child was recently considered by an international committee set up by the Health Organization of the League of Nations,* and it was found that in all countries concerned, statistical and medical information regarding this period was lacking. Even in countries which have done most towards improving the health of children generally, the pre-school child is still neglected, not so much because the importance for supervision at this age has escaped notice, but because of the practical difficulties involved.

The chief dangers to life which threaten the young child are the acute infectious diseases (including measles, whooping-cough, diphtheria, and scarlet fever), and respiratory ailments, such as pneumonia and bronchopneumonia. The younger the child the more likely are such illnesses to prove fatal or to have serious consequences. The object is therefore to endeavour to postpone the incidence of infection as late as possible, and to see that the child has effective medical and nursing attention if it contracts an infectious disease.

Effective protection from diphtheria can now be given by immunization, which can be practised safely and satisfactorily from the beginning of the second year, and the method is slowly gaining ground in this country. The prophylaxis of measles is more complicated and less certain, but something can be done, especially in the child under 5, to postpone or mitigate an attack by the use of serum obtained from convalescents or persons who have formerly suffered from the disease. Although the protection may be fleeting and uncertain, it is well worth attempting, as nearly all deaths from measles occur under 5. It is, however, most encouraging to note the steady fall in the death rate from this cause, which in 1911-15 was 1,110 per million living, and in 1926-30 was only 381. This marked fall synchronizes with the initiation and development of child welfare work in this country. Health visiting and advice given in the home or at the clinic have impressed upon mothers the importance of nursing and care in this disease.

Respiratory ailments, whether arising in connexion with epidemic diseases or as independent infections, are very prevalent, especially in the northern parts of the country. A clearer understanding on the part of the parents of the means of prevention, and better arrangements for nursing and treatment through the maternity and child welfare organization, might do much to reduce the gravity of these affections, which not only have serious immediate results but may prepare the way for other diseases.

There has been a substantial reduction in the death rate from tuberculosis in young children, especially in non-pulmonary tuberculosis. This welcome decline is no doubt due mainly to an improvement in nutrition, in the standard of living generally, and an increase in the use of pasteurized or dried milk for bottle-fed infants, in association with the special measures in the anti-tuberculosis campaign which are directed to eliminate or to minimize the risks of household infection. It is the improvement in environment which, apart from acute infections, will do most to lower morbidity among young children. The striking disappearance of severe rickets, for example, is a testimony to a better knowledge and practice of everyday hygiene, much of which is the result of the steady intensive educational work of the infant welfare staff. The importance of satisfactory nutrition in its immediate and remote results and in its effect upon general health and resistance to disease cannot be over-estimated, but the average mother is much less well informed as to the feeding of her little child than of her baby.

The welfare of the little child could, if seems, be further safeguarded by action which falls under three main heads. First, there is the need for protection from acute infec-

tion; secondly, for a better knowledge of mothercraft as applied to the little child; and thirdly, for continued supervision, which can best be given by regular home visits from trained nurses and periodical medical advice at a centre, together with such arrangements for the treatment of physical defects as can be made in co-operation with the medical profession, the school clinic, the orthopaedic centre, the children's hospital, etc., and of social defects through the day nursery or the nursery school.

We are all keenly alive to present-day difficulties, but, notwithstanding these, should not the care of women and little children be placed in the forefront of the health programme of to-day? Is it realized how comparatively small a sum is needed in a local area to provide for the gradual completion and perfecting of the existing organization? In any expansion of facilities there is likely to be an increasing scope for co-operation between the private practitioner and the public health officer. While the Public Health Service must almost necessarily remain the guiding force of maternity and child welfare schemes, it may confidently be anticipated that the family doctor will be willing to interest himself sufficiently in preventive medicine to study special problems which present themselves and to help in their solution.

TEMPORARY CHANGES IN THE REFRACTION OF THE EYE IN DIABETICS*

BY

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My own especial interest in this subject was recently stimulated by two middle-aged patients who consulted me within six months of one another with the same story—namely, that distant objects had become indistinct, while print and needlework, for which glasses had previously been necessary, could now be distinguished more clearly and comfortably without aid. Neither patient was aware that there was anything amiss with her general health, but in each case these ocular symptoms prompted me to an investigation of the urine; this revealed the presence of a large quantity of sugar, and so led to the discovery of a condition of advanced diabetes.

The occurrence of pronounced though transitory alterations in the refraction of the eye in diabetics has been reported sporadically in various medical publications, and a most illuminating paper on the subject was published by Duke-Elder in 1925. Apart from Foster Moore, however, who mentions it in his *Medical Ophthalmology*, writers of textbooks on ophthalmology, of textbooks on general medicine, and even of works dealing exclusively with diabetes, have usually ignored it. I have two reasons for bringing the matter forward: first, I wish to add my two cases to those already reported; and, secondly, I believe it is important that this condition, although admittedly a rare one, should be more generally recognized, leading as it may do to the discovery of the existence of serious disease which otherwise might remain undetected.

My first case was a woman, aged 50, who told me she had been long-sighted until about a year before, and that her distant sight had failed fairly quickly, while the near sight had improved. She produced several pairs of glasses of different strengths, all minus lenses, which she had obtained during the past year; none of these glasses had she ever worn with comfort. She also stated that her sight was

* Report by the Reporting Committee on Maternal Welfare and the Hygiene of Infants and Children of Pre-School Age. C.H. 1060.

* Read in the Section of Ophthalmology at the Centenary Meeting of the British Medical Association, London, 1932.

variable, sometimes more blurred in the distance and sometimes less so.

An examination of the eyes revealed nothing abnormal; both lenses were clear, and the fundi looked healthy. Under homatropine three dioptres of myopia were present in each eye, and with the correction visual acuity was 6/6 in each. The patient was, of course, able to read perfectly without glasses. After the discovery that the urine was loaded with sugar she saw Dr. George Graham, who reported a blood sugar of 220 mg. per 100 c.cm., associated with a condition of extreme toxicity; in fact, she was on the verge of diabetic coma. Dr. Graham kept her in a nursing home for three weeks, during which time she rapidly improved under treatment with insulin. I saw the patient again some two months later, at which date, according to Dr. Graham's report, her blood sugar was normal. Myopia was still present, but had decreased to one dioptre in each eye; as I have not seen her since then I cannot say whether there has been a further decrease.

My second patient was a woman, aged 58, whose distant sight, which had previously been good, had been failing for six months, while her reading sight had correspondingly improved: she also gave a history of variability. Examination of the eyes showed clear lenses and normal fundi, with a myopic error of $1\frac{1}{2}$ dioptres in each eye and a visual acuity of 6/6 with a suitable correction. The urine was loaded with sugar. The patient was seen by Dr. Izod Bennett, who reported a blood sugar of 258 mg. per 100 c.cm. She was treated without insulin, and her blood sugar rapidly became normal on a suitable diet. A fortnight after her first visit all traces of myopia had disappeared: she has been seen several times since and has remained emmetropic.

Here, then, are two cases of transient myopia associated with diabetes, with an apparent relation between the degree of refractive error and the amount of sugar in the blood. It is true that diabetic patients not infrequently become myopic as the result of changes in the refractive indices of lenses which are becoming cataractous—the association of myopia with cataract is, of course, well known—but this variety of myopia is progressive, and would hardly be susceptible to treatment; besides which, in neither of my patients was there a trace of lens opacity.

TRANSIENT MYOPIA AND HYPERMETROPIA IN DIABETES

The acquired refractive error in both cases was a myopic one, but the literature of these transient changes in refraction shows that this is by no means always the case; in fact, an acquired hypermetropia seems to be quite as common, and in a certain percentage of cases a temporary astigmatism accompanied the change in general refraction. The first case on record is one reported by Horner of Zürich in 1873, in which the observed error of refraction was a transient hypermetropia. Since then many other observers have reported a similar condition, and a certain amount of confusion seems to have resulted. Gould, who reported one case of transient myopia in 1907 and took the opportunity of reviewing the literature, suggested that in the hypermetropic cases a temporary loss of accommodation had been mistaken for an alteration in static refraction. Roberts, on the other hand, who in 1923 reported five cases of temporary hypermetropia, did not consider the possibility of the occurrence of myopia. A clue to the elucidation of this apparently contradictory state of affairs was first furnished by Westcott and Ellis, who reported a case of a diabetic patient in whom the transient changes in refraction varied between hypermetropia and myopia in different stages of the disease.

The real significance of these variations was, however, first demonstrated by Duke-Elder, who, in the paper already mentioned, reported three cases of sudden change of refraction. The first one was specially interesting from this point of view; the patient's blood sugar was estimated at intervals over a period of six months, and it was found that a myopic change accompanied the

increase in blood sugar, while a hypermetropic change accompanied a decrease with almost mathematical precision. The second case showed a hypermetropia accompanying a decrease in blood sugar, and the third a myopia which developed with increasing blood sugar. He reviewed the whole of the literature, and was able to classify a total of 45 reported cases into four groups as follows: 14 cases of myopia coinciding with blood sugar increase; 16 cases of hypermetropia coinciding with blood sugar decrease; 8 cases showing both changes in refraction varying with the degree of blood sugar; 7 anomalous cases lacking sufficient data for classification. It seems clear, therefore, that the hypermetropia and myopia described by the different observers are merely an indication of a different phase of the same disease, the variation being associated with the changes in the blood sugar content.

Further light is thrown on this problem by a case recently described by Jensen, of a non-diabetic patient, a woman of 63, who went through a course of reducing treatment and who developed a transitory hypermetropia on three separate occasions, which apparently coincided with the elimination of carbohydrates from her diet. This patient's blood sugar was estimated on several occasions, and the fact that it was never above normal is used as an argument by Jensen in his assumption that the blood sugar is not the determining cause. He seems to lose sight of the fact, however, that though the patient's blood sugar, when tested, was never actually below normal limits, yet on each occasion it was definitely on the hypoglycaemic side, and I think it is reasonable to suppose that if it had been estimated more frequently it would probably have been found to be even more so when the diet was at its strictest. In fact, at these periods the blood sugar may quite likely have been less than normal. On the whole, then, I think this non-diabetic case of Jensen's supports Duke-Elder's view that hypermetropia coincides with hypoglycaemia and myopia with hyperglycaemia, and that the blood sugar concentration is probably closely associated with these variations in refraction, although, of course, not necessarily the determining cause.

Jensen also quotes two cases of transitory hypermetropia, reported by Gallus, who were suffering respectively from a disease of the liver and from a severe degree of tuberculosis with rapid emaciation, and in whom there was no demonstrable glycosuria or diabetes.

CAUSATIVE AGENCY OF CHANGE IN REFRACTION

The explanation of the physical basis of these phenomena is by no means simple. Horner, in common with the earlier observers, assumed that the change in refraction was due to a temporary diminution in the tension of the eyes, causing a decrease in length of the eyeballs and alterations in curvature of the cornea. Lundsgaard, however, who reported two cases of transient hypermetropia, showed that this assumption was erroneous; he took the tension with a Schiøtz tonometer and examined the cornea with an ophthalmometer and found no change either in tension or curvature. It had also been suggested that the vitreous might temporarily become swollen, displacing the lens forward, but this assumption has also been shown to be incorrect.

The only possible explanation seems to be the occurrence of transient changes in the refractive index of the lens, depending on changes in the amount of fluid in the lens substance, and this is the conclusion arrived at by Duke-Elder, who discussed this question exhaustively, giving at least six considerations pointing to the lens as being the causative agency in the phenomenon. Strong evidence of this assumption is afforded by one of Elschnig's cases, a diabetic patient from one of whose eyes the lens had been removed for cataract. The character-

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

BY

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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