NEUROLOGICAL BASIS AND POSSIBILITIES OF THE REHABILITATION AFTER BRAIN INJURY

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Utilization of contemporary technology in patients with brain injuries (BI), in acutre state of disease is enabling a great number of severly injured human's to survive the respective injury. But, the consecutive consequences of the injuries, both in somato-motor and mental spheres impairs the health to such an extension that essentially it influent the quality of life.

Since up to now the preventive medicine of such injuries is insuficiently effective and the injured and his family claim for adequate help, we considered the solution of the mentioned problems to be the obligation and challenge of the medicine in general.

The proposed research goal is to examine the recovery process following brain lesions from various standpoints - the clinical observations and the results from animal experiments. Lesions of the brain give rise to alterations in structure and functions of different hierarchical levels of neural organizations - multicellular, cellular and molecular, i.e. brain as whole, different brain regions, nerv cells and subcellular organels. Our previous animal studies as well as clinical observations indicated various options that higher heve by using their adaptive abilities to cope with the functional consequences of lesions. We stressed the importance of brain commissures in the conduction and integration of different sensory modalities. Our results, as well as results of other indicates that sensory information processing in the brain besides classical and transcommissural and other interhemispheric connections has a considerably imporatnt role.

Comparing neurophysiological, behavioral, anatomo-histological and biochemical data, we shall attempt to examine the question of wheter brain responses to such specified lesions in the context of different experimental manipulations, can be considered as a specific repair process, or adaptive processes occuring normally in intact brain of animals.

The animal model of brain injury rehabilitation as well as clinical studies will place more emphasis on the role of alternative pathways and bilateral systems and the potentials of these systems in functional recovery.

Special attention will be paid to biochemical and anatomo-histological reorganization on different levels of the systems investigated, and the influence of various external and internal stimulations, the developments of the recovery processes, including those in acute phases following the injury.

The study of neuroplasticity and repair in the CNS is the key to attain the target of more sophisticated approach to restorative, as well as to reconstructive neurology.

Neuroplasticity may be described as the capacity of cells of the nervous system to regenerate anatomically and functionally, after being subjected to developmental or patological influences, including trauma and disease.

The limits of the scientific topic of neuroplasticity are broadened by the fact that the term can be used operationally to cover any of the adaptive mechanisms by which the nervous system restores itself towards normal levels of functioning after injury. Unquestionable, there are innumerable dynamic elements in the adaptive regulation of molecular, synaptic, and behavioral function which can be used by the nervous system to overcome clinical or experimental insults. However, neuroplasticity also has more explicit meanings when to descibe the series of steps by which specific injured central circuits attempt to repair themselfes after injury to restore function directly by the repair of the damaged circuits. In connection with this one might perhaps expect the application of innovative approaches to improve the care of persons with nervous system injury.

Neuroplasticity does not concern only the recovery of function if this letter is defined as "a return to normal or near normal levels of performance, following the intially disruptive effects of injury to the nervous system (Laurence,Stein,1978).

Neuroplasticity does not refer only to the structural and functional changes of the neuronal organization with follow up on the injury, but also includes the capacity of the central nervous system to adapt the new physiological conditions emerging either during its maturation or its interaction with the enviroment.Therefore, neuroplasticity consists in the ability of the nervous system to adapt (in both, anatomical and functional sense) its structural organization to new situations emerging from developments and environmental influences as weel as from injuries.

For restitution of function after nerve tissue lesions, neuroplasticity may operate by means of synaptic reorganization, through either regenerative and collateral spronting of axons or actual recruitment of potential pre-existing connections.

The latter may insolve spared structures located in the affected area, i.e. intact structures temporarily excluded from their functional role which are capable of reassuming their functions. Alternatively, compensation phenomena may involve structures located in undamaged areas.

Practical advances in this area cannot be expected in the abscence of basic research. Such research is of necessity highly specialized and technical, involving the use of various experimental and pharmacological models for the study of the subject. It would not be appropriate do deal here in depth with the technicalities of this research, but it may be useful to list the lines along which investigations in this field are currently progressing.

Summarizing facts mentioned in previous text we would like to point out important dirrections in recent and future research activities:

-Synaptic connections and transmitter systems

-The regenerative capacity of central neurons after experimental injury

-The immunocitochemistry of central neurons

-The regenerative capacity of central neurons as revealed by grafting experiments. (Stimulation of axonal regeneration by intercerebrally grafted target tissues; intracerebral implants to promote the bridging of regenerating central axons across leions in the brain and spinal cord; reformation of severed connections by intercerebral neural implants)

-Menoamine grafts into the striatum (grafts of fetal substantia nigra; grafts containing peripheral depamine cells)

-The effects of ganglioside treatment on the plastic response of central neurons after denervation (recovery of nigro-striatal neurons; recovery of cholinergic and noncholinergic neurons in the hippocampus)

-The capacity of central nervous system for axonal regrowth. (The growth of axons form recovery of the central nervous system into peripheral nerve grapths; Synapse formation after regrowth of axons of the central nervous system)

-Axonal elogantation components (The fast transport component and axonal regeneration; the cytoskeleton and axonal regeneration)

-Intermediate filament proteins (astrocystic filament and neurofilament proteins in peripheral nerve graphted to murine brain; fibrinolytic enzymes and regeneration of the central nervous sustem)

-In vitro models for neuroplasticity and repair (neuroneutrophic factors; neurite promoting factors)

-In vivo model to analyze neural regeneration.

-In vitro development of dopaminergic neurons (mesencephalic neurons in primary culture; addition of striatal target cells in co-culture; the role of striatal cell memebrane)

-Humoral-chemical factors in the reorganization of interneuronal connections (brain extract factors inducing postural asymetry; posturel factors carried in the cerebrospinal fluid; dynamics and properties of the cerebrospinal fluid and extract factors).

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