istic changes in refraction occurred only in the eye in which the lens was still present. Again it is impossible to explain the astigmatic changes on any other grounds.

With regard to the factors which are at the root of these changes in the index of refraction of the lens, the biochemical problems involved are of a highly complex nature. It seems to me that one cannot go further at present than to say that these lens changes are associated with changes in the water balance of the tissues of the body associated with changes in the blood sugar concentration, and that they cannot be explained by a mere difference in concentration of sugar or salts in the intra-ocular fluids. The cases on record have been mostly middle-aged people, but that age is not an essential factor is shown by the fact that the youngest patient reported was 14 and the oldest 74. A curious feature of the phenomenon is its rarity, but it must be remembered that even the commoner complications of diabetes, such as retinitis and cataract, are by no means invariably present.

SUMMARY

1. Transient myopic and hypermetropic changes in the refraction of the eyes occur in association with certain metabolic disturbances.
2. A remarkable relation seems to exist between those refractive changes and the blood sugar concentration.
3. The local cause of these variations in refraction is most probably a variability in the refractive index of the lens.
4. The underlying complex biochemical causes are still obscure.

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EXCRETORY BACILLURIA IN RELATION TO THE DIAGNOSIS OF RENAL TUBERCULOSIS

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Notwithstanding modern differential staining methods, the biological test is still the best means of detecting the presence of tubercle bacilli in the urine. It is not infallible, but with careful technique the percentage of error is low and can often be attributed to concomitant circumstances rather than to failure of the test itself. A negative result may sometimes be found in early renal tuberculosis, when the organisms are few and their excretion periodic, or when the focus is closed. Occasionally, too, in a more advanced lesion, tubercle bacilli may fail to gain access to the urine owing to occlusion of the ureter on the affected side. Again, when the human type of organism is very attenuated and the resistance of the guinea-pig high, morbid changes may not become discernible in the animal during the period allowed for their development, especially if the duration of the test is much under six weeks. A positive result may sometimes be obtained by the inoculation of urine drawn off by catheter from the ureter of the apparently healthy kidney of a patient suffering from unilateral renal tuberculosis. This occurrence has been attributed to regurgitation of infective material from the bladder, to contamination of the ureteral catheter during its passage through the bladder, and to excretory bacilluria.

TUBERCLE BACILLURIA IN ABSENCE OF KIDNEY DISEASE

Some authorities assert that tubercle bacilli may be found in the urine when there is no lesion of the genito-urinary tract. They consider that the micro-organisms can be carried from a distant focus and excreted by

healthy kidneys. The literature reveals a great lack of agreement as to this possibility.

Hübner,⁴ discussing diagnosis, states that the value of the demonstration of tubercle bacilli microscopically, or by animal inoculation, is much overrated. He claims that the kidneys can transmit tubercle bacilli from some distant focus without being themselves involved. Hyman and Man,⁵ in an article on the laboratory diagnosis of renal tuberculosis, review 126 cases. They consider the finding of tubercle bacilli in a catheter specimen of urine from the kidney or bladder no absolute proof of renal tuberculosis. They emphasize that the diagnosis must not rest on the recovery of the bacilli alone, but that pus or blood, even in microscopic amounts, should be found associated. Van Rijssel⁹ also doubts the value of the guinea-pig test for the detection of tuberculosis of the urinary tract. He states that four kidneys removed on a diagnosis of tuberculosis by this method failed to show tubercle on microscopical examination. In two of the four instances the kidneys were normal, but the lungs showed a slight apical tuberculosis. In the remaining two benign renal tumours were present. Thomson-Walker⁸ also supports the doctrine of excretory bacilluria, and insists that the presence of pyuria, haematuria, and other signs is essential to establish a diagnosis of actual disease. Ramanis and Mitchiner⁷ are of opinion that some patients who have phthisis, but whose kidneys are normal, can excrete tubercle bacilli in the urine. On the other hand, Boyd,¹ writing on this important subject, expresses himself in the following words:

"The question whether tubercle bacilli can be excreted by a healthy kidney has long been, and still is, a debatable one. Large lists of cases have been published showing that in pulmonary tuberculosis there may be an excretory bacilluria without any tuberculous lesions being discernible in the kidney. But everything depends on the thoroughness of the search for the lesions. Medlar,⁶ in an important contribution on experimental renal tuberculosis, has shown that tuberculous lesions in the kidney could be found in every case in which there were tubercle bacilli in the urine. He has shown, moreover, that the number of bacilli in the urine bears no relation to the size of the lesions; that in many cases the lesions are microscopic; and that it may even be necessary to employ the method of serial sections. It would appear probable that the conception of an excretory bacilluria should be given up."

Bumpus and Thompson² take a similar view to Boyd. They believe that the presence of tubercle bacilli in the urine almost always indicates renal involvement. They do not think it possible for a normal kidney to filter tubercle bacilli from the blood stream into the urine.

A great deal of work has been, and still is being, done to try to clear up this question. Most people have concentrated on the correlation of the ante-mortem and post-mortem findings. Investigation along these lines is tedious and prolonged.

THE INVESTIGATION DESCRIBED

It seemed to the writer that the practical aspect of the question could be more easily settled by examining the urines of a series of patients suffering from fairly advanced pulmonary tuberculosis, but failing to reveal on careful examination and inquiry any signs or symptoms of genito-urinary involvement. Seventy-six patients having tubercle bacilli in their sputa, but showing no chemical or microscopical abnormality of the urine, were chosen. In addition to the phthisis, fourteen had dry pleurisy, two pleural effusion, one tuberculosis of the knee-joint, one tuberculosis of a rib, one tuberculosis of the larynx, one chronic otitis media, one silicosis, and one asbestosis. A specimen of urine from each patient was submitted to the guinea-pig test, the time allowed being six weeks.

Only one specimen produced discernible tuberculosis. As already indicated, this first sample of urine was otherwise normal, and there was an entire absence of albumin, blood, pus cells, and casts. There were no symptoms of kidney disease, and the x-ray showed no abnormal shadows in the renal regions. This patient, a man aged 30 years, gave a history of illness since March, 1931, but Dr. Stevenson, the medical superintendent of the sanatorium, considers that

the disease is probably of longer duration, for on February 2nd, 1932, the date of the reception of the first specimen of urine, this patient showed extensive disease of both lungs, with a good deal of fibrosis on the left side. His sputum is persistently positive, and contains numerous tubercle bacilli. He is not suffering from any of those complications which have already been enumerated. A second sample of urine from this patient, received on March 31st, also gave a positive biological test, but showed no other abnormality. A third sample, received on April 4th, gave a similar result. The organisms producing the tuberculosis were of the human type. They were recovered from the site of inoculation, and the direction of spread and the relation of the tuberculous lesions to the site of injection were sufficiently characteristic to exclude any possibility that they were due to spontaneous disease in the animal. The fact that the infection could be repeatedly induced by the urine of the same patient taken at different times is additional evidence in support of this contention.

At first it was thought that this patient afforded an example of true excretory bacilluria. It was not easy, however, to reconcile the repeated positive findings with this conception, except on the far-fetched assumption of an abnormal permeability of the renal epithelium and a persistence of the organism in the circulating blood of this man, which did not obtain in the other seventy-five individuals. Biological tests on the blood were negative. It was therefore decided to make repeated examinations of this patient's urine from time to time, in order to see if any evidence was forthcoming of actual renal involvement. Samples tested on May 7th, 10th, and 11th still failed to show any chemical or microscopical abnormality. A specimen examined on May 12th, however, showed a very faint trace of albumin with the Clapp-Cohen reagent (seven parts 10 per cent. phenol and one part of glycerin); all the other hitherto described methods gave negative results. Some granular and hyaline casts were also present on this occasion. On May 15th a very faint trace of albumin, some hyaline casts, and a few leucocytes were present, and on the following day there was an increase in the amount of albumin, and casts and leucocytes were still evident. Subsequent examinations revealed the presence of albumin by ordinary tests.

DISCUSSION OF FINDINGS

The positive results obtained from this patient's urine cannot, in view of the subsequent findings, be attributed to uncomplicated excretory bacilluria. In fact, the sequence of events suggests that the presence of tubercle bacilli in the urine may often be the first sign of renal tuberculosis. The writer's experience agrees with that of Medlar, that the number of bacilli present bears no relation to the size of the lesion, for a great deal depends on the site of disease and the facility with which the organisms can gain access to the tubules. Consideration of the pathology of a tuberculous focus is sufficient to convince one that any extensive degree of haematuria or pyuria is a concomitant of very advanced disease, and is not often likely to occur in the early stages. The opinions of some eminent authorities of bygone days, that the presence of pus and blood in the urine is essential for the diagnosis of renal tuberculosis, can no longer be maintained. Chute,³ several years ago, laid great stress on the slight urinary signs which may accompany early disease. These contentions are of more than academic interest, and anyone who excludes the possibility of renal tuberculosis simply on the absence of gross microscopical and chemical changes in the urine is likely at times to be misled.

Whether or not we attribute this one positive case to actual disease, it must be admitted that excretory bacilluria is a rare occurrence, and that in practice it is not likely to vitiate the value of the biological test in the diagnosis of renal tuberculosis. Moreover, it can be safely assumed that if it occurs so rarely amongst such advanced cases as those that have been under test in this investiga-

tion, it is still less likely to occur in those instances where early diagnosis is of value from the point of view of treatment.

SUMMARY

Seventy-six patients were selected who suffered from advanced pulmonary tuberculosis, but who had no obvious signs or symptoms of genito-urinary involvement.

Their urines were tested biologically.

All the specimens were negative except one.

Tubercle bacilli were repeatedly present in the urine of this exception, and were of the human type.

The presence of the micro-organism was for a time the only abnormality, but other signs developed gradually in this urine, which suggested early renal tuberculosis.

No definite evidence of excretory bacilluria was found in this series of cases.

My thanks are due to Dr. W. D. Carruthers for his sanction to obtain the necessary material, and to Dr. J. Stevenson, medical superintendent of Prestwood Sanatorium, for his assistance in securing specimens from suitable patients, and for the thorough clinical notes which he placed at my disposal.

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Memoranda

MEDICAL, SURGICAL, OBSTETRICAL

TWO CASES OF BOTULISM

We print below the separate accounts of two cases of botulism which resulted from the consumption of the same meal—a rabbit and pigeon broth. The patients, who were staying together in a house in Buckinghamshire, were affected at about the same interval after eating this food. Case I (Mrs. F.) returned to her home at Bedford, where treatment was undertaken by Mr. W. Gifford Nash, F.R.C.S., and where she subsequently made a complete recovery. Case II (Mrs. S.) was taken into the Radcliffe Infirmary, Oxford, and died shortly after admission. The case notes, by Mr. Gifford Nash and Dr. Percy Fox, are self-explanatory.

CASE I

(MR. GIFFORD NASH)

Botulism is a rare disease in Great Britain according to Savage (*Medical Annual*, 1926, p. 185), who investigated 100 outbreaks of food poisoning in which only one was due to botulism. The rarity of the disease and the comparatively mild nature of this case must be my excuse for not at once recognizing it. There were some advantages in this, as it enabled me to watch and note the various symptoms, and also to obtain much valuable information concerning the source of the poisonous food. In Osler and McCrae's *System of Medicine* (vol. i, p. 233) is an excellent description of the disease, from which I gather that my patient had practically every symptom. The history and the presence of the symptoms were