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Human Y Chromosome and Male Infertility

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The human Y chromosome is known for sex determination. This chromosome is a haploid formation within the genome, where no recombination takes place. The Y chromosome is under much study due to its anomalies within the human body with multiple genetic techniques. The first study hoped to understand the relationship between the Y chromosome and Y-linked genetic anomalies. In this study the researchers are providing information on the Y chromosome and its involvement within genetic anomalies. So far it is known that mutations within the genes of the Y chromosome and autosomes result in male infertility. Due to the male infertility anomalies research has also began studying the azoospermia factor regions. The scientists are performing research on three different regions in relation to the Yq arm (long arm) region of the chromosome. The research determined that deletion of one or all three of factor regions will result in male infertility.

Introduction

The human Y chromosome is known for having millions of DNA base sequences. Of these about 95% of these sequences are known as the non- recombining region. In this region there are twenty genes. Of these there are approximately twenty genes twelve are grouped into two distinct categories. Five of the twelve have homologs on the X chromosome and are expressed in a range of tissues in the addition to the testis. The remaining seven lack the X homologs and are only expressed within the testis. Each gene has particular cellular function. In the non-recombining region of the Y chromosome there are distinct protein families, eleven of which are expressed within the testis (Skaletsky et al., 2003). Deletions that have occurred within testis genes have resulted in spermatogenic failure. There are two repeating domains, DYZ1 and DYZ2. These two domains have been used as satellite fractions to detect abnormal Y chromosomes for sexing ([Cooke et al., 1982], [Lau, 1985], [Kobayashi et al., 1988] and [Nakagome et al., 1991]). Due to X females scientists were able to detect the Y chromosome and led scientist to find that patients with Turner's syndrome (45, X) and mixed gonadal dysgenesis showed 20-30% increase rate of malignancy of gonads.

Recent Progress

The sex determining region of the Y chromosome encodes the testis-determining factor which is the main determinant in the male sex. These genes are mainly responsible for the formation of gonadal tissue to form testis. The sex determining region is a member of the DNA binding protein in conservation with the 'HMG-box' domain. Mutations within this certain genes give rise to the XY female chromosomes which give rise to gonadal dysgenesis (Swyer Syndrome). It also relocates parts of the X and Y chromosome which guides males with XX chromosomes. Recent research has led scientist to believe that observing Swyer syndrome may give rise to a mutation located on the Y chromosome. Numbers of mutations were found within the HMG box that gave rise to gonadal dysgenesis. It is believed that the mutations are being transmitted through the female carriers with 46, XX chromosome and may be X- linked or due to autosomal genes. This is of huge importance to scientific research. The scientists also believe that if a defective Y

chromosome gene is present it could be linked with male infertility. With these genetic anomalies it does not yield in the production or formation of a particular gene that has spermatogenesis.

A particular gene (USP9Y) that results with four base pair deletions will result in an shortened encoded protein, which in turn, leads to infertility. However, not both homologous pairs (USP9X and USP9Y) are both required for cell development (Sun et al., 1999). The more important factor that is possible for male infertility is that of the azoospermia regions. It is believed that it could be due to a microdeletion of the azoospermia sequences. Scientists believe there are three ways to best test these conditions, polymerase chain reaction (Kocova and Trucco 1994), cloned probe (Nakahori et al., 1986) and short synthetic oligonucleotide probes (Ali et al., 1992). In the overall experiment, it is believed that patients with gonadal dysgenesis and sex chromosome genetic mutations may be due to the loci DYS1. Before making conclusions, it is important to know that all the Y- linked genes have all equal potential for becoming mutations in gonadal dysgensis. This is important when it comes to homologous paring within mutations of the switching of XX males and XY females. The locus DYZ1 and DYS1 may give rise to mutations in gonadal dysgenesis. An important statement that the scientists concluded was that in the presence or absence of the Y chromosome does not particularly mean that there are mutations. One must determine the chromosome and DNA analyses to be certain of mutations. Previously stated, deletions within the testis specific genes result in male infertility. Long arm are known to contain the azoospermia. Deletions of the azoospermia result in male infertility by spermatogenic failure (Repping et al., 2002). AZFb and AZFc are not independent of one another but are overlapping one another, whereas AZFa is independent of these two factors (Repping, et al., 2002). Certain factors deleted within the AZFa have been shown to have complete deletion of 100%. AZFb has caused more deletions than AZFa. Within the AZFc region there is a DAZ region of the Yq arm, which stands for deleted in azoospermia. The DAZ gene encodes RNA binding proteins where it was thought to be the control of the spermatogenic function (Yen, 2004). A partial deletion of the AZFc region can result in subfertility. Since it is believed that autosomal genes also play a part in male infertility, scientists are concluding that these genes have control over the paracrine system or signaling transduction could possibly give rise to male infertility. In the second article it finds that a total of twenty-three specific transcripts have been lead to show deletions resulting in spermatogenic failure. Looking at particular transcripts it has been shown that certain genes play a more predominant factor in biological roles while others have no correlation.

Discussion

The Yqh plays an important role within pregnancy. A question that scientists are still trying to determine is how fathers are tolerating this during embryonic development. Currently the possibility that scientists have concluded is that there must be an inappropriate balance causing spontaneous abortions. These scientists believe a way to determine this is to study patients who are known to have experienced abortions and determine if the role of DYZ1 in the Yqh regions of the chromosome plays an important role. Examining the azoospermia factor it is difficult to determine the number of unknown genes or the types of mutations that are causing infertility in males. On the other hand, looking at the partial AZFc deletions scientists believe that with new research they will be able to find a new genetic cause of the infertility in males.

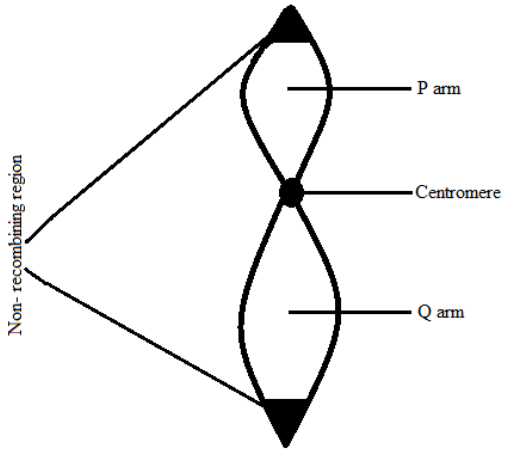

Figure 1 is a figure of a chromosome representing the non-recombining region with the Yq and Yp arms of the chromosome.

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