AUTISM- NEURAL NETWORKS AND EARLY INTERVENTION

Abstract: Autism Spectrum Disorder (ASD) is a lifelong developmental disorder very often detected in the first three years of life. It causes hindrances in three major areas namely communication, social understanding and individual thinking process. Early intervention is very crucial for the betterment of the individuals with autism. The neural networks in the brain changes progressively during development for a longer span of time. Due to this neuroplasticity of the brain, brain’s networks modify as per the stimulations. Thus it is essential to undergo early intervention for the children with ASD so that the behavioural issues can be reduced to a greater extent. Recent researches in the field of neuroscience have indicated about the brain plasticity and thus early intervention has proven to be beneficial for these children.

Key words: Autism spectrum disorder, neurology, neural networks, early intervention

Introduction: The research in the field of neuroscience has enabled us to view the images of the functional brain as well as the different brain pathways. The various images have pointed out to developmental differences in the brain connections of the individuals with ASD. Children with ASD experience a difficult time with their perceptions as well as actions relating to themselves and others. Children with autism spectrum disorder are characterized by impaired reciprocity in social communication and social interaction together with restricted, repetitive patterns of behaviour or interests (American Psychiatric Association, 2013). These children having developmental delays struggle to communicate, being inflexible in different situations as well as face difficulty in socialization. The wiring of the neurons occurs in such a manner which makes it even more difficult for them to perform various activities and is considered to be ‘unhelpful’. With appropriate stimulation, the brain has the capacity to reprocess and rebuild the helpful and functional circuits. It is suggested that earlier these helpful connections are created in the child’s brain, the better the behaviours and the skills are stored in the brain in a rightful manner.

Functional Magnetic Resonance Imaging studies: Functional Magnetic Resonance Imaging (fMRI) research has had a profound effect at the expertise of the neurobiological foundation for ASD. Initial studies brought about the delineation of many neural systems for mind–conduct relationships in ASD. Some relationships had been formerly well hooked up, however others have been elucidated in reaction to exceptional impairments in autism. This frame of studies truly hooked up autism and its signs and symptoms as being of neurological origin, decomposed the uncommon complex behaviour into recognizable neural additives, and depicted autism as a distinct neural structure related disease that disproportionately impaired many higher order abilities. The second section of fMRI research in autism focused largely at the development of practical connectivity based on fMRI (fc-fMRI) strategies and evidences autism as a disease of under-connectivity among the mind areas participating in cortical networks. The constellation together with other proofs, identified the cortical neuron(s) as the unit of dysfunction in autism. The increase in dysregulation, i.e. early mind overgrowth followed with the aid of increased plateau, was a traditional evidence of disturbances in developmental neurobiological events, especially neuronal organizational contexts. Notably even though, all developmental trajectories for mindboom are seen in autism, suggesting extensive heterogeneity inside the specific underlying genetic mechanisms being affected. With the invention of approximately 20 ordinarily uncommon genes or gene mutations which are involved in the molecular component of the improvement of neuronal connections, the fMRI and genetic findings in autism closed a loop that validated a developmental neurobiological based version of autism. Recent fMRI research in autism focus on the addition of articulation of functional connectivity disturbances, further delineation of the neural bases of deficits and abilities, and delineation of disturbances in higher degrees of mind-agency associated with control and regulation of thinking, feeling, and behaving.

Pathological findings: Post-mortem studies being conducted on autistic brains identify the neuroanatomical changes associated with ASD. Smaller size of the cells and increased density of cells in the hippocampus, limbic system, entorhinal cortex, and amygdala are found in all ages of ASD individuals. Young individuals with autism exhibited abnormally enlarged neurons in the cerebellar nuclei, inferior olive, and vertical limb of the diagonal band of broca. Other post-mortem studies have found an increased number of neurons in the prefrontal cortex in the brain of ASD children. Purkinje cell count was observed to be less in number in the archi-cerebellar and neo-cerebellar cortices of the cerebellar hemisphere in individuals with autism. Some more studies observed a lesser number of small pale neurons in the brains of adult individuals with autism. Further a post-mortem study of the brain of patients with ASD indicated altered axonal density and the presence of impaired myelin in white matter. Overall, the pathological findings indicate a restricted pattern of brain development in individuals with autism.

Neurodiversity: The exact cause of autism is still unknown though a combination of genetic and environmental factors during the critical period of development has been implicated (Hallmayer et al. 2011). A deficit model has largely dominated most professional discourse regarding ASD in the last decade. This model indicates that individuals with ASD are severely limited by disoriented neurology causing major impairments in their cognition and socialization skills. Various publications from several scholarly communities
have examined ASD with respect to neurodiversity (Davidson, 2007; Fenton & Krahn, 2007; Glannon, 2007; Robertson & Ne'eman, 2008; Broderick & Ne'eman, 2008). Harvey Blume (1998) have said about the importance of neurodiversity being as crucial for humans as biodiversity. The brain is the most crucial organ of the body as it organises our movements, thoughts, feelings, emotions and actions. When child is born, the brain's construction remains unfinished. The brain skin be considered as malleable like plastic in which various neural pathways can be created by incorporating new habits and behaviours. It also denotes the flexible characteristic of a brain. Coming to the term neuroplasticity, it refers to the inherent potential of the brain to create new neural pathways as and when it needs. Brain plasticity describes the ability to form new functions through the modifications of internal structures of the synapses (Knudsen, 2003). The cerebellum is considered to be a very important structure and is thought to play a role in language processing, visual and spatial skills and executive functions (Blat, 2012). In case of children with autism the two structures within the limbic system being hippocampus and amygdala are reported to be altered. These abnormalities in the frontal lobe are intended to play a major role regarding the inability to interpret the emotional state of others as well as causing difficulties with various social-emotional behaviours (Berger, 2013). Recent studies indicate that the brain plasticity in children with autism is not only limited to the developmental years (Voos et al, 2013; Ventona et al, 2015). It includes both the school-age period and adulthood (Murdaugh et al. 2015, 2016; Bolte et al. 2006, 2015).

- **Early intervention:**
  
  It is very vital to identify children with autism as early as possible so that the child receives proper interventions and further delays are being prevented. Early intervention is considered to be extremely beneficial influencing long term outcome in the children having autism. The brain rewires itself and adjust in terms of the cortical representation with respect to changes in environment. To maximize it’s potential, the brain needs training to reorganize itself functionally. For children with autism neuroplasticity is considered to be enhanced by intervention (Dawson, 2008). Though it is not known whether any significant change occurs in the brain’s physical structure and function due to being engaged in thinking and learning. Early intervention for children with autism is very much essential for the betterment of these children. Within the first few years of life the development of brain occurs at a very rapid rate. The behavioural symptoms of ASD begins to develop during these early years. There has been an increased focus on early interventions in the first three years of life as during this period plasticity of the brain is maximum and thus the behavioural issues of the child can be reduced at a quicker rate during this phase. The importance of early intervention is well documented in young children with or at risk for ASD (Bradshaw, 2015). Present research suggests that positive outcomes from interventions are three times more before the age of 3 years than starting after 5 years of age (Harris and Handleman, 2000). A child with autism follows schedule for activities. Putting interventions in the context of daily activities for the child is very much essential to get the best benefits from it. Embedding intervention throughout the daily activities and interactions with these children instead of putting specific 'therapy time' increase the opportunities for the child to become more functional (Wetherby et al. 2014). Since there is a no clear understanding regarding the biological cause of ASD as well as no specific medications are available for this disorder, hence early intervention is documented to be the best option providing long term benefits for these children. Recent research suggests that early intervention improves the long-term outcome of individuals having autism (Estes et al. 2015). Early intervention has a dual effect that is; it not only helps the child to develop age appropriate skills but also prevents the child from developing socially inappropriate behaviour being consequent to the developmental issues faced by the child. Early intervention can even reverse some of the symptoms of ASD (Rogers et al. 2014). Thus it has a role in shaping the brain in accordance to the outside world and also prevents the severity of the symptoms associated with ASD (Wallace and Rogers, 2010).

**Conclusion:**

Thus early intervention is very much important for children with ASD. It addresses the specific issues of the developmental period and helps to reduce the building up of the behavioural consequences. Ongoing research in the field of developmental neuroscience, genetics and neurobiology has contributed to a more positive side regarding the outcomes for the individuals with autism.

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