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Genetic Basis of Parkinson's Disease: Bangladesh Perspective

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Parkinson's Disease (PD) is a progressive neurodegenerative disorder characterized by motor symptoms such as tremor, bradykinesia, rigidity, and postural instability. Globally, Parkinson's Disease is understood to arise from a combination of genetic and environmental factors, with genetic mutations accounting for approximately 5.0% to 10.0% of cases[1]. In Bangladesh, where genetic research on neurodegenerative diseases is still in its early stages, a comprehensive understanding of the genetic basis of Parkinson's Disease remains limited. However, global research on Parkinson's Disease genetics offers insights that may be relevant to the Bangladeshi population.

Global Genetic Basis of Parkinson's Disease

Several genes have been identified as key contributors to Parkinson's Disease. These include SNCA, LRRK2, PARK2, PINK1, and GBA. Mutations in these genes lead to either autosomal dominant or autosomal recessive forms of Parkinson's Disease, each with varying degrees of penetrance[2]. For instance, mutations in the SNCA gene, which encodes the alpha-synuclein protein, contribute to Lewy body formation, a pathological hallmark of Parkinson's Disease[3]. Similarly, mutations in the LRRK2 gene are one of the most common genetic causes of familial Parkinson's Disease, especially in certain ethnic groups such as Ashkenazi Jews and North African Berbers[4]. Additionally, mutations in PARK2 (parkin), PINK1, and DJ-1 have been linked to early-onset Parkinson's, often following an autosomal recessive inheritance pattern[5]. These mutations cause dysfunction in cellular processes like protein degradation and mitochondrial function, which are crucial for neuronal survival.

Genetic Context of Parkinson's Disease in Bangladesh

In Bangladesh, most Parkinson's Disease cases are sporadic, with no clear genetic etiology established. However, given the genetic overlap between South Asian populations, studies from neighboring countries like India provide valuable insights. Several studies in India have reported PARK2 and LRRK2 mutations in Parkinson's Disease patients, suggesting that these mutations might also be present in Bangladesh[6]. Additionally, the high prevalence of consanguinity in Bangladesh, particularly in rural areas, may increase the likelihood of autosomal recessive forms of Parkinson's Disease, making mutations in genes like PARK2 and PINK1 more relevant.

While no large-scale genetic studies on Parkinson's Disease have been conducted in Bangladesh, this population's relatively homogeneous genetic makeup due to historical endogamy could facilitate the identification of specific mutations. Such homogeneity might lead to an increased frequency of certain genetic variants, making Bangladesh an important population for studying the genetic underpinnings of Parkinson's Disease.

Current Challenges in Genetic Research

Genetic research in Bangladesh faces several challenges, including a lack of funding, infrastructure, and expertise in genomics and neurodegenerative diseases. Additionally, public awareness regarding genetic diseases and genetic counseling is low, contributing to underreporting of familial Parkinson's Disease cases. Few hospitals in Bangladesh offer advanced genetic testing for neurodegenerative diseases, limiting the ability to detect genetic mutations in Parkinson's Disease patients.

Opportunities for Research and Collaboration

Despite the challenges, there are emerging opportunities for genetic research in Bangladesh. The Michael J. Fox Foundation (MJFF) for Parkinson's Research is a US non-profit organization founded in 2000 by Canadian-American actor Michael J. Fox to find a cure for Parkinson's disease. Aligning Science

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Across Parkinson's (ASAP) is fostering collaboration and resources to better understand the underlying causes of Parkinson's disease. The Global Parkinson's Genetics Program (GP2) is a resource program of the Aligning Science Across Parkinson's (ASAP) initiative focused on improving our understanding of the genetic architecture of Parkinson's disease (PD) and making this knowledge globally relevant. GP2 aims to collect samples and data from around the world, specifically with the goal of including groups traditionally underrepresented in genetics research. The program has assembled more than 100 cohorts from around the world with the ultimate goal of collecting and genotyping more than 150,000 unique samples, especially from diverse populations. We want to share the good news that National Institute of Neurosciences and Hospital (NINS&H) from Bangladesh has been included in this global research. Hopefully, by the next year we will be able to know the genetic databases of our population. Furthermore, the development of population-specific genetic databases could aid in creating personalized therapeutic strategies, such as gene-targeted treatments, for Parkinson's Disease patients in Bangladesh.

Although genetic research on Parkinson's Disease in Bangladesh is currently limited, the potential for discovery is significant. With advances in genomic technology and increasing research collaboration, there is hope that the genetic underpinnings of Parkinson's Disease in Bangladesh will become clearer. Understanding the genetic basis of Parkinson's Disease in this region could lead to more precise diagnostics and targeted therapies for the Bangladeshi population, ultimately improving patient outcomes.

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