**Role of Physical therapy in paediatric cases of neuro-oncolgy**

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Cancer is a leading cause of death for children and adolescents affecting approximately 400 000 people between 0-19 years. The most common types include leukaemia, brain cancers, lymphomas and solid tumours, such as neuroblastoma and Wilms tumours. Childhood cancer cannot generally be prevented or identified through screening**.** The likelihood of surviving a diagnosis of childhood cancer depends on the country in which the child lives: in high-income countries, more than 80% of children with cancer are cured, but in many LMICs less than 30% are cured.

EPIDEMIOLOGY

In Asia, the leading cause of paediatric carcinoma is leukemia. All CNS tumours are mostly prevelant in United States followed by Japan,Denmark ,Scandinavian nations and other parts of Eurpoe. In U.S., Whites and Asians-Pacific Islanders have a higher CBT incidence than Blacks and American Indians/Alaska Natives, while Non-Hispanics have higher incidence than Hispanics.

The lowest incidence is in Africa while its highest level is in northern Europe. a difference in the incidence between different regions is due to genetic backgrounds and ethnic differences among different populations . The highest incidence rates in the men of Armenia, Albania, Macedonia, Serbia, Georgia. In women, the highest incidence is seen in Sweden, Albania, Serbia, Latvia, Norway.

A brain tumour occurs due to genetic alteration in the normal cells in the brain. This causes the cells to undergo a series of changes that result in a growing mass of abnormal cells. Brain tumours may be low grade (less aggressive) or high grade (very aggressive). Some tumours have germ line mutations while the majority result from somatic mutations. CNS tumours are the most common solid tumours in children.

The majority of paediatric tumours are in the posterior fossa.

1. Juvenile pilocytic astrocytoma (JPA),
2. Ependymoma,
3. Diffuse intrinsic pontine rhabdoid tumour (ATRT).

Other 40 percent of pediatric brain tumours are in the cerebral hemispheres.

Strocytomas, Gangliogliomas, Craniopharyngiomas, Supratentorial primitive neuroectodermal tumours (PNET), Germ cell tumours, Oligodendrogliomas, Meningiomas dysembryoplastic neuroepithelial tumours (DNET),

**1.GLIOMA**

**Astrocytoma**.- most common type of childhood glioma. They typically occur in the cerebellum, a part of the brain that coordinates voluntary muscle movements and maintains posture, balance and equilibrium

OTHERS:

Malignant Gliomas and Ependymoma (affecting the ventricles)

**2.Mixed neuronal-glial tumours-**Tumours containing a mix of glial cells (most commonly astrocytes) and neurons (ganglion cells). They typically appear in the cerebrum, an area of the brain involved in motor function and personality. Surgery often is effective.

**3.Ganglioglioma**. This is the most common of the mixed neuronal­glial tumours. The majority are benign.

OTHERS- Subependymal giant cell tumour (tuberous sclerosis(genetic)), Pleomorphic xanthoastrocytoma

**4**.**Embryonic tumours** (25%) are due to poorly differentiated neuroepithelia cells which are responsible for nerve and glial cell formation. **Primitive neuroectodermal tumour (PNET).** Typically appears in the cerebellum, it is called medulloblastoma. **Atypical teratoid/rhabdoid tumour-**commonly occurs in children >2 yrs old due to abnormality of chromosome 22. Typically appears in the cerebellum.

**5.Tumours arising from non-neuroepithelial tissue**- The intracranial (inside the skull) and intraspinal (within the spine)

**6.Craniopharyngioma**- Originates from residual tissue left behind following the development of the head. Because they occur at the front base of the brain near the pituitary gland and optic nerves, they may cause serious neurological and endocrine problems.

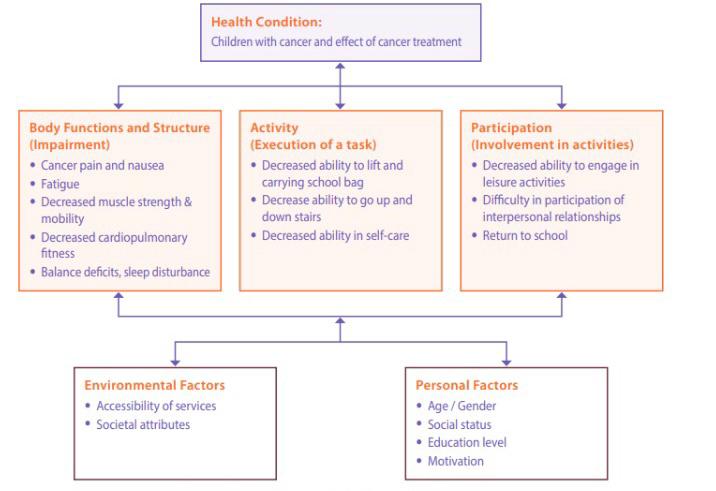
**REHABILITATION**

Brain tumors have been the most common paediatric solid tumor and leading cause of morbidity and mortality. Even after surgery at times the quality of life is lost or severely affected. The side effects Radiotherapy and chemotherapy are often radical. Patients have reported reduced muscle power and sensation in the area with localised radiotherapy who are often then referred to PT and OT.Children or adult survivors often develop reduced knee and hip extension, postural issues reduced hand grip, inability to reach normal VO2 max. reduced tolerance to exercise and early osteoporosis. Deficits in executive functioning and problem-solving interfere with maintaining proper nutrition and engaging in physical activity. Under nutrition decreases muscle mass, affecting exercise capabilities and malnutrition can lead to infection and mortality.These challenges lead to a sedentary life and often become a cause of obesity in these individuals.

**OTHER COMPLICATIONS**

Increased intracranial pressure, Headache, nausea, vomiting, fatigue ,decreased up gaze, sixth cranial nerve palsies, papilledema

Infants: macrocephaly, failure to thrive, developmental delay ,Ataxia ,“Flu-like” symptoms ,Cranial nerve deficits ,Cognitive deficits or changes in school performance ,Mental status changes , Seizures



**POSTURAL IMPAIRMENT IN BRAIN TUMOUR SURVIVOR ADULTS**

A known neurotoxic side effect from vincristine and methotrex may appear initially. Moreover, ototoxic drugs induce a gradual loss of sensory cells and primary vestibular neurons which may develop into a significant functional lesion many years after the end of treatment. This was more visible amongst the younger age groups as immaturity of the peripheral and central nervous systems in children made these systems more susceptible to physical and functional changes and irreversible damage from chemotherapeutic agents. Using positron emission tomography, have caused alterations in resting metabolism and cerebral blood flow in the basal ganglia, inferior frontal gyrus and cerebellum during memory activation in women who had received chemotherapy 5–10 years earlier.

**CANCER PAIN & RELATED SYMPTOM**

Cancer pain is one of most prevalent symptoms in children with cancer. It was found that TENS, heat / cold therapy and massage therapy had been shown to relieve musculoskeletal pain . 80% of children undergoing chemotherapy experienced some degree of Oral Mucositis an inflammatory, erosive, and/or ulcerative process inside the mouth, which may affect their eating, drinking, and talking. Research shows that Low-level Laser Therapy could significantly reduce pain and duration symptoms in patients. Acupuncture was reported as a safe adjunctive therapy for symptom management including pain , nausea and vomiting .It began to gain more notice and acceptance by children and parents as a non-pharmacological intervention for symptom management.

**CANCER-RELATED FATIGUE (CRF), MUSCLE WEAKNESS, BALANCE DEFICITS AND DECREASED CARDIOPULMONARY FITNESS**

One chemotherapy agent i.e.Vincristine is known to cause chemotherapy-induced peripheral neuropathy. The clinical manifestations include muscle weakness, areflexia, neuropathic pain, sensory loss and significant gait abnormalities. Research found that low intensity aerobic exercise had significant positive effect on CRF in cancer survivors and literature has proven that hydrotherapy is a good exercise intervention to treat patients with CRF. It also promotes relaxation. The buoyancy is particularly suitable for children who suffer from bones, joints or soft tissues pain. Other water properties including hydrostatic pressure, thermodynamics and viscosity can achieve various therapeutic purposes e.g. decrease pain and muscle tension, improve muscle strength, balance and cardiopulmonary efficiency. Literature showed that Deep Water Running (DWR) training decreased CRF in cancer survivors and it yield similar improvement of VO2max as compared with land-based running. DWR is a kind of running in water deep enough to cover the shoulders with the feet keep off the bottom of the pool and hence with a much lower musculoskeletal stress to the joints.

**SLEEP DISTURBANCE**

The most common sleeping disorder of children with cancer was Obstructive Sleep Apnea which could be caused by inadequate control of the muscles that maintain patency of the upper airway. A meta-analysis study reported that Orofacial Myofunctional Therapy (OMT) could decrease apnea-hypopnea index by 62% .OMT emphasizes on the training of tongue and facial muscle. Tongue exercise includes moving the tongue along the superior and lateral surfaces of the teeth, positioning the tongue tip against the anterior aspect of the hard palate etc while facial exercises address the lip , buccinators, and jaw muscles.

**IMPROVING PHYSICAL ACTIVITY**Group and home exercise programs in a graded manner are prescribed to the patient. Some researched have used wearable fitness trackers in children to study the difference in activity level and fatigue in such children. Stretching and ROM exercises to improve functioning and ADL

**INTERVENTION WITH AI**

Active video gaming (AVG) could bring about regular, enjoyable, physical exercise in children treated for brain tumours. Weekly Internet coaching sessions were used to sustain motivation and evaluate enjoyment. Energy expenditure (EE) levels were measured as Metabolic Equivalent of Task (MET). The body coordinatio0n and fitness score improved significantly.

**IMPORTANCE OF NUTRITION WITH EXERCISE**

Nutritional status improved with proactive ETF and nutritional supplements (as in decreased episodes of febrile neutropenia with shorter hospital stays using Nigella seeds. Proper nutrition improves body composition and overall health and immunity of the child which is low post treatment. It is also important for children who have developed dysphasia or oral muscular disorders post treatment or due to compression because of tumour growth.

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