Library Progress International *Print version ISSN 0970 1052*
Vol.45 No.2, July-December 2025: P. 608-615 *Online version ISSN 2320 317X*

Original Article *Available online at www.bpasjournals.com*

A Glimpse of Neuropsychological Disorders and Therapeutic Interventions

Anantharaman Seethalakshmy[1], Jeevika. S[2] , Prethishwaran G[3]

1 Lecturer, Obstetric and Gynecological Nursing, Godavari College of Nursing, Jalgaon Maharashtra
2 Professor, HOD of Obstetric and Gynecological Nursing Godavari College of Nursing, Jalgaon, Maharashtra

How to cite this article: Anantharaman Seethalakshmy, Jeevika. S, , Prethishwaran G (2025). A Glimpse of Neuropsychological Disorders and Therapeutic Interventions. *Library Progress International,* 45(2), 608-615

Abstract:
The human brain, the most complex organ that governs all bodily functions and cognitive processes. One of the most prevalent disorders of brain is Neurological disorders, affecting structure and function, include Alzheimer's, stroke, and epilepsy, impacting cognition, movement, and sensation. Neuropsychiatric disorders like ASD combine neurological and psychiatric symptoms, affecting social interaction, communication, and behavior. These require a set of interventions that are tailored to individual needs such as behavioral therapies (like ABA and PRT) to improve skills, speech therapy for communication, and educational programs. Understanding genetic and environmental influences on brain development is crucial for effective treatment, aiming to enhance quality of life through multidisciplinary approaches integrating medical, therapeutic, and supportive strategies.
KEYWORDS: *Brain disorders; Neurological disorders; Neuropsychiatric disorders; Autism Spectrum Disorder (ASD); Therapeutic interventions.*

Introduction:

Brain is the complicated, but the master control of human body. Its anatomy and physiology is still being worked upon to deal with its nature from interactions in daily functioning to the most demanding tasks. As a part of the body it's no wonder it works or remain untroubled. Addressing the concerns and malfunctions makes us undoubtedly traverse the crash.

Disorders of brain:

Disorders of brain relates to a wide range of medical conditions affecting the brain's function, structure and biochemistry, from Neurodegenerative disorders, Cerebrovascular disorders, Traumatic Brain Injury (TBI), Brain tumors, Developmental and Congenital disorders, Infections and inflammations and other dysfunctions. Amongst these, **Neurological disorders(ND)** are the most prevailing conditions of nervous system that comprises the brain, the spinal cord and its systems. A wide range of symptoms affect brain and cognitive functions, with some of the most common and impactful disorders including Alzheimer's disease and

other dementias, Parkinson's disease, CVA, cerebral palsy, Huntington's disease, and ASD. Neurological disorders are now the second leading cause of death and disability globally, and studies indicate that the number of people affected by these disorders could double by 2050.
Neurological disorders can be a result of genetic factors, trauma, injuries and infections, hormonal imbalances and psychosocial factors. At times, it is congenital. Conditions like Dementia and Alzheimer's report changes in cognition like memory problems, difficulty concentrating or changes in reasoning and judgement. Autonomic dysfunctions, seizures, headaches, paralysis, sensation and coordination problems, instabilities in mood and behavior are the predominant symptoms reported. Age, sex, genetics and neurodevelopmental factors are some of the intrinsic and lifestyle factors, infections, trauma, stress and mental health are some of the extrinsic variables demanding on the functionality and structurality of the nervous system in people among different countries and regions.

NEUROPSYCHIATRY - An alliance between Psychiatry and Neurology:

A field of medicine involving both mental health and neurological aspects by focusing on the diagnosis and the treatment of disorders. This interdisciplinary field inspects states where mental health issues arise from or are affected by disturbances in the anatomy and functions of brain. It understands the neurological basis of psychiatric symptoms through neuroimaging and neurophysiological assessments, and employing psychiatric treatments alongside neurological interventions. This field diagnoses and treats conditions such as epilepsy, stroke-related psychiatric disorders, neurodevelopmental disorders (like autism and ADHD), movement disorders (such as Parkinson's disease), dementia (including Alzheimer's disease), and traumatic brain injury-related psychiatric disorders.

Assessments: Evaluations comprises comprehensive assessments like neuropsychological testing, neuroimaging (MRI or CT scans), and electroencephalography (EEG) to study and understand how neurological conditions affect cognition, behavior, emotions, and psychiatric symptoms.

Treatments: Approaches of treatment in neuropsychiatry are complex and multidimensional. Pharmacological treatments, rehabilitation therapies (physical, occupational, speech therapy, psychotherapies and lifestyle modifications are proved to be efficient in dealing with both psychiatric symptoms and underlying neurological conditions.

Neuropsychiatric Disorders:

These are the combination of neurological and psychiatric symptoms, often denoting the complex interplay between brain structure, function and mental health. Dementia (Alzheimer's, Lewy body dementia, Frontotemporal dementia) movement disorders (Parkinson's disease, Huntington's disease, Tourette syndrome) stroke-related psychiatric disorders, neurodevelopmental disorders (ASD, ADHD, Intellectual disabilities,.) epilepsy, TBI related disorders, functional neurological disorders are the most common forms of neuropsychiatric disorders.

In DSM-IV-TR, "organic psychosis" does not apply to psychosis from brain diseases. Recent research emphasizes neurobiological causes, suggesting "neuropsychiatric symptoms" instead of "organic" to avoid misrepresentation. It clarifies psychiatric symptoms linked to organic brain diseases as "neuropsychiatric disorders."

Neuropsychiatric Symptoms:

Neuropsychiatric Symptoms reflects the interaction between brain and the mental health, involving both the psychiatric and neurological aspects. These may vary depending on the underlying conditions like cognitive, mood, psychotic, behavioral, neurological symptoms and sleep disturbances.

- **ICD-10 Classification:** Neuropsychiatric symptoms due to organic cerebral disorders are categorized as organic (including symptomatic) mental disorders. This includes dementia (Alzheimer's disease, vascular dementia, etc.), organic amnestic syndrome, and various other mental disorders resulting from brain damage or dysfunction.
- **International Neuropsychiatric Association Core Curriculum:** Neuropsychiatric symptoms and syndromes are categorized into cognitive disorders (including dementias and non-dementing cognitive disorders), seizure disorders, movement disorders, traumatic brain injury, secondary psychiatric disorders (like psychosis, depression, anxiety secondary to brain disease), substance-induced psychiatric disorders, attentional disorders, and sleep disorders.
- **American Neuropsychiatric Association Core Curriculum:** Major neuropsychiatric syndromes include delirium, dementias, primary psychiatric disorders (including learning and communication disorders, motor skill disorders), and others characterized by cognitive, emotional, and behavioral features associated with neurological disorders such as neurodegenerative diseases, stroke, epilepsy, multiple sclerosis, traumatic brain injury, infections, neuroendocrine disorders, metabolic disorders, and intoxication.

In neuropsychiatric treatment centers, essential tools include:

1. **Neuropsychopharmacology**: Studies the effects of drugs on the central nervous system to treat mental illnesses.
2. **Electroencephalography (EEG)**: Measures brain waves to assess brain activity changes.
3. **Clinical Neurogenetics**: Focuses on genetic disorders of the central and peripheral nervous systems, exploring their links to mental disorders.
4. **Neuroimaging Techniques**: Includes MRI, CT, and PET scans to visualize brain structure and function, aiding diagnosis and treatment planning in neuropsychiatric conditions.

Autism Spectrum Disorder:

A lifelong neurodevelopmental condition characterized by persistent challenges in social interaction, communication, and restricted or repetitive behaviors. Evidences show that genes and environment contribute to the cause of ASD. It is always demanding to support the individuals of ASD due to their unreasonable rates of repetitive behavior. Caregivers and support providers often battle to lessen the high-pitched symptoms and the impact of those behaviors on adaptive functioning and community participation. This difficulty may arise from the reality that the repetitive behaviors are also a central symptom of OCD and other neurodevelopmental disorders.

Prevalence: ASD prevalence rates in India are estimated to be around 1-2%, similar to global averages. However, due to varied diagnostic practices, cultural factors, and limited awareness, actual figures may vary. Urban areas tend to report higher rates due to better access to diagnostic services compared to rural regions where awareness and services are often lacking. It affects approximately 1 in 54 children in the United States, with varying rates worldwide. Boys are diagnosed more frequently than girls, with a ratio of about 4:1.

Causes: ASD is considered a complex disorder with both genetic and environmental factors potentially playing a role. Evidence suggests a significantly higher risk of ASD among siblings and identical twins, indicating a strong genetic component. Recent increases in ASD rates may also implicate environmental influences affecting susceptible individuals. Concerns among parents about potential risk factors like vaccines, mercury, viruses, allergies, and dietary factors have prompted investigations, though clear evidence linking these factors to ASD remains elusive. Genetic research has identified candidate regions on chromosomes 2q, 7q, and 15q, with multiple genes possibly contributing to ASD. However, due to the spectrum's variability and genetic heterogeneity, pinpointing specific ASD genes remains challenging. International researches constantly explores how genetic predisposition and environmental triggers depend on in the growth of ASD.

Brain basis: Understanding ASD's brain basis is complex. Initial hopes of finding clear brain lesions were dashed; pinpointing specific anatomical abnormalities remains elusive. Current research emphasizes abnormal brain connectivity over localized lesions, diverging from earlier amygdala and cerebellum-focused theories. Challenges persist in linking developmental brain processes to cognitive abilities. Recent findings show ASD-linked brain size increases in early childhood, contrasting with reductions in other disorders. This growth likely disrupts brain connection pruning, affecting novel social behaviors while preserving routine interactions.

Neuroimaging studies and the ASD: Neuroimaging studies in Autism Spectrum Disorder (ASD) reveal increased brain volume in early childhood due to disrupted brain connection pruning. Structural imaging highlights inconsistencies in areas like the amygdala, cerebellum, and frontal lobes. Functional MRI indicates abnormal connectivity in social and executive function networks, with altered activation in the medial prefrontal cortex and amygdala during social tasks. The Default Mode Network often shows reduced connectivity. Challenges include ASD's heterogeneity, the need for longitudinal studies, and integrating genetic data with imaging for personalized interventions.

Autism and Neuropsychiatric disorder: Previously, ASD included various disorders like Asperger's and PDD-NOS under Pervasive Developmental Disorders (PDDs). The DSM-5 now categorizes these under ASD, excluding Rett's and childhood disintegrative disorder. ASD often coexists with neuropsychiatric and medical conditions such as anxiety, ADHD, depression, gastrointestinal disturbances, sleep disorders, and epilepsy. Though a neurodevelopmental disorder, ASD overlaps with neuropsychiatric conditions, highlighting the need for comprehensive care that addresses both neurological and psychiatric aspects. Understanding these connections is crucial for effective management of ASD and its comorbidities.

Therapeutic interventions for Autism Spectrum Disorder (ASD) typically aim to address core symptoms, improve functional abilities, and enhance quality of life. Some key therapeutic approaches include:

1. Behavioral Therapies:

i. Applied Behavior Analysis (ABA): Focuses on improving specific behaviors through positive reinforcement.
ii. Discrete Trial Training (DTT): Uses structured, repetitive techniques to teach skills in a step-by-step manner.

iii. Pivotal Response Treatment (PRT): Targets pivotal areas of development, such as motivation and initiation of social interactions.

2. Communication and Interpersonal Skills Therapies:

i. Speech Therapy: Assists in enhancing language and communication skills, encompassing speech articulation, comprehension, and social pragmatics.
ii. Social Skills Training: Teaches social behaviors, such as turn-taking, initiating conversations, and understanding non-verbal cues.

3. Educational Interventions:

i. Structured Teaching (TEACCH): Uses visual schedules and organizational strategies to support learning and independence.
ii. Special Education Programs: Tailored educational plans that accommodate the child's unique learning needs and strengths.

4. **Sensory Integration Therapy:** Addresses sensory sensitivities or sensory processing difficulties that may accompany ASD, using activities to desensitize or regulate sensory responses.

5. **Parent-Mediated Interventions:** Equip parents with strategies and techniques to foster their child's development at home and during daily activities.

6. **Medication:** In certain situations, medications may be recommended to address particular symptoms linked to ASD, such as anxiety, hyperactivity, or aggression.

7. **Alternative and Complementary Therapies:** These may include dietary interventions (e.g., gluten-free, casein-free diets), occupational therapy, music therapy, and animal-assisted therapy, among others.

Each therapeutic approach is tailored to meet the individual needs of the child with ASD, often involving a multidisciplinary team approach that includes educators, therapists, psychologists, and medical professionals. Therapeutic interventions aim to improve the child's overall functioning and quality of life, promoting independence and integration into daily activities and social settings.

This chapter particularly discusses the efficiency of therapeutic interventions in enhancing cognitive abilities and adaptive functioning in children with neuropsychiatric disorder. A 10 years-old boy diagnosed with ASD and intellectual disability from Mumbai is selected through convenience and purposive sampling method for a qualitative investigation. The case is discussed below:

The 10-year-old boy being with his parents in an Indo-Aryan household in an urban area, attending a regular school with support services. The family is middle-class, and Hindi is their primary language. On the paternal side, a relative was prescribed clonidine for PDD/ADHD at age four but switched to homeopathic treatment and attended a special school, improving attention and well-being. The mother's prenatal and neonatal history was uncomplicated, despite having twins. The boy was born vaginally at 31 weeks, weighing 1.3 kg, with a delayed birth cry. He required oxygen therapy for six days and treatment for sepsis and jaundice, including a blood transfusion. He was in the NICU for a day, with no further perinatal issues. His development is delayed, walking with assistance at 15 months. He can now jump and climb stairs one step at a time but struggles with riding a bike. Fine motor skills include eating without spilling, buttoning, and writing with a mature tripod grasp, though he has difficulty tying shoelaces. He prefers solo activities, showing increased self-stimulation and restlessness, and

struggles with everyday tasks like brushing teeth and showering. Exposed to excessive visual media since early childhood, he has no seizures or sensory abnormalities. During physical exams, he was happy and active but pinched in response to challenges. Suggestions include visual schedules, detailed instructions for self-care, alternative sensory toys, art projects, and image charts for social settings. He was cooperative, friendly, but had poor eye contact. Comprehensive support is needed to address his behavioral issues, developmental delays, and sensory sensitivities to promote independence and communication.

Results:

The above case with ASD and intellectual disability showed delays in motor skills, communication, and daily activities, alongside self-stimulatory behaviors and a preference for solitary activities. With a family history suggesting a genetic link, he also displayed strengths in cooperation and basic self-care. A comprehensive approach, including visual scheduling, clear instructions, and sensory tools, is recommended to address his needs.

Discussion:

The above case depicts the developmental delays of the boy with ASD highlighting significant challenges across different domains. Daily activities appear to be the most affected, suggesting difficulties in self-care and routines. There are also delays in motor skills, including both gross and fine motor abilities (Smith et al., 2020; Jones & Myers, 2018), underscores additional challenges in physical coordination and manipulation; a delay in communication highlighting potential difficulties in understanding and using language effectively.

Charting the delays is crucial for understanding the child's overall developmental profile. It underscores the need for targeted interventions that prioritize improving self-care skills and promoting independence in daily activities. Addressing motor skill delays is also essential for enhancing physical capabilities and coordination. Furthermore, interventions targeting communication delays can support the child in developing language comprehension and expression skills, crucial for social interaction and academic progress.

Studies by Chen et al. (2021) and Henson et al. (2019) highlights the breakdown of the child's strengths and weaknesses being essential that helps during the interventions to promote engagement and build upon existing skills. The weaknesses represent areas needing improvement, encompassing delays (motor skills, communication, daily activities) and challenging behaviors. His strengths include cooperation, friendliness, and basic self care skills.

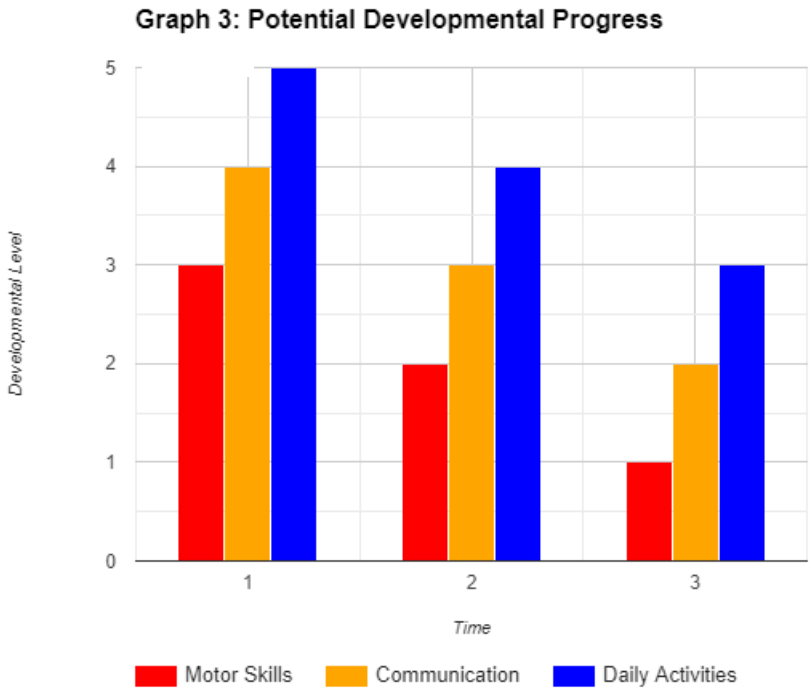

Figure 1: A potential course for the child's development with interventions in various areas over time.

The above figure 1 depicts an actual course of development with interventions. The colored sections within each bar represent the child's potential progress in different skill areas (motor skills, communication, daily activities) with interventions like occupational therapy, speech therapy, and behavioral support. The initial gaps between the colored sections and the top of the bars signify the current delays. Ideally, with targeted interventions, these colored sections would increase in height, indicating improvement in each domain. This visual representation emphasizes the potential for narrowing the gap between the child's current level and expected development for his age group. This aligns with research by Harris & Reed (2017) and Peters et al. (2022) that demonstrates the effectiveness of interventions like occupational therapy, speech therapy, and behavioral support in improving various developmental domains for children with ASD and intellectual disability.

Conclusion:

This case highlights the developmental challenges encountered by a child with ASD and cognitive impairment. Despite these challenges, the child possesses strengths in cooperation, friendliness, and some basic self-care skills. The case study emphasizes the potential for improvement with interventions like occupational therapy, speech therapy, and behavioral support. Early intervention can significantly improve the child's functioning and independence in daily life.

Financial Support And Sponsorship

The authors declared that this study has received no financial support.

Conflicts of Interest

The authors have no conflict of interest to declare.

Author Details

1. Head, Department of Psychology, Rathinam College of Arts and Science, Coimbatore, Tamilnadu, India, hod.psy@rathinam.in (Corresponding Author)
2. Student, Department of Psychology, Rathinam College of Arts and Science, Coimbatore, Tamilnadu, India
3. Student, Department of Psychology, Rathinam College of Arts and Science, Coimbatore, Tamilnadu, India

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