The effect of magneto-treated blood autotransfusion on central hemodynamic values and cerebral circulation in patients with essential hypertension

Ilgar G. Alizade, MD, PhD, Nigar T. Karayeva, MD.

ABSTRACT

Objective: The work was carried out to study the effect of magneto-treated blood autotransfusion on the values of central and cerebral hemodynamics in patients with essential hypertension.

Methods: Sixty-six patients with stage II essential hypertension aged 31-60 years who underwent magneto-treated blood autotransfusion were evaluated and treated, at the Cardiology Department, Hospital of Ministry of Internal Affairs of the Azerbaijan Republic, over a period of 8 years. The diagnosis was based on clinical examination and generally accepted criteria of essential hypertension stages proposed in 1978 by the World Health Organization.

Results: Sixty-six patients with stage II essential hypertension with stable drop in blood pressure, simultaneously showed a positive clinical effect. Central hemodynamic changes in the process of magneto-treated blood autotransfusion were different and depended on the initial state of circulation. High clinical effect showed the patients with hyperkinetic type of hemodynamics. Their blood pressure were significantly lower than the patients with hypokinetic type of circulation.

Conclusion: Rheoencephalographic study demonstrated that magneto-treated blood autotransfusion possessed insignificant effect on cerebral hemodynamics, mainly expressed by the reduction of arterial blood flow tension in the patients with hypokinetic type of hemodynamics.

Keywords: Essential hypertension, central hemodynamics, cerebral circulation, magneto-treated blood, treatment.

Saudi Med J 2002; Vol. 23 (5): 517-520

Over a recent period, great attention has been paid to non-medicamental methods of essential hypertension (EH) treatment, including magnetotherapy (MT)[1-7] that actively mobilizes certain physiologic compensatory mechanisms with no development of negative metabolic effect.[8] Moreover, it should be noted that physiologic mechanisms of treatment effect of this exposure at the level of organism system are not studied enough. This work was carried out to study the effect of magneto-treated blood autotransfusion (MTBA) on the values of central and cerebral hemodynamics in the patients with EH.

Methods. Sixty-six patients with stage II EH aged 31-60 years who underwent MTBA were evaluated and treated. The diagnosis had been based on clinical examination and generally accepted criteria of EH stages proposed in 1978 by the World

From the Department of Cardiology, Hospital of Ministry of Internal Affairs, Baku, Azerbaijan.

Received 9th September 2001. Accepted for publication in final form 16th October 2001.

Address correspondence and reprint request to: Dr. Ilgar G. Alizade, Chief of the Cardiology Department, Hospital of Ministry of Internal Affairs, 9 Huseyn Javid Street, Apt. 51, 370002 Baku, Azerbaijan. Tel. +994 (12) 627879. Fax. +994 (12) 985525.

Health Organization (WHO). Before MTBA was started all patients received antihypertensive therapy including beta-blockers, calcium channel blockers, angiotensin-converting enzyme (ACE) inhibitors, diuretics for 3-7 days. The dosage of drugs was chosen individually. However, we failed to obtain a significant antihypertensive effect in the majority of cases. Control date was obtained in 30 practically normal subjects aged 32-58 years with similar parameters to that of the main group observers. High blood pressure (BP), lack of effect of medicament therapy, necessity to reduce the dosage, presence of allergic reactions to antihypertensive therapy are the indications of MTBA. The technique of MTBA was implemented by the methods developed by the following manner:[3] after the cubital vein had been punctured with the needle being a constituent part of container Hemakon-500, 400-500 ml of blood was taken. The required amount of blood was measured using the scales on which the container had been placed during blood taking. After blood had been exfused, a tube connecting the needle with container was clamped by 2 forceps at 10-12 cm from the needle and a median cut made using sterile scissors. The end of the tube with the needle was connected to the tube of a single use dropper PK 11-01 containing isotonic solution via rubber tube coupling (tube connector). After the clamp was removed, a 10-20 ml of solution to wash parietal red blood aggregates that could occlude the needle was intravenously administered by stream transfusion. After that, the container with blood was fixed between the inductors of apparatus Polyus-1 and the inductors were tightly applied. The needle of the system PK 11-01 was stuck into the container nest. Simultaneously, magnetized blood reinfusion at 40-60 drops per minute was started. The duration of magnetic exposure was 15-20 minute for 50 mT magnetic induction. After the apparatus Polyus-1 was disconnected thereby ceasing direct exposure on blood by alternating magnetic field and the rest, magnetized blood was continued to be administered to the patient by drip transfusion at the same rate. A course of treatment comprised 5 to 8 procedures with a one day interval. Blood pressure did not change during the sessions of MTBA. However, its graduate fall from 185.5±9.8/102.8±8.1 to 149.1±6.2/ 92.2±4.3mmHg was observed from session to session, the reduction of headache, giddiness, disappearance of pains in the heart area, improvement of general condition showed in all of the patients with simultaneous drop in BP. After the treatment with MTBA, the dosage of antihypertensive drugs was reduced (on average by 42% as compared with that of the initial value) in most of the patients. In 11 (20%) patients, the antihypertensive drugs were discontinued and no complications were observed. A positive clinical effect was observed during 2-6 months after the discharge from the hospital. All patients underwent study of central hemodynamics by tetrapolar rheography before and after a course of treatment. Records and analysis of basic and differential rheograms had been evaluated according to Kubicek et al,[9] modified by Pushkar et al.[10] The study was performed via a 2-channel rheoplethysmograph RPG-2-02 and register Elkar-6. Stroke volume (SV), minute blood volume (MBV), cardiac index (CI) and total peripheral resistance (TPR) were assessed by the level of pulse blood filling, state of elastotonic features of cerebral vessels and values of venous blood flow. Rheographic attachment 4 RG-1M-U was used as a recording device, records were made at a 6-channel electrocardiograph (EC) 6T-02. According to the study of the initial values, the patients receiving MTBA were subdivided into 3 subgroups: group I consisted of 17 (25.7%) patients with hyperkinetic type of hemodynamics, group II – 13 (10.7%) patients with eukinetic type and group III – 36 (54.5%) patients with hypokinetic type. The results of the study of central hemodynamic basic values are described in detail in **Table 1**.

Results. The reduced TPR level by 13.3% was 2247.7±94.5 dyn x sec x cm-5 ($p<0.02$) when studying the values of central hemodynamics after a course of MTBA on the background of retained antihypertensive effect. Stroke volume was increased and reached on average 65.4±2.02 mm^3 ($p<0.05$). Cardiac index and MBV showed a tendency to increase but it was not evident. High clinical efficacy showed patients with hyperkinetic type of hemodynamics (94.7%). Central hemodynamic changes in the process of MTBA were different and

Table 1 – Dynamics of central hemodynamic values in patients with essential hypertension in the course of treatment with magneto-treated blood autotransfusion.

Values (M±m)	Controls (30)	Before Treatment (66)	After Treatment (66)	*P-value
Mean BP, mmHG	93.60±2.5	134.4±4.9	111.1±3.7	<0.01
HR, sec^{-1}	70.00±6.4	76.6±3.17	70.3±3.2	>0.1
MBV, 1/min	5.32±0.21	4.54±0.21	4.60±0.17	>0.1
SV, mm^3	76.00±3.32	59.4±1.96	65.4±2.02	<0.05
CI, 1/min x m^2	2.80±0.11	2.38±0.13	2.42±0.10	>0.1
TPR, $dyn \times sec \times cm^{-5}$	1710.20±62.4	2591.5±101.8	2247.7±94.5	<0.02

M±m - mean arithmetical and mean quadratic deflexion,
HR - heart rate, MBV - minute blood volume, SV - stroke volume,
CI - cardiac index, TPR - total peripheral resistance,
dyn - unit of elasticity, min - minute, sec - second,
*P-statistically significant difference as compared with the values before treatment, BP - blood pressure.

depended on the initial circulatory state. The opinion of Orlov et al[6] may indicate that the effect of magnetic field (MF) is achieved with the participation of nervous system central parts that regulate BP. In eukinetic type of circulation in the process of treatment with MTBA, a drop in BP took place both due to the reduction of TPR and MBV (in 4 patients – 6.1%). Moreover, in 2 (3%) patients with high MBV values a fall in BP occurred due to the reduction of MBV in the absence of significant changes of TPR. The change of reaction is similar to the reaction of the patients with hyperkinetic type of circulation. Altogether, TPR was reduced by 4% ($p>0.1$) in the group. Patients with hypokinetic type developed positive dynamics in the process of treatment. A fall in BP was achieved due to the reduced TPR (by 22.4%, $p<0.01$). Moreover, 22 (33.3%) patients showed a slight increase of the initially reduced MBV (by 24.2%, $p<0.01$), predominantly due to the increase of myocardial contractility.

Discussion. The investigation demonstrated a high effect of MTBA in patients with EH. Remarkably, higher positive hemodynamic changes showed the patients with hyperkinetic type of hemodynamics. They had significant drop in BP than a patients with hypokinetic type of circulation. Eleven (16.6%) of 17 (25.7%) patients with hyperkinetic type of hemodynamics retained this type. The number of patients with eukinetic type increased from 13 (19.7%) to 28 (42.4%). The reduction of myocardial contraction, decrease of cardiac output and MBV had been caused by the decreased of myocardial energetic supply under the effect of MF. Energetic transformation of metabolic chemical links utilized by the cell into the energy of macroergic compounds occurs mainly in mitochondria. Myocardial mitochondria are prevailing cellular organelles and rather sensitive to the exposure of MF, particularly alternating.[11] The reduced MBV may relate to the beta-blocking effect of MF. The inhibiting effect of MF on beta-adrenergic reactions as well as the suppression of catecholamines' deposition in isolate cardiac muscle was reported in a series of experimental works.[12] The decrease in catecholamines' effect on heart had been caused, probably by the stimulation of inhibited M-cholinoreceptors and indirect inhibition of alpha-adrenoreceptors and stimulation of alpha-adrenoreceptors.[13] While studying cerebral circulation of 39 (59%) patients, the reduction of cerebral vascular blood filling was recorded by rheoencephalogram (REG), rheographic index (RI) was 0.093±0.001 ohm, $p<0.05$. The state of vascular tension was characterized by dystonic signs in 29 (74.3%) patients and by spastic signs in 23 (58.9%) patients. The ratio of anacrotism to wave duration was on average of 19.8±1.1%, ($p<0.05$). The signs of difficult venous blood flow developed in 10 (25.6%) patients. After a course of MTBA the study of cerebral circulation demonstrated that positive REG changes developed in 33 (84.6%) patients. Twenty-six (66.6%) showed an increase of cerebral vascular blood filling (RI was increased 0.092±0.001 to 0.095±0.001 ohm, $p<0.05$) much more in the occipital area and elastic features of vascular wall were improved. The ratio of anacrotism to wave duration showed a tendency to the reduction (20.2±1.1 to 17.2±1.0%, $p>0.1$). In 7 (17.9%) patients a positive changes were expressed by the reduction of signs of venous blood flow. Negative changes showed 6 (15.3%) patients and were expressed by the reduction of RI (by 0.04 ohm), and increase of dystonic signs. Cerebral circulatory changes depend on the initial state of central hemodynamics. By the end of the treatment course, the patients with hyperkinetic type of circulation had cerebral blood flow insignificantly reduced (RI– 0.1±0.0069 to 0.096±0.0062 ohm, $p>0.1$). Spastic signs were reduced (anacrotism ratio to wave duration – 17.3±1.8 to 16.3±1.2%, $p>0.1$). The patients with eukinetic type of hemodynamics showed increased cerebral pulse blood filling volume (RI–0.0866±0.006 to 0.098±0.0076 ohm, $p>0.1$), vascular tension was reduced (anacrotism ratio to wave duration – 22.2±1.8 to 19.1±1.7%, $p>0.1$). Patients with hypokinetic type of hemodynamics showed significant reduction of spastic signs (anacrotism ratio to wave duration – 23.8±1.9 to 17.2±1.3%, $p<0.05$). Moreover, some increase of cerebral blood supply was observed (RI – 0.085±0.0063 to 0.099±0.0088 ohm, $p>0.1$).

In conclusion, the results of REG study demonstrate that MTBA possessed insignificant effect on cerebral hemodynamics, mainly expressed by the reduction of arterial blood flow tension, namely in the patients with hypokinetic type of hemodynamics. The capacity to reduce cardiac output in the patients with hyperkinetic type of cerebral circulation typical for MTBA may contribute to the reduction of cerebral circulation in the patients of this category.

Acknowledgment. We wish to extend our thanks to Mrs. Gulya M. Akhundzale for her translational help in preparing this manuscript.

References

1. Alizade IG, Ananchenko VG, Kerimov AA, Karayeva NT. Magneto-treated blood autotransfusion in the treatment of patients with essential hypertension. *Azerbaijan Medical Journal* 1993; 8: 34-36.
2. Alizade IG, Karayeva NT, Aliyeva SN. Magnetic treatment of autoblood in complex treatment of patients with essential hypertension. *The Questions of Resort, Physiotheraphy and Exercise Therapy* 1994; 1: 32-33.

3. Alizade IG, Karayeva NT. The use of new magnetotherapeutic methods for essential hypertension. *Cardiology Journal* 1994; 34: 154.
4. Burlutsky AP, Borisov IA, Ginzburgh BP. Magnetobiology and magnetotherapy in medicine. In: Akhmanova O, editor. Russia: Vitebsk; 1980. p. 4-5.
5. Buyavikh AG. Early diagnostic and prophylaxis of cardiovascular diseases. In: Elkina I, editor. Siberia (RS): Novosibirsk; 1983. p. 229-230.
6. Orlov LL, Alekseyeva NP, Galuza GL. Indications for the use of new magnetotherapeutic method for essential hypertension. *Soviet Medical Journal* 1991; 8: 23-24.
7. Sorokina EI. Physical methods of treatment in cardiology. In: Smirnov A, editor. Moscow (RS): Soviet Medicine; 1989.
8. Gmitrova AD, Golod LI, Gmitrov YM. In: Alekseyev I, editor. Magnetobiology in medicine. Russia: Vitebsk; 1980. p. 28-30.
9. Kubicek WG, Kargnegis JN, Paterson RP, Witsoe DA, Mattson RP. Development and evolution of impedance cardiac output system. *Aerosp Med* 1966; 37: 1208-1212.
10. Pushkar YT, Bolshov VM, Elizarova NA, Savitski NN. The determination of cardiac output through thoracic tetrapolar rheography and its methodic possibility. *Cardiology Journal* 1977; 7: 89-90.
11. Udintsev NA. To the mechanism of biological action of magnetic field. *The Questions of Resort, Physiotheraphy and Exercise Therapy* 1981; 4: 9-12.
12. Shishlo MA. Hemodynamic and humoral mechanisms of influence of the magnetic field in essential hypertension. Proceedings of the All-Union Meeting of Physiotherapy and Health Resort; 1977 Feb 12-15; Siberia, Russia. Russia: Novosibirsk: 1997.
13. Zhdanova NF. The study of mediator receptors in the heart and the effect of constant magnetic field on it. Moscow (RS);