Diagnosis for Down syndrome

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***Dr Priya Kadam**, Program Director, MedGenome NIPT, elaborates on how gene-based diagnostics can help early detection of chromosomal abnormalities in pregnancies*

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For any expecting parent, the prospect of having a child with a congenital/ genetic disability is always daunting. Every parent wants to have a child that is healthy and normal in every aspect. Unfortunately, approximately 2.5 per cent of infants are born with congenital anomalies; these accounted for 8-15 per cent of perinatal deaths and 13-16 per cent of the neonatalmortality in India(1). Of these, six per cent are identified to be afflicted with chromosomal anomalies (2). These are disorders which arise from a missing, extra or irregular portion of chromosomes. While a healthy human cell has 23 pairs of chromosomes, often individuals affected by chromosomal disorders, have an abnormal number of chromo somes – a condition referred to as Aneuploidy. Aneuploidy can manifest as monosomy (missing a chromosome from a pair) or trisomy/tetrasomy (having more than two chromosomes per pair).

Down syndrome is the most commonly occurring chromosomal abnormality. Most cases of Down syndrome are caused by an extra copy of chromosome 21. Parents of these children are genetically normal, the extra chromosome occurs by random chance. In two to four per cent of the cases of Down syndrome, the extra chromosomal material on chromosome 21 is transferred by a Robertsonian Translocation. The probability of this type of Down syndrome is not related to the mother's age. Some children without Down syndrome might inherit this type of translocation and have a higher probability of having children of their own who might have Down syndrome. These cases are often referred to as familial Down syndrome.

Every year between 23,000 and 29,000 children are born in India with Down syndrome, which is the highest in the world (3).Children with Down syndrome have delayed physical and mental development, specific head and facial features, and short stature. They tend to typically have speech impediments, as well as hearing and vision disorders. They tend to have poor immune function, and are prone to leukaemia, epilepsy and thyroid disease. They are also prone to gastrointestinal disorders as well as face a higher risk of periodontal diseases. These children are at a greater risk of autistic behaviour, especially those with severe intellectual disability, and also risk having heart defects. Depression is also observed among people with Down syndrome.

The International Society for Prenatal Diagnosis (ISPD) recommends the use of Non Invasive Prenatal Testing (NIPT) as a first line screening in all pregnant women. NIPT is a trial to check chromosomal abnormalities in an unborn baby. The NIPT test can be used to screen for chromosomal disorders in pregnant women from the ninth week of gestation onwards. It has the highest accuracy rate of 99.84 per cent and negative predictive value, which means that it will prevent women from having to undergo unnecessary invasive tests. NIPT is superior to traditional screening methods like NT scans or maternal serum screening, since they have relatively lower detection rates, for instance a detection rate of 79 – 90 per cent for Trisomy 21. These low detection rates mean that a proportion of affected pregnancies go undetected until birth. Positive screen results typically have to be followed up with invasive screening methods like amniocentesis or chorionic villus sampling (CVS), that have a one in 300 rate of procedure induced pregnancy loss.

Non Invasive Prenatal Screening (NIPS) is also better than other any other non invasive screening tests available in the market today, as it is the only NIPS test that detects Triploidy. Triploidy is caused by an extra copy of all chromosomes. Abnormalities are often present in both the placenta and the foetus. It is found in about one in 1000 first trimester pregnancies; most babies with triploidy are miscarried or stillborn. Of those rare babies born alive, most die before one year of age. Mothers carrying triploidy foetuses may also experience pregnancy complications such as pre-eclampsia, severe nausea, excessive bleeding, and placental disease. Microdeletions are a group of conditions caused by a loss of small portion of certain chromosomes. These are largely undetected during pregnancy. They cause physical and/ or intellectual impairments, which can be more severe than whole chromosome abnormalities.

Early detection of Down Syndrome by prenatal genetic testing can help in timely identification of the disorder. This helps parents choose appropriate disease management options, and in cases where there is no cure, can help them choose the best care giving options that they can provide. Early intervention with educational and other services improves the functioning of young children with Down syndrome.

REFERENCES :

1. PS, Arya, Viji A. Thottumkal, and M. G. Deepak. "CONGENITAL ANOMALIES: A MAJOR PUBLIC HEALTH ISSUE IN INDIA." International Journal of Pharmaceutical, Chemical & Biological Sciences 3.3 (2013).
2. Sheth, Frenny, et al. "Prenatal screening of cytogenetic anomalies–a Western Indian experience." BMC pregnancy and childbirth 15.1 (2015): 1.
3. Krishnekumaar and Dr. K.S. Meenakshisundaram. "A Study of Down syndrome – The Medicare & Positive Parenting for A Healthy India." AEIJMR – Vol 3 – Issue 9 – September 2015 ISSN – 2348 – 6724