

Reversible cognitive deterioration after a single episode of severe hypoglycaemia: a case report

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Abstract

A case of a male 34-year-old Type 1 diabetic patient who experienced a prolonged severe hypoglycaemic episode is presented. After the hypoglycaemic event, the patient suffered from moderate to severe neuropsychological impairments. On the basis of neuropsychological assessment results, diabetes therapy was modified (less complex insulin regimen, fixed insulin doses and fixed carbohydrate distribution). At a follow-up examination (3 months), presumable complete recovery of cognitive function was observed. This case demonstrates the possible detrimental neuropsychological effects of severe hypoglycaemia, that, in this case, turned out to be reversible. It highlights the clinical implications of impaired cognitive function on self-care and self-management abilities and the usefulness of neuropsychological testing in clinical diabetes care.

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Case report

We report about a 34-year-old male patient with Type 1 diabetes (duration of disease: 21 years). The patient had been in tight glycaemic control over the previous year (current HbA_{1c}: 6.5%, reference range 4.2–5.8%; A1CHA8140 HPLC, Menarini Diagnostics, Firenze, Italy) and was free from diabetic complications except mild retinopathy. He had no history of severe hypoglycaemia or impaired hypoglycaemia awareness and was not on any medication other than insulin. He was a student at a local university and living alone at that time. Upon suffering a severe nocturnal hypoglycaemic episode of unknown duration (the unconscious patient was found by a relative in the morning), the patient was transferred to an intensive care unit, as i.v. glucose, administered by the emergency physician, did not result in recovery of consciousness. Diagnostic procedures (CT scan, serological markers) did not reveal any possible causes for prolonged coma. After 2 days in intensive care, he finally regained consciousness. As neuropsy-

chological deficits persisted, the patient was diagnosed then with a 'post-hypoglycaemic cerebral psychosyndrome'. He was discharged after 5 days and transferred to our diabetes centre for blood glucose control.

At the beginning of his stay, he reported neuropsychological deficits. Furthermore, he appeared impatient and aggressive, as well as having profound difficulties in calculating insulin dosages and in remembering to inject before meals. Therefore, he was referred to the centre's psychological department for a neuropsychological examination, 10 days after the hypoglycaemic incident.

A structured neuropsychological anamnesis was performed first. The patient's complaints included the areas of attention, verbal fluency, orientation, and emotional changes fitting the clinical picture of a dysexecutive syndrome [1]. A marked slowing in speech was observable. No other events other than the hypoglycaemic episode were identified that could be associated with the present complaints.

Hypoglycaemia during testing was ruled out by blood glucose tests at the beginning and the end of each session. The following tests were administered in three 45-min sessions distributed over 2 days: Wechsler Adult Intelligence Scale Revised (WAIS-R) battery (German version [2]), Five-Point-Test [3], and a verbal fluency task (Thurstone's 's word' list

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Table 1 Neuropsychological test examination results (initial examination 10 days after the hypoglycaemic event; follow-up at 3 months)

Measure	Initial examination	Follow-up
WAIS-R (scores)		
Verbal IQ	128	141
Performance IQ	77	103
<i>Verbal subtests</i>		
– information	14	15
– digit span	15	16
– vocabulary	15	15
– arithmetic	15	14
– comprehension	15	19
– similarities	14	13
<i>Performance subtests</i>		
– picture completion	5	12
– picture arrangement	7	13
– block design	6	8
– object assembly	7	6
– digit symbol	9	10
Five-Point-Tests		
No. of unique designs	28	35
No. of perseverations (%)	8 (28.6%)	1 (2.8%)
Verbal fluency ('s words')		
No. of unique words	15	43

WAIS-R, Wechsler Adult Intelligence Scale Revised; WAIS-R, reference range for IQ (M ± SD): 100 ± 15; subtests (M ± SD): 10 ± 3 [2].

[4]) to assess mental flexibility and executive functioning (see Table 1 for results). The patient achieved a verbal IQ (VIQ) above average, whereas performance IQ (PIQ) was clearly below average. This discrepancy is assumed to be typical for trauma-induced neuropsychological deficits, PIQ being more afflicted. Subtests revealed deficits in visuo-perceptive/visuo-constructional functioning (block design, picture completion), as well as attentional deficits (digit symbol). Five-Point-Test results revealed several perseverations indicating deficits in executive functioning. Verbal fluency results pointed in the same direction, with only few uniquely produced words.

Several clinical decisions regarding his insulin regimen were made to take into account the patient's still observable neuropsychological deficits: the patient, currently under an intensified insulin regimen with dosage-adjustment and free choice of carbohydrates, was temporarily transferred to a simple, more rigid regimen (twice NPH, fixed doses soluble insulin for meals, fixed carbohydrates), that he could handle more easily, while simultaneously aiming at avoidance of hypoglycaemia in order to assist performance recovery.

Three months after the first examination, the patient (still in good glycaemic control, HbA_{1c}: 6.9%) stated that his cognitive

functioning had greatly improved. The patient was more relaxed and spoke normally. VIQ and PIQ improved both compared with the initial testing, the increase being markedly higher in PIQ so that no discrepancy between VIQ and PIQ was observable anymore. Five-Point-Test and the verbal fluency results were within the normal range.

Discussion

This patient demonstrated the effects of severe hypoglycaemia on neuropsychological functioning which persisted for 10 days after normal blood glucose levels had been restored. It has been shown previously, that there is usually recovery of cognitive function induced by severe hypoglycaemia after a much shorter period (1.5 days [5]); As we had the opportunity to perform a follow-up assessment, we were able to document a complete recovery of performance. Conclusions have to be cautious, as no baseline data with regard to 'pre-morbid' neuropsychological status before the hypoglycaemic event are available and practice effects, especially regarding the improvement in WAIS performance subtests, cannot be ruled out. This case demonstrates the clinical utility of neuropsychological assessment in diabetes mellitus, as it led to several clinical decisions. Diabetes mellitus can be regarded as a 'model' disease in medical neuropsychology [6,7]: cognitive dysfunction can be associated with diabetes. However, treatment strategies vary with regard to their complexity. Thus, matching the competencies of cognitively impaired diabetic patients and the demands of different treatment strategies is important in order to achieve the best outcomes. In this light, the availability of cognitive assessment may be useful.

References

- 1 Lezak MD. *Neuropsychological Assessment*. Oxford: University Press, 1995.
- 2 Tewes U. *Hamburg-Wechsler Intelligenztest für Erwachsene. Revidierte Fassung. Handanweisung*. Goettingen, Germany: Hogrefe, 1991.
- 3 Regard M, Strauss E, Knapp P. Children's production of verbal and nonverbal fluency tasks. *Perceptual Motor Skills* 1982; 55: 839–844.
- 4 Thurstone LL, Thurstone TG. *Primary Mental Abilities*. Chicago, IL: Science Research Associates, 1962.
- 5 Strachan MWJ, Deary IJ, Ewing FME, Frier BM. Recovery of cognitive function and mood after severe hypoglycaemia in adults with insulin-treated diabetes. *Diabetes Care* 2000; 23: 305–312.
- 6 Ryan CM. Neurobehavioral disturbances associated with disorders of the pancreas. In: Tarter, RE, van Thiel, DH, Edwards, KL, eds. *Medical Neuropsychology*. New York: Plenum, 2001: 127–162.
- 7 Ryan CM. Assessing medically-ill patients: diabetes mellitus as a model disease. In: Goldstein, G, Nussbaum, PD, Beers, SE, eds. *Neuropsychology*. New York: Plenum, 1998: 227–247.