Chapter 16
Spectrum of Neurodegeneration in Autism Spectrum Disorder

Kirti Rani
Amity University Noida, India

ABSTRACT

Autism spectrum disorder (ASD) is neurodevelopmental disorder which is characterized by lack of social behaviors and impaired non-verbal interactions that start early in childhood. It can also lead to progressive neurodegeneration like schizophrenia disorder, Alzheimer's disease, Parkinson's disease, and dementia. Genetic studies of ASD have confirmed the mutations that interfere with neurodevelopment in mother's womb through childhood and these mutations are further involved in synaptogenesis and axon motility. Crucial role of amygdala is found to be deficit in ASD individuals whose association cognition with nucleus accumbens lead to impaired social behaviors and cognitive stimulus. Educational and behavioral treatments are considered the key steps used for its management along with pharmacological and interventional therapies. In this chapter, the author presents the etiology of ASD, proof of neurodegeneration in ASD, as well as the clinical feature and the management of ASD.

INTRODUCTION

ASD is a set of neurodevelopmental disorders characterized by a lack of social interaction, verbal and nonverbal communication which is noticed in the first 3 years of childhood. In some of cases, mental and health conditions are progressively deteriorates with the time if not diagnosed and treated at time. The distinctive social behaviors include an avoidance of eye contact, fluctuate emotional control and difficulties in understanding the emotions of other people (Mattila *et al.*, 2011). Environmental factors are also likely to interact with the genetic profile and cause aberrant changes in brain growth, neuronal development, and functional connectivity. Increase in prevalence of ASD has been found and higher rate is reported in males than females (Kim *et al.*, 2011; Elsabagh *et al.*, 2012; Fombone *et al.*, 2011). Various post-mortem evaluations of ASD individuals have been postulated that these individuals experienced a loss of neuron cells and pyramidal cells in their amygdala than control samples. These observations have supported that these microglia can be responsible for the dissolution of neurons that can also induce the

DOI: 10.4018/978-1-5225-5282-6.ch016

production of toxic cytokines that can damage neurons and lead to neurodegeneration in ASD individuals (Kern *et al.,* 2013). In last decades, despite growing evidence for the involvement of endogenous biomarkers in the pathophysiology of ASD is reported and early detection of this disorder remains a big challenge that describes the main behavioral and cognitive features of ASD, as well as the symptoms that differentiate autism from other developmental disorders such as reduced brain connectivity, mirror neurons deficits, and inhibition-excitation imbalance in individuals with ASD. In ASD patients, the frontal and temporal lobes are the markedly affected brain areas. And the role of amygdala in cognition and ASD has been proved in numerous neuropathological and neuroimaging studies (London & Etzel, 2001; Kern & Jones, 2006). The amygdala is a major component of the limbic system and affective loop of the cortico-striato-thalamo-cortical circuit. The amygdala located the medial temporal lobe anterior to the hippocampal formation has been thought to have a strong association with social and aggressive behaviors ASD patients (London & Etzel, 2001; Kern & Jones, 2006). ASD is clinically diagnosed on the basis of the presence of its associated non-specific manifestation like individual abilities in intelligence and verbal domains. The onsets of nonspecific manifestation are noticed in infants or toddlers such as irritability, passivity, and difficulties with sleeping and eating, followed by delays in language and social involvement (Kolevzon *et al.,* 2007). Previously, some of reported data of few ASD patients have been studied for experiencing the improvements after deep brain stimulation as one of the interventional treatments. The key bone of neurobiology of ASD development is still a target for laying out its treatment and clinical management that required broadening its clinical horizons to understand ASD (Kolevzon *et al.,* 2007). Hence, ASD is noted as multifactorial disorder and still unpredictable for investigators for drawing its fate to postulate its correlation with neural loss and progressive neurodegeneration in ASD individuals. So, the information provided in this chapter can be helpful for the researchers to postulate the effective therapies and treatments for ASD individuals. As well as, to provide points know more about the role of various genetic, environmental and epigenetic factors that have deleterious effects in ASD individuals such as cognitive impairment and immune homeostasis.

BACKGROUND

ASD affect the brain with the time that leads to neurodegeneration in ASD individual if left untreated or neglected so, many clinicians and researchers are involved to understand the ASD for long decades. However, pinpointing ASD's root cause may be aided by postulated all previous findings and clinical studies into a neurodegeneration hypothesis. This hypothesis can suggests that ASD can be regressive if ASD children are diagnosed and treated at time, so that they can acquire certain skill abilities before any serious neurological impairments happens to them. This ASD regression is said to helpful in 15% to 65% of ASD cases and hence, whether ASD can be considered a neurodegenerative disorder has remained under clinical critics and debate (Kern *et al.,* 2013). Previously, the development of the brain in individuals with ASD is discussed to be a complex neurodevelopmental disorders which is followed by interaction of various genetic and environmental factors and their interactions. Genetic studies of ASD have identified mutations in genes that interfere with typical neurodevelopment in childhood that involved in synaptogenesis and axon motility. An altered ratio of short to long diameter axons and disorganization of cortical layers are also observed along with MRI studies assessing brain volume in ASD individuals. Hence, as a result of the observed altered pattern of axons and MRI studies are found to responsible for altering the socioemotional networks (Mattila *et al.*, 2011). Characteristics of normal