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## EFFECT OF NEURODEVELOPMENTAL OCCUPATIONAL THERAPY WITH PLAY ACTIVITIES IN FUNCTIONAL RECOVERY OF A 5-YEAR-OLD CHILD WITH CERVICAL INTRAMEDULLARY SPINAL TUBERCULOMA - A CASE REPORT

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### INTRODUCTION

Tuberculosis (TB) is an infectious disease caused by *Mycobacterium tuberculosis*. Tuberculosis commonly affects the lungs, but can also affect other parts of the body. It spreads from person to person through the air, when people who are infected with TB infection cough, sneeze or otherwise transmit respiratory fluids through the air.<sup>1</sup> About one-quarter of the world's population is estimated to be infected by TB bacteria but out of these only 5-15% of people will fall ill with active TB disease. The rest have TB infection with no illness and cannot transmit the disease. According to WHO, an estimated 9.9 million people fell ill with TB and 1.5 million people died globally in 2020, despite being a preventable and curable disease.<sup>2</sup>

Tuberculosis of the central nervous system (CNS) is rare, with an incidence of only 0.5–2% of patients with systemic tuberculosis. Neurotuberculosis is a rare disease, representing less than 2% of extrapulmonary tuberculosis infections.<sup>3-5</sup> Tuberculoma of the CNS is unusual, whereas intramedullary tuberculomas are rare. The incidence of intramedullary tuberculoma (IMT) is extremely low and is seen in 2 of 1000 cases of central nervous system tuberculosis.<sup>6</sup> In most cases, it is found in the thoracic cord; the chance of tuberculoma growing in the cervical and lumbar regions of the cord is lower.

This study aims to report a relatively rare entity—intramedullary tuberculoma of cervical spine—and describe its management and some key learning points. Intramedullary tuberculomas are rare entities. Intramedullary tuberculoma is most commonly found in the thoracic cord of a patient and is rarely seen in the cervical cord.

Neurodevelopmental Treatment (NDT) is a client-centred, hands-on, problem-solving approach used to manage and treat individuals with central nervous system pathophysiology (NDTA, 2012). NDT was developed by Berta and Karel Bobath. This approach has evolved over the three main paradigm shifts experienced in the history of the occupational therapy profession. In occupational therapy, NDT is considered a preparatory treatment because it is directed toward establishing sensorimotor performance components that are prerequisites for occupational performance. It involves direct handling to guide normal movement patterns. The client's strengths and impairments are addressed in relation to functional abilities and limitations. Intervention is guided by the client's reactions throughout every treatment session. NDT addresses sensory and motor consequences in posture and movement associated with cerebral palsy, TBI, CVA, and developmental disability). Treatment incorporating NDT principles has improved the quality of life for many people living with functional limitations.

Play has been identified as one of the primary occupations in which people engage, according to the American Occupational Therapy Association (AOTA) Practice Framework. As defined by Parham and Fazio, play is “any spontaneous or organized activity that provides enjoyment, entertainment, amusement or diversion”<sup>11</sup>

An occupation-based view of play is built on basic notions concerning the importance of an occupation to an individual. In occupational behaviour and science, play is viewed as an occupation, determined by the individual and his or her interaction with the environment.<sup>8</sup>

The improvement of play skills and playfulness enables competent interaction with the world. In Primeau's study of play patterns in families, she suggested that parents modify the environment, incorporate play into the family's routine, and provide verbal suggestions to improve and increase the child's play.<sup>9</sup>

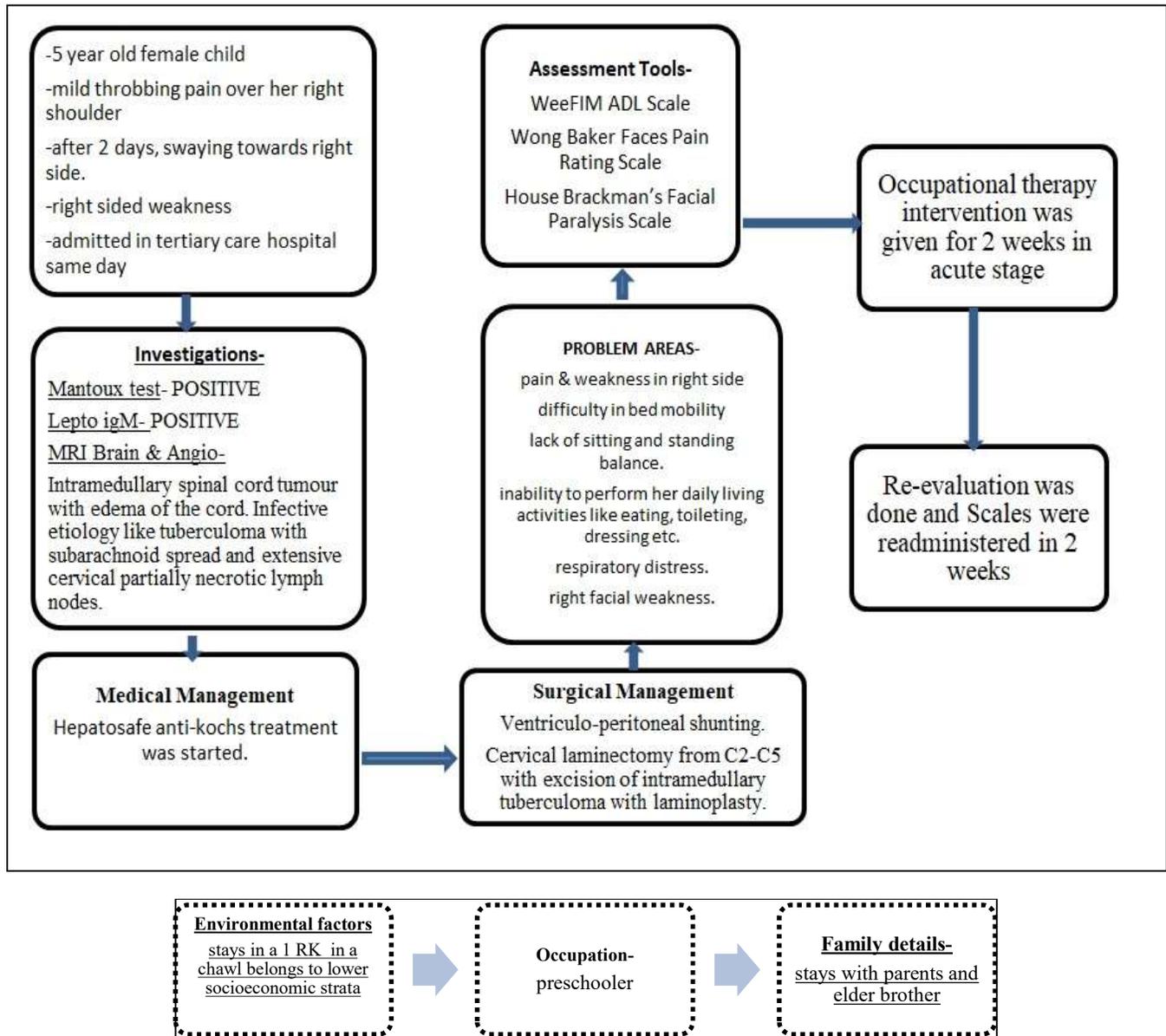
Facilitating playfulness in the child can be an important goal of therapy. The more playful child may generalize this flexible approach into environmental interaction beyond play and into other aspects of his or her life. For the child with a condition that impedes his or her ability to interact with the social or physical environment, a flexible (playful) approach may enable the child to succeed more frequently in these difficult situations.<sup>10</sup> Whether the goals of therapy are to use play a medium, to develop play skills, or to develop playfulness, planning intervention must always take into account the interaction among the therapist, the child, and the equipment and play objects in the environment. The therapist needs to create a playful atmosphere and attitude for the child to respond playfully.

### HISTORY AND CLINICAL PICTURE

A 5-year-old female child with normal physical and social development was apparently alright till 20<sup>th</sup> January 2022 when she developed mild throbbing pain over her right shoulder on movement which subsided at rest. After 2 days mother observed child having difficulty in walking, swaying towards right side and reduced movements in her right upper and lower extremity she was immediately admitted to a tertiary care hospital. On the basis of investigations, she was diagnosed as a case of cervical intramedullary spinal tuberculoma, she was managed on anti-tubercular drugs, underwent surgical intervention after 8 days.



Patient had respiratory distress during hospital stay and was managed on artificial oxygen support. She also developed right sided lower motor neurone facial palsy after surgery and was referred to occupational therapy department for further management.



Fig\_1: Flow of Clinical Presentation and Management

As per illustration in fig-1, patient was evaluated, goals were formulated, patient received occupational therapy intervention for 2 weeks and was discharged to follow up on outpatient basis.

#### ASSESSMENT

1. **WeeFIM SCALE-** The WeeFIM is a standardized measure of functional performance developed for use in children 6-months to 8-years of age but with application through adolescence. It includes 18 domains of performance which are scored on a 7-point scale from 'total assistance' to 'complete independence'. It rates children on their performance of an activity by taking into account their need for assistance from a helper or a device. If help is needed, the scale quantifies that need. Higher score indicates higher level of functional independence.

- WONG BAKER FACES PAIN RATING SCALE-** The Wong-Baker FACES Pain Rating Scale (WBS), used in children to rate pain severity. It is the pain scale most preferred by physicians, parents and children. It proves to be an inexpensive, yet easy to use, pain scale, these factors are important, as measuring pain in children can be extremely difficult. The scale consists of six faces that range from no pain at all to the worst pain imaginable. It is recommended for person age 3 years and older.
- HOUSE BRACKMAN FACIAL PARALYSIS SCALE-** The House-Brackmann Scale is one of the most commonly used tool for the clinical evaluation of facial nerve function. The scale is based upon functional impairment, ranging between I (normal) and VI (no movement). It is used to determine the severity of facial nerve dysfunction in people with facial palsy. It can be used irrespective of the cause of the palsy.

### SHORT- AND LONG-TERM GOALS

Goals were formulated on the basis of parent's requirement and patient's stage of development.

#### Short term goals-

- ▶ Patient will be able to roll over to right (affected) side independently within a week.
- ▶ Patient will be able to sit with four post collar and hand support for 10 minutes twice a day to watch poem video in 2 weeks.
- ▶ Patient will be able to hold 1/4<sup>th</sup> filled water bottle with both the hands and drink water with minimum assistance in 1 week.

#### Long term goals-

- ▶ Patient will be able to walk with four post collar and minimum support at least twice a day in next 4 weeks.
- ▶ Patient will be able to do her some basic ADL tasks like eating, grooming and dressing independently once a day in 4 weeks.

### OCCUPATIONAL THERAPY INTERVENTION

Occupational therapy treatment was given for 2 weeks. Early intervention was started immediately after surgery in intensive care unit. Neurodevelopmental techniques were used by engaging the child in play activities to encourage active participation, reduce discomfort and make therapy sessions more interactive, playful and goal oriented. Appropriate reinforcements in the form of more play time, favourite toys and new games were given to encourage the behaviour and facilitate movements. Directive and controlled play approach was used where child's activities were structured and directed by the therapist.



Fig\_2- Occupational Therapy Intervention- Neurodevelopmental Therapy with Play Activities

Occupational therapy intervention was divided into two phases on the basis of number of weeks after surgery:

1. Immediate post-operative care
2. Early inpatient rehabilitation

NO. OF WEEK	GOAL	INTERVENTION
Week Immediate Post-operative Care	-Correct positioning -prevention of secondary complications. -Improvement of vital capacity -Tone normalization -Pain management -Roll over to affected side	-Correct positioning of right extremity with the help of pillows and foot drop splint was done. Precautions to prevent bedsores like weight relieving techniques. <b>In bed mobility</b> exercises like <b>log rolling</b> with assistance was done with reinforcement in the form of more play time and also taught to mother for handling. <b>DBEx</b> with frequent <b>rest periods</b> were provided. Balloon blowing activity was given to make activity more fun and divert patient's sense of pain.



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		Different tone normalization <b>facilitatory techniques</b> like fast brushing, stroking, alternate contraction of muscles, joint compression, in supine and side lying position was taught and advised. PNF patterns of quick stretch and repetitive contraction was given. Patient was advised to try <b>voluntarily contracting</b> muscles during facilitation. Attractive toys, alphabets and number repetition used to encourage active participation of patient.
<b>Weeks Early In-patient Rehabilitation</b>	<ul style="list-style-type: none"> <li>-In bed mobility and transition</li> <li>-Sitting tolerance activities.</li> <li>-Desensitization</li> <li>-Facial muscle strengthening</li> <li>-sit with four post collar and hand support</li> <li>-Drink 1/4<sup>th</sup> filled water bottle with both the hands and drink water with minimum</li> </ul>	<p><b>Reach out activity of ring transfer</b> was given with both hands. Bilateral hand activity of ball throwing was given. Facial muscle exercises were given in front of mirror with poems and PNF techniques of hold-relax was applied. Patient was <b>transitions</b> from supine to side lying to sit with collar as tolerated and was practiced in every session. <b>Desensitization</b> of right arm and forearm is started by using different light <b>self-touch of the child</b> followed by <b>mothers' touch</b>. Also different textures ranging from smooth to rough can be used to reduce pain sensitivity. Different textures of toys and sand play were used. Hand function exercises were incorporated in play regime from gross movements like throwing a ball to sand play and joining links.</p>

Table No. 1 Overview of Occupational Therapy Intervention Timeline

RESULTS

All short-term goals were achieved and significant changes were seen in pre and post scores of WeeFIM ADL Scale, Wong Baker Faces Pain Rating Scale and House Brackmann's Facial Paralysis Scale. Change of the WeeFIM, score indicates significant improvement in activities like eating, drinking milk and grooming. As per Wong Baker Faces Pain Rating Scale, Pain severity was reduced from severe to moderate. House Brackman Facial Paralysis Scale score suggests improved facial movements.

SCALES	Pre-treatment 17/02/2022	Post- treatment 23/02/2022
WeeFIM ADL Scale	48	58 (Improved function)
Wong Baker Faces Pain Rating Scale	10 (Hurts Worst)	2 (Hurts Little)
House Brackman Facial Paralysis Scale	5- severe	3- moderate

Table no. 2- Comparative Pre-treatment and Post-treatment Scores of Assessment Tools

DISCUSSION

Intramedullary tuberculoma of the spine is a rare manifestation of disseminated haematogenous tuberculosis. Approximately 180 cases of intramedullary tuberculoma have been reported in the world literature, with most recent case reports from developing countries and HIV-positive populations.<sup>12</sup>

Although there have been many studies about primary treatment (surgery, radiation therapy, chemotherapy) results in adult patients with spinal tumours, there are a few studies about early rehabilitation in children following spinal tumour surgery.<sup>13, 14</sup> The purpose of the current study was to investigate the effect of play based early occupational therapy intervention on functional outcome after surgery in child with cervical intramedullary spinal tumour.

In our study, patient showed symptoms of neuropathic pain, unilateral weakness, respiratory distress, facial weakness, superficial sensory loss, loss of bowel and bladder control and difficulty in performing all daily living activities and mobility.

According to the study conducted by Mckinley et al titled as 'Rehabilitative functional outcome of patients with neoplastic spinal cord compression', published in journal, Archives of Physical Medicine and Rehabilitation in year 1996, states that the main sign and symptoms that characterize spinal cord compression are pain, weakness, autonomic dysfunction, and sensory loss. Clinical complications of this condition include paralysis of muscles innervated caudal to level of spinal cord involvement, impairment of bladder, bowel, and sexual function, pain, and a decrease in functional mobility and self-care skills.



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The Functional Independence Measure for children (WeeFIM) is a user-friendly functional outcomes tool that has been used to detect changes in the functional performance of child. As per the study conducted by Thomas Noh et al titled as 'Paediatric intramedullary spinal cord tumour outcomes using the WeeFIM scale' published in journal children nervous system in September 2018, The WeeFIM scale is an appropriate and useful scale for measuring postoperative improvements in patients with Intramedullary Spinal cord Tumours undergoing aggressive resection surgeries.

Immediate post-operative care in terms of positioning, parent education about techniques of handling and in bed mobility, deep breathing exercises, etc. were effective in reducing secondary complications and enhancing the activity levels.

According to study published by Noh T et al titled as 'Paediatric intramedullary spinal cord tumour outcomes using the WeeFIM scale' published in journal of child's nervous system in September 2018, early rehabilitation is an essential component in the management of paediatric spine and spinal tumours. This should begin as soon as the child is clinically well enough and any potential spinal instability has been managed (surgical fixation/bracing). Regular physiotherapy should be used to maximize mobility, and early occupational therapy is essential both to provide equipment and to undertake an assessment of the child's home if their mobility has been significantly impaired.<sup>15</sup>

Although rehabilitation was started early, treatment of child in terms of in bed mobility and transitions from supine to sit was challenging due to presence of neuropathic pain, surgical pain, generalized weakness and lack of motivation. This finding is supported by the study published by McKinley WO et al titled as 'Rehabilitative Functional Outcome Of Patients With Neoplastic Spinal Cord Compression' in journal Archives of Physical Medicine and rehabilitation in year 1996, which states that, although pain may be secondary to compressive and destructive mass effects, it may also be due to post-operative pain syndromes, radiation therapy, and chemotherapy. Patients are more susceptible to both anorexia and cachexia. Consideration should also be made for decreased caloric intake due to diminished appetite and malaise, competition between tumour and host for nutrients, and tumour-elaborated and -induced factors from neoplastic syndromes that could impair the desire to eat.<sup>16</sup>

As per the 5-year review of patients admitted to a spinal cord injury rehabilitation unit with a diagnosis of neoplastic spinal cord compression in study published by McKinley WO et al titled as 'Rehabilitative Functional Outcome Of Patients With Neoplastic Spinal Cord Compression' in journal Archives of Physical Medicine and rehabilitation in year 1996, children achieved and maintained improvements in upper and lower extremity dressing, grooming, toileting, tub transfers, wheelchair use, ambulation, and stair climbing, 3 months after discharge.<sup>16</sup> In our case, patient achieved bed mobility and sitting with mild support in 2 weeks, this improvement in function within short span of time could be attributed to early rehabilitation, supportive and compliant family members and play and fun based neurodevelopmental therapy sessions. In our study, we also found that the functional outcome of patient in self-care areas of eating, drinking, grooming and assisted dressing was significantly increased, whereas outcome in mobility domain was limited, the reason could be shorter duration treatment sessions, short hospital stays, acute illness and overprotective parents.

In our study, we found that the functional outcome of patient in self-care areas of eating, drinking, grooming and assisted dressing was significantly increased, whereas outcome in mobility domain was limited. As per the Garcia RA et al in a study titled 'Functional improvement after paediatric spinal cord injury' published in American journal of physical and medical rehabilitation in year 2002, children typically received therapy for a minimum of 3 hours per day, including individual physical therapy and occupational therapy. The children showed both improvement in neurofunctional skills and reduction in caregiver assistance across mobility and self-care domains.<sup>17</sup>

Kose N et al found a negative correlation between age in a study titled as 'Early rehabilitation improves neurofunctional outcome after surgery in children with spinal tumours' published in journal of Neural Regeneration Research in January 2014 and suggested that neurofunctional recovery was faster in older children who participated in rehabilitation programs better. Despite this, there was no significant relationship between age and the percentage change of WeeFIM score. This finding was considered to be due to postoperative fear sensation in children and inability to show their independence as a result of the protective attitude of their parents.<sup>18</sup>

## CONCLUSION

Supplementing neurodevelopmental occupational therapy with play activities and appropriate behavioural modifications is effective in functional recovery of child with cervical intramedullary spinal tumour. Early rehabilitation helps to enhance the recovery. Parental counselling, education and involvement in rehabilitation of the child are essential components in the management of paediatric cervical intramedullary spinal tumour.

## References

1. [https://www.who.int/health-topics/tuberculosis#tab=tab\\_1/](https://www.who.int/health-topics/tuberculosis#tab=tab_1/)
2. <https://tbcindia.gov.in/>
3. Lin J, Feng H, Ai S, Wang X. Intramedullary cervical tuberculoma. *Spinal Cord*. 2006 Dec;44(12):809-12.
4. Torii H, Takahashi T, Shimizu H, Watanabe M, Tominaga T. Intramedullary Spinal Tuberculoma—Case Report—. *Neurologia medico-chirurgica*. 2004;44(5):266-8.
5. Park HS, Song YJ. Multiple tuberculoma involving the brain and spinal cord in a patient with miliary pulmonary tuberculosis. *Journal of Korean Neurosurgical Society*. 2008 Jul;44(1):36.
6. Liu YD, Wang FY, Xu JM, Guan Y, Guan H. Intramedullary thoracic tuberculoma. *Spinal cord*. 2010 Jan;48(1):80-2.
7. <https://prezi.com/wffbh5yqeahw/neurodevelopmental-treatment-ndt/>



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8. Burke, J. (1993). Play: The life role of the infant and young child. In J. Case-Smith (Ed.), *Pediatric occupational therapy and early intervention* (pp. 198–224). Boston
9. Primeau, L. (1995). *Orchestration of work and play within families*. Unpublished dissertation. Los Angeles: University of Southern California.
10. Morrison, C. & Metzger, P. (2001). Play. In J. Case-Smith (Ed.), *Occupational therapy for children* (4th ed., pp. 528–544). St. Louis: Mosby.
11. American Occupational Therapy Association. (2008). Occupational therapy practice framework: Domain and process. *American Journal of Occupational Therapy*, 62, 625–683.
12. Kirshblum S, O'Dell MW, Ho C, Barr K. Rehabilitation of persons with central nervous system tumors. *Cancer* 2001; 92(4 Suppl.):1029–38.
13. McKinley WO, Conti-Wyneken AR, Vokac CW, et al. Rehabilitative functional outcome of patients with neoplastic spinal cord compression. *Arch Phys Med Rehabil*. 1996; 77:892-895.
14. Mora J, Wollner N. Primary epidural non-Hodgkin lymphoma: spinal cord compression syndrome as the initial form of presentation in childhood non-Hodgkin lymphoma. *Med Pediatr Oncol*. 1999; 32:102-105.
15. Noh T, Vogt MS, Pruitt DW, Hummel TR, Mangano FT. Pediatric intramedullary spinal cord tumor outcomes using the WeeFIM scale. *Childs Nerv Syst*. 2018 Sep;34(9):1753-1758. doi: 10.1007/s00381-018-3831-9. Epub 2018 May 25. PMID: 29797065.
16. McKinley WO, Conti-Wyneken AR, Vokac CW, Cifu DX. Rehabilitative functional outcome of patients with neoplastic spinal cord compression. *Arch Phys Med Rehabil*. 1996;77(9): 892–5.
17. Garcia RA, Spira GD, Sisung C, et al. Functional improvement after pediatric spinal cord injury. *Am J Phys Med Rehabil*. 2002; 81:458-463.
18. Kose N, Muezzinoglu O, Bilgin S, Karahan S, Isikay I, Bilginer B. Early rehabilitation improves neurofunctional outcome after surgery in children with spinal tumors. *Neural Regen Res*. 2014; 9(2): 129-134.