Aspects of Hypoglycemia

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Abstract

To two groups of patients the standard six hour oral glucose tolerance test was administered. Over 80 percent of both groups had abnormal responses indicating either what is called reactive or relative hypoglycemia or a probable transition state between hypoglycemia and diabetes. The mechanisms and significance of this are discussed. It is concluded that the above terms should be abandoned and Reactive Hyperinsulinism be used as being more valid and more scientifically productive.

Introduction

"Abnormal Glucose Tolerance is very rare in psychiatric disease" is a common statement in the psychiatric community, and general medicine at large has come to accept it. In particular, Reactive or Relative Hypoglycemia has come to assume a pejorative status when patients ask about it of their family doctors.

I am a family doctor. I wanted to find out how significant abnormal glucose tolerances might be in my practice. Obviously I had no large captive hospital population to use as my experimental subjects. Nor could I believe that dragging people off the streets for such tests would be ethical. I had to take the patients that came to me and carry out such tests only when it was clear that the individual patient would gain some benefit from the result.

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Materials and Methods

I am one of eight family doctors serving a total population of approximately 15,000 people in a relatively isolated area in eastern British Columbia. The major sources of income are agriculture, lumber, fruit farming, tourism, and the servicing of a substantial retirement population.

The first group is a mixed series of alcoholics, depressives and schizophrenics, presenting as they were seen in my office. What prompted their being tested were variations in their symptoms that suggested some environmental factor was causing changes in their condition, dietary in particular.

The second series is of the students and some of the staff of an alternate school. Here all the students had learning difficulties, and were very prone to taking coffee and a cigarette for breakfast—as well as other dietary indiscretions.

All the tests were carried out after two or three days of a high carbohydrate diet, and in the standard manner at our local community hospital. The results are shown in the accompanying table (Table 1).

The diagnostic criteria for Reactive/Relative Hypoglycemia (RHG) that I used were a) a fall in the blood glucose level of 20mg/ dl. or more below the fasting level, or b) a fall of the blood glucose level in any one hour of 50mg/dl. or more, or c) a combination of both. Diabetes mellitus (DM) or a transitional state between RHG and DM (RHG/DM) was diagnosed when the blood glucose rose at any point above 180mg/dl.

Results

As can be seen from the table, in Series One, of the 66 patients, 37 were purely classified as RHG, and 17 were RHG/DM transitional for a total of 54 or 81 percent. There were no patients who were purely DM. One patient had a lag curve being a sustained rise of the blood glucose with a slow fall, a form of response that probably is at least potentially pre-diabetic. Another patient had a flat curve showing likely some problem with absorption of glucose. Including these, the overall number of abnormal responses was 56 or 84 percent. However, the tests numbered 17 and 20 were carried out on the same patient, the second occasion being ordered by a colleague who did not believe the first result. I include it for interest and completeness' sake.

In Series Two, with 15 patients tested, there were 12 or 80 percent diagnosed as RHG. This gave a combined total of RHG and RHG/DM of 66 or 81.5 percent.

Of interest is the distribution of the diagnostic features of RHG with respect to the time after the fasting blood glucose sample. These are shown graphically in Figure 1. While the peak lies in the third and fourth hours, a significant number still appear at the sixth hour.

Discussion

Does any of this mean anything? Until recently this was a matter for considerable dispute. The problem lay in the fact that there was no clear correlation between the apparent severity of the blood glucose abnormalities and the severity of the patients' symptoms. Some patients had very little deviation from the normal but very strong symptoms, while others had drastic-seeming abnormalities of their glucose tolerance with few or slight symptoms.

Hudspeth and his colleagues (1980) have recently shown that the correlation lies not between the symptoms and the glucose changes but between the symptoms and excessive insulin levels. These effects also correlated well with electroencephalographic changes and seem very likely mediated by an insulin induced hyperosmolality in the central nervous system (Arieff, 1974).

In other words it appears that the terms Reactive or Relative Hypoglycemia should be entirely abandoned, and Reactive Hyperinsulinism should be used since this is scientifically well established and is a useful concept.

While my groups of patients were highly selected, the extraordinarily high proportion of abnormal responders among them indicate that in psychiatric populations in general there is likely to be a high proportion of patients with Reactive Hyperinsulinism. These may still be diagnosed by the usual six hour oral glucose tolerance test, as I have indicated here, without embarking on expensive insulin estimations or E.E.G. tracings lasting six hours. Clearly large scale studies in our major psychiatric institutions seem indicated. Nor, from the distribution of the diagnostic features, can physicians get away with doing a two hour post-prandial blood glucose estimation to confirm or deny the diagnosis, since most of the abnormal features occur later.

What does this mean to therapy? Since hyperinsulinism is the mechanism, the usual advice given to patients to consume some foodstuff containing sugar or starch is grossly inadequate. Rather the patients should be instructed to avoid such foods entirely, along with caffeine which aggravates matters, and substitute highly non-refined sources of carbohydrate, taking, after a substantial breakfast, frequent high protein snacks, to avoid stimulating insulin oversecretion.

What does this mean to the psychiatric

patient in hospital? Since these patients' symptoms are likely aggravated by the usual hospital diet with the pushing, between meals, of large quantities of coffee and sweet stuffs, and the inevitable molasses laden tobacco of their cigarettes, a substantial saving in costs of nursing time and medications may be realised by simple dietary measures with the consequent improvement in the prognosis to these patients.

Apart from the larger scale studies that I have suggested above, where do we go from here? Reactive Hyperinsulinism seems related to the high consumption of refined foods in our society. We need to find out what social factors have led to such abnormal diet for so many people, and find ways to reverse these widespread habits. More importantly, we need to know why the islet cells of the pancreas respond in this fashion. Research into the fundamental mechanisms may go far to shedding further light on the basic patho-biochemistry of the very closely related diabetes mellitus. But such research is clearly beyond the scope of a General Practitioner such as myself in the interior of British Columbia.

TABLE 1

Results of 79 - 6 Hour and 2 - 5 Hour Oral Glucose Tolerance Tests

Series One

Patient		Fasting	*A* Hour	1 Hour	2 Hours	3 Hours	4 Hours	5 Hours	6 Hours	Remarks
1	w.c.	79	129	134	78	97	113	91	76	RHG
2	M.H.	88	112	130	91	99	66	84	89	RHG
3	V.P.	95	155	145	100	49	65	81	98	RHG
4	K.F.	91	109	87	100	85	74	74	79	N
5	A.K.	81	134	125	133	85	74	71	83	N
6	LP.	81	124	166	140	111	103	87	85	Lag Curve
7	E.H.	83	95	95	80	84	71	81	77	Flat Curve
8	E.K.	109	150	144	121	92	65	76	92	RHG
9	A.R.	84	141	108	120	71	76	80	85	RHG-border line
10	M. McG.	89	140	81	93	86	71	84	87	RHG
11	F.A.	85	153	139	88	85	86	67	79	RHG
12	M.K.	69	121	127	108	106	88	51	53	RHG
13	I.H.	82	102	78	82	75	64	75	86	RHG
14	L.K.	86	107	85	63	38	71	82	85	RHG
15	J.G.	82	151	176	124	76	83	92	98	RHG
16	E.W.	76	181	118	78	79	81	95	112	RHG
17	D.F.	69	156	202	108	85	41	59	76	RHG/DM
18	M.K.	131	262	286	187	303	50	72	87	RHG/DM
19	J.M.	83	167	192	114	56	54	67	86	RHG/DM
20	D.F.	83	169	241	153	81	68	76	81	RHG/DM
21	M.D.	84	210	232	164	122	51	68	61	RHG/DM
22	P.D.	69	86	103	102	92	75	89	89	N
23	K.R.	72	174	158	101	77	48	52	77	RHG/DM
24	B.P.	77	127	123	90	51	80	82	77	RHG
25	L.D.	97	158	80	86	82	82	72	94	RHG
26	P.A.	77	158	149	106	90	36	73	124	RHG
27	A.U.	95	158	122	88	44	76	86	86	RHG
28	L.U.	76	116	95	86	90	85	71	90	N
29	B.W.	87	146	131	85	88	32	67	78	RHG
30	D.W.	96	179	114	88	39	74	81	96	RHG
31	CD.	71	101	83	89	64	83	52	72	N
32	C.H.	92	167	149	66	53	72	84	93	RHG
33	C.C.	77	120	93	99	54	85	84	98	RHG
34	G.M.	94	79	68	44	65	81	84	93	RHG
35	G.S.	74	158	205	160	104	42	61	76	RHG/DM
36	P.B.	65	113	93	101	73	54	70	89	N
37	E.L.	89	151	221	252	152	83	40	63	RHG/DM
38	L.A.	59	111	112	98	98	67	66	53	N
39	D.B.	84	96	67	58	59	58	81	89	RHG

TABLE 1 CONTINUED

Results of 79 - 6 Hour and 2 - 5 Hour Oral Glucose Tolerance Tests
Series One

Patient		Fasting	1/2 Hour	1 Hour	2 Hours	3 Hours	4 Hours	5 Hours	6 Hours	Remarks
40	A.K.	78	163	190	104	81	41	88	89	RHG/DM
41	L.H.	74	128	160	133	151	116	79	62	N
42	L.J.	97	118	87	106	95	64	80	87	RHG
43	A.W.	150	280	371	408	226	128	93	98	RHG/DM
44	C.A.	89	169	216	159	188	138	128	119	RHG/DM
45	V.F.	85	121	136	144	87	87	61	75	RHG
46	E.B.	77	108	91	71	78	51	70	76	RHG
47	C.LaF.	82	105	84	80	60	71	84	82	RHG
48	E.G.	76	114	69	76	64	44	71	80	RHG
49	N.N.	71	180	199	153	118	126	48	65	RHG/DM
50	G.McL.	99	155	158	92	101	73	79	91	RHG
51	F.B.	80	165	220	201	166	64	61	67	RHG/DM
52	J.A.	116	256	238	152	111	61	71	95	RHG/DM
53	M.St.D	131	202	226	183	135	101	55	96	RHG/DM
54	V.D.	63	131	79	75	89	80	90		RHG
55	M.McL.	105	262	336	163	107	108	103	110	RHG/DM
56	R.B.	78	119	113	63	44	82	91	104	RHG
57	F.N.	88	193	196	94	95	65	70	82	RHG
58	H.L.	66	132	117	72	92	58	54	76	N
59	M.L.	81	145	90	78	67	78	81	91	RHG
60	P.L.	83	154	183	113	73	68	75	88	RHG
61	M.M.	94	170	205	104	40	70	77		RHG/DM
62	K.C.	82	158	123	97	87	56	70	81	RHG
63	L.D.	86	148	169	102	42	68	80	85	RHG
64	W.B.	86	133	137	90	92	64	78	86	RHG
65	D.H.	70	105	118	93	51	71	73	84	N
66	C.P.	82	149	108	67	41	59	71	95	RHG
(N=	66, RHG=37	RHG/DM=17, combined total=54=81%				Overall abnormal=		56=84%		

Series Two

1	L.B.	87	84	74	47	78	57	82	87	RHG
2	P.M.	84	154	148	89	63	66	73	81	RHG
3	B.K.	79	112	94	105	70	69	66	76	N
4	B.L.	82	104	87	83	85	57	66	85	RHG
5	T.D.	89	185	97	74	78	78	83	84	RHG
6	R.S.	94	164	138	114	74	86	90	96	RHG
7	B.C.	90	95	69	56	67	77	79	91	RHG
8	P.B.	89	147	103	135	81	89	79	86	RHG
9	G.T.	84	120	114	78	57	67	82	86	RHG
10	D.A.	79	136	112	99	55	75	82	81	RHG
11	D.P.	79	118	60	79	61	81	89	89	RHG
12	B.D.	77	111	92	64	65	77	82	84	N
13	J.D.	86	120	94	78	66	86	90	92	RHG
14	K.L.	92	139	112	85	78	88	91	89	N
15	J.A.	87	150	118	81	67	79	85	83	RHG
(N=15,	RHG =	=12=80 %.	Series 1+2:	N=81, Total RHG=49,		Combined total=66=81.5%)				

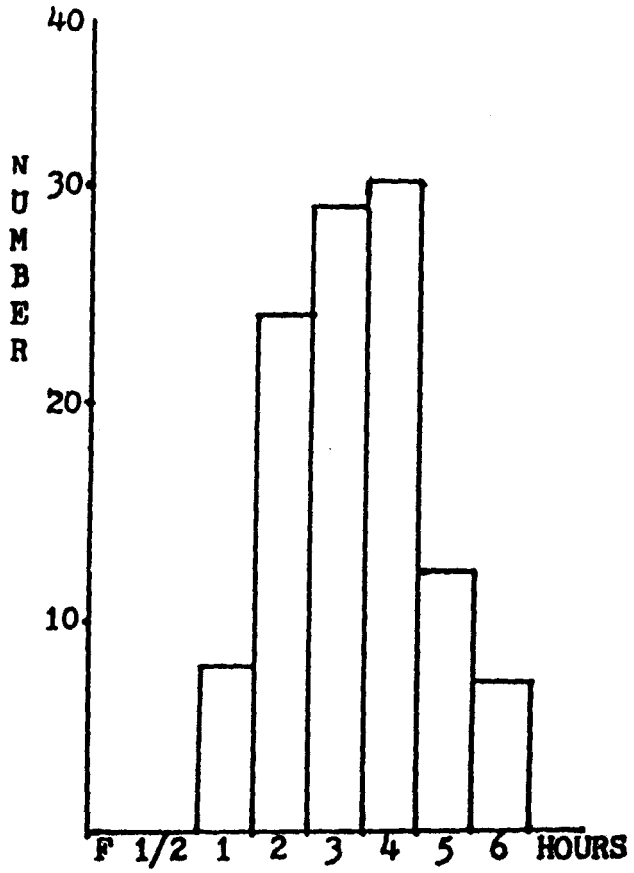

Figure 1: Time distribution of the diagnostic features of RHG after the fasting of blood glucose sample.

References

ARIEFF, A.I. et al.: Mechanisms of Seizures and Coma in Hypoglycemia: Evidence for a Direct Effect of Insulin on Electrolyte Transport in Brain. J. Clin. Invest. 54, 654-663, 1974.

HUDSPETH, W.J. etal.: Neuropsychological Aspects of Reactive Hypoglycemia/ Hyperosmolality. Neuro-psychologia, 1980.