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COMMUNICATIONS

SCLEROSIS OF THE RETINAL VESSELS

BY

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(*Concluded*)

The Retinal Vessels in Sclerosis of the
General Vascular System

Syphilis

Syphilis has an immemorial reputation as the greatest of vascular damagers, but it chiefly attacks definite parts of the system and is a good demonstration of the rule that different toxins have their spots of predilection in the patient's body. In the case of the central nervous system, the pathology of syphilis points out again the correctness of Weigert's sentence; being a foreign body to the proper nervous tissue, the vascular system may either be the chief sufferer (*e.g.*, gumma) or may more or less escape when the proper nervous tissue is greatly damaged (tabes dorsalis, general paralysis of the insane). But even in tabes, the aorta is often attacked, a striking difference from the retinal vessels. Pulay, of Vienna, found by X-rays syphilis of the aorta present in 56 per cent. of syphilitics of all ages. Kessler, of Vienna, made a post-mortem of 60 patients, who died from tabes, and in two-thirds of them he found definite syphilitic affection of the

aorta or of the aortic valves; the cause of this mesaortitis (tabetica) is not different in character from the ordinary mesaortitis specifica, although Frost believed that it is less frequent and more benign in tabetics. If it appears to be more benign clinically, this is because the tabetic usually leads a more restricted mode of life, anti-syphilitic treatment is usually commenced earlier, and, perhaps, the subjective sensation of pain and discomfort is not so sharply felt by a tabetic. Pineles, of Vienna, points also to the possibility of syphilis (mesaortitis, aneurysm, incompetence of the aortic valves, syphilis of the coronary vessels) in the case of "rheumatic" pains in the region of the sternum; in his opinion, this kind of syphilis has become much more frequent since the War. Mars still courts Venus! Bruhns thinks that he proved the presence of syphilis of the aorta in 30 per cent. of 200 cases of syphilitics, who were infected 9-30 years previously. Therefore, in his opinion, every sufferer from syphilis ought to be kept under very careful observation and a radiogram of the aorta should be taken frequently. Prof. Schlesinger makes the diagnosis of a syphilitic aorta if he hears a systolic murmur over the aorta along with an accentuated second aortic sound. *The blood pressure is usually normal.* Very often the patients complain of a severe burning pain behind the sternum. A radiogram shows a diffuse dilatation of the aorta, especially of the ascending arch; *Wassermann's reaction is not always positive.* If the openings of the coronary arteries in the aorta are affected we get the clinical picture of angina pectoris, if the aortic valves, insufficiency of the aorta. Stenocardia, aortic regurgitation, without endocarditis in the patient's history, and aortic dilatations, in younger patients, point to syphilis of the aorta, even if Wassermann's reaction be negative. *Nearly every aneurysm of the aorta is of syphilitic origin.* This view of the frequency of syphilis in aortitis and angina is so widespread now that a word of warning was given in Paris last year, when Danzelot in the Société Médicale des Hopitaux, according to the *Monde Médicale*, appealed to the profession to be much more reserved in this regard and to try to prove syphilis not only by the Wassermann test but by a very careful bodily examination. Gallavardin in his statistics showed that out of 100 cases of angina pectoris, in 40 syphilis could be entirely eliminated as an aetiological factor, 30 were doubtful, in 9 it was probable, and in 21 it was proved. Especially sarcastic was Laubry: "Pain, radiating in the left arm, an extra systole, provoke a state of anxiety, repeated palpitations are uncomfortable, an attack of dyspnoea of asthmatic character, and the talk starts on true or false angina, and it is very seldom that a fine laboratory examination will not reveal a Wassermann reaction slightly positive and the radiogram with its

shadows and mensurations will not relieve the medical man from his last scruples." Be it as it may, syphilis does attack the aorta and coronary arteries as an area of predilection and it does not behave in the same manner towards the retina. I shall quote from my cases only one, where the Wassermann reaction was negative, at first, in spite of definite syphilitic iritis and, later on, two gummata of the iris, but becoming positive a few weeks afterwards. In two other cases where the blood pressure was normal, nothing abnormal could be detected in the retinal vessels. It was the same with the third case, who had aortitis syphilitica with a positive Wassermann reaction and had an attack of mild coronary thrombosis last year. But the retinal picture of another case where syphilitic aortitis is also present, with a positive Wassermann reaction and who has been brought near death's door by a severe attack of coronary thrombosis with resulting permanent cardiac debility is quite different, because, in my opinion, essential hyperpiesis came into play, his blood pressure being 200/100 (it is only 110/80 now). I had a case of general paralysis of the insane successfully treated by malaria. His retina did not present anything characteristic, his blood pressure being normal. Especially remarkable was another case. Three years ago (No. 8 C. in my first paper) his blood pressure was 160-210/110-130. B.E. translucency absent; l.r. dotted: c.w. colour. Small cilio-retinal arteries were tortuous in the right eye, their lumen changed. All the arteries were narrow. The veins in both eyes were crushed by the arteries, but not deflected. In the left eye a vein was crushed and deflected centripetally. White lines accompanied the vessels at the crossings. In September, 1926, he fell unconscious. I found him on the ground in a state of coma and sent him to hospital with a diagnosis of probable cerebral haemorrhage. The Wassermann reaction proved to be positive in the cerebro-spinal fluid and a diagnosis of cerebro-spinal lues was made at the hospital. When discharged from the hospital his blood pressure was 150/90, fundi unchanged (11/1/27).

After months of treatment he did not improve. He was seen by Dr. Gordon Holmes, who made a diagnosis of general paralysis of the insane, and treated him with malaria; the success was a brilliant one. When discharged from the hospital on June 4, 1926, his blood pressure was 200/110, fundi unchanged.

On December 3, 1927, his blood pressure was 230/130. The veins were not only crushed, but deflected by the arteries. There were many retinal haemorrhages and also white lines on the disc. In the left eye the sup. temp. artery and the vein were running close together with white lines between them. The left was more crushed now than before. His blood urea was normal and urea concentration test satisfactory.

A girl aged 20 years complained of severe headache. Her doctor gave her a certificate to consult an ophthalmic surgeon. Her approved Society sent her to an optician who provided her with glasses. She was not relieved, because she had a double papillitis specifica, with a positive Wassermann reaction. For a few weeks, in her left eye, all the lower retinal vessels were quite clear, but behind them, especially with the increased light of the ophthalmoscope, was seen a white veil on the retina, which accompanied the vessels as a white tract. It disappeared later on. It was, in my opinion, an oedema of the external layers of the retina, probably caused by choroiditis.

Conclusions.—Syphilis *per se* does not especially attack the retinal vessels, but if arterial hypertension is also present the sclerotic changes are well marked and advanced, as in similar cases of essential hyperpiesis.

Atheroma

This serious disease is usually more or less localised. It more often attacks the large arteries, and is especially dangerous when situated in the coronary arteries or just at the point where they leave the aorta, causing either true angina pectoris or a myocardial infarction (coronary thrombosis). But, on the other hand, such an authority as Winkelbach, in a post-graduate lecture, delivered in Vienna in 1924, stated that sclerotic coronary arteries were detected in persons who never suffered from angina pectoris, and that people died from angina whose coronary arteries were not at all sclerotic. Pal also maintains the view that true angina pectoris is often an angiospastic neurosis of the coronary arteries. The pain is caused by an arterial stasis, especially at the point of entering the aorta; the flow of blood is interfered with; the vessels become tortuous and rigid. Sternberg, also of Vienna, quotes Ortner, in his description of abdominal angina, which is characterised by excruciating pain, motor insufficiency of the bowels, sometimes even collapse and a feeling of impending death. The cause of this attack, according to most authorities, is also an angiospastic condition of the intestinal vessels (vascular crisis of Pal). Ryle states that angina "is frequently, but not invariably, associated with changes in the arteries, and particularly—though not necessarily—with atheroma of the first part of the aorta and the coronary vessels." And, if my memory does not fail me, Nassau characterised the narrative of a neuropath, who thinks he has an angina, in a simple, but clever sentence: "There is much more noise than real danger." The true sufferer who has been near death, describes his sensations in a tragic,

brief and precise way, as opposed to the long, fantastic and full of "fine feelings" story of the neurotic.

It is different with coronary thrombosis. Here there is always atheroma present. The final blow to the diseased vessel is thrombosis (Parkinson and Bedford). This pathological condition differs from angina in the prolonged time of the attack, vomiting, collapse, and sometimes tenderness in the epigastrium, which may lead to a diagnosis of acute abdominal trouble. Winkelbach says that if the patient survives a severe attack of coronary thrombosis, he is usually a broken man and can never recover the same vigour of the heart's action as he enjoyed in the past.

What is the state of the retinal vessels in those tragic cases? Foster Moore states definitely in his "Medical Ophthalmology" when speaking of atheroma: "There was no evidence of any considerable disease of the retinal arteries in any case." This is a perfectly correct statement. In two cases, the first having had one of the most dreadful attacks of coronary thrombosis that I have ever witnessed, there is nothing exceptional in the retinae, the blood pressure being normal. Two other cases had definite signs of marked vascular sclerosis of the retina, but I never took their blood pressure before the attack, whilst during the attack and afterwards it may be low because of the myocardial insufficiency. One of them was a powerfully built ex-service man, an ardent follower of Bacchus, who has drunk a bottle of whisky a day regularly for the last few years. I would suggest that there is a slight possibility of differentiating between a false and a true attack of angina. The slightest degree of retinal sclerosis in combination with the subjective symptoms of the patient makes the correct diagnosis more probable; on the other hand, true angina may give a retinal picture of a normal person of corresponding age; the same applies to the heart, where coronary sclerosis may be absent. With arterial hypertension, however, the retinal picture changes immediately. A person with an extreme degree of coronary or aortic atheroma will not present anything specially abnormal in his retinal vessels if the blood pressure be normal; *arterial hypertension, super-added to atheroma, will give a characteristic appearance of marked and often advanced retinal vascular sclerosis.* It may be argued that atheroma here is the result of essential hyperpiesis which existed previously. I should only welcome this criticism, as it entirely coincides with my view, especially for cerebral atheroma. Especially noteworthy and demonstrative of my theory of a special affliction of the retinal vessels in cases of essential hyperpiesis is the following case. It is that of a man aged 59 years, ex-seaman; tall and powerfully built. On November 15, 1926, his blood pressure was 150/80. In his retina the translucency of the vessels was diminished, but still present. No

white lines on the disc or crossings. One vein was deflected centrifugally, but not depressed by the artery (a congenital deflection). On June 10, 1927, the fundi were the same. On September 29, 1927, he came to see me with blood pressure 180/100. Extra systoles; severe retrosternal pain. Fundi: translucency lost, copper-wire colour, light reflex dotted, white lines on the disc and crossings. In the right eye the sup. temp. vein was once deflected centrifugally by the artery whilst the second crossing did not as yet affect it. In the left eye the sup. temp. vein was crossed three times by the artery being not affected by the first, centripetally deflected by the second, and not affected by the third. He was able to walk home. On September 30, 1927, he developed a picture of coronary thrombosis and I sent him with this diagnosis to the London Hospital, without having time to describe his previous history. On October 23, 1927, the House Physician kindly informed me that the man actually had coronary thrombosis and auricular fibrillation as well. "His Wassermann reaction is, however, negative, X-rays show some general dilatation of the aorta, but no aneurysm. I think he must be a case of atheromatous arterial disease and *probably* (italics of the House Physician) had a high blood pressure before this attack." A correct surmise, as is shown by my history of the case. We have previously seen that atheroma with a normal blood pressure does not change the retinal vessels much. My patient had a normal blood pressure, without syphilis in his past, and his fundi were perfectly normal. Enter essential hyperpiesis, and it produces in a short time a complete change in the fundi and coronary atheroma as well. He died from cardiac failure in July, 1928.

Atheroma may attack the eye, too, but here again, it is a localised condition. It means a thrombosis of the vessels, usually in one eye only. In the purely classical, so to speak, form the blood pressure is normal. On the other hand, atheroma in my opinion, is often a complication and result of essential hyperpiesis. A good illustration in the first group is the noteworthy history of the following case. He is a man aged 50 years, who came to see me on August 27, 1926. His blood pressure was 140/100. Arterio-sclerosis of first or second degree of brachial and radial arteries. Under medication his blood pressure came down to 140/90. Fundi: B.E. myopia of 8.0 D.; posterior choroiditis. Arteries were narrow, their colour and light reflex stronger than usual, but not decidedly pathological. The veins were larger. They were not crossed by the arteries, so that I could not define their translucency. On February 13, 1927, his blood pressure was 120/80. He complained of a funny sensation in his right hand. A definite paraesthesia and weakness of the right palm followed four days later. I advised him to consult a nerve specialist and,

frightened, he disappeared. He appeared again on April 12, 1927, with a severe difficulty in his speech, lasting a fortnight or so, and a fresh embolism (thrombosis) of the central artery of his right eye, with complete blindness. The strange part in this remarkable picture was the pupil; enlarged to its maximum, it did not react to light or accommodation, nor consensually with the other pupil. The diagnosis was between arteritis obliterans of a very unusual localisation and neoplasm. A radiogram showed a normal skull. On July 2, 1927, the power of his hand was restored, the speech was better, blood pressure was 125/80. Atrophia n. optici dextri; the pupil did not react to light, but reacted consensually with the other pupil. Now, more than 18 months after the attack, he is in comparatively good health. The other eye has not been affected at all. A diagnosis of neoplasm may now be excluded. His heart is good and he has never shown signs of atheroma anywhere else in his body.

A patient was first seen on January 24, 1926, a man aged 64 years, with a blood pressure of 210/110, urine, sp. gr. 1010, traces of albumen. Fundi: translucency of arteries lost, copper-wire colour, light reflex dotted. White lines at the crossings. The veins were depressed or slightly crushed, without interference with the blood circulation. Venous pulse. Seen again on February 3, 1926, and February 9, 1926, the blood pressure being 210/105. On November 13, 1927, he came to see me complaining that for the last two weeks he had seen on four occasions "a fog" before his right eye; blood pressure 240/120. Fundi: strikingly small changes at the crossings. No silver-wire arteries seen. In the right eye a striking change in the lumen of two independent vessels, an artery and a vein, which were running towards the macula. An irregular haemorrhage near the other independent vessel. In the left eye were many retinal haemorrhages. Striking change in the lumen of many arteries, especially of the sup. temp. art. The sup. vein was deflected centripetally near the disc by a small arterial twig. Blood urea was 51 mgm. per 100 c.c. On December 1, 1927, the blood pressure was 250/125. Urine: sp. gr., 1015, albumen, traces. B.E. as before. On December 3, 1927, he developed thrombosis of the upper branch of the right central artery. All the upper part of the retina was white, oedematous, *but the oedema did not cover the vessels*. Roughly it corresponded to the upper hemisphere. The lower hemisphere was normal in colour. The veins of the upper hemisphere were not affected. The arteries were narrow, covered with a white sheath, but the blood stream was not interrupted. One independent artery, going upwards from the disc, was intact near the disc. Thence it was covered with a white sheath until it divided into two branches. The left branch, after being crossed by a vein, was again covered with a

white sheath. The right branch was intact. In red-free light the border line between the upper and lower hemispheres was beautifully seen; it was a festoon-like line leaving the macula intact. Complete blindness of the lower part of the visual field. Central vision 4/6. He came to see me immediately after he lost his sight, so that the picture was fresh. On December 11, 1927, he felt generally quite all right; very active. The blood pressure was 250/120, in spite of medication, low diet and three days' rest in bed. The main trunk of the arteria temporalis superior dextra was now free from the white sheath. It was only accompanied by white lines on either side. The left branch of the independent artery was still the same. Another artery, which was crossed by a branch of the sup. temp. vein was completely obliterated, the blood-column being interrupted. All other arteries of the affected area were narrow, but not obliterated. The macula escaped because it was supplied by a cilio-retinal artery, which showed a change in its lumen, but was not blocked. On December 23, 1927, the circulation was completely restored, the white lines along the artery were gone. Even the artery in which the blood-column was interrupted was now restored. Blindness was permanent. The state of the retina three and a half months afterwards is shown in illustration No. 37. Evidently some blood is passing through, because the arteries are not obliterated and reddish in colour. The whitish patch on the disc is obviously the perivascularis, or, more correctly, a scar of hypertrophied perivascularis; it is larger than a trunk even of a normal artery. The same happened to the sup. temp. artery and the white stripes of the degenerated and enlarged perivascularis are still seen at some distance from the disc. Evidently, the white sheaths that I saw covering some of the affected vessels soon after the arterial circulation ceased were the oedematous perivascularis, which later on hypertrophied at the expense of the collapsed arteries. It is of some interest to note that the venous compression by the arteries is not lessened, although the arteries are thin and collapsed.

The interest of this case lies in the fact that it was a purely localised severe atheroma, affecting only one branch of the artery. In essential hyperpiesis the changes are more widely distributed, affecting many vessels—as in the above patient's fundi on January 24, 1926. The important fact is that he had strikingly small changes at the crossings, but deep changes in the lumen of the vessels. One would say that his perivascularis was little affected, but his arterial walls very much indeed. Of interest are the rapid development of thrombosis in a few hours, without any cardiac or cerebral symptoms; the oedema of the retina behind the vessels and along them, but not covering them, as it does in cases of retinitis, especially of renal origin; and the festoon-like line of

division between the areas supplied by different arterial branches.

Conclusions.—Atheroma of the heart or large vessels with normal blood pressure, even in a severe form, does not produce any special changes in the retinal vessels; on the other hand, a severe atheroma of the retinal vessels and even of the cerebral ones may spare the heart and the aorta. Essential hyperpiesis, when added to atheroma, produces marked and advanced retinal changes which depend chiefly on the degree of arterial hypertension.

Involutionary Arterio-Sclerosis and Essential Hyperpiesis

“Old age alone does not produce these changes.” *Gunn.*

In the previous chapters I have pointed out so often the very insignificant part played by involutionary arterio-sclerosis of Allbutt, that here I need only summarise. If involutionary arterio-sclerosis were to attack the retinal vessels, retinal sclerosis would be seen much more frequently. After a certain age, involutionary arterio-sclerosis is present in everybody, and yet, although rarely, the retinal vessels may escape completely. If they are frequently mildly sclerotic this is because they can be changed by all toxæmias, whose number is legion, which attack every living being in this world of misery. But if one sees an elderly person with a fundus where the translucency only is lost, with corresponding changes in the light reflex and colour of the vessels, without white lines at the crossings and without arterio-venous compression, one can be sure that the blood pressure is normal. If, on the other hand, with a normal blood pressure at any age, one sees marked retinal sclerosis, it may be either a case of essential hyperpiesis in the past and the blood pressure has now become normal leaving behind permanent changes in the retinal vessels, or some kind of toxæmia was present in the past. Generally speaking, as is clearly seen from group No. 1 of my cases, involutionary arterio-sclerosis may cause loss of translucency of the retinal vessels, white lines at the crossings, and arterio-venous compression. But very rarely is it the cause of silver-wire arteries, change in the lumen of the vessels, or retinal hæmorrhages. Essential hyperpiesis will aggravate all these, the silver-wire arteries will appear, the vessels will be changed in their lumen, arterio-venous compression will increase in the number of vessels affected and in intensity, giving often the picture of an “hour-glass” contracted vein, retinal hæmorrhages will be present. I have excluded from my cases all those where the kidney efficiency was impaired, as shown by urinary, retinal and laboratory examinations. Atheroma has been described and discussed above. Therefore, we are only left with the unknown toxins of essential hyperpiesis, which attack the retinal vessels (and there-

fore, the cerebral, too) as a spot of predilection as syphilis does in the case of the heart and aorta. In my opinion, *the hyperpietic has a haemorrhage in his head so much more frequently than in other parts of the body, not because the cerebral vessels are mechanically ruptured by hypertension—why then should other vessels escape?—but because those vessels are the ones that are chiefly attacked and are the first to suffer.* It is a well-known fact that in essential hyperpiesis the vessels may remain histologically normal for many years. *As far as the retinal vessels are concerned this does not correspond to the results of my investigation; they lose their translucency early and completely, they change their colour, and “dot” the light reflex—all true histological changes, although so fine that they can be detected only in vivo, and most probably would appear normal in a microscopical preparation.* The connection between the retinal, cerebral and kidney vessels is a well-known fact, but how often do we see haematuria in hyperpietics? I take haematuria as an example because usually a patient is frightened when he passes blood in his urine and is not apt to overlook it and not consult a doctor. I presume here that retinal sclerosis usually means cerebral sclerosis also, but not *vice versa*. This was shown by Hertel and his opinion has not been challenged by anybody until now. Hertel divided his cases into two groups, one of which I call involutionary sclerosis, the purely senile type, and the other, pathological sclerosis. The microscopic changes in the first group were permanent and present throughout the vessel (*in der ganzen Ausdehnung der Gefasse.*) Opposed to that in the second group, the changes were typified by partial localisation (*fleckweise auftreten.*) They were met with only at localised points and *chiefly in the cerebral vessels.* In the retinal vessels they were very small, and very seldom were they seen with the ophthalmoscope. Am I justified in saying that my clinical conclusions coincide with those classical post-mortem findings of Hertel? Ramsay, p. 397, says “*arterio-sclerosis* may show itself very early in the retinal blood vessels”—I should say—*essential hyperpiesis*. The same applies to the sentence of Foster Moore (p.50). “In general arterio-sclerosis the retinal arteries, of course, share . . . consequently arterio-sclerosis is one of the diseases often first discovered by the ophthalmologist.” It is the chief purpose of this paper to affirm that in general involutionary arterio-sclerosis the retinal vessels are affected only very moderately, or not at all, and Foster Moore is correct only if he means essential hyperpiesis. The same applies to Parsons’ opinion (*Path. of the Eye*, p. 1271) “General arterio-sclerosis manifests itself by changes in the retinal vessels—often the first observable sign.” And farther on (p. 1281) “The cerebral vessels are sometimes highly sclerosed, although no

evidence of general arterio-sclerosis is furnished by the peripheral arteries." This coincides entirely with my view if only essential hyperpiesis is meant instead of "general arterio-sclerosis."

When Allbutt first characterised essential hyperpiesis as accompanied by the "Sergeant Death," the medical profession was most probably staggered. Since then the physician has found that the fatal end is not always near at hand, even with advanced essential hyperpiesis and the pendulum, it seems to me, is swinging to the other extremity—to regard arterial hypertension more or less light heartedly. This is very wrong indeed, since it would be comprehensible for the lay-mind, which by the term "danger" understands something serious for to-day or to-morrow. The insurance companies are the best judges and their publications leave no doubt on this matter. "Of 525 applicants accepted in earlier years who showed an average systolic pressure of 152.88, the N.W. Life Insurance Society suffered an excess mortality exceeding by over 30 per cent. the general average of that company. In another group of 1,970 lives, showing an average systolic pressure of 161.44 and representing the rejected risks, followed only in part and under great difficulties, the mortality rate was almost two and a half times greater than the general average of the company. Yet, of this group, at the time of examination, 1,082 showed no other impairment, than this relatively high systolic pressure and the individuals composing this subgroup and showing but the single blemish (B.P. 161.44) yielded an excess mortality more than double that properly to be expected." (Green, p. 478.) A medical man must always be on his guard and thoroughly examine a hyperpietic. And I earnestly affirm not only to the *deus minor*—the general practitioner, but the *dei majores olympici* of the profession that the ophthalmoscope, when properly used, will give very precious data, more cheaply and more quickly and even more certain sometimes than very complicated, costly and delicate auxiliary examinations, often outside the scope of an all-round consultant. And I gather from Fisher's publication that no ophthalmoscopic examinations were made by the "dei" of the insurance company.

If this fundamental idea were grasped, one would never cease to use the luminous ophthalmoscope in routine examinations. From time to time, I come across cases, seen by hospital and private medical men, crying out, so to speak, for ophthalmoscopic examination, which immediately reveals the seriousness of the situation. There is always hope for the man who acts, even though he makes *bona fide* mistakes, he will learn by them; but there is no hope at all for the one who does not act because he is afraid of making a mistake. Important is the revision, the reaction in the medical mind towards the ophthalmoscope; the

inertia and piety of to-day must go, the instrument must be used more often and its results appreciated more widely.

In *Brit. Med. J.* of March 3, 1928, appeared an article by R. Hutchison on the principles of diagnosis. His views are very much the same as mine. Clinical observation is eclipsed nowadays by laboratory examination. The leader, on p. 38, does not agree with this. "But laboratory methods do provide facts; and it is here that the clinician is sometimes at fault, for if the laboratory finding is not in harmony with his clinical conception of the case he is apt, especially in his teachings, to draw distinctions between "clinical observation" and "laboratory methods," which are by no means flattering to the latter. This is all wrong; there is no real distinction between the two types of observation. . . . The fact that a patient has . . . a raised blood urea or a positive Wassermann reaction is merely a clinical observation. . . ." It all sounds very clever in theory, but let me tell of a fact. A young woman aged 31 years, married a man whose first wife had died from phthisis a few weeks after her confinement, leaving a healthy baby. In May, 1927, when six months pregnant, she coughed up a mouthful of blood. Alarmed, she consulted her local doctor who wisely referred her to a well-known special hospital. Her temperature was constantly normal, her sputum negative. But an X-ray of the chest showed an active tuberculous process and she was advised to have her pregnancy immediately interrupted. She protested vigorously and was allowed to wait another week or so. At the end of this time, though the temperature was normal and the sputum negative, another radiogram showed that the process was spreading. She was then transferred to a large teaching hospital, examined afresh and again strongly advised to get rid of the foetus. Still dissenting, on the eve of her undergoing the operation, she consulted another local doctor who could not detect any physical signs in her lungs. The next day she saw a careful and elderly consultant, who agreed with the practitioner that she could be allowed to go to full term. She gave birth to a healthy baby—an anaesthetic being necessary—and is now, a year after her confinement, in good health, the child being likewise. Throughout this time she has not shown any clinical signs of pulmonary tuberculosis; normal temperature, no cough, putting on weight. The reader is asked to believe me, that I am very well aware of the dangerous character of haemoptysis in a pregnant woman!

Diabetes

In April, 1927, a man over 50 years of age was suddenly seized with vomiting, severe pain in the stomach, and signs of intestinal obstruction. After a day or two of agony, on the advice of two

local practitioners, he proceeded to a large teaching hospital for a laparotomy. After being admitted to the hospital he was examined by a surgeon, who also made a diagnosis of acute intestinal obstruction and advised an operation. Next morning, the third day of his illness, the patient was brought to the anaesthetic room and refused to allow an operation. The angry surgeon discharged him. At midnight of the same day he was seen by another practitioner: Temperature 96°F.; pulse 121; blood pressure 120/70. Soft, painless abdomen; meteorism. Black, furred, badly smelling tongue. Agonising pain in the upper part of the abdomen. Facies nearly Hippocratica. Extremely soft eye-balls (by palpation). Glycosuria present, acetone bodies absent by the ferric chloride test. Insulin in large doses injected. In five days the man recovered completely. In a month, insulin was stopped. Now, eighteen months after this attack, he is allowed to eat starchy foods freely, but no sugar or honey. He is sugar free, he has put on weight, his blood pressure is 160/90, his fundi are mildly arterio-sclerotic. How to label his case I really do not know. Very vaguely it may be described as an acute disturbance of the endocrine activity of the pancreas, but this does not help us. The absence of acetone in the urine does not alter the diagnosis of diabetic coma. Weichmann points out this fact, and, in his opinion, the findings in the urine are not decisive. Very nearly of the same opinion is Docent Elias, who shows that the amount of sugar and acetone in the urine may be very small, if the patient eats nothing and the vascular system is impaired.

In spite of tremendous progress since Banting's discovery, there are still many obscure points in our theory of diabetes. Is the blood pressure raised by the diabetes itself or by some secondary products of the faulty metabolism? Why are some cases refractory to insulin? What is the influence of insulin on the ocular changes? These and many other important questions are still undecided.

I wonder if a student would escape without grievous harm from his examiner if he were to omit the description and discussion of eye changes in his account of diabetes mellitus. And I am sure that many of the examiners were present at last year's conference of the British Medical Association, when McLean opened a discussion on diabetes mellitus and insulin. He divided diabetes into the true and the false variety; the former is a true disturbance of pancreatic activity and is accompanied by ketonuria—the second one, chiefly a disease of the aged, is simply an inability of the tissues of the body, especially the muscles, to utilise all the glycogen which is liberated by the liver. A lively discussion followed and only one speaker as an aside mentioned the importance of the ocular changes.

In *Brit. Med. Jl.* of May 7, 1927, is published a very good paper by Earl, of the Salford Royal Hospital, on the treatment of diabetics with insulin in the out-patient department. The utmost care is taken, the weight is recorded, the blood often tested for sugar, but the ophthalmoscopic examination is not mentioned at all. I presume it is not done. Minkofsky, in his paper, as far as I am aware, also does not pay any attention to the importance of the ophthalmoscopic examination.

And it is so important and helpful. My analytical table shows the average age as 50, males 12 cases, females 14, average blood pressure 188/98; retinal sclerosis marked and advanced. I have never seen a diabetic with the translucency of his retinal vessels preserved. How helpful the ophthalmoscopic examination may be is shown by the following two cases.

A man aged 52 years, suffered from diabetes two years ago. Presented himself now complaining of general malaise. Urine normal, sp. gr. 1015, blood pressure 140/70. Fundi: translucency lost, copper-wire colour, light reflex dotted. White lines on the disc and crossings. The right sup. nasal vein going upwards from the disc passes over a focus of old chorio-retinitis; the vein is very narrowed at this point and much banked above it. Many spots of old chorio-retinitis, corresponding to the lower temporal branch of the lower artery. In the central part of the retina, especially near the macula, many fresh spots of chorio-retinitis. Nothing special in the left eye. Following these findings, his sugar tolerance (not only the blood sugar) was tested. His fasting sugar was 0.105. Then 50 grammes of glucose in water were given to the patient; after 45 minutes his blood sugar rose to 0.180, glycosuria present. After two hours, glycosuria absent, blood sugar 0.095. Diagnosis: mild diabetes mellitus. Dieting improved his general health and also the eye condition.

Transitory myopia and symmetrical ulcers in the cornea have been described by Rosenstein, in the early stages of diabetes.

I do not like the term "retinitis diabetica." Retinitis implies, first of all, a hyperaemia, *an oedema of the retina*. And, as far as my experience goes, I have never seen this in pure diabetes. The exudation in the retina is clearly defined, not of such a "fat" colour as in nephritis; often surrounded by pigmentation; the vessels are clearly seen, although they may be markedly degenerated and haemorrhages may be present. With some training one can differentiate these changes from renal ones, although this is sometimes extremely difficult. Still, the presence or absence of retinal oedema would, in my opinion, be a deciding factor; the oedema is characteristic of nephritis.

A woman, aged over 50 years, was seen at the ophthalmic out-patient department of the London Jewish Hospital, on April 15,

1927. The diagnosis of diabetes mellitus was made two years previously in the medical department, and she was treated accordingly. Six months before she was admitted to a large teaching hospital for a minor operation and was told that she did not suffer from diabetes. Her eyes were not examined there. Fundi: translucency lost, copper-wire colour, light reflex dotted. The veins are crushed by the arteries and deflected centrifugally. Many small haemorrhages. Many old and fresh diabetic exudations, especially in the right eye, where a star is formed. Blood pressure 225/125. Urine: sp. gr. 1020, sugar ++, albumen +. The reader will no doubt agree that if the fundi had been examined at the large teaching hospital the diabetes would have been detected, in spite of the negative urine findings.

On April 26, 1927, her blood sugar was 0.287 and her blood urea 49 mgm. On June 14, 1927, her blood sugar was 0.26, and her blood urea 27. Urea concentration test:

Before urea	...	...	1.8 per cent.
One hour after	...	...	2.1 per cent.
Two hours after	...	...	2.1 per cent.

She was an obvious case for immediate insulin treatment. But she disappeared. She was seen again on February 10, 1928. Fundi: the same, "star" around the macula in the right eye. Small round haemorrhages in both eyes, discs clearly defined. No oedema of the retina present. Urine: sp. gr. 1010, albumen +, sugar -. Still I adhered to my diagnosis of diabetes because retinal oedema was absent, although the blood pressure was the same. The following week came the result of her blood test: Blood sugar 0.259, blood urea 42 mgm.

Her urea concentration test was:

9.30 a.m. (before urea)	...	...	1.9 per cent.
(urea given immediately afterwards).			
10.15 a.m.	...	...	1.4 per cent.
10.40 a.m.	...	...	1.3 per cent.
11.15 a.m.	...	...	2.0 per cent.
11.45 a.m.	...	...	2.1 per cent.

In my opinion, she was a case of diabetes with benign nephrosclerosis.

The following case is more complicated. She was described in my first paper under No. 6 C. Her blood pressure rose from 150-160/90 to 220/100, in spite of insulin injection. She

developed severe sclerosis of the retinal vessels, with many extensive retinal haemorrhages and foci of exudation all over the retina. Fine oedema of the retina. The specific gravity of the urine was 1005. The vision was very much impaired, as the retina was atrophied in many parts. This was in the autumn of 1926. Since then her blood pressure was 185-210/80-100. She still had extensive haemorrhages in her retina, but otherwise she was quite well, active, walking about, and doing her housework. On February 12, 1927, I saw in her right eye a branch of the lower ret. artery accompanied by a large area of white exudation, so that the artery was partly covered by it, narrowed and deflected. Other vessels were crossing over their exudation spots, unchanged and clearly seen. On May 7, 1927, the picture was the same, but in some places the vessels were covered by the exudation. On November 3, 1927, her blood pressure was 230/100. Fundi: unchanged, but there was a striking change in the lumen of the vessels, especially of the veins. Her blood urea was 49 mgm. per 100 c.c. blood. Phenolphthalein test 6.6—22.2—4.3—; urea concentration test 1.1 per cent. and 1.7 per cent. On November 23, 1927, with a blood pressure of 225/100, she complained of retrosternal pain. Urine normal, sp. gr. 1000. Fundi: exudation and oedema of the retina disappeared. Haemorrhages, old and fresh. Atrophy of the retina. The physician, under whose care she was in the hospital, kindly wrote to me on November 4, 1927. "I first saw her on January 7, 1924. There was glycosuria with a blood sugar of 0.36 per cent. She was admitted and remained sugar-free on a diet of 1,700 calories, being discharged after five weeks with a blood-sugar of 0.133 per cent. In May, 1927, she was again seen as an out-patient with glycosuria and a fasting blood sugar of 0.077 per cent. The first note of her blood pressure is in May, 1925, when it was 240/120. There were then hard radial arteries and the fundus showed silver-wire arteries, exudate and many old haemorrhages. In May, 1926, she was sugar-free with a blood-sugar of 0.22 per cent. and I put her on insulin, 5 units twice a day. In August, 1926, the blood-sugar was 0.1 per cent. In October, 1926, the retina showed recent flame and dot shaped haemorrhages and a spot of chorio-retinal atrophy."

A few interesting conclusions may be drawn from this case. We can exclude diabetes as the cause of her hypertension and retinal changes. She is on insulin, her blood sugar is normal, the urine is free from sugar, with a specific gravity of 1,000-1,005. Then we are left only with essential hyperpiesis and interstitial nephritis. The retinal changes are extremely severe; the most important point is, in my opinion, the oedema of the retina and the exudation not only behind, but also over the vessels. Unfortunately, when the retinal condition was at its worst, the hospital

did not test the efficiency of her kidneys, and a good opportunity was lost. The diagnosis lies, therefore, between benign and malignant nephrosclerosis. Considering carefully her retinal changes, I am inclined to think that she started as a case of interstitial nephritis (malignant nephrosclerosis) and the process now is either proceeding very slowly or is arrested altogether. That the last suggestion may prove to be the correct one is supported by the statement of Leber, p. 817, that "the retinal changes in true or albuminuric retinitis can recede if the basic pathological process in the kidney is healed or improved. In good cases even highly advanced retinal changes can recede completely." Here lies the chief interest of this case. Again, in considering this case, a conclusion presents itself that there is some intimate connection between the retina and the efficiency of the kidney (endocrine?). More than half of her vision is gone, more than half of her retinae is atrophied. If she would bleed to the same extent in the brain (I do not even say the lungs, etc., where the haemorrhage would be visible, so to speak, to the naked eye) she would surely be half paralysed or her mental capacity would be affected. And it is not. Even her hearing is not affected, except perhaps for slight giddiness, which is common to every hypertensive of her age and condition. Why then, of the whole of her brain, have only the retinae suffered so terribly?

The third case was fully described as No. 4 C in my first paper. Briefly, the particulars were as follow: Kept on insulin for three years. Her medical adviser thought that she suffered from "cataracts" because her vision was going. When seen by me, she presented haemorrhages in the retina, atrophy and fine oedema of the retina. Arterial hypertension. Two months later her blood pressure was 164/70. She died a few days afterwards, most probably from uraemia.

The connection between diabetes mellitus and nephritis has long been known to oculists. Leber writes, on p. 898, that retinitis, after the healing up (*Rückbildung*) of diabetes, is sometimes caused by nephritis. He goes even further than that, and on p. 915 he makes a very important statement, that with a large degree of probability we can assume that the disease of the retina starts only when the disturbance of the function of the kidney has caused already a rise of blood pressure. Yes, for the retina; no, for the retinal vessels, I should say. We shall see the difference immediately, when discussing the problem of nephrosclerosis.

On p. 949, he states that nephritis especially must be reckoned as the cause of retinitis, when the latter is of characteristic appearance and especially when the glycosuria is diminished or absent altogether.

Conclusions.—Even mild diabetes attacks the retinal vessels, but most probably to the same degree as the vessels are affected in the other parts of the body. Constant, frequently repeated, and careful supervision of the urine, blood pressure and retinae is necessary in every case of diabetes, be the treatment purely dietetic or by insulin; aggravation of the retinal changes, haemorrhages and especially oedema are often combined with rise of blood pressure and lowering of the specific gravity of the urine.

Nephrosclerosis

Many fascinating problems of importance immediately suggest themselves from the name of this chapter. But I am obliged in this paper to discuss only sclerotic retinal vessels, and shall therefore keep within those limits. The problem of the co-ordination or correlation between the kidney and the retina is too complicated and important to be treated only in a few lines. In the meantime, I shall discuss this question from the point of view of sclerotic vessels.

There are two items in my analytical tables, which I have purposely not discussed: Blurred disc and exudation on the retina. Again, as in the case of diabetes, I do not like the term of "sclerotic retinitis." Those exudations are usually not accompanied by oedema of the retina. They are usually small, sharply defined, and often, but not always, in the immediate neighbourhood of a vessel. They never cover the vessels, as usually occurs in renal retinitis. The vessels are clearly seen, they are sharply demarcated from the surrounding retina. Foster Moore also describes them in his "Medical Ophthalmology." They are already on the verge of retinal degeneration and are therefore not included in the theme of this paper. It is important only to note that they may disappear, sometimes in a few weeks, without leaving any traces, whilst the vascular changes, as has been pointed out many times previously, are always permanent. The parenchyma may improve, the vessel does not. This is in accordance with one of the most noteworthy laws of pathology, which applies to the retina as well as to any other organ of the body, that *there is no parallelism between vascular sclerosis and changes in the parenchyma*. This is also the opinion of Leber who quotes Opín and Rochon-Duvigneaud (p. 870). In spite of advanced endarteritis, an organ can function pretty well. And the visual acuity of the retina is usually not impaired even by advanced sclerotic changes. Even an advanced sclerotic kidney, primary nephrosclerosis, benign nephrosclerosis, arterio-sclerotic

kidney, call it what you please, will allow a good deal of excretory activity and will not endanger the well-being of the whole body to any excessive degree. On the other hand, in a severe parenchymatous degeneration, when the function of the organ is considerably and dangerously impaired, the vascular changes may be insignificant. In albuminuric retinitis the vessels may be nearly normal (Ginsberg). True interstitial nephritis—I should not like to be misunderstood, I do not possess more knowledge of its nature than anybody else, and altogether we know very little—is accompanied by rapid and tragic lesions of the whole body. Involutionary arterio-sclerosis implies only limitation of function; essential hyperpiesis is much more dangerous; interstitial nephritis (malignant or secondary nephrosclerosis) means a quick and tragic end. In the retina the first *per se* is seldom seen, and may be absent altogether; the second one means sclerosis of the perivascularis, change in the lumen of the vessels, haemorrhages and exudation; the third is accompanied by inflammation of the parenchyma, oedema, and its special form of exudation. For dialectic purposes I have described all of them separately; in life they are often combined, supplementing and replacing one another, making a clear distinction difficult and sometimes nearly impossible. However, this outline is very helpful for prognosis in certain cases. *Caeteris paribus*, the fate of the hyperpietic depends upon the degree to which his toxæmia is developed, his kidney is involved and its efficiency impaired. *One cannot, however, rely upon the blood pressure, the retinal picture, or the kidney efficiency tests alone*, in the prognosis; they must all be combined. A man with blood pressure 210/140 may be much nearer his end than another man with blood pressure 250/130. Retinal haemorrhages are less important if the blood pressure is steady, but if they increase, in spite of the blood pressure being steady or even going down, the outlook is gloomy. In my experience, the silvery-wire and tortuous independent small vessels around the disc are a bad omen. But worst of all is oedema of the retina. I do not mean by this retinitis albuminurica. The former is simply a fine veil, covering the vessels on the retina. One day you examine a fundus, well-known to you, and somehow you cannot see clearly the vessels. Changing the refraction does not help, nor increasing the beam-light. The vessels are covered and imbedded in a liquid. Sometimes it takes a few days, sometimes a few weeks, and this treacherous veil disappears to come again and again, playing with its victim, like a cat with a mouse. Sometimes the patient himself will tell you that he sees “foggy.” This oedema is a sure sign that the kidney efficiency is impaired and that the end is approaching. “Some degree of oedema of the retina is probably present in all cases,” says Foster

Moore; I entirely agree with this and emphasise it, but one has to examine the patient frequently and carefully. In the great majority of cases the kidney efficiency test, like the Wassermann reaction for syphilis, will coincide with this oedema and other clinical findings; in the minority it will differ. Theoretically, of course, the leader in the *British Medical Journal* is correct. The kidney efficiency test is also a clinical feature, but with our present imperfect knowledge the practical result will be different. "This patient is not suffering from malignant nephrosclerosis, his kidney efficiency tests being good; he suffers only from a gross cardiovascular lesion, and therefore the prognosis is not so bad," will say the laboratory worker. "You are wrong, Sir," modestly whispers the retina, "You are testing the kidney only for the toxins that you know, but there are others that you do not know, and they are poisoning me." Two cases will illustrate this.

A woman aged 65 years, an excessive eater, developed in 1923 acute intestinal obstruction. A laparotomy was performed and, in addition to the obstruction, the surgeon discovered a gall-bladder full of stones. It was not possible to remove it immediately; the woman recovered from her intestinal obstruction. She was discharged from the hospital and admitted again a few months later for an operation for gall-stones. She bore it quite well. In 1926 she was admitted into the medical wards of the London Jewish Hospital, suffering from pyelitis and cystitis, her blood urea being 250 mgm. Her systolic blood pressure was 195. As medicinal treatment failed to relieve her, the surgeon, Mr. Sourasky, decided to make a permanent suprapubic fistula. I saw her a few days after this operation with a blood urea of 175 mgm. Fundi: translucency absent, light reflex dotted, copper-wire colour, white lines at the crossings. The veins were crushed by the arteries with interference to the blood-stream. Some arteries showed a change in their calibre. No haemorrhages, no oedema. Blood pressure 105/65. Five weeks afterwards she was discharged from the hospital with blood urea 84 mgm. Fundi were the same, having been examined each week. A year afterwards I saw her again, she was now aged 70 years. Her blood pressure was 140-150/75-80, her fundi were the same, the veins being more crushed, her blood urea was 62 mgm. per 100 c.c. blood.

The second case was No. 17 C. of my first paper. I saw in her, on a few occasions, fine oedema of the retina. Her blood pressure was 250-300/130-160, in spite of medication and dieting. One kidney efficiency test gave "blood urea 17 mgm. per cent.; urea concentration test 0.4 per cent.—0.7 per cent.—0.8 per cent." The test was repeated many times by a prominent research worker in this country. He declared that her kidneys were fairly good.

Under pressure of the relatives, whom I warned of the gravity of the situation, I communicated with him. He kindly answered me: "She is really suffering from gross cardio-vascular changes. Her kidneys are by no means badly affected and any change that is present in them must be attributed to the primary arterio-sclerotic condition. I think that the eye changes seen in the majority of renal cases are due to the cardio-vascular changes which usually accompany the disease and not to the renal lesion. I have often seen a case where chronic nephritis was diagnosed by examination of the eyes and yet the patient's kidneys were apparently quite healthy, though he always suffered from cardio-vascular changes. I am quite certain that it is impossible to diagnose between high blood pressure alone and renal disease by eye examination. Mrs. X's kidneys are comparatively good. Her blood urea is normal and her urea concentration test quite satisfactory. If her kidneys were bad she would be dead long ago." And so she was ten months after this letter to me was written. She went out for a walk, being in "good condition," returned home and immediately died, sitting in a chair, most probably from a cerebral haemorrhage. I was away from London at the time, and I did not see her during the last few months. But the above was the impression of the doctor who saw her dying. Nevertheless, a gifted man is admirable even in his mistakes; as in a nutshell, in the letter quoted above, is put the whole controversy. If the retinal changes are only secondary to the vascular changes he is correct; if they are primary—an actual disturbance of the retinal metabolism as a result of the kidney intoxication—he is wrong. I have dealt at length with this difficult question in my first paper. Here I shall briefly state that the retinal changes are primary, and that my correspondent is wrong. That is why I have discussed throughout the present paper only the sclerotic vascular changes and have abstained from discussing sclerotic changes of the retina itself, and more so retinitis—they are different clinical entities, with different aetiologies and different prognoses, although they may co-exist.

It is a remarkable fact that this oedema of the retinae in my experience, is always connected with arterial hypertension, but there is no oedema of the subcutaneous tissue unless the heart is commencing to fail. On the other hand, I have seen in my life not a few cases of serum-sickness, and the oedema of the subcutaneous tissue, all over the body, but especially of the face was sometimes very considerable indeed. There was usually also a good deal of albumen in the urine, but I never noted a rise of blood pressure, nor oedema of the retinae, nor even a blurred disc.

And the kidney is still a very little-known and treacherous organ. Only recently I deplorably failed to recognise

an early stage of uraemia. I was called to see a woman aged over 50 years, thin and miserable looking, with chronic bronchitis. She was afraid to take food, quarrelled with the family, was sleepless and excited at nights. Her blood pressure was 160/90, traces of albumen in the urine, sp. gr. 1010. Fundi, as far as I could examine at the patient's house, in a darkened room, and with undilated pupils, were mildly arteriosclerotic. She complained of severe epigastric discomfort, but no headache, giddiness, or disturbance of sight. A diagnosis of some mental or hysterical excitement was made. As she did not improve, I sent her to a special hospital where the diagnosis of delusions was confirmed and admission to the Infirmary was suggested. She died three days afterwards in a state of uraemia. Post-mortem showed a very small contracted kidney with a very poor cortex and a partial thrombosis of the basal cerebral artery.

The blurred disc, when seen in hyperpictic cases, does not imply, in my opinion, anything special and dangerous. I speak, of course, of the mild form only. I simply think that the condition of the circulation is very unfavourable in the sclerotic vessels, compressed as they are on all sides, and, therefore stasis of the lymph is more easily produced. Larson points out the fact that even a "choked" disc may occur in cases with high blood pressure, without there being clinically any demonstrable renal disease.

What is the nature of hyperpiesis? Is it a disease *per se*, as described by Allbutt, or is it simply a protracted initial period of Bright's disease, interstitial nephritis? The dispute does not seem to be settled even now. Lyon, p. 766, is the advocate of the second theory; "In many cases, the syndrome of arterial hypertension well described by Dieulafoy under the name of minor signs of "Brightism," may develop with little of the symptoms of proper Bright's disease. . . . This cardio-vascular form constitutes also the first stage, often a long one, of Bright's disease, before it ends in the syndrome described under the name of interstitial nephritis." In German speaking countries, Pal is of the same opinion as Allbutt, and, if I am not mistaken, Volhardt is also. However, Kylon testifies that in the hospitals and clinics of Scandinavia and Germany the view still prevails that essential hyperpiesis is really an early nephritis. He himself thinks that essential hyperpiesis is not a kidney trouble at all, but a disease of the vegetative nervous system with the influence of the vagus being predominant over that of the sympathetic. In this country Batty Shaw is of Allbutt's school; the best résumé was made at the meeting of the Manchester Pathological Society. Maitland Ramsay, p. 397, writes "Arterio-sclerosis may show itself very early in the retinal blood vessels and give rise to haem-

orrhage long before there is any manifest renal inadequacy. It is prudent, however, to regard those cases as pre-albuminuric."

I have dealt at length in this paper with 269 cases whose average blood pressure was 200/110. It means that in a large proportion of them, roughly a third, the systolic blood pressure was 230-250 and the diastolic 110-140. In not one of them, although a few have been known to me for at least five years, was there any clinical evidence of renal impairment, as shown by the blood-urea test, frequent and careful retinal examination, testing of the urine and minute clinical investigation. Therefore, there is no reason whatsoever for considering that they represent the early stage of Bright's disease. Moreover, the retinal condition does not suggest it either, and I have purposely excluded all cases with oedema of the retina, even in its slightest degree. I agree with Lewandofsky when he considers that every systolic blood pressure of 180-200 or higher means a diffusé vascular nephritis, most often an arterio-sclerotic kidney. But I should reverse the sentence of Green: "*As a matter of practical application a decided and persistent hypertension with a high or relatively high diastolic level means chronic nephritis, until another cause is proved or rendered a reasonable assumption.*" (Italics of Green.) In my opinion, it means first of all essential hyperpiesis, until chronic interstitial nephritis is proved or rendered a reasonable assumption.

Extravaganza

"*Dans la nuit, ou nous sommes tous, le savant se cogne aux murs, tandis que l'ignorant reste tranquillement au milieu de la chambre*" (Anatole France). It is quite possible that when I was basking in the green light of my luminous ophthalmoscope and thought myself firmly established on the *membrana limitans interna retinae*, examining the details of vascular sclerosis, I was really suspended somewhere in the centre of the corpus vitreum at the end of one of its fragile fibres. But at least in the preceding chapters I have been able to show facts that could verify every word of my reasoning. Here, in the concluding chapter, I repudiate such a responsibility and shall make some general remarks rather of a fanciful nature, for which evidence should not be asked.

We have seen that sclerosis of the retinal vessels is produced chiefly by essential hyperpiesis; that it is represented by sclerosis of the perivascularis and pathological changes in the vascular wall itself. This sclerosis of the perivascularis tissue together with the change in the vessel wall is highly characteristic of essential

hyperpiesis. It does not correspond entirely to fibrosis, but it is something very similar. It is probably a defensive reaction; an attempt of the vessels to carry on their vital function as well as they can under pathological conditions. And this is in accordance with the whole picture of arterial hypertension, which is, after all, a defensive reaction of the body, a reaction which is usually overdone and is damaging in its effects, somewhat like the diarrhoea of infants. It means that the interstitial tissue degenerates and, contracting, squeezes in the vessels, compresses them. It would only be logical to look for an analogy in other parts of the body, the anatomy of which is better known than that of the retina. In the liver, and especially in the kidney, we shall find a very similar process. "In cases of albuminuric retinitis, post-mortem shows a contracted kidney, diminution of the organ, considerable overgrowth (*Wucherungen*) of the interstitial tissue and atrophy of the secreting parenchyma, especially of the cortex." (Graefe-Saemisch, p. 895.) In Price's text-book we find the following definition of chronic interstitial nephritis: "A fibrosis of the kidneys with degeneration of glomeruli and tubules, associated with raised blood pressure, hypertrophy of the heart and abundant urine." And lower down: "The vessels of the brain are particularly apt to be diseased, hence the special liability of such patients to die from a cerebral haemorrhage." Anders does not express quite the same opinion: "A chronic diffuse inflammation of the kidneys, attended with a growth of connective tissue in the stroma, degeneration and atrophy of the parenchyma and marked cardio-vascular changes. The destruction of the renal parenchyma is due to the circulation of noxious agents, and it is replaced by cicatricial fibrous tissue (Weigert)." He wisely differentiates four forms; the primary one, the arterio-sclerotic kidney, the senile type, and the secondary form. I think this is a very good definition and meets the case better. If the parenchyma is primarily attacked and destroyed, we have the secondary kidney, malignant nephro-sclerosis—and that is why the clinical picture is of an acute and severe poisoning, with very considerable danger to life; but if the parenchyma is only squeezed, compressed by the degeneration of the interstitial tissue, secondarily involved, we have primary sclerosis of the kidney, benign nephro-sclerosis. We shall get here the picture of essential hyperpiesis. Ultimately, of course, both forms will meet *in extremis* because whether primarily or secondarily affected, the parenchyma will go. Thus we see in the case of kidney how correct is the rule mentioned previously that an organ can function satisfactorily, although its vessels may be in a state of advanced sclerosis. The clinical picture is the same for patients with highly advanced retinal sclerosis and primary kidney (benign nephrosclerosis)

raised arterial pressure, especially in the diastolic one; low specific gravity of the urine; age over 40-50 years; restlessness and irritability of the nervous system—all pointing to some toxin, circulating in the blood and attacking the perivascular tissue and the vascular wall, but relatively sparing the parenchyma.

We have seen that for the retinal vessels essential hyperpiesis means sclerosis of the perivascularis. The retinal perivascularis contains the lymphatic vessels. If the perivascularis of other vessels also contains the lymphatic vessels, then this form of essential hyperpiesis is connected with toxins chiefly circulating in the lymph. The lymph is produced in the intestinal tract and the cells of the body, hence these toxins, in great part at least, are produced in the intestines either as by-products of metabolism or as the result of the bacterial flora. We already know that guanidine and cholesterine produce a rise of blood pressure in the vessels. Metchnikoff also pointed out the importance of chronic intestinal auto-infection in the premature ageing of mankind. And there is no doubt that arterial hypertension means the shortening of life. On the other hand, there is another form of vascular degeneration where the wall itself is the chief sufferer, fortunately in the minority of cases. And about the toxins of this form very little is known at present. The retina stands firm and fights long and hard against this intestinal toxæmia—essential hyperpiesis; it succumbs quickly and shows the affection very early when it is attacked by other toxins. Some of them, although circulating in the blood, produce benign nephrosclerosis. The others, perhaps produced chiefly by faulty metabolism of the body's own cells, but certainly associated primarily with bacterial infection, are intimately connected with impairment of the kidney and produce in the retina the characteristic retinitis albuminurica. Different toxins attack various parts of the vascular tree. To discover them, to trace them, is an enormous difficulty, but therein lies the thrill, the interest, and the reward of medical research. Unfortunately, the reward is seldom obtained because we are only beginning this new line of scientific investigation, and "life is short, art is difficult and the way uncertain."

It is my pleasant duty to express my sincere gratitude for the permission to use their drawings for the purpose of this paper to Prof. Krückmann (No. 1-1c), Mr. Ernest Clarke (No. 2), Mr. Dent (No. 3), Mr. R. Batten (Nos. 4, 7, 11, 14, 16, 18), Mr. Beaumont (No. 5), Mr. Thomson (No. 6), Mr. Joseph (No. 8), Mr. Summers (No. 9), Mr. A. H. Levy (Nos. 10, 12, 26), Mr. Ormond (No. 13), Mr. Marshall (No. 15), Mr. Goulden (No. 17), Mr. Davenport (No. 19), Mr. Evans (No. 25) and Mr. R. Junk (Nos. 31, 32).

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ANALYTICAL TABLE.

	No. 1 Group. (169 cases). Average age 47 years 4 months. Average blood pressure $\frac{118}{78}$		No. 2 Group. (269 cases). Average age 52 years. Average blood pressure $\frac{140}{90}$		Diabetic Group. (26 cases). Average age 50 years. Average blood pressure $\frac{148}{98}$	
	Cases	%	Cases	%	Cases.	%
Translucency diminished ...	2	1 $\frac{1}{2}$	—	—	—	—
Translucency lost ...	167	98 $\frac{3}{4}$	269	100	26	100
Light reflex dotted ...	128	76	256	95	26	100
Copper-wire colour ...	133	79	256	95	26	100
Silver-wire arteries ...	1	$\frac{1}{2}$	44	16	2	7
Change in the lumen of the vessels	7	4	65	24	6	23
Tortuosity of the vessels increased	1	$\frac{1}{2}$	—	—	2	8
Veins depressed only ...	13	7	18	7	2	7
Veins depressed and deflected	11	6	14	6	1	4
Veins crushed with interference with the circulation	20	12	108	40	5	20
Veins crushed without interference with the circulation	24	14	48	18	9	35
Veins crushed and deflected centrifugally	29	17	97	36	10	40
Veins crushed and deflected centripetally	15	9	37	14	5	20
White stripes on the disc ...	78	46	122	45	11	4
White stripes on the crossings	74	44	178	66	17	65
White stripes on the retina only	3	2	11	4	1	4
Narrowing of the vessels	4	3	15	6	1	4
Discs are not sharply outlined	2	1	10	4	—	—
Oedema of the retina	—	—	2	1	1	7
Old retinal haemorrhage ...	1	$\frac{1}{2}$	7	2 $\frac{1}{2}$	2	4
Fresh retinal haemorrhage	—	—	25	9	4	15
Exudation on the macula	2	1	8	3	1	4
Exudation on the retina	—	—	8	3	2	7
White stripes between the vessels	4	3	13	5	1	5
Aneurysm on the retina	1	$\frac{1}{2}$	3	1	—	—
Aneurysm on the disc	1	$\frac{1}{2}$	1	$\frac{1}{2}$	—	—

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