ALGORITHMS FOR THE DIAGNOSIS, EVALUATION, AND MANAGEMENT OF HEREDITARY HEMORRHAGIC TELANGIECTASIA (HHT)



Description:

The HHT Foundation International, Inc. ("Cure HHT") has developed algorithms for the diagnosis, evaluation, and management of Hereditary Hemorrhagic Telangiectasia (HHT). These algorithms are designed to guide the screening and management of HHT according to the "Second International Guidelines for the Diagnosis and Management of Hereditary Hemorrhagic Telangiectasia". HHT, a genetic disorder characterized by abnormal blood vessel formation, requires a systematic approach for effective patient care, encompassing diagnosis, screening, and ongoing management.

Key Components of the Algorithms:

1. Diagnosis

- Clinical Criteria: The algorithm incorporates the Curaçao criteria, which includes recurrent nosebleeds, mucocutaneous telangiectasia, visceral arteriovenous malformations (AVMs), and a family history of HHT.
- Genetic Testing: Recommended for patients meeting clinical criteria or with a family history suggestive of HHT.

2. Evaluation

- For Patients: Screening for visceral lesions, such as cerebral and pulmonary AVMs, is advised. This includes imaging modalities like MRI and echocardiography, based on individual risk factors and clinical presentation.
- Family Members: Screening for asymptomatic relatives is recommended, particularly in those with a known family history of HHT.

3. Management

- Symptomatic Treatment: Focuses on managing epistaxis and gastrointestinal bleeding through medical and procedural interventions.
- Preventative Treatment: Guidelines suggest specific approaches for the management of AVMs, including embolization and surgical options.

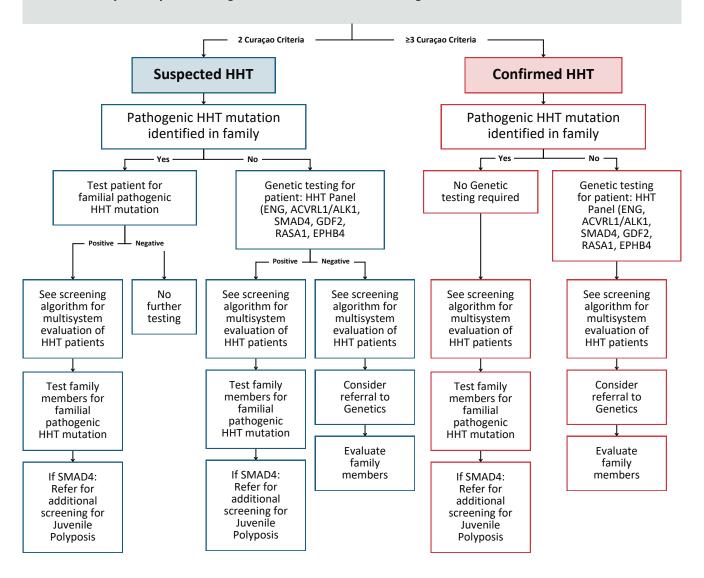
4. Follow-Up

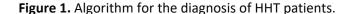
 Regular Monitoring: Emphasis is placed on regular follow-up to monitor disease progression and manage complications.

These algorithms align with the comprehensive recommendations provided by Faughnan et al. (2020)¹, ensuring that patients with HHT receive consistent and evidence-based care. The guidelines emphasize a multidisciplinary approach, incorporating specialists from various fields to address the complex needs of HHT patients.

Diagnosis of HHT Using Curação Criteria

- **Epistaxis:** Spontaneous and recurrent
- Telangiectases: Multiple at characteristic sites (lips, oral cavity, fingers, nose)
- **Visceral lesions:** Gastrointestinal telangiectasia, pulmonary, hepatic, cerebral, spinal arteriovenous malformations
- Family history: A first-degree relative with HHT according to these criteria







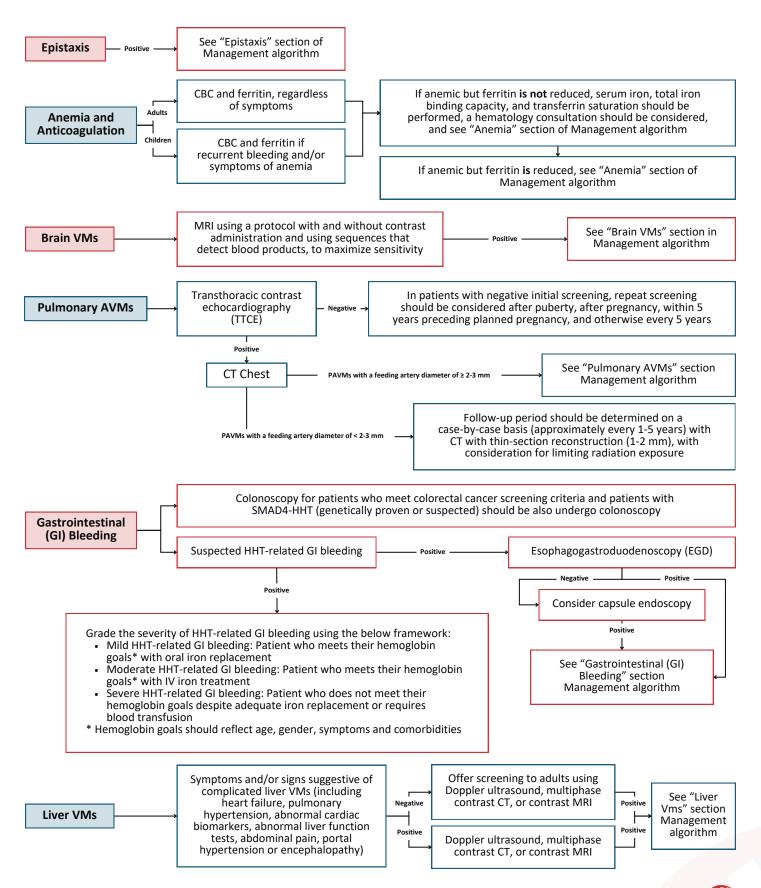


Figure 2. Screening algorithm for the multisystem evaluation of HHT patients.



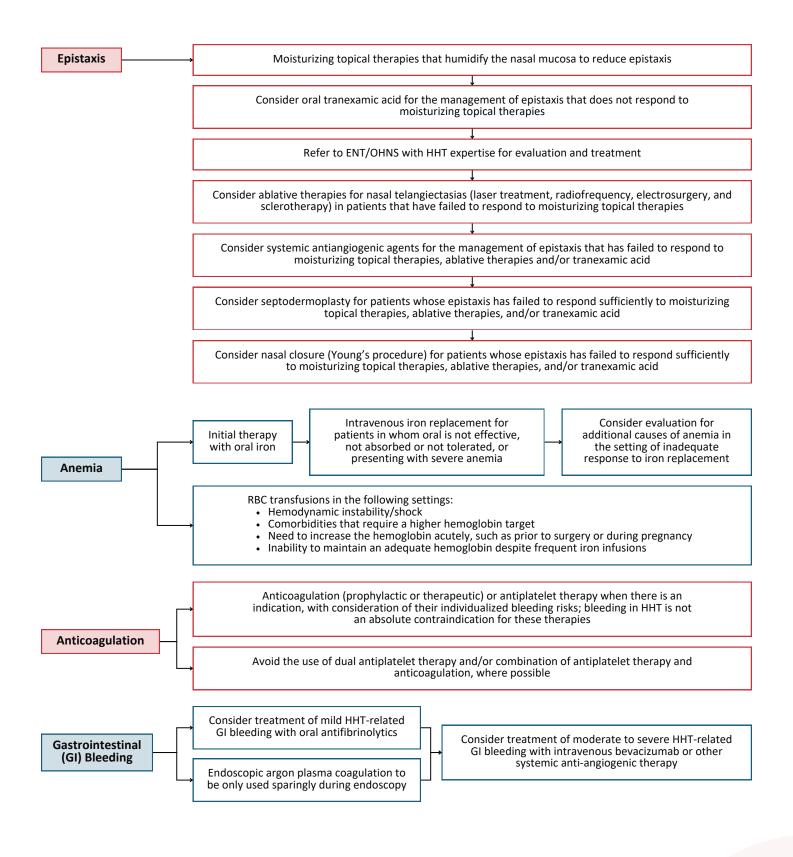


Figure 3. Management algorithm for epistaxis, anemia, anticoagulation, and gastrointestinal (GI) bleeding in HHT patients.



Refer all adults presenting with an acute hemorrhage secondary to a brain VM to a center with neurovascular expertise to be considered for definitive treatment Refer all other adults with brain VMs to a center with neurovascular expertise to be **Brain VMs** considered for cerebral angiography and individualized management Pregnant woman with an asymptomatic brain VM during pregnancy should have definitive treatment of their brain VM deferred until after delivery of their fetus. Delivery of the fetus should follow obstetrical principles Provide the following long-term advice to patients with documented PAVMs (treated or untreated): Antibiotic prophylaxis for procedures with risk of bacteremia When intravenous access is in place, take extra care to avoid intravenous air **Pulmonary AVMs** Avoidance of SCUBA diving Treat pulmonary AVMs with a feeding artery diameter of ≥ 2 - 3 mm with transcatheter embolization CT with thin-section reconstruction (1-2 mm) should be undertaken within 6-12 months after embolization and then approximately every 3 years after embolization Provide long-term follow-up for patients who have PAVMs, in order to detect growth of untreated PAVMs and also reperfusion of treated AVMs **Liver VMs** Avoid liver biopsy in any patient with confirmed or suspected HHT HHT patients with high-output cardiac failure and pulmonary hypertension should be co-managed by the HHT COE AND an HHT cardiologist OR a pulmonary hypertension specialty clinic Estimate prognosis of liver VMs using available predictors to identify patients in need of closer monitoring Avoid hepatic artery embolization in patients with liver VMs as it is only a temporizing procedure associated with significant morbidity and mortality Consider intravenous Referral for consideration of liver Intensive first-line bevacizumab for patients with transplantation for patients with management only for symptomatic high-output symptomatic complications of patients with complicated cardiac failure due to liver VMs liver VMs, specifically refractory and/or symptomatic liver who have failed to respond high-output cardiac failure, biliary VMs, tailored to the type sufficiently to first-line ischemia or complicated portal of liver VM complication(s) management hypertension



Figure 4. Management algorithm for brain VMs, pulmonary VMs, and liver VMs in HHT patients.

Diagnostic genetic testing should be offered for asymptomatic children of a parent with HHT Screen for pulmonary AVMs in asymptomatic children with HHT or at risk for HHT at the time of presentation/diagnosis is recomme. Screening may be performed with either chest X-ray and pulse oximetry OR transthoracic contrast echocardiography (TTCE). Screening with CT is not recommended, though CT chest remains the confirmatory diagnostic test when screening tests are positive Treat large pulmonary AVMs and pulmonary AVMs associated with reduced oxygen saturation in children to avoid serious complications Repeat pulmonary AVM screening in asymptomatic children with HHT or at risk of HHT, typically at 5 year intervals Screen for brain VMs in asymptomatic with HHT, or at risk for HHT, at the time of presentation/diagnosis. Some pediatric centers also repeat brain VM screening in asymptomatic children every 5 years Treat brain VMs with high-risk features



Figure 5. Algorithm for the evaluation and management of pediatric HHT patients.

Pregnancy and Delivery Discuss pre-conception and pre-natal diagnostic options including pre-implantation genetic diagnosis with HHT affected individuals Screen for brain VMs with unenhanced MRI in pregnant women with symptoms suggestive of brain VMs Pregnant women with known, non-high risk brain VMs can labor and proceed with vaginal delivery. Patients may require assisted second stage on a case by case basis Screen for pulmonary AVMs in pregnant women with HHT who have not been recently screened and/or treated for pulmonary AVM should be approached as follows: · In asymptomatic patients, initial pulmonary AVM screening should be performed using either agitated saline transthoracic contrast echocardiography (TTCE) or low-dose non-contrast chest CT, depending on local expertise. Chest CT, when performed, should be done early in the second trimester In patients with symptoms suggestive of pulmonary AVM, diagnostic testing should be performed using low-dose non-contrast chest CT. This testing can be performed at any gestational age, as clinically indicated Pulmonary AVMs should be treated starting in the second trimester unless otherwise clinically indicated Manage at tertiary care center by a multi-disciplinary team, if they have untreated pulmonary AVMs and/or brain VMs OR have not been recently screened for pulmonary AVMs Do not withhold an epidural because of a diagnosis of HHT Screening for spinal vascular malformations is not required



Figure 6. Algorithm for evaluation and management during pregnancy and delivery in HHT patients.

References:

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- 4. Beslow LA, White AJ, Krings T, et al. Current Practice: Rationale for Screening Children with Hereditary Hemorrhagic Telangiectasia for Brain Vascular Malformations. *AJNR Am J Neuroradiol*. 2024;45(9):1177-1184. Published 2024 Sep 9.

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