ACTA2 Gene

Subjects: Genetics
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Definition

actin, alpha 2, smooth muscle, aorta

1. Normal Function

The *ACTA2* gene provides instructions for making a protein called smooth muscle alpha (α)-2 actin, which is part of the actin protein family. Actin proteins are important for cell movement and the tensing (contraction) of muscles.

Smooth muscle α-2 actin is found in smooth muscle cells. Smooth muscles line the internal organs, including the blood vessels, stomach, and intestines. Within smooth muscle cells, smooth muscle α-2 actin forms the core of structures called sarcomeres, which are necessary for muscles to contract. Smooth muscles contract and relax as part of their normal function without being consciously controlled.

Layers of smooth muscle cells are found in the walls of the arteries, which are blood vessels that carry blood from the heart to the rest of the body. Smooth muscle α-2 actin contributes to the ability of these muscles to contract, which allows the arteries to maintain their shape instead of stretching out as blood is pumped through them.

2. Health Conditions Related to Genetic Changes

2.1 Familial thoracic aortic aneurysm and dissection

More than 30 *ACTA2* gene mutations have been identified in people with familial thoracic aortic aneurysm and dissection (familial TAAD). This disorder involves problems with the aorta, which is the large blood vessel that distributes blood from the heart to the rest of the body. The aorta can weaken and stretch, causing a bulge in the blood vessel wall (an aneurysm). Stretching of the aorta may also lead to a sudden tearing of the layers in the aorta wall (aortic dissection). Aortic aneurysm and dissection can cause life-threatening internal bleeding.

ACTA2 gene mutations that are associated with familial TAAD change single protein building blocks (amino acids) in the smooth muscle α-2 actin protein. These changes likely affect the way the protein functions in smooth muscle contraction, interfering with the sarcomeres' ability to prevent arteries from stretching. The aorta, where the force of pumping blood coming directly from the heart is most intense, is particularly vulnerable to this stretching, resulting in the aortic aneurysms and dissections associated with familial TAAD.

2.2 Other disorders

At least one mutation in the *ACTA2* gene causes multisystemic smooth muscle dysfunction syndrome. This disorder impairs the activity of smooth muscles throughout the body and leads to widespread problems including blood vessel abnormalities, decreased response of the pupils to light, a weak (hypotonic) bladder, and impairment of the muscle contractions that move food through the digestive tract (hypoperistalsis).

The mutation that causes multisystemic smooth muscle dysfunction syndrome replaces the amino acid arginine with the amino acid histidine at protein position 179, written as Arg179His or R179H. This mutation results in impaired contraction of smooth muscles in many organs, leading to the signs and symptoms of multisystemic smooth muscle dysfunction syndrome. It is unclear why this *ACTA2* gene mutation has effects on smooth muscles throughout the body while others affect only the aorta.

3. Other Names for This Gene

- AAT6

- ACTA_HUMAN
- actin, aortic smooth muscle
- ACTSA
- alpha 2 actin
- alpha-actin-2
- cell growth-inhibiting gene 46 protein
- growth-inhibiting gene 46

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Keywords

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