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A Case of Functional Hypoglycaemia— A Medico-Legal Problem

By DIANA BOVILL

Case Report

A family doctor's wife, aged 42, S.R.N., J.P., social worker and citizen of excellent character, drove her car through a nearby town at about 10.30 p.m. on an autumn night. Later a cyclist was found dead in the road along which she had just passed, parts of her car were found at the scene of the accident, and subsequently damage to her car was found to correspond with the damage to be expected had it been involved in this accident.

Arriving at her destination (she was delivering a wedding present), the patient explained a cut finger by saying that a lorry had backed into her car and smashed the near side windscreen, thus the near-side front seat, from which she had lifted the parcel, was covered with broken glass. She spent some two hours with her friends, engaging in conversation and helping with preparations for the next day's wedding; this included sewing, and it was noticed that she had difficulty with this task, being incapable of threading a needle. Otherwise her demeanour and behaviour were unexceptional in the opinion of people who knew her well.

She returned home along the same road, and at about 12.45 a.m. passed the scene of the accident, saw that there had been an accident and slowed preparatory to offering help, as was her usual practice; then, seeing that no help was needed, drove on. Near home she was stopped by a police patrol car. She co-operated with the police in every way; two breathalyser tests were taken and found negative, and she explained the damage to her windscreen by recounting how a lorry had thrown up a stone which broke it; she described this occurrence in detail as having occurred at a place beyond the site of the accident but on the same road. When she reached home some 15 minutes later her husband found her calm but detached. He later described her reactions to the presence of the police in her home as having been inappropriately disinterested, though polite and co-operative; he had attributed this first to the effects of alcohol, but had been assured that the breathalyser tests had been negative; he had then attributed it to shock until assured by his wife that she had been involved in no accident. In conversation and behaviour, under close questioning during the next hour, there was no hint that she had any knowledge whatsoever of the accident, though she made no denial of having been in the area of the accident at the time it was believed to have occurred. Furthermore, she appeared to have an inaccurate impression of the time scale of the night's events.

Over the following days the police evidence connecting the patient with the accident became increasingly strong; but her memory of the evening, as she had described it, was unwavering. As a result of this conflicting evidence her solicitor asked for a medical examination. She was first seen by a consultant physician and investigated, with negative results; she was then seen by a consultant psychiatrist who advised admission to hospital for observation.

Previous history

Showed no abnormal psychiatric features and no significant physical illnesses.

History of the present case

In 1963 and again in 1969 her husband suffered coronary thromboses, and from this time she had been under stress and had started to use alcohol as a sedative at night, and amphetamine derivatives occasionally in the day time. Her family and close associates had noticed uncharacteristic behaviour during two to three years, and had attributed this to her intake of alcohol which was estimated at a maximum of half a bottle of spirits in any one day and an average intake lower than this. Episodes were described, occurring at any time of day, in which she was irritable to the point of verbal belligerence with a paranoid flavour, and also showed failure of concentration and subsequent amnesia; and there had been other occasions when tremor and nausea suggested the 'hangover' state. At times her state of detachment and her lack of time sense and of

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concentration had suggested that she was bordering on delirium tremens or amphetamine psychosis. But the patient maintained that she took only two or three drinks in the course of most evenings, and she said that amphetamine had been prescribed at some previous time, and that recently she had only taken it occasionally when she felt so tired that she could not carry on. Such a discrepancy in the history is, of course, common in drug dependents and alcoholics.

The patient complained of episodes of exhaustion, irritability, anxiety and depression, with sweating, tremor and nausea. When these occurred she would 'pull herself together' and carry on. Episodes might occur at any time of day. She did not admit that they were linked with intake of alcohol or drugs, but attributed the condition to 'nerves' caused by her anxieties about her husband's health. She denied memory lapses, with the exception of the central one of the accident. She often felt generally unwell, but attributed this to her anxieties and/or her menopause, which she presumed might be approaching, though she had noticed no change in the menstrual pattern.

There had been special stress in the few days preceding the accident and on the day of the accident. Throughout this busy day she had taken no food but occasional cups of tea, thus she had fasted for about 21 hours and had taken her first meal in the form of one or two packets of sweet biscuits at 7–8 p.m. Between 9–9.30 p.m. she had taken a glass of sherry and perhaps a sandwich. At about this time the family had noticed in her the by now familiar strangeness, lack of concentration and unconcern for the passage of time; but when she had started out in her car at about 10.20 p.m. she had not seemed to them to be in any way incapable of driving. The patient's description of events up to 10.20 p.m. tallied with that of her family.

Condition while in hospital

Under close observation in hospital she showed no cravings or withdrawal symptoms; but she showed apparently mildly drunken behaviour on two occasions when, as far as was known, she had taken no alcohol. Her history, as given above, offered no hint of an hysterical personality; and though here, as in any psychiatric hospital, the population is sensitive to hysterical personality traits, these were not observed by either staff or patients. Though anxious and unhappy she was pleasant, co-operative, helpful and reliable. She showed normal grief and horror at what had occurred, exacerbated by normal fear of what the future might hold for one who could commit such a crime and remain unconscious of having done so. In short, apart from the two brief episodes, her behaviour appeared normal.

During the first twelve days in hospital she demonstrated two episodes of 'strangeness', one observed by the doctor and one by the nursing staff. In these she was detached, off-hand and irritable, but not ataxic. Her reactions to discussions of the accident were inappropriately unconcerned and thus different from her normal reactions. Subsequently she was found to be partially amnesic for these discussions.

Investigations

An organic pathology was considered, and investigations were carried out with this in mind.

Physical examination gave normal results, as did routine haematology, chemistry, liver function and electrolyte tests. Glycosuria was found once, but repeated tests were negative. A 'spot' blood sugar after a meal was recorded at 190 mg. Alcohol tolerance test, in which 100 c.c. of whisky was administered and blood sugar estimated at 1, 2 and 3 hours after, rendered blood sugar levels of 66 mg., 76 mg. and 74 mg. X-ray of skull and chest were normal.

Psychometric tests showed a WAIS. Full Scale I.Q. of 101 with no deficits suggestive of organic deterioration. MPI showed high extraversion (31) and neuroticism (23) at about the mean of the distribution of normal subjects.

An electroencephalograph was done; it was noted that the overall frequency was low, in other respects the EEG was normal. A blood sugar was done on the couch and a value of 65 mg. was found. In view of this, of the single positive glycosuria, of the observed episodes of slightly strange behaviour, and of the history, with special reference to that of the accident, a tentative diagnosis of hypoglycaemia was made.

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An extended sugar tolerance test was performed after an overnight fast. 50 G. of glucose was given by mouth and half-hourly estimations of venous blood sugar made (Fig. 1, broken line). The figures were interpreted as showing a late insulin response followed by a dramatic and profound hypoglycaemia of 30 mgm at 4 hours (the apogee of 184 mgm being at 1 hour). At the low blood sugar level the patient felt ill, thirsty, drowsy, irritable and unable to concentrate. A second confirmatory STT was carried out two weeks later (Fig. 1, dotted line); the pattern of the curve was similar to the first, although the initial rise in blood sugar was less dramatic. Yet another extended STT was carried out in the Middlesex Hospital, and again similar figures were obtained; on this occasion blood insulin and growth hormone assays were also recorded (Fig. 2). By now there was a strong impression, obtained from close observation of the patient, that there was a clear correlation between low blood sugar levels and abnormal cerebral function, as well as with her subjective feelings of illness. An attempt was made to demonstrate this factually.

An investigation parallel in many ways to that of Hill, Sargant and Heppenstall (1943) and involving further STT with EEG monitoring was arranged, physiologically following as closely as possible in the laboratory the conditions pertaining during the hours before and after and at the time of the accident. A fast of 21 hours was arranged, the patient was given 50 G. of glucose, a fasting blood sugar estimation made and EEG monitoring begun. The resting blood sugar was 76 mgm, and the background alpha rhythm of the EEG was at 10 c/s. symmetrical, of moderate amplitude, and responsive to eye opening and closure. Half-hourly blood sugar estimations were made, and the by now familiar values were once more

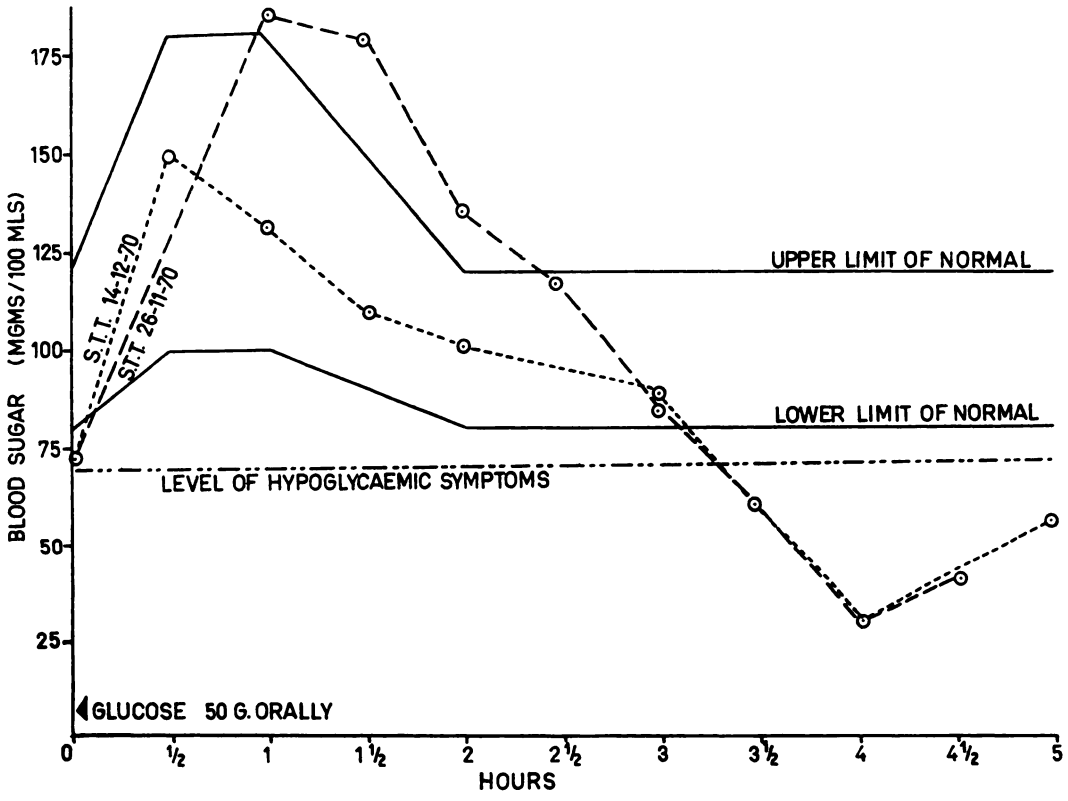


FIG. 1.

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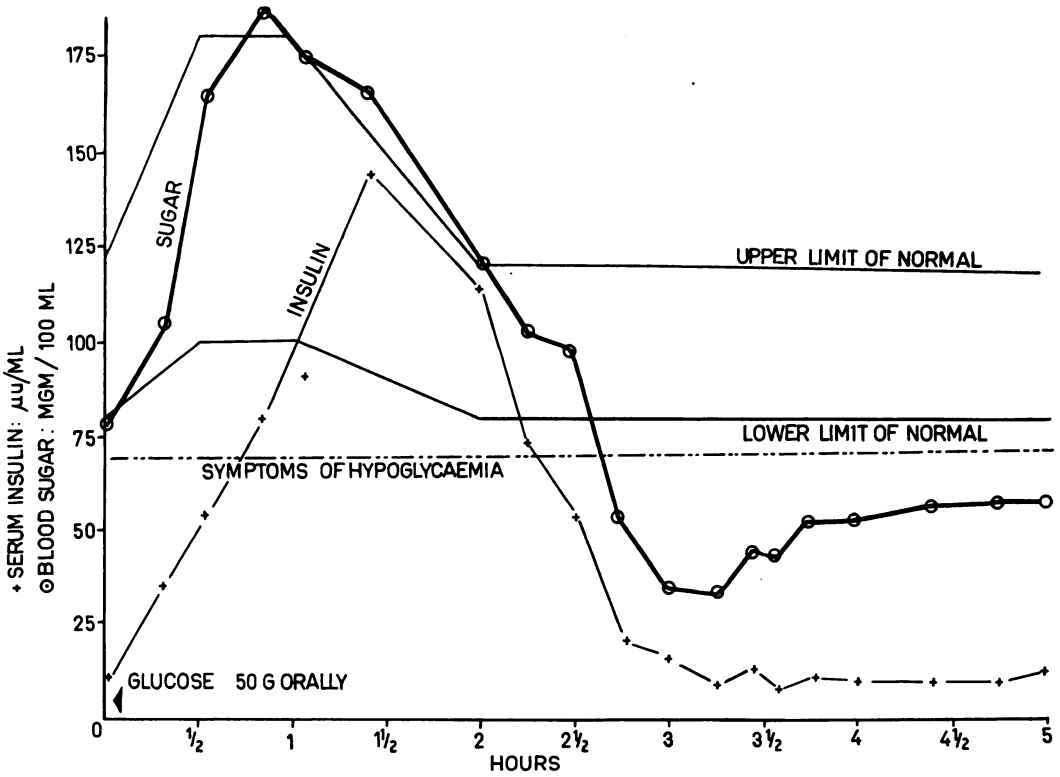


FIG. 2.

obtained (Fig. 3). The highest blood sugar was again at one hour and was 176 mgm. Estimations were discontinued at 4½ hours, and although at this time the readings had not yet begun to rise the curve was flattening out, the blood sugar was 42 mgm. Throughout the EEG monitoring the alpha rhythm tended to slow gradually, but the background activity did not drop below 8 c/s. However, as the blood sugar dropped, overbreathing produced bursts of slow wave activity between 2 and 6 cycles per second. At these low blood sugar levels alterations in behaviour and abilities were noted, the patient drifted easily into sleep and experienced feelings of illness. With a blood sugar below 70 mgm she had difficulty with simple calculation and in answering simple quiz type questions to which she knew the answers; below 50 mgm she was unable to recite nursery rhymes. But it was only when the blood sugar reached 44 mgm, and cycles/second were down to 4, that she became slightly ataxic, incoordinated and unable to perform automatic movements. At the end of the recording the patient seemed unaware of the length of time that had passed (a little over 4½ hours).

DISCUSSION

Epilepsy or post-ictal state have often been put forward as a cause of disturbed behaviour or consciousness leading to the commission of crime or offence: but though doctors and others who have been associated with diabetes mellitus or with insulin shock therapy are aware of the serious derangement of cerebration and eventual loss of consciousness caused by hypoglycaemia, there is only one case reported in the medical or legal literature in which functional hypoglycaemia was shown by the defence to have an effect on the behaviour of the defendant, and was adduced as a mitigating circumstance (Hill, Sargant and Heppenstall, 1943).

The patient's complaint of nausea, tremor, exhaustion and anxiety is typical of hypogly-

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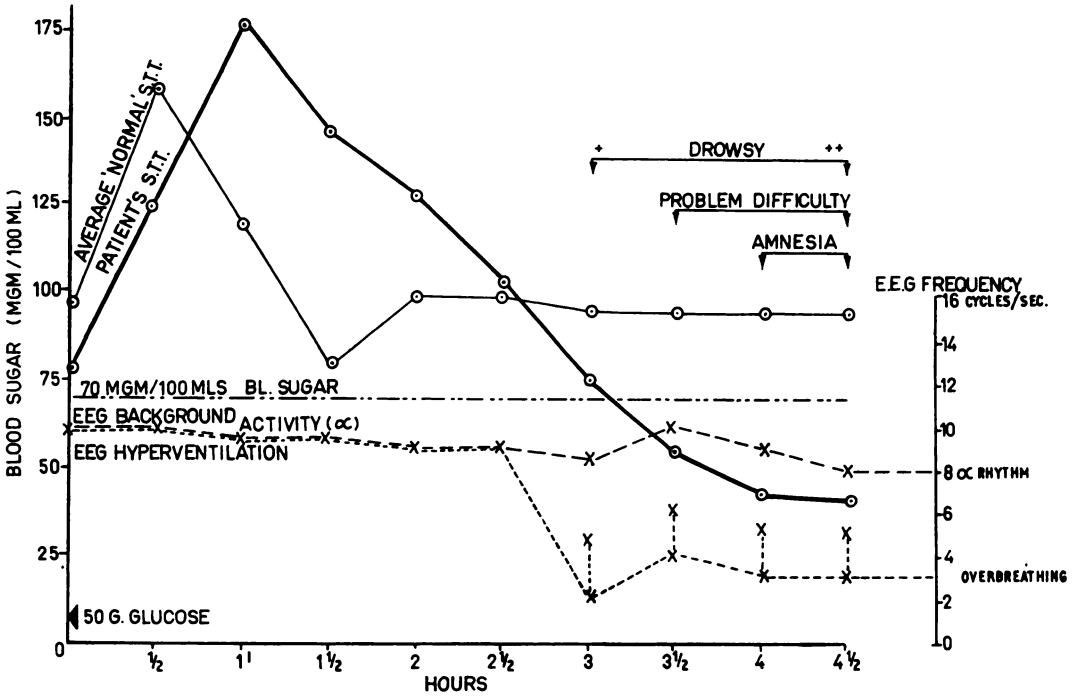


FIG. 3.

caemia. The taking of alcohol and amphetamine to allay these symptoms is understandable, as is the relatives' assumption that these drugs caused the episodes of uncharacteristic behaviour, disinhibition, aggression, disorientation and confusion, which, as others have observed, may suggest a diagnosis of drunkenness (Slater and Roth, 1969; Williams, 1970; and Flanders, 1967). And, as can be seen from the relatives' description, the degree of confusion or alertness, and of mood, may vary during the day, and anxiety and stress can play a part in inducing or increasing hypoglycaemia (Williams, 1970). On the day of the accident the patient had fasted for about 21 hours and had taken a carbohydrate meal 3 to 4 hours before the accident; our investigations showed that this course of events would be highly likely to have brought her to the time of the accident in a severely hypoglycaemic state, though not necessarily incapable of driving a car automatically. Within an hour prior to the accident she had taken a glass of sherry, and it is known that a small quantity of alcohol is capable of enhancing the effects of hypoglycaemia (Williams, 1970), though, of course, the breathalyser tests would be negative. Detachment, general lack of concern and poor concentration were noticed, as a familiar pattern in her, by relatives immediately before she left home and also immediately on her return home. During the visit, which was the object of the drive, she was noticed to have difficulty in threading needles and sewing; visual disturbance is known to occur in hypoglycaemia (Williams, 1970). It should perhaps be stressed that all the investigations were carried out without the use of insulin, and that there was nothing out of the ordinary in the test conditions: 21 hours fast is not uncommon, nor is a meal containing the equivalent of 50 G. of glucose.

The occurrence of confabulation, in relation to the damage to the car, is perhaps of interest, I have not found it to have been previously recorded in a case of hypoglycaemia.

Medico-legal considerations

The patient was charged with 'Causing death

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by dangerous driving'; secondary charges were 'Failing to report an accident within 24 hours', and 'Failing to stop after an accident' (Birmingham, March 1971). At the trial only medical evidence was called by counsel for the defence. Using the material forming the basis of this report, counsel was able to show the court that the defendant suffered from reactive hypoglycaemia, and that at the time of the accident she was probably hypoglycaemic to the extent that her state of consciousness was altered. The patient pleaded 'guilty' as a matter of fact, even though she had no memory whatsoever of the accident. A nominal fine was imposed, with a driving disqualification, on the grounds of her present ill health, for seven years.

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