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Poster Presentations

P-66

The role of the *SYCE1* gene in the male and female fertility: A literature review

Ghasemi A[1, 2], Alavi A[1].
1 Genetics Research Center, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran.
2 Student Research Committee, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran.
Email: afaghalavi@gmail.com, af.alavi@uswr.ac.ir

Background: Infertility is described as the inability to become pregnant after at least a year of unprotected intercourse. It affects approximately 10-15% of couples worldwide and can involve males and females. There are different risk factors for infertility. Genetic factors are one of the most important among those and some of them affect synaptonemal complex (SC). It is a protein set that facilitates synapsis formation and crossing over during meiotic division in males (spermatogenesis) and females (oogenesis).
Objective: Here, we try to summarize the roles of SC especially, the synaptonemal complex central element-1 (SYCE1) in fertility.
Materials and Methods: We used the search term TITLE-ABS-KEY (SYCE1) from article names, keywords, and abstracts to search the article in PubMed. In addition, we screened all references to related papers for extra research.
Results: The SC comprises several compartments: lateral elements (LEs), which are located on both sides of homologous chromosome axes, and a central region containing a central element (CE), and transverse filaments (TFs). The protein components of the mammalian SC include synaptonemal complex protein-2 (SYCP2), synaptonemal complex protein-3 (SYCP3) in the LEs, synaptonemal complex central element protein-1 (SYCE1), synaptonemal complex central element protein-2-testis-expressed protein-12 (SYCE2-TEX12), synaptonemal complex central element protein-3(SYCE3), and Six6 opposite strand transcript 1 (SIX6OS1) in the CE and synaptonemal complex protein-1(SYCP1) in the TFs. All components have been associated with meiosis division, so mutations in those can be associated with abnormalities of gametogenesis. Mutant mice have been associated with infertility for all SC proteins, except for female mutants in Sycp2 and Sycp3. Functional studies revealed that the male *Syce1*-knockout mice had excessive primary spermatocytes with maturation arrest, and the females had small ovaries with almost complete lack of follicles. In humans, the function of the *SYCE1* gene also appears to be as important as in mice. To date, homozygous mutations of *SYCE1* affecting infertility have been reported in three families worldwide. In 2014, a nonsense homozygous mutation (c.613C>T; p.Gln205*) in two sisters affected with primary ovarian insufficiency (POI) was reported. Thereafter, in 2015 and recently in our study in 2020 by whole exome sequencing (WES), two multi affected families were described with non-obstructive azoospermia (NOA), who carried splice-site mutations c.197-2A>G and c.375-2A>G, respectively. Whereas, the C-terminal of the SYCE1 protein is essential for interaction with SYCE3 and thereby assembly of SC, all three aforementioned mutations produce the truncated proteins without C-terminal of the normal protein. It can be possible that nonsense mediated decay (NMD) causes no expression of the mutated mRNA.
Conclusion: To date, all three reported families with mutations in *SYCE1* have originated from the Middle East; Israeli-Arab, Iranian-Jewish, and Iranian families. Therefore, screening of SYCE1 mutations among the large cohorts of infertile males and females in Iran and other Middle East countries is recommended.
Key words: *Synaptonemal complex, SYCE1, Infertility, Iranian population.*