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Original article

## Orthostatic hypertension in normotensive type 2 diabetics: What characteristics?

*L'hypertension orthostatique chez les diabétiques de type 2 normotendus : quelles caractéristiques ?*

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### Abstract

**Aim of the study.** – We aimed to determine the prevalence of orthostatic hypertension (OHT) in normotensive, newly diagnosed type 2 diabetics, to assess clinical, biological characteristics of those patients and evaluate the evolution of their blood pressure, after one year of follow-up.

**Materials and methods.** – It is an observational, prospective, cohort study, on 108 normotensive, newly diagnosed diabetics, 40 men and 68 women aged from 40 to 70 ans. OHT was defined as an increase of systolic blood pressure (SBP)  $\geq 20$  mmHg and/or diastolic blood pressure (DBP)  $\geq 10$  mmHg, after 1 and 2 min of standing from supine position. Arterial hypertension and metabolic syndrome were respectively defined according to WHO and AHA 2009 guidelines. Clinical and biological data were collected for all patients. They had a screening for diabetic complications and a follow-up during one year. Statistical analysis was performed with Epi-Info 6.04.

**Results.** – We found OHT in 22 patients (20.4%). Patients with OHT had a higher SBP at lying position ( $P=0.029$ ), a higher waist circumference ( $P=0.022$ ) and LDL ( $P=0.041$ ). They had more frequently obesity ( $P=0.036$ ) left ventricular hypertrophy ( $P=0.024$ ), metabolic syndrome ( $P=0.042$ ) and cerebrovascular events ( $P=0.050$ ) when compared with those with normal blood pressure response to orthostasis. One year after follow-up, the prevalence of permanent hypertension was significantly higher in the OHT group ( $P=0.0008$ ).

**Conclusion.** – Our study suggests that OHT is associated with insulin resistance syndrome and onset of sustained arterial hypertension in normotensive, newly diagnosed diabetics.

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**Keywords:** Type 2 diabetes; Orthostatic hypertension; Arterial hypertension; Metabolic syndrome; Risk prediction

### Résumé

**Objectif de l'étude.** – L'objectif de l'étude était de déterminer la prévalence de l'hypertension orthostatique (HTAO) chez des diabétiques de type 2 normotendus nouvellement diagnostiqués, d'étudier les caractéristiques de ces patients et de suivre l'évolution de leur tension artérielle après un an de suivi.

**Patients/Patientes.** – Il s'agit d'une étude observationnelle, prospective, de cohorte de 108 diabétiques de type 2 normotendus, nouvellement diagnostiqués, âgés de 40 à 70 ans. L'HTAO est définie par une augmentation de la pression artérielle systolique (PAS)  $\geq 20$  mmHg et/ou diastolique (PAD)  $\geq 10$  mmHg à 1 ou 2 minutes d'orthostatisme. Le diagnostic de l'hypertension artérielle (HTA) et du syndrome métabolique a été posé, respectivement, selon les critères de l'OMS et de l'AHA 2009. Nous avons collecté les données cliniques et biologiques, recherché les complications du diabète et suivi tous les patients durant une année. L'analyse statistique a été réalisée à l'aide du logiciel Epi-Info 6.04.

**Résultats.** – Une HTAO est retrouvée chez 22 patients (20,4 %). Les patients avec HTAO ont une PAS de repos ( $p=0,029$ ), un tour de taille ( $p=0,022$ ) et un LDL ( $p=0,041$ ) plus élevés. Ils ont plus fréquemment une obésité ( $p=0,036$ ), un syndrome métabolique ( $p=0,042$ ) et un accident cérébro-vasculaire ( $p=0,050$ ), en comparaison aux diabétiques ayant une normotension à l'orthostatisme. Après un an de suivi, l'HTA permanente est plus prévalente dans le groupe avec HTAO ( $p=0,0008$ ).

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**Conclusion.** – Notre étude est en faveur d'une association de l'HTAO au syndrome d'insulinorésistance et à l'apparition d'une HTA permanente chez les diabétiques de type 2, normotendus, nouvellement diagnostiqués.

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**Mots clés :** Diabète de type 2 ; Hypertension orthostatique ; Hypertension artérielle ; Syndrome métabolique ; Prédiction de risque

## 1. Abbreviations

ACR	albumin-creatinine ratio
AHA	American Heart Association
BMI	body mass index
BP	blood pressure
CKD	chronic kidney disease
DBP	diastolic blood pressure
GFR	glomerular filtration rate
HbA1c	glycated hemoglobin
HDL	high density lipoprotein cholesterol
JNC7	seventh report of the Joint National Committee on prevention, detection, evaluation and treatment of high blood pressure
LDL	low density lipoprotein cholesterol
LVH	left ventricular hypertrophy
MDRD	modification of diet and renal disease
Min	minute
OH	orthostatic hypotension
OHT	orthostatic hypertension
ONT	orthostatic normotension
SBP	systolic blood pressure
SD	standard deviation
WHO	World Health Organization

## 2. Introduction

Orthostatic hypertension (OHT) in diabetes is less known than orthostatic hypotension (OH), both represent an autonomic dysregulation. OHT is an over-reacting of the sympathetic nervous system, involving a hypersensitivity of vascular baroreceptors [1] in response to orthostasis. Regarding data of several studies, it has a potential importance in clinical practice, after all, there is a growing sum of evidence that OHT is a risk factor of cerebrovascular events in hypertensive patients [2,3] and is presented as a marker of sustained arterial hypertension in normotensive subjects [4]. In the present study we examined the prevalence of OHT in normotensive patients with newly diagnosed type 2 diabetes; we determined their clinico-biological characteristics and assessed the evolution of their blood pressure (BP), after one year of follow-up.

## 3. Material and methods

### 3.1. Study site

The study has been performed in the health sector of Ain-Taya that is located in the East side of Algiers in Algeria. The health

sector includes four towns on the coastline (Ain-Taya, Heraoua, Bordj El Bahri and Marsa) and has one university teaching hospital and 12 primary care units. This area has a medical coverage of one doctor for 400 people [5]. The study procedures were centralized in the principal investigator consultation box, inside the hospital, so he could follow-up all recruited patients.

### 3.2. Study design and population

Data for this study derived from an observational, mono-centric; prospective cohort study described previously [6]. We studied 108 normotensive newly diagnosed type 2 diabetics, recruited consecutively, in an exhaustive way, between January 2009 and December 2013, in all primary care consultations and in the emergency units of the health sector. All patients benefited from trimestral consultation by the principal investigator, until complete assessment and screening for diabetes' complications. All patients had a follow-up of at least one year. Eligible criteria were: patients aged from 40 to 70 years, newly diagnosed for type 2 diabetes and voluntary consent to take part to the study. We excluded from analysis all hypertensive patients, pregnant women and those who could not stand up for at least two minutes.

### 3.3. Protocol of BP measurement

All patients, we assessed for OHT, had a hemodynamically stable situation. We solved, before proceeding, all glycemic abnormalities and acute conditions, that could have affected blood pressure, by hospitalization. The same physician measured, at office, after 10 minutes of quiet rest, the systolic (SBP) and diastolic blood pressure (DBP) of the patient, with a validated electronic tensiometer (OMRON III), at the right arm, in supine position, with an appropriate cuff size. According to WHO/ISH guidelines [7], we measured the blood pressure 3 times, respecting an interval of one minute between each measure, the third value was considered for analysis. After the lying measures, we asked the patient to stand up; the assessment of orthostatic BP begun as soon as the feet touch the floor, we performed, then, two additional BP measurements at 1 min and 2 min after standing and considered the highest value of BP at orthostasis.

### 3.4. Definitions

Arterial hypertension was defined as a SBP  $\geq$  140 mmHg and/or DBP  $\geq$  90 mmHg [7,8], we classified BP as recommended by the JNC 7 report [8].

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