

# Padovan Method of Neurofunctional Reorganization As a Way for Neurological Recovery in Newborns

ORIGINAL

Lilianny Medeiros Pereira<sup>1, 2</sup>, Daniele Correa Vileicar<sup>2</sup>, Samara Bezerra Sales<sup>2</sup>,  
Maria do Socorro Landim Rodrigues Alves<sup>1</sup>, Jamile de Melo Casado Pereira<sup>2</sup>,  
Lourena Maria Lourenço Alves<sup>2</sup>, Carla Joseane Rodrigues Figueiredo<sup>2</sup>, Hermes Melo Teixeira Batista<sup>2, 3</sup>,  
Woneska Rodrigues Pinheiro<sup>3</sup>, Italla Maria Pinheiro Bezerra<sup>3</sup>, Luiz Carlos de Abreu<sup>3</sup>

## Abstract

The physiological basis of neurofunctional reorganization in stimulating the nervous system is justified and ratified by the concepts of neuroplasticity and therefore, its use in neonatology is well indicated.

**Objective:** Describe how Neurofunctional reorganization through Padovan method can contribute to restore neurologic function of newborns and can avoid the need for gastrostomy and shortening hospital stay.

**Method:** Descriptive and retrospective study performed in a hospital at Ceará's inland, Brazil, through analysis of medical records. 92 patients from the neonatal ICU who suffered perinatal asphyxia and evolved with neurological disorders were evaluated. Patients received Neurofunctional Reorganization therapy, which is the performance of physical and oral exercises that complement each other in order to recover lost functions and also prepare the body to acquire functions and capabilities which it has potential for.

**Results:** Eighty-two patients completed the therapy and showed positive results (89.1%). The main expected outcome was the recovery of suction and this was achieved in between 8 and 150 days. 48 cases showed an improvement between 8 and 30 days of treatment (56%).

**Conclusions:** The Neurofunctional reorganization proposed by Padovan is effective in the recovery of neurological function of newborns, especially the suction, shortening the hospital stay and avoiding gastrostomy.

- 1 Hospital Municipal São Lucas.
- 2 Estácio Juazeiro do Norte.
- 3 Design and scientific writing laboratory of FMABC.

## Contact information:

Lilianny Medeiros Pereira.

✉ liliannypediatra@hotmail.com

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## Introduction

The Neurofunctional Reorganization (NFR), also known as "Padovan Method" was developed by Beatriz Padovan, speech therapist, in the beginning of the 70s, based on studies performed by Rudolf Steiner about the interrelationship between the three human activities of walk-talk-think and the researches performed by the neurosurgeon Temple Fay about organization of the nervous system. Physical exercises and re-education of the reflex-vegetative oral functions (breathing, suction, mastication and swallowing) were performed in an attempt to recover lost functions or not yet acquired, but within the range of the body's potential. The physical exercises were applied to the recapitulation of ontogenetic development, acting in the failures and development of motor and neurological maturation as a whole and the oral exercises consisted of the re-education of the reflex-vegetative oral functions (breathing, suction, mastication and swallowing) [1, 2].

The method is suitable for all ages, as a curative, preventive or of maintenance of the nervous system. However, there is no record in the literature of its use in newborns with hypoxia. The method can be performed by any health professional, with higher education, who has realized the training course. This method is applied since 2008 at the Hospital Municipal São Lucas, in Juazeiro do Norte, Ceará, in an attempt to improve the quality of life of patients who faced hypoxia.

The neonatal hypoxia is the most common cause of neurological damage in newborns and it results in impairment of neurodevelopment. Usually occurs in the period before birth. Affects indiscriminately the full term and premature newborn, and contributes significantly to perinatal and neonatal morbidity and mortality [1].

The incidence varies around 1.5% depending on the criteria used and the gestational age. The perinatal asphyxia is caused by the decrease on the flow of the umbilical circulation, resulting in alterations

in gas exchange, changes in placental perfusion, decreased fetal oxygenation. It can result in malformation, airway obstruction, fluid in the lungs, prematurity and it is strongly associated with high-risk pregnancy [2].

The main clinical manifestations of hypoxia are the neurological disorders and they may present a state of hyperreflexia, tremors, changes in posture and movement, apnea, respiratory failure, abnormal swallowing, pupillary and oculomotor responses also abnormal, tense anterior fontanelle, and even convulsive state [3].

The diagnosis of perinatal hypoxia is based on the following criteria: low Apgar score, below 3 on the 5th minute; metabolic acidosis or acidosis mixed by gases of the umbilical cord blood with blood  $\text{pH} < 7.0$ ; neonatal neurological dysfunction and multiple organs dysfunction [4].

Over the past 20 years, the neonatal mortality has been suffering a reduction, especially in premature newborns with low birth weight, because of advances in intensive care in the Neonatal Intensive Care Units (NICU), improved knowledge of the professionals involved in the care of these patients, and the development of neurostimulation and humanization techniques of the ICUs (Intensive Care Units). Together these factors lead to an improvement of the transfer of affection between parents and newborns, and consequently, a fast recovery [5, 6]. In general, these patients require being hospitalized for a long time, with exposure to noxious stimuli such as pain, stress, lights, noise, invasive procedures and temperature variations of the environment. Besides, they remain separated from their parents for a long period [6, 12].

Advances in research have helped in improving the quality of life of patients facing damage caused by failing oxygenation of the brain. Among the issues discussed by experts there is the neuroplasticity, nervous system ability to designate a particular cell, different function than what was originally programmed to be performed replacing the function

of other damaged cell<sup>7</sup>. That is, the ability to adapt and dynamic reorganization of the nervous system when facing environmental changes [8].

This neural reorganization is the primary goal of neural recovery to modulate recovery of function and may be influenced by experience, behavior, practice of tasks and in response to brain injuries [9].

It has been observed that the learning of a specific activity and its repetitive practice induces dynamic and plastic changes in the central nervous system (CNS). This occurs because the motor training induces neurogenesis, synaptogenesis, angiogenesis, pre and post synaptic modulation among others, and all these events result in improved recovery of motor disorders related to hypoxic injury [7, 13].

Up to 2 years of age a person has greater potential for neuroplasticity, essential for a normal development of the nervous system, called critical period. The processes involved include synaptogenesis, axonal plasticity or ontogenetic. However, an environment rich in stimuli is essential for the acquisition of multiple cerebral capabilities, since they provide the excitation required for modification of the neural circuits [10].

Current studies report that neural reorganization can occur and facilitate the recovery of neural function. Studies confirm that this reorganization can be facilitated by incorporating repetitive activity, practice of specific tasks, sensory training and mental practice, all integrated to rehabilitation strategies [10, 11].

Therefore, the present study aims to describe how the Neurofunctional reorganization by Padovan method can help to restore neurological function in newborns and can avoid the need for gastrostomy and shortening the hospital stay.

## Methods

It is a descriptive and retrospective study performed from the analysis of records conducted by three

professionals of the institution who are responsible for implementing and monitoring the evolution of hypoxic newborns admitted to an intensive care unit of a hospital located in the region of Cariri, Ceará, Brazil.

The study included medical records of patients admitted between 2008 and 2015 and its objective is to evaluate the neurological recovery of newborns who received the Padovan method of neurofunctional reorganization. The patients received body exercises and re-education of the reflex-vegetative oral functions (breathing, suction, mastication and swallowing).

The method was applied to every newborn with alterations in their neurological examination and/or presenting difficulty in sucking, after explaining to parents and getting the Informed Consent signed by them. The therapy was initiated from the time when the newborn was found to be stable and it was performed once a day, 5 times per week. Even if using a ventilator, the patients received the therapy as long as they were hemodynamically stable, and with more limited exercises. The child received evaluation through neurological examination continually, always comparing it with the previous examination and describing the improvement.

## Results

From 2008 until July 2015, 92 newborns were looked after using a therapy called neurofunctional reorganization by Padovan method, being premature or full term, with weights ranging from 780g to 3.800g. As an indication for the therapy, there were 31 cases for early stimulation of premature (33.6%), one case of congenital facial paralysis (1.08%), 34 cases of change in neurological examination including absence or deficit of suction by asphyxiation (36.9%), eight cases of respiratory distress impairing coordination for sucking (8.6%), eight cases of laryngeal dysfunction by malformation or prolonged mechanical ventilation (8.6%), 2 cases of apnea

by immaturity (2.1%) and eight cases of neurological changes by syndromes (8.6%).

The age for onset of the therapy ranged from two days old to 102 days of life. Seven patients died during hospitalization due to complications from sepsis, two patients were transferred to other hospitals, one to undergo a tracheostomy due to congenital paralysis of the vocal cords and the other for surgical procedure of branchial cyst. 82 patients completed the therapy with appropriate conditions of discharge (89.1%) and one remains in treatment.

The therapy time ranged from two days to five months and 12 patients had a response in less than seven days (14.6%), 36 between seven days and less than a month (43.9%), 18 between one and two months (21.9%). Three patients were treated for more than two months (3.6%) and in 13 cases it was not possible to determine the length of therapy from the medical records. Among the eight children with syndromes we had a case of Treacher-Collins syndrome, a case of Down syndrome, two cases of fetal alcohol syndrome a Moebius Syndrome, one thoracic dysplasia and two syndromes to clarify.

## Discussion

The incidence of neurological impairment of newborns is still high in our country; it is due to prenatal, perinatal or post-neonatal events, prolonging their hospital stay [2].

In addition to the neurological deficit resulting from hypoxic-ischemic encephalopathy that accompanies the child for the whole life, requiring multi-disciplinary care, the absence of suction in the early days is a difficulty for hospital discharge, leading to prolonged hospital stay, increasing the risk of nosocomial infection [4, 5]. According to our results, the therapy based in the Padovan techniques shortened the hospital stay and avoided gastrostomy, palliative procedure of feeding for discharge, which is not free from complications.

Despite the Padovan Method of Neurofunctional Reorganization exists and is being used since the 70's, there are no reports in the literature of its use in patients with perinatal hypoxia. The difficulty in eating is the main factor that interferes with comorbidities of the patient, since it is responsible for bronchoaspirations and recurrent pneumonia, which are the leading cause of death [6]. With the therapy, all patients were discharged with good coordination of sucking, swallowing and breathing. These patients remain being monitored in the hospital outpatient care system.

The foundations of Padovan method of applying exercises through primitive movements, proper of ontogenetic development and recognizable by the central nervous system is ratified by the current studies about the neural plasticity [1].

If the method has a good response in adults and elderly, where neurodegeneration has already started, the chance of excellent responses in newborns is very high, since the neural plasticity is at its highest during childhood and the stimulus is critical to the acquisition of brain skills, since they provide the excitation required for permanent modification of neural circuits [10].

In the present study, there is no control group to compare this therapy with the others already existing, as the institution has standardized the Padovan method to be used whenever indicated. However, we can evaluate the case of the first patient to receive the therapy who have had hypoxia and the first case of children with fetal alcohol syndrome, who were already in the hospital for three months in traditional speech therapy without sucking response, with indication for a gastrostomy, who were in prolonged hospitalization, and who had a positive response after starting the Padovan method, in 15 days and three weeks, respectively.

From these cases the therapy has become prematurely used as soon as they noticed change in the neurological examination of patients. One of the babies with laryngomalacia presented suction,

however, due to a dysfunction, the baby could not coordinate it with breathing. In this case the therapy was also initiated on a trial basis, as there was no improvement with respiratory physiotherapy. The baby evolved positively after the imposition of Padovan therapy with disappearance of stridor and respiratory distress, allowing the child to oral feed on the seventh day.

In 2013 the therapy was initiated as an early stimulation in premature infants, with treatment lasting an average of 30 days, a period equivalent to the weight gain of these children.

The Neurofunctional Reorganization provides stimulus to the baby's senses, touch, smell, sight, hearing and taste, which are damaged in cases of initial severe asphyxia and assists in the early stimulation of premature infants. The touch is stimulated by gentle contact with exercises; smell through the stimulation of the cranial nerves; the sight through photo motor exercise with a flashlight; hearing through the verses and songs that are expressed during the exercises and the taste through the exercises of stimulation to the taste buds [3].

In relation to existing therapies for recovery of neurologic sequelae, the Padovan Method is a different therapy, because it not only works the difficulty of the patient, it covers body exercises in a global way, stimulating proper motions of development, then breathing exercises and encompassing facial exercises of stimulation of 12 pairs of cranial nerves [5].

Researches should be implemented to give visibility for situations like these, however, while in Brazil the scientific production has been increasing, it would significantly increase with the proper training of health professionals who work with research in project management [14-16].

Therefore, more researches must be performed to provide visibility to the application of the therapy, since even with the early initiation of the application of the therapy, although the patient is still with low responsiveness, we observed a recovery and chan-

ge of hospital stay, after providing stimulus to the nervous system and new ways to perform their lost functions were created.

## Conclusion

The Neurofunctional reorganization proposed by Padovan was effective in the recovery of neurological functions of newborns, especially the suction, shortening the hospital stay and avoiding gastrostomy.

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