Arteriospastic Disorders of the Extremities

By Ray W. Gifford, Jr., M.D.

THERE is a relatively uncommon group of conditions that cause intermittent or permanent ischemia of the extremities due to spasm of tiny arteries and arterioles without structural occlusion of their lumens. These "arteriospastic disorders" include Raynaud's phenomenon, livedo reticularis, and acrocyanosis (table 1).

Much confusion exists regarding the diagnosis of these conditions, not only because of inconsistent terminology in the literature, but also because the first two conditions may occur as primary disease entities or they may be symptoms of other and often more serious diseases (table 2). Further confusion arises because, although arteriospastic disorders produce ischemia in the absence of organic occlusive disease, they can occur as symptoms of associated chronic or acute occlusive arterial disease, and prolonged arterial spasm can, in some cases, lead to organic occlusive changes.

Unlike the organic occlusive arterial diseases usually affecting major arterial trunks, the arteriospastic disorders involve tiny arteries and arterioles supplying the skin of the hands and feet, and, in the case of livedo reticularis, the extremities and trunk as well. The clinical manifestations, then, are primarily changes in color and temperature of the skin. Occasionally, ulcerations occur when ischemic skin breaks down. Since ischemia is confined to the skin, intermittent claudication and extensive gangrene requiring major amputation do not occur as a result of these arteriospastic disorders unless there is associated organic occlusive disease of larger arteries (table 3).

Patients with arteriospastic disorders are frequently young women who are nervous, easily fatigued, emotionally labile, and often unmarried. In addition to the typical color changes of the skin, their extremities may be chronically cold and often tend to perspire excessively. Sometimes more than one of the arteriospastic disorders occur in the same individual.

Raynaud's Phenomenon

Raynaud's phenomenon is characterized by intermittent, discrete, short episodes of pallor or cyanosis or both of one or more fingers or toes (table 1; fig. 1). Only rarely are the adjacent hand or foot or the ears, nose, and lips affected. Typically an initial phase of pallor is followed by cyanosis, but either may occur alone. The third phase of rubor due to reactive hyperemia frequently but not invariably supervenes before normal color returns to the affected parts. The paroxysms are usually precipitated by exposure of the extremities to cold or simply by chilling of the body. Sometimes emotional reactions trigger the arteriospastic episodes, and sometimes they occur spontaneously. Pain is infrequent and if present is mild.

Etiology. The cause of the intermittent arteriospasm characteristic of Raynaud's phenomenon is unknown. Whether it is due to overactivity in the sympathetic nervous system or hypersensitivity of the arteries and arterioles to normal sympathetic stimulation is still being debated.

Diagnosis. It is usually easy to establish the fact that patients have Raynaud's phenomenon from the history alone. If necessary, attacks can be precipitated by immersing the extremities in cold water, or by applying ice cubes to them, or by placing the patient in a cool environment without adequate wraps. In order to make the diagnosis of Raynaud's phenomenon there must be a history of color changes of the skin of the digits (pallor or cyanosis). History of coldness, paresthesias, pain, or ulceration is not an adequate basis for this diagnosis if the characteristic color changes do not occur.

From the Division of Medicine, The Cleveland Clinic Foundation, Cleveland, Ohio.
More difficult than making the diagnosis of Raynaud’s phenomenon in the first place, is the differential diagnosis between primary (Raynaud’s disease) and secondary forms of Raynaud’s phenomenon; yet this decision has an important bearing on treatment and prognosis. Raynaud’s phenomenon may be the first symptom of a variety of diseases (table 2) and it may precede other manifestations by months or years. Therefore it is imperative that appropriate examinations be conducted to rule out possible underlying disease and that a reasonable length of time elapse (usually 2 years) to allow such diseases to manifest themselves before one can safely make the diagnosis of Raynaud’s disease.

Allen and Brown proposed five criteria for establishing the diagnosis of Raynaud’s disease: (1) Raynaud’s phenomenon excited by cold or emotion; (2) bilaterality of Raynaud’s phenomenon; (3) ischemic lesions, when present, limited to small areas of cutaneous gangrene; (4) exclusion of diseases that might be causal (table 2); and (5) symptoms for at least 2 years in the absence of any disease that might be causal.

An extensive follow-up study of women with Raynaud’s disease confirmed the validity of these criteria, for in 95 per cent of cases the diagnosis was correct when established by these five points.

Clues that Raynaud’s phenomenon may be secondary to underlying disease include onset after age 50 years, especially in men; unilateral Raynaud’s phenomenon, especially when confined to one or two digits; rapid progression to ulceration shortly after onset of symptoms; extensive ulceration or gangrene; absence of one or more arterial pulses; presence of fever, systemic symptoms, anemia, and elevation of the sedimentation rate of erythrocytes.

**Physical Examination.** In the search for diseases or conditions that might be responsible for Raynaud’s phenomenon complete physical examination is essential. Between episodes of arteriospasm the extremities of patients with uncomplicated Raynaud’s disease usually appear normal, although coolness and excessive perspiration may occur at times. If Raynaud’s phenomenon is primary, arterial pulsations are invariably palpable at the wrist and in the feet, although an unusually warm environment is occasionally necessary to overcome spasm and make them evident.

**Treatment.** When Raynaud’s phenomenon is primary (Raynaud’s disease), reassurance of the patient and protection of the extremities from thermal, chemical, and mechanical trauma are frequently the only measures needed. If the arteriospastic episodes occur

### Table 1

**Differential Diagnosis of Arteriospastic Disorders**

<table>
<thead>
<tr>
<th>Clinical features</th>
<th>Raynaud’s phenomenon</th>
<th>Livedo reticularis</th>
<th>Acrocyanosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sites involved</td>
<td>Fingers, toes (rarely ears, nose, hands and feet)</td>
<td>Extremities (sometimes trunk)</td>
<td>Hands and feet</td>
</tr>
<tr>
<td>Characteristics of color change</td>
<td>Pallor or cyanosis or both</td>
<td>Reticulated or mottled cyanosis</td>
<td>Diffuse cyanosis</td>
</tr>
<tr>
<td>Duration of color change</td>
<td>Intermittent (usually 10 minutes or less)</td>
<td>Persistent</td>
<td>Persistent</td>
</tr>
<tr>
<td>Pain</td>
<td>Rare and only with paroxysm of color change</td>
<td>Occasional</td>
<td>Never</td>
</tr>
</tbody>
</table>

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Table 2
Classification of Arteriospastic Disorders

I. Raynaud’s phenomenon
A. Primary (Raynaud’s disease)
B. Secondary (these conditions must be ruled out before a diagnosis of primary Raynaud’s phenomenon can be made)
  1. Chronic occlusive arterial disease
     a. Arteriosclerosis obliterans
e. Thromboangiitis obliterans
  2. Collagen disease
     a. Rheumatoid arthritis
     b. Systemic sclerosis (progressive systemic sclerosis)
     c. Disseminated lupus erythematosus
     d. Periarteritis nodosa
     e. Dermatomyositis
  3. Occupational trauma to hands of
     a. Pianists, typists
     b. Pneumatic hammer operators
     c. Butchers, mechanics, dairy workers, obstetricians, farmers
  4. Intoxication
     a. Lead, arsenic, ergot
  5. Abnormalities of blood
     a. Cryoglobulins
     b. Cold agglutinins
  6. Neurologic disorders
     a. Thoracic outlet syndromes
     b. Diseases of the central nervous system
  7. Late result of cold injury
     a. Trench foot
     b. Immersion foot
     c. Frostbite

II. Livedo reticularis
A. Primary
  1. Intermittent (eritis marmormata)
  2. Persistent (livedo reticularis idiopathica)
B. Secondary (livedo reticularis symptomatica)
  1. Collagen disease
     a. Periarteritis nodosa
     b. Disseminated lupus erythematosus
  2. Cryoglobulinemia
  3. Paralysis or prolonged dependency and immobility, or both, of one or more extremity for months or years
  4. Exogenous hypercortisonism
  5. Prolonged local application of heat (“heat livedo”)
  6. Late result of cold injury (see 7 above)

III. Acrocyanosis
A. Primary

with troublesome frequency, vasodilating drugs such as phenoxybenzamine hydrochloride (Dibenzyline) in doses of 10 mg. three or four times daily or cyclospasmol (Cyclospasmol) in doses of 100 or 200 mg. three or four times daily may be tried, but these drugs are not routinely necessary. An emollient such as lanolin should be applied to the hands (and feet, if they are involved) at least twice daily to keep the skin soft. If ischemic ulcerations occur, the affected part should be soaked in a lukewarm saturated solution of boric acid for \(\frac{1}{2}\) hour three or four times daily. If pathogenic organisms are isolated, appropriate antibiotics should be given systemically. Local application of a 1 per cent solution or ointment of neomycin sulfate may be helpful in eradicating organisms resistant to the usual antibiotics. Extreme caution to prevent even minor trauma is indicated when ischemic ulcerations occur, and this usually means cessation of all types of work. Sympathectomy should be reserved for those patients with Raynaud’s disease whose symptoms cannot be controlled by medical measures. By this criterion, less than 20 per cent of patients will require surgical treatment, and less than 60 per cent of these can be expected to get significant relief from symptoms in the upper extremities. Results of sympathectomy are much better in the lower extremities, but lumbar sympathectomy is not necessary as frequently as cervicothoracic sympathectomy.

The conservative symptomatic measures described above may be helpful for patients with secondary Raynaud’s phenomenon, but treatment of the underlying disease is usually of equal if not greater importance. With the exception of some patients whose Raynaud’s

Figure 1
Raynaud’s phenomenon, pallor phase.

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phenomenon is secondary to occlusive arterial disease, sympathectomy should not be advised when Raynaud's phenomenon is secondary to underlying disease, for results have been extremely poor.4

Prognosis. When Raynaud's phenomenon is primary (Raynaud's disease), complications such as ischemic ulceration of digits and scleroderma confined to the fingers without other cutaneous or visceral involvement (sclerodactylia) occur in about 30 per cent of patients, but only infrequently do they lead to more than temporary disability. Major amputations are never necessary and even amputations of phalanges are required in less than 1 per cent of cases.3 No deaths have been attributed to primary Raynaud's disease.

When Raynaud's phenomenon is secondary, however, the situation may be quite different, depending upon the underlying causative disease or condition. Complications may be more severe, major amputations may be necessary, and death may result.

Livedo Reticularis

Livedo reticularis is characterized by cyanotic mottling of the skin in a "fish net" pattern (table 1; fig. 2). Except for the innocuous "cutis marmorata," the discoloration is persistent, though it is more marked when the patient is exposed to cool temperatures. It may involve all or parts of the extremities and is not infrequently seen on the trunk, especially over the buttocks and lower abdomen.

Etiology. The cause of the arteriospasm is unknown. Presumably, only some of the tiny arteries that penetrate the subcutaneous tissue and branch out in the skin are affected, thus explaining the reticulated, spotty pattern of cyanosis.

Table 3

| Differential Diagnosis of Organic Occlusive Arterial Disease and Arteriospastic Disorders |
| ------------------------------------------------- | --------------------------------- | --------------------------------- |
| Clinical features | Arteriospastic disorders | Organic occlusive arterial disease |
| Arteries involved | Cutaneous arteries and arterioles | Large, medium, and small arteries |
| Intermittent claudication | Never* | Frequent |
| Cutaneous color changes | Always | Sometimes |
| Ischemic ulcerations of skin | Sometimes | Sometimes |
| Major gangrene and amputation | Never* | Sometimes |
| Coolness of skin | Frequent | Frequent |
| Absence or diminution of pulsations in palpable arteries | Never* | Usual |

*In absence of underlying organic occlusive arterial disease.

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Diagnosis. The diagnosis can be made easily by simply inspecting the skin. As with Raynaud’s phenomenon, however, the greatest difficulty is distinguishing primary or idiopathic livedo reticularis from that secondary to other diseases (table 2). Sometimes livedo reticularis is the first symptom of a collagen disease or cryoglobulinemia and many weeks or months may lapse before the true diagnosis becomes evident. When livedo reticularis appears abruptly; is severe from the onset; is complicated early by ulceration; and is accompanied by anemia, fever, joint symptoms, and accelerated sedimentation rate of erythrocytes, it is likely due to some underlying disease.

Physical Examination. Inspection of the skin is the clue to the diagnosis of livedo reticularis. Early in the course of the disease all arterial pulsations are palpable, although a warm environment may be necessary to overcome spasm and make them evident. Adequate physical examination is imperative to search for systemic disease that may be responsible for the livedo reticularis.

Treatment. No treatment other than to reassure the patient is necessary for the evanescent mottling (‘‘cutis marmorata’’) that appears on the skin of the legs and arms of many women when they become chilled. This is also true for most patients with primary livedo reticularis that persists regardless of environmental temperature, for serious complications are uncommon. If the patient objects to the unsightly appearance of the skin, as many women do, vasodilating drugs such as those mentioned in the previous section may be helpful cosmetically. Only occasionally is primary livedo reticularis complicated by ischemic and usually painful ulcers of the fingers or toes or around the malleolar areas. The treatment for these ulcers is similar to that described previously for ulcers secondary to Raynaud’s phenomenon. If a hard crust of exudate and necrotic material covers the ulcer, enzymatic debridement with an ointment containing fibrinolysin and deoxyribonuclease (Elase) or a solution of streptokinase and streptodornase (Varidase) may speed healing. Sympathectomy is rarely necessary for primary livedo reticularis and is of no help in the secondary form; treatment of the underlying disease is important when livedo reticularis is secondary.

Prognosis. When livedo reticularis is primary, the outlook is excellent. Complications in the form of ischemic ulcerations are uncommon, minor amputations are seldom necessary, major amputations are never necessary, and there is no mortality. The prognosis in secondary livedo reticularis depends on the underlying disease.

Acrocyanosis

The rarest and most innocuous of the arteriospastic disorders is acrocyanosis. It is characterized by persistent, diffuse cyanosis of the fingers and hands and usually also of the toes and feet (table 1). The discoloration does not extend more proximally. It is a chronic condition, and most patients cannot recall the date of onset. Although the cyanosis is less marked in a warm environment, it does not disappear entirely.

Etiology. The etiology of the arteriospasm is unknown.

Diagnosis. The striking cyanotic appearance of the hands and feet should suggest this diagnosis, although it is only natural that the physician should question the presence of cyanotic heart disease. The absence of clubbing, of any evidence of heart disease, and of cyanosis elsewhere as well as normal arterial oxygen saturation should rule out the latter possibility. Since acrocyanosis is always primary, one does not have to be concerned about the possibility of occult disease’s causing it.

Physical Examination. The physical examination is not remarkable except for the obvious cyanosis of the hands and feet. Arterial pulsations are normal.

Treatment. No treatment other than reassurance is necessary. Young women are often embarrassed by the unsightly appearance of their blue hands, and this may be improved by use of vasodilating drugs such as those mentioned previously. Sympathectomy has
been helpful in improving the appearance of affected extremities, but this is rather heroic treatment for nothing more than a cosmetic defect.

Prognosis. The prognosis is excellent. Ischemic complications never occur and longevity is not affected.

References

Additional References
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