that which characterizes the organization of blood clot in other thromboses.

In short, the lesions in thrombo-angiitis obliterans are in chronological order: (1) an acute inflammatory lesion with occlusive thrombosis, the formation of miliary giant-cell foci; (2) the stage of organization or healing, with the disappearance of the miliary giant-cell foci, the organization and canalization of the clot, the disappearance of the inflammatory products; (3) the development of fibrotic tissue in the adventitia that binds together the artery, vein, and nerves.

A CONSIDERATION OF THE TREATMENT OF PERIPHERAL GANGRENE DUE TO THROMBO-ANGIITIS OBLITERANS, WITH REFERENCE TO FEMORAL VEIN LIGATION AND SODIUM CITRATE INJECTIONS.¹

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The surgical treatment of impending or actual gangrene of the extremities due to pathological changes in the peripheral bloodvessels, termed thrombo-angiitis obliterans by Buerger, embraces a number of procedures which attempt to increase the circulation in the impaired limb. The successful application of a surgical principle to cure a pathological process presupposes the possibility of either totally extirpating the diseased area or structure, or the correction of a departure in normal organic function until such time as may be required for tissue restoration or regeneration to take place.

Buerger's convincing demonstration of the true pathological entity of the disease which bears his name leaves no doubt as to the presence of the extensive bloodvessel changes which have already taken place when these cases are first observed. In most instances the disease has progressed to the point of impending gangrene or actual digital death, and all surgical measures for relieving the great suffering and distress of these patients are really only palliative in nature.

A considerable amount of experimental laboratory work, performed abroad and in this country, for the purpose of establishing the value of arteriovenous anastomosis in the treatment of this disease, has proved rather conclusively that true reversal of the circulation in the affected limb cannot be accomplished, even though Carrell and Guthrie successfully established in their labora-

¹ Read before the College of Physicians of Philadelphia.
tory experiments the possibility of conducting arterial blood to the peripheral capillaries by way of the veins.

Arteriovenous anastomosis, femoral vein ligation, section of the sympathetic fibers about the femoral vessels, multiple ligations of the superficial varicose veins in the affected limb (Lilienthal), high amputation and intravenous saline injections have been proposed and performed by observers all over the world in their efforts to combat the circulatory failure in the affected limbs. In addition to these measures, every conceivable form of local treatment to stay the impending or spreading gangrene has been employed with almost uniform failure in the final results obtained.

Willy Meyer has recently contributed an important article upon the employment of conservative measures in the treatment of peripheral gangrene, and refers to the interesting work of von Oppel, who has performed femoral vein ligation in these cases, with the belief that the peripheral venous stasis thereby induced from the anatomical point of view has the same relative value as arteriovenous anastomosis.

This latter operation, often incorrectly termed reversal of the circulation in the affected limb, was first performed by San Martin and Bistrustigni in 1902, and has been exploited by Coenen, of Breslau, Wieting, of Constantinople, and many others both abroad and in this country. The operation owes its conception to the successful end-to-end suture of bloodvessels practised by Carrell and Guthrie. As originally performed it consisted in an end-to-end anastomosis in Scarpa's triangle between the femoral artery and vein, attended by section of each structure and ligation of the proximal end of the vein and of the distal end of the artery. Later, lateral arteriovenous anastomosis of these vessels in the thigh was suggested by Herrbheim and Stone, of Baltimore, with ligation of the femoral vein proximal to the site of the anastomosis as a necessary and important feature of the operation. As a rule the anastomosis in the thigh was made below the profunda femoris vessels.

The final results obtained and a study of the philosophy of this surgical procedure lead to the conclusion that the operation is founded upon a faulty anatomical and physiological basis. Guthrie has stated that he did not believe that arteriovenous anastomosis successfully applied to animals in the laboratory should be employed in the human being suffering from advanced vascular disease of the type under discussion. Steffen, of New York, in stating his views regarding the futility of arteriovenous anastomosis in the treatment of impending gangrene of the lower extremity, supplemented his condemnation of this operation by reporting convincing proof based upon injection experiments and dissections of the bloodvessels in amputated limbs. His studies have been confirmed by Horsley, of Richmond, whose conclusions are in unity
with those of Cuenen and Wiewiorowski who likewise concluded, in 1911, that the operation was unsound and dangerous.

Stetten studied 136 published arteriovenous anastomoses, or attempts at this operation. He found that 30 deaths resulted immediately or shortly following the operation, and 11 patients died after amputation following the performance of the anastomosis. The immediate death-rate therefore was 30 per cent., and of those that did not die, 15 required amputation. Therefore in more than 72 per cent. of the cases arteriovenous anastomosis had either failed or could not be accomplished, owing to the technical difficulties encountered. Insufficient lumen of the vessels or advanced arteriosclerotic changes precluded even a successful attempt at blood vessel suture in many of the failures reported.

If any value attaches to arteriovenous anastomosis it is probable that the good resulting from the operation is solely due to the ligation of the femoral vein on the proximal side of the newly created opening, thereby practically accomplishing in principle a pure femoral-vein ligation. Meyer has recently reported a case of Buerger's disease with involvement of the base of the big toe and adjacent metatarsal bone in which he performed arteriovenous anastomosis, with a good result. An analysis of the history of his case compares so closely with one of my own, in whom only ligation of the femoral vein was performed, as to make the cases identical from the standpoint of involvement and successful end-result achieved. In this instance the success attending the operation is credited to the so-called "reversal of the circulation" which is believed to have resulted.

No doubt there have been many failures following arteriovenous anastomosis for peripheral gangrene which have not been reported, and I can personally add to the long list of failures one of my own, of which no previous mention has been made.

It is apparent that arteriovenous anastomosis has no place in the treatment of this disease, since the high percentage of failures will always exist, owing to the technical difficulties attending the operation and the advanced state of the disease when the operation is performed. It must be borne in mind that while these patients suffer principally from peripheral vascular disturbances they are also poorly nourished and bear other evidence of a clinical syndrome of which their peripheral trophic disease is the most striking feature.

Femoral-vein ligation is a simple technical procedure and will certainly and effectively produce circulatory stasis, and thereby bathe the affected limb in more blood than is present when no retardation of the venous system exists. Since Buerger has shown that the principal changes are largely confined to the peripheral arteries the tissue asphyxia resulting from deficient oxygenation is not overcome by this operation. This operation has been per-
formed by von Oppel, Coenen, Lilenthal, Horsley and others and by myself in 4 cases. If desirable it may be done under local anesthesia. In effect, this operation has, no doubt, been performed many times, since the examinations after death, following arteriovenous anastomosis, have shown thrombus occlusion at the newly created bloodvessel stoma, or contraction amounting to a complete functional closure of the opening between the artery and the vein.

Independently, or in conjunction with this operation, the employment of intravenous injections of a saline solution, either 2 per cent. sodium citrate or Ringer's solution, has been carried out, following the suggestion of Kogo and Mayesima, of Japan. They reported 15 cases of this disease treated with injections of a saline without femoral-vein ligation in the surgical clinic of Professor Ito. Employing a viscosimeter for testing the blood they concluded that there is an increased viscosity in the blood of patients suffering from this disease. Based upon this observation came the conclusion to employ sodium citrate solution for intravenous injection in order to decrease the degree of viscosity.

Garbat, of New York, has recently stated and proved that multiple injections of 2 per cent. sodium citrate solution into the veins of the human organism do not have a deleterious effect, and I have also employed multiple injections of this solution in varying amounts in conjunction with femoral-vein ligation.

Other than the mere mention of a single case (Lakeside Hospital in Cleveland) I have been unable to find any reference to the results obtained by section of the sympathetic fibers about the femoral vessels. Many cases of thrombo-angiitis obliterans have as a concomitant feature of the symptom-complex pronounced vasomotor disturbances; but it is difficult to conceive how the advanced thrombus occlusion of the bloodvessels can be antagonized by section of the vasomotor fibers surrounding the large bloodvessels in the thigh.

When one witnesses the excruciating pain which these patients suffer, with the attendant loss of sleep, often uncontrolled by sedatives, the temptation is quite strong to perform early amputation before or at the first evidence of peripheral digital death. Haste in amputating, without first employing conservative measures, will often sacrifice extremities which may have been saved. In many instances, even though palpable pulsation of the vessels is wanting, patients will carry limbs for years with lessened pain and arrested disease after one or more toes have been lost. If the process is rapidly gangrenous and conservative measures are contra-indicated, early high amputation should be advised to obviate the greater dangers of delay.

These cases haunt the hospitals for months and years, and one surgeon will begin by amputating a toe, and after having visited
many institutions the final termination of the disease in the extremity or extremities involved will be high amputation by a surgeon in another institution. The first operation is not always the last, and if a follow-up system is employed in these cases, one is not surprised to learn that physical usefulness usually ceases with the early onset of the disease. One patient who came under my observation had had his first operation at the hands of Mixter, of Boston, fourteen years previously. Then followed successive operations by many surgeons in various institutions, and he finally entered Mount Sinai Hospital with two unhealed stumps a few inches below Poupart's ligament. Employing spinal anesthesia his long-continued suppuration was finally terminated. He had been an inmate of hospitals almost constantly since his first operation, and between his cigarette habit and the use of drugs to which he had become addicted, due to his great pain, he was in a restful state of mental apathy.

Another patient, whom I saw from the earliest physical appearance of the disease, a man, aged forty years, a carpenter by trade, suffered first the amputation of the toe of one leg, and then the leg itself was removed just below the knee, with long-continued suppuration and final slow healing of the stump, preserved for an artificial limb. A tourniquet was not required and there was scarcely any spurting from the tibial vessels when the amputation was performed. A year later he developed involvement of the big toe of the other leg, followed by slow and progressive involvement of the foot, refusing operation, until finally driven by the fearful pain in the gangrenous foot and leg to have removal of the limb in another hospital.

With reference to local treatment we have tried various saline foot-baths, heat, illier's hyperemia, electrotherapy, and many drugs locally to the diseased parts, none of which have appeared to have any specific value. Much has been claimed for ascitic fluid applied locally to the involved digits. I personally have amputated limbs where free use of ascitic fluid was made and have never seen any benefit result from its employment.

During the period of life in which this tragic disease is commonly observed in the male adult the female is engaged in repeated pregnancies and thereby suffers from constant engorgement of the lower extremities as the result of increased pelvic pressure due to the gravid uterum. This might possibly be a factor of some significance in determining the discrimination of the disease in favor of the male sex. Most patients suffering from this disease are inveterate cigarette smokers, using a cigarette of cheap tobacco rolled in paper of very poor quality.

Among the causes assigned to the production of this disease are infection (Buerger), some underlying toxemia, and altered quality of the blood (Meyer). The determination of the causative factors...
producing a disease of this type, having sharp limitations with reference to age, habits, nativity, and sex, calls for more determined and prolonged study in order to elicit a method of treatment more successful than any now at our disposal.

With reference to femoral-vein ligation the important facts in 4 cases are as follows:

Case I.—W. K., male, aged fifty-three years; Russian; fruit dealer; admitted to the Jewish Hospital May 21, 1916. Chief complaint: excessive burning pain in the right first and second toes. In December, 1914, the patient felt a burning sensation in the right big toe associated with constant severe pain, making sleep impossible. The toe became blue and extremes of temperature applied to the foot increased the pain. Electrotherapeutic treatment in the hands of the late Dr. W. L. Rodman improved his condition and the pain was lessened for a period of six months. In December, 1915, the pain and discoloration spread to all of his toes, involving the dorsal surface of the foot. Patient was born in Kommitz, South Russia, and came to this country when nineteen years of age. He began to smoke cigarettes when ten years of age, smoking ten to fifteen daily. He had typhoid fever at the age of sixteen; denies venereal disease; does not use alcohol; has worked hard all his life. He is married and the father of nine children, two of whom died in early infancy; the others are living and well. The winters are very severe in his birthplace, thirty miles from Odessa, and he was subjected to severe climatic exposure when he resided in Russia. Before he came to America he worked at a machine for about twelve years, employing both feet to run the machine. After coming to this country he peddled fruit for two years and then worked in a fish store, and finally went into the fruit business, being constantly exposed all this time to weather conditions. He has never been a big fish-eater.

Ten years ago, at the age of forty-three years, he was in the Jewish and Medico-Chirurgical Hospitals, the left foot having been amputated in the former institution for the condition which is now affecting his right lower extremity. This amputation followed multiple operations upon the foot for the relief of his condition. At the present time the pain in his right foot is persistent and unendurable without a sedative. The posterior tibial and dorsalis pedis arteries are not palpable. The mesial surface of the big toe at the first interphalangeal joint shows a trophic skin ulcer. The break in the skin is not complete. The nails of the first and second toes show marked trophic changes, the nail-bed of the second toe being the site of an ulcer of small dimensions. The dorsal veins of the foot are numerous but are fine and not distended, and the circulatory failure in the foot is marked by a line of cyanosis about 1 cm. proximal to the metatarsophalangeal joints, and the toes are mottled and cold.
May 22. 50 c.c. of 2 per cent. sodium citrate solution injected intravenously.

May 25. 32 c.c. of 2 per cent. sodium citrate solution injected intravenously.

May 26. 75 c.c. of 2 per cent. sodium citrate solution injected intravenously into the femoral vein, with coincident ligation of this vein by silk and catgut ligatures, with separate ligation of the long saphenous vein. The limb following ligation became deeply cyanotic, with intense mottling and marked diminution in temperature.

May 27. The appearance of the lower extremity is unchanged. The toes are intensely cyanotic, having a deep blue hue, and the foot is cold.

May 28. The leg is warm down to the ankle, with slight distention of the dorsal veins of the foot. The toes are less cyanotic, the blue color having given way to a purple-red hue, sharply defined at the metatarsophalangeal junction. The patient says he has less pain and slept better last night than any night since his admission into the hospital. Over the upper third of the leg there is some venous distention, an oblique vein crossing the tibia from within and outward and downward. The dependent position of the foot hanging over the side of the bed increases the reddish-blue hue of this part.

May 29. There seems to be more prominence of the dorsal veins of the foot and the color of the toes is assuming a normal red tone. The toes, however, are still cool and the lowered temperature of the part extends to the upper third of the leg. The nailbed of the second toe is dried up.

May 31. 100 c.c. of 2 per cent. sodium citrate solution injected intravenously.

June 5. The foot is warm, there is little pain, and the venous stasis has completely disappeared. The toes are still discolored and reddish blue, but there is very pronounced improvement in the circulation of the foot.

June 6. 100 c.c. of 2 per cent. sodium citrate solution injected intravenously.

June 7. Patient's leg is much warmer, and he states that he feels less pain. Patient requested that further intravenous injections be discontinued, and at his request was allowed to go home. (Total 357 c.c. of 2 per cent. sodium citrate injected.)

August 4. The right leg is somewhat edematous, toes are cyanotic, tense, and uniformly involved in the disease. The dorsal surface of the foot is blue and very painful. There is no venous distention such as he had shortly after his operation, and apparently little permanent good has resulted from the operation. His pain has returned and is becoming severe, necessitating the constant employment of narcotics.
This case has been reported somewhat in detail because it is a typical example of a case of thrombo-angiitis obliterans relative to nativity, history, and onset of the disease; terminating in the loss of one extremity and the future loss of the other, following a total occlusion of the femoral and saphenous veins, with coincident injection of sodium citrate solution.

**Case II.**—M. G.; male, aged twenty-seven years, operator by trade; born in Russia. Admitted to Mount Sinai Hospital May 8, 1916. Diagnosis: thrombo-angiitis obliterans of the left foot, with the presence of digital ulceration. He was treated for many weeks in the Polyclinic and Jefferson Hospitals without relief. The details of the disease are too time-consuming to enumerate.

May 11. Ligation of the femoral vein was performed below the point of entrance of the long saphenous vein. Marked venous stasis promptly resulted, assuming the startling appearance of the case previously reported. He received daily injections of Ringer's and sodium citrate solution in large quantities from May 12 to May 19 inclusive, when he refused further injections and left the hospital against advice. The social service worker following this case traced him to another hospital and reported that amputation of the leg was necessary, owing to the progression of the disease.

**Case III.**—J. E.; male, aged thirty-six years; Russian; baker by trade. Admitted to Mount Sinai Hospital January 10, 1916; discharged February 8. Diagnosis: thrombo-angiitis obliterans of left foot. Patient came to the hospital with severe pain in the big toe of the left foot, which became gangrenous, the gangrene extending to the tarsometatarsal junction corresponding to this digit. The acute process was of six weeks' duration, the toe becoming gangrenous two weeks previous to admission. Patient was an inveterate cigarette smoker.

January 10. Disarticulation of the big toe and the metatarsal bone was done; the wound was not sutured and no ligatures were required.

January 14. The wound was suppurating and gangrene was apparently slowly spreading; temperature, 100° to 102°. Patient was discharged February 8, with a suppurating wound and marked failure in the circulation of the foot. He was readmitted to the hospital May 31 with an unhealed wound and discoloration of the remaining toes of the left foot. The toes and dorsal surface of the right foot likewise show circulatory failure. The dorsalis pedis artery is not palpable in either foot and the veins are small and not distended.

June 3. Femoral vein ligated, with coincident injection of 100 c.c. of 2 per cent. sodium citrate solution.

June 4. Left foot is much warmer than the right; the veins are congested and the patient states that he feels more comfortable. 100 c.c. of 2 per cent. sodium citrate solution injected intravenously.

June 5. Patient is comfortable.
June 6. Patient's left foot and leg are slightly swollen, due to the venous congestion produced by the operation. Extremities quite warm to the toe-tips, with normal color and very marked distention of the surface veins of the foot. The opposite foot (right), which has not been operated on thus far, is distinctly colder than the left, and is giving much pain and discomfort, with marked cyanosis of all the toes, the big toe being especially involved. In comparison the left foot seems considerably better nourished and the result of the ligation at this time is unquestionably astonishingly good in this case. The transformation seems almost unbelievable, and the patient is considering the same procedure in the right lower limb. He has slept better and is having practically no pain in his left foot.

August 1. Patient has been at work all summer, having little pain in the left lower extremity, which is markedly swollen, the edema having increased the leg to almost twice its normal size. The nutrition of the limb at the present time is good and the progress of the disease seems arrested. The wound resulting from the removal of the big toe and the contiguous metatarsal bone has completely healed. He is now suffering from involvement of the other extremity and the problem of treatment arises again in this case.

The patient was observed on October 3, and the examination of his left lower extremity showed considerable diminution in the size of the limb as the result of stasis resulting from ligation of the femoral vein. He is suffering practically no pain in this limb, and complains of pain and feeling of fatigue affecting the right lower extremity.

Case IV.—M. T.; Russian; male, aged fifty-eight years; a truck driver in his native land, becoming a huckster upon his arrival in this country. Began smoking cigarettes at twelve years of age, averaging ten to twenty daily, and has been a heavy whisky drinker for many years. Married, had twelve children, eight of whom are living and well. Was in the Russian army for six years. Father died at ninety, mother at seventy-five. Family history negative in relation to the present disease. Ten years ago, when forty-eight, patient suffered from pain in the calves of both legs, compelling him to stop work at intervals. This pain continued until nine months ago, when his condition became so aggravated that he had to cease working. He has had a reddish-blue discoloration of the toes of both feet for the last six years and ulcerated areas over the anterior surface of both legs for the past five years, with failure of healing accompanied by great pain. The ulcers are trophic and pulsations in the vessels of the foot are absent. He was treated in the Polyclinic Hospital for six weeks by Dr. George P. Müller, who believed that the case was one of thrombo-angitis obliterans, and submitted the patient to saline injections. This case was one
in which there was circulatory failure, but owing to the age of the patient and the atypical location of his trophic ulcers I do not know whether he can be termed a typical case of thrombo-angiitis obliterans, although the examination of both feet confirmed the proper classification of the disease as one of this type.

May 31. 50 c.c. of 2 per cent. sodium citrate injected intravenously.

June 3. 100 c.c. of 2 per cent. sodium citrate injected intravenously into the femoral vein, accompanied by ligation of this vessel. The leg immediately assumed an intensely purple hue, with a most pronounced venous stasis of the limb below the knee-joint. The patient was in a state of shock at the conclusion of the operation, with subnormal temperature and rapid pulse, and cried out because of intense pain in the limb.

June 4. Suppression of urine was marked, only one-half ounce having been recorded in the past twenty-four hours. The right lower limb is now mottled and markedly cyanotic below the knee-joint. The left leg still remains cold and blue. Anuria is complete, the patient having the odor of urine on his breath, is vomiting, and has a subnormal temperature.

June 5. Patient's condition remains the same. There is very marked or total venous obstruction of both lower extremities, suggestive of a thrombus of the inferior vena cava. Patient died on this day, apparently of suppression of urine.

He was a poor operative risk, and undoubtedly not a good case for femoral-vein ligation.

Femoral-vein ligation based upon the experience of these few cases is an operation of doubtful value, since only 1 of the 4 patients showed any improvement following its performance. This case has unquestionably improved to the point of security of the limb in which the venous current was obstructed. Involvement of the other leg is now taking place and the value attaching to the procedure may be still greater in the future, since it may preserve one of his extremities.

The operation is a hazardous one and may cost the life of the patient, as occurred in Case IV of my series. If ligation is done the ligature should always be placed below the entrance of the long saphenous vein into the femoral vein, thereby preserving some collateral venous circulation in the affected limb. Following this operation there is developed a large posterior femoral vein passing from the popliteal space as a tributary to the sciatic or inferior gluteal vein.

In one of my cases ligation had no effect whatever in retarding the progress of the disease, and even failed to produce venous stasis in the affected extremity. It was a convincing example of how greatly impaired was the arterial distribution to the peripheral parts in the affected limb, and proved that the problem cannot
be attacked except by dealing with the arterial element in this disturbed circulation.

I believe that the poor arterial circulation present is much better than the results attained by any of the proposed surgical measures to increase the circulation in the involved extremity.

We must bear in mind that this disease is almost invariably seen in its terminal stages and that surgical measures are simply palliative in nature and cannot achieve a positive cure. My own experience with the injection of the sodium citrate solution has not been very satisfactory, since I have noted little improvement in the patients, and have found it difficult to continue the injections over a long period of time, since so little early relief has followed them. This experience is in agreement with the later reports dealing with the value of saline injections in this type of peripheral gangrene. Much of the early improvement noted by other observers has only been temporary, and lasting results have not been attained.

THE NEWER CONCEPTS OF THE NEUROSES: AN ESTIMATE OF THEIR CLINICAL VALUE.¹

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I have tried to put to a kind of test some of the ideas concerning the neuroses that have seemed worth while and have endeavored to see what truth there is in them. In doing this I have attempted to be unprejudiced and, as far as one may with clinical material of a varied kind, to adopt a detached and unbiased attitude.

The questions I have set myself to answer are: (1) what are the really important theories which cluster about the attempt to explain the neuroses; (2) of what use are they; (3) what remains after the untrue and useless are set aside.

What is to be understood by the term “neuroses?” They are clinical pictures of diseases which are primarily psychogenic in origin and in manifestation, the objective symptoms of which do not conform to the known laws of anatomical distribution or physiological function, and in which the intelligence is not sufficiently affected to be included within the limits of the psychoses, and in which conduct is kept within the limits of what is called normal.

This definition as set forth here is intended merely to delimit a large class of nervous diseases from the organic on one side and from

¹ Read by invitation before a combined meeting of the Chicago Medical and Chicago Neurological Societies. The introduction is here omitted.