Management of Hypertension in the Elderly by Modern Methods

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Abstract

Introduction: Monitoring of antihypertensive therapy is a challenge for any patient, but especially for the elderly. Management of high blood pressure in the elderly raised many questions about lowering blood pressure and the risk of falls. Methods: A cross-sectional, observational study of 150 patients; mean-age 74.68±7.49 years with antihypertensive therapy. Daily blood pressure and hemodynamic modulators (volemia, inotropism, chronotropism) were measured using thoracic electrical impedance (TEB-System HOTMAN®). The evaluated haemodynamic profile was correlated with each administered antihypertensive drug/class. Results: 79.5% of patients were therapeutically controlled; 93.1% had at least one modified hemodynamic modulator (p <0.0001). Distribution of antihypertensive drugs: Indapamidum (85.7%), Carvedilolum (42.9%), Perindoprilum (36.7%), Candesartanum (16.3%). The correlation between hemodynamic and antihypertensive modulators: 72.7% had hypervolemia; only 29.7% were treated with diuretics, with statistically significant results [x²=2.79; p=0.09]; patients treated with ACEI/ARBs had hypoinotropism (52.3%)/hyperinotropism (40.9%). 54.5% of patients with beta-blockers had statistically significant results for hypocronotropy [x²=11.35; p=0.001]. Conclusions: Hemodynamic profile helps identify the causes of uncontrolled hypertension with different classes of antihypertensive drugs. The effect of beta blockers on chronotropism is depending on age and type (selective/non-selective). The effect of thiazide diuretics, associated with a high risk of falls in the elderly, shows the presence of hypervolemia in a small rate, which implies individualized treatment at the elderly, depending on comorbidities and drug interactions.

Keywords: hypertension, hemodynamic status, elderly

Rezumat

Introducere: Monitorizarea terapiei antihipertensive reprezinta o provocare pentru orice pacient, dar mai ales pentru vârstnic. Managementul hipertensiunii arteriale la vârstnici a ridicat numeroase întrebări privind scăderea tensiunii arteriale şi riscul de cădere. Material şi metode: Este un studiu observaţional, transversal, pe 150 de pacienţi cu vârsta medie de 74,68±7,49 ani, în tratament antihipertensiv. S-au măsurat tensiunea arterială zilnică, modulatorii hemodinamici (volemia, inotropismul, cronotropismul) utilizând impedanţa electrică toracică (TEB-System HOTMAN®). Profilul hemodinamic determinat a fost corelat cu fiecare medicament/clasa de antihipertensiv administrat. Rezultate: 79,5%dintre pacienţii au fost controlaţi terapeutic; 93,1% au avut cel puţin un modulator hemodinamic modificat (p<0,0001). Distribuţia medicamentelor antihipertensive: Indapamidum (85,7%), Carvedilolum (42,9%), Perindoprilum (36,7%), Candesartanum (16,3%). Corelaţia dintre modulatorii hemodinamici şi antihipertensive: 72,7% au avut hipervolemie, din care doar 29,7% au fost trataţi cu diuretice, au rezultate semnificativ statistice [x²=2,79;p=0,09]; pacienţii în tratament cu IECA/BRA prezinta hipoinotropism (52,3%)/hyperinotropism (40,9%). 54,5%dintre pacienţii cu beta-blocaţii au avut rezultate semnificativ statistic pentru hipocronotropism [x²=11,35; p=0,001]. Concluzii: Profilul hemodinamic ajută la identificarea cauzelor hipertensiunii necontrolate cu diferite clase

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An increasing public health concern is the hypertension in the elderly (above the age of 65 years)\(^1\), which is under-recognized as a major contributor to premature disability and institutionalization\(^4\). Numerical increase in older people and consequently the consumption of drugs, associated with morpho-functional changes of the old body, bring the elderly in relationship with drugs in different position than young adults. A individual pharmaco-geriatrics are a necessity\(^5\) especially that are a multitude of medications such as cardiovascular, gastrointestinal, central nervous system, analgesics, and vitamin agents\(^6\)-\(^7\).

Management of hypertension in the elderly raises particular challenges and has raised questions about the relationship between blood pressure (BP) lowering and risk of falls\(^8\) knows that in the fifth and sixth decade of life, systolic blood pressure (SBP) and diastolic blood pressure (DBP) increase linearly, after SBP continues to rise while DBP gradually decreases\(^9\).

Blood pressure is not under control in many cases

The goal blood pressure (<140/90 mmHg) achieved only in 57% cases and impedance cardiography is a better management than standard care in uncontrolled patients with 1-3 antihypertensive medications\(^10\)-\(^11\). Recent literature emphasizes the importance of identifying the hemodynamic profile of hypertensive patients as a valuable tool for the management of hypertension\(^12\)-\(^14\).

We want to identify the hemodynamic profile of elderly hypertensive patients and the relationship with the antihypertensive medication for a modern management of hypertension treatment. The Thoracic Electric Bioimpedance (TEB) is a noninvasive technology developed by HemoSapiens\(^15\),\(^16\), who allows standard evaluation of hemodynamic modulators and has demonstrated its usefulness and replicability in various populations\(^17\),\(^18\).

**RESULTS**

**Prevalence of antihypertensive medication in studied group**

The most used (60%) antihypertensive drugs were ACEI/ARBs (perindoprilum, ramiprilum, enalaprilum, candesartanum, telmisartanum) than while calcium-channel-antagonists (lercanidipinum, amlodipinum) represented only 22.7%. Perindoprilum was the most used drug (36.7%) from ACEI class, next to candesartanum (16.3%) from ARBs used as monotherapy. Indapamidum was the leading class (85.7%) from the patients under diuretics. Among beta blockers, carvedilolum was the most used drug (42.9%).
Relationships between hemodynamic modulators and current therapy

Approximately 79.5% of the patients had a controlled BP, from which 93.1% present at least one altered modulator (p<0.0001). The distribution of altered modulators was: 72.7% hypervolemia, 52.3% hypoinotropy vs 40.9% hyperinotropy and 43.2% vasoconstriction vs 6.8% vasodilatation. Inotropism profile shows that using telmisartanum is the most balanced from ACEI/ARBs classes, the rest of them determining hypoinotropy (Figure 1).

The treatment effect of beta blockers on chronotropism is different, depending on age and type of beta blockers used (selective/non-selective). Most patients (54.5%) with controlled blood pressure by beta blockers had semnificative statistic results for hipochronotropism [$\chi^2=11.35; p=0.001$] for adult inpatients (42.9%) and very old age group (33.3%) than metoprololum (8.7%). The incidence of normochronotropism is semnificative observed at elderly and old age groups in treatment with carvedilolum (25.0% respectively 26.1%) (Table I.)

Patients included in the study had treatment with indapamide of fixed dose of 1.5 mg daily and furosemide administered inconstant at a half dose than ESH/ESC guidelines. Outcomes for volemia profile show: 65.5% of the the controlled blood pressure from which 29.7% with diuretics therapy group, reported hypervolemia [$\chi^2 = 2.79; p = 0.095$]. Only the patients on indapamideum treatment have had more frequent hypovolemia comparative with those on furosemide treatment which had hypervolemia. Spironolactone and the combination of the diuretics are better for a normovolemic status (Figure 2).

**DISCUSSION**

The current state of knowledge of hypertension by age, sex and drugs interactions shows that in the absence of hemodynamic information, the clinician cannot assess the cause of lack of response among compliant patients. The hemodynamic management system helped identifying the causes of the lack of therapeutic control. Particularly in the elderly may not be beneficial to lower the SBP below 140 mmHg, so, the recommendations from the clinical trials should be approached with caution.

Different meta-analyses have shown that here is no clinically difference between beta-blockers and other

<table>
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<th>Normochronotropy</th>
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Table 1. The relationship between types of beta blockers and chronotropic profile by age groups
drug classes in decreasing high blood pressure at the elderly but the new beta-blockers, as nebivololum, carvedilolum and celiprololum, offer additional important advantages, compared with traditional β-blockers. Our study shows that carvedilolum had an advantage in chronotropic profile. An observational study conducted in nine European Hypertension Excellence centers that evaluated 134 treated but uncontrolled hypertensive patients showed that almost of them (98.5%) presented with altered hemodynamic modulators and that the hemodynamic profile was very heterogenous. This results are comparable to our study (93.1% with at least one altered hemodynamic modulator), but with a lower rate of hypervolemia (72.2%) than that reported by Viigimaa et al. (96.4%)11. A careful analysis of all hemodynamic modulators should preceede pharmacological treatment, in order to achieve a normo-hemodynamic status. The potential clinical benefits of using cardiac impedance technique for the daily management of patients on a large-scale would require further testing of outcomes through longitudinal studies12,20 and of hemodynamic status among patients with unresponsive hypertension too. Antihypertensive therapy with diuretics is particularly effective when combined with reduced dietary sodium intake. The vast majority of hypertensive patients are treated with thiazide diuretics and one third of them have hypervolemia, as a consequence of under dosing the diuretics, compared with the recommended standards. Several randomized controlled trials of patients with systolic-diastolic hypertension in antihypertensive treatment showed that the most used line of therapy was a diuretic or a beta-blocker regardless of age group21. Benetos et al. as a expert opinion of the management of hypertension in very old patients highlights that the treatment decisions in frail elderly patients must base on comorbidities and must carefully monitor the effects of treatment. Therapy with ARBs and ACEIs, particularly using brain-penetrating drugs such as captopril, perindopril and telmisartan appears to improve blood–brain barrier function, increase cerebral blood flow and reduce inflammation. Long-term treatment with diuretics may also reduce the cardiac after load by promoting systemic vasodilatation, which can lead to improved ventricular ejection. Old and very old patients may have episodes of hypotension with the possibility of falls. This phenomenon could be avoided through knowledge/evaluation of hemodynamic status and changing their actual antihypertensive medication. Drug-drug and drug-disease interactions are common in older adults and may have a negative impact on health–related quality of life.

For the future, after the new hypertension guidelines by American College of Cardiology and American Hypertension Association, which eliminates the category of pre-hypertension, categorizing patients as having either Elevated (120-129 and less than 80) and stage I hypertension(130-139 or 80-89) we can have a new perspective. In this area we should also focus the future research on issues related to implementation of a risk-based approach to cardiovascular disease prevention, including the use of BP-lowering medications especially in elderly patients.

**CONCLUSIONS**

The majority of participants presented at least one altered hemodynamic modulator. Hemodynamic profile helps identify the causes of uncontrolled hypertension with different classes of antihypertensive drugs. Telmisartanum is more protective for inotropism and the effect of beta blockers on chronotropism is depending on age and type (selective/non-selective). The effect of thiazide diuretics, associated with a high risk of falls in the elderly, shows the presence of hypervolemia in a small rate, which implies individualized treatment at the elderly, depending on comorbidities and drug interactions.

**Compliance with ethics requirements:**

The authors declare no conflict of interest regarding this article.

The authors declare that all the procedures and experiments of this study respect the ethical standards in
the Helsinki Declaration of 1975, as revised in 2008(5), as well as the national law. Informed consent was obtained from all the patients included in the study.

References


