abnormal tissue-waste, and consequently increases the weight of the body; it causes neither narcosis nor constipation in doses which would be positively dangerous if given in other diseases. Still more efficacious is morphine, in doses of from 1 to 3 grains daily. The beneficial effect of these drugs, however, does not last very long; after three or four months they lose their effect, and there is, moreover, the risk of the opium-habit becoming confirmed. They should, therefore, be taken only at long intervals, and under strict medical supervision. Salicylic acid, phenol, and salicylate of sodium, are far less useful.

In conclusion, I venture to lay down the following propositions, as summing up the results of my studies and observations:

1. We are still in total ignorance as to the etiology of diabetes mellitus.
2. The quantity of sugar found in the urine is of no significance at all in judging of the severity and danger of any particular case of diabetes.
3. The smallest traces of sugar, found only by most careful chemical examination of the urine, are of considerable importance in a great many cases, so that they cannot be left out of account in trying to arrive at a correct diagnosis and prognosis.
4. The dietetic treatment must be adapted to the special requirements of each case, as there are cases in which, without regard to the amount of sugar excreted, complete abstinence from starchy matters is not only useless, but directly injurious.
5. According to the present knowledge, strict antidiabetic diet, combined with the use of the mineral waters of Carlsbad, is the best method of treating diabetes mellitus.

ON DIABETES AND ITS CONNECTION WITH HEART DISEASE.

By JACQUES MAYER, M.D.,
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A GLANCE at the literature of diabetes, which, more especially since the remarkable discoveries of Claude Bernard, has attained very large proportions, shows us that singularly little is as yet known about certain affections of the heart and blood-vessels which are apt to occur in the course of that disease. This may perhaps be accounted for by the circumstance that those who have occupied themselves with investigating the pathology of diabetes seem to have given their chief attention to the examination of those organs which experimental physiology had shown to be more particularly involved in its production. Thus Seegen, Cantani, Senator, and other authors hardly mention this point at all; while Donkin, Schmitz, Leyden, and others only casually allude to it. Nine years ago I published a paper (*Berliner Klinische Wochenschrift*, 1879, Nos. 21, 31, and 32) on certain symptoms which I had observed in cases of diabetes complicated with obesity. These patients were apt to be suddenly taken with dyspnoea; they complained of pain and oppression in the cardiac region; the pulse was abnormally quick, beating at the rate of 120 to 140 in the minute, with marked want of rhythm (*delirium cordis*). The pain sometimes spread from the heart to the shoulder or to the left arm. In fact the symptoms were analogous to those of angina pectoris.

Attacks of this kind have come under my notice in the initial stage as well as in the further progress of the disease, but more frequently at an advanced period, after the obesity had more or less subsided; and the physical examination of the heart showed mostly dilatation of the ventricles.

I did not then think that there existed an etiological connection between these symptoms and the diabetic process, or, more strictly speaking, the saccharine blood; more especially so because the same cardiac symptoms and physical state of the heart on which Leyden has thrown a flood of light have also been frequently observed in cases of obesity without diabetes.

Subsequently, however, I discovered similar symptoms in diabetes uncomplicated with obesity, and I then thought it would be important to ascertain accurately, as far as possible, from the very beginning of the disease, the physical condition of the heart in every single instance which came under my observation. I expected to arrive at some interesting results in this matter, as the waters of Carlsbad attract year after year a very large number of

patients suffering from diabetes, who belong to all classes of society, and the cases being in all the various degrees of intensity. I am fully aware that observations of this kind cannot claim the same degree of accuracy as those made in hospital practice, but I have been anxious to atone for this want as far as possible by written notes taken at the time. The number of cases being comparatively large, some degree of value may perhaps be attached to these observations.

From 1879 to 1888 I have had under my care 380 cases of diabetes, of which 266 occurred in males and 114 in females; the large majority of these cases, namely, 248, occurred between the ages of 40 and 60; 337 cases were in the first, and 43 in the second stage of the disease.

In this, as in previous papers on the subject, I prefer speaking of "stages" rather than of a "mild and severe form;" as experience has shown me that the former classification meets the facts of the case far better than the latter. Out of 43 cases of the second degree, 26 merged, as it were under my eyes, from the first into the second stage.

If we leave out of sight for the present the degree of intensity of the malady, and direct our attention to the general appearance of the patients, we notice certain distinctive features in them, which, though they are not absolutely constant, are yet sufficiently characteristic to enable us to distinguish three well-marked types of diabetic patients.

We have to do then: 1. With patients of a feeble and delicate constitution, a more or less pale complexion, and a timid and anxious expression.

2. With patients who, on the contrary, have a vigorous and healthy appearance, a florid complexion, and a lively and animated expression.

3. With obese patients, some of whom are pale and sallow, while others have either a ruddy or a livid complexion.

In the beginning of the complaint, or soon after it has commenced, the physical examination of the heart and vessels hardly ever shows in any case belonging to the three types just mentioned, that the sugar which is circulating with the blood, or any increased production of urea which may have occurred, have had an unfavourable influence upon the cardiac muscle. Auscultation and percussion reveal the same signs as in patients of similar condition who are not subject to diabetes.

After the malady has, however, lasted for some time, the physical signs undergo certain changes which come on sooner or later according to the individual case. To these I now proceed to direct attention.

In cases belonging to the first type, that is in those of a more or less anæmic and feeble constitution, I have occasionally seen endocarditis supervene after some little time, as described by Lecorché (*Archives Générales*, etc., April, 1882, p. 385), but much less frequently than this author, and not so much in patients of an advanced age.

In other cases of the same type the well-known symptoms of cardiac debility came on suddenly, while the physical signs found on examination of the heart did not show that any morbid changes had occurred either in the endocardium or in the muscular substance of the organ. In these we may however conclude from the quality of the pulse, which is very easily compressible and of varying frequency, as well as from the weakness of the heart's sounds and the occasional presence of the so-called "galloping murmur," that the functional power of the heart is lessened, and that this is owing either to atrophy or to retrogressive changes in the muscular fibres, that is, fatty degeneration.

In a further number of cases the physical examination of the heart, which had in the beginning shown nothing abnormal, revealed as time went on dilatation of the organ, which for a period did not seem to lead to any very striking symptoms, but which was, as soon as an exciting cause of some sort had acted, followed by severe dyspnoea and delirium cordis.

Cases of this kind are analogous to those of over-strain of the heart having a protracted course, in which Leyden (*Die Herzkrankheiten*, etc., Berlin, 1886, p. 34) has, with Da Costa, distinguished a first stage of functional disturbance of the heart's action, and a second period of organic lesion with dilatation of the ventricles.

With regard to diabetic patients of the second type, I have found in the majority of cases, after the malady had lasted for a variable time, a well-marked group of symptoms pointing to the development of cardiac hypertrophy. The complexion becomes reddish, the mucous membrane of the mouth and the conjunctiva

are congested, the eyes are lustrous, and the carotids pulsate strongly as soon as there is the slightest emotional excitement. Vertigo, headache, and singing in the ears are frequently complained of. The first signs of shortness of breath appear habitually after a somewhat abundant repast; walking exercise after meals causes discomfort; there is pain in the stomach and belching, and the action of the bowels becomes irregular; sleep is broken, and often disturbed by a dry cough. The pulse is full and strong, but does not show unduly high tension. It is regular and not accelerated, but, on the contrary, sometimes rather retarded.

The physical examination of the heart shows a strong impulse, which extends over several intercostal spaces. The apex-beat is either within or without the mamillary line towards the left side, mostly in the fifth or sixth intercostal space. Percussion shows an enlarged sphere of dulness upwards and downwards, and less so in the transverse direction. The heart's sounds are loud and normal. In short, we have to do with idiopathic hypertrophy of the left ventricle, which has become gradually developed.

Further observations have shown me that this condition of the heart may persist for a number of years without producing much systemic disturbance, provided the patient avoids over-exertion and emotional excitement, is temperate in his habits, more especially in regard to alcoholic stimulants, and is careful to take regular exercise. On the other hand, where there is impaired nutrition; where, as is sooner or later always the case in diabetes, the food taken does not suffice to supply the wants of the system; where, therefore, the structure of the organs themselves is called upon for the maintenance of work, or where sedentary habits of life promote arterio-sclerosis, then the functional activity of the heart becomes lessened. The cardiac muscle is then relaxed and dilated, or sooner or later severe symptoms of disturbed balance of power make their appearance. Signs of cardiac debility, in fact, are then of cardinal importance for the further progress of the disease.

In a considerable number of cases of diabetes, therefore, hypertrophy and dilatation of the heart become developed without there being any morbid changes in other organs, such as the kidneys, arteries, etc., which so frequently lead to these affections. They must therefore be owing to chemical irritation of the heart by the sugar and urea which are circulating in the blood. Diabetic patients eliminate more urea, other things being equal, than healthy persons; cases are on record where from three to five times the average quantity of urea has been excreted. The quantity of sugar contained in the blood in this disease likewise far exceeds that which is found in the normal blood, and it may therefore act as an irritant on the heart's structure.

This abnormal condition of the blood leads to polyuria, glycosuria, and agoturia, which are known to have a prejudicial influence on the kidneys by causing hypertrophy and hyperplasia of those organs. In connection with this I may here refer to the experiments of Gravit and Israel (Virchow's *Archiv*, vol. 86, p. 299), who have produced hypertrophy of the heart in rabbits, first, by causing chronic nephritis, and, secondly, by removing one kidney. These observers explain the increased cardiac function which took place in their experiments by the partial loss of renal function, and conclude that the matters which are excreted from the blood by the kidneys constitute an irritant for the heart leading to increased function, and eventually to increased volume.

Israel has, in another series of experiments, arrived at results which afford a considerable amount of support for the views which I have been led to form with regard to heart affections being the sequelæ of diabetes. He fed rabbits with large doses of urea, and found, after a few weeks, that hypertrophy of the heart came on, which was preceded by hypertrophy of the kidneys, showing that the system gradually gets accustomed to increased claims on the functional activity of the organs, as no serious deviation from health occurred in these animals. A similar result occurred after the introduction of nitrate of sodium, while grape sugar did not appear suitable for prolonged administration. If, however, injections of a concentrated solution of one or two grammes of this substance were made, either into the veins or into the peritoneum, it could be shown with a kymographion that increased blood-pressure was the result.

From these experiments Israel has drawn the conclusion that healthy kidneys will, to a very great extent, answer the increased calls made on their power, but that, in extreme cases, such as diabetes and feeding with urea, they eventually become insufficient, and this sooner or later, according to individual circum-

stances. This insufficiency is then met by increased action of the heart, which, if persisting for a considerable time, leads to hypertrophy of that organ.

It is in this sense that I wish to be understood to account for the hypertrophy and dilation of the heart which is so frequently found in diabetes.

It is well known that the kidneys are often found after death in a state of hypertrophy and hyperplasia; and while the results of necropsies of such cases which are hitherto recorded do not seem to confirm my theory, I would point to the fact that these *post-mortem* examinations have been made on hospital patients, who are generally admitted for more or less acute diabetes, which is connected with rapid wasting of the substance of the organs.

The cardiac muscle in such cases behaves much the same as other muscles when they have to do more work, yet do not become hypertrophied if they are badly nourished.

A very telling analogous instance is furnished by pernicious anæmia, where the small quantity of oxydisable constituents of the blood, and the necessity of supplying the system with oxygen, act as irritants on the heart, and would lead to hypertrophy, provided the heart were well nourished; but as such is not the case, and the heart is called upon for undue efforts, fatty degeneration will, on the contrary, be the result.

We may therefore take it for granted that the anatomical lesions to be found in diabetic patients of a better class would differ, so far as the heart is concerned, from those to be met with in average hospital patients.

Considering the fact that of the former class of cases hardly anything is known in this respect, I thought it all the more important to go carefully through the records of the Pathological Institute of Berlin, in order to ascertain any anatomical changes in the latter class, more especially as Israel had already found in 10 per cent. of diabetic cases which had proved fatal in the Charité hypertrophy of the heart without valvular disease, and without affections of the arteries and kidneys.

Professor Virchow was kind enough to allow me to peruse these records from 1856 to 1887. I gave special attention to the stated condition of the heart, blood-vessels, and kidneys, and found that the percentage of hypertrophy and dilatation of the heart was 13.0, while in the cases observed by myself it amounted to 21.6 (82 out of 380).

Want of space prevents me from giving the details of the *post-mortem* records of the Pathological Institute, but I may say that most of them show simultaneous severe affection of the lungs, and nearly all of them morbid changes in the brain; while in my own 82 cases no organic disease could be discovered, either by clinical symptoms or physical examination. The percentage of 13.0 must therefore be looked upon as considerable. I will not omit to mention that in a number of the other *post-mortem* records, hypertrophy of the heart with chronic endo-aortitis, as well as endo-arteritis and hypertrophy, were the primary affections.

While therefore heart disease in diabetes has only quite recently been described, and that by a very few authors, the occurrence of arterio-sclerosis in that disease has been much more fully dwelt upon, more especially by Frerichs. Those who leave out of account the increased functional activity of the heart have to look to the chemical alteration of the blood as the cause of the vascular disease.

We have seen above that the accumulation of sugar and urea in the blood is not proportionate to the quantity of these substances which is eliminated, but that, on the contrary, in consequence of increased cardiac activity, a compensatory elimination takes place in the urine, which is partly owing to enlarged kidneys and partly to changes in the heart's structure. The dilatation of the blood-vessels which occurs subsequently is simply owing to the increased work of the heart, which throws more blood into the vascular system in a unit of time. Vascular disease is the consequence of permanent mechanical irritation.

Sir William Gull's and Dr. Sutton's "arterio-capillary fibrosis" as occurring in nephritis, and Dr. Ewald's "muscular hypertrophy of the arterioles" must be looked upon as secondary consequences of the cardiac disease. In the same way, the occurrence of arterio-sclerosis in diabetes has to be traced to the mechanical influence of cardiac changes.

I hope to have rendered it evident that the cases of cardiac disease which I have observed in patients suffering from diabetes have to be traced to morbid changes of metabolism. My argument is, moreover, well supported by the observations of several authors, such as R. Schmitz, who have apparently found fatty

degeneration of the heart in a large percentage of cases of diabetes.

If we read such statements by the side of the anatomical records which I have mentioned, it will be seen that they have to be taken for what they are worth; for neither fatty metamorphosis nor infiltration of fat has been at all commonly met with *post mortem*. On the other hand, such observations have a clinical value, since, as far as symptoms are concerned, fatty degeneration, infiltration of fat, brown atrophy, dilatation, and other anatomical lesions of the heart may show at times the same clinical aspect, namely, that of cardiac asthenia, which latter appears to me due to the claims made upon the heart by the diabetetic change of metabolism. Compensation under these circumstances must always be temporary, more especially where the nutrition of the system in general suffers at an early period, and where the formation of urea and sugar exceeds that limit within which well-nourished kidneys and a well-nourished heart are able to eliminate these substances.

As far as treatment is concerned, it appears from the foregoing that everything should be avoided that may impair the action of the heart and kidneys; for we know that organs which are in a state of hyperactivity easily become diseased. I may here refer to the frequent occurrence of valvular disease in nephritis, and of nephritis in diabetes. The latter I have found recorded in 30 out of 66 cases contained in the records of the Pathological Institute of Berlin. Stokvis has forcibly drawn attention to the same point in his able paper on diabetes read before the late Medical Congress at Wiesbaden, while I have seen nephritis in 64 out of 380 cases, although not frequently in the form of granular contracted kidney.

The principle of sparing the suffering organs as much as possible has, in my opinion, to be carried out particularly as regards diet. In many cases a rigid nitrogenous diet cannot be enforced. I have, on this account, during the last few years, frequently added milk to the diabetic diet, and can fully corroborate the favourable testimony which Hoffmann gave on this point before the late Medical Congress.

ON THE INDICATIONS FOR THE USE OF THE KREUZNACH WATERS IN STRUMOUS DISEASE.

By DR. HEUSNER,
Kreuznach.

THE motive which leads me to publish this article is the fact that patients are frequently sent from England to Kreuznach suffering from diseases for which the waters of this place are not suitable, while, on the other hand, many persons, for whose successful cure reasonable hopes might be entertained, are not ordered to Kreuznach at all.

General Treatment of Struma.—In the treatment of strumous diseases it is pre-eminently necessary to bring about an improvement in the constitution. The treatment of local affections, though frequently indispensable and very beneficial to the constitution, is seldom in itself sufficient, and will certainly be facilitated and rendered more efficient by the adoption of a suitable general regimen.

Kreuznach Treatment.—The question which I propose to answer is whether a course of the Kreuznach waters is beneficial in all cases of struma, and under what circumstances their use is contra-indicated. I am unable to answer this question by quoting statistical data, partly because a physician practising at a watering-place is apt to lose sight of the majority of the patients after too short a time, and partly because it is extremely difficult to give a decided opinion as to whether the strumous taint is definitely and totally eradicated. In many cases one cannot speak with certainty of a cure, but only of a general improvement. The result of my observations goes to prove that this improvement of the constitution has been attained, with very few exceptions, in nearly all cases after a steady and persevering course of the Kreuznach waters. In many cases the local symptoms so greatly predominate over the constitutional that the improvement of the former directly indicates the degree of constitutional amelioration. The favourable climate, and the possibility of exactly regulating the desired curative action, make a visit to Kreuznach advisable for individuals of the most opposite and varying constitutions. In some

cases, however, the hopes entertained with regard to Kreuznach have been doomed to disappointment, simply because people imagine that a single stay—and that often of very short duration—is sufficient to effect a cure. It is, however, only in very slight cases that a single course of treatment suffices; deep-rooted constitutional affections cannot be so easily eradicated; they necessitate not only repeated and lengthened visits to Kreuznach, but also continuous and careful dietetic treatment; while a subsequent stay at the seaside, or in the mountains, etc., is frequently indispensable.

Contra-indications of the Kreuznach Treatment.—Some complications of strumous disease make a course of Kreuznach waters futile, while others render it objectionable. For instance, I consider it distinctly contra-indicated in decided tubercular disease of the lungs; also in disease of the kidneys at an advanced stage, and in any chronic state of feverishness, from whatever cause. But when slight manifestations of fever are kept up by a strumous affection which, from its very nature, seems to point to Kreuznach as a place where an improvement is to be hoped for, a trial may fairly be made—more especially when it is impossible to attack the disease at its seat, as is the case, for instance, with caries of the vertebræ. Particular care should be exercised with patients suffering from valvular disease of the heart, or from degeneration of the heart-muscle, as the Kreuznach baths often unfavourably influence these complaints. Nor does the warm, dry climate which generally exercises such a beneficial influence on strumous persons, always suit patients suffering from asthma. I have not witnessed any favourable results from the use of the Kreuznach waters in cases of leukaemia or malignant lymphomata (pseudo-leukaemia, Hodgkin's disease, *adénie*), nor in cases of cancer or sarcoma.

The Kreuznach Treatment in Glandular Enlargements.—The obstinacy with which glandular affections resist any treatment is well known, and the question arises whether it is not advisable to extirpate the diseased glands at once before seeking other remedies. A source of tuberculosis is thus removed that might endanger the general health. My opinion is that, as long as the glands do not show decided signs of suppuration, weighty reasons may be urged against their extirpation, one frequent obstacle being the impossibility of removing all the diseased glands. Besides which, the scars of the operation are permanent. A still weightier reason against the operation is, that an outbreak of general tuberculosis has been known, in some cases, to follow immediately on the extirpation of the glands. Even glands that are already softened are capable of reabsorption, as well as the hard tumours mentioned in the preceding sentence. When suppuration has commenced, however—especially if accompanied by feverish symptoms of a more serious kind—surgical treatment undoubtedly affords better prospects of a rapid cure with small cicatrices than any other treatment. But, among the non-surgical curative methods, the treatment pursued at Kreuznach is certainly that most adapted to cause indolent glandular swellings to decrease in size, and even to be entirely reabsorbed. In order to put a stop quickly to suppuration, when it has become established, and to promote cicatrization, a course of Kreuznach waters is frequently a most valuable addition to the surgical treatment. The above remark also applies to cold abscesses, not originating from glandular disease, from which scrofulous people often suffer.

In Skin Disease.—As to eczema and other superficial skin diseases of a strumous nature, they are cured with surprising rapidity by a course of Kreuznach waters. In lupus vulgaris success is more doubtful, though I am of opinion that a relapse may be considerably retarded by a course of Kreuznach. But as, in this insidious disease, no one is secure from the danger of a relapse even after several years, I do not venture to assert that the cure is definitive and permanent.

In Catarrh.—Chronic catarrhs of the various mucous membranes, the obstinate nature of which is well known, are, without exception, favourably influenced by the Kreuznach waters, though of course deeply degenerated mucous membranes cannot be restored to their normal state. This has special reference to the almost unavoidable coryza of strumous patients. In the various catarrhs of the pharynx and fauces, the effects of Kreuznach treatment are most favourable. Adenoid vegetations of any considerable size are not, it is true, diminished by its use to any noticeable degree; but small lymphatic follicles may disappear from the back wall of the fauces. Hypertrophy of the tonsils, it may as well be mentioned here, is but seldom cured or even notably decreased.

In Ophthalmia.—The success attending the treatment of stru-