

Post Stroke Rehabilitation

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Abstract

The modern stroke rehabilitation programs focuses on specific bio-physiological targets. Modern rehabilitation programs mainly make use of its potential plasticity to compensate for injury. Constraint-induced movement therapy (CIMT), bilateral arm training, and task specific training of the paretic limb, are examples of rehabilitation techniques promoting brain neuro-plasticity. There are many tasks other than locomotor function to be addressed by rehabilitation team. Sensory deficits, speech deficits, dysphagia, memory loss, post stroke central pains and bowel and bladder derangements are among the most important of these challenges that makes a multidisciplinary approach to stroke patients necessary. [GMJ.2016;5(Supp.1):62-65]

Keywords: Stroke; Rehabilitation; Physical Treatment; Neuroplasticity; Plasticity.

Introduction

Stroke, although increases in incidence with advanced age is neither an inevitable consequence of aging, nor the end of a happy life. “New hope for the handicapped” is the title of a book written by Dr Howard Rusk, an internist, who is called by many authorities “the father of rehabilitation”. Before reaching the knowledge of rehabilitation, whenever he encountered the survivors of stroke he felt his knowledge to be woefully inadequate. This feeling is described by him with these sentences: “In front of such patients I was overcome by a feeling of insecurity. Deep down inside I felt guilty because I didn’t know how to help them” [1].

As a physician, he sought ways to help his handicapped patients who survived stroke; and he understood that there are many ways to help them to improve their health, function, and the quality of life. He was successful in preventing contractures in these patients by using footboards, posterior leg splints, sand bags, and even a simple pillow. He made use of pulleys for stretching, and could improve

his patients ambulation to much extent by practicing standing balance, gait training, use of splints, parallel bar, and so on. And he found how to train the patients in activities of daily living [2].

Going through this way he was no more frustrated in front of stroke patients, because he knew that he can help them much and doesn’t need to just sit and watch the patient going downhill by complications of stroke any more. Years after, pointing to the efficacy and necessity of rehabilitation of stroke patients his message to his colleagues was: “The physician who fails to see that those patients under his care receive the full benefits of modern methods of medical rehabilitation is in the same category as the physician who still persists in using dietary restriction alone in the management of diabetes, when insulin is available” [2].

Modern vs. Ancient Stroke Rehabilitation

At the beginning, the stroke rehabilitation was based on the empiric evidences. But the modern stroke rehabilitation programs focuses on specific bio-physiological targets. These tar-

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gets can be in the brain, in the spinal cord or in peripheral tissues.

Targeting the brain, rehabilitation programs mainly make use of its potential plasticity to compensate for injury. Constraint-induced movement therapy (CIMT) in which the patient is encouraged and trained to use the paretic limb while constraining the healthy one, is one of the most effective rehabilitation programs targeting the brain neuro-plasticity potential [3]. Bilateral arm training, and Task specific training of the paretic limb, are other examples of rehabilitation techniques promoting brain neuro-plasticity [4, 5].

Plasticity is not limited to the brain, but also it occurs at the level of the spinal cord. The basis for this theory is the time laps between the brain injury and the appearance of upper motor neuron signs in stroke patients. We know that loss of brain control over the reflex circuits of the spinal cord, as occurs in stroke, will lead to hyperactivity of these reflexes and the signs which are known as upper motor neuron signs. If the loss of brain inhibition over these reflexes were the only mechanism of upper motor neuron signs they would appear immediately after stroke. But the time taken by these signs to develop has led to the hypothesis that some plasticity at the level of spinal cord such as maladaptive rewiring of afferent fibers, change of some inhibitory synapses to excitatory ones, or up-regulation of some receptors may play some role in the development of upper motor neuron signs. Targeting these mal-adaptations at the level of spinal cord, some neuro-rehabilitative techniques such as 'Bobath neuro-developmental technique' try to overcome the development of upper motor neuron syndrome and its sequels such as spasticity, contractures, pain and deformities [6-8]. More over some automated movements such as stepping are believed to be produced by some central pattern generators in the spine. These generators in the spinal cord are the other target of neuro-rehabilitative programs, when trying to overcome disability by gait training [9].

Even in the peripheral tissues such as skeletal muscles, there are many bio-physiological processes that have been targeted by modern rehabilitation programs to overcome post-

stroke disabilities. Muscular atrophy, insulin resistance and increased fat deposition in muscle tissue, and change in the phenotype of muscle fibers in favor of more fatigable ones are some of these processes to be addressed by specific rehabilitation programs. Making use of electrical stimulation and biofeedback, and resistance exercise are some of these strategies [10-12].

Ten Principles of Stroke Rehabilitation

Klein and Jones introduced 10 principles of neurorehabilitation based on their neuroscience and literature review. The concept of neuroplasticity can be detected in these 10 principles [13]:

Use it or lose it:

This principle emphasizes that any brain function that is not in active use for a while will gradually regret.

Use it and improve it:

This principle points to the fact that any function can be improved by practicing and training.

Specificity:

This principle is saying in clear words that the type of training will determine the way of neuroplasticity; that means we can modify plasticity in the way of our needs by modulating rehabilitation programs and training the patients in specific functions that help overcome their disability.

Repetition matters:

This principle suggests that learning and plasticity is dependent on practice and it needs sufficient repetition to emerge and establish.

Intensity matters:

This principle is completing the 4th principle, showing that in order to learning and plasticity to establish not only the repetition but also the intensity of training programs is of paramount importance.

Time matters:

Since plasticity is time dependent, this principle emphasizes on the importance of post stroke time frame in which the rehabilitation program is being conducted. Even a perfect rehabilitation program with correct intensity and repetition may be futile if it is conducted in a wrong time frame.

Salience Matters:

This principle notes that for a rehabilitation program to be successful and promoting plasticity in the correct way it is important to be familiar with the patient's needs and aim of therapy.

Age matters:

This principle is pointing to the importance of the patient's age in the extent of plasticity and rehabilitation successfulness. That is the younger the patient, the more plasticity potential and more achievement through rehabilitation programs.

Transference:

This principle denotes the flexibility of motor control.

Interference:

This principle points to the fact that a previous experience that has led to a specific plasticity may interfere with a new plasticity to occur in response to training. This means that an established learned task may prevent new learning (using the same circuit) to occur.

Post stroke functional recovery and rehabilitation

Several studies have shown functional recovery after stroke particularly in the first 3 months with the curve of recovery rising rapidly in the first 6 weeks and reaching plateau in three months post stroke. There is little chance of further functional recovery 6 months after the initial event. Although part of this recovery is due to natural course of the disease and intrinsic potential of neural recovery, certainly rehabilitation plays a major role in maximizing this potential and leading the recovery process in the correct and the most efficient way. Body weight supported treadmill training, for example, leads to changes in cortico-motor excitability and improvement of balance and gait asymmetry [14, 15].

Regarding the time frame of functional recovery after stroke and the role of rehabilitation in it, one can understand the importance of early initiation of rehabilitation program in the outcome of stroke patients. Nowadays, based on fMRI evidence, some researchers suppose that task specific therapy provided early in the course of post stroke recovery and being of sufficient intensity may limit some maladaptive motor control process in walk-

ing [16]. There are also some claims on the role of behavioral compensation strategies in functional improvement where normal motor control cannot be restored [17].

In order to programming an efficient rehabilitation course for motor improvement in stroke survivors not only familiarity with neuro-plasticity principles and biophysiological processes of recovery is necessary, but also the knowledge of kinetic and kinematic both in healthy subjects and stroke patients. Knowing which muscle groups are working in any phase of gait and their role in gait pattern and speed and analyzing the stroke patient's gait deficit and how it is different from the normal pattern, the physiatrist may focus the patient's rehabilitation program on these deficits by targeting specific muscle group training. Although the rehabilitation strategy being emphasized recently is 'task oriented training', and no doubt it should be the main rehabilitation approach in stroke patients, the value of specific muscle group training cannot be ignored in improving kinetic deficits and muscle imbalance.

Different challenges in stroke rehabilitation

Although motor deficit is the most evident disabling factor in stroke patients, it is not the only problem these patients are facing with. The brain is the organ conducting the whole body and its injury will lead to derangements in all organ systems. So there are many tasks other than locomotor function to be addressed by rehabilitation team. Sensory deficits, speech deficits, dysphagia, memory loss, post stroke central pains and bowel and bladder derangements are among the most important of these challenges that makes a multidisciplinary approach to stroke patients necessary.

Conclusion

With the help of rehabilitation we don't have to just watch our stroke patients to go downhill anymore; but through our knowledge of the pathophysiology of stroke we can prevent stroke complications, improve and guide neuroplasticity, and optimize the patients' function.

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