

**APPLICATIONS OF PHYSICAL THERAPY IN THE
REHABILITATION OF PATIENT WITH CEREBRAL TUMORS:
FOURTH VENTRICLE INFILTRATION IN
MEDULLOBLASTOMA**

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Abstract

Primitive brain tumors of the central nervous system are a major health problem. Most intraterritorial tumors affect functionally important areas of the brain and postoperative motor disability are unfavorable. Given its location, the fourth ventricle interposes between the cerebellum and the brainstem, therefore, a tumor that grows into the fourth ventricle, can produces a mechanical pressure on the nearby anatomical elements with specific symptoms.

On a 15-year-old patient, diagnosed with medulloblastoma into fourth ventricle (W.H.O. grade IV) molecular subgroups WnT, the initial tratament involved surgery to remove as much of the tumor as possible (after two surgeries, some residual tumor was still left behind because it was too close to normal brain structures), then further treatment with chemotherapy and radiation therapy followed.

After the treatment, the symptoms related (effects owing to the tumor itself and the effects of treatment) was: poor static and dynamic balance, truncal ataxia with impaired tandem gait, lack of the coordination and balance to walk safely and independently, (resulted from affecting the archicerebellum and paleocerebellum), appendicular ataxia (manifesting a difficulty with rapid alternating movements, finger-nose-finger), hypotonia, poor coordination (asynergy, dysmetria- resulted from the affected neocerebellum), dysarthria, nystagmus (due to pressure on the brainstem- vestibular syndrome).

The purpose of this study was to restore lost motor skills, prevent complications, maximize function, and improve the quality of life.

Introduction

Brain tumors present a special challenge for both patients and physiotherapists. The impact that a diagnosis of brain tumor has on a patient, either adult or child, can be overwhelming: some brain tumors

can cause significant disability and drastically worsen the quality of life. Therefore the relationship between a patient of this type and the physiotherapist must be that of an indestructible alliance. Recovery through physical therapy offers opportunities to extend life, regaining lost motor skills and minimize disability.

Medulloblastomas represent a heterogeneous group of highly malignant primary tumors of the Central Nervous System in children. These are rare tumors with a very aggressive behavior, characterized by a noticeable tendency to metastasize [1]. This type of tumors accounts for ~20% of all intracranial tumors in children, and for 40% of all childhood posterior fossa tumors [2]. Three-quarters of medulloblastomas (also referred to as primitive neuroectodermal tumor or PNET) arise from the cerebellar vermis and often grows into the fourth ventricle [3].

The neurological implications of the cerebellar syndrome resulted from a brain tumor are: balance problems and gait disorders along with difficulties in coordination resulting in ataxia, uncoordinated movements, imbalance (dysfunction manifests as clumsiness and "drunken" gait) speech problems (dysarthria) and visual problems (nystagmus) (4).

All medulloblastomas are W.H.O. grade IV, classification system subdivides medulloblastoma by their histological sub-types into classic medulloblastoma, desmoplastic/nodular medulloblastoma, medulloblastoma with extensive nodularity, and large-cell/anaplastic medulloblastoma (also correlates with a poor prognosis). Currently, data suggests that medulloblastoma can be further classified into molecular subgroups, which have prognostic significance. These molecular subgroups include tumors with activation of the Wnt or SHH (sonic hedgehog) pathway and tumors with amplification of MYC. Wnt pathway tumors appear to have the best prognosis, SHH pathway tumors have intermediate prognosis, and expression MYC tumors have a poor prognosis [5, 6].

Despite the potential poor outcomes of these lesions, with comprehensive treatment the 5-year overall survival rate is now greater than 80 %. [7] A multifaceted approach, including surgery resection, radiotherapy, chemotherapy and rehabilitation is considered as the most effective strategy against these malignant cerebellar tumors [8].

Material and method

Hypotheses of the research: We hypothesized that an adequate physical rehabilitation program will lead to significant improvement in static and dynamic balance by restoring muscle control, improvement in movements coordination, increase muscle tone and strength and improve

quality of life in a 15-year old patient with significant neurological sequelae after medulloblastoma.

The purpose of the research: To determinate the potential role of physiotherapy-based interventions in relation to surgery, current conventional chemotherapy and radiation in the treatment and rehabilitation of patients with medulloblastoma.

Subjects of research: Name and surname: M.I.S, feminin, date of birth: 27.12.2002, diagnosed in 2017 with medulloblastoma into fourth ventricle (W.H.O. grade IV) molecular subgroups WnT. First surgery excision took place at the Emergency Clinical Hospital „ PROF. DR. N. OBLU „ Iași. Second surgery excision took place at the Tor Vergata Polyclinic, Rome. The treatment with chemotherapy and radiation therapy took place at the Bambino Gesù Pediatric Hospital, Rome. The duration of physiotherapy-based interventions was almost 2 years, May 2019- March 2021 with a frequency of 3-4 sessions per week, predominantly at the patient's home.

The research methods:

- method of study of specialized literature;
- observation method;
- experiment method;
- graphical and tabular method.

Tests used in research

For the assessment of patient progress were used:

- Medical Research Council scale (MRC);
- Tinetti Gait and Balance Assessment Tool;
- Karnofsky Scale of Performance Status (KPS);

The means used in research:

- Frenkel exercises for static and dynamic balance training;
- customized gait training and customized interventions targeting balance and independence in activities of daily living;
- PNF techniques;
- Bobath techniques (NDT);
- exercises for muscle tone and strength in all four limbs and trunk customized to individual difficulties;
- proprioceptive exercise.

Physiotherapy stage interventions used are as follows:

- improving the muscle tone and strength in all four limbs and trunk;
- increase stability and balance in a sitting position, quadrupedia and on kneeling position;
- increase stability and balance in orthostatism;

-increase stability and balance in gait.

Rehabilitation strategies included were, for exemple: walking aids, high levels of repetition, high intensity of practice, conscious attention rather than automatic execution, avoiding secondary tasks while make the exercises, using of stepwise prompts to learn rather than trial and error, compensatory strategies to increase stability, for example using wide base of support, slowing down movement, adapting the individuals environment to avoid unexpected accidents. It is therefore very important and essential during recovery sesion that the patients have to actively think about each step, rather than it occurring automatically.

Results

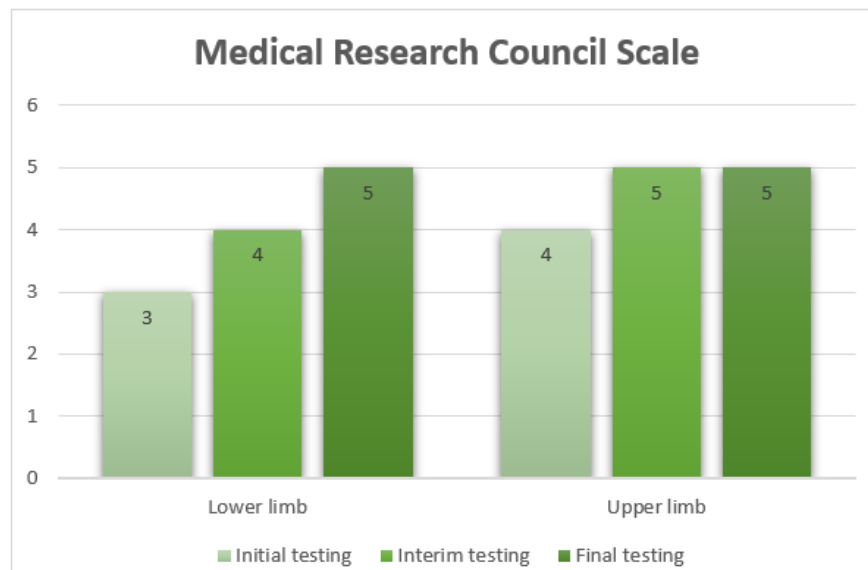


Figure 1. The values of Medical Research Council Scale

Tinetti Balance Test

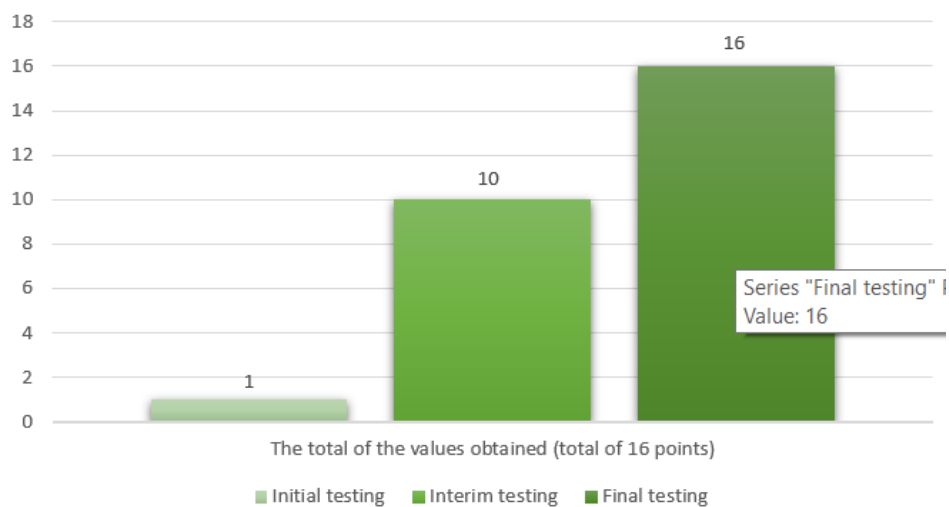


Figure 2. The values of Tinetti Balance Test

Tinetti Gait Test

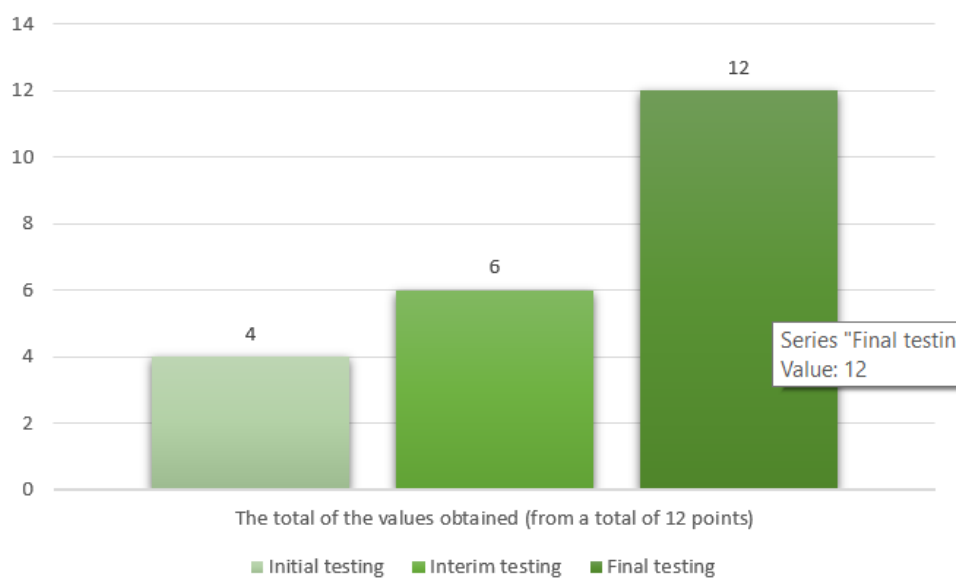


Figure 3. The values of Tinetti Gait Test

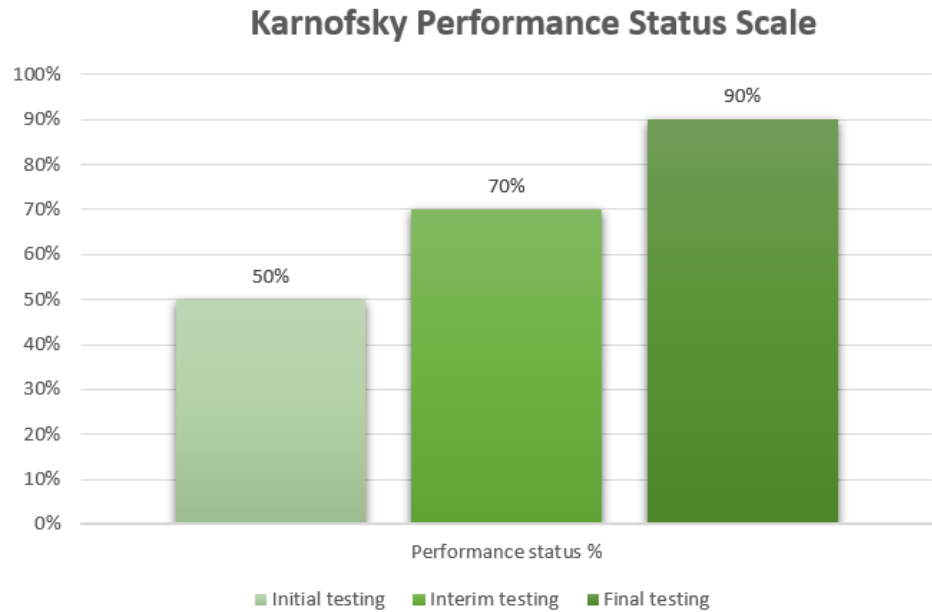


Figure 4. The values of Karnofsky Performance Status Scales

Conclusions and discussions

Initial, intermediary and final measurements were performed to compare the results and evaluate the effectiveness of the physiotherapy program. Our results indicated the beneficial impact of physiotherapy interventions in the treatment and rehabilitation of pediatric brain tumor patients. Physiotherapy has significant implications in gait rehabilitation, increase postural control, increase coordination, muscle tone and power, increase balance reactions. I determined the efficacy of commonly used physiotherapy and rehabilitation techniques and strategies in order to ensure that my patient achieve the best possible outcomes from her therapy. From my experience recovery following a brain tumor is slow and often incomplete, therefore the physiotherapists must consider that goals will take longer to achieve and individuals will need to continue to practice the skills they have learnt in order to ensure they do not deteriorate.

Physiotherapy-based interventions have a huge impact on the everyday lives of individuals with brain tumor and i consider that physiotherapy is the main treatment with positive effect on gait outcomes. The physiotherapy-based intervention has no negative effects. After almost two years of physical therapy, in January 2021, the big aim was achieved, the patient was able to walk safely and independently again

and able to carry on normal activity with minor signs or symptoms of disease.

Despite substantial improvements of recovery, in malignant cancer, there is a fine line between remission and recurrence. The never-ending challenge of medulloblastoma, makes the disease recurrence in a more aggressive way in May, 2021. The patient is currently at the Bambino Gesù Pediatric Hospital, Rome, where is trying an experimental treatment.

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