

LYMPHSPIRATION

TREATMENT OF PERIPHERAL LYMPHEDEMA BY CONCOMITANT APPLICATION OF MAGNETIC FIELDS, VIBRATION AND HYPERTHERMIA: A PRELIMINARY REPORT

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ABSTRACT

Although treatment of peripheral lymphedema has included magnetic fields, vibration, and hyperthermia individually, no one has administered all three at the same time. Accordingly, ten patients with unilateral leg secondary lymphedema were treated using daily therapy for 20 days with each modality for a duration of 60 minutes for a total of 3 hours. The clinical response was evaluated by the coefficient rate of contraction, i.e., by measuring the circumference of the leg 10 cm above and below the patella edge before and after therapy. This preliminary uncontrolled trial resulted in 8 highly effective, 1 improved, and 1 unaffected outcome. In 6 of the 8 highly effective outcomes, the volume of the treated leg became nearly the same as that of the untreated, non-edematous contralateral leg. One patient developed skin erythema which subsided spontaneously several hours after therapy ended. This combined modality therapy for treatment of lymphedema should be explored further.

Numerous operative and non-operative methods for treating lymphedema have been recommended but none is entirely satisfactory. Application of a magnetic field

and hyperthermia to a lymphedematous limb has previously been tried (10) as has vibration (11) and hyperthermia (6-9). No one, however, has tried all three therapies concomitantly.

CLINICAL MATERIAL

Ten patients with unilateral secondary lymphedema of the leg (*Table 1*) underwent treatment consisting of pulse magnetic field (10mT), vibration (frequency 100-130/sec) and hyperthermia (set temperature 43°C or 50°C). These 3 modalities were administered in tandem for 1 hour duration each for a total of 3 hours, 5 days a week for 4 weeks. During and between treatment session, both elastic and low stretch elastic bandages were tightly administered on the edematous leg. The clinical effect was primarily evaluated by a relative coefficient rate of contraction (CRC or $CRC = \frac{C1 - C2}{C1} \times 100$ where C1 is circumference measured before treatment and C2 after treatment. A $CRC \leq 10$ was considered highly effective treatment; CRC 7-10 was "effective" and < 7 ineffective or worsened. When the results differed between the thigh and the lower leg, the "better" value was listed.

TABLE 1
Demographics and Outcomes

Patient	Age (yrs)	Sex	LE	Treated leg Circumference (cm)				CRC & effectiveness		Control Contralateral leg Circumference (cm)				CRC & effectiveness	
				T	LL	T	LL	T (%)	LL (%)	T	LL	T	LL	T (%)	LL (%)
1	75	F	R	40	36	37	30	7.5	16.7	31	29.5	31	29	0	1.7
2	35	F	L	38	32	35	30	7.9	6.3	31.5	29	31	27	1.6	6.9
3	62	F	R	39	32	29	24	25.6	25	29	24	29	24	3.4	0
4	71	F	L	44	39	39.5	33.5	10.2	14.1	39	33	30	28	1.4	1.5
5	68	F	L	39.5	30	34	29	13.9	3.3	36	30	33.5	28.5	6.9	5
6	57	F	L	36	29	35.5	28.5	1.4	1.7	28	26	30	28	7.1	7.7
7	72	F	L	40.5	33.5	36	26	11.1	22.4	32	27	34	28	6.2	3.7
8	45	F	L	40	33	36.5	27	8.8	15.1	34	28	37.5	28.5	10.3	1.8
9	76	F	R	44	39	35	29	20.5	28.6	37.5	29.5	36	28	4.0	5.1
10	67	F	L	55	56	43	35	21.8	16.1	9.5	36	39	34	6.3	5.6

F=female, right and left; unilateral secondary lymphedema of the right and left leg; CRC=relative coefficient rate of contraction (%); T=tight, LL=leg; circumference difference from the untreated extremity is less than 1 cm.

LE=lymphedema leg; L=left; R=right

RESULT

Treatment was highly effective in 8 patients, effective in 1, and ineffective in the other. The volume of the treated extremity became similar to that of the untreated non-edematous contralateral leg in 6 of 10 patients (*Table 1*). There were no adverse sequelae of treatment except for 1 patient who developed transient skin erythema. The clinical outcome was better in this trial than a historical control treated group of patients by microwave hyperthermia combined with low stretch elastic bandage which the author previously carried out (8).

COMMENT

This triple modality of pulsed magnetic fields, vibration, and hyperthermia combined with compression bandages is the best treatment of leg lymphedema this author has tried. Whereas the physiologic mechanism behind its efficacy is unclear, Okano et al reported that static magnetic fields alter rabbit skin vasomotion (i.e., constriction and dilation) (13). Ohhashi et al has shown that vibration increases lymph flow, lymph protein concentration, and lymph cell transport in the dog (14). As for potential adverse effects, the Japanese people have used magnetic fields (80mT) for more than 30 years for shoulder and other joint stiffness without notable side effects. Vibration sequelae, if it occurs, is related to much stronger vibration frequency with higher amplitude. With hyperthermia, skin burn is averted because the surface temperature during therapy was only 38.3°C. On the other hand, the patient with a cardiac pacemaker, pregnant females, and children are best not treated with these devices until evidence of complete safety is assured. Patients, too, who have been operated upon with indwelling metal rods (as used for bony fractures) should also not be treated. Snug external compression is also needed to have a satisfactory outcome.

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REFERENCES

1. Kinmonth, JB: *The Lymphatics—Diseases, Lymphography and Surgery*. Edward Arnold, London, (1972),169-193.
2. Foeldi, M, E Foeldi: Conservative treatment of lymphedema. In: *Lymph Stasis: Pathophysiology, Diagnosis and Treatment*. Olszewski, WL(Ed.), CRC Press, Boca Raton(1991),469-478.
3. Baumeister, RGH: Microsurgical autologous lymph-vessel graftung. In: *Lymph Stasis: Pathophysiology, Diagnosis and Treatment*. Olszewski, WL(Ed.), CRC Press, Boca Raton (1991),545-552.
4. Guzman, A, J Deleveaux, L Rossi: Lymphatic venous anastomosis in the treatment of lymphedema. *Lymphology(Suppl.)* 31(1998), 599.
5. Brorson, H, M Aberg, H Svensson: Complete reduction of lymphedema of the arm by liposuction after breast cancer—3 year results. *Lymphology (Suppl.)* 31(1998),570.
6. Chang,Ti-Sheng, Ji-Liang Gan: Heating and bandaging in the treatment of chronic lymphedema of the extremities. In: *Lymph Stasis: Pathophysiology, Diagnosis and Treatment*. Olszewski, WL (Ed.), CRC Press, Boca Raton(1991), 483-500.
7. Chang, Ti-Sheng: Microwave heating in the management of peripheral lymphedema. *Scope* 2(1995), 18.
8. Ohkuma, M.: Combined therapy for lymphedema by microwave, oral Chinese drugs, manual lymph drainage massage and the less elastic bandage *Lymphology (Suppl)* 31(1998), 206.
9. Fox, U, B Lucani, G Ribaldone: Hyperthermia in the treatment of chronic limb lymphedemas: 6 years of experience. *European J. of Lymphology* 3 (1992),73.
10. Dubois, E, P Schuler, I Lecomte: A new treatment of limbs lymphedema by combination of hyperthermia, by use of life-saving coverlet, sequential pressotherapy by Lympha-Press, electromagnetic fields by G.E.M., Endermology by Cellu M6 and manual lymph drainage. *Lymphology (Suppl.)* 29 (1996), 240.
11. Ohkuma, M: Trial treatment of lymphedema

- by vibration. *Lymphology(Suppl.)* 33(2000), 2.
12. Ohkuma, M: Clinical method how to evaluate therapeutic effect in lymphedema. *The European J. of Lymphology* 2(1991), 129.
 13. Okano, H, J Gmitrov, C Ohkubo: Biphasic effects of static magnetic fields on cutaneous microcirculation in rabbits. *Bioelectromagnetics* 20(1999), 161.
 14. Ohhashi, T, S Yokoyama, E Ikomi: Effects of vibratory stimulation and mechanical massage on micro- and lymph-circulation in the acupuncture points between the paw pads of anesthetized dogs. *PACD* 12(Suppl.)(1991), 125.

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