CHROMOSOMAL ABERRATIONS AND FERTILITY – A REVIEW

Abstract

Genetic disorders are the disorder which are caused due to the mutation or any change in the genome of individual. Genetic disorders are majorly divided into three groups : single gene disorders, chromosomal disorders and/ or multifactorial disorders. Single gene disorders or we can say that the mendelian disorders are occurs by any change in the DNA sequence of a gene like autosomal dominant, autosomal recessive, sex linked dominant, sex linked recessive. Chromosomal disorders are occurs because of chromosomal aberrations, occurs by numerically and/or structural changes. Molecular and cytogenetic techniques are widely used to examine the genetic changes that causes disorders.

Keywords: Mutations, Infertility, ICSI, Molecular and Cytogenetic techniques and so on.

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I. INTRODUCTION

The human genome consists of 23 pairs of chromosomes. 22 pairs of chromosome are autosomes and one pair of Chromosome is allosomes. Approximately 3 billion base pairs are present in these 23 pairs of chromosomes. One pair of each chromosome is comes from the paternal lineage and one copy of each chromosome is comes from the maternal lineage. Therefore, the DNA is composed of four kinds of nitrogenous bases : Adenine (A), Thymine (T), Guanine (G), Cytosine (C). Genes have DNA base pairs which are present on chromosome. A gene is a sequence of base pairs, that gives functional product composing RNA molecule and/or polypeptide chain (or protein). An allele is an alternative form of a gene, that is present on each pair of chromosome, so the diploid genome have two alleles of each gene.

Central dogma in which the genetic information transmits includes Replication (DNA makes the DNA), Transcription (DNA makes the RNA), Translation (RNA makes the protein). A lots of post-transcriptional events or RNA processing events are occurs for the formation of functional RNA molecules. Events includes capping, splicing, tailing and translocation of RNA from the nucleus to the cytoplasm. Similarly, a lots of post-translational events are occurs in the cytoplasm. Events like attachment of any functional group, acetylation, methylation, glycosylation, phosphorylation, sumoylation etc., protein folding, for the formation of functional protein.

II. DISORDERS IN SPERMATOGENESIS

Failure of primary endocrine either GnRH or deficiency of gonadotropin causing adverse effects on the process of spermatogenesis. Thus, we treated these disorder by gene therapy or by giving a combination of FSH and LH. Another disorder like process of spermatogenesis failed to respond to the endocrine therapy and requirement of some approaches like ICSI, if a very small number of sperm cells are available for their recovery from the ejaculation through the orgasm. Individuals who are suffering from Azoospermia may be helpful when the sperm cells are recoverable from the epididymal duct or also may be isolated from the epithelium of seminiferous tubule after the testicular biopsy. Round spermatids are widely used with ICSI, if the process of spermatogenesis is as arresting at the late spermatid stage, but we say that we get optimal success by giving motile sperm cells.

III. ABERRATIONS IN Y-CHROMOSOME

There is involvement of translocation in Y-chromosome. Translocation is mainly occurs in the Y- chromosome to the autosome chromosomes like chromosome 1, chromosome 3, chromosome 11 and alters the process of spermatogenesis due to the interference of pairing of sex chromosomes and also incomplete inactivation of X-chromosome. A lots of breakpoints are usually occurs in Y-chromosome and gives Yq11 and Yq12 regions which includes the region of AZF.

And other abnormalities of Y chromosome alters the process of spermatogenesis includes dicentric short arm and formation of ring , involves loss of major region of long arm of Y chromosome which have AZF region. Spermatogonia is unable to differentiate with dicentric short arm of Y-chromosome or ring formation of Y-chromosome. In those

individual, short stature and anomalies in birth are observed. Changes or we can say that mutations in SRY or TDF region of Y-chromosome causes adverse effects. It is present on the short arm of Y-chromosome i.e., Yp11.3 adjacent to PAR. SRY region is very crucial for producing the anti-mullerian hormone and thus helpful in the formation of testis. Point mutation in the region of SRY, causes the structure and functional effects as same in deletion or translocation.

SRY region has approximately 35 Kilo base pairs, also have HMG box region that is essential for the functioning of gene. Mutation in this region causes the dangerous effects on the phenotype of male. SRY encoding DNA binding protein and transcribed as the single gene. This protein is responsible for the responsible for the formation of tests in the development of foetus. Mutation in SRY region during paternal meiosis causes feminine characters along with gonadal dysgenesis. Underdevelopment of ovaries, underdevelopment of female genital tract and also underdevelopment of secondary sexual characters like breast, external genitalia and so on, are observed, in this condition. Individuals who are phenotypically male, but also have normal female genomic composition, 46, XX, called XX – male syndrome. Individual suffer from this syndrome have masculine secondary sexual characters and also have gynaecomastia. Body weight and height is abnormal as compared to normal individual. These individuals have small testes. Microdeletion in the Yq11.21 - 23 region of Y chromosome takes place as De - novo mutation and are absent from the genome of paternal side. Denovo mutation results in the complete loss of germ cell and also causes SCOS. In the region of why Yq11.21 - 23 of Y-chromosome have four different candidate genes includes RBM1 , SMCY , TSPY & EIF1AY , responsible for the process of spermatogenesis. Mutation in any four genes, causes early arrest of spermatogenesis at this stage of pre - meiotic spermatocyte and post - meiotic spermatocyte.

IV. CONCLUSION

Accuracy in the diagnosis of disease is very important for the treatment of disorder, genetic counselling and also prevention strategy. ICSI can be working in those individuals , whose testis have elongated spermatids, if a few sperm cells can be recovered by the testicular biopsy. Male offsprings are infertile, because of lack of genes on Yq11.21 - 23 region of Y-chromosome, which are responsible for the process of spermatogenesis. Defects in chromosome structure and chromosome numerical , causes polyploidies and unbalanced translocations causes the death of an embryo. Physicians gives knowledge about the contemporary diagnostic protocols to those individuals who are suffering from any disease and/or disorders, that will be emerge the range of treatment which is offered to assist the infertile males and females.

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V. ABBREVIATIONS

1. DNA : Deoxyribonucleic Acid
2. RNA : Ribonucleic Acid
3. GnRH : Gonadotropin Releasing Hormone
4. LH : Leutenzing Hormone
5. FSH : Follicle Stimulating Hormone
6. ICSI : Intracytoplasmic Sperm Injection
7. AZF : Azoospermic Factor
8. SRY : Sex Determining Region on Y-chromosome
9. TDF : Testis Determining Factor
10. PAR : Pseudoautosomal Region
11. SCOS : Sertoli Cell Only Syndrome
12. HMG : High Mobility Group

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