Liebenberg Syndrome

Subjects: Genetics & Heredity

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Liebenberg syndrome is a condition that involves abnormal development of the arms, resulting in characteristic arm malformations that can vary in severity.

genetic conditions

1. Introduction

In people with Liebenberg syndrome, bones and other tissues in the elbows, forearms, wrists, and hands have characteristics of related structures in the lower limbs. For example, bones in the elbows are abnormally shaped, which affects mobility of the joints. The stiff elbows function more like knees, unable to rotate as freely as elbows normally do. Bones in the wrists are joined together (fused), forming structures that resemble those in the ankles and heels and causing permanent bending of the hand toward the thumb (radial deviation). The bones in the hands (metacarpals) are longer than normal, and the fingers are short (brachydactyly), similar to the proportions of bones found in the feet. In addition, muscles and tendons that are typically found only in the hands and not in the feet are missing in people with Liebenberg syndrome. Affected individuals also have joint deformities (contractures) that limit movement of the elbows, wrists, and hands. Development of the lower limbs is normal in people with this condition.

Individuals with Liebenberg syndrome have no other health problems related to this condition, and life expectancy is normal.

2. Frequency

Liebenberg syndrome is a rare condition. Fewer than 10 affected families have been described in the medical literature.

3. Causes

Liebenberg syndrome is caused by genetic changes near the *PITX1* gene. The protein produced from this gene plays a critical role in lower limb development by controlling the activity of other genes involved in limb development, directing the shape and structure of bones and other tissues in the legs and feet.

The genetic changes involved in Liebenberg syndrome delete, insert, or rearrange genetic material near the *PITX1* gene. These changes affect regions of DNA known as regulatory elements, which help turn on or turn off genes (known as enhancers or repressors, respectively). They control when and where certain genes are active. The mutations that cause Liebenberg syndrome are thought to relocate enhancers that normally promote the activity of genes involved in upper limb development to be near the *PITX1* gene, where they can promote its activity. Alternatively, the mutations may remove repressors that normally turn off the *PITX1* gene during upper limb development. As a result, the *PITX1* gene is abnormally active during development of the upper limbs. Because the PITX1 protein normally directs lower limb structure, bones, muscles, and tendons in the arms and hands develop more like those in the legs and feet, leading to the features of Liebenberg syndrome.

3.1. The gene associated with Liebenberg syndrome

- PITX1

4. Inheritance

Liebenberg syndrome is inherited in an autosomal dominant pattern, which means having a genetic change that affects the *PITX1* gene on one copy of the chromosome in each cell is sufficient to cause the disorder. In most cases, an affected person has one parent with the condition.

5. Other Names for This Condition

- brachydactyly with joint dysplasia
- brachydactyly-elbow wrist dysplasia syndrome
- carpal synostosis with dysplastic elbow joints and brachydactyly

References

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