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ORIGINAL ARTICLE

The efficacy of lymphatic drainage and traditional massage in the prophylaxis of migraine: a randomized, controlled parallel group study

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Abstract This study aimed at examining the efficacy of lymphatic drainage (LD) and traditional massage (TM) in the prophylactic treatment of migraine using controlled prospective randomized clinical trial of 64 patients (57 women, 45 ± 10 years) with migraine with and without aura. Patients were randomized into three groups: LD ($n = 21$); TM ($n = 21$); waiting group (WG, $n = 22$). After a 4-week-baseline, a treatment period of 8 weeks was applied followed by a 4-week observation period. The patients filled in a headache diary continuously; every 4 weeks they filled in the German version of the CES-D and the German version of the Headache Disability Inventory. The main outcome measure was migraine frequency per month. At the end of the observation period, the number of migraine attacks and days decreased in the LD group by 1.8 and 3.1, respectively, in the TM group by 1.3 and 2.4, and in the WG by 0.4 and 0.2, respectively. The differences between LD and WG were significant ($p = 0.006$ and $p = 0.015$, respectively) as well as the differences between TM und WG ($p = 0.042$ and $p = 0.016$, respectively). There was a significant decrease in the amount of analgesic intake in the LD group compared to the two other groups ($p = 0.004$). TM and LD resulted in a reduction of migraine attack frequency. The analgesic intake only decreased significantly during LD intervention. Useful effects were identified for LD and TM as compared to WG for the prophylaxis of migraine. LD was more efficacious in some parameters than TM.

Keywords Migraine · Prophylactic treatment · Lymphatic drainage · Traditional massage

Abbreviations

CESD-20	Center for epidemiologic studies depression scale
CGI	Clinical global impression
HDI	Headache disability inventory
IHS	International headache society
LD	Lymphatic drainage
TM	Traditional massage
WG	Waiting group

Introduction

Lymphatic drainage (LD) and traditional massage (TM) are used in the preventive treatment of migraine. However, this practice is only based on anecdotal reports particularly in acute migraine [1–4]. For TM, mechanical, biochemical, immunological, neuronal, and psychic effects are discussed. LD might lead to a more rapid transportation of perivascular inflammatory exudate in the leptomeningeal vessels and subsequently in extracranial lymph collectors. This might lead to an increased protection against inflammatory pain in the meninges [1]. Physical therapy for the prevention of migraine is in general still inadequately studied.

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Only few non-pharmacological treatment strategies such as aerobic sports [5, 6] including nordic walking and jogging, relaxation therapy and behavioural treatments including biofeedback [7, 8] and acupuncture [9] showed some evidence to be efficacious in the prevention of migraine and have been included in treatment guidelines [10].

We performed a randomized, controlled, parallel-group study on the efficacy of LD and TM in the prevention of migraine with and without aura. The study protocol was designed according to the recommendations of the International Headache Society (IHS) [11].

Methods

Patient selection

We enrolled consecutive patients with migraine without or with aura according to the criteria of the IHS [12]. Inclusion criteria were that patients had to be older than 18 years of age and suffer from migraine with a frequency of two or more attacks per month during the past 3 months with a baseline diary in the preceding 4 weeks (baseline). Migraine had to be present for at least 1 year. Other types of idiopathic or symptomatic headache were not accepted except tension-type headache. In the latter cases, patients had to be able to differentiate between the two headache types. Exclusion criteria were pregnancy or lactating women, other types of migraine, any type of substance abuse (including medication overuse headache). Changes of drug treatment with a possible migraine preventive efficacy within the past 3 months were not allowed. A current treatment with steroids, and any contraindication for LD (e.g., thrombosis; thrombophlebitis; acute bacterial inflammation; acute skin changes in treatment area; acute heart insufficiency; lung oedema; asthma; local tumour; carotis-sinus-syndrome; hyperthyreosis; cardiac arrhythmias) and for TM (e.g., acute feverish general infection; anticoagulation; severe heart/circulation disorder; skin or muscle disorder in treatment area; thrombophlebitis; thrombosis; haematoma; acute injury with immobilisation; arterial occlusion disorder; complex regional pain syndrome; severe bone affections; tendovaginitis; peripheral nerve compression; cardiac or renal edema; malignancies).

After written informed consent was given, the patients were asked to keep a headache diary and to return to the clinic after a baseline of 4 weeks. In the diary, the patients had to write down the days with migraine and the intensity of migraine, the days with other headaches, accompanying symptoms, and acute medication for the treatment of migraine attacks. The study was approved by the Ethics Committee of the Physician Board of Bremen, Germany.

Treatment procedure

When the baseline diary confirmed the inclusion criteria, the patients were allocated to one of three treatment groups by a computer-generated randomisation list. One investigator (MH) received a sealed envelope with the randomisation number. The envelope contained the treatment group. The patients were treated either with LD ($n = 21$) of the face, head, and neck area; this included soft tissue massage of the draining pathways on both sides of the head and in both the jugular vein territory and the vertebral vein territory. Or they were treated with TM ($n = 21$) of the neck and upper as well as lower back area according to a standardized protocol which included deep tissue massage without trigger point pressure of the occipital skull muscles, the cervical spine muscles, and the autochthonous back muscles on both sides. A third group received no therapy (waiting group, WG, $n = 22$). After a baseline of 4 weeks, the different therapies were applied 30 min once a week over 8 weeks, followed by a 4-week observation period. All patients were examined by a physician at the beginning of the study and every 4 weeks. They continuously filled in a headache diary. After the baseline period, after 4 and 8 weeks of treatment, and at the end of the observation period, all patients filled in the German version of the Center for Epidemiologic Studies Depression Scale (CESD-20, maximum score 80) [13] and the German version of the Headache Disability Inventory (HDI, maximum score 100) [14]. Clinical Global Impression (CGI, maximum score 7) [15] was rated by the same physician at each visit.

Statistics

The primary outcome measure was migraine frequency (number of migraine attacks). Secondary parameters were the reduction of days with migraine headache, the reduction of days with other headache types, the reduction of the doses of acute antimigraine drugs, the number of patients with a reduction of migraine frequency by at least 50 % at the end of the observation period and at the end of the treatment period as compared to baseline, the reduction of accompanying vegetative symptoms (presence of photophobia, phonophobia, nausea, and vomiting), the improvement of the CGI, HDI, and the CES-D scores between baseline and the end of the observation period and at the end of the treatment period.

All analyses were performed using the intent-to-treat population. We used SPSS software package version 20.0. The statistical power was strong enough to detect differences of more than 30 % between the three treatment groups for the primary efficacy parameter. We used non-parametric tests with the χ^2 test for qualitative data

(Fisher's exact test if applicable) and the Kruskal–Wallis test for quantitative data (Mann–Whitney *U* test as post hoc test). Friedman test was used for paired parameters (Wilcoxon test as post hoc test). $p < 0.05$ was set as significant.

Results

Out of 64 patients (57 women, 45 ± 10 years) who were finally enrolled in the study, 56 could be followed up for the complete study period of 4 months. Drop-out reasons were acute disorders ($n = 3$), no compliance to the time schedule ($n = 3$), new preventive drugs (n = 1), and change of preventive drugs ($n = 1$). All patients were Caucasian. Eleven patients were on stable prophylactic migraine medication. The demographic data of the three different treatment groups are presented in Table 1. There were no significant differences between these groups.

End of the observation period

The data at the end of the observation period are presented in Table 2. The rate of patients with at least 50 % reduction of migraine attacks and migraine days (responder rate) between baseline and end of the observation period was not different between the groups. However, there was a significant decrease of migraine attack frequency and days of migraine in LD as compared to WG ($p = 0.006$ and $p = 0.015$, respectively) and in TM as compared to WG ($p = 0.042$ and $p = 0.016$, respectively).

The CES-D ($p = 0.043$) and the CGI ($p = 0.001$) were decreased in the treatment groups at the end of the observation period as compared to the WG. The HDI did not differ between the groups but was significantly reduced at the end of the observation period as compared to baseline ($p < 0.01$) (see Table 4). There was a decrease in the

Table 1 Clinical and demographic data of all patients with migraine ($n = 64$) differentiated by treatment condition with lymphatic drainage (LD, $n = 21$), traditional massage (TM, $n = 21$), and waiting group (WG, $n = 22$)

	LD ($n = 21$)	TM ($n = 21$)	WG ($n = 22$)	p value
Sex				
M	2	3	2	0.835
F	19	18	20	
Type of migraine				
MMA	2	6	4	0.408
MOA	13	10	15	
MMA + MOA	6	5	3	
Tension type headache	6	2	7	0.180
Age in years	45 ± 10	45 ± 10	46 ± 11	0.958
BMI	26 ± 6	26 ± 5	25 ± 6	0.653
Duration of migraine in years	21 ± 10	23 ± 14	23 ± 13	0.835

Values are given as numbers with mean ± standard deviation

MOA migraine without aura, *MMA* migraine with aura

Table 2 Results of primary outcome-measures (difference between baseline and observation period) given as percentage or arithmetic mean ± standard deviation

	LD ($n = 21$)	TM ($n = 21$)	WG ($n = 22$)	p value
Responder (migraine attacks)	38 %	33 %	18 %	0.326[c]
Responder (migraine days)	38 %	38 %	14 %	0.126[c]
Difference of migraine attacks	1.8 ± 1.7	1.3 ± 1.4	0.4 ± 1.1	0.016[a]
Difference of migraine days	3.1 ± 4.4	2.4 ± 3.9	0.2 ± 2.5	0.019[b]
Difference of headache days	3.1 ± 4.8	2.8 ± 3.5	0.5 ± 2.6	0.064

Statistical analysis by χ^2 test or Kruskal–Wallis analysis (Mann–Whitney *U* test as post hoc test)

LD lymphatic drainage, *TM* traditional massage, *WG* waiting group

[a] LD versus TM $p = 0.419$; LD versus WG $p = 0.006$; TM versus WG $p = 0.042$

[b] LD versus TM $p = 0.869$; LD versus WG $p = 0.015$; TM versus WG $p = 0.016$

[c] post-hoc tests not significant

amount of antimigraine drugs in the LD group with significance between baseline and end of observation period ($p = 0.004$). Although the number of analgesics did not decrease significantly in the TM group, it was significantly lower at the end of the observation period as compared to the WG ($p = 0.004$) (see Table 5).

The analysis of accompanying symptoms (presence of photophobia, phonophobia, nausea, and vomiting in each individual patient) showed a significant reduction of photophobia in the LD group as compared to baseline ($p = 0.029$), but not in the TM and in the WG group (see Table 6).

End of the treatment period

The responder rates of migraine frequency and migraine days between baseline and end of the treatment period were not different between the groups. However, there was a significant difference in the number of migraine attacks between LD und WG ($p = 0.013$) and between TM und WG ($p = 0.033$). The days of migraine ($p = 0.162$) and the days of other headaches (p = 0.290) were not significantly different (see Table 3).

The CES-D ($p = 0.032$) and the CGI ($p = 0.001$) were reduced in the treatment groups at the end of the treatment

Table 3 Results of secondary outcome-measures (difference between baseline and the end of treatment period), given as percentage or arithmetic mean (SD)

	LD ($n = 21$)	TM ($n = 21$)	WG ($n = 22$)	p value
Responder (migraine attacks)	24 %	29 %	14 %	0.479
Responder (migraine days)	29 %	14 %	5 %	0.093[a]
Difference of migraine attacks	1.5 ± 1.7	1.1 ± 1.3	0.3 ± 1.1	0.025[b]
Difference of migraine days	1.6 ± 4.2	1.4 ± 3.5	0.6 ± 1.6	0.162
Difference of headache days	2.8 ± 4.4	1.3 ± 3.2	0.8 ± 1.7	0.290

Statistical analysis by means of χ^2 test or Kruskal–Wallis analysis (Mann–Whitney U test as post hoc test)

LD lymphatic drainage, *TM* traditional massage, *WG* waiting group

[a] LD versus WG $p = 0.033$; TM versus WG and LD versus TM not significant

[b] LD versus TM $p = 0.656$; LD versus WG $p = 0.013$; TM versus WG $p = 0.033$

Table 4 Data of the CES-D, the HDI, and the CGI scores at baseline, after treatment period, and after end of observation period presented as arithmetic mean with simple standard deviation

	LD ($n = 21$)	TM ($n = 21$)	WG ($n = 22$)	p value
CES-D				
Baseline	14.9 ± 8.3	14.0 ± 8.5	15.1 ± 7.7	0.843
End of treatment	9.6 ± 6.8	12.0 ± 7.8	15.8 ± 8.1	0.032[a]
End of observation	11.2 ± 10.0	12.1 ± 9.0*	16.7 ± 9.8	0.043[b]
HDI				
Baseline	64.2 ± 12.9	58.7 ± 19.8	54.7 ± 16.8	0.101
End of treatment	49.5 ± 19.3	49.5 ± 20.8	45.3 ± 13.7	0.554
End of observation	49.9 ± 24.7**	48.2 ± 22.6***	42.0 ± 20.4***	0.498
CGI				
Baseline	2.0 ± 0.9	1.8 ± 0.6	1.9 ± 0.5	0.684
End of treatment	1.0 ± 0.2	1.2 ± 0.4	1.8 ± 0.4	0.001[c]
End of observation	1.1 ± 0.5***	1.1 ± 0.3***	1.8 ± 0.5	0.001[d]

The significance levels are given for the comparison between the three treatment groups (Kruskal–Wallis test, Mann–Whitney U test as post hoc test). Comparison within one group by Friedman-test

LD lymphatic drainage, *TM* traditional massage, *WG* waiting group

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

[a] LD versus WG $p = 0.019$; TM versus WG $p = 0.041$; LD versus TM $p = 0.464$

[b] LD versus WG $p = 0.036$; TM versus WG $p = 0.026$; LD versus TM $p = 0.970$

[c] LD versus WG $p < 0.001$; TM versus WG $p < 0.001$; LD versus TM $p = 0.202$

[d] LD versus WG $p < 0.001$; TM versus WG $p < 0.001$; LD versus TM $p = 0.921$

period as compared to the WG. The HDI did not differ between the groups but was significantly reduced at the end of the treatment period as compared to baseline ($p < 0.01$) (see Table 4). The number of analgesic drugs did not show a significant decrease (see Table 5). Photophobia was significantly reduced in the LD group as compared to baseline ($p = 0.001$) (see Table 6).

Discussion

This is the first study comparing LD and TM in the prevention of migraine with or without aura. Both physical interventions were associated with a significant reduction of migraine frequency as compared to a waiting group. The amount of acute analgesic drugs and the occurrence of

Table 5 Number of analgesics in the three groups at baseline, after 4, and after 8 weeks of treatment and after 4 weeks of observation presented as arithmetic mean with simple standard deviation

	LD ($n = 21$)	TM ($n = 21$)	WG ($n = 22$)	p value
Baseline	8.8 ± 5.2	6.7 ± 5.6	6.6 ± 3.1	0.177
4 weeks	6.9 ± 4.6	4.7 ± 3.7	7.2 ± 5.3	0.134
End of treatment	5.4 ± 4.4	4.5 ± 3.2	7.1 ± 4.2	0.131
End of observation	5.3 ± 4.0	4.6 ± 4.0*	7.2 ± 4.6	0.015

The significance levels are given for the comparison between the three treatment groups (Kruskal–Wallis test, Mann–Whitney U test as post hoc test). Friedman-test: LD $p = 0.004$; TM $p = 0.214$; WG $p = 0.740$ (with significance between baseline and end of observation in LD)

LD lymphatic drainage, *TM* traditional massage, *WG* waiting group

* $p = 0.004$ as compared to WG

Table 6 Accompanying symptoms (days with nausea, vomiting, photophobia and phonophobia in each individual patient) in the three groups at baseline, after 4 and 8 weeks of treatment and after 4 weeks of observation presented as arithmetic mean with simple standard deviation in brackets

	LD ($n = 21$)	TM ($n = 21$)	WG ($n = 22$)	p value
Baseline				
Nausea	3.1 (3.6)	2.8 (3.0)	2.5 (2.0)	0.938
Vomiting	0.4 (1.0)	0.3 (0.6)	0.4 (0.7)	0.692
Photophobia	6.3 (5.0)	5.0 (4.9)	3.3 (3.0)	0.048
Phonophobia	3.7 (3.2)	4.3 (4.5)	1.7 (2.6)	0.023
4 weeks				
Nausea	2.2 (2.3)	2.3 (3.2)	2.7 (3.1)	0.793
Vomiting	0.4 (1.0)	0.4 (1.4)	0.1 (0.3)	0.384
Photophobia	4.4 (3.4)[a]	5.0 (4.4)	3.3 (3.1)	0.451
Phonophobia	3.3 (3.1)	3.7 (4.2)	2.3 (3.2)	0.241
End of treatment				
Nausea	2.1 (2.7)	1.7 (2.4)	2.3 (2.1)	0.378
Vomiting	0.3 (0.7)	0.2 (0.7)	0.5 (1.1)	0.649
Photophobia	3.2 (3.3)[b]	4.1 (4.7)	2.6 (3.0)	0.703
Phonophobia	2.2 (3.0)	3.4 (3.3)	1.7 (3.0)	0.121
End of observation				
Nausea	1.6 (2.0)	2.2 (3.7)	2.6 (2.9)	0.321
Vomiting	0.2 (0.5)	0.4 (1.2)	0.3 (0.6)	0.775
Photophobia	3.9 (3.2)[c]	3.8 (5.5)	3.2 (3.3)	0.488
Phonophobia	2.3 (3.0)	2.8 (3.6)	2.3 (3.2)	0.807

The significance levels are given for the comparison between the three treatment groups (Friedman test, Wilcoxon test as post hoc test)

LD lymphatic drainage, *TM* traditional massage, *WG* waiting group

Wilcoxon test (post hoc): [a] $p = 0.009$; [b] $p = 0.001$; [c] $p = 0.029$ as compared to baseline

photophobia only decreased under the LD intervention. Additionally, the CGI and the HDI decreased in both treatment groups, and the depression scores in both treatment groups were lower at the end of treatment and observation periods.

Since no other controlled studies on the efficacy of LD or TM in the prevention of migraine are published, results cannot be discussed comparatively.

We enrolled consecutive migraine patients without any selection bias. In particular, we did not focus on migraine patients known to be refractory to preventive drugs. The demographic profile of our patients confirms that we enrolled a typical sample of migraine patients in headache clinics. The placebo rate of up to 18 % for the primary efficacy parameters is also in line with studies on the preventive migraine treatment [16]. The number of patients with concomitant tension-type headache was not significantly different between the three treatment groups. Therefore, we believe that our study reflects the typical situation of other published migraine prevention studies. No adverse events were reported by the patients. LD and TM occurred to be safe in the mode as applied in our study.

Since also the CGI showed significant improvement in both treatment groups, one can conclude that the subjective data are valid. Decreased HDI and depression scores underline the additional positive affect of LD and TM on mood and quality of life.

Limitations

Our study gives evidence for the efficacy of LD and TM in the preventive treatment of migraine. However, the statistical power of this study was too weak to detect minor differences (i.e., less than 30 % difference for the primary efficacy parameter) between the WG and LD or TM. The optimal mode of treatment, intervals, and frequencies remain still to be determined in larger patient groups. Furthermore, we cannot conclude whether the effects of LD and TM were specific or just the result of caring for the patients. Since we detected some significant differences between LD and TM, it is likely that specific effects, at least in LD, contribute to the effects observed in this study.

Conclusion

In conclusion, useful effects were identified for LD and TM as compared to a control-group (WG) for the prophylaxis of migraine. LD was more efficacious in some parameters than TM. Larger studies are warranted to definitely identify the role of LD and TM in the treatment concepts of migraine.

Compliance with ethical standards

Conflict of interest The authors report no conflict of interest.

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