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THROMBO-ANGIITIS OBLITERANS

A Review and Report of the Disease in Koreans*

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In May 1908, before the Association of American Physicians, L. Buerger¹ proposed the term "thrombo-angiitis obliterans" for the group of cases of presenile gangrene which had been described by the Germans under the name "endarteritis obliterans."

Etiology

Numerous etiological factors have been suggested but none have been proven to be the exciting cause of thrombo-angiitis obliterans.

1. *Race.* At first there was a general opinion that this condition was peculiar to the Jewish race due to the fact that the majority of cases were found in the large American cities among the Jewish immigrants from Poland, Galicia and Russia. A later review of literature showed an increasing frequency among Gentiles and the condition was found in many other countries as Russia, Austria, Serbia, Bulgaria, Turkey,² France,³ Japan,⁴ China,⁵ and Korea.⁶

2. *Sex.* The occurrence of thrombo-angiitis exclusively in males has been noted by all authors except Buerger,⁷ Koyano,⁸ Meleney and Miller,⁹ and Telford and Stopford.¹⁰ Pathologic proof was lacking in all except the case of a woman aged forty-eight with a five-year history, reported by Meleney and Miller. All patients in a series of more than 300 cases of

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thrombo-angiitis obliterans in the Mayo Clinic in the years 1922 to 1927 inclusive were males.

3. *Age.* Practically all authors have agreed as to the common occurrence of thrombo-angiitis obliterans between the ages of 20 and 50 years.

4. *Occupation.* Work necessitating standing for long periods has been regarded by some as a prominent factor but many patients are found among sedentary occupations.

5. *Tobacco.* Meyer W.¹¹ ascribes the disease to tobacco smoke poisoning:

The characteristics of the patients who are particularly prone to develop thrombo-angiitis obliterans seem to indicate an hereditary weak sympathetic nervous system. Hence the functioning of the eliminating glands, enervated by that system, is probably subnormal. When the system of such a patient is kept incessantly flooded with tobacco smoke poisons over long periods of time the elimination of the poisons by glands is liable to fall behind and the system will gradually become saturated with the poisons. This is the starting of the trouble.

Erb¹² in studying a great number of these cases came to the conclusion that the excessive use of tobacco is the real etiological moment. Buerger¹³ admits that tobacco poisons may safely be regarded as a predisposing cause by rendering the vessels more susceptible to special agents, but adds that tobacco as the only exciting cause is extremely doubtful and highly improbable.

6. *Syphilis.* Haga¹⁴ thought that the disease was due to syphilis only. Later investigations, however, proved this was not the case. Buerger and Kaliski¹⁵ state that clinically they had been rarely able to elicit a history of lues and only two out of eighty cases had had a syphilitic infection. In view of the fact that lues was so frequently entertained as the cause of this condition, Dr. Kaliski made the usual serological tests in 29 consecutive cases with not a single positive reaction. A careful study failed to reveal the presence of spirochaeta pallida in a large number of vessels removed from the amputated limbs. Goodman² excludes syphilis as an etiological factor by the fact that in a series of cases which he studied the Wasserman reaction was invariably absent.

7. *Alcohol.* Among patients with thrombo-angiitis obliterans there have been both users and non-users of alcohol so that this cannot be regarded as a strong factor.

8. *Cold.* Zoege V. Manteuffel considered the most important factor to be cold and ascribed the prevalence of the disease among Russians to the fact that they live in a cold climate. Cold could certainly not be ascribed as a cause among natives of South China.

9. *Diet.* The consumption of too much salted meat has been suggested as a cause but this would not apply to many in the Orient whose diet is largely vegetarian.

10. *Metabolism.* Meyer W.¹⁶ expressed the conviction, based on chemical analysis of the blood of the patients, that in this affliction there is a disturbance of the carbo-hydrate metabolism with a consequent tendency to hyperglycaemia and he suggested that the disease should be called "glycophilia." The studies of M. Kahn carried out at the Beth Israel Hospital convinced him that the disease was not due to a disturbance of metabolism. Bernhart, A¹⁷ carried on a series of experiments to determine if there were any changes in the chemical composition of the blood. He found the nitrogenous constituents, cholesterol, chlorides and calcium normal. No acidosis was demonstrable, the combining power of the blood plasma being normal. A few cases showed a high blood sugar concentration.

11. *Nervous Disposition.* Oppenheim¹⁸ and Goldflam¹⁹ laid great weight on the nervous disposition of patients but Erb considered that the prevalence of men would speak against this reason. Meyer's patients were Russian-Polish Hebrews who migrated from, or whose ancestors had migrated from, a narrow belt stretching from the Baltic to the Black Seas. He believes that the long years of persecution under which many generations of these Jews lived have kept them in a more or less constantly hysterical condition, making them neurasthenics by heredity and that a predisposition of the nervous system is an important factor.

12. *Minor Surgical Procedures.* Gottlieb²⁰ called attention to this as a factor and concluded:

The symptoms and signs of the disease are often mistaken for some other minor surgical affection and surgical treatment is resorted to in order to relieve the patient. The trauma to the tissues and the blood vessels still more interferes with the nutrition of the parts and ulcers are produced which are extremely painful and do not readily heal and often gangrene supervenes. In any complaint of the foot one should always bear

in mind the possibility of the disease and the physician should go thoroughly into the history of the patient and ascertain carefully the circulatory condition of the foot.

13. *Toxin or Organism.* Buerger makes the following statement:

I will concede that the exciting etiological factor has not as yet been discovered; nor am I presumptuous enough to suggest anything more has been done by my own studies than to point out in what direction future researches on etiology should be conducted. My own investigations of the acute stage of the disease, thromboangiitis obliterans, warrant me in feeling confident that some specific agent, quite foreign to the many factors predisposing or otherwise that have hitherto been held responsible, must be the exciting cause.

Buerger in a study of 50 amputated legs of thrombo-angiitis patients observed histological changes in the vessels resembling miliary giant-cell foci which aroused the suspicion of some microbial process. He then looked carefully for spirochaetae, tubercle bacilli, and the ordinary pyogenic agents in cultures and microscopical sections and by the inoculation method but without result. Following this line, Goodman^{2 21} presented a preliminary report of a serological study of the possible etiological relationship of typhus fever to presenile gangrene. This study was continued in a paper entitled "Thrombo-angiitis Obliterans—Further Confirmation of its Relationship to Typhus Fever." His main points were:

(a) Thrombo-angiitis is found in almost every country but is more prevalent in those countries where typhus fever is epidemic.

(b) Even the early writers enumerate among the cardinal symptoms of typhus gangrene of the extremities.

(c) Saltikow, Buerger and others have suggested that thrombo-angiitis obliterans might be caused by some organism.

(d) In reference to the conclusions of a somewhat tentative nature which I drew from the serological tests with the Plotz bacillus in 1916, the reports of the Bulgarian campaign preceding the European war have confirmed my contention that thrombo-angiitis obliterans is of infectious origin.

(e) Wolff wrote in 1916 that gangrene of the extremities was among the frequent manifestations of typhus and quotes Professor Brauer of Hamburg as ascribing this gangrene to the specific inflammation of the arterial intima. Wolff cites the report of E. R. Granz and that of Schuer von Waldheim as testimonies given to the frequent occurrence of gangrene after typhus and concludes with Fraenkal, Brauer and Jochman that the

secondary gangrene was due to a vascular lesion produced by the typhus infection. Wolff gives beautiful illustrations of cases of gangrene which were identical with those we see here in the cases of thrombo-angiitis obliterans.

Goodman is further convinced that further studies he has undertaken will bring additional proof to his arguments that thrombo-angiitis is a later manifestation of a previous typhus infection.

Rabinowitz²² made experiments on the infectious origin of thrombo-angiitis and claimed to have isolated a specific organism from the blood stream. The bacillus which he isolated produced the same lesions in the ears and feet of a rabbit as those which were present in the calf of the leg of a human being. The lesions produced were similar in their gross and microscopic pathology to those produced in the disease known as thrombo-angiitis obliterans. The bacillus was isolated both from the blood of the local portion affected and from the general blood stream. The organism was distinctly haemaglobinophilic. He gave a full description of the differential characteristics of the organism isolated.

Of all the foregoing etiological factors none have as yet been found to be a direct causal agent. Many believe that a specific organism will be found.

Pathology

Many theories have been put forth to explain the pathological anatomy of thrombo-angiitis obliterans. Von Winiwater and Friedlander looked upon the disease as due to a primary endarteritis obliterans. Their theory was disproved as many of the involved vessels show no obliterative endarteritis. Also there are decided clinical and age differences.

The theory of Weiss and Von Manteuffel, that the disease is caused by a primary endarteritis with the formation of a white descending thrombus with subsequent organization, arteritis and so on, was also overthrown by later investigations.

Buerger summed up the lesions of thrombo-angiitis obliterans in chronological order as follows:

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.

Telford and Stopford, Perla and Koyano failed to confirm Buerger's view of the acute inflammation of the vessel with thrombosis as the initial lesion in the disease.

Mahorner²³ suggests that:

Thrombo-angiitis obliterans is fundamentally a chronic inflammatory condition of the vessels accompanied by proliferation of the intima and resulting in thrombosis with organization and canalization of the clot, fibrosis of the adventitia and an attempt on the part of the vasa vasorum and other vascular channels to establish a collateral circulation. At times acute inflammation is superimposed on the chronic process. The nerves are involved apparently by virtue of their relationship to the vessels and by ischemia in the distal portions.

Symptoms

Buerger has grouped the symptoms as follows:—

1. The disappearance of the pulses, particularly the dorsalis pedis, posterior tibial and popliteal, more rarely the femoral, radial and ulnar.

2. The development of typical manifestations of impaired circulation, to wit: blanching of the lower extremities when these are elevated above the horizontal, hyperemia (rubor) or reddening of the foot in the pendant position during certain stages of the disease and trophic disturbances, such as impaired growth of the toenails, slightly atrophic condition of the skin, ulcers and gangrene.

3. True vaso-motor phenomena of transitory nature, such as alternating syncope, rubor, coldness, apparently independent of those chronic changes that are distinctly traceable to the occluded condition of the arteries and veins.

4. The symptoms of pain, either in the form of intermittent claudication or the severe pain that is associated with the advent of trophic disturbances, especially with ulcers and patches of gangrene.

5. The slow course of the disease, symptoms of intermittent claudication preceding the development of trophic disturbances for months or years.

6. Its frequent occurrence in Hebrews and young males.

7. The onset of symptoms in the lower extremities, one of the legs being first affected.

8. The comparative infrequency of involvement of the upper extremities.

9. The association of a peculiar type of migrating phlebitis in the territory of the external or internal saphenous, less frequently in the larger veins of the upper extremities.

10. The slow but steadily progressive course, leading in a majority of cases to amputation of at least one limb, not infrequently of both lower extremities, and in rare instances to amputation of one of the upper extremities as well.

Treatment

Attention should be directed to the predisposing etiological factors with a view to prophylaxis. Every effort should be made to protect the extremities from trauma; the use of strong irritating ointments should be avoided; slight abrasions must be carefully treated and it should be borne in mind that minor surgical procedures on the toes or foot may be a factor in starting the gangrene. In early cases smoking should be diminished or prohibited.

Medical Treatment

1. Local Treatment.

(a) Postural. Elevation of the limb or alternately raising and lowering the limb perpendicular to the bed for a minute, then over the edge of the bed for a minute, then horizontal for a couple of minutes. This should be done for fifteen minutes two or three times a day.

(b) Heat. Hot air or electric bath at 38°C.

(c) Alternating warm and cool soaks. Placing the limb for one minute each in water of temperatures of 40 to 50°F. and from 100 to 110°F.

(d) Bier's Treatment. Sinkowitz²⁴ used an ordinary Bier's suction apparatus in which the affected foot was enclosed and by means of a suction pump negative pressure applied. The results noticed were improvement in color, either considerable abatement or entire disappearance of pain in the toes and foot, rapid healing of ulceration, increased warmth, etc. The treatments are given daily or three times a week, the usual length of treatment being about 15 minutes.

(e) Local Applications. Normal or hypertonic saline dressings may be used to advantage in the presence of ulcer or secondary infections. Various kinds of non-irritating ointments such as boric acid or scarlet red may be used.

2. Administration of drugs.

Little benefit is seen from the use of drugs aside from the control of pain. The formation of a drug habit must always be kept in mind. Potassium iodide and nitroglycerine have been recommended. Glandular extracts have been used with no effect.

3. Injections.

(a) Ringer's Solution. Acting on the suggestion of Mayesima, Koga²⁵ used Ringer's solution hypodermatically over long periods of time and reported many cures. Meyer followed Koga's idea. He used 8 to 10 quarts of Ringer's solution of a solution of sodium bicarbonate (from 15 to 30 grams of salt per day) of body temperature given by the rapid drop method within 24 hours. This was also given through a duodenal tube supplemented with several daily subcutaneous injections. Koga reported the return of an almost normal pulse in 10 out of 13 Japanese treated with hypodermoclysis. Koyano⁴ also recommended repeated hypodermic injections of Ringer's solution.

(b) Sodium Citrate. Meyer was the first to use sodium citrate intravenously in conjunction with Ringer's solution hypodermatically. Steel²⁶ used sodium citrate by the following technic: during the first month the patient is kept in bed with the legs constantly under a hot air electric bath at 110° F.; 250 c.c. of a 2 percent sodium citrate solution is given intravenously every second day. The second month the interval of injection is lengthened to every third or fourth day; daily massage is given and the patient is put in a wheel chair with the feet hanging down a short time each day; or, if the case is not advanced, allowed to walk. The intervals of injection are now gradually lengthened until at the end of a year the patient gets one every two weeks. Increased walking is permitted as the symptoms subside and evidences of functional collateral circulation appear. He reports six cases and concludes:

One cannot hope for full functional regeneration in such badly damaged members but these six cases would seem to show that suffering

can be relieved; that the progress of an otherwise fatal disease can be checked; that amputation can be avoided and that a certain percentage of patients can be returned to active life and others fitted in some measure to help themselves.

(c) Sodium Chloride: Hypertonic Solution. Silbert S.²⁷ selected sodium chloride for the hypertonic solution:

Because it is a salt to which the body is accustomed and because 15 grams can be administered without danger of toxicity. The solution is prepared in freshly distilled water, filtered and immediately sterilized. Five per cent. sodium chloride is used, 150 c.c. for the first injection and 300 c.c. for all subsequent injections. The injections are at first given three times a week, later, twice a week, and the length of intervals further increased as the patient improves. The injection is given into a superficial vein in the usual manner by the gravity method; the fluid is allowed to run into the vein slowly during ten minutes and the patient is kept flat on his back during this period. I have given or supervised the giving of more than 2,500 injections without any serious accident or reaction.

In a more recent report Silbert²⁸ states:

More than 19,000 injections have now been given with no fatalities or serious reactions. In the majority of cases, treatment has been continued for from one to two years without evident harm to any part of the body.

However, it is contraindicated in patients over 60 years of age and in those who show signs of an injured myocardium or poor renal function. It is also contraindicated in instances in which obstruction of the circulation is due to embolism from cardiac disease of other sources. Silbert summarizes his results as follows:

The results obtained in 225 cases of typical thrombo-angiitis obliterans and sixty-four border line cases of this condition treated with intravenous injections of hypertonic salt solution indicate that this method of treatment is effective and safe. Satisfactory results are obtained only if patients stop using tobacco.

(d) Nonspecific protein. The application of protein intravenously in the treatment of peripheral vascular diseases was suggested by Goodman and Gottesman; they noted relief of pain and improvement of the general appearance of the extremities. Brown and Allen²³ have been using this form of treatment at the Mayo Clinic for the last five years and they believe it to be the most effective medical measure. They base the rationale of the treatment on two considerations: (1) the relief of pain and (2) the increase of blood supply to the affected part.

The technic has been the use of the triple typhoid vaccine consisting of typhoid bacteria and paratyphoid bacteria A and B. An initial dose of from 20,000,000 to 50,000,000 is given intravenously. This can be increased by 50,000,000 at a time up to 250,000,000 or 300,000,000. Such doses are usually given every fourth or fifth day or, when occasion demands, every second or third day for a short period. A satisfactory reaction is manifested by a mild chill and a maximal period of fever; an increase in temperature of 2° or 3° F. is desirable. The systemic symptoms are usually those of headache, mild nausea and malaise which usually disappear in twenty-four hours. We have given many hundred injections of the typhoid vaccine in the treatment of vascular diseases and many thousands have been given in cases of chronic arthritis without harmful effects. Our plan is to give from four to six injections in a course, then allow a period of three or four weeks and repeat the course if indicated. The best effects are obtained in cases in which there are rest pain and early trophic changes.

Surgical Treatment

1. *Incision and Amputation.*

(a) Incision of toes or removal of toenails. As mentioned under etiology such procedures interfere with the nutrition of the part and should be avoided. Few successful results have been reported.

(b) Amputation of toes. Toes were amputated in six cases at the Mayo Clinic. The operation was successful in four. Incisions did not heal in two cases in which amputation was carried out at the insistence of the patients. In twenty-five cases one or more toes were amputated elsewhere. In five of these healing was prompt, but in one case amputation at a higher level was required later. In nine cases in which amputation was performed elsewhere the incision failed to heal and higher amputation was necessary in seven.

(c) Amputation below the Knee. This is not commonly acknowledged to be successful. However, in a total of twenty-one cases, twelve at the Mayo Clinic and nine elsewhere, healing by primary intention occurred in fifteen cases (71 percent.); it was delayed in 10 percent. In only four cases (19 percent.) was there failure to heal. Silbert²⁸ reports:

Of the twenty-one patients who were subject to amputation only eleven remained under my control. In several of these it was obvious that amputation was inevitable but treatment was given in order to make a lower amputation. In nine of these eleven cases amputation was done below the knee with good results. In the remaining ten cases in which treatment by this method (hypertonic saline injections) was discontinued all the amputations were above the knee.

(d) Amputations above the Knee. Buerger⁹ reported sixty-five cases in which he performed the Gritti-Stokes amputation above the knee and believed this to be the most satisfactory operation. Telford and Stopford²⁹ were of the same opinion. This operation was performed at the Mayo Clinic in seven cases. In six of these the healing was prompt and in one it was prolonged. Amputations above the knee were performed elsewhere in nine cases in eight of which healing was prompt; it was prolonged in one case.

2. *Various surgical procedures other than amputation in the treatment of thrombo-angiitis obliterans.*

(a) Arterio-venous anastomosis. Anastomosis of the femoral artery and vein was first suggested and carried out by Lilienthal; the patient died thirty hours after operation. Halstead and Vaughan³⁰ also advocated this method. Buerger stated his objections to this form and treatment and believes that:

Experimentally, it is practically impossible to convert veins into arteries by anastomosis and further the clinical reports do not justify us in recommending this procedure.

Most surgeons agree that this operation is unjustifiable.

(b) High Ligation of the Main Artery. Lewis and Reichert³¹ have advocated this method of producing a collateral circulation in cases of thrombo-angiitis obliterans and the former³² has used it in seven patients, four of which showed definite improvement, two came to amputation and one died of hemiplegia. Lewis himself feels that this method should be employed in the early stages of the disease in order that time may be given for the collateral circulation to become established before further occlusion of the arteries, especially the popliteal, which he thinks is occluded late, takes place.

(c) Ligation of the Main Vein when the Main Artery is occluded. In late cases, the kind usually seen in the Orient, this method for developing the collateral circulation seems to Van Gorder³³ to offer the most promising form of therapy in that it affords relief of pain, cessation of gangrene and surely postpones, if not obviates entirely, high amputation.

(d) Injection of Absolute Alcohol in the Exposed Nerve. This was proposed by Silbert³⁴ and

Consists in blocking the transmission of the sensation of pain by an injection of absolute alcohol into the exposed nerve as far proximal as is necessary and as far peripheral as possible.

The operation can be performed in a few minutes under local anesthesia and in five cases reported by Silbert it has been found sufficient to inject the posterior tibial nerve at the level of the internal malleolus. A failure to obtain relief from the injection at the ankle would indicate that a higher injection of either one or both main nerves, perhaps at the lower level of the popliteal space, would succeed. The writer has been unable to find any further report from Silbert.

(e) Stretching of the Sciatic Nerve. This has been advocated but Diez³⁵ reported negative results.

(f) Suprarenalectomy. Herzberg³⁶ analyzed 110 cases of suprarenalectomy for spontaneous gangrene. Fifty-two of these patients were traced from six months to two years; the disease was quiescent in eleven, nine were improved and thirty-two had had amputation.

(g) Perivascular Sympathectomy. This operation which consists of the stripping of the main artery of its outer sheath containing the sympathetic fibers was first performed by Jaboulay in 1899 and recommended by Leriche³⁷ in 1913. This work, while somewhat disappointing clinically, has stimulated a great deal of clinical investigation on the vasomotor nerves.

(h) Lumbar Ganglionectomy. Brown²³ reports:

In eighteen cases of thrombo-angiitis obliterans the second, third and fourth lumbar ganglia and the intervening rami have been removed by Adson. The results thus far have been distinctly beneficial in fifteen. Subsequent amputation has been necessary in three; in one of these, thrombosis of both the femoral arteries occurred nine months after the lumbar ganglionectomy. More time will be necessary to determine whether the operation is justifiable.

Having thus reviewed the subject of thrombo-angiitis obliterans we desire to summarize our experiences with this disease in Koreans.

Report of Fifty Cases of Thrombo-angiitis obliterans in the Korean

In response to an editorial on "Thrombo-angiitis Obliterans" in the *China Medical Journal* of September, 1917, special attention was directed to this condition by the surgical staff of Severance Hospital. During the years 1912-1917, five cases of

gangrene of the extremities were observed in men from 25 to 35 years of age. It is probable that all five were cases of thrombo-angiitis obliterans but, lacking positive evidence, we have not included them in our report.

The first patient in whom we made the definite diagnosis of thrombo-angiitis obliterans was admitted to Severance Hospital, April 22, 1918. This was one of the four cases which the writer⁶ reported in the *China Medical Journal*, January, 1920, and so far as we have been able to ascertain it was the first published report of this disease in the Korean.

As yet no accurate statements can be made as to the prevalence of thrombo-angiitis obliterans in Korea. The replies to a questionnaire, sent to twenty doctors in charge of mission hospitals in Korea, indicate that the disease is found, not infrequently, in all sections of the country. Uemura²⁸ formerly of the Government General Hospital in Seoul (Kejio) reported many cases both in the Japanese and Koreans. We agree with Brown and Allen²³ in their statement:

It is probable that the racial element in thrombo-angiitis obliterans depends largely on the clientele and the geographic distribution of the physicians who are interested in this disease.

This present report is based on 50 cases of thrombo-angiitis obliterans among Korean in-patients on the surgical service of Severance Hospital, 46 cases from the years 1922 to April, 1930, inclusive, and the four cases previously reported,⁶ giving an average of 5.5 cases a year. The ratio of patients with this disease to the total number of in-patients is 1:400 and the ratio to the total number of male in-patients is 1:250. Many patients with thrombo-angiitis obliterans seen in the out-patient department, have not been admitted to the hospital for lack of available beds.

Sex. All the patients in this series were Korean males. We have observed one case of thrombo-angiitis in a Korean female but were unable to persuade her to enter the hospital for further study of the case.

Occupation. Eighty percent of our patients were farmers and ordinary laborers. The remainder were merchants, students and others leading sedentary occupations.

Age. Tables No. 1 and No. 2 show the age group of the 50 cases.

TABLE NO. 1.

Age Group	*Year of age when symptoms were first noticed	No.
15-20	18-19-19-19-20-20-20	7
21-25	22-22-23-24-24-25-25-25-25-25	12
26-30	26-26-27-27-28 29-29-30-30-30-30	11
31-35	31-31-32-32-33-33-33-33-34-34-34-35-35	13
36-40	37-39	2
41-45	41-44-44-44	4
46-50	0	0
51-55	0	0
56-60	60	1
	Total	50

*It is probable that the figures in Table No. 1 are too high since it is difficult to estimate the exact age at which the disease began.

TABLE NO. 2.

Age Group	Year of age on admission to hospital	No.
15-20	19-19	2
20-25	21-22-22-23-25 25-25	7
26-30	26-26 27-27-27-27-29-29-29-29-30-30	13
31-35	32 32-33-33-33-33 33-33-33-33-34 34-34 35 35	15
36-40	36 36-37-37-39 39-40	7
41-45	43-44-45	3
46-50	48	1
51-55	53	1
56-60	60	1
	Total	50

At the time the symptoms were first noticed, the youngest patient was 18 years of age and the oldest 60 years of age.

The average age at the time when the symptoms were first noticed was 29.9 years, and at the time of admission to the hospital was 32.4 years.

Duration. The duration of the disease before admission to the hospital varied from one month to 11 years with an average of 2.5 years.

Tobacco. In our series tobacco was used, though in most instances not excessively, by ninety percent. of the patients. The amount of tobacco consumed by this class of patients depends largely upon their ability to secure it. Many of the poorer class use various weeds or grasses in place of or mixed with tobacco.

Syphilis. There was no clinical evidence of syphilis in 45 patients. The Wasserman was negative in 15 out of 18 patients in whom the test was made.

Alcohol. Our records were not sufficiently accurate on this point. The majority of this class of patients used Korean wine but there were a few who used no alcohol.

Cold. Five patients gave a history of frost bite which upon further inquiry we regarded as due to the lessened circulation rather than as the predisposing cause of the gangrene.

Diet. The Koreans are mainly vegetarian in their diet. Rice is the great staple, millet and barley being frequently substituted for it in whole or part. Meat is not much eaten by the class of patients in this series. Fish is eaten in considerable amount, especially when salted or dried.

Metabolism. Our observations confirmed the results given by Koyano who found the blood sugar normal in most Japanese patients with thrombo-angiitis obliterans.

Nervous Disposition. Nervous disposition was not a prominent factor in our Korean series.

Toxin or Organism. We made two attempts to repeat the experiments of Rabinowitz,²² obtaining a bacillus from the blood of the part affected. While the bacillus was similar to that

described by Rabinowitz it failed to produce any lesions in the ears or feet of the inoculated rabbits.

Although typhus is common in Korea, only 4 of our 50 patients gave any history of typhus previous to the onset of thrombo-angiitis obliterans and even this number must be questioned as Korean patients often confuse typhus and typhoid.

Laboratory Examinations

(a) Intestinal Parasites. Intestinal parasites are extremely common in all our hospital patients. Ova of trichuris and ascaris were found in nearly every patient and ankylostoma was present in 18 out of the 50 patients.

(b) Urine. The urine was never positive for glucose. Albumen was found in small amounts in only five patients.

(c) Sputum. The sputum was normal except for the finding of paragonimus westermanii in one patient.

(d) Blood. Estimations of the hemoglobin and white blood counts were made in 45 patients and the red blood count and differential count in 35 patients. The hemoglobin was low (55 percent) in only one instance, a patient with ankylostomiasis. The white blood counts ranged from 4,800 to 22,400. The red blood counts ranged from 2,588,000 to 4,928,000. The average findings were as follows:—

Hemoglobin	73.5 per cent.
Red blood cells	4,104,000 "
White blood cells	10,858 "
Polymorphonuclear leucocytes	71.4 "
Large mononuclear leucocytes	5.5 "
Small mononuclear leucocytes	18.4 "
Eosinophiles	4.7 "

These averages are almost identical with those found in 100 cases of amebic liver abscess and in a series of 50 patients with hernia, all of them Korean patients in Severance Hospital.

Further Clinical Observations. On admission to the hospital nearly every patient showed a slight increase in temperature (average 37.5°C.) while in some with secondary infection the temperature was 39°C. or over. In no case was the blood pressure above the normal range for the age of the patient.

The patients complained chiefly of pain and varying degrees of gangrenous involvement of the toes, foot, leg, fingers or hand. One patient had become an addict to the morphine habit on account of the severity of the pain. A few patients in spite of the pain had allowed gangrenous toes to auto-amputate. One patient had cut off his own toes. Some begged for amputation in order to obtain relief from pain. Anodynes were necessary in a third of the patients. In cases of extensive gangrene pain was occasionally absent. Superficial phlebitis was observed in one patient. In order of frequency, pulsation was absent in the dorsalis pedis, posterior tibial, popliteal and femoral. In three of the patients pulsation was present in the dorsalis pedis of the involved extremity.

Extent of Gangrene. The extent of the gangrenous process in our series of 50 patients is shown in Table No. 3.

TABLE NO. 3.

Extent of the lesion when the patients were admitted to the hospital

Gangrene of the toes only	22
Gangrene of the toes and dorsum of the foot	10
Gangrene of the distal half of the foot	8
Gangrene of the fingers and toes	4
Gangrene of the fingers and hand	2
Gangrene of the finger only	1
Gangrene of the whole foot and part of the leg	1
Gangrene of fingers, toes and dorsum foot	1
Gangrene of the toes and ulcer of heel	1
<hr/>	
Total	50

In nearly every operative case we have made a careful macroscopic examination of the vessels affected by thrombo-angiitis obliterans and have observed the various changes from the thickened vessels to the state where the arteries, veins and nerves have become densely adherent. The artery was found more frequently obliterated than the accompanying vein. Many of the cases showed a soft red adherent thrombus. At times the lumen was patent between two points of occlusion and in some cases it was difficult to split the vessel longitudinally on account of the dense whitish material filling the lumen. Those cases which have been examined microscopically have shown the typical lesions described by Buerger.

Treatment

Most of our patients have been of the poorer class with the disease well advanced. This, together with the great demands upon our available charity beds, have made prolonged treatment difficult.

Medical Treatment

The number of patients, thirteen, who have received medical treatment only, is too small to warrant any final conclusions.

I. Local Treatment. We have not tried systematically postural heat or Bier's treatment. Of local applications the one most commonly used has been hypertonic saline dressings for local infections.

2. Injections. Injections of Ringer's solution or sodium citrate have not been tried.

(a) Subcutaneous injections of normal saline have been used with some benefit in cases of frost bite so we decided to try them in thrombo-angiitis obliterans. The temporary effect was fair but the patients objected to repeated treatments so this method was abandoned.

(b) The administration of hypertonic salt solution intravenously, according to Silbert's method, gave better results than the subcutaneous injections of normal saline. The patients were far more willing to submit to repeated intravenous injections of the hypertonic solution and frequently asked for the treatment. The patients often commented on a feeling of warmth in the extremities and relief of pain following the injection. On account of its ready acceptance by the patient, simplicity, absence of dangerous reactions and small cost, the intravenous administration of hypertonic salt solution would seem particularly applicable in the treatment of thrombo-angiitis obliterans in the Orient.

(c) Autohemotherapy. At the suggestion of Dr. K. W. Chung, of our surgical out-patient department, 350 injections of the patients' own blood have been given, during the year 1930, for a variety of conditions. As autohemotherapy has proved of special value in the treatment of gonorrheal arthritis and many cases of obscure arthritis, it was decided to give this

method a trial in thrombo-angiitis obliterans patients who were unable to gain admission to the hospital.

The technic used was as follows: With the patient in a reclining position blood was drawn from the median basilic vein into a large glass syringe which contained a 2.5 percent. solution of sodium citrate (1 c.c. of sodium citrate for each 10 c.c. of blood). The syringe was gently shaken to mix the citrate solution and the blood. The blood was then slowly injected into the gluteal muscle. The amount used varied from 40 to 70 c.c. but the usual injection was 50 c.c. The injections were given every fifth day. There was seldom any pain following the injections and after a few minutes' rest the patient was allowed to go home. No severe reactions have been observed and in no case has there been an infection. A summary of this treatment is shown in Table No. 4. (These patients were not included in our series.)

TABLE NO. 4.

Summary of thrombo-angiitis patients treated by autohemotherapy

Case No.	Sex	Age Yrs.	Duration	Part Involved	Amount Blood	No. Injec.	Result
1	M	26	1 year	Toe	40-50 c.c.	16	Unimproved
2	M	28	5 yrs.	Toe & fingers	40-50 c.c.	17	Improved Pain relieved
3	M	36	8 mos.	Toe	40-50 c.c.	5	Unimproved
4	M	31	15 yrs	Amp. stump R. Toe L.	50-70 c.c.	6	Unimproved
5	M	38	3 yrs.	Amp. stump R. foot. Toe L.	40-50 c.c.	12	Improved Pain relieved
6	M	28	4 yrs.	Toe	50 c.c.	3	Unimproved
7	M	39	1 year	Toe	50 c.c.	2	Unimproved
	M	44	3 yrs.	Toe	50 c.c.	3	Unimproved

If relief from pain and improvement has taken place in two out of eight cases of advanced thrombo-angiitis obliterans it seems reasonable to hope that autohemotherapy (the injection of an endogenous protein) may prove of more value in early cases. This form of treatment is simple, safe, inexpensive and

applicable to out-patients. We hope it may be given a thorough trial in other countries especially where early cases of thrombo-angiitis obliterans are frequently seen.

With an increased knowledge of the disease, both on the part of the profession and laity, conservative measures should receive increasing emphasis. For the present, however, most Korean patients with thrombo-angiitis obliterans will probably need surgical treatment.

Surgical Treatment

The surgical treatment employed by us in thrombo-angiitis obliterans has been limited chiefly to amputation. The injection of absolute alcohol in the exposed nerve, as proposed by Silbert, was employed in one case without success.

Our experience with amputations has led to the proposal of the following general principles.

1. Give a thorough pre-operative preparation including rest, local applications of normal saline (hypertonic saline in infected cases), treatment for intestinal parasites and intravenous injections of hypertonic salt solution (5 percent), according to Silbert's method.

2. Avoid the use of a tourniquet. Digital compression of the femoral artery may be made whenever necessary.

3. Avoid local anesthetics in the region of the lesion. Primary anesthesia may be used for short operations such as the excision of a necrotic phalanx.

4. Avoid strong antiseptics, either before, during or after operation.

5. Use as few sutures as are necessary for the approximation of the edges of the wound and make no tension on the flaps.

In our group of fifty cases surgical procedures were carried out in thirty-seven (Table No. 5).

TABLE NO. 5.

*Surgery of the extremities in thrombo-angiitis obliterans.
Thirty-seven cases.*

O P E R A T I O N	No. of Cases
Amputation of toes (complete or partial)	13
Amputation below the knee	7
Amputation above the knee	14
Amputation of finger	1
Amputation of forearm	2
Total	37

Operation on the Toes. The toes were operated upon in thirteen cases as shown in Table No. 6. Eight complete amputations were performed of which four healed per primam, two by granulation and two failed to heal. Of two metatarsophalangeal disarticulations, without suture of the flaps, one healed by granulation and the second failed to heal. Healing by granulation occurred in all three cases in which exposed bone was excised. In the total of thirteen operations on the toes, four healed per primam, six by granulation and three failed to heal. Amputations of the leg and later the thigh were required in two cases. The first and second toes were most frequently involved.

TABLE NO. 6.

Operations on the Toes. Thirteen Cases.

No.	Age	Side	No. of Toe	Duration Symptoms	Type of Operation	Healed per primam	Healed by granul	Failed to heal
1	37	Left	1st	5 mo.	Excision of exposed bone		X	
2	32	Right	2nd	9 mo.	Amputation	X		
3	33	Right	1st	17 mo.	Amputation	X		
4	32	Right	2nd	6 yrs.	Amputation	-	-	X
5	25	Right	1-2-3	4 mo.	Amputation		X	
6	29	Left	1st	3 yrs.	Excision of exposed bone		X	
7	36	Left	5th	5 mo.	Amputation	X		
8	27	Left	3rd	7 yrs.	Disarticulation no suture		X	
9	35	Right	1-2	10 yrs.	Amputation		X	
10	34	Right	1st	6 mo.	Amputation			Discharged as X
11	34	Left	1-2-3	4 yrs.	Excision of exposed bone		X	
12	22	Left	5th	2 yrs.	Disarticulation no suture			X
13	19	Right	1st	4 mo.	Amputation	X		
					Totals	4	6	3

Amputation below the Knee. Seven amputations were performed below the knee, as shown in Table No. 7. In five cases, previous amputations had been performed elsewhere, including four of the toe (one an auto-amputation) and one of the opposite leg. Healing occurred per primam in four cases, was delayed in one and absent in two. The last two required secondary amputations. Case No. 1 is of special interest as the patient was seen on January 26, 1931, eight years after the amputation of the leg. The stump is still in good condition. The little toe of the left foot was recently frozen and dropped off. There is an ulceration on the outer side of the fourth toe. There is no gangrene of the fingers but the left radial pulse is absent and the left ulnar weak.

TABLE NO. 7
Amputations below the Knee. Seven Cases.

No.	Age	Side	Duration Symptoms	Previous operations	Site of ampu	Healed per primam	Delayed healing	Failed to heal
1	29	Right	3 years	Amp. toe	Upper 1/3	X		
2	27	Left	8 years	7 yrs. ago amp. toe	Lower 1/3	X		
3	36	Right	8 mo.	6 mo. ago amp. toe	Lower 1/3	X		
4	30	Left	7 years	6 yrs. ago amp. R. leg	Upper 1/3		X	
5	25	Left	3 years	Excis. tumor toe: 14 mo.	Upper 1/3			X
6	39	Left	3 years	—	Upper 1/3	X		
7	33	Right	3 years	Auto-amp. toe	Upper 1/3			X
Totals						4	1	2

Amputation above the Knee. A summary of the fourteen amputations of the thigh are shown in Table No. 8. Nine operations were performed on the left side and five on the right side of the thigh. Healing occurred by primary intention in twelve cases; it was prolonged in one and one patient died (cause undetermined) with the wound still unhealed. In four cases previous amputations had been performed on the toe, one on the opposite thigh and one on the finger. In four instances the femoral artery was found thrombosed at the site of amputation but there was a fair amount of collateral circulation.

TABLE No. 8

Amputation above the knees. Fourteen cases.

No.	Age	Side	Dura- tion symp- toms	Previous operations	Third thigh	Healed per primam	Delayed healing	Failed to heal
1	53	Right	9 yrs.	4 yrs. ago amp. toe	Lower	X		
2	45	Left	4 mo.	---	Middle			X
3	19	Right	1 yr.	10 mo. ago amp. toe	Upper	X		
4	26	Left	2½ yrs.	2 yrs. ago amp. toe	Lower	X		
5	37	Left	3 yrs.	---	Lower	X		
6	35	Left	5 yrs.	4 yrs. ago amp. R thigh	Lower	X		
7	29	Left	5 mo.	---	Lower	X		
8	33	Right	2 yrs.	---	Lower	X		
9	48	Left	4 yrs.	---	Lower	X		
10	27	Right	8 yrs.	2 yrs. ago amp. finger	Lower	X		
11	30	Left	6 yrs.	3 mo. ago amp. toe	Lower	X		
12	26	Right	14 mo.	Toe burned with oil	Lower	X		
13	30	Left	4 mo.	---	Middle	X		
14	60	Left	3 mo.	---	Lower		X	
				Totals		12	1	1

Amputation on the Upper Extremities. Three amputations were performed on the upper extremities (Table No. 9). In the first case an amputation at the middle third of the right forearm was performed on account of an infection of the hand following gangrene in the index and middle finger. Four days after operation serum collected and all the stitches except one were removed. Ten days later the wound began to heal and at the end of the third week following operation the wound was healed. In the second case an amputation of both thighs had been done four years previous. Four months ago the fingers of the right hand became gangrenous. An amputation was done on the upper third of the right forearm and the wound healed per primam. In the third case the little finger of the left hand was removed with healing by first intention.

6. There is a history of the use of tobacco, though in most instances not excessively, by ninety percent. of the patients.

7. Syphilis, alcohol, cold, diet, metabolism, nervous disposition and typhus fever play an unimportant part in the etiology of the disease.

8. We are unable to make any further contribution to the etiology but propose to continue our search for some toxin or organism as the direct causal agent of thrombo-angiitis obliterans.

9. Pain and varying degrees of gangrene of the toes, foot, fingers and hand are the chief complaints.

10. The number of patients, thirteen, who have received medical treatment only is too small to warrant any final conclusions. We suggest intravenous injections of hypertonic salt solution according to Silbert's method, as particularly applicable in the treatment of this disease, in the Orient.

11. Autohemotherapy, while still in the experimental stage, may prove of value in early cases of which, unfortunately, we see very few.

12. In thirty-seven cases having amputations, healing occurred per primam in twelve, was delayed in nine and absent in six cases. Most of the toe amputations may be regarded as conservative surgery.

13. With an improved economic condition and better knowledge of the disease, both on the part of the medical profession and laity, conservative treatment should be increasingly employed.

NOTE: My thanks are due to my Korean associates in surgery, Dr. M. U. Koh and Dr. Y. S. Lee, for their valuable co-operation in all this work; also to Dr. K. W. Chung for his contribution on autohemotherapy.

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THROMBO-ANGIITIS OBLITERANS**Treatment by Alcohol Injection of Wall of Femoral Artery**

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For several years we have been admitting from eight to ten cases of Thrombo-Angiitis Obliterans each year to this hospital, and in the journals that I see I have been greatly interested in the various ideas advanced for the treatment of these unfortunates. We have been using intravenous injections of normal saline solution for some two or three years, often giving it every day over long periods, and have certainly found this of great service very often. About a year ago I noticed an abstract of an article advocating the injecting of the wall of the femoral artery with alcohol for this condition and decided to try this out on my next suitable patient. This treatment is based on the idea that the nerve fibers controlling the expansion and contraction of the arteries of an extremity pass along within the wall of the main arterial trunk, such as the femoral artery in the leg, and when you block these fibers with alcohol you cause an expansion of all the arteries of that extremity, with a consequent improvement in the blood supply of that limb. Originally the operation was to take a knife and scrape off the outer arterial wall, for a distance of an inch, but the alcohol injections were found to be much safer and casier and fully as efficacious.

During 1930 we admitted twelve cases of thrombo-angiitis obliterans and I was able to try out this operation on eight of these. Four were so obviously hopelëss, with the gangrene so extensively developed that anything short of immediate amputation could not be thought of. Of the other eight, two had only a beginning cyanosis of the ends of the toes, more marked in some one or two toes, and the other six had fully developed gangrene of a portion of one toe, or perhaps of two toes, together with the characteristic cyanosis of some of the other toes of that foot, and all eight had that intense boring, aching, almost unbearable pain that is so characteristic of this disease.

The first one of these I operated on I found the femoral artery entirely without pulsation, this also being the case where the common femoral passed down into the leg from beneath Poupart's Ligament. It being much easier to find the obliterated, pulseless artery up near Poupart's Ligament, I went

in up there, found the artery entirely obliterated, just a band of round fibrous tissue, and carefully injected the wall of that band. This patient had the distal joint of the little toe gangrenous, with all the toes of that foot cold and blue, this cyanosed condition extending to the adjacent portion of the foot. He had been suffering intensely for weeks. I carefully injected the wall of the artery for a distance of about an inch and closed the wound in two layers. Although I had intended to amputate the gangrenous toe at the same time, I decided to wait and see first what would be the effect of the injection of the fibrosed arterial wall. That night when the anaesthesia had worn off (we did all these with spinal anaesthesia) I asked the patient how he felt, and he volunteered the information that his foot did not hurt as much as it had before the operation. By the next morning the cyanosis had largely disappeared from the foot, and a few days later we amputated the toe, and got prompt healing. However the wound where we had injected the artery broke down, turned black around the edges and gave some anxiety for several days before it finally healed up. The patient was discharged in about twenty five days in good condition, with apparently a good foot. He was instructed to return if any further trouble developed, but so far he has not returned.

The second patient we injected had only cyanosed toes, and the characteristic severe pain. On examination we found the femoral artery pulsating, and we injected this in Scarpa's triangle. Immediately following the injection, even before we closed the wound, the foot was seen to be of a pinker color and was distinctly warmer to the touch. That night the patient also told us that his foot no longer pained him, and he went on to a prompt and uneventful recovery, was discharged and has not returned.

The third case had two toes gangrenous, and the artery was entirely without pulsation at Poupart's Ligament. This one we injected in Scarpa's triangle, afterwards the wound broke down, but later healed satisfactorily. We amputated the two gangrenous toes at the same operation, these wounds also healed promptly, and the characteristic pain was fully relieved. The fourth operation was on a case that had one toe slightly gangrenous underneath, and with only faint pulsations of the common femoral discernable. This case we operated on in Scarpa's

triangle, and injected the artery wall, with the needle once slipping through the wall into the lumen of the vessel. The patient reported full relief from the pain, but three days later the wound broke down and that night there occurred an extensive haemorrhage, necessitating cutting and tying the artery, as there was a large erosion of its wall. I was uneasy about this, but the wound healed well, the toe healed up without any operation, with just the small black patch of gangrene underneath it sloughing off, and the patient was discharged in thirty days in good condition, and so far has not returned.

The fifth case we injected, who had only cyanosis of the toes, made a complete and prompt recovery, with full relief from the pain. The sixth case was not benefited at all apparently by the injection of the artery wall, and went on to amputation of the leg above the knee. There was no pulsation in the common femoral in this case. The seventh case did well, made a prompt recovery after injecting the artery wall and amputating a toe at the same operation, went home in good condition, but returned a week ago for a recurrence in the next toe to the one we amputated. The eighth case was apparently not benefited by the operation, and we had to amputate the leg below the knee.

One of these patients had also two fingers of his right hand cyanosed and paining him. After much difficulty in finding it, and identifying it, we injected the brachial artery in its upper portion, and although it was not pulsating, was fibrosed and hard like a cord, the pain ceased in his hand, one finger cleared up promptly and the other we amputated later through the distal joint, and he went home well pleased.

To summarize our results, out of twelve cases admitted last year, we promptly on admission amputated four legs, as being too advanced to hope for any good effect from injecting the artery wall. Of the other eight cases, we injected the wall of the femoral (or higher up, the common femoral, in two cases) with 95% alcohol, and found that six of these were markedly improved, with two failures, and one of those markedly benefited has since returned with a recurrence of his former trouble.

However I should here add that in addition to injecting the wall of the artery as I have described, we treated all these

patients by intravenous injections of normal saline. We wished to see what benefits we could get by injecting the alcohol, but as we were certain of some benefit at least from the saline, we didn't think it fair to the patient to omit this, just to experiment on another method of treatment. However the immediate effects in the prompt relief of the pain, and the improvement in the color and temperature of the foot were almost dramatic and highly desirable, and these cases did far better than any other cases we have treated by other methods. Also I fully realize that the time elapsed has been entirely too brief, for a disease with the characteristics of thrombo-angiitis obliterans, and the number of cases much too few to justify any conclusions as to the ultimate value of this method of treatment. This is being offered simply as a suggestion for those interested to try out for themselves, in the belief that this operation may be a valuable procedure in the treatment of these unfortunates whom all working in the Orient often see.

The operation itself is very easy and simple: merely cut down to and dissect out the artery, slip a bit of gauze underneath it to help rotate it while injecting its wall, and to take up any of the alcohol spilled from the needle, and using a fine needle and a small syringe, inject 95% alcohol all the way around the wall of the artery, for at least half an inch longitudinally, being sure to inject the entire circumference, so as not to miss any nerve fibers. Then close up the wound. It does not take fifteen minutes if the artery is pulsating and therefore easy to find; it has taken us longer at times when the artery was only a band of fibrous tissue. Ordinarily I would be inclined to think that an artery entirely obliterated, even if injected, would not result as satisfactorily as one that was pulsating, however this has not been entirely the case in our experience, limited though of course this is. The artery turns a dirty grey brown color when injected, sometimes perhaps with a whitish tinge instead of a brown one.

I would not suggest that this method of treatment be used to the exclusion of any other satisfactory methods of treating this disease, but only advocate its use in addition to any other methods found helpful; it can certainly do no harm, and in our limited experience we believe that it often greatly helps.

**THE CONSERVATIVE TREATMENT OF
THROMBO-ANGIITIS OBLITERANS**

**A Report of the results of ligation of the Femoral Vein
in six cases**

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In view of Van Gorder's,* conclusions with regard to the conservative treatment of Thrombo-angiitis Obliterans, the results of treatment of the following cases may be of interest.

Case A.

Male. Age about 60.

General condition—toxic and very emaciated.

Local condition—Gangrene of half of left foot. v. photo.

Treatment. Ligation of Femoral Vein in Scarpa's triangle.

Result. Some local reaction and separation of gangrenous tissues.

Patient's condition too bad to stand further operative interference. Patient died of toxæmia.

Case B.

Male. Age 43.

General condition. In general of healthy appearance with a typical Thrombo-angiitis facies—the result of long drawn out agony. Kahn Test negative.

Local condition. Left foot, five metatarsal bones exposed and bare of flesh. v. photo.

Treatment. Femoral Vein ligated in Scarpa's triangle. Dead bones removed.

Result. Marked relief of pain within two days. Granulations appeared at edge of wound, which gradually healed.

When the patient left hospital the whole of the ulcerated area was healed, and the foot and leg were free from pain.

*Van Gorder. The conservative treatment of Thrombo-angiitis Obliterans. *C. M. J.*, March 1929.

Case C.

Male. Age about 30.

General condition good. Thrombo-angiitis facies.

Kahn Test negative.

Local condition. Left foot three toes ulcerated off.

Large ulcer showing no signs of healing.

Treatment. Ligation femoral vein in Scarpa's triangle.

Result. Gradual decrease in intensity of pain. Ulcer slowly healed up. Patient returned home with ulcer incompletely healed. v. photo:.

Later patient returned to hospital—two small sequestra came away from ulcer, which healed rapidly.

Case D.

Male. Age 64.

General condition. Toxic and emaciated. Thrombo-angiitis facies. Kahn Test negative.

Local condition. Right foot tarsals ulcerated off.

Metatarsals exposed. Tissues gangrenous and full of maggots. v. photo:.

Treatment. Femoral vein ligated in Scarpa's triangle.

Result. Some local reaction. No relief from the pain.

Toxaemia increased. Patient was taken home *in extremis*.

In two other cases ligation of the Femoral Vein was not effective in relieving the pain or in causing any marked improvement in the local condition—in one case half of the foot was ulcerated away, Case E., and in the other case the ulceration extended above the ankle leaving a foul septic stump.

In both of these cases high amputation was performed, and the popliteal artery was found to be occluded. The amputation wounds however healed well, and both patients returned home free from pain.

In spite of the fact that only six cases have been treated, that these notes are very incomplete, and that it has not been possible to follow up the successful cases for any length of time, it is felt that the results may be of sufficient interest to justify reporting.



Case A.



Case B.



Case C.



Case D.



Case E.

THROMBO-ANGIITIS OBLITERANS

Treatment by Ligation of Femoral Artery and Vein below the Deep Femoral Vessels

Report of a Case

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Hospital number E8406, Chinese, male, farmer, married, age 29, native of Shantung. The patient entered the Shantung Christian University Hospital, Nov. 19, 1930.

Complaint. Ulcers on the toes of both feet.

The family and past history bear no relation to the present illness. There is no history of others of the same village having the same condition. The patient denies venereal and infectious diseases. The present condition began two years ago with a bruise and later ulceration of the small toe of the right foot due to tight shoes. The toe gradually swelled and the ulceration deepened and enlarged. The pain was not very severe. About a year after the process began the toe dropped off. The pain did not prevent the patient from walking. After walking a mile or more he experienced throbbing pain and swelling over both calves of the legs. Two months before the patient was admitted there was severe pain in both great toes, redness of both feet and a blister followed by ulceration appeared on the right great toe. Just before admission the pain over the right great toe and foot had decreased but that of the left foot had increased at night.

The general physical examination is negative except that the patient is thin and has an anxious expression.

The right foot is slightly congested. In the place of the small toe there is a deep penetrating ulcer. The great toe is discolored. The skin is hard and dead looking. The tips of the 2nd, 3rd and 4th toes show the same change. The great toe of the left foot is discolored and the skin is hardened, but there is no ulceration. The skin over both feet is cold. The patient lies with both legs drawn up, he does not like extending them. He complains of "numbness" which prevents him from sleeping but says there is no pain. The dorsalis pedis arteries of both feet do not pulsate.

Blood pressure, S128, D72. Urine acid, 1026, no albumin nor sugar. Hemoglobin 100. RBC 5,130,000. WBC 12-14,000. Wassermann negative. Temp. 37.5 to 38.5.

Diagnosis. Thrombo-angiitis Obliterans.

Amputation was advised but the patient refused.

Ligation of the femoral artery and vein was decided upon.

Spinal anesthesia, neocain .25 gram. The femoral artery and vein exposed in Scarpa's triangle. There was no evidence of inflammation about the vessels. A section of the artery was removed, the vein was cut and tied. The wound healed *per primam*. Examination of the section under the microscope shows slight thickening of the intima due to increase of fibrous tissue. The internal elastic lamella in most places is normal. The media appears normal. The walls of the blood vessels in the adventitia are slightly thickened. A sharp line formed about the discoloration on the toes. Because of the definite objective improvement it was decided to repeat this procedure upon the left leg three days after the first. The sharp line of demarcation which had formed about the gangrene of the toes of the right foot began to extend on the fifth day. After ligation of the vessels of the left leg the line of demarcation became clearer, then on the fourth or fifth day began to extend in the same way as upon the right foot only not so far up. Upon the right foot the line stopped just below the anterior annular ligament of the ankle joint. The subjective symptoms were in no way improved. Amputation was urged but the patient refused and left the hospital against advice. Eight days after discharge the patient requested readmission for amputation. The gangrene was of the moist variety with infection. There had been no extension since the discharge. Temp. 38.5-39. The pain was severe.

Under spinal anesthesia amputation above the knee joint was done. There was an uneventful convalescence with a good stump resulting for which a plaster bucket was made. An attempt to inject the posterior tibial artery was made with a thin solution of bismuth with the idea of taking an X-ray to determine the patency of the vessel but the solution could not be injected because the vessel was thrombosed. Fifteen days after the first amputation the left leg below the knee joint was

also amputated under spinal anesthesia with good healing of the stump and a plaster bucket was also made for this stump. There was an improvement of the general condition of the patient and a gain in weight. He was discharged two months after the second admission.

Comment. We have here a young man with slowly progressing gangrene of the toes of both feet, and with pain in the calves of the legs very much like intermittent claudication; also there is absence of pulsation of the dorsalis pedis arteries of both feet. From these symptoms and signs we are warranted in diagnosing the condition as thrombo-angiitis obliterans. With the hope that the disease process might be stopped, the extension of the gangrene checked and so make it possible to amputate low on the foot, a ligation of the femoral artery and vein below the deep femoral vessels was done. This procedure was suggested by the report of three cases treated in this way with encouraging results by G. L. McWhorter reported in the *The Surgical Clinics of North America*, 1930, Vol. X, p. 283, abstracted in the *International Abstracts of Surgery*, Oct. 1930, p. 340.

The places of amputation were probably the same as they would have been had the ligation of the vessels not been done, but because of the apparent direct relationship of the extension of the gangrene to the ligation of the vessels we feel that we should report this case.

THROMBO-ANGIITIS OBLITERANS IN SIAM

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(Extracts from a paper in the *Lancet*, 7th February 1931)

Analysis of Cases

The number of cases in my series (15) is not large but serves to point out the existence of this disease in Siam and how it differs from that seen in western countries. Of the 15 cases 14 were males and one a female; 12 were Siamese and 3 were

TABLE

No.	Nationality and Occupation.	Sex and age at onset.	Habits	Limbs affected and duration.	Treatment.
1.	Siamese: farmer	M. 31	Cigarettes.	Both legs, 3½ y. Both arms, 4 m.	Per. symp. both arms: amp. toes.
2.	Siamese: vendor	M. 33	Alcohol, tobacco, opium, Ind. hemp.	Both arms, 4 y. Both legs, 3 y.	Per. symp. both legs: amp. toes.
3.	Siamese: farmer	M. 37	Cigarettes Ind. hemp.	Both legs, 2 y.	Per. symp. amp. toes.
4.	Chinese: rice-miller	M. 38	Alcohol, tobacco, opium.	L. leg, 4 y. R. leg, 4 m. Both arms, 1 y.	Per. symp. both arms and R. leg amp. toes.
5.	Siamese: coolie	M. 38	Cigarettes, Ind. hemp, alcohol.	Both legs and both arms, 3 y.	Per. symp. both legs and arms, amp. toes.
6.	Chinese: vendor.	M. 26	Cigarettes	L. leg, 2 y.	Per. symp. amp. toes.
7.	Siamese: farmer.	M. 35	Alcohol, tobacco, Ind. hemp, opium.	L. leg, 5 y.	" "
8.	"	M. 34	Cigarettes, alcohol, Ind. hemp, opium.	R. leg, 3 y. L. leg, 2½ y. R. arm, 2 m.	Per. symp. both legs: amp. toes & fingers.
9.	Siamese: gardener.	M. 27	Cigarettes.	Both legs, 4 y. Both arms, 3 y.	Per. symp. both arms and legs. Amp. toes & fingers.
10.	Siamese: farmer.	M. 26	Cigarettes.	R. leg, 4 y.	Per. symp. amp. toes.
11.	Siamese: civil servant	M. 32	Cigarettes, alcohol, Indian hemp, opium.	Both legs, 5 y.	Amp. below knee; L. leg.
12.	Siamese: domestic servt.	F. 34	Betel-nut.	L. arm 6 y. R. arm, 2 m.	Medical measures.
13.	"	M. 36	Tobacco, opium.	Both legs, 2 y. Both arms, 2 m.	"
14.	"	M. 26	Tobacco, alcohol.	Both legs, 3½ y. Both arms, indefinite.	Per. symp. both legs.
15.	Chinese: teacher.	M. 30	Tobacco.	Both legs, 3 y. Both arms, 3 m.	Per. symp. both legs and arms.

Chinese, the female being a Chinese. The age at the onset of symptoms has been noted in each case; the youngest patient of the group was 26 and the oldest 38, while the average age at the onset of the symptoms was 32. The majority of the patients have an outdoor occupation; 6 are farmers, 4 coolies, and 2 outdoor vendors, while a teacher, a civil servant, and a rice-miller account for one each. This does not necessarily mean exposure, as the climate of Bangkok reaches a maximum of 100°F. to 104°F. each year during the hot season and about 95°F. at some time or other during almost every month of the other seasons. During the hot rainy season, March to October, the temperature rarely falls below 80°F., and during the so-called cool season, October to February, the temperature rarely falls below 60°F. These patients go about without shoes and subject their feet to minor traumata which sooner or later precipitate the onset of gangrene. All except one in this series are heavy cigarette-smokers; the one exception is the female patient, and she habitually chews betel-nut. In addition to smoking cigarettes, six of them habitually smoke opium, six take Indian hemp, and six alcohol in excessive quantities. A number take all three drugs, opium, Indian hemp, and alcohol. These drugs were taken for the relief of pain in the first instance; as the pain increased in severity the dose was correspondingly increased. The Siamese, and particularly the Chinese, have less appreciation of pain than the European, so that in many cases the taking of opium and Indian hemp relieves the pain sufficiently, and if it is taken over a sufficiently long period it enables a natural cure to take place without any other form of treatment.

The disease may affect one limb only and undergo a natural cure, or two legs or two arms may be affected, but generally one before the other. On the other hand, one leg may be affected, then both arms followed by the remaining leg, the disease in that way being spread over a period of four or five years; in other cases all four limbs may be affected simultaneously. The duration of the disease depends on the rate of development of the collateral circulation; it may be more than five years before a natural cure takes place, even with the aid of drugs, physiotherapy, and periarterial sympathectomy. Of the 15 cases, eight had all four limbs affected, one had three limbs, three cases two limbs, and three cases one limb. The average duration of the disease before coming for treatment in the eight cases where

all four limbs were affected was 3 to 4 years; in the cases with three limbs affected 3 years, two limbs 4.3 years, and one limb 3.9 years, so that the length of time appears to have no bearing on the number of limbs affected. The Wassermann reaction was negative in all except one case, and that was probably incidental.

The surgical procedures carried out have been confined to periarterial sympathectomy and amputation of fingers and toes. Only in one case was a major amputation performed and that was at the junction of the upper and middle thirds of the tibia; a small part of the tip of the anterior flap necrosed, but otherwise it healed satisfactorily. These operations are much less mutilating than the major amputations performed for this disease in western countries. In one case the dorsal interosseous artery in the right forearm was distinctly palpable and had taken the place of the right radial, illustrating again that in thrombo-angiitis obliterans only the main arterial trunk of the limb is closed, the other vessels being more or less normal—in contrast to arterio-sclerosis where the main arteries of the limb are patent but the collateral circulation is absent.

Treatment

Unfortunately there is no specific treatment for the inflammatory process, but if the disease is diagnosed early and careful prophylactic treatment instituted to diminish the functional demands on the local circulation, much can be done to relieve the sufferings of the patient and limit the spread of the gangrenous process. The circulation can be improved by the intravenous injection of foreign proteins, radium chloride, sodium citrate, or Ringer's solution, combined with application to the extremities of hot-air baths and diathermy. The patient should also be instructed in the avoidance of minor traumata to the extremities, the protection of the toes, and the treatment of any local condition which may develop.

By periarterial sympathectomy the circulation will be further improved and the pain further relieved. In Buerger's disease pain dominates the situation much more than does gangrene, and time that is free from suffering is time gained. During this interval of freedom a collateral circulation is gradually developing which will either render an amputation

unnecessary or enable it to be done at a lower level. The object of periarterial sympathectomy is to divide the afferent and efferent sympathetic fibres and thereby abolish vaso-constrictor control over the whole of that portion of the vessel which is distal to the point of division, as well as to abolish the pain. In practically all cases the effects of the operation are an initial vaso-constriction, which is probably due to local trauma, followed very soon afterwards by vaso-dilatation, a rise in the temperature of the limb, and relief of pain. Periarterial sympathectomy relieves pain and on that account alone justifies its performance in thrombo-angiitis obliterans.

The treatment formerly advised was early and high amputation, because of the patient's inability to endure pain but conservative measures, if carried out for long periods, will prevent the development of gangrene and most of the major amputations. There is a stage in this disease of acute or subacute vascular insufficiency, and if the patient can be carried past that stage without gangrene developing, sufficient collateral circulation will usually be established to leave the extremity adequately supplied with blood. In this series only one had a major amputation, and others had amputations of digits only. In thrombo-angiitis obliterans we are dealing with a process the striking feature of which is a collateral circulation, in contrast to arterio-sclerosis where the collateral blood-supply is poor. This further bears out the well-known fact that amputation below the knee is rarely satisfactory in arterio-sclerosis, whereas in thrombo-angiitis obliterans minor amputations are the rule and are successful in the great majority of instances.

Conclusions

1. Thrombo-angiitis obliterans has a universal distribution; in all probability it is as common in the East as in the West.
2. In the East it appears to be of a milder type than in the West.
3. Major amputations are now rarely necessary; operative treatment, apart from sympathectomy, is almost entirely confined to removal of fingers and toes.
4. The relief from pain by periarterial sympathectomy is very striking; it gives time for a collateral circulation to develop.

ELASTIC SOFT PALATE AND UVULA

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A patient consulting the writer for post-nasal inflammation, demonstrated the point of irritation by, what was to him, the simple method of running the tip of his tongue up behind his soft palate. The picture presented by the tongue extending up into the nasopharynx with the soft palate and uvula pushed forward, and resting on the under surface of the tongue, was most striking. The patient did not consider his act at all unusual, because as he said, he could not remember a time when he had not been able to run his "tongue up into the back of the throat." Also there was nothing in connection with this condition of the soft palate and uvula which gave him any inconvenience, with the possible exception of some difficulty in singing, but inasmuch as he had a very poor ear for music, this did not bother him.

With the soft palate at rest, there was nothing to distinguish it from the normal. The uvula was perhaps slightly longer than usual but did not touch the base of the tongue. On phonation the palate was lifted well into the nasopharynx; nor were there symptoms of paralysis such as alteration of vocalization for certain words, or fluid regurgitation through the nose.

Sensation however, over the entire soft palate, as well as the pharynx and nasopharynx, was greatly reduced. The writer's finger could be introduced into the nasopharynx and the entire area explored at leisure without causing any feeling of discomfort or producing the gagging reflex. Furthermore it was possible to lift the soft palate upward with a straight instrument and view directly the vault and lateral walls of the nasopharynx.

As the writer was on the point of sending off the report of the above case a second patient was referred to the nose, throat and ear service for nasal obstruction who demonstrated the point of nasal obstruction by running his tongue up into his nasopharynx. He stated that he had, what he had been led to think was an enlarged adenoid, which became large enough at times, to block his breathing. The location of this variable



CASE 1.

The tip of the uvula is grasped and extended outside the mouth.



CASE 2.

The tongue is extending up into the nasopharynx with the soft palate and uvula pushed forward.

body was described by the patient to be to the right of an "up and down ridge," which he could feel with the tip of his tongue. On post-rhinoscopic examination, the posterior end of the right lower turbinal was found to be somewhat enlarged, probably compensating for almost complete obstruction of the left nasal space by a markedly deviated septum.

This patient had never noticed anything wrong with his throat and did not know that he was doing something unusual when he ran his tongue up into the nasopharynx, an act which had started early in childhood. He admitted, however, that he had difficulty in singing high notes.

The soft palate and uvula were normal in appearance and on phonation were raised well into the nasopharynx. There was no history of regurgitation of fluids or any other symptoms to indicate partial paralysis.

Sensation over the soft palate and uvula was somewhat more normal than in the first case, but still greatly reduced. The gag reflex was quite active and it was not easy to explore the post-nasal space with the finger without setting it off. If, however, the soft palate was lifted without touching the posterior pharyngeal wall, the gag reflex did not operate, and there seemed to be no sense of discomfort to the patient. The uvula could be grasped, and extended some distance forward, but was several degrees less elastic than in the first case.

As intimated above, this condition had been present in both cases since early childhood, and perhaps from birth. It probably was an idiopathic condition and similar in character to Ballenger's case of elastic uvula reported many years ago in his text book. As with Ballenger's case, the elasticity of the parts could be demonstrated by grasping the tip of the uvula and extending it outside the mouth in the first case; and almost to the incisive teeth, in the second.

These cases are reported primarily as a matter of interest, but it is germane to such a report to say that a mild degree of elasticity and anaesthesia probably exists in a far larger percentage of our patients than we suspect. Routine examinations disclose a great variation in the sensitiveness of throats, and the ease with which they are manipulated.

THE PHYSIOLOGICAL ACTION OF LIGHT*

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It must at once be pointed out that the title of this paper is inaccurate, for Laurens clearly explains the fallacy of applying the term 'light' to radiant energy, whether visible or not. Light can refer only to visible radiant energy, and the inaccuracy in speaking of ultra-violet or of infra-red 'light' is obvious. I have ventured to use the term incorrectly, because our ultra-violet and infra-red radiations are derived chiefly from sources of light, and associated in our minds with the visible portion of the spectrum. In the same way, Laurens uses the term radiation, when he means 'radiant energy,' but the former term is sanctified by usage, and is more convenient.

The action of 'light,' in its broader connotation, on biological materials is a subject of both theoretical and practical importance. However it is a field beset with difficulties, as investigators have discovered. Observations of the action of light on life have been made since the dawn of history, and it is not insignificant that the sun has been worshipped by so many races. A mass of observations has steadily accumulated, but unfortunately our fundamental, theoretical knowledge has lagged far behind. This is not inexplicable, because the experimental difficulties are considerable, and even the science of pure photochemistry is not much better off. It is only in the last thirty years that the revolutionary investigations in the field of radiation have elucidated the structure of matter, and the mode of interaction of radiant energy and matter. The fundamental physics and chemistry of physiological light action must be worked out before we can hope to make any really significant advances in this interesting field.

Nature of Radiant Energy.

Many famous names have been associated with researches in the field of radiation. Since Newton, Faraday conceived and

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Maxwell formulated the electromagnetic theory; Hertz and Helmholtz demonstrated its truth experimentally. Scheele discovered photo-chemistry, when in 1777 he observed that silver chloride darkened on exposure to light. In 1819 Grotthus enunciated the first law of photochemistry—that only the rays which are absorbed are capable of producing photochemical change. This law which seems axiomatic now was independently announced by Draper in 1846. The Herschels discovered the infra-red spectrum, and Becquerel first photographed the ultra-violet.

It is well-known that radiation is the transfer of energy through the ether by means of electromagnetic waves. These waves may differ enormously in length, but all have the same velocity of 299,796 km. per second, or approximately 186,000 miles per second. The unit commonly used to express the wavelength of light waves is the Angstrom Unit, or A. U. It is equal in length to 10^{-10} metres or about four one-billionths of an inch. The following table gives the wavelengths of the known ranges of radiation.

TABLE I.

Hertzian Waves, (Radio)	1,000,000 — 0.1 cm.
Infra-Red	3,000,000 — 7500 A. U.
Visible	7500 — 4000 A. U.
Ultra-Violet	4000 — 75 A. U.
X-Rays	12 — 0.1 A. U.
γ -Rays	1.3 — .07 A. U.

Sources of Light.

There are several sources of radiant energy in common use, and of these the most important experimentally and clinically are the sun, carbon arc and quartz mercury vapour arc. The sun is of course our only important natural source of light. In comparing the effects of these various sources, it is of the utmost importance to measure not only the total energy output, but also the spectral energy distribution of the radiation emitted. This means the relative energy of each wavelength in the radiation in question. Coblenz, radiation physicist at the Bureau of

Standards, Washington, has done an immense amount of very valuable work in this field, and has analysed various lamps under different conditions.

For measurement of radiant energy, there are several methods available. The three most important are the thermo-electric, the photochemical, and the electron discharge. The first, represented by the thermopile and bolometer, is the most accurate and sensitive and the only absolute method. However the technique is too difficult for any but the trained physicist. The second method is the one most commonly used by biological and clinical investigators in measuring ultra-violet, and takes advantage of the actinic properties of that radiation. Eders exposes sensitive paper to the radiation and measures the degree of darkening in a photometer. Hill uses the acetone-methylene blue method, in which the bleaching of the blue dye is measured. Bering and Meyer devised the convenient iodide method, in which a solution containing sulphuric acid and potassium iodide is irradiated, and the liberated iodine titrated with thiosulphate. Miss Clark takes advantage of the darkening of lithopone, while Robinson and Anderson irradiate oxalic acid containing uranyl salts. The latter method has been standardised to give absolute results.

The measurement of radiation to be used in therapy is of great importance. Especially with ultra-violet, high intensities may cause much harm.

The spectral energy distribution of the common light sources has been fairly well worked out. Solar radiation is stated to cover the range 2900—50,000 A.U. or practically 3000—30,000 A.U. The atmosphere changes considerably the distribution, as the following table shows:

TABLE II.

	Upper Atmosphere	Earth's Surface.
Total Energy	2 cal/cm ² /min.	1 cal/cm ² /min.
Ultra-Violet	5%	1%
Visible	52%	40%
Infra-Red	43%	49%

The shorter waves are more readily absorbed by the atmosphere, as Langley's values show:

TABLE III.

Region	% Transmission
Ultra-Violet	39
Violet	42
Blue	48
Green	54
Yellow	63
Red	70
Infra-Red	76

That different sources of light have entirely different energy distributions is shown by the following table:

TABLE IV.

Source	Total	Ultra-Violet	Visible	I. R.
Sun (earth's surfac-)	1 cal.*	1%-01 cal.	40%	59%
Carbon Arc. (25 amp. at 40 cm.)	1 cal.	22%-02 c.	43%	35%
Mercury Arc. (at 40 cm.)	0.1 cal.	20%-02 c.	60%	20%

* calories per sq. cm. per minute.

It is apparent from these figures that a carbon arc of the same total intensity as the sun contains 22 times more ultra-violet. Also a mercury arc, giving only one-tenth the total intensity of the sun, may contain twice as much ultra-violet. Even sources giving the same amount of total ultra-violet are not necessarily comparable; in sunlight, only 5% of the ultra-violet is below 3000 A.U., whereas in the mercury arc 20% of the ultra-violet may be between 1850 and 3000 A.U. The significance of these figures will become apparent later.

Of all artificial light sources, the carbon arc approximates most closely the sun, but is still very different in having much more ultra-violet.

The transmission values of the most common media are interesting and important. For infra-red, glass transmits up to 30,000 A.U.; water up to about 14,000 A.U. The rays above that to a certain point are absorbed. The lower limit of transmission is in the ultra-violet:

glass	transmits	down to	3500	A.U.
water	„	„	2000	A.U.
quartz	„	„	1850	A.U.

The radiation of the mercury arc is variable, depending upon age and temperature, among other things. It has been stated that after 1000 hours of usage, the ultra-violet output falls to one-third of its original value, because of devitrification of the quartz. Great interest has been aroused lately in the new artificial ultra-violet transmitting glasses. The earlier products met with disfavor, because the transmission values fell off on use to an unfavorably low level. Glasses are now being produced whose permanent ultra-violet transmissions are very high, and the Corning Glass Works have produced a glass which transmits 86% of the rays at 2900 A.U. and is only slightly more expensive than ordinary glass.

Fundamental Considerations.

Our knowledge of the exact nature of the action of radiation on protoplasm is largely empirical. We know that the absorption of radiation follows the Lambert-Beer Law, which states that the fraction absorbed by a given thickness of protoplasm is independent of the intensity. This results in a logarithmic relation between thickness and intensity. The Grotthus-Draper Law also applies, that only absorbed radiation has any effect. In the ultra-violet region, the absorption rises rapidly with decreasing wavelength. The short Schumann rays (2000—1250 A.U.) are very completely absorbed and are very destructive. The quartz rays (above 1850 A.U.) are absorbed chiefly by the nucleus of a cell; cell division is inhibited. Bovie has demonstrated that protoplasm can be sensitised by heat to destruction by ultra-violet.

Downes and Blunt in 1877 first observed the bactericidal action of light, showing that the effect was due to the shorter waves, and to a direct action on the protoplasm of the cell. Destruction of simple cells by ultra-violet is due to a direct disruption of the protoplasmic complex. Henri showed that the

bactericidal rays are the ones absorbed by protein. Among the amino acids, the aromatic ones have very strong absorption in the ultra-violet. Harris and Hoyt demonstrated that the lethal rays could be completely absorbed by a 1% tyrosine solution.

Toxins are not very photostable, but antitoxins are stated to be fairly resistant to ultra-violet. Antibodies are destroyed. Enzymes are universally destroyed by ultra-violet, and with maximum sensitivity at the pH of optimum activity, according to Pincussen. Downes and Blunt were also the first to show that zymase was inhibited by sunlight in the presence of oxygen. The writer has demonstrated that urease is readily destroyed by short infra-red, an unusual effect to be ascribed to the non-actinic heat rays.

Action of Light on the Skin

Laurens, in his review, discusses the effect of radiation on certain functions and tissues of the animal body. He takes up first the skin; most of the light effects must be through or in the skin. Penetration is here of prime importance. Visible light, especially the red, can penetrate several centimeters of tissue, according to Jesionek. Living and dead skin are little different, but pigment and blood affect the penetration considerably. The penetration of ultra-violet into the skin is only superficial, for Hasselbalch showed that skin of 1 mm. thickness transmitted only .006% of the wavelength 3130 A.U. This is very important, for many extravagant claims have been made on the basis of the penetration of ultra-violet into the body. As a matter of fact it is only superficial, and ultra-violet can act only in the skin, or superficial capillaries. Sonne found that the penetration of infra-red was very considerable, the shorter waves penetrating several centimeters of tissue. He believes that the action of light on the body is due to local heating by these longer heating waves. Some people attribute sunstroke to the ultra-violet, but as seen from the above data, this is highly improbable. It is more probably due to the infra-red, which is very intense in the strong summer sun, penetrating to the medulla or spinal cord, and exerting its harmful effect.

Erythema and pigmentation are the two most obvious effects of light on the skin. On exposure to sunlight there is an immediate erythema due to heat, then a later erythema due to the action of ultra-violet on the cutaneous capillaries, causing inflammation.

Sunlight is stated to be a better pigmenting agent than any of the artificial sources of light. The very short ultra-violet produces violent inflammation, but very little pigmentation. According to Dorno, the most efficient region for pigmentation is in the region of 3000 A.U. Pigment is of course a protective mechanism against the harmful ultra-violet.

Opinion is divided as to the desirability of pigmentation in therapy. Some, as Rollier and Jesionek, regard its presence as favorable, because they believe that the therapeutic action of light is due to the local heating, and pigment acts as an absorbing screen. Finsen and Hasselbalch are convinced of the value of the ultra-violet, and naturally regard pigment as unfavorable, because it cuts off the desirable rays. Acquired pigment is extracellular, whereas the normal pigment of the negro is intracellular. Melanin is a tyrosine derivative, but the mode of formation under the action of light is unknown.

Bernhard, "the father of modern heliotherapy," was inspired to study the action of light on wounds by observing the curing of meat in the mountain sun. He secured striking improvements in wounds, burns and extrapulmonary tuberculosis, believing his results to be due to a stimulation of epithelisation by the longer waves. These visible and infra-red waves increased the blood supply, but ultra-violet was believed to be harmful.

The Action of Light on the Eye.

I shall not discuss the problem of vision, but other effects of radiation on the eye. Of prime importance again is the absorption of different radiations by the eye media. The following table gives the lower limit of transmission for the eye media:

TABLE V.

Medium	Transmission
Cornea	2330 A. U.
Aqueous Humor.	2570 A. U.
<u>Lens</u>	<u>3650</u> A. U. (approx.)
Vitreous Humor.	2260 A. U.

The lens is seen to be the least transparent portion of the eye, and its transparency governs that of the eye as a whole. It depends on the protein content, and varies in different individuals and at different ages.

The transparency of the lens decreases with age, as the protein content increases. At four years, the lens transmits down to 3060 A.U. on the average. At 65 years, this value has risen to about 4190 A.U., and the average is taken as about 3660 A.U. Hence this is the average lower limit for the whole eye. The striking fact is that the active ultra-violet, below 3000 A.U. cannot reach the retina, and the latter cannot be damaged by ultra-violet radiation. For infra-red, the transparency is about the same as that of water, up to about 14,000 A.U.

In man the wavelengths 3900 to 7600 A.U. are visible, but these limits are not exact, depending on the individual and the intensity of the light. Some persons can see ultra-violet down to 3130 A.U. if intense enough. The total energy of ordinary lamps is about 90% absorbed before reaching the retina, but only 25% of the energy of direct sunlight is absorbed, hence the possibility of injury. The ultra-violet below 2900 A.U. cannot reach the retina, but can produce corneal ulcers and conjunctivitis. The carbon and quartz mercury arcs are very injurious to the eyes, due to the large output of short ultra-violet.

The retina can be injured by very intense visible radiation, and by moderately intense infra-red, due to its heating effect. Verhoeff claims that snow-blindness is a general heating effect, due to the considerable increase in total intensity of the light. Glass blowers' cataract is due to the longer heat rays. There are various theories to account for senile cataract. Some investigators believe that it is due to the accumulated effect of ultra-violet on the lens. Burge thinks that it is a protein precipitation, while Hartridge and Hill believe that the responsible factor is a lack of secretion and nourishment to the lens.

Coblentz discusses protective glasses for work involving exposure to infra-red or ultra-violet. For the former he recommends black, yellow, green and gold-plated. For the latter, black, amber, green and red glasses were found most effective.

The Circulation and Blood.

Irradiation has some slight effect on the general circulatory system. It lowers the blood pressure, due to cutaneous dilatation and hyperaemia. Bach measured fall of pressure of 7 mm. and a slightly increased pulse rate in his subjects. Reed observed a reflex fall in blood pressure on illuminating the eyes of anaesthetised dogs.

Most diverse results have been obtained by observing the action of light on the blood. Jesionek states that the anaemic appearance of workers in dark rooms and of polar explorers is due to a decrease in peripheral circulation. There is not necessarily any reduction in pigment, some having very high hemoglobin values. We have seen that one effect of light is to stimulate the peripheral circulation. Laurens showed that irradiation increased the reds, whites, platelets, hemoglobin and H-ion concentration in dogs' blood. It decreased the blood volume, and clotting time. Levy believes that anaemic animals regenerate hemoglobin faster when irradiated with ultra-violet.

Light is said to decrease the bactericidal power of a patient in poor health, but has the opposite effect in a normal subject. Light may lower to a dangerous degree the resistance in acute infections, as active pulmonary tuberculosis. Leonard Hill has very recently tested the effect of ultra-violet on the resistance to infection of mice. He used over 1000 animals, exposing them to pasteurella infection, and concluded that the irradiation conferred no benefit. Those who claim striking benefits from periodic irradiation have little scientific evidence to support their claims.

Hasselbalch states that on irradiation, the CO_2 combining power of the blood falls then rises. The CO_2 tension falls, due to increased irritability of the respiratory centre. Intense irradiation is said to decrease the rate of respiration, but the depth is proportionately increased, due to cutaneous dilatation. Harris found that blood plasma when irradiated with ultra-violet absorbed oxygen. This was due to absorption by, and oxidation of the aromatic amino-acids.

Metabolism.

Light has little if any effect on general metabolism. However it has very definite effects on chemical metabolism, especially as regards the reactions of the mineral constituents of the body.

Laurens found that irradiation of normal dogs with the carbon arc increased the output of endogenous nitrogen, also the absorption of calcium and phosphorus from the intestine. He states that darkness and strong light have the same effect, a deviation from the normal.

Very interesting results have been obtained in studying the effect of the distribution of metallic ions in the body. Rothman claimed that irradiation decreased the sympathetic tone, and that the distribution of calcium and potassium between the skin and blood was shifted. Pincussen observed a decrease in serum potassium. In a recent paper, Loewy and Pincussen gave the results of experiments on the effect of altitude and of irradiation on rats at Davos in the Alps. Irradiation, and especially reduction of atmospheric pressure changed the distribution of potassium, calcium and magnesium in the vital organs. They found a decrease in K, and a corresponding increase in Ca. Pincussen believed that the therapeutic effect of light and of high altitude may be due to a shift in the ion distribution of the organs and tissues. McHargue has recently found that when rats were irradiated with ultra-violet there was an increased excretion of magnesium. He believes that ultra-violet has the effect of eliminating excess magnesium, and thus maintaining the Ca: Mg: P balance. These observations on the effect of light on ion distribution are very interesting, although their significance and explanation are not yet forthcoming.

Calcium Metabolism.

In the case of calcium, we have more definite evidence, however. We have been able to explain to some extent the effect of light on calcium metabolism, and show its significance. Of prime importance of course is the role of ultra-violet in the prevention and cure of rickets.

This subject has been thoroughly reviewed elsewhere, so only the salient features will be described. Essentially, ultra-violet radiation below 3000 A.U. has the power to prevent and cure rickets. It is found that the serum calcium is increased on irradiation, and this is apparently the mode of action of the radiation. How the ultra-violet brings about this effect is not definitely known. It has been believed that the mechanism is an increased absorption of calcium and potassium from the intestine. However, recent work of the Toronto investigators

suggests another mechanism. Taylor, Branion and Kay found that parathyroid tetany could be prevented in dogs by the administration of massive doses of irradiated ergosterol. This effect could not be produced when every trace of parathyroid tissue had been removed, so they concluded that the action of vitamin D was through stimulation of the parathyroid, with a consequent increase in serum calcium.

Grant and Gates produced a parathyroid hypertrophy in rabbits by irradiation with ultra-violet. They believed the effect to be due to the increase in blood calcium. Latent and manifest tetany can be cured by ultra-violet, and Swingle and Rhinhold showed that the lives of parathyroidectomised dogs could be prolonged by irradiation with ultra-violet. Whatever the exact relation between ultra-violet, vitamin D, the parathyroid and calcium, is, it is very interesting and significant. Miss Clark observed an increase in calcium ions on irradiation of calcium proteinate with ultra-violet, and this is another possible explanation of the effect of the radiation on blood calcium. It is well known that only a portion of the blood calcium is ionised, and is believed that the remainder is bound to serum protein. It is quite possible that ultra-violet deionises the protein, liberating the calcium.

The discovery of the formation of Vitamin D from ergosterol through the action of ultra-violet radiation is of extreme interest. Not only has the mode of formation of a vitamin been elucidated, but to the photo-chemist it is an extremely interesting reaction, and opens up numerous possibilities. Although ultra-violet and vitamin D have the same specific effect on rickets, Mackay and Shaw prefer the radiation treatment, because of its general stimulating effect. It is believed that vitamin D is formed in the skin, and carried by the blood to wherever it is needed. H. C. Hou of Peiping has recently stated in a significant paper that ergosterol is activated in the sebaceous secretion of the skin.

The chemistry of the formation of vitamin D is also very interesting. The nature of the change is unknown, although a rearrangement around the unsaturated linkage of the sterol has been suggested. Both substances have definite and characteristic absorption bands, which can be recognised. The action of ultra-violet does not stop at vitamin D, but a further inert substance

is formed. The maximum amount of vitamin D is about 35%, and the reaction should be stopped when this point has been reached. Reerink and Van Wijk found that the waves between 2750 and 2900 A.U. produced the vitamin, while the shorter waves formed other substances. The reaction is far from simple.

Mrs. Clausen has studied the effect of infra-red from a carbon arc on the rickets of rats. The radiation increased the growth and prolonged life, but had no effect on the rickets, A hypertrophy of the parathyroid was observed.

Effect of Light on Growth.

There are few definite examples of any influence of light on the growth of animals. Northrop has been led to observe that it is surprising that such a constant and important environmental factor as light should have so little effect on this vital function.

Animals grown in the dark are apparently normal, except for a lower calcium, magnesium and phosphorus. Sunlight or absence of light has little effect on the development of the eggs of lower animals. However ultra-violet stimulates cell division, and often produces abnormalities. Sheard and Higgins concluded that growing chicks required both ultra-violet and visible radiation. A normal parathyroid developed only in the presence of both these radiations in sunlight. The same workers in studying the growth and germination of seeds believed that the longer ultra-violet stimulated the endogenous growth of the cells, while the still longer visible and infra-red rays stimulated exogenous metabolic processes.

Radiation Therapy.

A brief summary of the conclusions of Mayer is given. Regarding experimental studies, he found that in the case of experimental tuberculosis in guinea pigs, light gave negative results. However, corneal T.B. in rabbits was improved by the application of ultra-violet.

Contraindications to radiation therapy were the following conditions: severe heart disease and arteriosclerosis, nervous irritability, nephritis, fever and active pulmonary tuberculosis.

Heliotherapy was subject to the following conditions: In pulmonary T.B. sunlight may be a prophylactic, but is of no use in the active form of the disease. It may be used with benefit in mild chronic T.B. with little fever. Regarding bone and joint T.B. there is considerable difference of opinion. There has been observed improvement in some cases, but it is not a general effect. Sunlight often affects favourably lymphnode, peritonitic, intestinal, eye and laryngeal T.B. and certain ear infections.

Therapy with Artificial Radiation produced about the same results. The effect on pulmonary T.B. was doubtful, but some improvement in pleural T.B. could be observed. Favourable results in intestinal T.B. had been obtained with the quartz mercury lamp. Hilum and peritonitic T.B. have also yielded favorable results. However the chief role of radiation therapy, and particularly the ultra-violet, is in certain superficial lesions, as lupus and tuberculosis of the tongue, pharynx and larynx. The artificial sources of radiation gave doubtful results with bone and joint T.B.

Duke-Elder has obtained favorable results using ultra-violet therapy in certain eye affections, as eye tuberculosis, kerato-conjunctivitis, infective irido-cyclitis and choroiditis, blepharitis and corneal ulcers. Van Breeman finds that infra-red therapy is excellent in certain chronic rheumatisms. The shorter infra-red is more effective in producing hyperemia and sweating, while the longer waves are better for relief of pain and for resorption.

Mode of Action of Light.

There are an enormous number of observations regarding the physiological action of light, but generalisations are singularly lacking. However we may conclude that in general, light has two effects—stimulative and lethal. These effects are attributed usually to the waves above and below 3000 A.U. respectively. Ultra-violet coagulates protein, destroys hormones and enzymes, and kills protoplasm by disruption of the vital structure. The longer visible and infra-red rays have a heating and stimulative effect.

Sonne believes that the therapeutic effect of the universal light bath is due to local heating of the blood. The blood is

heated to a very high temperature at the surface, without a marked rise in body temperature. Brieger and Harris think that the effect of light is due to a reflex action resulting from a stimulation of nerve endings in the skin. The formation of vitamin D in the skin suggests another very important mechanism of light action. We also have evidence that light affects the ion distribution of the organs and tissues, but have no inkling of the mechanism.

Atomic Structure and Radiation.

The chemical action of light should be explainable on the basis of our knowledge of atomic structure and the nature of radiation, but unfortunately our advance in photochemistry has not kept pace with the tremendous advances in atomic theory. However a brief review will be given of the advances of the last few decades in our knowledge of the interaction of radiation and matter.

Our present concept of the atom dates from 1913, when Niels Bohr applied the quantum theory to Rutherford's atom. The latter physicist had conceived the particulate atom, with central nucleus and revolving electrons, but his concept was purely qualitative. The brilliant Danish scientist placed this concept on a sound quantitative basis, as a result of his spectroscopic researches.

The quantum theory was first developed in the field of pure radiation and was only more recently applied to matter. Wien in 1896 formulated his Displacement Law, which described the manner in which heated bodies emitted radiation. However it was found experimentally that this law was not exactly obeyed. Planck, beginning in 1901, solved the problem by assuming that radiant energy was emitted, not continuously, as the classical theory demanded, but in discrete, finite bundles or "*quanta*." The energy of a quantum is not a fixed quantity, but varies directly as the frequency of the radiation in question. Planck's hypothesis has been confirmed from many sources, and has become one of the most fruitful theories ever propounded.

Einstein, on the basis of Planck's quantum, in 1912 formulated his Law of Photochemical Equivalence. This states that in a photochemical reaction, one quantum of light energy is responsible for a change in one molecule.

Bohr has elucidated the relation between matter and radiation. In his atom, the electrons revolve in elliptical orbits around the nucleus. There are only certain fixed orbits in which the electrons can move. Now it has been demonstrated that when an electron jumps from an outer to an inner orbit, radiation is given off. A jump of one orbit gives one quantum, and the frequency of the emitted radiation depends on the loss of energy in the jump. So that when a body gives off light, it is because electrons in the myriad atoms are jumping to smaller orbits. Conversely, when radiation is absorbed by an atom, the effect is to displace one or more electrons to an orbit farther from the centre. If the quantum energy of the incident radiation is great enough, as in the case of ultra-violet or X-rays, an electron may be knocked right out of the atom, thus ionising it, or changing its chemical properties.

On this basis, we can offer some explanation of the chemical action of light. In general, the longer rays, as infra-red, do not produce chemical action. Their quantum intensity is too low to displace an electron, so they are simply degraded to heat. They act on the molecule as a whole, increasing its kinetic energy, and therefore its temperature. The short ultra-violet rays are the actinic rays, because they are powerful enough to affect the electrons and produce chemical changes. If an outer electron is knocked off, the atom is ionised. If an electron is simply displaced to an outer orbit, the atom becomes activated, and is more ready to take part in a chemical reaction.

Miss Clark demonstrated that serum protein when irradiated with ultra-violet lost its negative charge. The extra electron in the protein anion was probably knocked off. This may also explain why the serum calcium is increased on irradiation. It is believed that some of the blood calcium is bound to protein, and if the latter were deionised, the calcium would be freed. Coagulation of protein by ultra-violet is probably due to a similar deionisation.

CONCLUSION

We are safe in drawing the conclusion that the study of the physiological action of light is both interesting and important. Its importance lies both in the practical field, as exemplified by phototherapy, and in the theoretical field. We

hope on the basis of such studies to increase our knowledge of protoplasm and its behaviour. The relation between ultra-violet and vitamin D is a striking example of the possibilities for the future. A field which ranges from clinical medicine to theoretical physics is rather comprehensive, but this will surely be justified. The need for advances in the fundamental aspects of the problem has been pointed out, and these will probably be forthcoming in the near future.

I wish to acknowledge my indebtedness to all reviewers quoted; and especially to Henry Laurens and Edgar Mayer, upon whom I have drawn heavily.

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**EXPERIENCES IN LITHOTOMY IN
THE TUNGKUN HOSPITAL***

OTTO HUECK, M.D., Tungkun, Kwangtung.

In the first edition of the "Diseases of China" by Jefferys and Maxwell there is a report of Dr. Olpp and Kuehne of the Tungkun hospital with a series of 189 lithotomies performed from 1901 to 1908. That is on an average 21 operations each year. It is interesting to note that the number of lithotomies is about the same now. In the year 1928 we had 27 lithotomies, in the year 1929 twenty and 1930 also twenty cases.

From November 1927 until January 1930 we had fifty operations. Of these patients one died on the sixth day after the operation. But at other times we lost more patients after the operation.

In nearly all cases, 46 out of fifty, we did the suprapubic operation. Almost always we operate under local anaesthesia without general narcosis. We infiltrate the abdominal wall with a half per cent solution of novocain and fill the bladder with a solution of cocain one to thousand.

I think local anaesthesia is a great advantage compared with general narcosis; our results are better now, than at first when we operated with general narcosis.

Only small children are operated on with general narcosis.

Some years ago I often put a drain into the bladder, but now I suture the bladder-wall completely. But it is very important that this suturing of the bladder-wall is exact and tight.

The first layer goes through the bladder-wall, but not including the mucous membrane. If these sutures of the first layer are not exact, there is a great danger, that the content of the bladder may infect the prevesical space, and this inflammation may even cause the death of the patient. There may be cases where it is better to put a drain into the bladder.

Our practice is the following. When the patient comes to the hospital, he is not operated upon at once but we wait some

*Read at a meeting of the South China Branch of the C.M.A. at Canton, on January 30, 1931.

days to examine his temperature, pulse, urine, faeces, blood-pressure and so on. Regarding the function of the kidneys we especially examine the quantity and the specific gravity of the urine after drinking a large quantity of water and see, the length of time for this quantity to be excreted.

The day before the operation the bladder is washed with a solution of *argentum nitricum* 1 to 2000 and then with a boric solution. At this time the position of the stone is definitely located.

Before the operation a metal catheter is passed in along the urethra, then we wash the bladder with a boric solution and fill it with a solution of *cocain* 1 to 1000.

In the second edition of his book "The Diseases of China," Dr. Maxwell proposes as the easiest and best method of dilating the bladder to fill it with air. I am sorry that I have had no experience with this method.

The incision in the abdominal wall is vertical in the middle line. Then the bladder-wall is approached, the prevesicular fat is removed, to lay clear the bladder-wall, the peritoneal reflexion is removed upwards and steadied with a hook. We must be quite sure, that we really see the muscular layer of the bladder, the muscular fibres have a vertical direction. In the bladder, we can usually feel the end of the metal catheter without difficulty. Then the place of the incision into the bladder is steadied by two sutures, one above the proposed line of incision and one below.

Now the pelvis is lowered with the operation table and the bladder is emptied by the metal catheter. In this way we try to prevent the contents of the bladder flowing all over the wound and infecting the prevesical space.

Then the patient is again put in Trendelenburg' position, and the bladder is incised. Formerly I always made a vertical incision, but now I prefer a transverse incision into the bladder. The reason, why we prefer this direction, is the following: In many cases, we see very big stones, sometimes as big as a hens egg. If we have to lengthen the incision on account of a big stone, then in the case of a vertical incision, the end of the incision sometimes lies deep below the public bone, and an exact suturing is very difficult. If we make a transverse incision,

we may in cases of big stones lengthen the incision, and the ends of the incision nevertheless may be sutured without great difficulty.

If there is some hemorrhage in the bladder wall, sometimes some sutures are necessary to stop it. I make the incision towards the end of the metal catheter, and after the incision the end of the catheter is extruded through the wound. Two small hooks are inserted into the bladder. Then I take off the rubber glove of the left hand and insert the forefinger of the left hand into the bladder. The metal catheter is removed. Stones adherent to the bladder wall are carefully separated from it with the finger. By means of a forceps and sometimes of a spoon the stone is brought to the surface.

After the stone has been removed, we have to examine the bladder, to know if there are still other small calculi. A rubber catheter, not too thin, is passed in along the urethra, and we have to see, before the wound of the bladder is closed, if the inner end of this catheter lies properly in the bladder.

Now, we have to suture the bladder. It seems very important to me, to make quite clear the boundary line between the mucous membrane and the muscular layer of the bladder.

We use catgut for the sutures. The threads of the first layer are passed rather close to each other the needle is put in and out not too near the wound. The threads going just unto the boundary line between the mucous membrane and the muscular layer are left long, until the last suture is passed.

The second layer of the sutures must likewise be passed very exactly through the muscular layer of the bladder and covers the whole length of the first layer.

The abdominal wall is closed. We put a small rubber drain into the prevesical space at the lower extremity of the wound for 48 hours.

During the first two days the flow of the urine is carefully controlled. The bladder is washed with boric solution twice a day. I generally remove the catheter after two days.

Vesical calculi in women are not often found. Among 50 patients with stone of the bladder there was only one woman. But last year there were three women operated upon. I usually make a vertical incision through the vagina to remove the stone.

If we have to operate on small boys, we do not insert a rubber catheter into the bladder after the operation.

It is very common in examining the faeces of our patients suffering from calculi of the bladder to find eggs of *ancylostomum*. In this case the patients get anthelmintic medicines before the operation. In each case of calculus of the bladder, we make an examination of the faeces and see if the patient is suffering also from *ancylostomiasis*.

Of fifty patients three were already operated on about 4 years ago. One of these patients complained of pain some seven or eight months after the first operation.

On October 1921 I operated on a patient and removed a stone as big as a hens' egg. In September of the following year, he came back to the hospital and was again operated on. A stone was removed as big as a walnut.

In operating on these cases of relapse, I saw how difficult the suprapubic operation may be, if the bladder has already been incised suprapubically. In two cases I found the peritoneal reflexion firmly adherent to the old scar in the bladder wall. I tried to separate the peritoneum from the bladder, but holes were torn in the peritoneum. There was great danger of infecting the peritoneum. I did not dare to incise the bladder so I closed the abdominal wall and at once removed the stone by perineal operation.

So in the last four cases of relapse I did not try the suprapubic way, but made the perineal section.

In July 1928, a man came 59 years old. Two stones as big as pigeons eggs were removed by suprapubic lithotomy. He suffered also from *ancylostomiasis*. At the beginning of the following year, he complained again of pain, and in March, 1930 I operated again and removed two stones as big as walnuts by perineal operation.

Generally we only find one stone in the bladder. Out of fifty cases we found one stone in forty-four cases, two stones in five cases, three stones in one case. Sometimes the stones are grasped firmly in the bladder wall. The prevailing shape is a flattened egg shape. In two cases out of fifty the stone had the shape of a dumb-bell. Once we removed by perineal section,

two stones which had the shape of the two halves of a hens egg. The planes as if formed by a cut were very smooth and even. The patient had been already operated on three years ago and two stones were removed as big as earth-nuts.

The biggest stone out of fifty was 7 centimeters long. The collection of bladder stones in our hospital shows many stones, which are much bigger.

Concerning the age of our patients, there were:

1 year to 20 years	10	patients.
20 „ to 40 „	11	„
40 „ to 60 „	18	„
60 „ to 80 „	11	„
	50	
altogether		

Thus patients of all stages of life come for the operation. The series of Dr. Olpp and Kuehne shows the majority of patients between thirty to sixty years of age.

Some time ago I read a paper published by a German physician at Tsingtao in Shantung (Dr. Weischer, Zur Kasuistik red Blasensteine unter der Land-bevoelkerung von Shantung, *Zeitschrift fuer urologische Chirurgie*, 25. Band, 3. und 4. Heft.) Out of eighty eight patients more than half were below 20 years. In our series only one fifth of the patients were below 20 years.

There is a difference too compared with experiences at Jerusalem. A German physician,* who performed many lithotomies there, said, most of the patients with stone of the bladder, are either small children or very advanced in years. He spoke of many lithotomies performed in children.

Concerning the occupations of the patients out of fifty there were

Farmers	25
Children	8
Merchants	7
Workers and other professions	10
	50
Total	

*Dr. Grussendorf Rhenische Mission.

Just as in these cases, in the series of Dr. Olpp and Kuehne about one half of the patients belong to farmers and their families. One must consider that Tungkun is not a very large place and that the surrounding farming population is enormous.

Out of fifty patients one complained of having had pain already for 25 years. The length of time that the others felt ill before the operation was on an average one year and seven months. In the series of Dr. Olpp and Kuehne the time was one year and eight months and a half.

The patients were in the hospital after operation 21 days, taking an average of twenty patients in the year 1929.

Concerning the aetiology of the illness, in the first edition of "The Diseases of China" the author speaks of the theory, "that hard labor in the hot sun has a strong influence in the causation of stone. The skin in this case takes a large part in the excretory function, and the bladder is insufficiently flushed. But other potent factors must enter into the question besides this one."

In 1928 there was a paper published by Perlmann and Weber in the *Muenchener medic. Wochenschrift*.^{*} They suppose, that the lack of vitamins in the food is of importance. They fed rats without vitamins and found calculi in the bladder in 25% of the rats, whereas rats fed with ordinary food or those rats, which got a food free of vitamin A, but got milk or cod liver oil, had no calculi at all.

It may be, that this lack of vitamins is one of the reasons why so many patients suffer from calculi of the bladder in our district.

The food of the people often consists of salt-fish and rice only. Cases of beri-beri are not rare. It is astonishing, that the farmers and their families in many cases do not eat many fresh vegetables, although in the fertile plain of the Pearl river there are so many vegetables cultivated. But in cases of illness, many patients do not dare to eat fresh vegetables. I think, following the theories of Chinese medicine, they fear, these vegetables are too "cool" for them.

But the difficult question, why in our district stones of the bladder are so very prevalent, is not quite clear yet.

^{*}1928, No. 51.

Clinical Notes

ABSENCE OF PULSE

D. M. BLACK, M.D., Lungchingsun, Kirin.

In the *China Medical Journal* of March, 1929, p. 269, Dr. Chauncey F. Brown reported a case in which there was absence of pulse in the radial, axillary and carotid arteries. The case reported herewith presents many points of resemblance and some important points of difference.

Yi Chun-sik, Korean, male, 48 years, was admitted to St. Andrew's Hospital, Lungchingsun, on March, 5, 1930.

Entrance Complaints.—General weakness; palpitation; absence of both radial pulses; failing eyesight; aching of all upper teeth; numbness of right parietal scalp.

Family History.—Father alive at 72. Has suffered from (?) diarrhoea for ten years. Mother died at 68. Wife alive and well. Two sons and three daughters alive and well.

Past History.—Born in northeast Korea. Moved to Kando (Chientao) about twenty years ago. Occupation has always been dry-land farming. About 22 years ago had gonorrhoea and syphilis and was treated with a considerable amount of mercury by an old-style doctor. About 20 years ago had dysentery. About 15 years ago had a second attack of gonorrhoea. Has several times had very severe attacks of constipation.

Marital History.—Wife has had six pregnancies. One child was still-born. The others are alive and well. Wife has had no pregnancies for the past ten years.

Present Illness.—Three years ago he was severely frightened by bandits. For three days he had palpitation with a choking sensation which has never since entirely left him. From that time he has felt his left arm weak though able to carry on his work. Twelve months ago he consulted an old-style doctor because of palpitation and general weakness. The left radial

pulse was found to be absent. Ten months ago he noticed that his right radial pulse was also absent but states that it may have disappeared before this time. For the past six months his vision has been failing and for this period he has also suffered from slight dizziness which he attributes to his poor vision. For the past four months he has had an aching pain around all his teeth, especially the upper ones. This is now one of his chief complaints. For four months, also, he states that his hearing has been dull.

For the past two months his nose has been dry and crusted.

Subjective Symptoms may be summarized as follows:— Feeling of numbness with tingling over right parietal region of scalp. Dulness of hearing—no tinnitus. Slight dizziness and feeling of lack of power. Slight palpitation and feeling of oppression in chest—no pain. No abdominal symptoms. Appetite rather small. Very constipated—bowels move about once in five days. Arms feel weak. Sensation is perfect. No numbness nor tingling. Never bothered by coldness. Never any pain. Legs feel normal and fairly strong. Sexual impotence for past seven months.

PHYSICAL EXAMINATION

A middle-aged man, thin, with a sallow face and appearing weak.

Pulse—average 80. *Temperature* 97 to 98. *Respiration*—19.

Eyes—react to light and accommodation. Cataract developing in both.

Nose—crusting of antrum—no obstruction.

Mouth—tongue lightly coated. Very marked pyorrhoea. No advanced caries.

Ears and Throat—negative.

Heart—Apex beat visible in 5th. space in mid-clavicular line. Percussion shows normal cardiac dulness. Sounds are rather indistinct—rhythm regular, rate 80. There is a slight presystolic murmur heard with almost equal intensity over the whole praecordium. No thrill, no bruit over the great vessels.

Lungs—percussion and auscultation negative.

Abdomen—Flat but not retracted. No masses, no tenderness.

Genital—Scar on dorsum of penis, probably from chancre.

Upper Limbs—Good color and well-nourished. No clubbing of fingers. Strength of arm muscles and handgrip quite good. No ataxia. No tremor. Sensation to touch and pinprick normal.

Lower Limbs—Normal in appearance. Knee-jerks active. Ankle clonus absent. Plantar reflex, flexor. No ataxia. Gait normal.

ARTERIAL SYSTEM

Head and Neck.—Subclavians—no pulse to palpation or auscultation. Carotids—very slight palpable pulse in each. Right facial and temporal—very slight pulsation. Left facial and temporal—no palpable pulsation.

Upper Limbs.—No pulse can be palpated in axillary, brachial, radial or other arteries. No evidence of arteriosclerosis. When cuff of sphygmomanometer is applied to arms not the slightest pulsation is transmitted to the needle.

Abdominal aorta and common iliac vessels are easily palpable and show strong, regular pulsation.

Lower Limbs—pulsation in all the larger arteries readily palpable.

Blood Pressure—see below.

SECOND ADMISSION

The patient was admitted again on Dec., 10, 1930.

Subjective Symptoms remained as before but in almost every case were of less intensity and the patient stated that he was feeling much better.

Eyes—The cataract in the right eye had become mature. Perception of light was fair, projection was poor. Combined extraction was performed. Haemorrhage from the iris filled the anterior chamber. Healing was uneventful. On discharge perception of light was improved but he was unable to count fingers.

Heart—Apex beat in 5th. space $\frac{1}{4}$ inch outside the mid-clavicular line. Presystolic murmur slightly more intense. No thrill nor bruit.

Arteries—No pulse palpable in either carotid nor in any of the arteries of head and neck. Other arteries as before.

THIRD EXAMINATION

The patient was again examined on April, 6, 1931.

Subjective Symptoms as before. Sense of well-being increased. Has occasional sexual desire.

Eyes—Still unable to count fingers. An attempt at retinoscopy showed the pupil nearly occluded by a dark irregular mass, probably organized clot. The retina could not be seen.

Heart—Apex beat in 6th. space one inch outside mid-clavicular line. A double murmur was heard over the whole praecordium, slightly more intense over the aortic area. No thrill nor bruit. Percussion showed apex dulness increased to left but base dulness remained normal.

Arteries—as at second examination.

LABORATORY INVESTIGATIONS, ETC.

X-ray—Chest plate (Mar/30) was not very clear but seemed to show some enlargement of the base of heart to the left. Lungs were clear.

Wassermann—very strongly positive. *Kahn*—positive.

	Mar/30	Dec/30	Apr/31
Urine	Negative	Negative	Negative
Faeces	Ascaris	Negative	Negative
Blood			
Haemoglobin	60%	65%	65%
R.B.C. (millions)	5.1	4.0	4.2
W. B. C.	10,800	7,800	7,800
Polymorph.	61	54	70
S. Lymph.	12	23	10
L. Lymph.	9	12	15
Eosinophil.	17	9	5
Basophil.	1	2	—
Blood Pressure			
R. Popliteal	120/70	150/68	204/100
R. Peroneal	112/54	152/60	200/100
L. Popliteal	128/84	152/62	196/90
L. Peroneal	120/60	144/60	192/88
Av. Pulse Pressure	53	87	103

DISCUSSION

The most remarkable aspect of the case is the absence, apart from cataract, of physical disability or severe subjective symptoms. Apparently the blood circulates sufficiently freely to maintain nutrition though the impulse of the heart beat is entirely lost.

It would seem probable that the syphilitic infection is the main factor in the case. The steadily increasing pulse pressure and dilatation of the heart point to a progressive aortic incompetence. The exact diagnosis is probably a matter for speculation. Dr. Brown, in a letter, suggests that a dissecting aneurism of the aortic arch could account for the condition.

It is possible that the comparatively early onset of cataract was partly due to poor blood supply. No cause apart from ascaris was found for the high eosinophilia.

The patient was put on potassium iodide but failed to continue it long enough to exert any influence on the course of the disease.

The case is reported now because of the proximity of my furlough and the uncertainty as to whether further follow-up will be possible. There would, in any case, be very little chance of securing permission for a postmortem examination.

PARAGONIMUS WESTERMANII***Encysted in the Sac of Inguinal Hernia**

PAUL D. CHOY, M.B. and A. I. LUDLOW, M.D., F.A.C.S.

A variety of parasites, including *Echinococcus*,¹ *Parocephalus*,² *Schistosoma japonicum*,³ and *Paragonimus westermanii*,⁴ have been found in hernial sacs.

The writers⁵ reported the first instance of the occurrence in Korea, of the ova of *Paragonimus westermanii* encysted in

*Article No. 48. Research Department, Severance Union Medical College.

the abdominal wall and now present the following cases, the first of the ova and the second of both the ova and larvae of *Paragonimus westermanii* encysted in the omental contents of inguinal hernial sacs.

Case No. 1. Clinical History of Patient: Korean, male, age 47 years, was admitted to the surgical service of Severance Hospital, on May 24, 1927, with the diagnosis of a right inguinal hernia, twenty years in duration. The family history had no special bearing on the case. Aside from an attack of dysentery several years previous to admission, the general health of the patient has been good.

Laboratory Examinations:

Feces: Trichuria, Ankylostoma and Trichostrongylus orientalis.

Blood: Haem. 70 per cent; R.B.C., 4,030,000; W.B.C., 12,600; Polymorpho. 81; Large Mono., 3; Small mono., 13; Eosinophiles 3.

Urine: Negative.

Sputum: Negative.

The patient was operated upon on May 25, 1927. The sac of the hernia was 10 cm. in length, with omentum adherent to the inner side in several places. A portion of the omentum was excised and was found to contain two cysts about 1 cm. in diameter. Pathological examination of the cysts showed connective tissue walls and calcification of a portion of the cysts. Imbedded in this tissue were the ova of *Paragonimus westermanii*.

The patient made a good recovery from the operation and was discharged from the hospital on June 8, 1927.

Case No. 2. Clinical History of Patient: Korean, male, age 14 years, was admitted to the surgical service of Severance Hospital on Oct. 4, 1928, with the diagnosis of a left, irreducible, inguinal hernia. The family history had no special bearing on the case.

Previous History: The patient had measles at the age of 6 years. About the same time a small left inguinal hernia was noticed. The hernia gradually increased in size until twenty days before admission to the hospital, when there was a rapid increase in size accompanied by constant pain and much tenderness on pressure. A cough which the patient had suffered since the age of 6 years, also became more pronounced with the increase in the size of the hernia.



Upon admission the hernia was irreducible and measured 14 cm. in diameter. Examination of the chest revealed some bronchial breathing over both lungs and moist rales at the right base.

Laboratory Examinations:

Blood: Haem. 70 percent; W.B.C., 10,800.

Urine: Negative

Feces: Trichuris, Ascaris. No *Paragonimus westermanii*.

Sputum: Many ova of *Paragonimus westermanii* were found. Operation on Oct. 5, 1928, by Dr. Y. S. Lee.

Usual left inguinal incision. The sac was thickened and contained a mass of omentum, densely adherent to it, and the sac to the scrotum. While the mass was being dissected away it ruptured and showed several cystic areas, some of which were filled with pus. (Culture Bac. coli.) After excision of the mass the hernia operation was completed by the Halsted method.

Pathological Examination: The excised mass measured 12×8×3 cm. and was composed of omentum in which were found several nodules about 4 m.m. in diameter, containing a yellowish-red fluid. Two adult *Paragonimus* were found in one of these nodules. Sections of the nodules showed the ova of *Paragonimus westermanii* (see figure).

Sections were also made of the parasite.

Post-operative History: The wound healed readily and the patient was discharged, in excellent condition, from the hospital on Oct. 24, 1928.

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CHRONIC ULCERATIVE COLITIS

The open-minded listener at the debate on this subject at the Royal Society of Medicine, on March 11th, probably came away with the generalization fixed in his mind that some cases of chronic ulcerative colitis are incurable and others curable. It would be interesting to know whether in the future this open-minded listener will incline to treat his cases of chronic ulcerative colitis by appendicostomy, antidysenteric serum, lavage, ionization, serum, vaccine, psychology, or starvation.

B. M. J., March 21, 1931,

REPORT ON KAHN TEST**Elizabeth Blake Hospital for 1930**

BY P. W. DZAO AND M. P. YOUNG, M.D.

	Serum Cloudy	±	+	++	+++	++++	Negative
January			2	7	4	3	37
February				3	4	7	78
March		3	5	9	7	3	96
April	2	4	2	3	9	3	95
May		5	10	11	20	17	183
June	2	3	4	3	13	8	108
July		4	5	8	14	14	121
August	1	5	4	4	6	38	151
September	3	5	11	7	6	18	265
October	4	5	11	11	16	12	133
November	4	11	10	7	9	12	129
December	6	7	5	8	12	11	59
Total	22	52	69	81	120	146	1455

Total Number Examined 1945.

Positive 416 or 21.3%
 Negative 1455 or 74.8%
 Doubtful 52 or 2.6%
 Cloudy 22 or 1.1%

Editorials

THROMBO-ANGIITIS OBLITERANS

We are able in this issue to present to our readers a series of articles on this very interesting and puzzling disease, puzzling alike as to its etiology and its treatment.

Historically the condition is one of considerable interest having first been thought to be confined to those of Hebrew race, later recognised to be present in the West both in America and Europe and later still found also in the East where it is possible that after all its chief incidence may prove to be. It is startling at any rate to find one small hospital in Korea admitting 12 cases of this disease in a single year and a large institute like that of Severance having a regular yearly admission of five cases over a considerable period, not allowing for a larger number who for various reasons were not admitted to the wards. Van Gorder also mentions 53 cases seen in six years in Peking (*C.M.J.* xliii 235).

In China itself thrombo-angiitis is no new disease though the recognition of this condition, except in occasional isolated instances, dates back only to Dr. Duncan Whyte's investigations on the subject at Swatow in the year 1917 and subsequently (*C.M.J.* XXXI 371; XXXIV 219). Whyte's enquiries showed that the disease was to be found in practically every province of China. The first mention of the condition in this country as far as we can trace dates back to the year 1889 when a group of cases were described by Dr. Irwin, (*Imperial Maritime Customs Medical Reports*, No. 37, p. 1.) under the title of cases of Ergotism in Tientsin. His references however make no suggestion of the presence of *Claviceps purpurea* in the food nor any indication that there was any possible adulteration to account for this. We have no doubt that these were really cases of thrombo-angiitis but the suggestion of a poison such as ergot being the cause of the condition is an interesting one as we shall note later.

Dr. Ludlow in his article in this issue gives us a very comprehensive survey of the published suggestions with regard both to etiology and treatment.

In the United States there have been quite a number of papers published of recent years in which there is an almost complete concensus of opinion that tobacco is the prime cause of the disease. The authorities in support of this opinion are so weighty that a connection between tobacco and thrombo-angiitis may be taken as proved. There is a real danger however of reading into this an explanation for the disease which it does not contain. Tobacco is not *the* cause of thrombo-angiitis obliterans. This is certain from the fact that cases are met with out here where tobacco has not been used, many cases are found where tobacco is only used in quite small amount and the heaviest smokers are seldom those who suffer from the disease. The explanation that best fits the case is that there is a double factor, a constitutional tendency and an exciting cause. Of the former we know at present little or nothing, of the latter there seems not much doubt that tobacco is the commonest at least in the United States but that ergot and other poisons possibly of a similar nature may take its place elsewhere. In the investigation of such causes it should be noted that while the disease is almost confined to men, women on very rare occasions are known to have been affected. It is evident that very particular attention should be paid to the study of the etiology in these very rare cases occurring in women.

If the etiology is in dispute, the treatment is even more so, as Dr. Ludlow shows in his article. Even in the few papers of this symposium almost as many suggestions for treatment are made. Happily there is a general concensus of opinion on the value of saline injections in some form or other and until more effective measures are found it would seem very unwise to neglect these.

Unfortunately the cases met with in this country are nearly always advanced before they come under treatment and pain is then one of the most important symptoms. It is hardly recognised sufficiently by some writers how excruciating this pain frequently is and, by almost completely depriving the victim of sleep, how seriously it adds to the gravity of the disease. It is a pain also that is seldom amenable to morphia or other

narcotics or if amenable to such only in small degree. There seems little doubt that peri-arterial sympathectomy relieves this immediately and completely, probably more efficiently than any other method and in a large majority of cases. The simplest way of performing this or its equivalent is by alcohol injections as advocated by Dr. Rogers in this issue. This treatment is followed also by improvement of the condition of the extremity in many of the patients. Here, however, an important warning must be given. No case of thrombo-angiitis can be considered as permanently relieved until it has been followed up for a period of years. The disease is an insidious one and very prone to recur. There are reasons for believing also that the effect of peri-arterial sympathectomy in dilating the vessels of the extremity is only a transient one and as a cure for the disease it will likely prove quite disappointing. This does not detract at all from its value in relieving pain and its probable value in determining a lower site for amputation where this is necessary but as to a cure we fear it will be found unsatisfactory.

Recently when at Cullion, P. I., we had the privilege of seeing a number of cases on which the operation had been done for intractable perforating ulcer of the foot in leprosy. The immediate results had been marvellous but in nearly every case the ulcer had recurred at some later period.

A method of treatment which has recently been advocated both in Europe and America is the injection of muscle extracts (see *Current Medical Literature*, page 574). Some time must yet elapse before it is certain that the continued use of these preparations bears out their early promise.

THE PHYSIOLOGICAL ACTION OF LIGHT

We welcome with great pleasure a new writer to the pages of our Journal this month. Dr. H. B. Collier of Chengtu contributes an article on the physiological action of light. This is the first systematic paper on this important subject which has so far appeared in the Journal and it deserves careful study.

The subject is highly technical and many of us have been inclined to avoid it on this account but Dr. Collier has given us a presentation which will be clear and comprehensible to all our readers.

The therapeutical, to us the more practical side, is necessarily little more than touched upon in a paper such as this but we hope that at some future date Dr. Collier will take up this aspect of the subject at greater length.

QUESTIONNAIRE ON MISSION HOSPITALS

Dr. Lennox asks us to remind our readers about the questionnaire the answers to which are only coming in slowly. It is very desirable to make this review of the Mission Hospitals as complete and inclusive as possible and it is likely to be many years before as excellent an opportunity for such a review occurs again. We are very anxious to make as full a use as possible of Dr. Lennox's generous services. We beg therefore that those who have received copies of this questionnaire and have not yet returned them would do so at the earliest possible opportunity. If there are any hospitals which have not yet received copies a note to the C. M. A. offices will secure one at once. If it is not possible to fill in all the entries in this very detailed paper, we ask that as many details should be filled in as possible and the paper then returned.

DR. C. F. JOHNSON

It is with great regret that we have to announce the death of our former President, Dr. Charles F. Johnson. Dr. Johnson was a man of great ability and gave freely of his talents in the service of the Association. A memorial notice is published in this issue.

Announcement

CENTRAL BUREAU OF HOSPITAL INFORMATION

UNDER THE AUSPICES OF
THE BRITISH HOSPITALS ASSOCIATION (INCORPORATED).
THE JOINT COUNCIL OF
THE ORDER OF ST. JOHN AND THE BRITISH RED CROSS SOCIETY.
THE INCORPORATED ASSOCIATION OF HOSPITAL OFFICERS.

Chairman: The Rt. Hon. the Earl of Donoughmore, K.P.

Joint Council House,
12, Grosvenor Crescent, London, S.W.1.

It has long been felt that a Bureau of Hospital Information, if it is to attain a maximum degree of usefulness, must rest upon the authority of the hospitals themselves. This status has now been acquired, The British Hospitals Association having formed with the Joint Council of the Order of St. John and the British Red Cross Society and the Incorporated Association of Hospital Officers a Joint Committee to carry on the work previously undertaken by the Hospital and Medical Services Department of the Joint Council.

The aims of the Bureau may be summarised as follows:—

To publish annually a "Hospital Year Book" containing a directory of hospitals in Great Britain together with a report giving particulars of the work done, finances, etc.;

To collect and summarise data concerning all matters of administrative interest to those engaged in hospital management;

To undertake enquiries with the object of obtaining facts for those responsible for guiding hospital policy;

To establish a library where books, pamphlets and diagrams dealing with matters of hospital administration, construction and equipment may be consulted;

To act as a Clearing House of information in order that the experience of all may be at the service of each.

The Committee of the Bureau welcome enquiries and would ask Administrators to let them know at once the subjects of importance upon which they believe collated information would be helpful, both to themselves and to others engaged in hospital work.

DONOUGHMORE,
Chairman.

August, 1930.

Hospital Reports

ST. LUKE'S HOSPITAL FOR CHINESE. SHANGHAI, 1930. A. C. M.

Medical Superintendent, Dr. A. W. Tucker.

Nursing Staff: 6 Foreign, 10 Chinese nurses.

In-patients 2664 Out-patient attendances 105,293

The report this year is of special interest as it includes details of the proposed new plant in the eastern district of Shanghai to which it is hoped to move the present activities of the hospital. Elevation and ground plans of the buildings are given and a strong appeal is made for financial support for the new enterprise. The new buildings will increase the capacity of the hospital from its present 150 beds to 260 beds.

It is to be hoped that this appeal will meet with a generous response. The medical needs of an enormous city like Shanghai are very great and as yet are very poorly met. Whatever the outcome of the present Municipal Commission on medical services in this city, the bulk of the acute work must still fall on the voluntary hospitals and the lack of adequate local support of these hospitals is not a credit to Shanghai.

The report is very well illustrated and the figures that it contains are eloquent of the amount of emergency work that a hospital in this city has to meet, injuries totalling close to 6,000 and poisoning cases 574.

There are good tables of diseases, operations, etc. at the close of the report.

**HANKOW UNION HOSPITAL. MEN'S DEPARTMENT
(THE THOMAS GILLISON HOSPITAL) 1930.****L. M. S., W. M. M. S.****Staff: Drs. Cundall (Med. Supt.), Owen Chapman, Hsiao, K. H. Gillison.****Nurses: Two Foreign, six Chinese graduates, 36 student nurses.****Inpatients 1,639 Out-patients attendances 26,467**

The report contains a brief summary of the work of the hospital throughout the year by the Medical Superintendent. Among the cases referred to one strikes us as unique—the case of the ninth man of a group beheaded by the ‘reds.’ The axe having become blunt in the process the man though left for dead was later rushed to the hospital by his friends and eventually discharged from the hospital well!

Reports are also given of the School of Nursing, the Evangelistic work and the Institute of Hospital Technology which last is unfortunately brief owing to the temporary suspension of activities from lack of staff.

A large part of the report is taken up with statistical tables—operations, diseases and laboratory examinations. These tables are very valuable. We are far from claiming that the system of classification in which we had ourselves a considerable share is anything like perfect but this table of in-patient diagnoses does give a very accurate picture of the diseases dealt with in the hospital and does so without any searching through a number of different classifications to arrive at the facts and figures desired. Accuracy and easy handling are the two great desiderata for such a table and it appears to us that these two requirements are here met.

The report of laboratory examinations is extraordinarily good from the same points of view of simplicity and accuracy though we must confess that the necessary contraction of names involves a certain amount of mental gymnastics.

We should like to comment at greater length on the interesting points that these tables bring out but space does not allow of this. There is one problem, however, that strikes one at once and to which we shall allow ourselves to refer.

The returns of Widal tests are typhoid 18, para A 10, para B 12, para C 10. The position in regard to the typhoid group in China is utterly confusing. Even in neighbouring areas the proportions of cases of the different types vary

enormously even where there is every reason to believe that the test is accurately and faithfully carried out. Here the figures are entirely different from other important centres in China and the introduction of para C which is seldom looked for in this country adds another element to the confusion. First of all, we need to arrive at the facts of the case and owing to the unsatisfactory nature of the reports from so many hospitals we cannot do this at present. When the facts are available a very interesting problem will arise for investigation.

The frequency of para C in Hankow is a matter of no little interest. Some important papers have appeared in medical literature of late on this type of infection emphasizing the difficulties of diagnosis and the extreme variety of symptoms which this organism may produce. We hope that more information on this disease, which one writer believes covers a large number of the group of undiagnosed fevers, will be forthcoming from Hankow.

CHURCH GENERAL HOSPITAL, WUCHANG, 1930. A.C.M.

Staff: Drs. H. W. Tseng (Med. Supt.) Mary L. James, C.P.P'en, M.S.Li, F.S. P'ang, L.G. P'oo, W.C. Ch'en, H.S. Leo.

Nurses: One Foreign, 15 Chinese graduates.

Beds 191. **In-patients** 3,354. **Out-patient Attendances** 28,721.

It is encouraging to note that during the year under review the funds have been provided for an X-ray outfit and electric plant. Other requirements are G\$6,000 for general equipment and G\$20,000 for a new maternity wing.

Detailed accounts of the different departments are given, all of which are of interest and the report closes with excellent tables of statistics.

The work of the hospital shows much cause for encouragement and an increasing number of in-patients despite the political troubles but the financial strain from the mounting cost of both imported and native articles is causing the management a good deal of anxiety.

**TUNGKUN HOSPITAL, KWANGTUNG. 1929.
RHENISH MISSION****Staff: Drs. Hueck and Hu. 1 Foreign Nurse.****Inpatients, 566. Out-patient attendances, 9,150.**

They report a peaceful year politically in Tungkun, though there were many disturbances in the surrounding districts, and unsuccessful attempts were made to commandeer the hospital servants.

As a result of the fighting in the province several wounded soldiers were received into the hospital.

Among major operations there were 25 cases of stone in the bladder, the oldest patient suffering from this was 74 years old.

Reference is made to the work in the Burschen clinic in Berlin on the question of vitamine A in relation to stone in the bladder. In Tungkun the people live largely on rice and salt fish and eat no fresh vegetables. It is suggested that patients get stone in the bladder because they drink spring water, whereas fisherman who drink river water hardly suffer at all, and their diet is richer in vitamins.

One case of Tetanus is reported in which no wound was discovered, but the patient gave a history of injury to the ear by a Chinese barber with a sharp instrument, and probably this was the route of infection.

There is a short report on the work of the Women's Hospital, and the work of the blind Biblewoman.

The report closes with a classification of the diseases treated.

GENERAL HOSPITAL, WUSUEH, HUP. 1930. W.M.M.S.**Staff: Drs. T. P. Tu, Ethel M. Rowley (Mrs.).****Nurses: One Foreign, two Chinese graduates, 18 pupil nurses.****Beds 30. In-patients 444. Out-patient attendances 3,348.**

The report opens with a brief history of the work in Wusueh and the establishment of the hospital there. The actual opening of the present hospital only took place a little more than a year

ago. It is interesting and pleasing to notice that in this new venture women nurses have been installed from the first.

Surgical work for wounded soldiers has occupied a great deal of the hospital activities during the past year but the people are beginning to value the place, and the prospects for the hospital are bright.

Interesting sections are given to the relations of the hospital with the military, evangelistic work, staff, etc., and the report closes with an excellent classification of diseases.

**ELIZABETH MEMORIAL HOSPITAL, LINTSING, SUNG,
1930. P. N.**

Staff: Drs. Robinson, Ta, Alma L. Cooke (Miss)

Nurses: Two Foreign, five Chinese graduates, 9 pupil nurses

In-patients 781. Out-patient Attendances 13,251.

The report registers an all round increase of the work of the hospital in the past year. Reference is made to the vaccination campaign, a full and interesting account of which has already appeared in the *Journal*.

The promise of an X-ray outfit mentioned in the last report was delayed owing to damage to the apparatus on the way out, but this will likely be in use now before long.

A number of interesting notes on the progress of the work are given and this part of the report closes with general statistics and a financial statement.

A medical report of the work of the hospital comes separately in the form of a type-written document covering four years of the hospital's activities. We are at issue with the doctors as to the statement that such reports have not sufficient general interest to warrant their being separately published. Our own experience was quite the reverse and we found that a medical report not merely confined to figures but giving brief notes of specially interesting cases and medical problems met with a warm reception from the profession at home. The tables given in this report are too valuable to be lost and we hope to be able to publish some of them in the *Journal* later.

Current Medical Literature

TREATMENT OF GANGRENE DUE TO THROMBO-ANGITIS OBLITERANS

SAUL S. SAMUELS, M.D., New York.

TREATMENT OF GANGRENE IN ITS VARIOUS PHASES

At the earliest intimation of the onset of gangrene in a toe, it is necessary to carry out the following procedures: In the first place, smoking must be prohibited in absolute terms. This factor is so important that one may expect marked relief from the pain after the patient has stopped smoking for a few days. Furthermore, because of its vasoconstricting action, nicotine will destroy whatever collateral reserve there may be left in the affected extremity and thus cause an unnecessary increase in the area of eventual gangrene. If an ulcer has developed beneath the edge of the nail, cleansing hot baths containing an antiseptic and deodorant, such as chloramine, should be prescribed. The baths are particularly valuable in the case of ulcers that have become secondarily infected. The practice of surgically removing the nail in the attempt to produce better drainage of the infection is unnecessary and productive of more pain and spreading of the infection. The cleansing baths are carried out three times a day for periods of fifteen minutes. During the bath the patient is instructed to keep the foot in motion so as constantly to loosen whatever slough or detritus may be present. Following the bath it may be necessary to apply an anesthetic ointment to the exposed portions of the ulcer. This must be applied liberally and in such a fashion that no air comes into direct contact with the gangrenous areas. As the gangrene progresses, the same procedure is continued; namely, chloramine baths followed by liberal applications of ointment to the entire gangrenous areas.

Complete rest in bed from the onset of the gangrene until the final healing stages is essential. Attempts to heal these ulcers by ambulatory treatment are usually unsuccessful. It is

necessary for healing that the affected extremity be kept horizontal *at all times*. The practice of allowing the patient to sit up with his foot hanging over the side of the bed in the belief that gravity will improve the arterial flow is erroneous. This dependent position soon produces an intense edema of the foot that is not conducive to resolution or healing. If one will observe such an edematous foot after twenty-four hours' rest in the horizontal position, one will see marked wrinkling of the skin of the foot wherever there has been edema. With this method of treatment of the acute stages I have rarely found it necessary to administer opiates. The duration of the acute stage may be from three to six weeks and it is during this period that the greatest number of amputations have been unnecessarily performed by surgeons of limited experience with this disease.

A very important adjunct in the treatment of gangrene in all stages is the internal administration of large quantities of fluids. This may be given in various ways. Some prefer the injection of large amounts of fluids through a duodenal tube. Others prefer the subcutaneous route. I believe the intravenous method to be the simplest and most efficient. The type of solution to be injected is a matter of individual preference. Some prefer Ringer's solution, others prefer sodium citrate or sodium chloride. I am in agreement with Silbert that hypertonic sodium chloride solution is the simplest to prepare and to administer. The usual procedure is to inject 300 cc. of 5 per cent solution of sodium chloride intravenously every other day. It will be found in rare instances that there is a tendency, with the use of so concentrated a solution, to produce obliteration of the vein at the site of the injection. This reaction resembles that seen in the treatment of varicose veins by the injection of concentrated salt solution. In these cases, which are rather uncommon, I have found it advisable to use a 3 per cent solution instead of a concentration of 5 per cent.

OTHER METHODS OF TREATMENT

As the clinical course of gangrene and gangrenous ulcers is characterized by rapid development and comparatively slow healing, it seems unreasonable to expect to produce healing by agents whose action is spasmodic and temporary. I refer particularly to the use of various vasodilators such as typhoid vaccine and operative procedures on the sympathetic system.

The use of typhoid vaccine in any stage of gangrene is attended with the risk of sudden occlusion of large arteries during the period of hyperpyrexia, not to mention the discomfort of the high fever and severe chills often associated with nausea and vomiting. Furthermore, there appears to be slight benefit from a transitory vasodilatation in a process that will require weeks or months to improve. The same may be said of the various operations devised to produce vasodilatation by the interruption of the sympathetic pathway in the affected limb. It appears to me that the complexity and risk of the operation of severing the lumbar sympathetic fibres is far too great in proportion to the temporary benefits obtained in these cases which are characteristically chronic in nature.

As far as the Leriche operation is concerned, the following quotation from Leriche's own article is self explanatory:

In Buerger's disease, periarterial sympathectomy has frequently been tried in the United States. This is wrong, in my opinion. The operation can accomplish nothing in thrombo-angiitis obliterans, for in order to produce its effect it requires at least a partially intact peripheral circulatory system. At the meeting of the American Surgical Association in 1921 I warned certain members against the temptation of trying sympathectomy in these cases. Since that time I have repeatedly published the view that sympathectomy should not be performed in thrombo-angiitis obliterans. Nearly all those who have attempted it have failed. Only recently Allen has published eight failures, and in the Royal Society of Medicine of London, Gash, Schesinger and others have reported failures. In these cases I have had no result from extensive periarterial resections and have done no better by dividing the lumbar communicating branches. Briefly, I am more and more led to think that no sympathetic operation is of value in Buerger's disease.

INDICATIONS FOR AMPUTATION

Amputation of a leg should be performed only when the gangrene involves the entire foot, *including the heel*. In other words, if it appears that the patient will be left with a foot that will have no functional value, it is just as well to amputate below or above the knee. Such extensive gangrene is, fortunately, very rare. Operative amputation of toes or fingers is, in my opinion, usually unsatisfactory and attended with the danger of postoperative spread of the gangrenous area, not to mention the frequent occurrence of subsequent chronic osteomyelitis.

Pain, per se, should never be used as an indication for amputation. With the use of properly selected anesthetic ointments, cleansing baths, the prohibition of nicotine and rest in bed, the pain can nearly always be controlled. If necessary, opiates may be used until the acute stage is over.

SUMMARY

Gangrene, which often occurs during the course of thrombo-angiitis obliterans, is a self-limiting process. Extreme conservatism, even in the severest forms of gangrene, is usually rewarded with an intact extremity, the value of which no one will question. Amputation of a leg should be advised only when it appears that the gangrene will destroy so much tissue that a non-functioning foot will be the ultimate outcome. Pain is no indication for amputation.

Rest in bed, cessation of smoking, cleansing baths, the application of anesthetic ointments, and the intravenous administration of large amounts of fluids are the essentials in the conservative treatment of gangrene due to thrombo-angiitis obliterans.

J. A. M. A., March 7, 1931.

MUSCLE EXTRACT TREATMENT OF SOME GRAVE VASCULAR DISEASES

M. S. SCHWATZMAN, M.B.

THROMBO-ANGIITIS OBLITERANS WITH ADVANCED GANGRENE

History.—A mechanic, aged 42, with no history of venereal disease, but who had been smoking ten cigarettes a day, complained that since 1924 he had felt pain in his calves on walking. Trophic disorders appeared on the toes and dorsum of the right foot in 1926. Gangrene developed in 1929, when his right leg was amputated, first below the knee (Mr. C. Price Thomas at Westminster Hospital), and soon after above the knee (Mr.

Tudor Edwards). At the operation the right popliteal artery was found to be thrombosed. In December, 1929, gangrenous changes appeared on the left big toe. In January, 1930, a periarterial sympathectomy of both left femoral and anterior tibial arteries was performed (Mr. E. Rock Carling). After a short period of relief the condition became gradually worse, and the patient was readmitted to the Westminster Hospital in July, 1930.

Examination.—The left leg, foot, and toes were stone cold, deeply blue, and oedematous. The soft tissues of the big toe were black, sloughing, and hanging in shreds. There was a very offensive discharge from underneath the slough. A black area extended alongside the bases of the toes; no inflammatory reaction was noticeable. The patient suffered such excruciating pain that he threatened to commit suicide. The dorsalis pedis and posterior tibial arteries were pulseless. The angle of circulatory sufficiency was about 70 degrees. The amputation stump of the right thigh ulcerated over a large area. The Wassermann reaction was negative; blood pressure was 135/90.

Treatment.—Treatment with daily injections of muscle extract was started by me on July 5th, and continued till August 9th at the Westminster Hospital (under Mr. E. Rock Carling), and later at the London Jewish Hospital (under Mr. S. I. Levy) till the middle of October. At first the soft tissues of the big toe and at a later date the distal $1\frac{1}{2}$ phalanges separated. The pain and swelling disappeared, the discharge stopped, the leg and foot became normally warm, and the wounds healed up. Neither elevation nor dependent position caused any pain. Return of colour was prompt at horizontal position. Blood pressure fell to 125/70. The arteries were pulseless as before treatment, and no change in oscillometric index could be detected.

The case terminated in spontaneous amputation of a part of the big toe, instead of a high amputation above the knee, which was thought to be indicated before the commencement of this treatment.

REMARKS

A great deal of research has still to be done to elucidate the rationale of this method and the nature of the active principle.

It is clinically evident, and confirmed by the physiological experiment, that the extract acts as a powerful depressor. It is most probably by overcoming the vascular spasm, which seems to be an important additional factor even in organic vascular diseases, that the extract partly produces its therapeutic results. The same depressor effect may account to a great extent for its beneficial action in angina pectoris. In our experiments both alcoholic and aqueous protein-free extracts of skeletal muscle of young animals (calves) were used.

There are no doubt present, particularly in an active muscle, some substances (? metabolites) which are partly responsible for the increased blood supply required for exercise. It is likely that these substances form the active principle of the muscle extract. Not much can be said yet about their chemical nature. The extract contains but very little histamine, if any. The substances are not identical with choline, and the depressor action is not counteracted by atropine. They may contain adenosine, as was recently suggested, but physiological experiments indicate that they are not likely to be identical with it.

B. M. J., March 21, 1931.

MODERN TREATMENT OF INCREASED INTRACRANIAL PRESSURE

FOSTER KENNEDY, M.D. and S. BERNARD WORTIS, M.D.

Lumbar Puncture.—Removal of cerebrospinal fluid by the lumbar route is performed early in most cases for both diagnostic and therapeutic purposes. Whenever possible, a spinal manometer should be placed in the puncture needle that pressure may be gaged from the beginning. When pressure within the skull is known or suspected of increase beyond the normal—from 60 mm. of spinal fluid pressure (water) to 200 mm.—the abstraction of fluid should be carried out drop by drop. If the fluid is clear, bloody, xanthochromic and clear, or xanthochromic and tinged with blood, it is best to be content

with removing 10 or 15 cc. If it is purulent, drainage should be continued as long as the flow is free; this procedure should be repeated daily throughout the acute phase. One should further fluid reabsorption by the use of drugs and hypertonic solutions (to be described later) rather than depend at the onset on lumbar drainage for dramatic results.

Hypertonic Solutions.—The next step in treatment is the intravenous injection of a solution of hypertonic dextrose of 50 per cent strength. One hundred cubic centimeters of this solution may be thus given twice or thrice in twenty-four hours. The sterile solution is purchasable in 50 cc. ampules.

Not only is such treatment serviceable for intracranial dehydration and pressure reduction, but it introduces a readily available food. It is valuable in combating acidosis caused by prolonged vomiting. Hypertonic saline solution in 25 or 30 per cent strength may be used in 200 or 300 cc. doses if dextrose is not available. Its lack of food value is, however, obvious.

Hypertonic solutions in contact with mucous membrane: The membrane of choice is that of the rectum or vagina; the solution, hypertonic solution of dextrose 25 or 30 per cent, saline solution 25 or 30 per cent, or saturated solution of magnesium sulphate; all of these medicaments may be given slowly in 4 ounce (120 cc.) doses every four hours, or continuously by rectal drip.

Caffeine Sodibenzoate.—This drug injected under the skin or into a vein in doses of $7\frac{1}{2}$ grains (0.5 gm.) reduces intracranial pressure for forty-five minutes. It may be repeated every two or three hours and may well be interspaced between rectal taps or intravenous injections of hypertonic solutions.

Posture.—For many years at Bellevue Hospital we have placed such patients in Goetsch beds with the head and trunk elevated at an angle of from 15 to 60 degrees from the horizontal position of the rest of the body.

Book Reviews

THE CLINICAL PATHOLOGY OF THORACIC PUNCTURE FLUIDS.

By S. R. GLOYNE, M.D., D.P.H. Published by Bale, Sons and Danielsson, London. Price 10/6.

The Author states the intention of this book is "an attempt to bring together information on a subject which is apt to be neglected because it lies between the domain of the clinician and the pathologist." It is an attempt to interpret the findings of thoracic puncture.

The book is thus somewhat unique and the facts which it gathers together in small compass are obtainable only with difficulty by the ordinary reader. It thus meets a very real need and meets it well. The subject matter is well arranged, clearly stated and the book is well indexed.

The subject matter may be divided into chapters dealing with the anatomy, physiology, pathology of the pleura and exploratory puncture. These chapters which occupy approximately a third of the book are its least interesting part as they cover at somewhat unnecessary length subject matter which should for the most part already be familiar to the readers.

There follow chapters on cytological, bacteriological and serological examinations. These and the succeeding chapters on the different kinds of pleural effusions are of very great value and make the book one of real importance for constant reference. The final chapters dealing with the dangers of autoserotherapy should be carefully studied.

This little volume has a real place in modern medical literature but the price is unnecessarily high and might well be reduced by the omission of many of the illustrations which are not really required. There is, however, a valuable coloured plate of endothelial cells in various stages of degeneration.

J. L. M.

PRACTICAL ANESTHETICS. For the Student and General Practitioner.

CHARLES F. HADFIELD, M.B.E., M.A., M.D. Camb. Second Edition, 1931.

Published by Bailliere, Tindall and Cox, London. Price 7/6.

In this edition the book has been completely revised and partly rewritten together with much new material dealing with the recent advancements in anesthesia. The book has 336 pages and covers the general subject of anesthetics sufficiently for the student or the general practitioner. Above all it covers the subject in a very practical way and describes the various procedures in a manner that is easy for the average man to follow. The author tries to keep the welfare and comfort of the patient foremost. He deals quite well with the very recent advancements in local and spinal anesthetics and endeavors to give them the place they are now taking in surgical work. However, it appears that the author himself has not fully adopted these procedures. The book is simply written, easy to read and follow and well arranged.

J. A. S.

HANDBOOK ON TUBERCULOSIS. By B. S. KANGA, M.D., D.P.H.

Published by John Bale, Sons and Danielsson, London. Price 5/-.

This is a little book dealing in a very elementary way with the symptoms and treatment of tuberculosis in its varied forms. We must confess that we are disappointed with it. While apparently attempting to cover the whole field, important subjects such as tuberculous peritonitis are not even mentioned, while entirely objectionable proceedings such as extirpation of the larynx for tuberculous laryngitis are referred to.

The book might be of some value to students were it not that it contains no index; that any medical book can be published without an index is a surprise to us.

J. L. M.

Obituary

Dr. Charles F. Johnson

Dr. C. F. Johnson was born in August 1857. He graduated from the North-western School of Medicine in Chicago in 1889 and was married in the same year to Miss Agnes Elliott. Dr. and Mrs. Johnson arrived in China the same year. After staying at Weihsien for a short time, they were sent to Ichowfu to begin medical work there. They had to leave during the Boxer trouble, but returned to Ichowfu afterwards. In 1908 they were transferred to Tsinan, to live in the East Suburb, where Dr. Johnson conducted a hospital.

While in Ichowfu, Dr. Johnson had helped Dr. Neal in teaching students and, after moving to Tsinan, he, with Dr. Neal and Drs. Watson and Patterson, conducted the so-called "peripatetic" medical class which was the beginning of the present School of Medicine of Cheeloo University.

The Tsinan Union Medical College was opened in 1910 and Dr. Johnson was a member of the faculty, teaching Obstetrics and Children's Diseases from that time until he resigned in 1921.

In 1920 Dr. Johnson was elected by the China Medical Association as its President and served his regular term in this capacity.

Besides his interest in medical work, and specially in the teaching of students, Dr. Johnson's good judgment, his fine Christian spirit and his executive ability made him one of the leaders in the Presbyterian Mission of Shantung. From 1919 until 1930 Dr. Johnson was Chairman of the Shantung Mission. On resigning from this position he was made Chairman Emeritus. For many years he was a member of the Cheeloo University Board of Directors.

Dr. Johnson is survived by his wife and two daughters, Mrs. Scott Corbett, of Portland, Oregon, and Mrs. Eric Clarke, of Shanghai, and by his son, Dr. Hosmer Johnson, of Weihsien.

Dr. Johnson was a man of unusually winning personality and he enjoyed the love and respect of a large circle of Chinese and foreign friends. In his death the Presbyterian Mission has lost a valued and able counsellor, and the cause of medical missions one of its pioneers and leaders.

WANTED COLUMN

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Proposers:—Dr. James L. Maxwell, Dr. H. Gordon Thompson.			
Knight, Edgar Warren	M. D. (Toronto)	C.I.M.	Luan, Shansi.
Proposers:—Dr. Stanley Hoyte. Dr. Paul E. Adolph.			

NEW MEMBERS ELECTED

Dr. Y. K. Chen	Lingnan University	Canton.
Dr. K. L. Hsu	Canton Hospital	Canton.
Dr. T. M. Tse	Kwongwah Hospital	Canton.
Dr. J. Willoughby	W. M. M. S.	Paoking, Hun.
Dr. H. K. Wang	K. M. A.	Linsi, Hopei.
Dr. G. Smithwick	P. S.	Suchowfu, Ku.
Dr. G. Lende	N. L. K.	Laohokow, Hup.

PRAYER CYCLE

The following returns have arrived too late for inclusion in the new edition of the Prayer Cycle. Members are requested to add them to their own copies.

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