KCNQ1OT1 Gene

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KCNQ1 opposite strand/antisense transcript 1

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1. Introduction

The *KCNQ1OT1* gene is located within another gene, *KCNQ1*. Because the two genes share a region of overlapping DNA, the *KCNQ1OT1* gene is also known as *KCNQ1* overlapping transcript 1 or *KCNQ1* opposite strand/antisense transcript 1. The DNA sequence of two genes is "read" in opposite directions, and the genes have very different functions. Unlike the *KCNQ1* gene, which provides instructions for making a protein that acts as a potassium channel, the *KCNQ1OT1* gene does not contain instructions for making a protein. Instead, a molecule called a noncoding RNA (a chemical cousin of DNA) is produced from the *KCNQ1OT1* gene. This RNA helps regulate genes that are essential for normal growth and development before birth.

People inherit one copy of most genes from their mother and one copy from their father. Both copies are typically active, or "turned on," in cells. However, the activity of the *KCNQ1OT1* gene depends on which parent it was inherited from. Only the copy inherited from a person's father (the paternally inherited copy) is active; the copy inherited from the mother (the maternally inherited copy) is not active. This sort of parent-specific difference in gene activation is caused by a phenomenon called genomic imprinting.

The *KCNQ1OT1* gene is part of a cluster of genes on the short (p) arm of chromosome 11 that undergo genomic imprinting. *KCNQ1OT1* and several other genes in this cluster that are thought to help regulate growth are controlled by a nearby region of DNA known as imprinting center 2 (IC2) or KvDMR. The IC2 region undergoes a process called methylation, which is a chemical reaction that attaches small molecules called methyl groups to certain segments of DNA. Methylation, which occurs during the formation of an egg or sperm cell, is a way of marking or "stamping" the parent of origin. The IC2 region is normally methylated only on the maternally inherited copy of chromosome 11.

2. Health Conditions Related to Genetic Changes

2.1. Beckwith-Wiedemann Syndrome

Beckwith-Wiedemann syndrome is a condition characterized by overgrowth and other signs and symptoms that affect many parts of the body. At least half of all cases of this condition result from changes in a process called methylation that affects the IC2 region. Specifically, the maternally inherited copy of the IC2 region has too few methyl groups attached (hypomethylation). This abnormality disrupts the regulation of several genes that are normally controlled by IC2. Hypomethylation of the IC2 region leads to an increase in the activity of the *KCNQ1OT1* gene and a reduction in the activity of other nearby genes. Because some of these genes are involved in directing growth, a loss of their activity leads to overgrowth and the other features of Beckwith-Wiedemann syndrome.

In a few cases, Beckwith-Wiedemann syndrome has been caused by deletions of a small amount of DNA from the maternally inherited copy of the IC2 region. Like abnormal methylation, these deletions disrupt the activity of several genes, including *KCNQ1OT1*.

3. Other Names for This Gene

- FLJ41078
- KCNQ1 opposite strand/antisense transcript 1 (non-protein coding)

- KCNQ1 overlapping transcript 1
- KCNQ1 overlapping transcript 1 (non-protein coding)
- KCNQ1-AS2
- KCNQ10T1
- KvDMR1
- KvLQT1-AS
- LIT1
- long QT intronic transcript 1

References

1. Bliek J, Maas SM, Ruijter JM, Hennekam RC, Alders M, Westerveld A, Mannens MM.Increased tumour risk for BWS patients correlates with aberrant H19 and notKCNQ1OT1 methylation: occurrence of KCNQ1OT1 hypomethylation in familial cases ofBWS. Hum Mol Genet. 2001 Mar 1;10(5):467-76.
2. Chiesa N, De Crescenzo A, Mishra K, Perone L, Carella M, Palumbo O, Mussa A,Sparago A, Cerrato F, Russo S, Lapi E, Cubellis MV, Kanduri C, Cirillo Silengo M,Riccio A, Ferrero GB. The KCNQ1OT1 imprinting control region and non-coding RNA: new properties derived from the study of Beckwith-Wiedemann syndrome andSilver-Russell syndrome cases. Hum Mol Genet. 2012 Jan 1;21(1):10-25. doi:10.1093/hmg/ddr419.
3. Du M, Zhou W, Beatty LG, Weksberg R, Sadowski PD. The KCNQ1OT1 promoter, a keyregulator of genomic imprinting in human chromosome 11p15.5. Genomics. 2004Aug;84(2):288-300.
4. Kanduri C. Functional insights into long antisense noncoding RNA Kcnq1ot1mediated bidirectional silencing. RNA Biol. 2008 Oct-Dec;5(4):208-11.
5. Kanduri C. Kcnq1ot1: a chromatin regulatory RNA. Semin Cell Dev Biol. 2011Jun;22(4):343-50. doi: 10.1016/j.semcdb.2011.02.020.
6. Pandey RR, Mondal T, Mohammad F, Enroth S, Redrup L, Komorowski J, Nagano T,Mancini-Dinardo D, Kanduri C. Kcnq1ot1 antisense noncoding RNA mediateslineage-specific transcriptional silencing through chromatin-level regulation.Mol Cell. 2008 Oct 24;32(2):232-46. doi: 10.1016/j.molcel.2008.08.022.
7. Thakur N, Tiwari VK, Thomassin H, Pandey RR, Kanduri M, Göndör A, Grange T,Ohlsson R, Kanduri C. An antisense RNA regulates the bidirectional silencingproperty of the Kcnq1 imprinting control region. Mol Cell Biol. 2004Sep;24(18):7855-62.
8. Weksberg R, Nishikawa J, Caluseriu O, Fei YL, Shuman C, Wei C, Steele L,Cameron J, Smith A, Ambus I, Li M, Ray PN, Sadowski P, Squire J. Tumordevelopment in the Beckwith-Wiedemann syndrome is associated with a variety ofconstitutional molecular 11p15 alterations including imprinting defects ofKCNQ1OT1. Hum Mol Genet. 2001 Dec 15;10(26):2989-3000.