COMMENTARY

The need for noninvasive methods to monitor hemodynamics in hypertension therapy

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In the guidelines for the management of hypertension published by the International Society of Hypertension, it is noted that ‘about one-third of adults in most communities in the developed and developing world have hypertension.’ The authors also mentioned that ‘the high prevalence of hypertension in the community is currently being driven by two phenomena: the increased age of our population and the growing prevalence of obesity, which is seen in developing as well as developed countries.’¹ The quantitative evaluation of the impact of obesity on arterial hypertension remains an important issue that has been analyzed in several research papers.^{2–6}

In the current issue of *Hypertension Research*, Krzesiński *et al.*⁷ present a study with clinical applications entitled ‘Abdominal obesity and hypertension: a double burden to the heart’, in which they describe how some parameters characterizing the cardiovascular system differ between hypertensive patients with and without abdominal obesity. They found that obese compared to nonobese hypertensive patients were characterized by lower indices of left ventricular performance, as evaluated by echocardiography and impedance cardiography (ICG), and by worse diastolic function indices. No relevant differences were identified for gender, age, blood pressure, heart rate, left ventricular ejection fraction or systemic vascular resistance. In addition, the authors concluded that arterial

hypertension and abdominal obesity ‘have overlapping effects on cardiovascular hemodynamics.’ Moreover, ‘at the early asymptomatic stage, this overlap is exhibited in the impaired cardiac function,’ which the authors described as a ‘double burden to the heart.’⁷ It is worth noting that most of the differences between the groups were identified via indices calculated using ICG. We would also like to emphasize the importance of paper’s conclusion: ‘The assessment of individual hemodynamic profile with the use of modern noninvasive diagnostic methods should be considered in personalized therapy that aims at the prevention of adverse cardiovascular events.’⁷

The search for a method that reliably estimates parameters of importance in hypertension treatment is ongoing.^{3, 5, 6} Even in developed countries, the effectiveness of antihypertension therapy (blood pressure < 140/90 mm Hg) is below 55%, whereas in less-developed countries, it can be as low as 15%.¹ The main reason underlying the poor effectiveness of these therapies is believed to be an inappropriate drug prescription combined with a lack of proper blood pressure monitoring.

The main advantage of noninvasive hemodynamic monitoring for the treatment of hypertension is the possibility of identifying patients with elevated systemic vascular resistance and normal or even lower cardiac output (CO), as well as patients with increased CO accompanied by normal or even lower systemic vascular resistance. These data are critical because hypertension therapy employs drugs that decrease systemic vascular resistance, CO or have a combined effect.

In theory, the application of devices offering noninvasive, continuous analysis of cardiac hemodynamics could assist medical

doctors in making appropriate decisions in the treatment of hypertension. ICG seems destined for this application.

ICG facilitates the noninvasive, continuous evaluation of the heart’s mechanical activity based on the changes in thoracic conductivity caused by the ejection of blood from the heart’s chambers. Recording this signal enables a beat-to-beat estimation of stroke volume (SV), CO, systolic time intervals (STIs), the maximum velocity of ejection and derived indices.⁸ ICG has been repeatedly verified using invasive and noninvasive methods as a reference for both research and clinical applications. The controversy surrounding ICG verification has been reviewed elsewhere.⁸

There have been several attempts to use ICG to individualize hypertension treatment. For example, Ferrario *et al.*⁹ published the results of a meta-analysis confirming the value of ICG-derived hemodynamic data as an aid in therapeutic decision making during patient-individualized treatment of hypertension. For a group of 759 patients with arterial hypertension, the success of therapy (i.e., the reduction of blood pressure to below 140/90 mm Hg) was increased more than twofold when ICG was used. Furthermore, another study (Krzesiński *et al.*) recently reported that hemodynamically guided pharmacotherapy results in a greater reduction in blood pressure. The authors noted that this effect is more pronounced in patients with a higher baseline blood pressure, whereas in patients with slightly increased blood pressure, the empirical approach seems to be comparable to ICG.¹⁰

The use of noninvasive methods to monitor hemodynamics could increase the success rate of antihypertension treatment due to the more precise application of pharmacotherapy

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for the modification of CO and/or systemic vascular resistance. Although ICG is limited to estimating changes in CO, it shows promise due to the availability of Holter-type devices that permit long-term monitoring of CO and STIs, which are considered indices of cardiac contractility.⁸ The application of this type of diagnostic device could also help to monitor the dynamics of pharmacological treatments.

It is now technologically possible to implement quantitative monitoring of cardiac hemodynamics via combined ambulatory SV and blood pressure measurements. In our opinion, these techniques would yield additional quantitative data that might be useful in clinical practice.⁸

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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