A scientific review of acupuncture

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Acupuncture, the ancient Chinese art of healing has become popular in many countries during the last few decades, not only as an anaesthetic agent for surgical procedures, but in many diseases which are resistant to conventional forms of therapy, acupuncture has proved remarkably effective.

Besides being free from the side-effects commonly encountered in drug therapy, it is simple, safe, effective and economical.

Whether acupuncture works or not, is no longer the question today. The only question is "How does it work?" This is not an easy question which can be fully answered in our present state of knowledge.

After several decades of dedicated research we know very little of how the normal nervous system functions in health, let alone in disease. Serious research on acupuncture commenced only a few years ago, and such a short period of time has been insufficient to unravel all the mechanisms of the complicated neurophysiological phenomenon which acupuncture evidently is.

Part of the difficulty lies in the fact that acupuncture works in a great variety of disorders and its wide spectrum of action must therefore be assumed to vary to a great extent with each type of pathology.

Nevertheless, many aspects of its action are now being understood in the light of recent research and are being pieced together in an attempt to solve this enigma.

Effects

The effects observed on needling are both subjective and objective.

(1) Of these the best known is the analgesic (pain-relieving) effect which is achieved by the raising of the pain threshold. This is the physiological basis of acupuncture anaesthesia and explains how acupuncture analgesia similarly produced during therapy is able to relieve the pain of arthritis, toothache, headache, low backache and other similar painful disorders. Some acupuncture points are more effective in this respect than others. This is an example of what is called "the specificity of acupuncture points."

(2) Secondly, the needling of certain specific acupuncture points results in sedation. Some people may even fall asleep during treatment but wake up refreshed. It has been shown that there is a decrease in delta and theta wave activity on the electroencephalogram during acupuncture treatment. These effects are utilised in the acupuncture treatment of insomnia, mental disorders, anxiety states, addictions, epilepsy and behavioural problems.

(3) The third effect is very important, it is called the homeostatic or regulatory effect which means adjustment of the internal environment of the body towards a state of proper balance. Normally, homeostasis is maintained by the balanced activity of the sympathetic and parasympathetic divisions of the autonomic nervous system and also by the endocrine system. In addition there are numerous homeostatic mechanisms in the body for regulating the respiration, heart rate, sweating, temperature, ionic balance of the blood and many other vital parameters. These mechanisms are seriously deranged in many diseases, and in such cases acupuncture is very helpful in restoring the original state of homeostasis.

Objective effects

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state of equilibrium. Very often the same set of points may be used for treating opposite disorders like high and low blood pressure, or diarrhoea and constipation. These are examples of the homeostatic or normalising action of acupuncture.

(4) Fourthly, there is the immune-enhancing action of acupuncture whereby body resistance to disease is strengthened. This has been shown to be due to an increase in the white corpuscles (leucocytosis), antibodies, gamma-globulins and other substances which increase the resistive powers of the body. In many cases a two- to four-fold increase in antibody titre has been observed, presumably brought about by activation of the reticulo-endothelial system. Acupuncture is therefore very useful in combating infections. Some workers believe that acupuncture increases the interferon levels in the body thus serving as a protective against infections and perhaps even against malignant disorders. Where antibiotics may have to be used, the need for prolonged antibiotic therapy can be considerably reduced by the concurrent use of acupuncture. It is also indicated in cases of resistance or hypersensitivity to antibiotics and in chronic infections where antibiotics have failed or given rise to serious side-effects. In the People’s Republic of China it has been shown that acupuncture alone can be effective in infections like appendicitis and tonsilitis. Here again, certain specific points have to be used to enhance the immunological effects.

(5) The fifth objective effect of acupuncture is the psychological effect which has a calming and tranquilising action apart from more sedation. This is believed to be due to an action on the mid-brain reticular formation and certain other parts of the brain. Measurable effects have also been reported on the metabolic chemistry of brain tissue. For instance, there is an increase in the dopamine content of the brain after acupuncture. This may account for its effectiveness in certain mental disorders and in Parkinsonism where there is a depletion of the dopamine content of the brain.

The psychological effect mentioned above should not be confused with hypnosis or autosuggestion. These effects follow (they do not precede) the use of acupuncture, and are therefore not a precondition for its success as erroneously supposed by some critics. Hypnosis and suggestion are very different from acupuncture in many important respects. Hypnotism has been found to work only in 10 to 14% of a population, whereas some degree of acupuncture analgesia can be induced in any person or animal. Patients with low hypnotisability scores respond equally well to acupuncture as those with high scores showing that suggestibility is by no means a requisite factor for success in acupuncture treatment. Also, prolonged training periods are required for hypnotic analgesia whereas emergency surgery can also be performed under acupuncture analgesia. Spontaneity of movement, gestures and facial expression are found in acupunctured patients unlike in hypnotised patients who move around like robots. Further injection of local anaesthetic (procaine block) at acupuncture points has been found to nullify the analgesic effect of acupuncture thus pointing to a neural and not an hypnotic explanation.

(6) The sixth important effect of acupuncture is that it hastens motor recovery in patients who have become paralysed from some cause or another. Even late cases of motor paralysis respond well to acupuncture therapy, despite previous failure with other forms of therapy. The explanation, which is complex, apparently involves antidromic stimulation of the anterior horn cells and their re-activation through a biofeedback mechanism operating through the Renshaw and Cajal cells of the spinal cord or their cranial equivalents.


What has been discussed above are the physiological effects of needling. As regards the scientific explanation of these effects, numerous theories of simple reflex action are insufficient as the neurological pathways are complex.

The situation has become further complicated by the demonstration that humoral (chemical) factors are also involved in acupuncture. As far as pain relief is concerned, the most popular neurological explanation is based on the “Gate control theory of pain” proposed by R Melzack and PD Wall in 1965.

According to this theory our perception of pain is modulated by a functional gate (or gates) within the

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central nervous system. Under normal circumstances this gate is wide open and pain impulses get through quite easily, but when acupuncture needling is carried out, a second stream of non-painful impulses is set up from the site of needling.

The result is over crowding or jamming at the gate causing it to close. In other words, there is competitive inhibition of the pain impulses and no pain or less pain is felt, even during a surgical operation. The gate control mechanism works by a process of pre-synaptic inhibition at the substantia gelatinosa.

The autonomic nervous system is also believed to play an important role in acupuncture. There is experimental evidence to show that it is along the sympathetic plexuses surrounding blood vessels that some of the acupuncture impulses travel to the spinal cord and brain.

Chemical or humoral mechanisms are also involved in acupuncture. For instance, if a rabbit is acupunctured its pain threshold is found to rise. If the blood from this animal is then circulated into a non-acupunctured rabbit, the pain threshold of the second animal also rises. Likewise, perfusion of spinal fluid from an acupunctured to a non-acupunctured animal results in a similar effect showing that chemical transmitters are definitely involved in the mechanism of acupuncture.

Research done at the Shanghai Institute of Physiology by Professor Chang Hsiang-Tung and his co-workers indicate that 5-hydroxytryptamine (serotonin) and noradrenaline are also actively involved in the mechanism of acupuncture analgesia.

Endorphin theory

The endorphin release theory (Pomeranz, 1976) is the most popular chemical theory which explains acupuncture today. It may be regarded as a natural successor to the older Humoral theory (Shanghai, 1972) which left open, owing to insufficient data at the time, the identity of the humoral agent involved in the animal cross-circulation experiments.

The endorphin theory is based largely on the work of Bruce Pomeranz, Professor of Neurobiology at Toronto University, Ontario, Canada. Pomeranz has put forward the view that acupuncture analgesia may be explained by the release during acupuncture of a group of substances called endorphins which are a naturally-occurring opiate-like substances discovered recently.

According to Pomeranz, endorphins could also explain how acupuncture gives relief in painful conditions and help to combat the withdrawal symptoms in drug addicts.

Endorphin belongs to a group of substances called neurotransmitters whose function is to convey impulses from one nerve cell to the next across the intervening gaps, the synapses. It is well known that conduction of nerve impulses, is an electrical event involving alternate polarisation and depolarisation along the course of the nerve fibers. However, these electrical impulses cannot "jump" across the synapses.

They come to a complete halt at the end of each nerve fibre.

Transmission at the synapses takes place by means of chemical messengers or neurotransmitters which are stored at the nerve-endings in very small sacs or vesicles and released from them, then these sacs are excited by the electrical impulses travelling along the nerve fibre. On being released from the containing sac, the transmitter moves across the synaptic gap at high speed (fractions of a second) and stimulates the adjacent nerve cell by interacting with specific receptors which are located on the postsynaptic membranes of the latter cell, thereby producing a local depolarisation which is subsequently propagated as a nerve impulse.

After completing this action, the major part of the transmitter travels back to the sacs which released them and wait once more for the next impulse to release them. By this method of re-cycling there is minimal wastage of the transmitter substance. In brief this is how endorphin and other transmitters act at the synapses under normal circumstances. Interference of these chemical transmitter mechanisms is possible by means of competitive substrate block and other mechanisms resulting from disordered metabolism or from the use of drugs.

Many different neurotransmitters have been identified since research on this commenced at the turn of the century. The best known of these are acetyl-choline and nor-adrenaline, which act as transmitters for the cholinergic and adrenergic nerves respectively. Acetyl-choline is also
well known as the active agent in
neuromuscular transmission due to
its liberation at the motor endplates.
Others are dopamine and serotonin,
and now endorphins and enkephalins have also been identified.

Neurotransmitters are regarded as
being very important in modern
dicine because they are crucial for
our understanding of the central as
well as the peripheral nervous system
functioning. They have in fact
become important research tools for
mapping the nerve pathways in the
brain. Also they seem to be involved in
great many derangements of
bodily function ranging from heart
disease and strokes to Parkinsonism
and psychiatric disorders.

It was for this work on
neurotransmitters that Julius Axelred
was awarded a Nobel prize some
years ago.

An important characteristic of a
neurotransmitter is that only nerve
cells having specific receptors are
responsive to their action, each
transmitter having its own specific
receptor. These receptors are three
dimensional structures having con-
figurations which enable the
transmitters concerned to fit into
them much in the same way that a
key fits into a lock. For example, in
the brain there are receptors which
have the propensity by virtue of their
chemical structure of binding with
morphine as well as certain other
morphine-like substances.

Such receptors are called opiate
receptors. It is the methyl group of
the morphine molecule which locks
into these receptors.

Another curious property of recep-
tors is their stereo-specificity. This
means that a particular receptor can
accommodate only one of the mirror
image (dextro or laevo) forms of the
substance. For example, laevo-
phanel which is a laevo (left handed)
derivative of morphine can fit the
opiate receptors whereas the dextro
isomer (right handed form) is unable
to do so.

Laevoephanel can therefore
stimulate the action of morphine and
is called a morphine agonist whereas
the dextro isomer is totally inactive in
this respect. Other examples of mor-
phine agonists are codeine, heroin,
methadone and hydro-morphine.
Endorphins and enkephalins also
have similar binding properties and
are called endogenous morphine-like
substances or endogenous opiates,
because unlike the others these two
chemicals occur naturally in the
body.

The concept of an agonist is
necessarily a biological one. Opiate
agonists may be defined as produc-
ing a change in physiological activity
by directly combining with a
membrane-bound receptor site,
which then initiates a series of
biochemical events related to the
final physiological response that are
not well understood. A substance
may be accepted as an opiate agonist
(i) if it produces a dose-related inhibi-
tion of nerve-mediated contractions
of the mouse vas deferens, cat nict-
titating membrane and guinea-pig il-
eum, (ii) if the effects are reversed by
narcotic antagonists such as nalox-
one or naltroxone, (iii) if both the
narcotic agonist and antagonist effects
are stereospecific, and finally (iv) if it
can be shown that low concentra-
tions (10-6) of the substance com-
pete with radioactive opiate ligands in
the opiate receptor binding assay.

Conditions (i) and (ii) are prere-
quisites for agonist action whilst (iv)
is the final confirmation for a direct ac-
tion at the receptor site.

The ancient Chinese believed that
disease ("dis-ease") was caused by
the imbalance in the body of two
principles which they called Yin and
Yang: By Yin they meant the
negative or female principle, while
Yang was the positive or male princi-
ple, both of which are universally pre-
sent in all nature. In the healthy state,
there was believed to be a har-
monious balance between these op-
posite but mutually interacting prin-
ciples — a state of affairs which today
we would call "homeostasis."

When disease supervenes, it was
believed that one or other principle
becomes dominant at the expense of
the other. Correction of this im-
balance was achieved by needling of
selected acupuncture points. While
these ideas may look esoteric and
irrational from today's standpoint,
we must remember that they were man's
first steps in logical thinking. To have
formulated these ideas at a time
when the rest of the world was living
in caves and on tops of trees was
itself a remarkable intellectual
achievement.

What we know today of
homeostatic mechanisms has an un-
mistakable Yin-Yang flavour. If a
modern physician accepts this pos-
tion, there is no contradiction in prac-
tising acupuncture as no one who is
familiar with this discipline has any
doubts that it works, and not infre-
dently when all other modalities
have failed.

Thus we see that there is no dearth
of theories to account for the many
aspects of acupuncture.

What is presently really lacking is
an integrated theory which covers all
the known facts. The very fact there
is a multiplicity of theories is an ad-
mission that each theory, by itself, is
unable to explain all the innumerable
aspects of the acupuncture
phenomenon. This is no reason
however for the modern physician to
be unduly disturbed.

The lack of a complete scientific
explanation regarding some
phenomenon does not make it any
less likely that the phenomenon ex-
ists, still less does it eliminate the
possibility of putting it to practical
use.

If we look dispassionately at so-
called "modern scientific medicine"
we find only an empirical basis or
none at all, for many procedures that
are carried out daily.

For example, many high-powered
procedures in physical medicine
such as short wave, micro-wave and
iontophoresis do not have much
scientific basis for their medical ap-
lications. In fact the little research
that has been done on these
methods has shown their value to be
nil or at the most equal to a hot water
bottle.

Similarly, it has not yet been
shown in the long term therapy of
rheumatic disorders that the ad-
ministration of large doses of
analgesics and steroids changes the
natural history. Many respectable an-
cillary methods such as
psychoanalysis have not been pro-
ven by any scientific methods.

It is against the backdrop of such
practices and the spiralling incidence
of iatrogenic (drug-induced or
doctor-induced) diseases that the
safety and efficacy of acupuncture
should be judged. Theories,
hypotheses, conjectures and
speculations are interesting, and

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