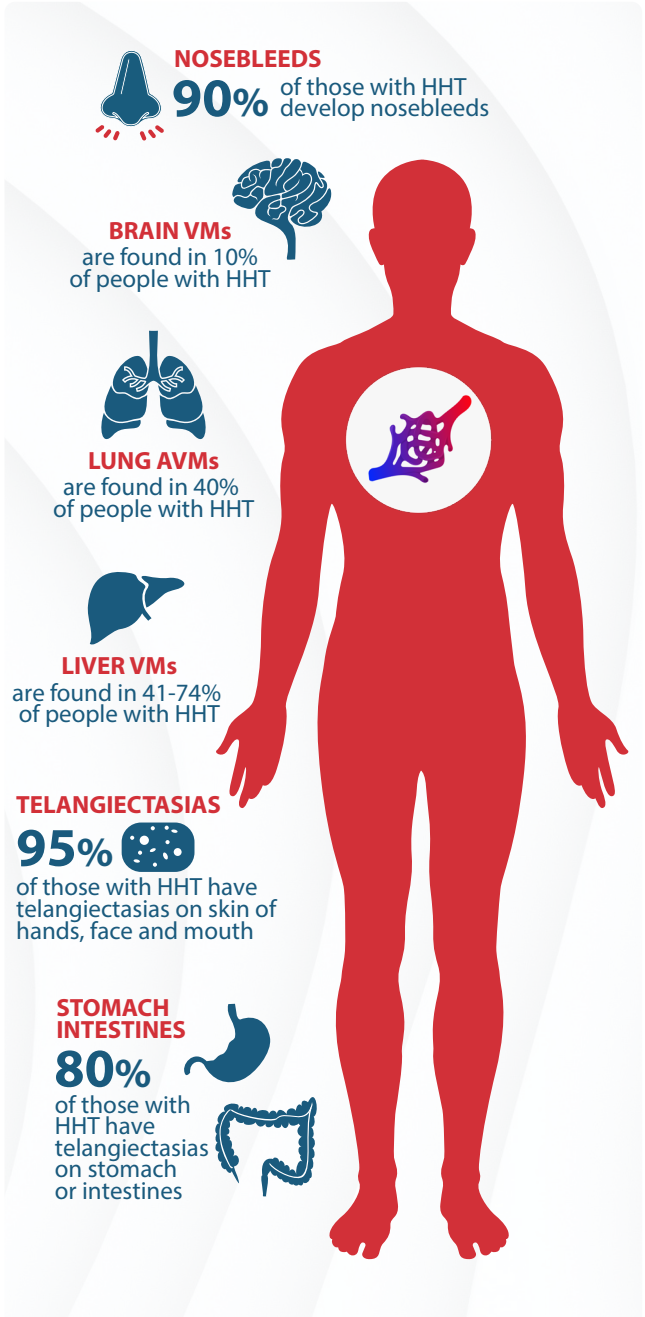
CAUSES & SYMPTOMS OF HHT

HHT is caused by alterations in genes that help maintain normal blood vessel formation. These alterations lead to blood vessel abnormalities in the lungs, brain, liver, gastrointestinal (GI) tract, skin and nose.



ADDITIONAL RESOURCES

www.CureHHT.org

Cure HHT Resource Library
www.curehht.org/provider-topics

Genetics of HHT
www.curehht.org/genetics

Nosebleed Severity Scoring Tool (ESS)
www.hhtess.com

Curacao Criteria
www.curehht.org/diagnostic-criteria

HHT Centers of Excellence
www.curehht.org/hht-treatment-center

International HHT Clinical Guidelines
www.hhtguidelines.org

Rare Genomes Project *(free testing)*
www.raregenomes.org

CONNECT WITH US

www.curehht.org | hhtinfo@curehht.org
P.O. Box 329, Monkton, MD 21111
Non-Profit Tax I.D. Number: 223115041

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cure hht
The Cornerstone of the HHT Community

An HHT diagnosis can save a life

HEREDITARY HEMORRHAGIC TELANGIECTASIA (HHT)

Osler-Weber-Rendu Syndrome

The Role of Genetics in HHT

HEREDITARY HEMORRHAGIC TELANGIECTASIA (HHT)

Hereditary Hemorrhagic Telangiectasia is a hereditary bleeding disorder characterized by abnormal blood vessel formation resulting in **telangiectasia** and **arteriovenous malformations (AVMs)**.

HHT is caused by a variant in one of several HHT-associated genes. The vast majority of people with HHT inherited the condition from one of their parents, but in rare instances, HHT can appear in individuals without a family history. **Genetic testing can be done using blood, saliva, cheek swabs, and prenatal samples** to identify unusual DNA that can cause HHT.

GENETICS OF HHT

HHT follows an *autosomal dominant* inheritance pattern. Approximately 90% of HHT cases are caused by alterations in the **ENG (HHT1)** or **ACVRL1 / ALK1 (HHT2)** gene.

Alterations in a third gene, **SMAD4**, can lead to a condition called **Juvenile Polyposis HHT Syndrome (JP-HHT)**. Individuals with this condition have HHT symptoms as well as specific GI polyps called juvenile polyps, and are at an increased risk for stomach and intestinal cancer.

Other cases of HHT can arise from variants in genes **GDF2**, **RASA1** and **EPHB4**.

Although HHT cannot skip generations, it may appear to since each individual is unique and can experience a number of different symptoms.

DIAGNOSIS OF HHT

Genetic diagnosis of HHT is preferred, however, patients with HHT can be clinically diagnosed according to the established **Curaçao Criteria**.

HHT can be difficult to diagnose since the symptoms vary among individuals, from very mild to severe, and can be age dependent. Children with HHT may not have any symptoms. There also tends to be a **15-30 year delay in diagnosis** from the onset of first symptoms due to lack of disease awareness in the medical community.

Why should patients get genetic testing?

Often times, clinical criteria alone are not enough to definitively diagnose HHT patients. Genetic testing can:

Identify at-risk family members

Determine the presence or absence of a familial variant to identify at-risk family members, especially asymptomatic children. HHT does not skip a generation

Improve drug therapy outcomes

Advances in precision medicine could mean that knowing your HHT-causing gene affects medicine and treatment recommendations.

Assist in family planning decisions

Options to reduce HHT risk in future children are also available to those who have a known HHT variant.

Confirm an HHT diagnosis

This may lead to earlier screening, additional screening needed (SMAD4), improved treatment, changes in insurance plans, school and work accommodations, and increased awareness for the family.

Rule out an HHT diagnosis*

This may alleviate concern and prevent unnecessary medical screenings and financial strain.

** For patients with variants of unknown significance, further clinical testing is required. HHT can only be ruled out by genetic testing if a family's HHT-causing variant is known.*

Your role as a medical professional

Intercede and consider an HHT diagnosis for patients with nosebleeds and strokes that run in the family!

Medical professionals have the opportunity to recognize HHT in their patients and direct them to the care they need.

Ask about family history and check for the presence of telangiectases in anyone with chronic nosebleeds; this could help to diagnose an entire family. If you suspect that a patient may be affected by HHT, there are several steps that should be taken:

- **Talk to your patient about HHT.** Explain the disease, symptoms and steps toward diagnosis and treatment.
- **Order HHT genetic test panel.** Primary panel including 6 genes (ACVRL1, ENG, SMAD4, EPHB4, GDF2, RASA1).
- **Direct your patient to www.curehht.org** where they can find information regarding diagnosis and treatment.
- **Refer your patient** to the nearest North American HHT Center of Excellence.

Statistics

- An estimated 1 in 5,000 people have HHT.
- Men, women, and children of all ethnicities are equally affected.
- 9 out of 10 people with HHT are undiagnosed.
- 20% of undiagnosed patients experience sudden disability or death.
- Brain and lung malformations can be life threatening at any age.
- When diagnosed and treated, HHT patients have a normal life expectancy.