

Peripheral Signs of Endocarditis

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Infective endocarditis is a condition characterized by microbial infection of the endothelial surface of the heart, most commonly involving the valves of the heart.¹ Infective endocarditis can be caused by a number of microorganisms and may present with such symptoms as fever, chills, anorexia, and dyspnea. The diagnosis of endocarditis can be difficult but may be made by satisfying certain well-described criteria, including the presence of positive blood cultures for typical causative microorganisms and evidence of endocardial involvement seen on echocardiography.² The physical signs of endocarditis are numerous and include heart murmurs, which are encountered frequently, and the peripheral signs of endocarditis (**Sidebar**), which are much less common. When uncertainty exists, the peripheral signs may be useful to support the diagnosis of endocarditis.

ROTH'S SPOTS

Roth's spots (**Figure 1**) are named for Swiss pathologist Moritz Roth (1839–1914), who, in 1872, described white-centered hemorrhages on the fundoscopic examinations of patients with sepsis.³ In 1878, the spots were found to consist of "round or elongated white foci occurring close to the nerve head . . . single or multiple and occasionally surrounded by a hemorrhagic ring."⁴ In 1931, these hemorrhages were associated with bacterial endocarditis and described as "pathognomonic canoe-shaped linear hemorrhagic spot(s) with a light central area."³

Pathogenesis

The pathogenesis of Roth's spots is unclear but is thought to involve several potential mechanisms. In his original studies, Roth believed that the spots represented embolic bacterial infiltrates producing localized retinal abscesses.^{4,5} The emboli were presumed to have originated from the endocardium. The currently accepted explanation involves anoxia that causes a sudden increase in venous pressure, which results in capillary rupture in the inner retinal layers.⁵ This rupture results in extravasation of blood and formation of a fibrin-platelet plug.⁴

PERIPHERAL SIGNS OF ENDOCARDITIS

Roth's spots: Oval-shaped, white-centered hemorrhages present on the retina of some patients with infective endocarditis.

Osler's nodes: Painful, erythematous nodules most commonly found on the pads of the fingers and toes of some patients with infective endocarditis.

Janeway lesions: Nontender, erythematous and nodular lesions most commonly found on the palms and soles of some patients with infective endocarditis.

Splinter hemorrhages: Small, linear hemorrhages under the nails that are usually asymptomatic and found in some patients with infective endocarditis.

Diagnosis and Differential Diagnosis

Although Roth's spots have been classically associated with endocarditis, they have also been found in many other conditions, including hematologic malignancies, connective tissue diseases, vasculitides, anemia, hypertension, diabetes mellitus, HIV disease, and intracranial hemorrhage.⁵ In the patient who has an otherwise typical presentation of endocarditis, Roth's spots may be helpful in the diagnosis; however, when nonspecific symptoms are present, Roth's spots should alert the physician to other possible systemic diseases.

OSLER'S NODES

Osler's nodes (**Figure 2**) are named for Canadian physician and educator Sir William Osler (1849–1919), who, in 1893, described painful, erythematous nodules on the pads of the fingers and toes in patients with endocarditis.⁶ Several other clinicians predated Osler in the description of these nodules,^{7,8} but he placed the

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Figure 1. Photograph of a Roth's spot on a patient's retina. Adapted with permission from Forbes CD, Jackson WF, eds: *Color Atlas and Text of Clinical Medicine*, 2nd ed. London: Times Mirror International Publishers Limited, 1997:248.

greatest significance upon the nodules and was the first to acknowledge their utility in the diagnosis of endocarditis.⁷

Pathogenesis

Like that of Roth's spots, the pathogenesis of Osler's nodes is unclear. One theory contends that these nodules are the result of septic microemboli originating from an endocardial valvular lesion, and that pathogenic organisms can sometimes be recovered from aspiration of these lesions.^{6,7} Another theory holds that the nodes are caused by an immunologically-mediated vasculitis caused by circulating immune complex deposition in the skin.⁷ A fair amount of evidence supports both explanations, therefore, the actual pathogenesis of Osler's nodes remains a mystery.

Diagnosis and Differential Diagnosis

Osler's nodes are usually associated with subacute bacterial endocarditis and appear late in the disease course. However, the sign may also be found in other conditions, including bacteremia, septic endarteritis, typhoid fever, gonococcemia, and systemic lupus erythematosus.^{6,7} Osler's nodes appear suddenly, are quite painful, and are sometimes heralded by premonitory paresthesias. Although generally located on the fingers and toes, the nodes may be present on the forearms,



Figure 2. Photograph of Osler's nodes on a patient's toes. Adapted with permission from Forbes CD, Jackson WF, eds: *Color Atlas and Text of Clinical Medicine*, 2nd ed. London: Times Mirror International Publishers Limited, 1997:248.

mucous membranes, flank, or trunk. With appropriate antibiotic therapy, Osler's nodes resolve within 1 to 3 days and leave no sequelae.

JANEWAY LESIONS

Janeway lesions (**Figure 3**) are named for noted American physician Edward G. Janeway (1841-1911), who, in 1899, described "numerous small hemorrhages with slight nodular character in the palms of the hand and soles of the feet . . . in malignant endocarditis."⁹ In 1906, Emanuel Libman, a student of Janeway, coined the term "Janeway lesion," and went on to further study these lesions and affirm their association with infective endocarditis.

Pathogenesis

The pathogenesis of Janeway lesions is also unclear. Some authors believe that these lesions are necrotic microabscesses with an inflammatory infiltrate that involves the dermis but not the epidermis.^{9,10} Other authors believe that the lesions are the result of septic microemboli that originate from the endocardium, a fact that has been substantiated by histopathologic studies in the literature.¹⁰⁻¹²

Janeway Lesions Compared with Osler's Nodes

Janeway lesions are usually associated with acute bacterial endocarditis.¹¹ They frequently have an irregular outline, are erythematous and nodular, and sometimes appear hemorrhagic. They have been confused with Osler's nodes; however, two important distinctions exist. First, Janeway lesions usually occur on the palms and soles, not on the pads of the fingers. Second,

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Janeway lesions are not tender, whereas Osler's nodes are often exquisitely tender, which is the most compelling difference between these two signs.

SPLINTER HEMORRHAGES

Splinter hemorrhages were originally described in 1920 in patients with endocarditis as "minute petechiae, in the form of a vivid linear splash of red at the side of the bed of a fingernail."¹³ In 1926, this association was affirmed by Blumer,¹⁴ and in recent years, various other authors have described splinter hemorrhages in other conditions, including trichinosis, mitral stenosis, psoriasis, onychomycosis, vasculitis, meningococemia, and trauma.^{13,15,16} Splinter hemorrhages have also been described in healthy individuals,¹⁶ patients on hemodialysis, and individuals who perform manual labor.¹⁵

Splinter hemorrhages are usually less than 2 to 3 mm long and lie under the distal one third of the nail, traveling outward as the nail grows.¹³ Early in development, the hemorrhages are reddish-brown; but with maturity, they become brown to black, a process that takes 1 to 2 days. Splinter hemorrhages are usually asymptomatic, but they may be painful or tender to palpation. They are caused by engorgement of capillaries under the nail, but the etiology of the hemorrhages is unclear. Potential mechanisms include digital vasospasm, embolic events, and local factors that promote capillary engorgement.

DIAGNOSIS OF ENDOCARDITIS

Because the diagnosis of endocarditis is often difficult, many researchers have sought to standardize the process and simplify the task. In recent years, two sets of criteria for the diagnosis of endocarditis have been described. The guidelines offered by Von Reyn et al¹⁷ rely on strict clinical criteria, including positive blood cultures, murmurs, fever, and peripheral manifestations, and ignore the importance of echocardiographic data and a history of intravenous drug use as a risk factor for endocarditis. The more recent Duke criteria rely on clinical manifestations as well, but these guidelines also factor in echocardiographic data and history of intravenous drug use in the diagnosis of endocarditis.¹⁸ The Duke guidelines also incorporate a system of major and minor criteria that make them more specific and sensitive than the Von Reyn criteria. Interestingly, whereas Janeway lesions, Osler's nodes, and Roth's spots are considered minor elements in the Duke criteria, splinter hemorrhages are not included within the Duke guidelines. Another recent study¹⁹ has suggested modifications to the Duke criteria, including adding splinter hemorrhages to the list of minor elements



Figure 3. Photograph of a Janeway lesion on a patient's finger. Adapted with permission from adam.com. Available at <http://www.adam.com/imagepage/2455.htm?topic>. Accessed April 4, 2000.

because they were found to be more common than the other peripheral phenomena in patients with endocarditis.

Despite the criteria outlined above, the peripheral signs are seen less frequently today in patients with endocarditis.¹ This decrease in frequency has been attributed to several causes, including earlier diagnosis of endocarditis, earlier institution of antibiotic therapy, and possible physician inexperience in recognizing the signs.⁶ A recent study examining 135 cases of endocarditis over 9 years noted that the peripheral manifestations were fairly uncommon, with Osler's nodes present in 6.7% of cases, Janeway lesions present in 2.2% of cases, Roth's spots present in 3% of cases, and splinter hemorrhages present in 39% of cases.² By contrast, murmurs were found in 94% of these cases, and fever was found in 87% of cases.

SUMMARY

The peripheral manifestations of endocarditis are venerable signs that may be useful adjuncts to the diagnosis of endocarditis. With advances in technology and treatment, the signs have become less common, but they nevertheless remain a subject for intense scrutiny. **HP**

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