DIABETES MELLITUS IN ASSOCIATION WITH DEGENERATION OF THE SUPRARENAL GLANDS

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(With Special Plate)

The association of diabetes mellitus with gross pathological changes in the suprarenal glands is uncommon, and is of great interest from the biochemical as well as from the clinical standpoint. The case of diabetes reported below is further noteworthy because of the unusually high blood sugar values recorded and the enormous doses of insulin required during the course of treatment.

CASE REPORT

The patient was a married woman of 61 years. She was said to have been in indifferent health for about a year prior to coming under observation. During the latter half of this period there had been noticeable loss of weight and some thirst and polyuria. Three weeks before she was admitted to hospital she had a shivering attack and frequency of micturition. The urine was examined at this time, and was found to contain no sugar, nor was any other abnormal constituent detected. Thereafter she appeared to be returning to normal health, until two days before admission she became drowsy, and ultimately semi-comatose. The urine was now found to contain much sugar.

On her admission to hospital on February 21st, 1933, at 11.30 p.m., she could be roused without much difficulty, and answered questions intelligently. Her breath smelled of acetone and the urine gave a strong Rothera reaction. The ocular tension was approximately normal, but her tongue was dry, and a subcutaneous saline, given shortly afterwards, was absorbed with great rapidity. Her state of nutrition was good, and physical examination failed to reveal the presence of any infective process. The heart was moderately dilated and the pulse of low tension, with a frequency of 104 per minute. The respiratory rate was 24, but respiration was otherwise normal in character. The temperature was 97° F. Insulin (30 units) was injected intravenously forthwith and the blood sugar estimated. The high value of 1,040 mg. per 100 c.cm. was obtained (Folin-Wu method). At 1 a.m. 100 units of insulin were given. At 4.30 a.m. the blood sugar was 935 and at 8.30 a.m. 844 mg. per 100 c.cm. These figures were verified by additional estimations on the same samples by another observer at a different laboratory. At 10 a.m. the patient received a further 100 units of insulin. At 12.30 p.m. the blood sugar figure was 606 mg., and at 1 p.m. 100 units of insulin were again given. At 3.30 p.m. the blood sugar had fallen to 400 mg., and at 6 p.m., after a further 100 units of insulin, to 200 mg. per 100 c.cm. By this time the urine was free from sugar and from acetone, the bowels had been well opened, and the liberal administration of fluid, with glucose, had completely relieved any dehydration originally present. At 8.30 p.m. the administration of 30 units of insulin was begun three-hourly, and by this means the blood sugar was kept within the limits 150-228 mg. per 100 c.cm. for the next three days. In spite of the apparent complete relief of the diabetic state, the general condition of the patient had improved but slightly. She was still drowsy and incontinent. The blood non-protein nitrogen was 39 mg. per 100 c.cm. and the Wassermann reaction negative. An attempt was made, with partial success, to maintain a fluid diet corresponding to six lines in R. D. Lawrence's¹ scheme. On February 24th the temperature rose to 104.2° F., and the patient began to suffer from occasional rigors.

She was found to have a leucocytosis of 42,500. No other evidence of septic infection could be discovered, and the blood culture was negative. The urine contained a trace of albumin and a few leucocytes, but was otherwise normal. On February 25th the dose of insulin was reduced to 20 units three-hourly. On the 28th a blood sugar value of 75 mg. per 100 c.cm. was recorded, though there were no symptoms pointing to hypoglycaemia, and the dose of insulin was reduced to 15 units three-hourly. On the following day, however, the blood sugar had risen to 296 mg. per 100 c.cm., and the former dosage of 20 units of insulin was resumed four-hourly. The temperature of the patient continued to fluctuate between 98° and 104°, and her general condition slowly deteriorated. She died, apparently of cardiac failure, on March 3rd, ten days after admission to hospital.

Post-mortem Findings

A necropsy was performed, about six hours after death, by Dr. R. Howard Mole, pathologist to the hospital, to whom we are indebted for the details which follow.

The liver, spleen, alimentary canal, lungs, and heart presented no abnormality. At the site of a subcutaneous injection in the right pectoral region there was a sharply defined area of necrosis, with some subcutaneous emphysema, but little evidence of inflammatory reaction. *Cl. welchii* was isolated. The right kidney showed on its surface numerous haemorrhagic areas and a few miliary abscesses. On section multiple areas of focal congestion were visible, and a few minute abscesses. Microscopically the organ showed widespread small-celled infiltration, congestion, and fibrosis. The left kidney, both renal pelvis, and the bladder were normal. The pancreas was smaller than normal. Microscopically the islets of Langerhans showed hyaline and fibrotic changes.

Both suprarenal glands were cystic, having the appearance of small semi-collapsed balloons. On section each was found to have been converted into a thin shell, which enclosed a single cavity containing a little yellowish fluid. Microscopically (see Fig. on Plate) the capsule was thickened, and the cortex showed marked changes, involving particularly the fasciculate and reticulate layers. Considerable atrophy of the cell columns of the former was noted, the columns being attenuated and broken up into small cell groups. The intervening tissue had a necrotic appearance; cell boundaries were difficult to demarcate and nuclei were absent. There was some fibrosis. The boundaries of the reticulate layer and medulla were difficult to make out. Both showed much round-celled infiltration and fibrosis, and no normal medullary tissue was seen.

DISCUSSION

Levy Simpson² has recently collected from the literature seven cases of diabetes in which lesions of the suprarenal capsules have been found at necropsy, and has added a further case of his own to this number. In four of the cases there were no adequate grounds on which a diagnosis of Addison's disease could be made during life. The present case must also be placed in this category. In spite of the existence of advanced disease of the suprarenal capsules, the classical symptoms of Addison's disease—pigmentation and vomiting—were not observed. The patient was asthenic and lethargic throughout, and though a sphygmomanometer reading was not taken examination of the heart and pulse suggested that the blood pressure was consistently below normal. A consideration of the biochemical and pathological data suggests that, apart from the suprarenal lesion, a fatal issue would hardly have been anticipated. The condition of the blood and urine after treatment indicates that the diabetic state was completely relieved. Renal function did not seem to be greatly impaired. The day after admission the non-protein nitrogen of the blood was 39 mg. per 100 c.cm., and a few hours before death it was 54 mg. Septic absorption from one or other of the foci of infection present may have been contributory to a fatal result, but neither the inflammatory process in the right kidney nor that in the pectoral region appeared to be of great severity, and the

condition of the organs in general did not suggest a severe toxæmia. It appears possible, therefore, that suprarenal inadequacy was an important factor in causing death.

The lesion is an unusual one. Brenner³ has reviewed the literature of suprarenal fibrosis in some detail, but in none of the case reports collected by him is there any reference to a cystic condition resembling that encountered in this case. The presence of fibrous tissue argues the existence of pathological changes in the glands of some months' duration at least, and it may well be, as Levy Simpson has suggested in other cases, that the same toxic agent has produced fibrosis in both suprarenals and pancreas. It is highly probable that the cellular necrosis and the cystic condition developed acutely in glands already the seat of chronic pathological change, either as a result of the diabetic toxæmia or of toxic absorption from the inflamed areas. The presence of suprarenal inadequacy in diabetes mellitus is of particular interest in view of the antagonism which is stated to exist between the suprarenal glands and the pancreas. In uncomplicated Addison's disease hypoglycaemia is the rule (Wadi⁴). Figures as low as 70 mg. of glucose per 100 c.cm. are commonly obtained. Patients with Addison's disease are very sensitive to insulin, and a fatal result has been recorded after so small a dose as five units (Maranon⁵). This being so, it is not surprising to find that when the subject of Addison's disease suffers also from diabetes the control of the blood sugar by insulin presents considerable difficulties. In both Arnett's⁶ and Levy Simpson's² cases hypoglycaemic crises were very readily induced. In contrast, the present case showed a remarkably steady blood sugar value of about 200 mg. per 100 c.cm. once insulin control had been established, and it must be admitted that this possibly argues against there being serious lack of the suprarenal hormone.

There seems to be no explanation available of the exceptionally high blood sugar level before treatment was instituted. Still higher values, amounting to 1,400 and 1,490 mg. per 100 c.cm. respectively, have been recorded by Joslin⁷ in two fatal cases. The massive doses of insulin required to bring the blood sugar back to the normal level are almost certainly related to the high initial blood sugar value. In the first twenty-four hours of treatment 460 units were given, for the next three days 240 units daily, and thereafter approximately 160 units daily. On one day, when the dose was reduced to 120 units, the blood sugar again rose to 296 mg. per 100 c.cm., indicating that the doses previously given were not unnecessarily large. As there was no rise of temperature until the third day after admission to hospital, by which time the blood sugar had been reduced to 200 mg. per 100 c.cm., neither the high blood sugar nor the necessity for the large doses of insulin can be ascribed with certainty to the presence of infection.

SUMMARY

A case of diabetic coma is reported in which exceptionally high blood sugar values were encountered, necessitating the administration of enormous doses of insulin.

At necropsy an advanced degenerative lesion of the suprarenal glands was discovered, and the bearing of this on the course of the patient's illness is discussed.

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REDUCTION OF FRACTURES OF THE SURGICAL NECK OF THE HUMERUS

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(With Special Plate)

The reduction of fractures of the surgical neck of the humerus often presents considerable difficulty. Resort to open reduction may be necessary, but one is naturally unwilling to adopt such a procedure unless compelled to. The method here suggested is offered as an alternative worthy of trial in cases in which the ordinary methods of reduction have proved unsuccessful.

The chief difficulty in this type of fracture is in obtaining fixation of the abducted head during the manoeuvre of reduction, and if this can be attained manipulation becomes considerably simplified. It is possible to do this, however, by the simple method of partial

transfixion of the head of the bone by a bone-awl passed through a stab incision on the outer aspect of the shoulder.

The subsequent steps in the procedure are carried out under the screen in the x-ray department. These consist, in the first place, of traction of the limb in the adducted position in order to pull the lower fragment down to the level of the upper, and, while maintaining this pull, adducting the arm across the chest. The abducted or upper fragment is now adducted by depressing the handle of the bone-awl. It is then easy to engage the upper end of the lower fragment in the fractured surface of the upper. Lastly, the arm is slowly brought back to a slightly abducted position, where it is maintained by splints. Once accurate approximation of the two surfaces is obtained there is little tendency to slipping of the fragments.

The accompanying diagrams will perhaps make it easy to understand what has been described in the text. The manoeuvre is simple and very satisfactory, and its various phases can be completely controlled on the screen.

Photographs—before and after—of an actual case treated by this method, are shown in the figures reproduced on the photogravure plate.

W. C. SPACKMAN: OVARIAN PREGNANCY

FIG. 1.—Embryo in situ in centre of ovary.

FIG. 2.—Reverse view showing resection through hilum of ovary.

R. W. BROOKFIELD AND H. V. CORBETT:
DIABETES WITH DEGENERATION OF SUPRARENALS

Photomicrograph of suprarenal gland showing thickened capsule and marked cellular changes in cortex (see text).

H. MORTON ANDERSON: METHOD OF REDUCTION OF FRACTURES OF THE SURGICAL
NECK OF THE HUMERUS

FIG. 1.—Before reduction.

FIG. 3.—Position on fourteenth day.

FIG. 2.—Immediately after reduction, showing bone awl in position.