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Case Reports

Serum Galanin Concentration is Increased in Subjects with Impaired Glucose Tolerance

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ABSTRACT

Objectives: Although extensive data have shown that galanin can regulate the food intake and glucose metabolism of animals, little is known regarding the galanin concentration in patients with impaired glucose tolerance (IGT). Therefore, the aims of this study were to investigate whether serum galanin levels and other metabolic parameters are changed in patients with IGT compared with controls with normal glucose tolerance (NGT).
Methods: Data regarding serum galanin levels and relative metabolic parameters were collected in 12 patients with IGT and 12 healthy patients with NGT.
Results: At 1 hour and 2 hours after dinner, serum galanin, insulin and glucose levels were significantly higher in patients with IGT than in controls with NGT. Additionally, the body weights of patients with IGT was higher than those of the controls. Furthermore, a negative correlation was found between galanin levels and 1-hour glucose concentrations (r=–0.580; p=0.048) in patients with IGT.
Conclusions: The higher serum galanin levels as well as the negative correlation between galanin levels and 1-hour glucose content in patients with IGT may result from the interaction between insulin and galanin in differing conditions, suggesting that the galanin level may be used as a potential biomarker for the prediction of IGT in clinical settings.

Mots clés :
galanine
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intolérance au glucose
insuline
sensibilité à l'insuline

RÉSUMÉ

Objectifs : Bien que les données de vastes études aient montré que la galanine peut réguler l'apport d'aliments et le métabolisme du glucose chez les animaux, on en connaît peu concernant la concentration de galanine chez les patients présentant une intolérance au glucose. Par conséquent, cette étude visait à déterminer si les taux sériques de galanine et les autres paramètres métaboliques sont modifiés chez les patients présentant une intolérance au glucose comparativement aux sujets témoins ayant une tolérance normale au glucose.
Méthodologie : Les données sur les taux sériques de galanine et les paramètres métaboliques relatifs ont été recueillis chez 12 patients présentant une intolérance au glucose et 12 sujets en bonne santé ayant une tolérance normale au glucose.
Résultats : Une heure et deux heures après le souper, la glycémie et les taux sériques de galanine et d'insuline étaient significativement plus élevés chez les patients présentant une intolérance au glucose que chez les sujets témoins ayant une tolérance normale au glucose. De plus, le poids des patients présentant une intolérance au glucose était supérieur à celui des sujets témoins. Également, une corrélation négative a été observée entre les taux de galanine et les glycémies une heure après le repas (r=–0,580; *p*=0,048) chez les patients présentant une intolérance au glucose.

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Conclusions : Les taux sériques de galanine plus élevés ainsi que la corrélation négative entre les taux de galanine et la teneur en glucose une heure après le repas chez les patients présentant une intolérance au glucose peuvent être le résultat de l'interaction entre l'insuline et la galanine dans différentes conditions, laissant supposer que le taux de galanine peut être utilisé comme un biomarqueur potentiel pour prédire l'intolérance au glucose dans des contextes cliniques.

Introduction

Impaired glucose tolerance (IGT) is a major risk factor for the development of type 2 diabetes (1). Increasing evidence reports that patients with IGT show some altered parameters of glucose tolerance, such as immunoglobulin E, tryptases and typically marked chymase concentrations (2). These parameters are unable to be taken as special biomarkers for the prediction of IGT in patients because most of them are also markers of inflammatory risk. More effective tools to diagnose patients with IGT would have a major impact on the management of this disease in clinical settings. Therefore, it is necessary to explore novel biomarkers responsible for the prediction of patients with IGT for clinical utility.

Galanin, a 29/30-amino-acid peptide, plays an important role in the regulation of glucose homeostasis in humans and animals (3–5). Higher levels of plasma galanin were found in patients with obesity, gestational diabetes mellitus and type 2 diabetes mellitus (6–9). During a glucose tolerance test, galanin secretion is positively correlated with the blood glucose level in healthy volunteers and patients who have type 2 diabetes (10,11). Furthermore, the results of our and Bu's studies showed that administration of M35, a galanin antagonist, reduced glucose infusion rates in the hyperinsulinemic euglycemic clamp test, which is a direct assessment of insulin sensitivity (12–17), implicating that endogenous galanin can enhance glucose tolerance and insulin sensitivity in humans and animals. However, whether patients with IGT have altered serum galanin concentrations and the value of galanin level in the diagnosis of IGT is unknown. Therefore, the aim of the current study was to investigate the possible interrelationship between galanin levels and glucose tolerance.

Methods

According to the results of physical examination and routine laboratory tests, 12 patients with IGT and 12 controls with normal glucose tolerance (NGT) were recruited into the present study from the Clinical Medical College, Yangzhou University. All participants were determined to be without diabetes mellitus, active hepatitis/liver cirrhosis, chronic renal failure on hemodialysis, congestive heart failure or other known major disease as well as family histories of diabetes. Written information was obtained from all participants or their relatives. The protocol of this study was approved by the Ethics Committee of the Clinical Medical College, Yangzhou University.

All participants remained in a sitting position and ingested 75 grams of glucose in 300 mL of water during less than 5 minutes. Blood samples were collected at 0, 1 and 2 hours after the ingestion for the measurement of serum glucose, insulin and galanin levels. The blood samples (2 mL) were collected in pre-chilled EDTA tubes containing 100 µL aprotinin (1 µg/mL) and were immediately centrifuged for 15 minutes at 1000×*g* at 4°C (7). The 100 µL serum in each assay point was analyzed for the galanin content using an enzyme-linked immunosorbent assay (ELISA) (CUSABIO, Wuhan, China). According to the manufacturer's specification, the range of the assay was 4.7 to 300 pg/mL, and the average sensitivity was 1.17 pg/mL. Intra-assay precision coefficient of variation percentage was less than 8%, and interassay precision coefficient of variation percentage was less than 10%.

The assignment of patients with IGT and controls with NGT must meet the diagnostic criteria of the World Health Organization. For IGT: fasting venous serum value <7 mmol/L, 75 g (2-h) oral glucose tolerance test (OGTT) and venous serum values between 7.8 and 11.1 mmol/L. For NGT: fasting venous serum value <6.1 mmol/L, 75 g (2-h) OGTT and venous serum value <7.8 mmol/L (18).

Statistical analysis

Statistical analysis was performed using SPSS for Windows, v. 17.0 (IBM, Armonk, New York, United States). All data were presented as mean ± SD. The differences between the groups were analyzed with independent t tests. Comparisons between the means of 0-, 1- and 2-hour galanin levels were analyzed by 1-way ANOVA with Duncan tests. Possible correlations between parameters were evaluated by Spearman correlation coefficient analyses; $p<0.05$ was regarded as statistically significant.

Results

The results showed that postprandial blood glucose, galanin and insulin levels (at 1 hour and 2 hours) were significantly higher in patients with IGT than in controls with NGT (Table 1) (Figure 1). The body weights were also higher in patients with IGT compared with the controls. There were no significant differences in fasting galanin levels or 1-hour and 2-hour galanin levels in the IGT or NGT groups, which were examined separately (Figure 1).

In addition, except for body weight (r=–0.724; p=0.012), no significant correlations were found between galanin levels and other anthropometric or metabolic parameters in controls with NGT (Table 2). Interestingly, there was a significant negative correlation between galanin levels and 1-hour glucose concentrations

Table 1
Biochemical and demographic characteristics of 2 groups

	NGT	IGT	p value
N	12 (6 male, 6 female)	12 (5 male, 7 female)	
Age (years)	43.083±21.811	38.83±15.71	0.589
Body weight (kg)	68.50±11.23	78.08±9.63	0.035
Body mass index (kg/m^2)	26.27±4.78	28.99±2.78	0.106
A1C (%)	6.37±0.91%	5.87±0.31%	0.397
Fasting glucose (mmol/L)	4.94±0.73	5.97±2.35	0.163
1-hour glucose (mmol/L)	7.46±1.30	10.12±2.88	0.021
2-hour glucose (mmol/L)	6.89±0.62	9.58±1.45	<0.001
Fasting insulin (mIU/L)	13.93±6.22	19.52±8.98	0.127
1-hour insulin (mIU/L)	28.19±23.62	128.67±92.51	0.007
2-hour insulin (mIU/L)	21.94±19.44	126.56±106.06	0.006
TG (mmol/L)	2.39±1.13	3.01±0.95	0.160
TC (mmol/L)	5.34±1.40	5.406±1.08	0.900
HOMA-IR	3.24±1.56	4.76±2.10	0.084
Fasting galanin (pg/mL)	17.18±4.56	61.59±28.25	<0.001
1-hour galanin (pg/mL)	12.40±4.25	49.01±31.85	0.005
2-hour galanin (pg/mL)	13.93±10.53	53.74±35.93	0.008

A1C, glycated hemoglobin; *HOMA-IR*, homeostasis model assessment-estimated insulin resistance; *IGT*, impaired glucose tolerance; *N*, number of cases; *NGT*, normal glucose tolerance; *TG*, triglycerides; *TC*, total cholesterol.
Note: Results are shown as means ± SD; statistical significance, $p<0.05$.