BAPNE method and Neurorehabilitation in patients with severe acquired brain injury

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ABSTRACT

The use of body percussion through BAPNE method in neurorehabilitation offers the possibility of studying the development of motor skills, attention, coordination, memory and social interaction of patients with neurological diseases.

The experimental protocol was carried out on 52 patients with severe acquired brain injury.

Patients were selected for the cut-off scores in the standard neuropsychological tests of sustained attention, divided and alert ; at least one emisoma intact, cut-off scores in the standard for procedural and semantic memory ; eyesight , hearing and speech intact.

The first group of patients has supported the protocol BAPNE thogher with the traditional rehabilitation activities.

The control group continued to perform exclusively the cognitive and neuromotor rehabilitation according to traditional protocols.

At 6 months after administration of the protocol is expected to re-test to assess if present , the maintenance of the effects of rehabilitation obtained.

Experimentation is carried out for 10 weeks following the protocol of BAPNE method in the Roboris Foundation of Rome:

The research is led by three neurologists from the center of neurorehabilitation.

Keywords: Stroke, Neurorehabilitation, BAPNE method, Severe acquired brain injury, Attention.

1. Introduction

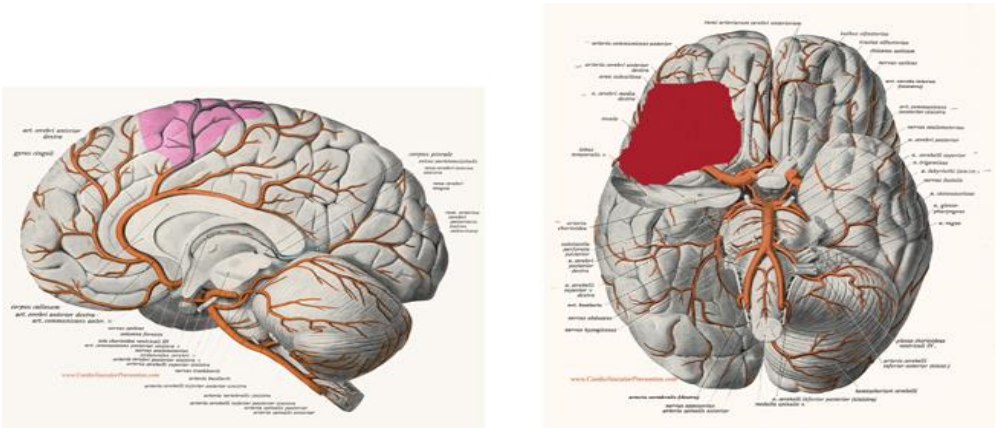
1.1 Problem/Question

"Stroke is a sudden shock and devastating to the brain that is affected from the inside. A blood clot or bleeding in the brain arteries prevent the flow of oxygen to the tissues, killing them. The biggest victims end up becoming shadows of themselves, imprisoned in his own body without a minimum of autonomy "(Doidge N. 2014).

STROKE brain in Italy is the third leading cause of death after cardiovascular diseases and cancer, and the absolute number one cause of disability.

In Italy every year about 185,000 people are affected by cerebral STROKE. Of these 150,000 are new cases while 35,000 are STROKE that are repeated after the first episode.

Fig. 1: *ictus ischemico ed ictus emorragico*



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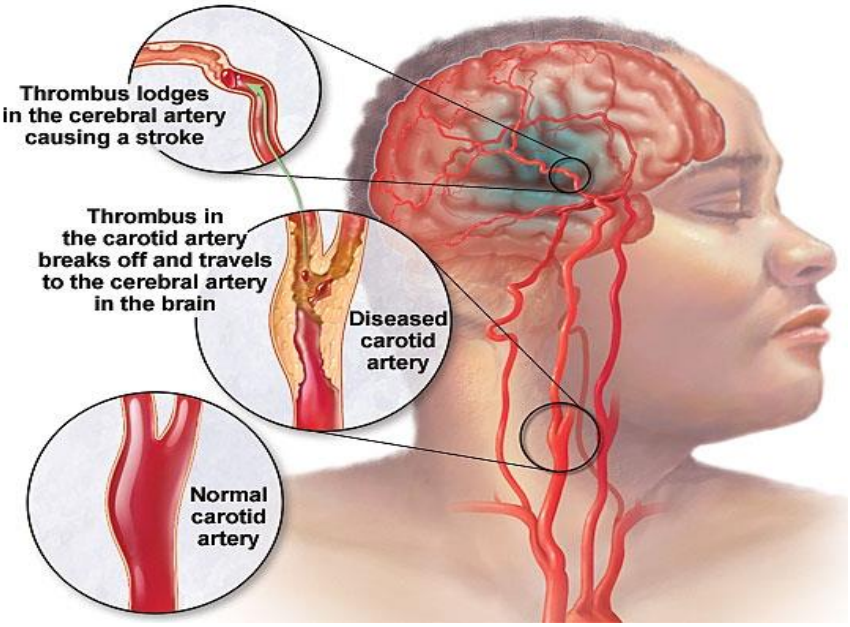
The incidence is proportional to the age of the population: is low up to 40-45 years, then gradually increases to soar after 70 years.

75% of cases STROKE affects people over 65 years. The average incidence (new cases reported each year in the general population) is about 220 cases per 100,000 inhabitants, reaching values of 280 cases in the octogenarian population. This means that each year, an Italian family doctor at least assists 4-7 patients who are affected by stroke and must be followed by at least a dozen survivors previously, with disabling outcomes.

10-20% of those affected by STROKE for the first time, died within 1 month and another 10% within the first year. (Zanchetti and Nappi, 2003). Among the remaining, about a third survive with a high degree of disability often, so as to make them dependents; about a third of a degree of mild or moderate disabilities that often allows him to return to his home, so partially autonomous, and third, those who have been affected by a stroke in mild form, return independently in their own homes. The

questions we would like to find answers through assumed experimentation are: Can the cognitive and motor stimulation through the methodology BAPNE (Romero-Naranjo, 2014) of body percussion, reactivate damaged brain areas or allow the creation of new neural maps, and then have a functional recovery of the hemiplegic? The same methodology can affect the ability to improve neuropsychological attentional and memory functions of those outcomes of severe brain injury? Can the method BAPNE improve mood and act on self-esteem of the person giving reasons for its commitment to traditional therapies? And assuming the presence of such improvements, the possibility exists to maintain the results in the long term?

Fig. 2 *Possible causes of stroke*



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1.2 Review of Literature

The human brain is able to modify itself. For four hundred years this statement was inconceivable. Traditional medicine and science argued that the anatomy of the brain was unchangeable. It was widely believed that after childhood, the brain would face only and exclusively to deterioration, and that brain cells were irreplaceable if they had not developed properly, if they had deteriorated or were dead. It was believed that the brain would not be able to alter its structure and find a new mode of operation in the event that a part was damaged. The theory of the unchanging brain decreed that people with neurological damage, would remain disabled for life.

The belief that the brain was incapable of change was based on three pillars:
1. Patients with brain damage, rarely undergo a complete cure;
2. Failure to observe a microscopic level the activity of the brain in vivo
3. The idea that the brain is like an amazing machine: on the one hand machines do extraordinary things, on the other hand can not change and grow.

In the late sixties and early eighties, a group of scientists had come to the unexpected discoveries: if some parts of the brain damage suffered in certain circumstances, others could replace them. It thus introduced the term "neuroplasticity" in which neuro stands for neurons, and plastic means modified, flexible, changeable. (Doidge N. 2013).

The first form of localizzazionismo was proposed in 1861 when Paul Broca, a surgeon, had to deal with a patient who, after suffering a stroke, had lost the ability to speak. The patient's death, Broca dissected the brain and discovered a lesion in the left frontal lobe tissue. Not long after, another physician, Carl Wernicke, identified the area responsible for language comprehension.

In 1868 Jules Cotard studied the case of some children who had suffered a brain injury early and extensive, and in which the left hemisphere (where the headquarters of Broca's area) was severely compromised: in spite of this, these children spoke normally.

Similarly, in 1876 Otto Soltmann, removed the motor cortex by some puppies dogs and rabbits: despite this, the animals were able to move.

In 1890 William James suggested the instability of neural circuits in the adult brain. In 1966 Terje Lomo, he discovered the long-term potentiation (LTP) or the strengthening or weakening of synaptic connections between neurons. In 1969 studies by Paul Bach-y-Rita on sensory substitution, provide the first experimental evidence of neuroplasticity in humans. The researcher was studying in Germany as seen through the operation of the measurement, through the electrodes, electrical discharges produced in the corresponding area of the brain of a cat. During the experiments noted that the same brain area was activated with both visual and tactile and auditory stimuli.

The researcher began to believe that various brain areas were "multi-sensory".

In 1981, David Hubel and Torsten Wiesel won the Nobel Prize for experiments on monocular deprivation in kittens. (surgical closure of an eye negatively influenced the development of the visual cortex, but if it went ahead with the reopening of the eye in a critical period of development, the changes could be reversed).

Mark Rosenzweig, a researcher at the University of Berkeley, California, had studied rats in stimulating and non-stimulating environments: he had found in the brains investigation post-mortem of rats, that those that were stimulated increased amounts of neurotransmitters, were heavier and showed a circulation sanguigan better than rats who had lived in non-stimulants.

The activity produces changes in brain structure.

Merzenich from the end of the eighties worked and participated in several studies that were designed to test whether brain maps have a time basis and if their boundaries and their operation could be manipulated. The neurons in the brain maps, develop strong reciprocal connections when they are activated simultaneously: if the maps can be changed, then there is the possibility that subjects with congenital or acquired neurological problems , can develop new neural connections , inducing healthy neurons to be active simultaneously and then to bond together forming a single map. The neurons that are exercised, they become more efficient and can process data faster. Merzenich discovered that attention is essential for neuroplastic changes in the long term . In numerous experiments he found that long-lasting changes occurred only when the monkeys were very concentrated. When the animals were carrying out their tasks in an automatic way, without paying attention , brain maps are altered but with short-term results .

Edward Taub is one of the most interesting scientists of our time, through the study of monkeys deafferentate, devised the ICD therapy, through which chronic stroke patients could be subjected, to a rehabilitation treatment with the recovery of plegic limb function, a process associated with the practice or experience that leads to permanent changes in the ability to produce movements finalized. The variables that impact significantly on the ability of learning are: the intense repetition, the functional significance of the gesture, and the use of visual feedback, auditory and tactile during exercise (Taub E., Nudo RJ, Milliken GW., Jenkins WM., Merzenich MM. 1980-1999)

The phenomenon of motor learning is the training of any kind, changes the structure of the brain. The training and practice make more precise the neural pathways involved in the task at hand, so as to increase the efficiency of the brain in the performance of the shares (Moheb Costandi in 2014).

1.3 Purpose

In accordance with the recent acquisitions in neurorehabilitation, new techniques have been proposed to try to maximize the potential of the motor recovery in patients with severe brain injury outcomes. This paper describes a research hypothesis being tested at the Adelphi Centre (Day Centre for the GCA) in Rome, through the use of the methodology BAPNE (Romero-Naranjo, 2012), to facilitate the process of rehabilitation and cognitive outcome of patients with severe acquired brain injury.

2. METHOD

2.1. Description of the context and participants

The Day Centre Adelphi (Foundation Roboris) working in Rome at the Pavilion 12 of the Monumental Complex of Santa Maria della Pietà (ASL RME), hosts inside 27 patients per day with an outcome of severe brain injury in rehabilitation treatment.

As Day Centre, is part of as a continuum between post-acute rehabilitation and social reintegration of the patient where possible.

The property is home to 27 patients per day under a semi-residential, from 9.00 to 16.00 and is equipped with machinery for the rehabilitation of the last generation, such as LOKOSTATION Treadmill, a particular robot-assisted gait, the VRRS (Virtual Reality rehabilitation system) equipment for rehabilitation in virtual reality that refines and perfects the active movement through a system with feedback; the rail to ceiling with H-pattern, capable of supporting the subject in an upright position while giving the maximum freedom of movement.

The property also has 2 gyms and a spa medical 30sqm where hydrotherapy is performed.

The main feature of the Centre Adelphi lies in multidisciplinary pursued, inherent in the concept of integrated rehabilitation.
The experimental treatment was evaluated and approved by the ethics committee.

All patients voluntarily agreed to participate in the trial, by signing the informed consent to the processing of personal data.

The experimental protocol involves 52 patients with GCA selected according to requirements shared and structured for the two groups (experimental and control).

The general criteria for inclusion in the experimental group provided by the clinical protocol are:

- Occurrence of cerebrovascular damage between 12 and 72 months after

start of treatment

- cut-off scores in standard tests neurospicologici of sustained attention, divided and alerts
- cut-off scores in the standard for procedural and semantic memory
- Absence of cognitive impairment (MMSE> 21)
- Absence of psychiatric disorders prior to the stroke
- At least one intact emisoma
- unassisted ambulation without aids
- Ability visual, auditory and speech intact

2.2. Materials

The application of the method does not require special materials. Requires a room large enough to contain the macro group of patients and operators in the spatial arrangement circular.

All therapy sessions were videotaped and will allow for the formation of a video archive of the parties involved.

2.3. Instruments

All subjects have been and will be: monitored cortisol levels at time 0-75 - 180 days (4 samples at fixed times daily); recorded beats per minute through a heart rate monitor on your wrist; through the use of Lybra (equilibrium) and Kimeja (virtual reality) will be recorded data regarding the ability to adjust the balance of the patient in standing and sitting using the visual input and data relating to the patient's ability to coordinate fine motor skills in a virtual environment; through the administration of neuropsychological tests (HADS, NPI) will be detected improvements in mood and behavioral disturbances in the regression if available. All data will be analyzed and compared using the SPSS statistical system. At 6 months after administration of the protocol is expected to re-test to assess if present, the maintenance of the effects of rehabilitation obtained.

2.4. Procediments

The experiment involves the combination with the protocol BAPNE (in two weekly sessions of 50 minutes for 10 weeks in a group of patients), to the traditional rehabilitation activities.

The arrangement of the group in the space of therapy is to help circulate a non-hierarchical and egalitarian relationship and to support the possibility of inter-and intrapersonal relationship.

The Bapne method provides a motor stimulation for the activation of brain areas multiple and simultaneous.

Through the coordination of the upper limb and the adjustment of the impact motor on the one hand contributes to the, ability of terpist to realize the functionality of sense-perception, the other works on the patient in the management and control of movement.

During the training is also asked patients to repeat an exercise in improvisation mode previously handled by the trainer, with the aim of stimulating the ideational capacity, understanding the financial year, and the positive feedback due to the improvement of mood in feeling active in the rehabilitation process.

In some types of exercises the therapist's presence allows the guided movement of the limb also hemiplegic, in controlled traction.

During all the training stimulates the patient's ability to maintain focused attention, divided and sustained through the execution of movements of body percussion sequences that are repeated in cyclic and steady pace.

The repetition of the movement allows motor learning.

The management of the movement in average liabilities allows the patient to increase motivation in rehabilitation as it gets positive feedback on the movement of a limb is not functional .

Patient groups are not homogeneous for disease severity and outcome.

The control group continued to perform exclusively the cognitive and neuromotor rehabilitation according to traditional protocols.

The traditional multidisciplinary rehabilitation activities include:

- Neuromotor Rehabilitation
- Neuropsychological Rehabilitation
- Speech and language therapy
- Psycho-Behavioral Rehabilitation
- Idoterapia

In addition, the patient undergoes a daily basis, in small groups, in various workshops designed to strengthen the specific deficits observed, including:

• Music Therapy

· Cognitive training through the use of computers

• Danzamovimento

• Training Kitchen

• Supervision and training in ADL and PAI

• Theatre Workshop / Cinematerapia

• Rehabilitation of the road

• Read and comment newspapers

• Communication pragmatic

• Experimental protocol of acupuncture for dysphagia and drooling

The purpose of these workshops is to promote an atmosphere of sharing and facilitating trade relationships between patients. In the structure are also organized groups of psychological support for families and supported research activities.

2.5 Clinical case :

S.S. is a boy of 35 years , the result of multiple injuries from a road accident with serious injury cranioencephalic with cerebral subdural hematoma. Diffuse lesions of the splenium, punctate areas in the frontal sn.

In the two months prior to the beginning of the administration of the Protocol BAPNE showed oppositional behavior , self-and hetero - aggressive with no motivation to treatment, which consisted of acts of closing the hood of his sweatshirt and put his head down placing itself in a defensive stance, shouting afinalizzato and inability of the operators to keep it for more than 20 minutes in a room of any therapy. Stephen refused to talk while having the ability to pronounce words understandable.

After 10 weeks of treatment the patient is collaborative and participatory, singing, relates and keeps the focus on the activity you are performing .

Even when you lower the level attentional and appear attitudes of rejection, you can bring attention to the work in progress. During the training sessions, the patient often looks to the group, we can say that the purpose to reach the objective of interpersonal relationship get satisfied.

3. RESULTS

The neurorehabilitation protocol is being tested. To date, there are no conclusive data for research and statistical comparisons. Let us assume, however, to publish these results in 2015.

We can not yet speak of standard protocols that you can give to other types of neurological patients, as although the results collected so far, are excellent, the application of the protocol is still too new and we have not yet collected all the data and performed all statistical comparisons.

In any case, we are absolutely convinced that such testing may provide important clues in the short term even on cerebral functional recovery in support of the theory of neuronal plasticity.

4. CONCLUSIONS

Recent acquisitions in the field of neuroscience have changed the approach to the patient with brain injury, including prospects for the use of new methodologies for the functional recovery of any damage. In the eighties , several experimental studies have shown that the adult brain retains the ability to regroup during the entire span of life (Taub E. 2006). Starting from this assumption, it has been hypothesized that the intervention is also crucial in the rehabilitation phase stabilized the injury, not only to prevent secondary complications, but also to encourage the acquisition of new motor patterns.

As of today it seems particularly interesting , given its potential transferability in clinical rehabilitation , the possibility of combining neuromodulation techniques with therapeutic exercise rehabilitation.

The results obtained from the application of the experimental protocol of the method BAPNE on a single subject, with marked behavioral disorders, put the focus on the effectiveness of the method even in patients with severe manifestations of brain damage suffered . The results of the neuropsychological tests and direct observation of the reduction of behavioral disorders, confirm the hypothesis of the validity of the method applied to the outcome of patients with severe brain injury.

The extension of the protocol to large heterogeneous group, in a short time will provide more detailed data and statistically significant.

In conclusion, the use of body percussion BAPNE method (Romero-Naranjo, 2011) in neurorehabilitation through the method offers the possibility to study and monitor the development of motor skills , attention, coordination, memory and social interactions in patients with neuropsychological disorders .

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