically an energy vehicle in which there are five bodies or vehicles of energy i.e. the physical system, the epikinetic body of motion, an electro-magnetic field, a combination of several cosmic energies and fields of these energies, and finally light synthesis and light experience mechanisms. All of these five modalities follow a certain meridian magnetic field relationship i.e. the physical system meridian pulling into the physical membrane all the energies of the next order of evolution.

More evidence of meridian system comes from Japanese medical texts of the seventeenth Century depicting various months of pregnancy during which the embryological development of the human organism is shaped by the magnetic field factors coming not only from the moon but from the various other magnetic fields surrounding the earth. These cosmic influences determine

the course and contours of meridians on the physical body particularly in reference to the visceral system of the body.

These conclusions were drawn from an extensive study of cosmic influences as judged from the Chinese bone oracle which depicts space travel techniques which necessarily also would have involved study of space cosmology and cosmic energies.

Originally there were 12 standard meridians described and two others have been subsequently added (10). Each meridian begins at the site of a visceral organ and is named after that organ. Hence there are five Tsang or Yang meridians of heart (Ht), liver (L), spleen (SP), Lungs (Lu), and kidneys (Ki) respectively and six Fu, Yin meridians of stomach (St), gall bladder (Gb), large intestine (Li), small intestine (Si), bladder (Bd), and triheater (combined digestive reproductive and respiratory sytems). Twelvth meridian is the heart constrictor (Hc). There are two other meridians the governer vessel and the conception vessel which do not represent any particular organ. The meridians are longitudinally running lines demarcated superficially under the skin between head end and the foot end of the body. They have on them acupoints which total from 365 to 1000 but the most important are only 50 or even less. Stimulation at these points produces what is called Qi echo or Qi phenomenon of soreness, swelling, heaviness and numbness. There is in addition a feeling of current flow in the direction of the meridian on which this point is situated. At these acupoints usually the skin resistance is considerably lower than the points around it. These points can be stimulated by a current of comparatively less voltage and ampearage. According to Chinese lore acupuncture needle used by insertion, withdrawal, rotation clockwise or anticlockwise at specific points potentiates the flow of blocked or reduced Qi energy & restores normal function of the organ. The circulation hours of Qi in various organs have already been described. To be most effective acupuncture must be done during the specified hour of flux in the specified organ to restore its normal function. The effect is further influenced by seasons and waxing and waning of the moon and other cosmic influences or dietery habits and general body fitness.

The maximum use of acupuncture is in relieving pain the most important symptom and most frequent too. The localization of meridian and therefore the organ which is diseased to produce symptoms of which pain and suffering are the most usual is done by studying the pulse. In Chinese system of medicine the palpation of pulse and making a diagnosis thereby is indication of the perfection of the art of medicine. It is said about the pulse examination that it does not only give the present state of health but tells also of the diseases of the past and predicts those which may appear in the future (8). It is important to feel the right and the left pulse at the wrist. It is done by puting three fingers and with each finger the pulse is felt is the segment under that finger by light and deep touch respectively. Thus there are six obervations on each side and total of twelve pulse are felt on both sides.

The best time to feel the pulse is at 3 a.m. when the Yin and Yang are comparatively at rest and the stomach is empty. The distal deep pulse felt at the left wrist is the heart pluse, the middle deep is the liver pulse, the proximal deep is the kidney pulse. The superficial pulses in the same order are small intestine, gall bladder and urinary bladder pulses respecitvely. On the right wrist

deep pulses in the same order are lung, spleen and circulation sex and superficially the large intestine, stomach and triple warmer. The deep pulses detect disorders of Yin organs and superficial pulses Yang organs. The pulses identify the organs diseased and so the meridians effected. The meridian gives the most effective acupuncture point to relieve pain and suffering.

The basic fundamental normal pulse has to be judged by experience taking into consideration the age and constitution of an individual. Comparing with the expected norm the pulse in its abnormality may be plethoric. All the pulses in an ensemble may be plethoric in which case all the twelve basic pulses beat too strongly and feel overful. This is known as the total plethora of Yin and Yang. All the superficial pulses alone may be plethoric. This indicates total plethora of Yang alone. If all the deep pulses are plethoric it means total plethora of Yin. All pulses deep or superficial on both sides may be weak. This indicates weakness of both Yin and Yang. Weakness of deep pulses or superficial pulses will correspondingly mean weakness of Yin and Yang respectively. If pulses on the right side are stronger than those of left there is excess of Yang. Converse is true of Yin when left pulses are strong. The plethoric or weak superficial or deep pulse also indicates the Yang or Yin state which reflects the quality of health and the meridian of the particular organ represented in the segment. Pulse is also said to inherit genetic characters. This is made use of when a person has lost an upper arm and the pulse of the arm is not available for palpation. If the pulse of any of his children is palpated in the arm right or left which is not available in the father, it will give the characters of the parents pulse. This becomes handy if an arm has been amputated or otherwise lost.

The extensive medical lore of the ancient Chinese in so far as Qi, meridians and pulse are concerned have recently attracted much attention of scientists so far as the effect of acupuncture is concerned in relieving pain. There are research centres in Peking, Canton, Shanghai in China and several centres dealing with neurophysiology in Japan, France, Russia and America which have taken up experimental studies of the subject of Acupuncture.

Publications of several workers in Chinese mainland research centres, are very informative. They have demonstrated that needle acupuncture or electrical stimulation at certain parameters relieve pain by its effect on the gate control system in the spinal cord due to strong inhibitory influences from the higher centres i.e. cerebral cortex, thalamus and brain stem through a descending tract recently defined or by stimuli emanating from the dorsal column ascending fibres (6). It has also been demonstrated by cross circulation preparation of rabbits that acupuncture in the donor animal produces a pain relieving substance which not only increases pain threshold in this rabbit but also increases the pain threshold in the receipient animal.

Chang Hsiang-Tung of Shanghai Institute (3) has shown that acupuncture of certain points leads to suppression of activity of parafascicular and centralis lateral nucleus of thalamus both of which by their activity help in the perception of pain due to noxious stimuli.

Andersson *et al.* (1) estimated the threshold of pain by electrical stimulation of the tooth pulp. They concluded that stimulation through needles or surface elctrodes increased the pain

threshold of the tooth pulp. However, threshold was significantly higher when surface electrodes were stimulated. The acupuncture points chosen for stimulation in this study were firstly the intermetacarpal region of the hand between first and second metacarpal bone and secondly the region of the infraorbital skin of the cheek. They hypothecised that this effect was due to increased activity of the descending control system which they had demonstrated previously by their experiments on cats.

Bruce Levey and Terua Matsumato (7) also chose rabbit for their experiments. They exposed the trunk and distal branches of the tibial nerve and stimulated at specific electrical parameters the proximal main nerve and distal thin terminal fibers. The pain threshold was judged from, withdrawal and cry of the animal when skin was pinched with Cocker's artery forceps. Also the simultaneous EEG taken showed an abnormal spike if the animal had pain.

Stimulation of the peripheral branches showed much more marked increase in pain threshold as judged from delayed reflex withdrawal, no cry and absence of EEG spike. Also the EEG showed far more of alpha activity after the peripheral nerve is stimulated. By their experiments they emphasized the change in electrical activity of the cerebral cortex in the form of the spike on pain stimulus and the alpha activity persistence to be an important contributory factor in increasing the pain threshold. Possibly the gate control mechanism functions also at the cortical level to shut off the pain impulses.

Foshieki Omura's (11) contribution to the subject of acupuncture is very extensive. It deals with changes in the nervous system, cardiovascular system, hormones and boichemical parameters such as enzymes, cholesterol, protein, fatty acids, prostaglandins, immunoglobulins etc. His conclusion is that acupuncture relieves pain by changing the speed of conduction of impulses in the peripheral and central nervous system due to the extensive biochemical changes which effect the microcirculation and the permeability of cell membrane.

Mann *et al*. (9) in thier paper on treatment of intractable pain by acupuncture suggests that the relief of pain in trigeminal neuralgia is not due to the direct spinotrigeminal pathway block but is brought about by inhibition of the spino-reticulo trigeminal route. This is because of the heterotopic convergence of stimuli in this region coming from far flung meridians and acupuncture points. The change in the reticular system sensitivity further effects the perception of pain at higher levels.

The extensive work so far quoted seems to indicate that stimulation of several acupuncture points in the various meridians increase the pain threshold by acting at several levels of the nervous system e.g. peripheral sensory endorgans, nerve fibres and gate control systems at spinal cord, brain stem, thalamic and cortical levels. The increase in pain threshold may also be through the inhibitory ascending and descending pathways. These mechanisms are further reinforced in their inhibitory activity so far as pain is concerned by hormonal, enzyme and other biochemical changes which effect the permeability of the cell membranes.

Thus it seems that whilst the concept of Qi energy, its flow through viscera and meridians, ts block and deficiency producing pain are not understood in all the aspects,sufficient experimental

proof is available as to how acupuncture of points on certain meridians is successful in producing analgesia.

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