CARDIOLOGIE TUNISIENNE

ARTICLE ORIGINAL

Hypertension among young adults : Leading causes

Les étiologies de l'Hypertension artérielle chez l'adulte jeune

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Summary

Introduction : The frequency of arterial hypertension (HTN) among young adults is on a steady rise contrasting with a scarcity of data in literature.

Aim: ascertain the leading causes of hypertension in young adults and find some predictors of an essential HTN.

Methods: a retrospective overview of hypertensive patients aged between 18 and 45 years old hospitalized in the Department of cardiology in Kairouan -Tunisia between 2018 and 2024.

Results:104 medical records were analyzed, 57 women and 47 men. Mean age at diagnosis of hypertension was 34, 72 years +/- 6, 65 SD. The cause of hypertension was found in 35.6% of the cases ,5 of which were iatrogenic due to oestroprogestative pills and anti-inflammatory drugs. Among organic ones, 2 cases of primary aldosteronism,1 case of Cushing syndrome ,4 renal artery stenosis, 7 cases of kidney disease ,9 Obstructive sleep apnea syndrome, 4 cases of pheochromocytoma and 5 cases of aortic coarctation. Hypertensive young women had more secondary hypertension than men (43.8% against 25.5%, p=0.04). Patients with secondary hypertension and those with final diagnosis of essential hypertension were comparable for: presence or not of symptoms, blood pressure and kaliemia. Multivariate analysis showed that male gender, Family history of hypertension, obesity are independent predictors of having an essential hypertension.

Conclusion: In our population, the prevalence of secondary hypertension is close to 35%. Our findings appeal for reappraisal of risk factors of hypertension among young adults.

Keywords

Hypertension, Young adults, causes,essential hypertension

Résumé

Introduction: La fréquence de l'hypertension artérielle (HTA) chez l 'adulte jeune est en constante augmentation contrastant avec la rareté des études s'intéressant à cette catégorie d 'âge.

Objectif: Identifier les principales causes d 'HTA chez l 'adulte jeune et rechercher des facteurs prédictifs d 'une HTA essentielle.

Méthodes: Etude rétrospective incluant les patients hypertendus âgés entre 18 et 45 ans hospitalisés au service de cardiologie Kairouan Tunisie entre 2018 et 2024.

Résultats: 104 patients ont été étudiés,57 femmes et 47 hommes. L 'âge moyen au moment du diagnostic était de 34.72 ±6.65 ans. Une cause à l 'HTA a été retrouvée dans 35.6% des cas dont 5 cas d 'HTA iatrogène à cause des pilules oestroprogestatives et des anti inflammatoires. Les causes organiques retrouvées étaient : 2 cas d 'hyper aldostéronisme primaire,1 cas de syndrome de cushing,4 cas de sténose de l 'artère rénale, 7 cas de néphropathie, 9 cas de syndrome d 'apnée de sommeil, 4 cas de phéochromocytome et 5 cas de coarctation. L'HTA secondaire était plus fréquente chez les femmes (43.8% versus 25.5% , P=0.04).Les patients avec HTA secondaire étaient comparables à ceux avec un diagnostic final d 'HTA essentielle concernant la présence ou non de symptômes, le niveau de chiffres tensionnels et la kaliémie. En analyse multivariée, le sexe masculin, l 'obésité et l'histoire familiale d 'HTA étaient des facteurs indépendants prédictifs d'une HTA essentielle.

Conclusion: La prévalence d 'HTA secondaire dans notre série est proche de 35%. L'HTA de l'adulte jeune reste majoritairement essentielle à cause de l 'augmentation du syndrome métabolique et des mauvaises habitudes de vie.

Mots-clés

Hypertension artérielle, causes, adulte jeune, Hypertension essentielle

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INTRODUCTION

In the 2010 Global Burden of Disease study (1), 9 million deaths were attributed to hypertension, making it the first cause of death worldwide. Data shows that in recent years the frequency of arterial hypertension (HTN) among young adults is on a steady rise (2).This may be attributed to several factors such as changed lifestyle and education pattern that leads to anxiety and stress. Other studies revealed also that many such patients have secondary hypertension due to a specific etiology in contrast to the great majority (about 95%) of older adult hypertensive patients who have essential hypertension.There is a paucity of information and guidelines on the best way to manage young patients mainly regarding how and how much to investigate them in order to rule out an underlying and so potentially reversible etiology.

AIM

We conducted this study in order to ascertain the leading causes of hypertension in young adults and find some predictors of an essential HTN.

MATERIALS AND METHODS

fter We performed a retrospective observational Cross-sectional monocentric study over 7 years from January 2018 to December 2024.The study was conducted in the Department of cardiology of Ibn El Jazzar hospital in Kairouan, Tunisia. All patients aged between 18 and 45 years (which define young adults in our study) and meeting the inclusion criteria and hospitalized in our department were included.

Our hospital is the biggest in the region of Kairouan.The city of Kairouan has a population that exceed 600.000 inhabitants. On the other hand, our department is a unit of 36 beds; it accepts patients from the city of Kairouan, but also its closer areas. Furthermore, in Kairouan wealthy patients may be admitted to private clinics.

Patients included are those aged between 18 and 45 years old, with a diagnosis of arterial hypertension based on European Society of Hypertension/ European Society of cardiology (ESH/ESC) guidelines criteria (3); hypertension is defined as an average blood pressure of greater than 140/90 mmHg or use of antihypertensive medication.

However, pregnant women with hypertension were excluded from this study because it implicates another physiopathology.

Data was collected from medical records. We proceeded first of all by identifying the files of patients under the age of 45years. Then we identified those with diagnosis of arterial hypertension. Data included demographic characteristics, clinical features at diagnosis mainly the presence of symptoms, stage of hypertension, the presence of cardiovascular risk factors such as diabetes mellitus, obesity, hypercholesterolemia, smoking .Biological data concerned dosages of kaliemia , plasma creatinine level.The results of the etiological work-up including ,if done plasma renin, aldosterone , vanilly mandelic acid (VMA), cortisol and thyroid analysis were meticulously recorded.

Recorded radiological examinations were transthoracic echocardiography, renal artery ultrasound , and if needed abdominal CT scan or other investigations used to determine a cause for the hypertension. Information was extracted from the folders and collected in a questionnaire.

Statistical analysis was performed using SPSS for Windows. Means and the respective standard deviations and proportions were used to describe the distribution of the data.The chi squared test or Fisher's test were used to determine the statistical significance of the differences between the proportions and the Student t test was used to compare means. Binary logistic regression was used to define some potential predictors of having an essential hypertension. P-values of less than 0.05 were considered to be statistically significant.

RESULTS

A total of 104 hypertensive patients were registered, corresponding to about 25% of all the young patients hospitalized in our department of cardiology (420 patients) during the 7 year period. The number of men and women in our population was roughly equal, though women held a slight lead with 57 women (54,8%) for 47 men (45,2%). The mean age at the diagnosis of hypertension was 34, 72 years +/- 6, 65 standard deviation (SD) with a minimum of 18 and a maximum of 45 years old. Age was stratified in 3 categories namely [18–29], [30-35] and [36-45] years old. At the time of diagnosis of hypertension, 24 (23,1%) were in the age-group [18–29] years old; and 58 (55.8%) were in the age group of [36-45] years old.

The discovery of hypertension was fortuitous in 13.5 % of cases (n=14). Hypertension is most commonly diagnosed when patients have symptoms (86.5%; n=90). A complication was the circumstance of diagnosis in nine cases (8.7%) within 4 men and 5 women. It was found that

headache was the commonest symptom (55.7%) followed by chest pain (17.31%) and shortness of breathing (8.65%).

About 95.7% (n=45) of men were symptomatic at the moment of diagnosis versus 78.9% of women with a significant P value (=0.01). Complications included coronary syndrome in 3 cases, pulmonary edema in 2 cases and hemorrhagic stroke in one case. The mean (±SD) systolic and diastolic blood pressure values at diagnosis were 176.4±31.3 mmHg (range, 130 to 280 mmHg) and 100.2±17.6 mmHg (range, 70 to 160 mmHg), respectively. Classification of blood pressure values according to ESC / ESH 2024 guidelines indicated that 46 patients (44.2%) had Stage 3 and 32 patients (30.8%) had Stage 2 hypertension. Forty-eight patients (46.2%) had one damaged organ and 18 (17.3 %) had two or more.

Heart involvement was the most frequent finding (51.9%, n =54) of all patients, followed by hypertensive retinopathy and nephropathy (17.3%, n=18), (15.4%, n=16) respectively.

Data analysis of clinical and biological parameters of the male and female groups showed that men were significantly younger at diagnosis time, they were more symptomatic than women with more frequency of target organ damage (Table 1).

Table 1. Comparison of clinical and biological data of females versus male groups in the studied population

	Male (n=47)	Female (n=57)	P value	IC 95%
Age at diagnosis mean(SD),Years	32.91 +/- 7.72	36.21+/-5.23	0.01	[-5.9;-0.66]
Age [18-29], N. (%)	20 (42.6%)	4 (7%)	0.000	
Age [36-45], N. (%)	21(44.7%)	37 (64.9%)	0.04	
SBP mean(SD),mmHg	177.74+/-33.45	175.43+/-29.79	0.7	[-10;14.7]
DBP mean(SD),mmHg	100.42+/-20.29	100.17+/-15.26	0.9	[-6.8;7.3]
HTA stage3, N. (%)	24 (51.1%)	22 (38.6%)	0.2	
Positive History Family of hypertension, N. (%)	24 (51.1%)	25 (43.9%)	0.55	
Presence of cardiovascular risk factors, N. (%)	32 (68.1%)	32 (56.1%)	0.2	
Obesity, N. (%)	14 (29.8%)	28 (49.1%)	0.04	
Diabetes, N. (%)	8 (17%)	9 (15.8%)	1	
Dyslipidemia, N. (%)	11 (23.4%)	10 (17.5%)	0.4	
Smoking, N. (%)	27 (57.4%)	5 (8.8%)	0.000	
Presence of symptoms, N. (%)	45 (95.7%)	45 (78.9%)	0.01	
Presence of complication ,N. (%)	4 (8.5%)	5 (8.8%)	1	
Kalemia	3.79+/-0.21	3.84+/-0.4	0.3	[-0.17;0.06]
EGFR mean(SD),ml/min/1.73m^2	88.29+/-30.8	104.17+/-28.23	0.00	[-27.4;4.27]
Presence of target organ damage, N. (%)	35 (74.5%)	31 (54.4%)	0.04	
Presence of heart damage,N. (%)	26 (55.3%)	28 (49.1%)	0.5	
Presence of kidney damage, N(%)	8 (17%)	10 (17.5%)	1	
Presence of retinopathy, N (%)	13 (27.7%)	5 (8.8%)	0.03	

A family history of hypertension was present in 47,1% of the patients and 32 (30,8%) were smokers. Within patients with one or more cardiovascular risk factors, eleven (17.2%) are aged between [18-29] years at diagnosis, 13 (20.3%) belong to group age [30-35] and 40 (62.5%) are in the third age group.

As a first set of etiological work up sets , all of hypertensive patients had undergone medical evaluation consisting of a 12-lead electrocardiogram (EKG), urinalysis, blood glucose, serum potassium, creatinin and a lipoprotein profile that includes triglycerides, total serum cholesterol, high density lipoprotein-cholesterol and low density lipoprotein cholesterol. Ninety five patients (91.3%) had undergone further screening interventions due to: high suspicion of renal disease (n=13), presence of hypokaliemia (n=32), patients with Stage 3 hypertension (n=46), presence of palpitations (n=7) and clinical profile of obstructive sleep apnea (OSA)(n=20). There was no a reason stated in the patients clinical file in 50 cases (48%).

The most prescribed test was renal artery ultrasound (82.7%) followed by thyroid analysis (64.4%), screening for pheochromocytoma (53.8%), plasmatic and urinary analysis for hyperaldosteronism (44%) and polysomnography in 39.4%.(Table 2)

Table 2. Distribution of diagnostic tests (Frequencies and results)

Diagnostic test	Frequency of test	Number of positive tests	Diagnosis (secondary hypertension)
Plasmatic aldosteron	44 (42.3%)	2	Primary aldosteronism
Plasmatic renin	44 (42.3%)	2	Primary aldosteronism
Biological Screening Tests for Pheochromocytoma	56(53.8%)	4	Pheochromocytoma
Urinary cortisol	52 (50%)	1	Cushing syndrome
Plasma cortisol	50 (48.1%)	0	
Thyroid analysis	67 (64.4%)	0	
Doppler ultrasonography of renal arteries	86 (82.7%)	3	Renal artery stenosis
Angio CT of renal arteries	30 (28.8%)	4	Renal artery stenosis
Renal Ultrasonography	48 (46.2%)	7	2Chronic nephropathy
1polycystic kidney disease	11 (23.4%)	10 (17.5%)	0.4
Immunological nephropathy	27 (57.4%)	5 (8.8%)	0.000
Body CT Scan	47 (45.2%)		
Scintigraphy of adrenal glands	23 (22.1%)	4	Pheochromocytoma
Immunological assessment	9 (8.7%)		2 Lupus
Rheumatoid arthritis	88.29+/-30.8	104.17+/-28.23	0.00
Angio adrenal MRI	0		
Cerebral scan	29 (27.9%)		
Polysomnography	41 (39.4%)	9	Obstructive sleep apnea

The diagnosis of essential hypertension was retained in 67 patients (64.4% of the population). The cause of hypertension was found in 37 (35.6%) of the cases 5 of which were iatrogenic, due to oestroprogestative pills and anti-inflammatory drugs and 32 (86.4%) were due to organic causes. Among organic ones, 2 cases of primary aldosteronism, 1 case of Cushing syndrome ,4 renal artery stenosis (1 of which because of fibromuscular dysplasia ,another because of Takayashu disease and 2 cases because of atherosclerosis), 7 cases of kidney disease (3 auto-immune kidney disorders, 1 case of polycystic kidney disease and 4 chronic nephropathies), 9 Obstructive sleep apnea syndrome and 5 cases of aortic coarctation. Figure 1 summarizes the different causes of hypertension in the studied population. According to gender, hypertensive young women had more secondary hypertension than men (43.8% against 25.5%) with a statistically significant difference (p = 0.04).

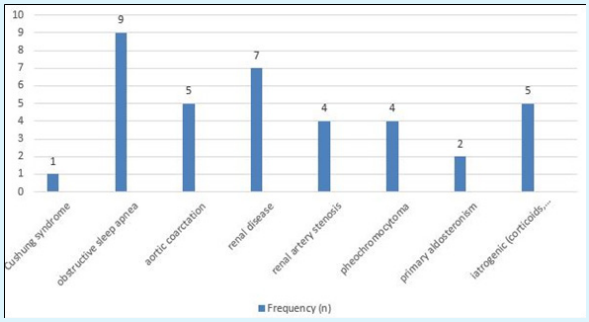

Figure 1. Different causes of hypertension in the studied population.

Regarding the age groups, essential hypertension was more frequent in age group 3 [36-45], but without statistically significant difference p=0.13.

When comparing secondary hypertension (Sn-HTN) and essential hypertension (Es-HTN) groups, the two groups were comparable for : presence or not of symptoms at initial presentation, number of anti-HTN drugs at admission, mean SBP and DBP. Twenty nine of patients with secondary hypertension had hypokalemia versus 12% in the essential hypertension group, without significant difference in mean potassium level. Nevertheless, it seems that Es-HTN group is characterized by more frequent complications and target organ damage; mainly heart damage (Table 3).

Multivariate analysis using logistic binary regression showed young age at diagnosis, male gender, and family history of hypertension to be independent risk factors for having an essential hypertension (Table4).

The probability of having a secondary hypertension in young adult is 5.67 times higher in female patients. However, hypertension is 0.3 times more likely to be essential if the patient has a positive family history of hypertension and 0.9 times more likely to be essential if the patient is aged between [36-45] years old. When focusing on patients aged between 36 and 45 years old, multivariate analysis showed that male gender, Family history of hypertension, obesity and presence of heart damage at initial evaluation to be independent risk factors for having an essential hypertension.

Table 3. Characteristics of patients with essential and secondary hypertension

	Es HTN (n=67)	Sn HTN (n=37)	P value
Age at diagnosis, mean (SD), y	35.88 (5.63)	32.62(7.83)	0.01
Age [18-29], N. (%)	12(17.9%)	12(32.4%)	0.1
Age [30-35], N. (%)	13	9	0.6
Age [36-45], N. (%)	42(62.6%)	16(43.2%)	0.04
Female, N. (%)	32(47.7%)	25(67.56%)	0.05
Male, N. (%)	35	12	
Positive History Family of hypertension, N. (%)	37(55.2%)	12	0.02
Presence of cardiovascular risk factors, N. (%)	47(70.1%)	17	0.01
Obesity, N. (%)	33(49.2%)	9	0.02
Diabetes, N. (%)	9	8	0.2
Dyslipidemia, N. (%)	13(19.4%)	8	0.8
Smoking, N. (%)	25(37.3%)	7	0.05
Presence of symptoms, N. (%)	60 (89.5%)	30(81%)	0.2
Headache,N. (%)	38(56.7%)	20(54%)	0.8
Shortness of breathing, N. (%)	7(10.4%)	2(5.4%)	0.4
Presence of complication ,N. (%)	3	6	0.05
(Fisher's Test)	29 (27.9%)		
Systolicarterial pressure mean(SD), mmHg	176.59 +/- 34.7)	176.27 +/- 24.6)	0.9 IC [-11.3;11.9]
Diastolic arterial pressure mean(SD),mmHg	99.89 +/- 18.84)	101.08+/- 15.37)	0.6 IC [-8;+5.5]
HTA stage1 ,N. (%)	17(25.3%)	9(24.3%)	0.5
HTA stage2 ,N. (%)	25(37.3%)	8(21.6%)	0.1
HTA stage3, N. (%)	26(38.8%)	20(54%)	0.1
Presence of target organ damage, N. (%)	47(70%)	19(51.3%)	0.08
Presence of heart damage,N. (%)	40(59.7%)	14(37.8%)	0.04
Presence of kidney damage,N. (%)	14(20.8%)	4	0.2
Kalemia mean(SD), (Mm)	3.81 +/-0.28	3.84 +/-0.39	0.62 IC [-0.18;+0.11]
Hypokalemia,N (%)	8 (11.9%)	11(29.7%)	0.3

Table 4. Multivariate analysis of factors related to hypertension etiology

Variable	P	
Age at diagnosis	0.02	0.89 (0.82-0.98)
Gender	0.01	5.67(1.34-23.9)
Family hypertension	0.02	0.31(0.11-0.87)
Cardiovascular risk factor	0.5	1.5(0.39-5.9)
Complication	0.39	1.2(0.7-2)
Obesity	0.13	0.39(0.11-1.3)
Smoking	0.78	1.2(0.25-5.9)
Target organ damage	0.8	1.1(0.17-7.5)
Heart damage	0.1	0.29(0.05-1.6)
Nephropathy	0.5	0.6(0.12-2.9)

DISCUSSION

The exact prevalence of hypertension in young people is difficult to assess, For example, according to the American Heart Association' Statistics, about 15% of adults aged between 18–39 years old have prevalent hypertension (4). These results were different from those of the National Health and Nutrition Examination survey (NHANES), in which only 4 % of young adults suffered from hypertension (5). Also, the prevalence of hypertension in a cohort of 1464 African individuals was estimated to be 21.2 % for men aged between 18 and 40 years old (6). Whatever the prevalence is, HTN among young adults is far from being an accessory problem.

Secondary hypertension means a hypertension with an underlying and so potentially reversible etiology. It makes up only a small fraction (5% to 10%) of hypertensive cases all ages included (7, 8).Few studies concerned the prevalence of different causes of hypertension among young adults. To the best of our knowledge, this is the first Tunisian monocentric study conducted in young hypertensive patients that tries to define the proportion of essential versus secondary hypertension, and to determine the etiologies of hypertension in this very specific population.

Our retrospective analysis of a 7-year register of patients younger than 45-year of age and admitted for a hypertension diagnosis showed a prevalence of about 35% of secondary hypertension. These results are comparable to those previously described by some other studies (9).However, secondary hypertension seems more frequent in patients younger than 30 years where an underlying cause should be considered even in the absence of suggestive signs and symptoms; 50% of all hypertensive subjects in the age group (18-29 years) had a secondary hypertension.

Our findings are also quiet similar with results of the French monocentric study of C. Noilhan et al (10).In this study including 148 young hypertensive adult , the diagnosis of secondary hypertension was considered in 33.8% of cases of the cohort .Our population however was characterized by 2 facts : The first one is a more prevalent cases of iatrogenic causes (13%) of all secondary hypertension are due to oestroprogestative pills and anti-inflammatory drugs. Thus, a meticulous anamnesis and a detailed social history including drugs misuse should be done before more advanced investigations mainly among women as seen in our studied sample .The second fact is a significant percentage of OSA (24% of all causes).

Our study also showed a gender difference concerning the prevalence of secondary hypertension, since 43.8% in female versus 25.5% in men. This difference is partly explained by the use of anti inflammatory drugs and oestroprogestative pill in the female population that explains13.5% of hypertensions in this sub-population. Moreover, women showed a higher prevalence of OSA, renal artery stenosis and renal disease which could be explained by the higher prevalence of obesity and systemic disorders in females in our population (Takayashu disease, atheromatic artery stenosis) as well as a prevalent auto immune disorders in young adult women.

About 64% of our patients haven't any specific etiology after exhaustive analysis and 38.4 % don't have even any clear cardiovascular risk factor. This is in concordance with recent data suggesting that long-established risk factors for hypertension in the general population, which are increasing in prevalence in the younger population, such as physical inactivity, diabetes, and obesity certainly, but not completely, explain the increasing incidence of hypertension being observed in young adults (11).On the other hand , In our population, in multivariate analysis, Family hypertension was significantly associated with having essential hypertension in young adults in the 3 age groups. Peixoto et al showed that young women with a family history of hypertension have lower cardiovagal baroreflex sensitivity. This alteration in autonomic function may be one mechanism contributing to the future incidence of hypertension in this patient population (12, 13).

For patients without evident cause nor cardiovascular risk factors (38% of our patients), according to recent

data, different nutritional , psychological and social factors may also be playing a role. For instance, one study concluded that diet rich in red meat and low in fruit was associated with hypertension among Kenya defense forces (14).In another study Steffen et al found that Plant food intake (whole grains, nuts ,legumes, refined grains, fruit or vegetables) was inversely associated with development of hypertension, while red meat intake had a direct relationship with hypertension in young adults aged 18–30 (15)

Lower socioeconomic status, assessed by education level, has also been associated with a higher incidence of hypertension in young adults aged 18– 30 (16). Moreover, impatience ,urgency and hostility were associated with the risk of developing hypertension at 15 years of follow-up for young adults (17).

When focusing on patients aged between 36 and 45 years old, multivariate analysis showed that male gender, Family history of hypertension, obesity and presence of heart damage at initial evaluation are independent risk factors for having an essential hypertension. That means that probably the physician doesn't need a very detailed workup for secondary etiologies in these situations.

CONCLUSION

These findings appeals for reappraisal of risk factors of hypertension among young adults. However, there are many areas where more evidence is needed in order to guide clinicians who manage young people with hypertension; Randomized controlled trials of interventions are urgently needed to answer this question as the number of young adults world-wide with hypertension increases.

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