

GENERALIA

Acupuncture: Its neurophysiological basis

An anaesthetist's foreword

by Rudolf Frey and Walied Abdulla

Department of Anaesthesiology, University of Mainz, D-65 Mainz (Federal Republic of Germany)

The method of acupuncture or 'needling' had its place in Chinese Medicine as early as 1000 b.c. This method for relieving pain has long been applied on a purely empirical basis, hence the widespread scepticism by the medical profession in the Western World. Over the past decade information has accumulated from laboratories both in the East and in the West, attempting to identify the nervous pathways for acupuncture signals and to describe the sites and modes of interaction with pain signals (for references, see Frey¹). An important step towards the practical application of the technique was the finding that pulses of electrical current through needles left within the tissue could be substituted for mechanical movement of the needles. This idea has been developed one step further. In the case of ophthalmic surgery, a small electrode placed against the skin at the proper site replaces the insertion of a needle². The advantages of non-invasive stimulation are obvious. There is no risk of infections, no problem with keeping a needle in situ.

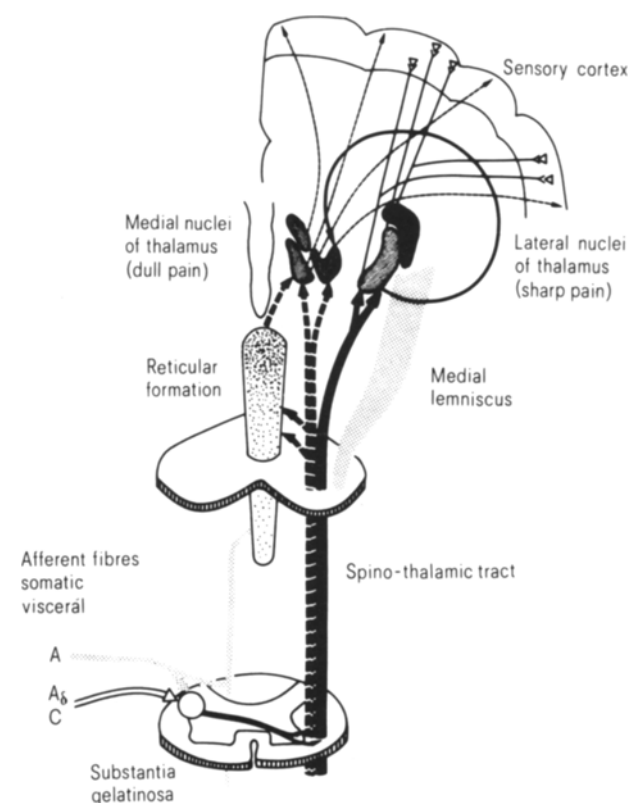
The pathways for pain signals are illustrated by the figure. Pain fibres from skin, muscle or viscera enter the spinal cord via the dorsal roots and project to nerve cells located in the dorsal horns (substantia gelatinosa). The secondary neurons cross to the opposite side, either within the same segments joining the tractus spino-thalamicus or ascending ipsilaterally to cross at the level of the medulla oblongata reaching the lateral nuclei of the thalamus. Certain nuclei within the reticular formation receive connections from the tractus spino-thalamicus, and there is functional evidence to indicate that the synapses located in the substantia gelatinosa are continuously being inhibited by impulses reaching them from the reticular formation as well as from the cortex (not shown in the figure). An increase of pain signals reaching the thalamic level may thus result either from an increase of peripheral inflow or from an impairment of so-called descending inhibition.

The pathways taken by 'acupuncture signals' is not well understood at the present moment. There can be

little doubt, however, that interactions between pain signals and acupuncture signals take place both at the spinal and at the supraspinal level.

As to the central perception of the sensation 'pain' astonishingly little information is available. While fibres originating at the thalamic level reach the cortex, there is no evidence of a cortical receiving station which might be destroyed to relieve patients from unbearable pain.

The search for a possible chemical mediator involved in acupuncture treatment has made considerable prog-



Structures of the neurons system responsible for signalling and perception of pain. Simplified diagram from Struppler and Hiedl³.

ress in recent years. The observation of a time lapse of some 20 min between the beginning of the treatment and the patient reaching an optimum of hypalgesia have vaguely pointed to the participation of a humoral agent. Reports from Shanghai and Peking have given support to this notion. Thus using the classical cross-circulation experiment in rabbits acupuncture to only 1 animal resulted in a state of hypalgesia in both animals. Similarly, applying cerebrospinal fluid from acupunctured to nontreated rabbits had a hypalgesic effect in the recipient animals. No less than 3 different groups⁴⁻⁶ have extracted from brain tissue a pentapeptide - enkephalin - which was shown to have morphine-like effects. The striking resemblance between the effects of enkephalin and morphine was revealed by Mayer et al. These authors administered naloxone (a substance known to be a specific morphine antagonist) to cats and human patients undergoing acupuncture like stimulation and demonstrated a prompt suppression of the acupuncture effect⁷. It appears, therefore, that the transmitter set free by acupuncture and acting at one or several levels of the CNS may well be identical or related to enkephalin.

The place of acupuncture, as seen by 2 anaesthetists, might be the following. Needling alone in the absence of other analgesic agents will hardly ever become the method of choice for pain relief for surgical interventions. This has been recognized even in China. Muscular relaxation would usually be insufficient and has to be reached by adequate pre-medication. Even if the relief of pain is considered sufficient, the patient may still suffer from modalities other than pain, namely pressure, traction and changes of temperature. If acupuncture in combination with other interventions

is used to substitute for general anaesthesia, it is indispensable to gain the collaboration of the patient by explaining the course of the surgical procedure and pointing out possible sensations which she or he may perceive at certain stages. A gentle surgical technique and the avoidance of blunt dissection contribute to the avoidance of pain.

The possibility of using acupuncture should be seriously considered whenever it appears highly desirable to decrease the over-all risk of a surgical intervention by using a minimum of narcotics.

Apart from its application in surgery, electro-acupuncture as well as transcutaneous stimulation of nerves enjoy an increasing popularity in the treatment of chronic pain⁸. It is often possible to place the method of transcutaneous nerve stimulation into the hands of the patient. However, this requires a preceding exploratory phase by a medically qualified person with an adequate theoretical background and much practical experience regarding the indications for this particular method.

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Work in progress at the Shanghai Institute of Physiology, Division of Acupuncture

by Silvio Weidmann*

Department of Physiology, University of Berne, Bülhplatz 5, CH-3012 Berne (Switzerland)

Most Western visitors to China reporting on acupuncture are concerned with the effectiveness of the method for pain relief during surgery, rather than with possible mechanisms underlying the method. A review by Birger Kaada⁸ is an exception. Kaada, a Norwegian neurophysiologist, being well informed on Western work relating to pain perception, was in a position to critically evaluate the results he was shown in China, in 1973. In June 1976, the author of the present text had the opportunity to visit the Shanghai Physiological Institute, where most of this work relating to the neurophysiological mechanisms of acupuncture is being done. It was easy to communicate

with Professor Hsiang-Tung Chang, a neurophysiologist with experience in laboratories of the United States, now a responsible member of the Acupuncture Division. In contrast to Kaada's detailed and critical review the present text is essentially a factual report which had been written up in July 1976 for private circulation.

Meanwhile, a number of biochemically oriented groups have made it appear likely that acupuncture signals release a substance - enkephalin - which has the ability to suppress pain signals. Moreover, a specific morphine antagonist - naloxone - has been shown to reverse the pain-relieving action of acupunc-