

Homans' Sign in the Diagnosis of Deep Venous Thrombosis

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Deep venous thrombosis (DVT) is a common condition that can have serious complications. Deep venous thrombi have a high probability of propagating and leading to pulmonary emboli, which may cause chest pain, breathlessness, and sudden death. Thus, an accurate and timely diagnosis of DVT is imperative.

Although DVT is often clinically silent, it may present with a number of signs, including calf pain, edema, and venous distention. Homans' sign¹—pain associated with forced dorsiflexion of the ankle—is often elicited as part of the physical examination of the person with suspected DVT. However, a diagnosis based solely on the evaluation of clinical signs has proven unreliable, and specific diagnostic procedures (eg, venography, ultrasonography) should be performed in the diagnosis of DVT.

Although a number of reports have questioned the clinical utility of Homans' sign, it is still widely used in clinical practice. This may stem from its historical role in clinical examination prior to the availability of the more reliable diagnostic studies, as well as from the ease of performing the Homans' sign test. This article reviews the history, elicitation, and clinical utility of Homans' sign. Diagnostic studies currently used in the definitive diagnosis of DVT are discussed also, as is the role of the clinical examination in stratifying patients prior to undergoing specific diagnostic tests.

HISTORICAL PERSPECTIVE

John Homans (1877–1954) was an American surgeon who studied peripheral vascular disease at Peter Bent Brigham Hospital (Boston, MA) and Harvard University (Cambridge, MA), where he later became Professor of Surgery. He also authored a popular textbook, which went through 4 printings, based on the Harvard surgical education course.² In 1938, Homans wrote a now famous article on thrombophlebitis, which described the causes of thrombosis and the varieties of thrombophlebitis.³ He followed this with another noted

HOMANS' SIGN:

Elicitation: With the knee in the flexed position, forcibly dorsiflex the ankle.

Response: Pain in the calf with this maneuver may be consistent with the diagnosis of deep venous thrombosis.

article in 1944, entitled "Diseases of the Veins," in which he first mentioned the clinical sign that bears his name.⁴ In this latter article, Homans described how a group of colleagues found a sign involving pain in the calf and popliteal region on dorsiflexion of the ankle in 42% of 139 patients with suspected venous thrombosis, which his colleagues named Homans' sign. Homans felt that this sign was caused by posterior calf muscle irritability that occurred in the early stage of venous thrombosis. He also speculated that this sign would be found more frequently than either tenderness or swelling in patients with venous thrombosis. This, however, has never been confirmed.

ELICITATION

When evaluating a patient for Homans' sign, the patient's knee should be in the flexed position. The examiner should forcibly and abruptly dorsiflex the patient's ankle and observe for pain in the calf and popliteal region, which constitutes a positive sign (**Figure 1**).^{5,6} If the dorsiflexion is not forceful, an accurate result may not be obtained, and the test result may be falsely negative.⁶

The mechanism thought to be at work in Homans' sign is that of flexion of the knee with concomitant

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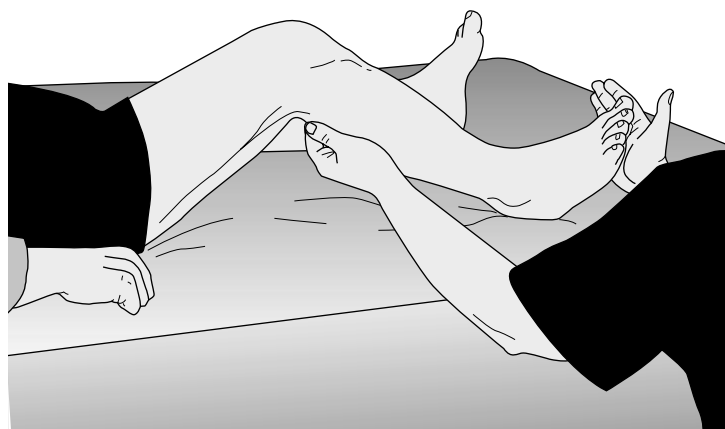


Figure 1. Elicitation of Homans' sign.

forced dorsiflexion of the ankle exerting traction on the posterior tibial vein, causing pain.^{5,6} While classically described in patients with venous thrombosis of calf veins, patients with herniated intervertebral discs and many other conditions have also been noted to exhibit a positive Homans' sign. Theoretically, any condition that causes signs and symptoms of venous thrombosis may cause a positive Homans' sign, including calf muscle spasm, neurogenic leg pain, ruptured Baker's cyst, and cellulitis.⁷ In addition, women with short heel cords may exhibit a positive Homans' sign when they go from wearing high heels to flat shoes.

CLINICAL UTILITY

The accuracy and utility of Homans' sign have been well studied.⁷⁻¹³ One early study compared a number of clinical parameters, including Homans' sign, in patients with and without thrombosis of the leg, as documented by phlebography.⁸ In these patients, all of the clinical signs were unreliable, and specifically, Homans' sign was present in only 33% of patients with true thrombosis. However, it was also present in 21% of patients without thrombosis. This led the authors of this study to conclude that "the clinical signs cannot be trusted."

Numerous other studies have documented the unreliability of Homans' sign. Estimates of the accuracy of Homans' sign range from it being positive in 8% to 56% of cases of proven DVT,^{7,9-13} and positive in greater than 50% of symptomatic patients without DVT.⁷ In addition, 1 study showed that Homans' sign was more common in patients with clinically suspected DVT and a negative venogram than in those patients with clinically suspected DVT and a positive venogram.¹³ This has led nearly all authors to declare that Homans' sign is unreliable, insensitive, and nonspecific in the diagnosis of DVT.

DIAGNOSTIC STUDIES FOR DEEP VENOUS THROMBOSIS

Because of the unreliability of a clinical evaluation in the diagnosis of DVT, specific diagnostic procedures have been carefully studied for their usefulness. Venography is a highly accurate test for the diagnosis of both proximal and calf vein thrombi. However, it is invasive and expensive and may actually cause DVT in 3% of patients.¹⁴ Impedance plethysmography relies on measurement of electrical impedance in the leg, with decreased impedance suggesting venous occlusion and therefore venous thrombosis.¹⁵ This technique is helpful in the diagnosis of occluding proximal vein thrombi but is less useful for nonobstructing thrombi and not useful for calf vein thrombosis. Compression ultrasonography assesses compressibility of the leg veins, with noncompressibility being diagnostic of DVT and compressibility excluding it. As with impedance plethysmography, calf vein thrombi are not reliably detected with this method, but ultrasonography may be more accurate than impedance plethysmography when the two are compared.

A study assessed the cost-effectiveness of clinical diagnosis, venography, and noninvasive testing in patients with symptomatic DVT.¹⁶ In this study, a total of 478 patients were diagnosed on clinical grounds with DVT, but only 58% actually had DVT. As a result, the cost of the diagnosis and treatment of each patient whose diagnosis of DVT was based on clinical grounds alone was more than \$6,000. In contrast, the use of any other method to diagnose DVT (ie, venography, impedance plethysmography, or ultrasonography) cut the cost by approximately one half. This was largely due to the fact that these methods were more likely to exclude false-positive diagnoses of DVT, which could not be accomplished with clinical evaluation alone.

In light of the relative inaccuracy of clinical diagnosis and the expense of currently available diagnostic tests,

Wells et al¹⁷ developed a clinical evaluation model for predicting the pretest probability of DVT. The purpose of this model was to determine the potential for improving and simplifying the diagnostic process for DVT. Specifically, in predicting the pretest probability of DVT based on clinical grounds with this method and then combining this with the results of noninvasive testing, the diagnostic accuracy could be improved, and unnecessary testing could be avoided. This would aid in saving money and expediting the diagnosis and treatment. For example, patients with both a low pretest probability for DVT and a negative result from an ultrasonographic evaluation are very unlikely to have DVT, and therefore, another diagnosis can be entertained. Alternatively, patients in whom the pretest probability and noninvasive study results are discordant would need to undergo venography to determine if DVT is present. Therefore, by using this model, patients can be stratified into high- and low-risk pretest probability groups, which can assist in determining the likelihood of DVT being present. Clinical criteria used by the authors of this study included malignancy, immobilization of the lower extremities, bedridden status, leg swelling, and a family history of DVT. Interestingly, Homans' sign was not among the criteria used.

SUMMARY

The accurate diagnosis of DVT is an important topic in current clinical practice. A clinical evaluation alone is considered unreliable for the diagnosis of DVT, but it can be useful in conjunction with more accurate and specific diagnostic procedures, such as ultrasonography and venography. Homans' sign is generally unreliable as a clinical sign of DVT, but it remains a part of the traditional physical examination of patients with suspected DVT, perhaps because of its ease of performing and its historical role in the evaluation of patients with suspected DVT.

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