

## THROMBO-ANGIITIS OBLITERANS

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Thrombo-angiitis obliterans is an organic disease which involves the arteries and veins. It is inflammatory in nature and usually involves the peripheral vessels. Vasospasm secondary to the organic process is a characteristic feature of the disease.

Von Winnwater originally described this condition in 1879 and termed it endarteritis obliterans. In 1908 Leo Buerger<sup>1</sup> gave a more accurate description of the disease and called it thrombo-angiitis obliterans. Dr. Buerger's work initiated further study by numerous investigators, but up to the present time the etiology has not been determined. Many believe that Buerger's disease is a specific inflammatory process which is the result of some bacterial or virus invasion. Conclusive proof of this contention has not been demonstrated. The difficulties involved in making experimental studies on patients with this disease are obvious.

Thrombo-angiitis obliterans is one of the most destructive of all peripheral vascular diseases. Because it occurs in young individuals and may result in a physical handicap, an early diagnosis is of extreme importance. If the diagnosis is made early and proper treatment instituted, the course of the disease may be checked. If the patient is seen too late or if the diagnosis is delayed, surgical removal of the limb may be the only form of treatment available.

*Diagnosis:* Thrombo-angiitis obliterans should not be difficult to diagnose if several distinguishing and characteristic features are remembered. The disease occurs almost exclusively in young men, and the ratio of men and women is thought to be at least 75 to 1. The age incidence varies, but the great majority of cases occurs between the ages of 25 and 45. In a patient over 50 years of age the diagnosis should be made with great caution. Although 50 per cent of patients observed are Jews, any race may be subject to the condition.

The vessels chiefly and initially involved are those of the lower extremity, and the symptoms and signs at first are unilateral. The disease usually progresses from one extremity to the other, and in a large percentage of cases the arms may become involved. Typical lesions of the cerebral, coronary, and mesenteric arteries have been reported.

The clinical course frequently is characteristic. Accurate histories indicate that the disease is definitely intermittent in nature. A patient seen for the first time should always be questioned for a history of

phlebitis. Although this episode of phlebitis may have occurred years before the present symptoms, it may have been the actual onset of the disease.

Periods of arterial or venous involvement are usually followed by a remission of symptoms. During this time collateral circulation may form, and the symptoms of occlusion may be relieved. As the disease progresses, the degree of closure usually becomes more pronounced. Usually the patient is seen within two years after the onset of the disease, which may run an intermittent course of five to 15 years. Occasionally in acute cases some changes develop within a few months.

If it is remembered that thrombo-angiitis obliterans is a progressive intermittent disease producing various grades of ischemia, the resulting symptoms and signs can be easily explained. The earliest symptom is usually a sense of cold in one or more extremities which may be present for several years. Frequently the patient observes that the feet have changed color and have a ruborous appearance especially in dependent positions. Mild cyanosis is also present at times. The presenting symptom, however, is pain, which at first may be described as fatigue and in early stages may be mild and observed only after strenuous effort. This pain, or fatigue, usually occurs after the patient has walked a certain distance and is relieved by rest. This intermittent claudication generally involves the calf area, but may involve the foot and entire leg. Examination at this time reveals color and temperature changes. One foot may be definitely colder to the touch than the other. Also, the peripheral pulses may be absent or diminished on palpation. These changes may be slight, and special temperature and oscillometric studies may be necessary to determine the presence of occlusion.

As the degree of occlusion progresses, the ischemia becomes more marked; the pain becomes constant and often is worse at night. The color and temperature changes are more marked, and trophic changes such as ulceration may involve the terminal portion of one or more toes. Arterial thromboses occur and cause very severe pain. The patient is unable to sleep, becomes nervous, and smokes heavily, which in turn increases the vasospasm and produces more severe ischemia. If the disease progresses, true gangrene results with necrosis and spread of infection. Severe toxemia may make amputation necessary.

#### DIFFERENTIAL DIAGNOSIS

The differential diagnosis of thrombo-angiitis obliterans should not be difficult if the aforementioned clinical features are kept in mind. The two common conditions with which it might be confused are arteriosclerosis obliterans and Raynaud's disease. The chief points of differentiation are summarized in Table I.

*Treatment:* If the presence of thrombo-angiitis obliterans is suspected, the patient usually should be hospitalized in order to permit a complete study of the case. Proper treatment also can be started without delay, and the patient can be informed of the true nature of his disease. Horton<sup>2</sup> has stated: "It is just as important to educate the patient who has thrombo-angiitis obliterans regarding the nature of his disease as to instruct a patient who has diabetes regarding his diet." In addition, complete bed rest is a very important part of treatment, particularly if the disease has progressed beyond the stage of simple intermittent claudication, and is fundamental if there are any trophic changes.

Whether or not the patient goes into the hospital, a careful and thorough physical examination with complete blood studies should be made. The presence of syphilis, diabetes mellitus, and polycythemia vera must be excluded. Also, special tests such as temperature readings and oscillometric readings may be made, and the degree of organic and spastic involvement determined.

After the diagnosis has been established, the patient first should be instructed in the general care of the extremities. (Table II)

TABLE I

**Differential Diagnosis**

	<i>Thrombo-Angiitis Obliterans</i>	<i>Arteriosclerosis Obliterans</i>	<i>Raynaud's Disease</i>
Sex	Men—99%	Men—90%	Women—95%
Age	25–45	50 and over	15–35
Race	Any—50% Hebrew	Any	Any
Tobacco	Large amounts	Moderate	Not frequent
Type of pain	Severe and sharp	Dull—aching	Frequently absent
Location	Unilateral— any extremity	Bilateral—usually lower extremity	Bilateral—upper extremity
Color changes	Rubor and pallor	Same	Cyanosis and pallor
Type of ulcer	Inflamed—moist	Dry	None
Gangrene	Common	Common	Rare
Pulses	Absent	Absent	Normal
Phlebitis	Common	Absent	Absent

TABLE II

**General Directions for Home Care of the Feet**

The following instructions are outlined for patients with circulatory disturbances of the extremities. The instructions should be followed carefully, as they constitute an important part of the treatment.

1. Do not use tobacco in any form.
2. Drink at least four quarts of water daily unless specified not to by doctor.
3. Eat a normal, well-balanced diet unless ordered to follow a special diet.
4. The following routine should be carried out every night:

Wash feet every night, using warm (not hot) water and neutral (face) soap. Dry feet with a soft towel. Dry carefully between toes. Do not rub feet.

Apply 70 per cent rubbing alcohol and a liberal amount of lanolin or 5 per cent boric acid ointment. Never apply strong antiseptics such as iodine or lysol to feet. If ulceration is present changes in this routine will be made by the physician.

Cut toe nails after feet have been cleansed and always cut straight across and not too short.

Do not cut corns or callouses at any time.

5. Keep feet warm at all times. Wear proper shoes as directed. Wear protective stockings and warm under-clothing. Wear loose-fitting bed socks at night. Never apply a hot water bottle or electric pad to feet or legs. Avoid exposure to cold weather.
6. Do not wear circular garters or sit with legs crossed.
7. Carry out the leg exercises as directed.
8. Special instructions:—

DO NOT ATTEMPT TO TREAT BLISTERS, INGROWING TOE NAILS OR INFECTIONS OF THE TOES AT HOME. IF ANY OF THESE CONDITIONS DEVELOP, NOTIFY YOUR PHYSICIAN AS THIS MAY BE THE FIRST SIGN OF SERIOUS ULCERATION AND GANGRENE.

Although the treatment cannot be standardized for every patient, the principles outlined apply to the average case, and changes may be made whenever necessary. All patients are advised to discontinue the use of tobacco in any form. Although smoking may not be the cause of this disease, it certainly plays an important part in the patient's recovery. Frequently, patients show spontaneous improvement when smoking is discontinued. In my own experience, a case of thrombo-angiitis obliterans has never improved until the patient has discontinued smoking.

As has been previously mentioned a period of bed rest for all patients with extensive involvement should be prescribed. During this time heat should be applied with extreme care. I use a thermostatically-controlled cradle which is placed over the lower extremities and maintained at a temperature of about 96 degrees F. This eliminates the possibility of burns such as may occur from the use of a heating pad or a hot water bottle. It is my impression that diathermy should not be used in any case of thrombo-angiitis obliterans.

Buerger-Allen exercises are prescribed routinely and should be done at least twice daily for an hour at a time. In the average case they consist of elevating the feet at an angle of 60 degrees for three minutes, allowing the feet to hang over the side of the bed for three minutes,

during which foot exercises are done, and finally resting for three minutes at bed level. This procedure may be repeated six times during the hour. The periods of elevation and dependency frequently have to be changed in accordance with the degree of vascular occlusion. Otherwise, pain may be experienced, especially in the elevated position.

In my experience, the intravenous administration of typhoid vaccine is the most satisfactory form of medical management. I prefer to use relatively small doses of typhoid vaccine and make a definite attempt to avoid high elevations of temperature. The usual initial dose of 5 million bacteria is given intravenously, and the temperature reaction is observed. An attempt is made to elevate the temperature about 2 degrees F. After the temperature has been normal for about 24 hours, a second injection is given. The dosage may be increased in order to maintain a 2 degree rise in temperature and on an average ranges between 5 million and 20 million bacteria. During a two-week period of hospitalization approximately eight injections may be given, and after a period of rest of from three to four weeks the course may be repeated. Following the injections a definite vasodilatation occurs for a period of from six to eight hours. If the fever rises too high, thrombophlebitis may occur. Typhoid therapy does not benefit all patients suffering from thrombo-angiitis obliterans. Patients having rest pain and early trophic changes usually show the best response. In the presence of definite, regular, intermittent claudication less benefit may be expected. When ulceration and gangrene are advanced, typhoid therapy is of very little value, but may be used as a general measure to help arrest the progress of the condition.

Numerous other medical measures have been advised for the treatment of thrombo-angiitis obliterans. The use of hypertonic sodium chloride solution administered intravenously has been advised by many. I continue to use this type of medication, but do not think its results are as satisfactory as those from the typhoid routine. In some cases it is used to supplement the typhoid vaccine regimen. The administration of tissue extracts and acetyl- $\beta$ -methylcholine (mecholy) by iontophoresis also has been recommended. My experience with these methods has been generally unsatisfactory. The sulfonamide drugs seem to produce some benefit, particularly if there is evidence of extensive infection. I recommend their use routinely, particularly in the presence of ulceration and gangrene when the process is extending rapidly.

During the past few years the use of heparin has been tried. This is, of course, given intravenously with the thought of preventing extensive thrombosis. More recently an oral preparation known as [3,3'-methylene-bis-(4-hydroxy coumarin)] has been tried. This product

has an effect similar to that of heparin on the prothrombin time and coagulation time. It is too early to evaluate the results of this type of therapy.

Except for the controlled use of heat and the Buerger-Allen exercises, physical therapy measures have not been found to be of particular benefit. The positive and negative pressure apparatus, which is of value in cases of arteriosclerosis obliterans, does not seem to be helpful in cases of thrombo-angiitis obliterans. My experience with the intermittent venous occlusion apparatus has been limited and to date does not indicate that it is any more beneficial than the positive and negative pressure apparatus.

Sympathetic ganglionectomy may be valuable in properly selected cases. The operation does not cure the disease, nor does it alter the course of the disease in the blood vessels, but to a certain extent it does relieve any secondary vasospasms and may allow a maximum blood flow. Before the operation is performed, temperature studies should be made to determine definitely the degree of vasospasm. In the presence of a vasospastic element the procedure should be considered seriously.

It is always difficult to determine whether or not a surgical amputation should be performed. The natural tendency is to delay and to try every possible conservative measure before resorting to amputation. If the area of ulceration is not extensive and if there is a definite line of demarcation, it is my belief that amputation should be postponed and an attempt made to restore the circulation. If the disease is progressing rapidly and there are definite signs of toxemia, surgical amputation at a safe level should not be delayed.

#### SUMMARY

Thrombo-angiitis obliterans is an organic disease of the arteries and veins which causes extensive damage unless its progress is checked in the early stages. The disease usually affects men between the ages of 25 and 45. It is not confined to any racial group, although Jews are more susceptible. An early diagnosis is exceedingly important and is one of the factors most essential for successful treatment. The patient should be thoroughly familiar with the nature of his disease so that he may co-operate in protecting himself from the dangers which may ensue. The use of typhoid vaccine intravenously is suggested as a satisfactory form of medical treatment. However, general measures are equally important and probably benefit the patient more than any specific form of treatment.

#### REFERENCES

1. Buerger, Leo: *The Circulatory Disturbances of the Extremities*. (Philadelphia: W. B. Saunders Co.) 1924.
2. Horton, B. T.: The outlook in thrombo-angiitis obliterans. *J.A.M.A.* 111:2184-2189 (December 10) 1938.