In virgins the treatment may be effectually carried out by means of a rectal electrode, the procedure being similar to that used for heating the prostate in men. In married women an intrapelvic electrode, introduced into the vagina, is used.

CASE I.

In a girl, aged 16, the illness began at the end of 1923. The symptoms were then a general feeling of illness and pain in the left hip. She was confined to bed for a short time, but was able to walk after this till just after Easter, 1924. At this time the knees became swollen and stiff, and when admitted to the West Middlesex Hospital on May 1st she was unable to walk. Most of the joints were affected, the knees and wrists most severely.

When first seen the knees were flexed and could not be extended beyond a right angle, and the wrists were fixed in an extended position; the patient was thin and anaemic. Diathermy was applied by a rectal electrode on eight occasions, over a period from June 2nd to June 30th, 1924. At the end of this time the knees could be completely extended and there was full range of movement of the wrists and fingers. There were no pains and she was beginning to walk. Synovial swelling of the knees was still present. The quadriceps extensor muscles, especially the vastus internus, in both limbs were wasted.

Massage and exercises were then commenced. On August 8th her general condition was good and she walked fairly well, but with an awkward gait. On November 3rd she walked well. All joints were freely movable. There was slight swelling of the wrists and knees. On November 27th the wrists and knees were still slightly swollen. She was then doing physical exercises, including skipping.

At Christmas, 1925, complete functional restoration of all joints had taken place. She was fat and well, but still had an awkward gait.

Menstruation had started at the age of 15, and had been regular for six months. It then ceased for six months. At the end of this time it was re-established and remained regular afterwards.

CASE II.

A woman, aged 40, suffered from generalized arthritis resulting in much suffering and ill health. She was so crippled as to be hardly able to walk with the aid of two sticks. She was thin and had a sallow, unhealthy appearance. There was a marked tendency to growth of hair on the face. The wrists, knees, and ankles were swollen, painful, and tender. The right knee could be fully extended, but the left was flexed and could not be extended and the patella was fixed. The left hip was flexed and fixed in that position.

The illness had begun two and a half years previously, and she had had a long course of treatment, including various forms of electrical treatment. During this the tonsils had been removed without effect. Treatment by diathermy applied by a rectal electrode was begun on January 24th, 1924. At the end of one month her general health had much improved, and she had gained 7 lb. in weight. The joints were more movable and almost free from pain. Treatment was then left off till November, when she was found to have continued to improve during the interval. Her general health was good and pain slight. The right knee was normal, the left knee only slightly movable from the fixed position of 120 degrees. The left hip was still fixed. The treatment was renewed for one month and then left off till March, 1925. At this time her general health was good. There was no pain, but the left knee remained flexed to 120 degrees and almost fixed.

During the last course of treatment she had menstruated quite normally, though the periods had been absent for four or five years previously. X-ray examination of the left knee showed diminution of joint space, great lipping of upper and lower margins of the patella with osteophytic formation, and extensive lipping of tibia and fibula at joint surfaces, with a fair amount of bone destruction.

It is obvious that when the destruction and new bone formation in the joint has advanced to such a condition as existed in this case in the left knee, restoration of function is out of the question. The treatment resulted, however, in relief of pain and in restoration of function in the other joints, and a return to good general health. It is only when the arthritis is recent and destruction and organic changes of bone have not proceeded beyond a certain point, that complete functional restoration may be obtained, as occurred in the first of these two cases.

Both of these patients were virgins, and in neither was there any evidence of infection of the pelvic organs. In both there was evidence, apart from the arthritis, of deficiency of ovarian internal secretion. In the younger of the two patients it may be considered doubtful whether the onset of puberty can be considered abnormal. There is, however, some evidence of deficiency of ovarian internal secretion in the interval of amenorrhoea after the original onset of menstruation. In the older there was evidence of deficiency of ovarian internal secretion in the early cessation of menstruation and in the growth of hair on the face. It is noteworthy that in this case, as in some others of a similar kind treated in this way, the menses appeared after having ceased for some years.

Corroboration of the possibility of stimulating the formation of the ovarian hormone by heating the pelvic organs

consists in the relief by this means of subjective symptoms and irregular haemorrhage due to the deficiency of ovarian internal secretion at the menopause. Several such results have been obtained recently in this way in the electrical department of St. Bartholomew's Hospital.

The object of this paper is to put forward the contention that there exist cases of arthritis occurring at either end of menstrual life which are not due to infection, that in some of these, at all events, the arthritis is due to deficiency of ovarian hormone, and that in these the arthritis and accompanying ill health are efficiently treated by heating the pelvic organs by means of diathermy.

This is the first of a series of articles which we hope to publish on work carried out in the electrical departments of St. Bartholomew's and West Middlesex Hospitals on the treatment of arthritis and of gynaecological cases.

A REVIEW OF THE LATER RESULTS OF INSULIN TREATMENT.*

BY

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In this paper I propose to review the results obtained by the insulin treatment of 100 cases of diabetes, in all of which the treatment began over a year ago, and in rather more than half of which it has continued for nearly two years. Detailed consideration of early progress under insulin treatment will be omitted—first, because this matter has already been extensively reported, and it is now well known that the vast majority of cases do very well in the initial period; and secondly, because the progress of patients after their return to ordinary life is a matter of greater practical importance.

The cases have been taken in strict chronological order, and no case of any type that has received insulin treatment for diabetes has been excluded, with the exception of 15 patients it has been impossible to trace. Of the 100 cases (44 in hospital, 56 in private) whose records are available, 25 are now dead (13 in hospital practice, and 12 in private); 15 deaths occurred during the early period of treatment, the remainder within a few months of beginning insulin.

Causes of Death.

In no fewer than 17 of the 25 cases it was clear that death resulted from some complication of the diabetes: 5 of them had severe tuberculosis (4 pulmonary and 1 renal); gangrene was present in 4; 2 patients died of angina, and 2 of heart failure without coma (both were over 70 when insulin treatment was tried as a last resort); 3 cases had gross septic infections (1 mastoid disease, 1 pyonephrosis, and 1 ischio-rectal abscess); 1 case of renal infantilism with slight diabetes died of uraemia; 7 cases died of coma that was apparently uncomplicated (there were *post-mortem* examinations in 3 only). In 2 early cases which occurred when the supply of insulin was limited the treatment was inadequate; 2 others were of the special type of coma to be described later; in 1 case death followed rapidly from coma when insulin was left off against advice and an unrestricted diet was taken; the treatment of the 2 remaining cases was begun when the coma was far advanced. One patient died as the result of insulin treatment, a woman with diabetes of moderate severity who was doing well when she suddenly became unconscious. The diagnosis of hypoglycaemia was made at once, and glucose was given intravenously. She appeared to rally slightly and a small injection of adrenaline was made intravenously to expedite recovery, but ventricular fibrillation occurred and was immediately fatal. Death was probably due to the adrenaline, and this case demonstrates again the danger of the intravenous injection of this drug.

An examination of these details shows that the 25 per cent. mortality recorded in this series gives too serious an

* Being the substance of a post-graduate lecture at the General Hospital, Birmingham.

impression of the true position of patients treated by insulin; it is clear that many (at least 10) of these patients who died were fatally ill from causes other than diabetes before treatment was begun, and I think it is fair to point out that with greater experience of insulin four others might have been saved.

Coma and its Treatment.

The general features of full diabetic coma, which are familiar, need not be described, but I wish to emphasize the fact that it is comparatively rare for this serious complication to develop suddenly, and that now that insulin is available it should be possible to avoid it in a larger number of cases. Quite frequently the warning symptoms of commencing coma extend over a few days, and they are frequently ushered in by vomiting and either constipation or diarrhoea, with vague abdominal pain without rigidity. If the urine be examined diacetic acid is always present, and these symptoms, particularly if associated with hurried respiration, in a patient known to be passing sugar should call for energetic treatment.

Diabetic coma cannot, of course, be properly treated on any routine plan, but, for the sake of clearness, I will state dogmatically the important points.

The patient should be put to bed and an enema and saline purge should be given at once. Complete and repeated physical examination should be made for any complicating factor, such as sepsis, which may have precipitated the attack, and treatment of this complication will accompany the treatment of coma, and is, indeed, a feature of it; this is a matter of extreme importance, for it is probable that the majority of attacks of coma are precipitated by infection. It should be emphasized, too, that the absence of fever in severe diabetes does not warrant the assumption that no infection is present, for it is undoubtedly true that diabetics may have severe general infections (such as pneumonia) while the temperature remains normal. Hot broth, weak tea or coffee, with very little milk, should be given every hour by the mouth. If the patient cannot drink, subcutaneous, rectal, or intravenous salines should be given instead; 10 grains of sodium bicarbonate should be given with each drink until the urine becomes alkaline, and then should be discontinued, for excess of alkali may do harm.

In average adult cases I give 30 units of insulin at once, 20 units in two hours' time, and 10 units two hours later, making 60 units in the first four hours in decreasing doses. Later, 10 units are given every four hours for as long as the glycosuria persists. The nurse is told to obtain hourly specimens of urine, by catheter if necessary, and to test them at once for sugar; immediately a specimen of urine is obtained free from sugar, 4 oz. of hot milk and some thin bread-and-butter is given by the mouth.

With treatment of this kind, most cases of diabetic coma, not too far advanced and uncomplicated by gross sepsis, recover very well.

A Special Form of Coma.

I wish to draw attention to what is, I believe, a special form of coma occurring in patients previously treated by insulin; the following is a description of a case illustrative of the condition to which I refer.

A farmer, in whom diabetic symptoms first declared themselves in July, 1921, when he was 30 years of age, was treated in September of the same year on Allen lines in a nursing home, and returned to his ordinary work on a diet of 1500 calories, with a carbohydrate content of 30 grams, protein 70 grams, and fat 110 grams. He was then sugar-free and his blood sugar was normal.

During the next two years he had several breakdowns; it was necessary to restrict his diet still more, and he became extremely wasted. Early in 1923 he slipped into coma, and was rescued by some injections of pancreatic extract which I was then using for some experimental work with animals in conjunction with Dr. A. F. Wright. In May, 1923, insulin became available and he steadily improved. In September of the same year the daily dose of insulin was 40 units and he began to gain weight.

I saw nothing of him until November, 1924, by which time he had become extremely fat. I warned him against excess of diet and told him to take free exercise, but within a month he was admitted to a nursing home in coma. He was treated energetically with insulin (120 units in twenty-four hours) and appeared to improve slightly, but the next day, despite the fact that his blood sugar was normal, that his urine was free from sugar and contained no diacetic acid, he remained unconscious and

extremely ill. His pulse became very rapid and feeble, respiration was shallow and slow, and, although glucose was given intravenously with further doses of insulin, he died.

Shortly afterwards I saw a woman who had run a very similar course; and after her second attack of coma, when she remained unconscious with normal blood sugar and without glycosuria, I performed lumbar puncture, withdrew about 20 c.cm. of cerebro-spinal fluid, and injected 5 units of insulin, diluted with 10 c.cm. saline, direct into the theca. Within a few hours she was conscious and well on the way to recovery. The cerebro-spinal fluid gave a strongly positive Rothera test, and contained 0.5 per cent. sugar. In a third similar case I injected the insulin by cistern puncture. Recovery followed in about the same time, but the method appeared to have no striking advantage over simple lumbar puncture and injection.

I do not suggest that these cases are very common, but, on looking back over the hospital records, I have met with two other fatal cases. Both had been previously treated with insulin, and were admitted to the hospital in coma. The notes show that some hours before their deaths the blood sugar was normal and the urine free from sugar and diacetic acid.

The explanation of these cases is, I believe, that the changes in the blood after administration of insulin occur very much more rapidly than they do in the cerebro-spinal fluid, and that the medulla is poisoned by the acidosis of the fluid while the blood is normal. Gross disparity between the condition of the blood and cerebro-spinal fluid is more likely to occur in cases already undergoing treatment by insulin. I mention these cases because it seems to me that they justify one further measure in the treatment of diabetic coma when the response to the normal treatment by insulin is not satisfactory within a short time—namely, intrathecal injection of 5 units of insulin diluted with saline.

Twenty-one attacks of coma were treated—9 in hospital and 12 in private practice. Of the 9 hospital cases 5 recovered, but all of these died within a year; they were all cases in which the diabetes was complicated by other factors. Of the 12 attacks treated in private practice 5 cases died, but the remaining 5 are in good health and two of these have had two attacks of coma each.

The Survivors.

Of the 75 patients who survive 14 are in poor or moderate health—that is, they are still unable to do their usual work. I have made a careful analysis of these cases to discover the causes of failure in them, and I have come to the conclusion that the principal factors, in order of importance, are:

1. *Incidence of Infections.*—Frequent catarrhal illnesses, the source of which is commonly in the nose and throat; they seem to be due to diminished resistance. Of this group several have refused treatment for fear of operations. In three cases in which vaccines have been used no benefit has resulted.
2. *Lack of control of diet* due to want of care or intelligence on the part of the patient.
3. *The Severity of the Disease.*—There appears to be a small group of cases in which, despite efficient treatment, the condition becomes more serious as time goes on.

Of the 100 cases, 61 remain in good health, able to do their ordinary work comfortably, some doing very hard work. They include manual labourers, men controlling large businesses, and children going to ordinary schools and developing normally. In several women menstruation has been normal and two of them became pregnant; one of them unfortunately had an extrauterine gestation which ruptured. My colleague Mr. B. T. Rose operated, and she recovered and is still well. In the other case the pregnancy was terminated.

This seems to be a satisfactory result, particularly when it is remembered that in this early period the cases treated were severe, as many of those of moderate severity did not receive insulin owing to expense and the uncertainty of its value.

An examination of the records of these 61 cases shows that the chief factors of success in treatment are the adequate instruction, self-control, and intelligence of the

patient, coupled with circumstances which are favourable to good personal hygiene. The care of the teeth, of the nose, nasal sinuses, and throat, the regulation of the bowels, scrupulous attention to the feet, are details which in the diabetic assume great importance. Careful routine overhauling to discover and eradicate focal sepsis should be an essential in the after-care of every diabetic patient, whether treated with insulin or not.

As regards the diet, I have used slight modifications of the scale which I have already described (*BRITISH MEDICAL JOURNAL*, March 15th, 1924, p. 457), and my aim has been to keep the patients at work at a weight a few pounds less than the average for their age and build; the dose of insulin has been adjusted accordingly, but I do not exceed 40 units daily for general use, and the diet and weight are reduced when necessary.

Whether it is essential to keep the blood sugar normal and the urine constantly free of sugar is a question of interest and practical importance; on theoretical grounds it is desirable to do so, and all those in whom this aim has been attained have done well; but I am bound to confess that they are few, and I have been surprised to find that in spite of the fact that the greater number do at times pass sugar they nevertheless remain in good health. I insist that no effort should be spared to keep the first specimen passed in the day free from sugar, as by that means it is possible to make sure that the blood sugar is normal or nearly so during the hours of sleep, and as an ideal this has been of practical value. Conscientious patients become very worried about occasional glycosuria, which, in the many vicissitudes of their daily lives, seems to be almost unavoidable, and it is a relief to be able to tell them that they need not worry provided the early morning specimen is free. Elaborate blood sugar control is unnecessary once the condition has been stabilized.

Certain other points emerge which are of importance. As a general rule those patients have done best in whom insulin treatment has been instituted soon after the symptoms of diabetes have first appeared. This is particularly true of the younger cases; it is, I think, significant that there is no record in this series of satisfactory subsequent progress in a patient under 25 years who put off insulin treatment for more than four months from the onset of symptoms, even when dietetic treatment had been stringent and efficient during the early period of the disease. The conclusion is warranted that all young diabetics should be treated with insulin without delay.

I have been compelled to revise my former opinion that insulin treatment in the elderly and long-standing cases of diabetes was not of much value, for I am bound to admit that several cases of this type have shown remarkable mental and physical improvement with it. In early days I was misled by the fact that in this class of patient improvement comes more slowly and much less dramatically than in the young, and it may be some months before the advantage is manifest.

There appears to be no definite relationship between the rate of early progress and the ultimate prognosis. Recovery of tolerance undoubtedly occurs in a greater proportion of cases and to a far greater degree than in the days of simple dietetic treatment. Four of my patients (all of them over 40) have given up insulin after varying periods of treatment, and have now a tolerance for an adequate diet with nearly 100 grams of carbohydrate. The most striking case is that of a man who, on leaving hospital over a year ago, took 60 units daily and yet did not remain sugar-free. He has now been without insulin for three months and remains sugar-free with a more liberal diet. It is unwise for the border-line case to give up insulin; several patients have attempted to do this and to continue treatment by dieting alone, but almost without exception they are glad to renew the irksome injections for their "tonic effect."

Summary.

1. Of 100 cases of diabetes of all types treated with insulin and dieting 75 survive—61 in good health and 14 in poor or moderate health. This result will almost certainly improve in future, as during this period the treatment was mainly limited to the more severe cases. Of the 25 deaths that occurred, 1 resulted from the treat-

ment and 10 others were not directly due to diabetes but may have been accelerated by it; in 17 of the fatal cases there were definite complications.

2. Of 21 attacks of coma either actually treated in the stage of full unconsciousness or close to it, 12 recovered. Of the 10 patients concerned, 5 remain in fairly good health; the others have since died.

3. A type of persistent coma which is, I believe, particularly liable to occur in treatment by insulin is described. Recovery from this type of coma after intrathecal injection of insulin is recorded.

4. The importance of early insulin treatment in young patients is emphasized.

5. All cases which have kept a normal blood sugar and have remained free from glycosuria have done well; their condition at this time, however, does not appear materially better than that of those who have shown glycosuria at times but who nevertheless have managed to keep the early morning specimen free.

Memoranda:

MEDICAL, SURGICAL, OBSTETRICAL.

FISSURED FRACTURE OF THIGH WITH FEW SYMPTOMS UNTIL A MONTH LATER.

THE following history of fracture of thigh in a youth is so unusual as to warrant its being reported.

A lad, aged 16, a pony driver in a pit, met with an accident on October 13th, 1925, which was diagnosed as a contusion of the right hip; he had some discoloration in this region. He was able to walk about after the accident, at first with the aid of a stick; by November 14th the contusion had cleared up, and he could walk and bend his hip perfectly and felt quite well. He returned to work in the pit on November 16th; there was no work in the pit on November 17th, but he worked on November 18th. Whilst out for a walk on November 19th he slipped on frosty ground with his left foot and states that his right leg gave way. He was removed to hospital, where x-ray examination revealed an oblique fracture of the right thigh at the junction of the upper with the middle third, and marked angular deformity.

At subsequent proceedings in the county court, taken under the Workmen's Compensation Act, it was maintained successfully that a result of the accident on October 13th had been a fissured fracture of the right thigh; it was given in evidence that there was callus when the x-ray examination was made six hours after the accident on November 19th, and that the callus was not firm on account of the youth walking about too soon.

I have never before heard of a case where a person with a fractured thigh could walk about, practically without pain, resuming work for two days, and that then a trivial accident should reveal a fissured fracture of a month earlier.

Barnsley.

H. A. L. BANHAM.

ACUTE GASTRIC ULCER ASSOCIATED WITH PERNICIOUS ANAEMIA.

THE combination of acute gastric ulcer and pernicious anaemia in the following case seems to be of sufficient interest to be placed on record.

A married woman, aged 42, was admitted, as an emergency case, to the Royal Alexandra Infirmary, Paisley, on March 1st, 1926, with a history of having, on February 25th, while at housework, retched and vomited 10 ounces of dark blood; two brighter coloured vomits of similar amount followed the same day. The next day a mouthful of bright blood was brought up. Her next and last vomit was half an hour after admission—about 6 ounces of partly clotted blood. She stated that she had had "bilious turns" for two years, that she had been yellow for five weeks, but that she had been able to do her household duties quite well.

On admission the temperature was 101° F., pulse 160, and respirations 28; she was a well nourished woman. The skin was decidedly lemon-tinted and the mucous membranes very blanched. She was very collapsed. The pulse was barely perceptible at the wrist; sounds heard easily on auscultation over brachial and femoral arteries; blood pressure 115/40.

She died in thirty-six hours. Examination of the blood showed: haemoglobin 9 per cent., white cells 27,000, red cells 940,000, colour index 0.5. Poikilocytosis, anisocytosis, polychromatophilia,