CARDIOLOGY
NEWS • OPINIONS • TRAINING
Journal for continuous medical education of physicians
Volume 6, № 4 (19), 2018

ORIGINAL STUDIES

Possibilities of blood pressure correction using non-invasive transcutaneous electrical stimulation in elderly patients

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The **aim** of the work was to investigate efficacy and safety of blood pressure (BP) correction using non-invasive percutaneous electrostimulation in elderly patients. Twenty patients aged 60 years and above with arterial hypertension (grade III, II and I) and highly probable senile asthenia syndrome took part in the study. All patients underwent correction of BP using transcutaneous electrostimulator “ABP-051” (Electrostimulator for blood pressure normalization, model ABP-051) produced by “Inferum” LLC (Yekaterinburg) followed by BP assessment with 24-hour blood pressure monitoring (BPLab, Russia). Control points of the assessment were performed within 4 hours since the monitoring. Following blood pressure correction by transcutaneous electrostimulator “ABP-051", systolic BP was reduced by 19.8 mm Hg in 2 hours after the exposure, and diastolic blood pressure was significantly reduced by 16.6 mm Hg (p=0.026). Non-drug treatment methods are relevant for management of senile-aged patients, especially in the context of modern recommendations of more rigid BP control. Further studies are required to assess safety and efficacy of the more prolonged use of the method in elderly patients with arterial hypertension and probable senile asthenia syndrome.
Keywords: blood pressure, elderly patient, senile asthenia, syndrome, non-drug treatment methods

Cardiology: News, Opinions, Training. 2018; 6 (4): 14–17.
doi: 10.24411/2309-1908-2018-14002.
The article was received by the editor office: 12.10.2018. Accepted to print: 30.11.2018.

LIST OF ABBREVIATIONS

AH – arterial hypertension
AHT – anti-hypertensive therapy
BP – blood pressure
DBP – diastolic blood pressure
BMI – body mass index
SBP – systolic blood pressure
SAS – senile asthenia syndrome

Treatment of arterial hypertension (AH) in elderly age represents certain challenges both for attending physicians and patients themselves. The possibilities of blood pressure (BP) correction without additional anti-hypertensive drugs are of interest due to comborbidity in the group of patients and consequently polypragmasy which increases the risk of adverse effects of drug therapy. All this makes us to search safe methods for BP correction.

The problem of treatment of elderly patients is associated with the increasing probability of their senile asthenia syndrome (SAS) – patients having the condition for

which the benefit of decrease of increased BP is not clear, are not enrolled to randomized clinical studies [1, 2].

In this context, while managing elderly and senile-aged patients, it is important to assess the functional status, to identify geriatric syndromes. The principal geriatric syndrome – SAS, age-associated syndrome which main manifestations are general weakness, sluggishness and/or unintended weight loss [3, 4]. SAS promotes dependence on physical assistance in everyday life, loss of ability to self-care and aggravates prognosis [3, 4]. SAS incidence is increased with the age achieving 26.1% among persons aged 85 years and above [5].

Due to that, a practicing physician has 2 principal challenges: to determine SAS presence or absence in a patient, as well to decide on administration of anti-hypertensive therapy (AHT) and decrease of drug load due to non-drug treatment methods.

The article presents the data on influence of non-drug method for BP correction using non-invasive percutaneous electrostimulation with device “ABP-051” in elderly patients.

Percutaneous electrostimulator for BP (blood pressure) correction ”ABP-051” produced by “Inferum” LLC (Yekaterinburg) – an autonomous physiotherapeutic device for non-invasive exposure to low frequency impulse electric current in distal portions of dermatomers located on the left forearm. It is intended for general regulating exposure to physiological functional systems of the human body in healthcare facilities, home and field settings for treatment and secondary prophylaxis in systemic BP disorders and concomitant symptoms in persons above 14 years. The course of procedures promotes correction and stabilization of impaired BP, elimination of pain and other syndromes accompanying BP increase, improvement of general health and emotional condition, as well patient’s quality of life, increase of working capacity, decrease of weather and time dependence [6].

MATERIAL AND METHODS

The study approved by the local ethics committee. All patients signed the informed consent for the study.

Inpatients were selected for the study in order to provide close monitoring of the method safety. Patients aged 60 years and above with systolic BP ≥140 mm Hg regardless of AHT and highly probable SAS which was revealed on the basis of screening scale “Age does not interfere” [7]. The scale contains 7 questions related to unintended weight loss, decrease of vision and hearing, mood, traumas related to falls, memory disorders, urine inconsistence and mobility limitations. Each affirmative response is assessed as 1 score, negative – 0 scores. With the result of ≥3 scores, SAS was considered highly probable.

Patients with orthostatic hypotonia, aggravated or decompensated diseases requiring priority treatment in relation to AH, cognitive disorders of severity higher than moderate and dementia were not enrolled in the study.

All patients underwent BP correction with percutaneous electostimulator “ABP-051” (marketing authorization № RZN 2016/3776 dated 31.03.2016), an autonomous physiotherapeutic device for non-invasive exposure to low frequency impulse electric current in distal portions of dermatomers located on the left forearm.

Prior the exposure, the study personnel introduced the device to each patient clarifying the exposure goal, recommending that all the items from the left hand (watch, rings, chains, etc.) should be taken off, and released the distal third of the left forearm.

For better contact, the device electrodes and skin in the exposure area were treated with a wet drape or cotton swab moistened slightly with water or saline (0.9% aqueous sodium chloride solution). The left hand was inserted into the cuff so that the symbol of program № 1 on the deice display was located above. For greater efficacy of the correction, the device was located in the lower third of the forearm so that the right edge of the device was parallel to the wrist fold. The cuff was drawn tight and fixed so that the device electrodes contacted the skin closely, no free space between the cuff and forearm surface should remain, but the forearm was not bound tightly. The device was switched on pressing “On/Off” button of program № 1 (the program for BP decrease) which lasted for 5 min. After the session, a sound signal was heard, the device was switched off

automatically, and the light-emitting diode faded. After the session, a patient was recommended to have some rest for 20–30 min.

BP levels were assessed using 24-hour monitoring (BPLab, Russia). The control points of BP assessment were performed within 4 hours of the monitoring.

Statistical processing

The results are expressed as the mean (± standard deviation) for quantitative parameters or as values and per cent for quantitative ones. The comparison results were expressed with paired Student's *t*-test.

RESULTS

20 patients aged 60 to 81 years (average age – 69.4±6.8 years), 16 (80%) women were included to the study. The mean body mass index (BMI) was 34±6.1 kg/m^2.

At the examination, the mean systolic pressure (SBP) was 156.2±16.9, diastolic BP (DBP) – 92.2±11.0 mm Hg.

There were 11 (55%) patients with systolic BP 140–159 mm Hg, 8 (40%) patients with SBP 160–179 mm Hg, 1 (5%) patient with SBP ≥180 mm Hg.

17 (85%) patients took AHT. The combined therapy was administered to 15 (75%) patients, monotherapy – to 2 (10%) patients. 5 classes of drugs were used as AHT: angiotensin converting enzyme inhibitors (ACEi), angiotensins II receptor blocker II (ARB), β-blockers (BB), calcium channel blockers (CCB), thiazide and thiazide-like diuretics (TD) – indapamide.

The following class combinations were used: ACEi with TD, ACEi with BA, ACEi with BB and CCB, ARB with TD and CCB, ARB with CCB.

All patients were recommended that they should continue routine therapy in previous dosages.

The analysis of SBP/DBP values per BPLab monitor readings showed BP decrease in 2 hours after the exposure, with gradual increase by the 3-rd hour to baseline levels (*see the table*).

The table showed that the mean BP value was 156.2/92.1 mm Hg. Immediately after the device exposure, DBP decrease from 92.1±11.0 to 85.7±11.8 mm Hg was observed, and the evident BP decrease was achieved in 2 hours (SBP/DBP levels - 136.4±23.1/75.5±14.2 mm Hg, correspondingly, $p<0.05$). By the 3-rd hour after the device exposure, BP levels tended to return to baseline.

By the 4-th hour, SBP decrease up to 147.4±19.7 mm Hg was insignificant, but DBP decrease to 83.4±16.6 mm Hg ($p=0.026$) was still significant in comparison with baseline.

BP was decreased in patients both taking and not taking AHT. There was no relationship between baseline BP level and intensity of the decrease after the device exposure.

Patients exposed to device "ABP-051" did not have any complaints, 3 (15%) patients described mild tingling in the exposure area which resolved spontaneously within several seconds.

Systolic (SBP) and diastolic blood pressure (SBP) values during the monitoring after its correction

Measurement interval	**Blood pressure**	**Mean value, mm Hg**	***p***
Baseline	SBP	156.2±16.9	–
	DBP	92.1±11.0	–
1 min after correction	SBP	157.2±22.9	–
	DBP	85.7±11.8	–
1 hour after correction	SBP	140.7±22.0	0.0058
	DBP	77.9±13.2	0.00016
2 hours after correction	SBP	136.4±23.1	0.0018
	DBP	75.5±14.2	0.00004
3 hours after correction	SBP	156.1±32.5	0.98
	DBP	84.7±15.0	0.023
4 hours after correction	SBP	147.4±19.7	0.073
	DBP	83.4±16.6	0.026

CONCLUSION

In the study, the method of BP correction using transcutaneous electrostimulator "ABP-051" produced by "Inferum" LLC was first used in elderly patients with highly probable SAS. Elderly patients represent a very vulnerable group that requires the specific therapeutic approach and control of the condition. Non-drug treatment methods are also relevant for senile-aged patients, especially in the context of modern recommendations of more rigid BP control.

In the presented small-scale pilot study, the single exposure was performed, followed by BP monitoring. Following BP correction by percutaneous electrostimulator "ABP-051", SBP decrease was observed in 2 hours after the exposure by 19.8 mm Hg, significant DBP decrease by 16.6 mm Hg (p=0.026). BP values returned to baseline levels approximately by the 4-th hour. The patients tolerated the procedure well and did not present any subjective complaints. No cases of dramatic BP decrease were reported.

Further studies are required to assess safety and efficacy of the more prolonged use of the method in elderly patients with AH and probable SAS.

Conflict of interests. The authors declare no conflict of interests.

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REFERENCES

1. Villevalde S.V., Kotovskaya Yu.V., Orlova Ya.A. Recommendations on the management of arterial hypertension of the European Society of Cardiology and the European Society of Arterial Hypertension in 2018. Heart Failure Association, 06.26.2018. (in Russian)
2. Williams B., Mancia G., Spiering W., et al.; ESC Scientific Document Group. 2018 ESC/ESH Guidelines for the management of arterial hypertension. Eur Heart J. 2018; 39 (33): 3021–104.
3. Fried L.P., Ferrucci L., Darer J., Williamson J.D., et al. Untangling the concepts of disability, frailty, and comorbidity: implications for improved targeting and care. J Gerontol A Biol Sci Med Sci. 2004; 59 (3): R255–63.
4. Fisher A.L. Just what defines frailty? J Am Geriatr Soc. 2007; 53 (12): R2229–30.
5. Collard R.M., Boter H., Schoevers R.A., Oude Voshaar R.C.

Prevalence of frailty in community-dwelling older persons: a systematic review. J Am Geriatr Soc. 2012; 60 (8): 1487–92.
6. Malakhov V.V., Fedorov A.A., Gulyaev V.Yu., Ryzhkin V.M., et al.
Use of transcutaneous electrostimulator ABP-051 for correction of systemic bloof pressure in clinical practice: methodical guidelines. Ekaterinburg: UGMU, 2018: 26 p. (in Russian)
7. Ostapenko V.S., Runikhina N.K., Tkacheva O.N., Sharashkina N.V. Screening tools for frailty in ambulatory care. Uspekhi gerontologii [Advances of Gerontology]. 2016; 29 (2): 306–12. (in Russian)