Case Report

DOI: 10.7860/JCDR/2022/57782.16878

Physiotherapy Section

Combined Neurophysiotherapy and Accelerated Skill Acquisition Programme in Improving Upper Extremity Motor Function in Hemiplegia after Brain Tumour Resection

PURVA HANUMANPRASAD MUNDADA[1], RAKESH KRISHNA KOVELA[2], PALLAVI LALCHAND HARJPAL[3], NIKITA ATMARAM KAPLE[4], GAYATRI SURENDRA KAPLE[5]

ABSTRACT

Astrocytomas are one of the most common primary tumours of central nervous system seen in paediatric population. Although it is treatable and has a good prognosis, some individuals suffer from motor dysfunction following brain tumour resection which could result in decreased mobility, difficulty with daily tasks, increased risk of immobility-related problems, falls, pain, anxiety/depression. Thus, having a negative impact on overall quality of life and functional independence. Comprehensive neurophysiotherapy in such cases play a critical role in preventing and alleviating motor dysfunction, and its effects, and improve functional independence. This is the report of a 10-year-old female with astrocytoma in the right frontoparietal lobe, which was diagnosed using magnetic resonance imaging and immunohistochemistry. She underwent craniotomy for the same. But after tumour resection, she developed left hemiplegia wherein involvement of upper limb was more as compared to lower limb. She was given neurophysiotherapy and Accelerated Skill Acquisition Programme (ASAP) which aided in improving upper extremity motor function and functional independence.

Keywords: Diffuse fibrillary astrocytoma, Neurophysiotherapy, Quality of life, Rolling facilitation transition training

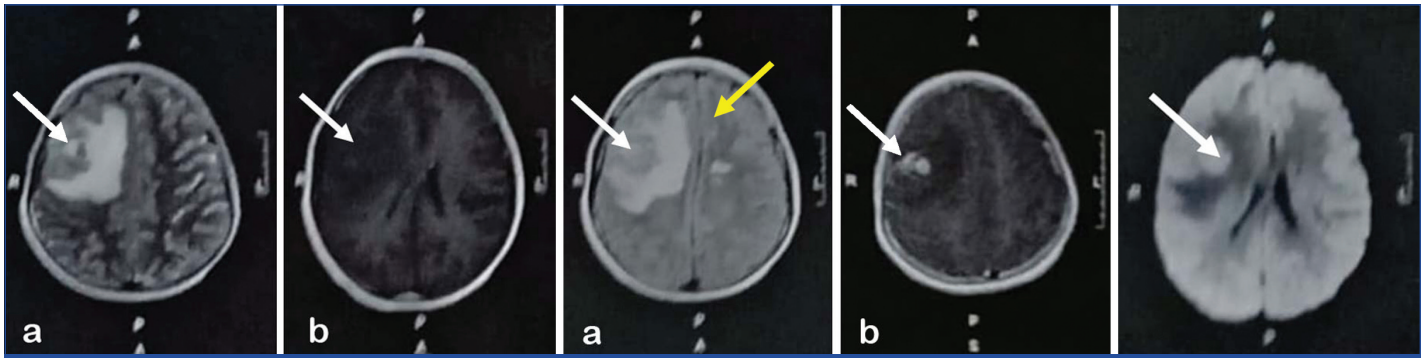
CASE REPORT

A 10-year-old female patient presented to the Department of Neurology with the complaints of headache on and off from last 4-5 months which increased during the last month with multiple episodes of vomitting since 15 days which increased subsequently in last three days. She had history of two episodes of Generalised Tonic Clonic Seizures (GTCS), one episode of fever and incoherent talk 15 days ago. The patient was not taking any medications for the same. Magnetic Resonance Imaging (MRI) brain (plain and contrast) revealed High Grade Astrocytoma (HGA) in the right frontoparietal lobe [Table/Fig-1-3]. Right frontal minicraniotomy and navigation-guided excision of the tumour was done under general anaesthesia. The tumour was subcortical greyish white soft to firm and had no plane of cleavage with brain parenchyma. Complete tumour excision was done. Immunohistochemistry testing of the biopsy sample confirmed the diagnosis as diffuse fibrillary astrocytoma, World Health Organisation (WHO) grade II [1]. Repeat MRI brain (plain and contrast with spectro) showed T2 hyperintense cystic lesion with peripheral haemorrhages involving right frontotemporal lobes [Table/Fig-4,5].

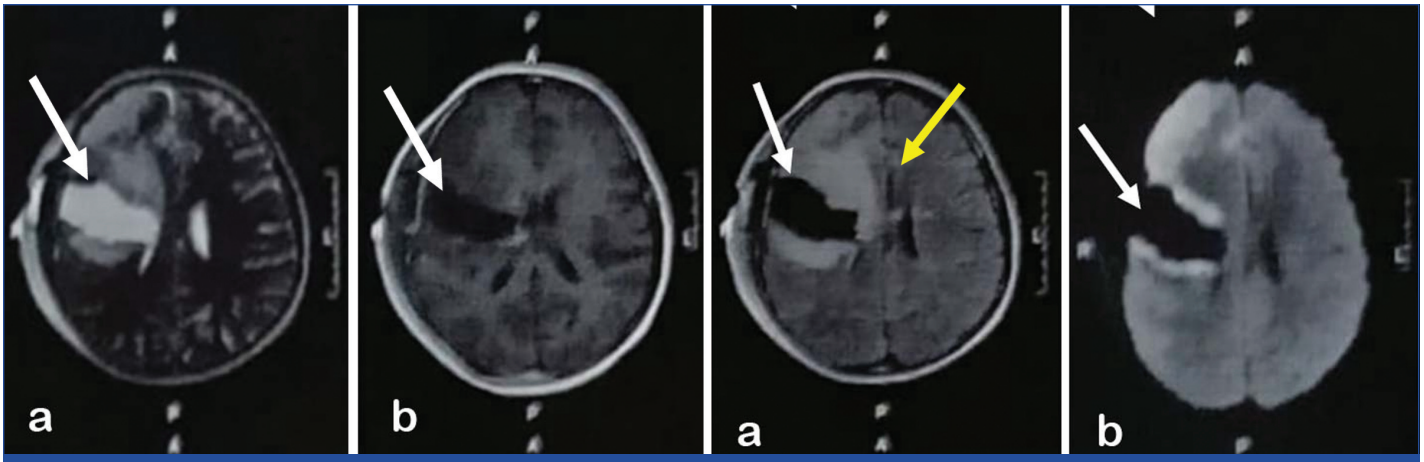
Postoperatively, she developed left hemiplegia which was greater in the Upper Limb (UL) than Lower Limb (LL). She was referred to Physiotherapy Department for the same. After taking consent from her mother, physical examination was carried out.

The patient was assessed in supine lying position on the bed with pillow under cervical spine for support. On general examination, vitals were stable. She was conscious, co-operative and well oriented to time place and person. On observation, the attitude of limbs for the right UL was adduction and internal rotation of the shoulder with elbow and wrist in extension by the side. On left side, shoulder was adducted, externally rotated with elbows and wrist in extension by the side. In bilateral LL, her hips were extended, adducted, externally rotated with the knee in extension and ankle in slight plantar flexion. On examination, higher mental functions were normal (the score was 26/30 on Mini Mental Scale Examination (MMSE) [2]. Cranial nerves were intact.

On sensory examination, superficial, deep, and cortical sensations were intact bilaterally over UL and LL along with the trunk. On motor examination, muscle tone was flaccid for left UL and LL and normal for right UL and LL. On Voluntary Control Grading (VCG), her left UL



[Table/Fig-1]: Preoperative MRIs. a) Axial T2-Weighted Images (T2WIs) and; b) Axial T1WIs show ill-defined intra-axial mass lesion in right frontoparietal lobe with significant mass effect and perilesional white matter oedema. Lesion appears iso to hyperintense in both T2WIs and T1WIs (arrows). **[Table/Fig-2]:** Preoperative MRIs. a) Axial T2 Fluid Attenuated Inversion Recovery (FLAIR) Images showing lesion of hyperintense signal intensity (white arrow) and mild midline shift of approximately 6 mm towards the left side (yellow arrow); b) Postcontrast coronal T2WIs showing nodular and patchy areas of enhancement within the lesion (white arrow). **[Table/Fig-3]:** Preoperative MRIs - Diffusion Weighted Imaging (DWI) showing restricted diffusion and low ADC in right caudate nucleus and basal ganglia; and corpus callosum (arrow). (Images from left to right).



[Table/Fig-4]: Postoperative MRIs. a) Axial T2WIs showing hyperintense cystic changes with peripheral haemorrhages involving right frontotemporal lobe and; b) Axial T1WIs showing hypointense lesion (arrows). **[Table/Fig-5]:** Postoperative MRIs. a) Axial T2 FLAIR images showing diffuse non enhancing hyperintense signal intensity and perilesional oedema in right frontotemporal lobes (white arrow). Mild mass effect on right lateral ventricle with minimal midline shift of 2mm to the left (yellow arrow) and; b) DWI showing no restriction in diffusion. (Images from left to right).

Deep tendon reflexes	Grading	
	Right	Left
Biceps jerk	2+ (Normal)	1+ (Diminished)
Supinator jerk	2+	1+
Triceps jerk	2+	1+
Knee jerk	2+	1+
Ankle jerk	2+	1+

[Table/Fig-6]: Grading of Deep Tendon Reflexes (DTRs) [3].

and LL had grade 0. Muscle power was 0/5 for UL and 1/5 for LL on left side and for right UL and LL 4/5. Grading of Deep Tendon Reflexes (DTRs) is given in [Table/Fig-6] [3] and superficial reflex (plantar) in [Table/Fig-7]. As for functional ability, she was able to roll in bed on her own on the affected side.

Superficial reflex	Response	
	Right	Left
Plantar reflex	Flexor	Extensor

[Table/Fig-7]: Grading of superficial (plantar) reflex.

Therapeutic intervention: Neurophysiotherapeutic interventions and Accelerated Skill Acquisition Programme (ASAP) with rationale, strategy and regimen are given in [Table/Fig-8] [4,5] and [Table/Fig-9] [6], respectively. Follow-up and outcome details are stated in [Table/Fig-13-16] [7,8].

Intervention	Rationale	Strategy	Regimen
Patient and family education	Prevent anxiety and ensure adherence to the prescribed physiotherapy protocol.	Counselling, education, and establishing supplementary supportive systems should all be included. Education and Counselling approaches boost caregiver's knowledge considerably. It's important to teach specific care practices, such as: • Carrying out physical tasks such as transfers, mobility, and other Activities of Daily Living (ADL). • Encouraging patients to engage in whatever activity that they are capable of. • Preventing complications.	
Rolling Facilitation Transition training from supine to sit	Improve bed mobility and/or functional status. Prevent secondary complications arising due to immobility such as [Deep Venous Thrombosis (DVT)], pressure sores, contracture development, orthostasis, and/or pneumonia.	Rolling facilitation Rolling from supine to side lying using upper extremities momentum and crossing the ankles. Transition training from supine to sit: • Prone on elbows • From prone on elbows, elbow walking to achieve long sitting • Supine on elbows • Walk into a C position	• Given from day 1 to week 2 (10 repetitions 1 set). • Week 3 (10 repetitions 1 set), Week 4 (10 repetitions 2 set).
Range of Motion (ROM) exercises for bilateral upper extremities and lower extremities	Maintain joint integrity and mobility and prevent contractures	• Passive Range of Motion (PROM) exercises for left Upper Limb (UL) than Lower Limb (LL). It is shown in [Table/Fig-10a,b] and [Table/Fig-11a]. • Active Assisted Range of Motion (AAROM) exercises for right UL and LL.	• For left UL and LL, PROM exercises from day 1 to week 4, AAROM exercises from week 4-6 and AROM exercises from week 6-8 (10 repetitions 2 set). • For right UL and LL, AAROM exercises from day 1- week 2, AAROM with 1 kg weight from week 2-4, AROM with 1 and 1.5 kg weight from week 4-6 and week 6-8 respectively (10 repetitions 2 sets).
Rood's facilitatory technique for left UL and LL	Facilitates muscle contraction and thus help to normalise tone or reduce flaccidity by stimulating receptors	Passive movement of left UL and LL with tapping facilitation, icing and joint approximation for each joint [Table/Fig-11b].	Given from day 1- week 4 for 10 repetitions 2 sets.
Stretching of tightened muscles	Helps to lengthen the tightened muscles and thus improves ROM	Passive stretching for Tendo-Achilles (TA) and Hamstring muscle of left LL.	10 repetitions 15 second hold 1 set from day 1- week 2. Thereafter, 3 repetitions 30 second hold 1set.
Pelvic bridging and pelvic rotations	Helps to develop trunk and hip extensor control. Additionally pelvic rotations help to stretch the thoracolumbar fascia	• Pelvic bridging initially without hold and then with holds [Table/Fig-12]. • Side to side pelvic rotations with neck rotation to opposite side.	10 repetitions 5 second hold 1 set from day 1- week 2. Thereafter, hold was increased by 5 seconds every week.
Upper crunches	Strengthen upper abdominals especially Rectus Abdominis (RA) and obliques. Facilitate trunk rotation as well as control.	Upper crunches with holds (straight and oblique).	10 repetitions 5 second hold 1 set from day 1- week 2. Thereafter, hold was increased by 5 seconds every week.

Manual Muscle Stimulation (MMS)	Stimulates muscle thus facilitating movement and improving muscle performance.	MMS to left UL with PROM of wrist and digit	Given from day 1- week 4 (10 repetitions 2 sets).
Functional Electrical Stimulation (FES)	Improve motor recovery, reduce spasticity, strengthen muscles and increase ROM and helps to retrain voluntary motor functions such as grasping, walking.	FES was given to left UL. Electrodes were placed on wrist flexor and extensor compartment as well as biceps and triceps.	Grasp/flexion/extension mode given for 15 mins from week 2-6
Gripping or prehension exercises	Facilitate gripping and prehensile activities.	For gripping, grip strengthener was used. Prehension exercises: • Spherical grasp • Cylindrical grasp • Hook grasp • Lateral pinch • Palmar pinch • Tip pinch	• Given from week 2-8 (10 repetitions 1 set). • Thereafter set was increased by 1 after every 2 weeks.
Rood's inhibitory technique for left UL and LL	Inhibit abnormal tone or reduce spasticity.	Passive movement of left UL and LL with deep tendon pressure	Given from week 4-8 for 10 repetitions 2 sets.
Bed side sitting	Helps to improve sitting balance as well as to train sit to stand transfer.	Short sitting: feet supported, hip and knee 90 degrees flexed, trunk neutral and elbows locked. • Weight shifting • Trunk mobility exercises • Reach outs • Perturbations • Dynamic Quads	• From week 4-8 for 10 repetitions 2 sets for all. • Progression was made by having patient perform these exercises on swiss ball week 6 onwards.
Sit to stand transfer	Strengthens the muscles of LL.	Strategies include: • Hip hiking/pelvic lift with holds. • Butt walking/scooting. • Sit to stand with holds. Note: Before initiating sit to stand, strengthen the muscles responsible for it such as gluteus maximus, hip abductors and tibialis anterior.	From week 4-8 for 10 repetitions 2 sets for all.
Standing	Activities performed in standing help to improve standing balance.	Standing with support in parallel bar: • Spot marching. • Partial wall squats • Weight shifts (forward-backward and side to side). • One leg stance. • Tandem standing • Reach outs. • Perturbations. • Stepping (forward-backward and side)	• From week 4-8 for 10 repetitions 2 sets for all. • Progression was made by having patient perform these activities in standing without support in parallel bar from week 6 onwards.
Gait Training	Helps to normalise gait pattern and eases ambulation.	• Walking (forward-backward and side). • Step up and step down. • Obstacle walking Gait training should be given with emphasis on gait parameters.	Gait Training with support in parallel bars from week 4-6 and without support from week 6 onwards
Facial exercises	Strengthen facial muscles.	Exercises include- • Raising eyebrows, • Frowning, smiling, • Blowing a candle, • Puffing cheeks and clenching teeth. These exercises were performed in front of mirror as it provides visual biofeedback.	Active assisted from day 1- week 4. Actively from week 6 onwards.

[Table/Fig-8]: Conventional Neuro-physiotherapeutic intervention with rationale and strategy used and regimen [4,5].

Action Research Arm Test (ARAT): ARAT is an arm-specific activity limitation test that evaluates a patient's capability to handle objects of various sizes, weights, and shapes. It is ordinally graded on a scale of 3 (normal movement) to 0 (no movement) [9]. Intervention induced changes on different ARAT components (Grasp, grip, pinch and gross movement) is shown in [Table/Fig-14a,b,c,d]. For all the components, findings were nil on day 1. However, intervention induced improvements were notable on day 28 and day 56.

Wolf Motor Function Test (WMFT): The WMFT is a test that evaluates stroke survivors' UE motor skills [10]. Intervention induced changes on different WMFT tasks is shown in [Table/Fig-15]. From the figure, it can be noted that before intervention the tasks that were affected were- Extending elbow with weight (side), lifting pencil and paper clip and flipping cards, however, as with other tasks, notable intervention induced changes were seen in these tasks as well on day 28 and 56.

Inter-vention	Rationale	Strategy	Dosage
ASAP	Task specific practice (skill) is necessary for neuroplasticity; addressing impairments in strength and control (capacity) forms the fundamental basis for restoration of UE function and motivation is necessary for active participation and adherence to treatment. Thus these 3 elements are fundamental for effective incorporation of paretic UE into Activities of Daily Livings (ADLs).	Tasks that were included: • Opening a water bottle, pouring water in glass/cup/mug and lifting the glass/cup/mug to drink water. • Using knife/fork to cut the food, picking food with spoon to feed. • Picking up a toothbrush, holding it and brushing teeth • Picking up a comb, holding it and combing hair. • Grasp and release towel, wiping table with a towel, folding towel and stacking them. • Kneading putty (gripping activities). • Grasping and releasing ball. • Card and/or coin manipulation (shuffling, picking, holding and placing) using different types of grasp/grips. • Turning pages of a book. • Peg board activities (removing and placing it in board again, making numbers and alphabets, etc.). • Writing with a pencil/pen (holding, writing alphabets and numbers, copying small sentences and paragraphs, writing in large and small print and drawing a picture).	Training sessions were given for 1 hour per day, 5 days per week for 6 weeks.

[Table/Fig-9]: Accelerated Skill Acquisition Programme (ASAP) with rationale, strategy and regimen [6].

[Table/Fig-10]: a) Passive knee flexion and extension; b) Passive hip flexion.

[Table/Fig-11]: a) Passive shoulder flexion; b) Passive movement with tapping facilitation (Biceps).

[Table/Fig-12]: Bilateral pelvic bridging.

Parameters	Day 1	Day 28	Day 56
Modified Ashworth Scale	Flaccid	1+	Normal tone
Voluntary Control Grading (VCG) [7]	0	2	5
Brunnstrom's recovery stages [8]	1	2	5

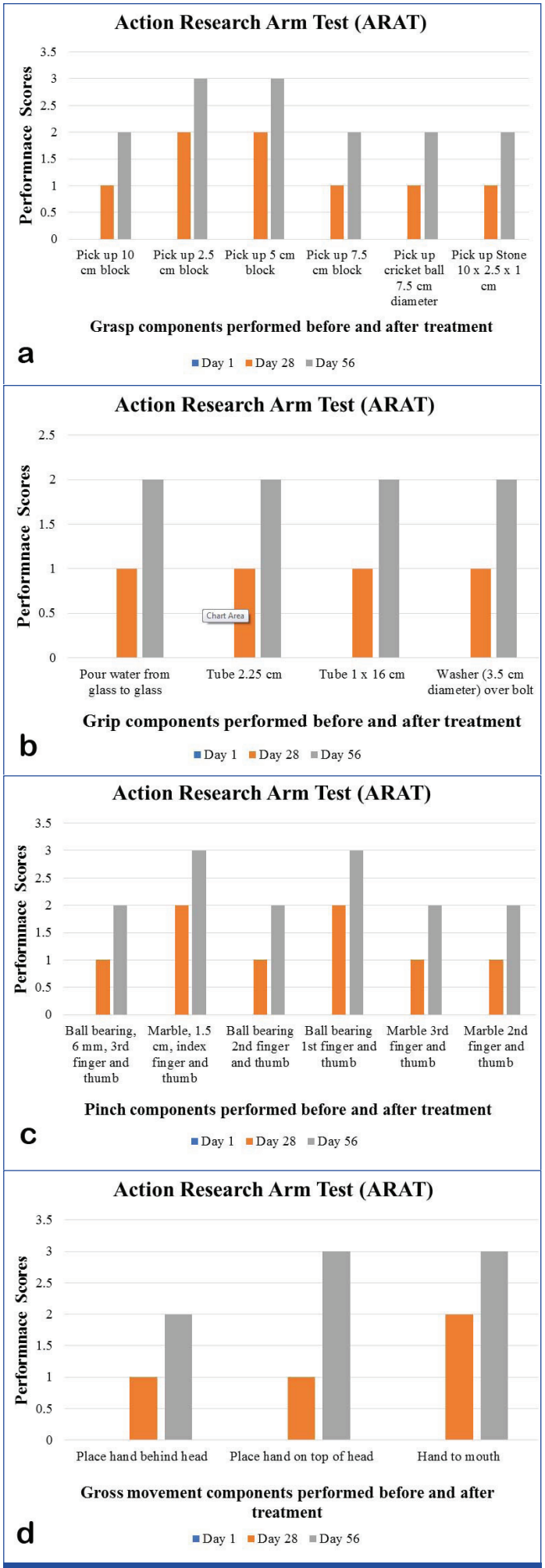
[Table/Fig-13]: Outcome measures taken at day 1, day 28 and day 56 [7,8].

European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire-Brain Neoplasm (EORTC QLQ-BN20)

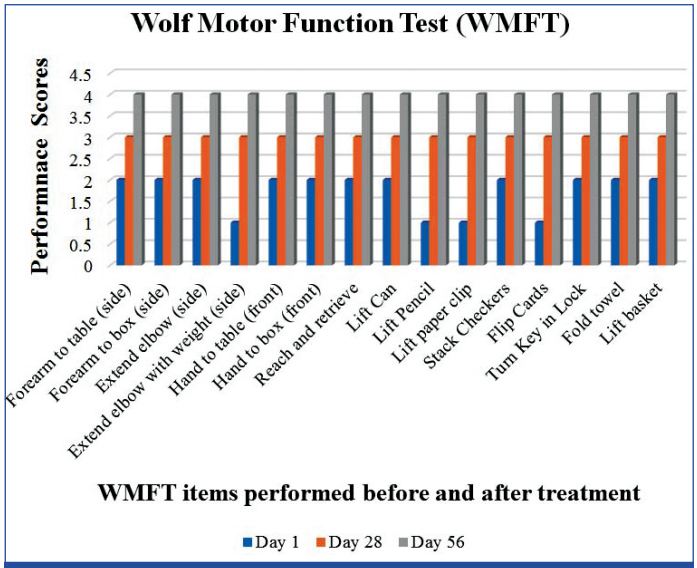
It is a validated 20-item QOL questionnaire for PBT patients. Later two extra questions were included to test cognitive function [11]. Intervention induced changes on EORTC QLQ-BN20+2 is shown in [Table/Fig-16]. It could be noted that following neurophysiotherapeutic and ASAP intervention, changes were seen not only in motor dysfunction and leg weakness components, but on some other components as well showing these interventions play an important role in improving overall QOL and necessitating utilisation of holistic approach in terms of patient and caregiver's counselling and constant encouragement.

DISCUSSION

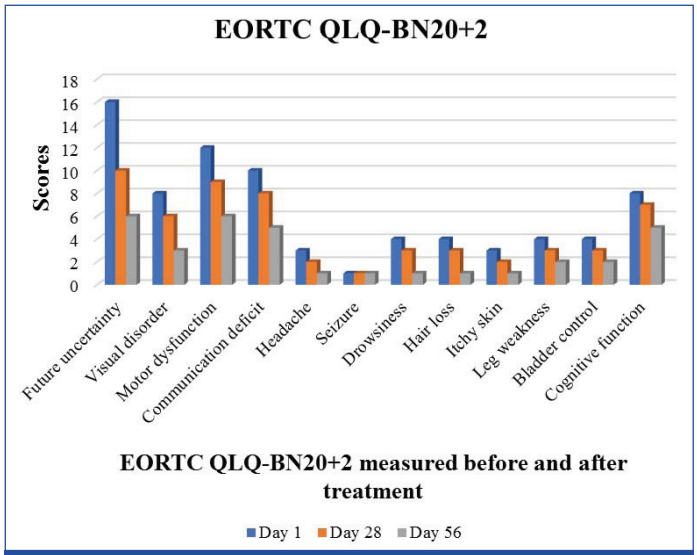
Astrocytic Brain Tumours (BT) are the most frequent type of juvenile neoplasm, accounting for almost 20% of all intracranial tumours in children under the age of 18 [12]. Central Nervous System (CNS) tumours account for 1.9% of all cancers diagnosed in India [13]. Astrocytomas (38.7%) were the prevalent Primary Brain Tumors (PBT), with the majority being high-grade gliomas (59.5%), according to an analysis of hospital-based datasets tracking CNS malignancies [14]. In both children and adults, gliomas are the frequently seen PBT arising from glial cell neoplasia [15]. The World Health Organisation (WHO) divides this diverse group of tumours



[Table/Fig-14]: a, b, c and d: Intervention induced changes on different ARAT components.



[Table/Fig-15]: Intervention induced changes on different WMFT tasks.



[Table/Fig-16]: Intervention induced changes on EORTC QLQ-BN20+2.

into four main categories i.e, astrocytomas, oligodendrogliomas, mixed oligoastrocytomas, and ependymal tumours [16]. The most frequent of these tumours is astrocytoma [17]. Astrocytomas are tumours that develop from astrocytes, which are glial cells having a star-shaped form that protect and support neurons, as well as assist in the transmission of information between them and are important for decoding signals in the brain [18]. There are the four types of astrocytic tumors defined histopathologically according to WHO criteria [1]:

- Pilocytic astrocytoma (grade I),
- Diffuse astrocytoma (grade II)
- Anaplastic astrocytoma (grade III)
- Glioblastoma (grade IV).

Histologically grade II astrocytomas are defined by homogeneous masses with uneven boundaries and worsened differentiation, caused by a suspected p53 gene mutation (causing hereditary propensity to cancer) and loss of chromosome 17 heterozygosity [12]. These tumours have more likelihood to develop in younger adults as well as they frequently advance to higher-grade tumours, although sequential evolution is seldom recorded in children [15]. They have a high recurrence rate because of hypercellularity and widespread invasion into the surrounding cerebral parenchyma [1,17].

Bases on the tumours, location, aggressiveness, and age of onset, the signs and symptoms may differ [19]. Before being diagnosed, almost half of the children will have experienced symptoms for 6 months or more [20]. Symptoms are vague and could be the result of increased intracranial pressure caused by ventricular obstruction, viz headache particularly in the morning, nausea, vomiting and lethargy. Reduced upward gaze, sixth cranial nerve palsies and papilledema are among the physical examination findings. Seizures, behavioural abnormalities, unilateral paresis, monoparesis, hemisensory loss, dysphasia, aphasia, irritability, an alteration in feeding pattern, and deterioration of recent memory are among other clinical manifestations [19,20]. This is consistent with the clinical findings reported in the present case.

Basic MRI modalities, native T1-Weighted Images (T1WIs), T2-WIs and T2-Fluid-Attenuation Inversion Recovery (T2-FLAIR) sequences, provide preliminary information about tumours [21]. On conventional MRI, HGA usually shows strong contrast enhancement, peritumoral edema, mass effects, heterogeneity, central necrosis, and intra-tumoral haemorrhage [22]. This is in consistence with the present case which revealed ill-defined intra-axial mass lesion in right frontoparietal lobe with significant mass effect and perilesional white matter oedema. The lesion was iso to hyperintense in both T1WIs and T2WIs and showed hyperintense Signal Intensity (SI) on FLAIR images. Postcontrast study revealed nodular and patchy areas of enhancement within the lesion. Diffusion Weighted Images (DWIs) showed multiple foci of low Apparent diffusion coefficient (ADC) in right caudate nucleus, right Basal Ganglia (BG) and corpus callosum with corresponding diffusion restriction. DWI findings are not consistent with those reported by Alshoabi SA et al., [21]. In present case, on Magnetic Resonance Spectroscopy (MRS), reduced N-Acetyl-aspartate (NAA) levels were noted which is in consistence with Alshoabi SA et al., [21]. Although, MRI findings were suggestive of HGA, immunohistochemistry testing of the biopsy sample confirmed the diagnosis as diffuse fibrillary astrocytoma (WHO grade II). Some

Authors	Age/ Gender	MRI Findings
Alshoabi SA et al., 2020 [21]	48/ Male	Irregularly outlined lesion with multiple low SI foci on T1WIs and high SI foci on T2WIs and FLAIR images in the left parietal lobe. Postcontrast T1WIs showed heterogeneous enhancement. DWIs showed no restricted diffusion in most parts of the lesion. Apparent diffusion coefficient (ADC) showed slightly high SI in some parts of the lesion. Magnetic Resonance Spectroscopy (MRS) showed reduced N-Acetyl-aspartate (NAA) levels.
Soliman S and Ghaly M, 2021 [23]	58/Male	**Preoperative findings:** Large intra-axial mass infiltrating left frontotemporal lobes, measuring 9.5 cm with 13 mm midline shift from left to right. **Postoperative findings:** Partial resection of the tumour, with decreased peripheral contrast enhancement and decreased mass effect, resulting in diminished midline shift from left to right now measuring 9 mm. MRI of the brain revealed acute left posterior, frontal, and parietal infarct status post recent partial resection of the left frontotemporal lobe tumour.
Present Case, 2022	10/ Female	**Preoperative findings:** Ill-defined intra-axial mass lesion in right frontotemporal lobe with significant mass effect and perilesional white matter oedema. Iso to hyperintense lesion in both T1WIs and T2WIs and hyperintense SI on FLAIR images. Postcontrast study revealed nodular and patchy areas of enhancement within the lesion. Diffusion-weighted images showed diffusion restriction. Mild midline shift of approximately 6 mm towards the left side. **Postoperative findings:** T2 hyperintense cystic changes with peripheral haemorrhages involving right frontotemporal lobe. The lesion appears hypointense on T1WIs without restricted diffusion. T2 FLAIR images showed diffuse non enhancing hyperintense SI and perilesional oedema in right fronto-temporal lobes. Mild mass effect on right lateral ventricle with minimal midline shift of 2 mm to the left. MRS through right basal ganglia lesion did not show any raised choline and decreased NAA levels.

[Table/Fig-17]: Review of similar cases published [21,23].

of the postoperative MRI findings were in consistence with those reported by Soliman S and Ghaly M, [23] [Table/Fig-17].

The primary treatment for high-grade gliomas is surgical excision, it allows pathologists to obtain a tumour sample, lowers intracranial pressure, and shrinks the tumour. Complete resection has been linked to a better prognosis, but it is difficult to obtain. The fact that BT borders are difficult to determine and surgery could affect brain function pose challenges [19]. Furthermore, due to the close vicinity to the brain stem and enlarged and soft cranial nerves (oedema) during tumour resection, neurological deficit usually occurs in 30% of postoperative patients, but half of this is transitory [24]. In most cases, complete surgical removal of these tumours is not possible [17]. Post-tumour resection, hemiplegia is one of the common neurological issues seen in these patients which affects functional independence and thus an individual's quality of life [23]. In present case as well, post-tumour resection, hemiplegia was noted.

Brain tumours has been demonstrated to be a risk factor for acute ischaemic infarction, and vice versa. Ischaemic stroke patients are more likely to develop BT, usually glioma, as a result of alterations in the cell's functional and metabolic status caused by ischaemia and hypoxia. Astrocytic activation, reactive gliosis, angiogenesis, and other changes in the tumour microenvironment are all generated by cerebral ischaemia as a result of glioma growth and are thought to play a role in the interaction among the two processes. Moreover, the frequency with which gliomas are resected increases the risk of ischaemic damage [23]. 50 % of the patients experienced ischaemic infarction in an acute stage post tumour resection in a research trial of 66 patients with ischaemic stroke and an antecedent BT [25].

Preoperatively, the index patient suffered from weakness over right side and postoperatively, from left sided hemiplegia. Given the resemblance in symptoms between stroke and BTs, this is not astonishing that rehabilitative efficiency is comparable in terms of several outcome measures. Yu J et al., found significant functional improvements in BT patients who received comprehensive rehabilitation for motor, balance, cognition, and Activities of Daily Living (ADL) function. This was comparable to the improvement seen in stroke patients [26]. Motor dysfunction in PBT results from direct impact of tumour site and swelling, and/or treatments such as surgery, chemotherapy, radiation, steroids, and/or other medications. It is characterised by unilateral or bilateral weakness, ataxia, spasticity, and the inability to execute complex movements [3]. Following brain surgery, paralysis-related weakness is most noticeable. Over the course of weeks or months, strength may recover. In general, the sooner one regains strength, the faster the recovery [27]. Consequently, patients need long-term integrated and coordinated management, comprising of rehabilitation, in order to improve their functional, mental and emotional well-being, and quality of life.

As per reports, people with BT can achieve functional improvements comparable to those with stroke and traumatic brain injury when undergoing inpatient rehabilitation. Physiotherapy and occupational therapy are recommended by the Australian Cancer Network (ACN) for patients with residual motor deficits (strength, coordination, and balance) and residual issues in self-care and functional independence respectively [28]. As soon as the patient is stabilised following surgery, neurophysiotherapeutic rehabilitation should begin in PBT patients during an acute care stay.

Preventing medical problems and encouraging early mobilisation and resuming of self-care activities are the primary consideration during acute care [3]. Along with, all of these above-mentioned facts, thorough patient assessment and reference from literature related to physiotherapy management of hemiplegia were taken into consideration while designing rehabilitation protocol for the present case. As literature have stated, main focus of rehabilitation was on improving functional mobility, strength, co-ordination, balance, gait and ability to execute ADLs and also more importantly on prevention of hazards of bed rest. Needless to say, all of these motor functions are inter-related with each other, so all of them should be given attention to while designing treatment protocol as well as while administering the same. Rationale, strategy and regimen of all the neurophysiotherapy interventions is mentioned in therapeutic intervention [Table/Fig-8]. As mentioned previously as left UL was more involved than left LL, along with conventional neurophysiotherapy interventions we have also given one of the proven UE motor training intervention- ASAP to the patient [Table/Fig-9].

The ASAP is a patient-centred motor training intervention. The acquisition of skilled movements is achieved through task-oriented training, impairment is reduced, and self-confidence is built through correct task selection, problem solving, and decision-making [29]. It is a task-oriented intervention reported to improve functional abilities by addressing activity limitations and participation restriction. The fundamental problems that ASAP addresses are conceived as the learning or relearning of motor skills to optimally affect neural plasticity as well as skills to self-direct post training activities. Skill acquisition is facilitated by mitigation of impairments (e.g., muscle weakness and low self-efficacy) to enhance capacity. In this intervention, attention is given to motor learning, motor control and basic exercise physiology (e.g., overload in terms of training load/intensity and speed) principles. Social-cognitive psychological theories of motivation are applied in this intervention for immediate and particularly longer-term participant motivation [30].

The ASAP have demonstrated faster performance, improved quality of movement, and better functional improvement especially in individuals with hemiplegia [31]. Authors adopted this treatment method as their was motor impairment (muscle weakness) in the UE which resulted in functional limitations (inability to perform ADLs) and also because it was proven to be effective in individuals with hemiplegia for mitigating motor impairments thus producing functional improvements. The main aim of physiotherapeutic intervention was to improve or restore independence in ADLs and thus improving quality of life. For that purpose, we mainly focused on improving mobility, strength, balance and co-ordination. Also, as UE was more involved, both gross and fine UE motor skills were affected, for which along with neurophysiotherapeutic interventions (ROM exercises, Rood's facilitatory techniques initially and later inhibitory techniques, Manual Muscle Stimulation (MMS), Functional Electrical Stimulation (FES) and gripping or prehension exercises) the patient was given ASAP. This resulted in fulfilment of the main aim of physiotherapeutic intervention which was observable in terms of improvement in ARAT, WMFT and EORTC QLQ-BN20+2 scores.

Prognostic factors include number of patient and tumour characteristics, such as age at diagnosis, gender, performance status, histology subtype, presence of seizures at diagnosis and extent of resection. Female patients had a longer survival compared with males [1]. Postoperative management is directed toward close clinical and radiographic follow-up (MRI), especially if the tumour histology has concerning features [20]. Differential diagnosis for astrocytoma includes-Glioblastoma multiforme, brain metastasis, brain abscess, oligodendroglioma, encephalitis, multiple sclerosis, cardioembolic stroke [32].

CONCLUSION(S)

Motor dysfunction following brain tumour resection is likely to occur and can result in decreased mobility, difficulty with daily tasks, increased risk of immobility-related problems, falls, pain, anxiety/depression, functional dependency and QoL. This case study demonstrated the effectiveness of conventional neurophysiotherapy and ASAP in improving UE motor function and functional independence thus improving overall quality of life in a case of hemiplegia postbrain tumour resection.

REFERENCES

[1] Tove LL, Andreas Hanssøn H, Stein S, Sverre H. Prognostic value of histological features in diffuse astrocytomas WHO grade II. Int J Clin Exp Pathol. 2012;12;5(2):152-58.
[2] Yadav V, Gera C, Yadav R. Evolution in hemiplegic management: A review. Int J Health Sci Res. 2018; 8(5):360-69.
[3] Gillis T, Yadav RR, Guo Y. Rehabilitation of Patients with Neurologic Tumors and Cancer-Related Central Nervous System Disabilities. 2002. Corpus ID: 6432987.
[4] Kushner DS, Amidei C. Rehabilitation of motor dysfunction in primary brain tumor patients. Neuro-Oncol Pract. 2015;2(4):185-91.
[5] Gardas S, Sawant N. Role of Physiotherapy in Juvenile Pilocytic Astrocytoma of Brainstem: A Case Report. Int J Health Sci Res. 2019;9(1):321-25.
[6] Winstein C, Wolf S, Dromerick A, Lane C, Nelsen M, Lewthwaite R, et al. Interdisciplinary Comprehensive Arm Rehabilitation Evaluation (ICARE): A randomized controlled trial protocol. BMC Neurol. 2013;11;13:5.
[7] Stein J, Harvey RL, Winstein CJ, Zorowitz RD, Wittenberg G. Stroke recovery and rehabilitation. 1st ed. New York, NY: Demos Medical Publishing; 2008.
[8] Babar T, Dadgal R, Kovela R, Qureshi MI. Case Report on the role of physiotherapy in improving the quality of life of a patient with Amyotrophic lateral sclerosis. Medical Science, 2022, 26, ms241e2160. Doi: https://doi.org/10.54905/disssi/v26i124/ms241e2160.
[9] Naghdi S, Ansari NN, Mansouri K, and Hasson S on a neurophysiological and clinical study of Brunnstrom's recovery stages in the upper limb following stroke. Brain Inj. 2010;24(11):1372-78. Doi: 10.3109/02699052.2010.506860.
[10] Ward NS, Brander F, Kelly K. Intensive upper limb neurorehabilitation in chronic stroke: outcomes from the Queen Square programme. J Neurol Neurosurg Psychiatry. 2019;90(5):498-506.
[11] Wolf SL, Thompson PA, Morris DM, Rose DK, Winstein CJ, Taub E, et al. The EXCITE trial: attributes of the Wolf Motor Function Test in patients with subacute stroke. Neurorehabil Neural Repair. 2005;19(3):194-205.
[12] Nguyen J, Zhang L, Clemons M, Vassiliou V, Danielson B, Fairchild A, et al. Content validation of the EORTC QLQ-BN20+2 with patients and health care professionals to assess quality of life in brain metastases. J Radiat Oncol. 2012;01.
[13] Santos CCT, Kimura CA, Pacondes De Miranda CSS, Menezzes Da Silva KDJ, dos Santos AC, et al. Astrocytomas children grade ii in frontal region case study. J Cancer Prev Curr Res. 2018;9(2):93-95. Doi: 10.15406/jcpcr.2018.09.00327.
[14] Yeole BB. Trends in the brain cancer incidence in India. Asian Pac J Cancer Prev. 2008;9(2):267-70.
[15] Dasgupta A, Gupta T, Jalali R. Indian data on central nervous tumors: A summary of published work. South Asian J Cancer. 2016;5(3):147-53.
[16] Gerges N, Fontebasso AM, Albrecht S, Faury D, Jabado N. Pediatric high-grade astrocytomas: A distinct neuro-oncological paradigm. Genome Med. 2013;5(7):66.
[17] Louis DN, Ohgaki H, Wiestler OD, Cavenee WK, Burger PC, Jouvet A, et al. The 2007 WHO classification of tumours of the central nervous system. Acta Neuropathol (Berl). 2007;114(2):97-109.
[18] Dong X, Noorbakhsh A, Hirshman BR, Zhou T, Tang JA, Chang DC, et al. Survival trends of grade I, II, and III astrocytoma patients and associated clinical practice patterns between 1999 and 2010: A SEER-based analysis. Neuro-Oncol Pract. 2016;3(1):29-38.
[19] Chaulagain D, Smolanka V, Smolanka A. Diagnosis and management of astrocytoma: A literature review. Int Neurol J. 2022;18(1):23-29.
[20] García-Cárdenas JM, Zambrano AK, Guevara-Ramírez P, Guerrero S, Runruil G, López-Cortés A, et al. A deep analysis using panel-based next-generation sequencing in an Ecuadorian pediatric patient with anaplastic astrocytoma: A case report. J Med Case Reports. 2020;14(1):136. Doi: 10.1186/s13256-020-02451-4.
[21] Sievert AJ, Fisher MJ. Pediatric low-grade gliomas. J Child Neurol. 2009;24(11):1397-408.
[22] Alshoabi SA, Alareqi AA, Omer AM, Suliman AG, Daqqaq TS. Diffuse astrocytoma and the diagnostic dilemma of an unusual phenotype: A case report. Radiol Case Rep. 2020;16(2):319-26.
[23] Lee EJ, Lee SK, Agid R, Bae JM, Keller A, terBrugge K. Preoperative grading of presumptive low-grade astrocytomas on MR imaging: Diagnostic value of minimum apparent diffusion coefficient. Am J Neuroradiol. 2008;29(10):1872-77.
[24] Soliman S, Ghaly M. Ischemic stroke after tumor resection in a patient with glioblastoma multiforme. Cureus. 2021;13(2):e13232.
[25] Riefma D, Adhimarta W, Islam AA, Widodo D, Nasrullah, Ihwan A, et al. Juvenile high-grade astrocytoma mimicking a cerebral abscess: A case report. Med Clínica Práctica. 2021;4:100230.
[26] Kreisl TN, Toothaker T, Karimi S, DeAngelis LM. Ischemic stroke in patients with primary brain tumors. Neurology. 2008;70(24):2314-20.
[27] Yu J, Jung Y, Park J, Kim JM, Suh M, Cho KG, et al. Intensive rehabilitation therapy following brain tumor surgery: A pilot study of effectiveness and long-term satisfaction. Ann Rehabil Med. 2019;43(2):129-41.
[28] Ching W, Luhmann M. Neuro-oncologic physical therapy for the older person. Top Geriatr Rehabil. 2011;27(3):184-92.
[29] Kim WJ, Novotna K, Amatya B, Khan F. Clinical practice guidelines for the management of brain tumours: A rehabilitation perspective. J Rehabil Med. 2019;51(2):89-96.
[30] Winstein C, Lewthwaite R, Blanton SR, Wolf LB, Wishart L. Infusing motor learning research into neurorehabilitation practice: A historical perspective with case exemplar from the accelerated skill acquisition program. J Neurol Phys Ther JNPT. 2014;38(3):190-200.
[31] Adhikari SP, Tretriluxana J, Chaiyawat P, Jalayondeja C. Enhanced upper extremity functions with a single session of action-observation-execution and accelerated skill acquisition program in subacute stroke. Stroke Res Treat. 2018;2018:e1490692.
[32] Kapoor M, Gupta V. Astrocytoma. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2022.

PARTICULARS OF CONTRIBUTORS:

1. Intern, Department of Neurophysiotherapy, Ravi Nair Physiotherapy College, Datta Meghe Institute of Medical Sciences (DU), Sawangi Meghe, Wardha, Maharashtra, India.
2. Associate Professor, Nitte Institute of Physiotherapy, NITTE (Deemed to be University), Deralakatte, Mangaluru, Karnataka, India.
3. Resident, Department of Neurophysiotherapy, Ravi Nair Physiotherapy College, Datta Meghe Institute of Medical Sciences (DU), Sawangi Meghe, Wardha, Maharashtra, India.
4. Intern, Department of Neurophysiotherapy, Ravi Nair Physiotherapy College, Datta Meghe Institute of Medical Sciences (DU), Sawangi Meghe, Wardha, Maharashtra, India.
5. Intern, Department of Neurophysiotherapy, Ravi Nair Physiotherapy College, Datta Meghe Institute of Medical Sciences (DU), Sawangi Meghe, Wardha, Maharashtra, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Purva Hanumanprasad Mundada,
Arihant Apartment, F2, Behind Yashodeep Convent School,
Wardha, Maharashtra, India.
E-mail: m8538.rnpc@dmimsu.edu.in

PLAGIARISM CHECKING METHODS: [Jain H et al.]

- Plagiarism X-checker: Jun 09, 2022
- Manual Googling: Jul 14, 2022
- iThenticate Software: Sep 14, 2022 (10%)

ETYMOLOGY: Author Origin

AUTHOR DECLARATION:

- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. Yes

Date of Submission: **May 14, 2022**
Date of Peer Review: **Jun 11, 2022**
Date of Acceptance: **Jul 21, 2022**
Date of Publishing: **Oct 01, 2022**