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EFFECT OF NEURO DEVELOPMENT TREATMENT ON DETECTION AND SCREENING OF HIGH-RISK INFANTS

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ABSTRACT

The experimental group received physical therapy interventions once a month from the time they were discharged from the NICU until they were four months of age, including tactile, proprioceptive, visual, vestibular, and auditory stimulation in the NICU and multi-modal sensory stimulation, facilitation of righting / equilibrium reactions of the body, and movement patterns using Neuro-Developmental Therapy (NDT) techniques. Parents were responsible for implementing the interventions in the home, with social workers checking in to verify they were doing so. In high-risk preterm very low birth-weight infants, physical therapy therapies as part of Developmental Care Interventions have been shown to be more effective, and may help to mitigate the motor developmental delay that would otherwise be present. Infants at at risk for motor delays should have physical therapy therapies integrated into DCI to improve neuro-developmental outcomes. This randomized controlled clinical trial (RCCT) seeks to determine the efficacy of early physical therapy intervention in enhancing motor results at four months corrected age among preterm very low birth weight infants at high risk of developing severe neuro-developmental outcomes.

KEYWORDS: Neuro Development Treatment, high-risk preterm, physical therapy

INTRODUCTION

Autism, which is part of the Autism Spectrum Disorder that primarily affects children's neurological development, is a handicap that lasts a lifetime and often manifests itself within the first three years of life. Autistic children struggle to interact socially, have speech impairments, and have repetitive behaviors. Nowadays, one in 68 children is diagnosed with autism spectrum disorder (ASD), making it the third most prevalent developmental illness worldwide (centre for diseases control and prevention - 2014). Because autistic children appear to be typically developing youngsters and over 40% of autistic children have average or above-average IQs, the disorder cannot be diagnosed visually. Families in developing

countries like India are particularly vulnerable because of the prevalence of autism spectrum disorders; in that nation alone, 18 million individuals have been diagnosed with ASD. Children with autism have a much lower locomotor quotient than their typically developing peers due to the motor delays they experience. Poor or delayed motor skill appear to heavily affect, including fitness and motor skill components such as eye-hand coordination, cognitive or perceptual issues, and difficulty with body balance in children with Autism Spectrum Disorder, with some scholars indicating that the majority of Autists have these difficulties Having trouble keeping up with their peers in physical activities due to poor motor coordination is a source of frustration for many children with autism spectrum disorder. Group activities, which are oftentimes more competitive or continuing, may lead the youngster to lag behind. Overweight, obesity, and sedentary behavior are more common in children with autism spectrum disorder (ASD), according to multiple studies. Several studies have shown that autistic children do not participate in enough physical exercise to meet the national guidelines. Both researchers and parents of children on the autism spectrum have noted their children's difficulty with participating in physical activities, namely their delays in locomotor development, poor body control, and motor coordination.

Young people, including those with and without impairments, can greatly benefit from participating in regular physical activity and exercise programs, and doing so is crucial to the development of a higher quality of life. Obesity, heart disease, joint pain, and bone disorders are all greatly reduced in autistic children. Several studies found that children with ASD who participated in a structured physical activity program showed a decrease in stereotypical behaviors. The Richmond program recommended activities like walking, jogging, and a ball toss, with each session lasting up to 15 minutes. Children with autism spectrum disorder (ASD) showed significant improvement in their gross motor abilities after participating in a physical exercise intervention for 12 weeks.

Preterm birth and consequences

Neonatal medicine progressed by focusing on advances in supportive care, which resulted in improved survival for critically ill neonates. Furthermore, these children are at a substantial risk of brain injury, which includes cerebral palsy, cognitive impairment, and seizures (Volpe, 2008). The sensory perceptions of the foetus in the womb are very important for normal perinatal brain growth. Since they lack in-utero sensory experiences, premature

infants are categorized as extra-uterine foetuses. They are, however, subjected to a variety of sensory stimulations in the neonatal intensive care unit (NICU). Consequently, the developing brain is vulnerable to negative neurodevelopmental consequences (Lickliter et al, 2011).

Neurologic outcomes, as well as its treatment due to preterm birth, result in structural and functional impairments that last a lifetime. Despite significant improvements in the intervention over the last two decades, neurodevelopmental anomalies such as the mental and the psychomotor developmental indices in extremely preterm infants remain large and unchanged (Kobaly et al, 2008; Hutchinson et al, 2013).

Visual impairment, hearing impairment, prematurity-related chronic respiratory illness, chronic heart disease and neurodevelopmental or behavioural disorders such as mild cognitive impairment, from mild to severe developmental delay, mental health and behavioural sequelae, are all linked to preterm birth (Blencowe et al, 2013).

Extremely premature new-borns are more prone to develop intraventricular haemorrhage (IVH), bronchopulmonary dysplasia (BPD), chronic lung problems, necrotizing enterocolitis, vision and hearing impairment, cerebral palsy, and cognitive impairment. Premature birth will impact a baby's life for the rest of his or her life. This may result in long-term intellectual and developmental disabilities such as physical growth, learning, communication skills, socialising skills, self-care, behaviour issues, such as, anxiety, and developmental impairments, such as cerebral palsy and autism. Early detection and treatment of these health issues will help these babies live longer and happier lives (Kobaly et al, 2008).

Brain development in third trimester

Throughout the third trimester of pregnancy in-utero, cortical, dendritic, and axonal ramifications, along with glial cell proliferation and differentiation, synaptogenesis, and myelination, all take place normally. The size of grey and white matter of the cortex increases four to five times as a result of this neurodevelopment (Huppi et al, 1998). The cerebellum exhibits granule cell proliferation, formation, and migration simultaneously during the same period of development of cortex (Limperopoulos et al, 2005).

The brain will only be half its full size at 30 weeks of pregnancy, and the cerebellum will be developed to 35 to 40 percent of its estimated volume at 40 weeks. Vessels inside the brain develop after 34th week of pregnancy. The anastomosis increases with the development of short and longer penetrator vessels around the ventricles. When compared to the cortex, blood supply to the white matter would be just 25% at mid-gestation (Kinney, 2006; Volpe, 2009).

Pathophysiology of prematurity in preterm infants

Cerebral blood flow is passive in extremely low birth weight babies (ELBW). Because of the high variations in "natural" blood pressure, the autoregulation of the blood circulation in these infants is disrupted. In more than half of ELBW infants, scattered white matter disruption has been found. Along with the white matter injury, deep grey matter development has failed (Boardman et al, 2006; Kapellou et al, 2006). Therefore, perinatal injuries interrupt the brain's synchronised growth, resulting in diffuse delays in higher cognitive performance (McQuillen et al, 2005; Volpe, 2009).

Early detection and screening of high-risk infants

The neurological assessments are done periodically to assess the development of premature infants. These scales are not inexpensive and can be used in any environment around the world. Dubowitz assessment for neonates, Hammersmith infant neurological test, Prechtl infant neurological examination, Touwen infant neurological examination, and Amiel Tison-Neurological evaluation of the maturity of new-born infants are the most wellknown scales. These scales have strong predictive validity, with sensitivity and specificity estimates of 88 and 92 percent, respectively (Constantinou et al, 2007). The test can be used in NICU, developmental care settings, including research centers because it is repeatable and has high inter-rater reliability. This test detects neuromotor problems that are only present for a short time.

The major component of paediatric rehabilitation is identification of vulnerable babies and referring them to appropriate referral clinics as early as possible. Continuous and systematic developmental evaluation and assessment can help with this. Early identification of issues by developmental screening, and evaluation using standardised diagnostic tools, are all part of

developmental assessment (Glascoe et al, 2005). Developmental screening should be conducted on a regular basis and incorporated into practise (Earls et al, 2007; Small et al, 2007).

There are a variety of developmental screening methods available. All the tools are founded under the principle of achieving all the milestones at precise chronological ages. The screening scales must be accurate and reliable, with sufficient accuracy and precision to differentiate abnormal children with a slow rate of developmental ability acquisition from typical children. It should also be simple to administer the test (Frankenburg, 2002; Levine, 2006).

The DDST-II is a well-known screening method for children from birth to six years of age. In Denver, Colorado, it was first tested on 1036 children aged between two weeks and six years (Frankenburg et al, 1967). It was renamed as DDST-II after it was revised and standardised with 2096 children in 1992. The test is accurate, and the test-retest reliability is 90%. The interrater reliability is 80–95%. (Shahshahani et al, 2010). It has a high sensitivity rate (83%) and can detect developmental delays in infants (Glascoe, 2001).

Early intervention

Since the 1960s, controlled animal experiments shown that an ideal environment can increase brain volume by raising the number of nerve cells, dendrites, synapses, as well as some forms of supporting cells, with obvious impacts on behaviour, particularly cognition and memory (Diamond et al, 2001). These results inspired future studies and influenced the introduction of appropriate sensory stimulation therapies for infants and preterm infants in particular.

At the young age, the child's brain is not in a sustained state and can undergo multiple changes and supports neuropsychological intervention. The structure and function of the brain changes dynamically, according to brain plasticity, and this capacity enables the brain to respond to changes in the environment or inside the body (Mazzitelli et al, 2008).

Early intervention (EI) is a broad concept that encompasses a variety of interventions. Its aim is to make it easier for the child to meet the needs of the environment. The early exposure to different sensory experiences helps to modulate the sensory perceptions of babies (Ramachandran and Dutta, 2013). This intervention promotes the well-being of the child,

improves newly emerging capabilities, reduces developmental delay, prevents functional decline, and promotes compatible parenthood.

All preterm new-borns are at-risk of developmental disorders. They are at-risk because of their low birth weight, gestational age, and immaturity of the organs. Therefore, early intervention should be provided to these infants with the help of their parents. They should be educated on how to provide an ideal environment for their child's development (Benzies et al, 2013).

Components of early intervention

Early intervention entails providing children with continuous multidisciplinary care from birth. It necessitates therapy particularly for developmentally delayed babies, as well as regular developmental assessments of motor, cognitive, language, and adaptive functioning (Meena et al, 2013).

Early intervention tends to modulate the sensory experiences of the infant due to its early exposure. These programmes provided by highly trained professionals, can help a child's development and enhance outcomes for infants, families, and communities. If the intervention is started earlier in life instead later, it will be more successful and less expensive.

The evaluation of neurodevelopmental progress is based on the assessment of neuro maturation. This can be used to recognize at-risk children and provide them with early intervention programmes. Furthermore, parents should feel secure. Parental psychosocial assistance, parental education, and therapeutic developmental care intervention for preterm infants are the core components of this programme.

In preterm infants weighing 2000g or less, kangaroo mother care is recommended for thermal control. Several studies have found that the environment significantly influence the child's development. Preventive treatments include behavioural and developmental approaches. Physiotherapy treatments are one form of highly focused preventive intervention. These interventions can help parents and caregivers accustomed to their preterm infant's social and cognitive abilities.

The developmental system approach is a preventive intervention that focuses on cognitive, motor, socio-emotional, sensory-perceptual, executive function, motivation, and emotional control. Another developmental care programme is the new-born individualised developmental care and evaluation programme (Als, 1994). In the NICU, developmental care strategies are provided to reduce the stress experienced by the babies. Tactile, kinesthetic, vestibular, visual, auditory, oral motor, positioning the babies are all examples of external stimuli that can be regulated with these interventions (Symington et al, 2006).

Need for early intervention and follow-up

Several longitudinal studies were done to understand the developmental progress of prematurely born babies (Hack and Fanaroff, 1999; McGrath et al, 2009). The Utah University Early Intervention Institute reviewed 316 papers and concluded that early intervention has an immediate positive impact. Early intervention resulted in improved ability acquisition, cognition, intellectual, and social functioning, as well as increased weight gain. Early social, emotional, and physical growth helps to develop cognitive and language skills. It also helped the mother-infant relationship easier (Mayer et al, 1981).

Early positive experiences are essential for later success in education, and in the community. Children at-risk for developmental delays showed positive outcomes in language and communication, memory, and social/emotional growth after accessing developmental care services. Families benefited from early intervention because it enabled them to better address their infant's special needs from an early age. By reducing the need for special education, the financial burden is reduced. (Hebbeler et al, 2007).

The monitoring would support the children, their relatives, and the doctors who care for them in improving the efficiency of the intervention. In the future, it seems that many children with small gestational age and low birth weight may need early intervention. A high-risk follow-up primarily focuses on the early monitoring and treatment of developmental delay and recurrent illnesses. These need to be given adequate attention. It's important to identify the high-risk neonates and monitor their progress.

Despite dramatic changes in neonatal mortality, several studies have found that the incidence of chronic morbidity and adverse outcomes among survivors has not decreased significantly

(Escobar et al, 1991). Several studies have yielded inconclusive results. Many experts suggest looking into unique developmental training strategies to see if there are any beneficial effects of early intervention on infants' neurodevelopment. This emphasize the importance of post-hospitalization follow-up care facility to ensure effective monitoring of general health and neurodevelopmental outcomes (Bieleninik et al, 2014).

CONCLUSION

It is important to investigate the efficacy of physical therapy interventions as part of a developmental supportive care program for high-risk newborns, therefore future research should consider a bigger sample of high-risk infants recruited from a multi-centric study. An evaluation of the impact of compensating mother-child interactions in high-risk preterm control groups can be made with the inclusion of a full-term reference group in a future clinical study. While refining the interventional protocol for a developmental supportive care program, it is important to consider the available research on the spatial and temporal characteristics of multi-modal sensory stimulation. Singleton preterm extremely low birth weight children who are at risk for motor developmental delay benefit from early physical therapy therapies (including multi-modal sensory stimulation and facilitation of movement pattern approaches).

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