International Journal of Diabetes and Endocrinology
2021; 6(4): 131-133
http://www.sciencepublishinggroup.com/j/ijde
doi: 10.11648/j.ijde.20210604.12
ISSN: 2640-1363 (Print); ISSN: 2640-1371 (Online)

Evaluation of C-peptide in Type 2 Diabetic Patients in Douala Cameroon: C-peptide Correlation with Arterial Hypertension and the Types of Treatment Administered

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To cite this article:
Manta Diane, Mbango-Ekouta Noel Désirée, Nda Mefo'o Jean Pierre, Assiene Oyong Damase Serge, Eloumou Bagnaka Servais, Adiogo Dieudonné. Evaluation of C-peptide in Type 2 Diabetic Patients in Douala Cameroon: C-peptide Correlation with Arterial Hypertension and the Types of Treatment Administered. *International Journal of Diabetes and Endocrinology*. Vol. 6, No. 4, 2021, pp. 131-133.
doi: 10.11648/j.ijde.20210604.12

Received: August 17, 2021; **Accepted**: October 16, 2021; **Published**: October 28, 2021

Abstract: *Introduction*: C-peptide is the best indicator of endogenous insulin secretion; it makes it possible to optimize the treatment, and to prevent the occurrence and the evolution of the damages resulting from type 2 diabetes. The present study reports the variation of C-peptide levels according to the types of treatment administrated and the high blood pressure in type 2 diabetes in two hospitals (General Hospital and Gyneco-Obstetric and Pediatric Hospital) in the city of Douala Cameroon. *Methodology* Over a period of 9 months (from October, 1st 2017 to June, 30th 2018), we conducted an analytical cross-sectional study involving subjects with type 2 diabetes regularly monitored at the General Hospital and Gyneco-Obstetric and Pediatric Hospital of Douala Cameroon. *Inclusion criteria* we included any subject whose diagnosis of type 2 diabetes was mentioned in the medical file. The fasting C-peptide assays were performed according to the principle of electrochemiluminescence. The ANOVA and PEARSON tests were use to investigate on the one hand the correlations between the C peptide levels and the types of treatment administered, and on the other hand between the C-peptide levels and arterial hypertension. The significant threshold was set at $P < 0.05$. *Results*: Our population, made up of 90 subjects, had a mean age of 58±12.31 years, sex ratio 0.8 in favor of women. The mean duration of diabetes was 8.71±6, 94 years, we had 30 hypertensive subjects under hypertensive treatment, the mean C-peptide levels was 2.50±1.68ng / ml. We found that C-peptide levels increased with patient ages ($P=0.004$), a significant correlation between C-peptide levels and high blood pressure ($P=0.022$), and C-Peptide levels varied significantly depending on the type of treatment ($P=0.04$). *Conclusion*: Type 2 diabetic patients on oral antidiabetic drugs, and having a low level of C-peptide, should undergo a modification of their treatment by the addition (or the replacement) of insulin, for better glycemic control. Diabetic and hypertensive patients are more exposed to micro and macrovascular complications. Hence the importance of instituting more assiduous blood pressure control, appropriate hypotensive therapy, as well as training patients in self-management and prevention of the onset of complications related to diabetes.

Keywords: C-peptide, Type 2 Diabetes, Hypertension, Douala

1. Introduction

Type 2 diabetes, a disease associated with obesity and some time with environmental facts and genetics predispositions, is linked to peripheral insulin resistance [1, 2]. It is the cause of microvascular (retinopathy, nephropathy and neuropathy) and macrovascular complications [3]. The clinical management of type 2 diabetes, with the aim of reducing morbidity and mortality, requires therapeutic adaptation over time [4, 5]. And its biological monitoring requires, in addition to the quarterly dosage of glycosylated hemoglobin, the dosage of C-peptide (considered the best marker for monitoring endogenous

insulin production) under certain conditions during therapeutic monitoring with the aim of anticipating therapeutic adaptations and preventing the occurrence of complications [3, 6, 7]. A study shows that, C-peptide levels can be used to identify patients in need of insulin and those who does not need it more [8] The present study was undertaken to assess the relationship between serum C-peptide levels with the type of treatment administrated, and the C-peptide levels with arterial hypertension,

2. Methodology

We conducted over a period from October 1st, 2017 to June 30, 2018, that mean 9 months, an analytical cross-sectional study involving subjects with type 2 diabetes. We recruited the subjects directly after selection of the medical files of interest, and during consultations with the endocrinologist.

We included any type 2 diabetic subject regularly monitored and agreeing to participate into the study, and we excluded any case of secondary and gestational diabetes, any type 2 diabetic subject presenting with acute or chronic renal failure or on dialysis, a Cushing's syndrome, pancreatitis, or referenced insulinoma.

The fasting C-peptide assays were performed according to the principle of electrochemiluminescence on Cobas E411 and the standard thresholds were those indicated on the leaflet used for the assay (C-peptide elecsys for Cobas e411: low values <1.1ng / mL, normal values 1.1 - 4.4ng / mL, high values> 4.4ng / mL) [9].

The ANOVA and PEARSON tests were use to investigate on the one hand the correlations between the C-peptide levels and the types of treatments administered, and on the other hand between the C-peptide levels and arterial hypertension. The significant threshold was set at P <0.05.

3. Results

Our study population consisted of 90 subjects, 50 of whom were women and 40 were men. The mean age was 58.5±12.31 years, the extreme ages 29 to 84 years.

Table 1. *C-Peptide correlation with arterial hypertension (AHT).*

		C-peptide levels ng/mL				
		Low<1,1	**Normal [1,1 – 4,4]**	**High>4,4**	**P**	**OR**
AHT?	**YES**	2 (12,5%)	21 (34,42%)	7 (53,85%)	0,022	0,307
	NO	14 (87,5%)	40 (65,58%)	6 (46,15%)		

p=P-value, OR=Odd-ratio

Table 1 shows a significant correlation between C-peptide levels and arterial hypertension (P=0.022; OR=0.307; 95% CI=0.155 - 0.867). We have 53.85% of hypertensive subjects had C-peptide levels greater than 4.4 ng/mL. We also found that, a large proportion of normotensive subjects had a C-peptide levels below 1.1 ng/mL.

Table 2. *Correlation C-peptide levels with type of treatment administered.*

		C-peptide levels ng/ml			C-peptide means	ANOVA test	
		<1,1	**1,1 – 4,4**	**>4,4**		**F**	**P**
Type of Treatments							
Non medical	MHD	0 (0%)	2 (66,67%)	1 (33,33%)	3,72±2,31		
	monotherapy	2 (5,71%)	27 (77,14%)	6 (17,14%)	2,76±1,73		
	Dual therapy	4 (12,12%)	25 (75,76%)	4 (12,12%)	2,52±1,46	2,629	0,04
Medical	Triple therapy	1 (25,00%)	1 (25,00%)	2 (50,00%)	3,25±3,11		
	ADO +insulin	1 (25,00%)	3 (75,00%)	0 (0%)	2,10±0,92		
	Insulin only	8 (72,73%)	3 (27,27%)	0 (0%)	1,16±0,93		

F=ANOVA coefficient; P=P-value; threshold 0.05, MHD=dietary hygiene measures, ADO=oral antidiabetics

The analysis of Table 2 shows a therapeutic escalation in relation to an average decrease in the concentration of C-peptide levels.

4. Discussion

Our study showed a significant correlation between C-peptide levels and high blood pressure (P=0.022). This fact has been also notified by RAMAZAN SARI [10] in 2005 in Turkey, and INUKAI [11] in 1999 in Germany. This could be explained by the fact that insulin resistance causes insulin inaction, resulting in a modification of the structure of the long polypeptide chains of the basement membrane. The more numerous hydroxylysine radicals then attach short side chains formed of glucose and galactose (increased activity of the enzyme glucosyl-galactosyl-hydroxylysine-transferase). The ultimate term of this disorder is an increase in the thickness of the basement membrane leading on the one hand to fragility (possibility of dilation and formation of micro-aneurysms, hyperpermeability and risk of hemorrhage) and on the other hand, a decrease in blood pressure. Blood current with possibility of thrombosis (anoxia and downstream ischemia) and arterial hypertension. The poor action of insulin will promote cellular suffering responsible for metabolic changes in the cells leading to a change in the type of collagen produced by fibroblast cells and leading to a process of fibrosis and atherosclerosis. Hence the need for high C-peptide to monitor blood pressure and vascular complications associated with type 2 diabetes [12]. Hypertension

and type 2 diabetes mellitus are two major health public problems on a global scale, due to their frequency, the need lifelong follow-up and drug treatment, and by their vascular complications [13]. in addition, these two associated pathologies contribute to an increase in the cardiovascular risk, in particular in the elderly [14, 15]. Economic analyzes have shown that a control strict blood pressure in diabetics had a better cost / effectiveness of tight blood sugar control [16].

We noted a positive correlation between the C-peptide levels and the type of treatment administered: the lowest C-peptide levels were found in patients on insulin only, and the highest levels in patients on dietetics. This could be explained by the fact that the oral antidiabetics administered stimulate the production or the activity of insulin in order to delay the onset of complications due to a deficit in insulin activity, and the insulin secretory activity of the pancreas is sharply reduced in patients on insulin. Moreover, this variation in the C-peptide levels depending on the treatment could be explained by the difference between the different treatments themselves. Because the pancreatic betta cells of subjects under monotherapy unlike those under dual or triple therapy are supposed to produce more active insulin [17, 18].

5. Conclusion

Type 2 diabetic patients on oral antidiabetic drugs, and having a low level of C-peptide, should undergo a modification of their treatment by the addition (or the replacement) of insulin, for better glycemic control. Diabetic and hypertensive patients are more exposed to micro and macrovascular complications. Hence the importance of instituting more assiduous blood pressure control, appropriate hypotensive therapy, as well as training patients in self-management and prevention of the onset of complications related to diabetes.

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