German Acupuncture Trials (GERAC) for Chronic Low Back Pain

Randomized, Multicenter, Blinded, Parallel-Group Trial With 3 Groups

Michael Haake, PhD, MD; Hans-Helge Müller, PhD; Carmen Schade-Brittinger; Heinz D. Basler, PhD; Helmut Schäfer, PhD; Christoph Maier, PhD, MD; Heinz G. Endres, MD; Hans J. Trampisch, PhD; Albrecht Molsberger, PhD, MD

Background: To our knowledge, verum acupuncture has never been directly compared with sham acupuncture and guideline-based conventional therapy in patients with chronic low back pain.

Methods: A patient- and observer-blinded randomized controlled trial conducted in Germany involving 340 outpatient practices, including 1162 patients aged 18 to 86 years (mean ± SD age, 50 ± 15 years) with a history of chronic low back pain for a mean of 8 years. Patients underwent ten 30-minute sessions, generally 2 sessions per week, of verum acupuncture (n = 387) according to principles of traditional Chinese medicine; sham acupuncture (n = 387) consisting of superficial needling at nonacupuncture points; or conventional therapy, a combination of drugs, physical therapy, and exercise (n = 388). Five additional sessions were offered to patients who had a partial response to treatment (10%-50% reduction in pain intensity). Primary outcome was response after 6 months, defined as 33% improvement or better on 3 pain-related items on the Von Korff Chronic Pain Grade Scale questionnaire or 12% improvement or better on the back-specific Hanover Functional Ability Questionnaire. Patients who were unblinded or had recourse to other than permitted concomitant therapies during follow-up were classified as nonresponders regardless of symptom improvement.

Results: At 6 months, response rate was 47.6% in the verum acupuncture group, 44.2% in the sham acupuncture group, and 27.4% in the conventional therapy group. Differences among groups were as follows: verum vs sham, 3.4% (95% confidence interval, −3.7% to 10.3%; $P = .39$); verum vs conventional therapy, 20.2% (95% confidence interval, 13.4% to 26.7%; $P < .001$); and sham vs conventional therapy, 16.8% (95% confidence interval, 10.1% to 23.4%; $P < .001$.

Conclusions: Low back pain improved after acupuncture treatment for at least 6 months. Effectiveness of acupuncture, either verum or sham, was almost twice that of conventional therapy.

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Author Affiliations: Orthopedic Department, University of Regensburg, Bad Abbach, Germany (Dr Haake); Institutes for Medical Biometry and Epidemiology (Drs Müller and Schäfer) and Medical Psychology (Dr Basler) and Centre for Clinical Trials (Ms Schade-Brittinger), Philipps-University Marburg, Marburg, Germany; Departments of Pain Management, BG-Kliniken Bergmannsheil (Dr Maier) and Medical Informatics, Statistics and Epidemiology, Ruhr-University Bochum, Bochum, Germany (Drs Endres and Trampisch); and Centre for Clinical Acupuncture and Research, Düsseldorf, Germany (Dr Molsberger).

LOW BACK PAIN IS A COMMON, impairing, and disabling condition, often long-term, with an estimated lifetime prevalence of 70% to 85%.[1] It is the second most common pain for which physician treatment is sought and a major reason for absenteeism and disability.[1,2] Considering direct and indirect costs in terms of health care and lost productivity, the annual cost of low back pain to society is staggering.[2,3]

National and international guidelines do not recommend one treatment over another. While many treatment methods have been tried, including behavioral modifications, nonsteroidal anti-inflammatory drugs, and physiotherapy, randomized controlled trials have failed to demonstrate that any of these is clearly more effective for relieving pain or improving functional outcomes.[4] Thus, acupuncture is increasingly used as an alternative therapy. However, the value of acupuncture for the treatment of low back pain is still controversial. A recent Cochrane review could only conclude that acupuncture may be useful as an adjunct to other therapies.[5] To our knowledge, no studies have directly compared acupuncture with guideline-based conventional therapy. The German Acupuncture Trials (GERAC) was designed to investigate whether acupuncture is more efficacious in reducing chronic low back pain than conventional therapy or sham acupuncture.

METHODS

STUDY DESIGN AND PARTICIPANTS

The design of this multicenter, randomized trial has been described.[6] Main inclusion criteria were as follows: age 18 years or older, clinical diagnosis of chronic low back pain for 6 months or longer, mean Von Korff Chronic Pain Grade score[7] of grade 1 or higher and a Hanover Func-

Table 1. Eligibility Criteria

Inclusion Criteria
Signed written informed consent
Clinical diagnosis of chronic low back pain for 6 mo or longer
CPGS grade I and HFAQ less than 70%
Therapy-free interval 7 d or longer
Older than 18 y
Ability to speak, read, and write German
Exclusion criteria
Treatment with needle acupuncture for low back pain at any time in the past
Treatment with needle acupuncture for any other indication within the last year
History of spinal fracture (eg, osteoporosis or trauma) or disc or spinal surgery
Infections or tumors of the spine
Systemic bone or joint disorders (eg, rheumatoid arthritis)
Scoliosis or kyphosis
Sciatica or chronic pain from other disease
Hemorrhagic disorders or anticoagulant therapy
Skin disease in the area of acupuncture
Abuse of drugs or pain medication
Pregnancy
Epilepsy
Patient included in any other studies

Abbreviations: CPGS, Von Korff Chronic Pain Grade Scale; HFAQ, Hanover Functional Ability Questionnaire.

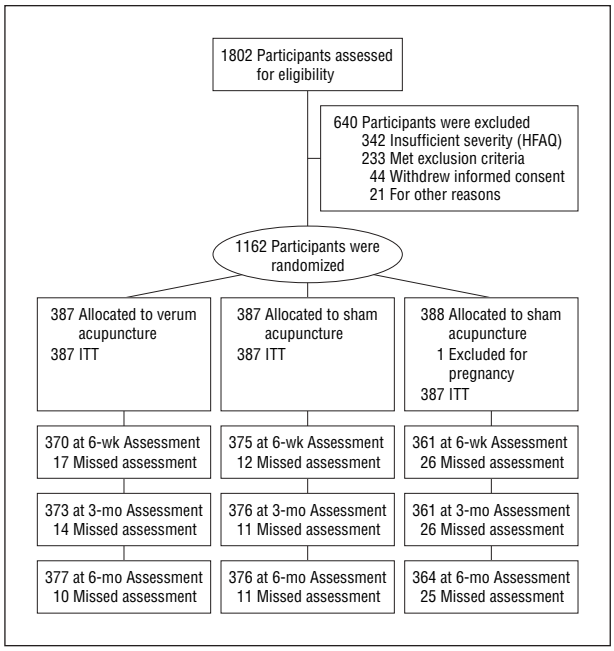

Figure 1. Participant flowsheet. HFAQ indicates Hanover Functional Ability Questionnaire; ITT, intention to treat.

tional Ability Questionnaire score of less than 70%,[8] no previous acupuncture for treatment of chronic low back pain, and signed informed consent. Primary exclusion criteria were previous spinal surgery; previous spinal fractures, infectious, or tumorous spondylopathy; and chronic pain caused by other diseases[6] (**Table 1**). Patients were made aware of the study through newspapers, magazines, radio, and television. A list of physicians participating in the randomized trials was available on the Internet or could be requested from the medical insurance companies or the study center. Only patients who had been therapy-free for at least 7 days were eligible for screening. **Figure 1** shows participant progress through the study.

Acupuncture was administered in 340 outpatient practices by physicians of various specializations who had at least 140 hours of acupuncture training: 55% had undergone basic training (mean, 213 hours) and 45% had advanced training (mean, 376 hours). The study physicians had practiced acupuncture for 2 to 36 years (median, 8.0 years). All took part in a 1-day training session with emphasis on acupuncture methods and study design. Each patient in the study practices was seen by the same physician-acupuncturist at each session. Independent telephone interviewers assessed outcome measures.

The study was conducted in accord with International Conference on Harmonization [of Technical Requirements for the Registration of Pharmaceuticals for Human Use]–Good Clinical Practice (ICH/GCP) criteria, including independent regular monitoring and establishment of an independent data safety monitoring committee. All study participants provided written informed consent and the study was approved by local ethics committees.

INTERVENTIONS

Patients were randomized to receive verum acupuncture, sham acupuncture, or guideline-based conventional therapy. All interventions comprised ten 30-minute sessions, generally 2 sessions per week, and 5 additional sessions if, after the tenth session (**Figure 2**), patients experienced a 10% to 50% reduction in pain intensity (Von Korff Chronic Pain Grade Scale).[6] Interviewers and patients were blinded to this criterion. In all telephone interviews, patients were asked specifically about use of medication and physical therapy.

The sterile, disposable needles (Asiamed, Pullach near Munich, Germany) used for verum and sham acupuncture were identical and were either 0.25×40 mm or 0.35×50 mm. Only body needle acupuncture, without electrical stimulation or moxibustion, was allowed. Verum acupuncture consisted of needling fixed points and additional points (from a prescribed list) chosen individually on the basis of traditional Chinese medicine diagnosis, including tongue diagnosis. Fourteen to 20 needles were inserted to a depth of 5 to 40 mm depending on location. Induction of de Qi (the sensation felt when an acupuncturist reaches the level of Qi [numb radiating sensation indicative of effective needling] in the body) was elicited by manual stimulation. Sham acupuncture on either side of the lateral part of the back and on the lower limbs was also standardized, avoiding all known verum points or meridians. As with verum acupuncture, 14 to 20 needles were inserted, but superficially (1-3 mm) and without stimulation.

The methods of acupuncture and Chinese diagnosis were established on the basis of the international literature and a consensus process with international experts. The exact method of acupuncture has been published.[6,10] For acute episodes of pain, only rescue medication was permitted in both acupuncture groups. This was strictly defined as nonsteroidal antiinflammatory drugs to be taken on no more than 2 days per week up to the maximum daily dose during the therapy period and only 1 day per week during follow-up. Use of any additional therapies for pain during the entire study period was prohibited

Patients in the conventional therapy group received a multimodal treatment program according to German guidelines.[11] The guidelines provide the treating physician with recommendations about the treatment algorithm and assess the various therapy forms according to the degree of evidence based on a literature search and recommendations of the specialist associations. Conventional therapy included 10 sessions with personal contact with a physician or physiotherapist who administered physiotherapy, exercise, and such.

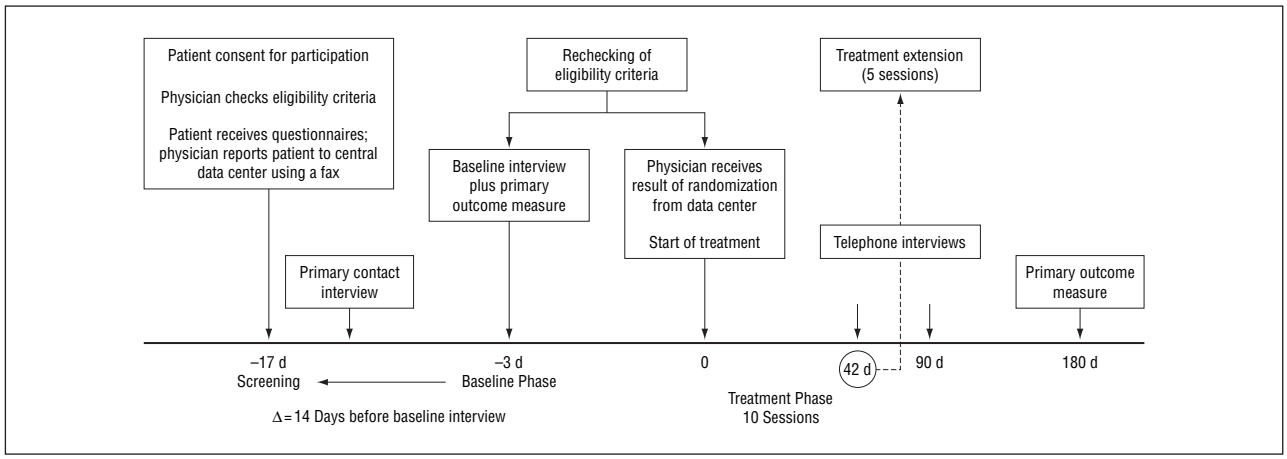

Figure 2. Study design for German Acupuncture Trial for Chronic Lower Back Pain. Adapted from Endres et al.[9]

Physiotherapies were supported by nonsteroidal anti-inflammatory drugs or pain medication up to the maximum daily dose during the therapy period. Rescue medication was identical to that for the acupuncture groups.

During acupuncture treatment, communication with the patient was limited to necessary explanations to avoid unblinding the patient by suggestive remarks. Patients in all 3 groups were informed before randomization that acupuncture would be offered after completion of the trial.

OUTCOME MEASURES

Telephone interviews by trained employees of the study center were conducted at baseline and at 1½, 3, and 6 months. Our primary outcome was treatment response 6 months after randomization, defined as 33% improvement or better on 3 pain-related items on the Von Korff Chronic Pain Grade Scale[7] or 12% improvement or better on back-specific functional status measured by the Hanover Functional Ability Questionnaire.[8] Patients who had recourse to additional treatments other than rescue medication were classified as nonresponders, as were unblinded patients.

Secondary outcomes were responder rate at 1½ and 3 months after randomization, scores on the 12-item Short Form Health Survey,[12] and patient global assessment of therapy effectiveness on a scale of 1 (very good) to 6 (fail).[13] Physicians documented medication use, acupuncture treatment, and adverse events at each session and at the final examination after 6 months. Patient blinding was assessed at the 6-month interview by asking whether their physician had informed them of their allocation and, if not, by asking the method of acupuncture and how certain they were of their response.[14] All interview questions were given to the patients during the baseline visit.

RANDOMIZATION AND BLINDING

The 1:1:1 randomization was performed dynamically by a computer program balancing for 2 levels of chronification (<2 or ≥2 years), 2 levels of fear avoidance belief[15] (<4 or ≥4 average total points), 2 levels of activity (<60 or ≥60 minutes), patient expectations,[16] and trial center. The previous allocation scheme and a prespecified list of random numbers were used. After successful completion of the baseline interview and once the patient had come for the first treatment, the physician called a randomization hotline that registered the patient in the study and faxed the patient's assigned treatment group to the physician.

Patients were blinded to the type of acupuncture. They were told they would be treated with a traditional Chinese form of acupuncture (verum), with a form of acupuncture developed especially for this study (sham), or with conventional therapy. Investigators could not be blinded to the method of acupuncture, but the interviewers were.

STATISTICAL ANALYSIS

The primary analysis included all randomized patients on the intent-to-treat basis. Patients in all groups who missed the 6-month-assessment were, therefore, classified as nonresponders. Response rates were tested for differences using the 2-sided Fisher exact test. The multiple testing problem caused by the comparison of 3 treatment methods was handled by a closed test procedure to guarantee the type I error level of 5% for all pairwise comparisons. Two tests comparing verum acupuncture with the 2 control groups at a level of 2.5% each were performed as a first step.[6] If this global test ruled out the null hypothesis of no difference among the 3 treatments, then all 3 pairwise comparisons were performed at a level of 5%. The study was powered to detect a change of 10% in response rates (verum acupuncture, 60%; conventional therapy, 50%; and sham acupuncture, 40%), with 95% power for the global test. Assuming a 30% dropout rate, this led to a required sample size of 354 patients per group. Exploratory analyses were performed for all secondary end points. Sensitivity analyses included comparisons with grouping by treatment, dropping patients who missed the 6-month assessment, and best and worst imputation of missing data at 6-month assessment in all pairwise comparisons.

RESULTS

PARTICIPANTS

Overall, 1802 patients with low back pain were screened, and 1162 were randomized between March 7, 2002 (first randomization), and December 12, 2004 (last randomization) (Figure 1). The primary reason for nonrandomization was insufficient severity of disability as measured with the Hanover Functional Ability Questionnaire. One patient dropped out because of pregnancy and was excluded from the primary analysis. Twenty-three patients in the intent-to-treat population in the conventional therapy group missed the 6-month telephone assessment and were, thus, classified as nonresponders. They

Table 2. Baseline Characteristics in 1162 Patients Randomized and 640 Patients Screened-Only[a]

Baseline Characteristic	Verum Acupuncture (n = 387)	Sham Acupuncture (n = 387)	Standard Therapy (n = 388)	Screened Only (n = 640)
Sex, No.(%)				
Men	165 (42.6)	140 (36.2)	165 (42.5)	267 (41.7)
Women	222 (57.4)	247 (63.8)	223 (57.5)	373 (58.3)
Age, y	49.6 ± 14.6 (380)	49.2 ± 14.8 (382)	51.3 ± 14.5 (381)	48.5 ± 14.7 (619)
Body mass index[b]	26.9 ± 4.7 (381)	26.5 ± 4.8 (378)	26.3 ± 4.5 (378)	26.1 ± 4.4 (614)
Prognostic factors				
History of back pain, y	8.1 ± 7.7 (380)	7.7 ± 8.2 (382)	8.1 ± 8.3 (380)	7.6 ± 7.6 (617)
Patient expectations[c]	7.6 ± 1.7 (387)	7.7 ± 1.8 (387)	7.7 ± 1.8 (388)	7.4 ± 1.9 (512)
Fear avoidance beliefs[d]	3.3 ± 1.3 (387)	3.2 ± 1.3 (387)	3.3 ± 1.3 (388)	3.6 ± 1.2 (54)
Physical activity,[c] min/d	70.5 ± 121.5 (377)	67.1 ± 119.3 (347)	67.5 ± 117.4 (381)	48.8 ± 106.9 (54)
Pain, CPGS	67.7 ± 13.9	67.8 ± 13.2	67.8 ± 14.6	NA
Disability, HFAQ	46.3 ± 14.7	46.3 ± 15.3	46.7 ± 14.5	NA
Quality of life, SF-12				NA
Physical component summary	31.8 ± 6.8	31.5 ± 6.9	31.6 ± 6.8	
Mental component summary	46.6 ± 12.3	46.6 ± 11.5	47.1 ± 11.6	

Abbreviations: GCPS, Von Korff Chronic Pain Grade Scale (low values better); HFAQ, Hanover Functional Ability Questionnaire (high values better); NA, not available; SF-12, 12-item Short-Form Health Survey (high values better).
[a] Data are given as mean ± SD (number of patients) unless otherwise indicated.
[b] Calculated as weight in kilograms divided by height in meters squared.
[c] Not at all helpful, 0; extremely helpful, 10.
[d] Beliefs about back pain caused by physical activity: not at all, 0; absolutely true, 6.

were not included in a secondary sensitivity analysis, thereby statistically favoring the conventional therapy. This reduced the therapy effect in the response rates between acupuncture and conventional therapy by less than 1%. Overall, the primary results remain stable. Balanced randomization ensured that there were no relevant differences between the 3 treatment groups insofar as the 5 potentially prognostic factors (**Table 2**).

TREATMENTS AND BLINDING

A total of 13 475 treatment sessions were conducted (verum acupuncture, 4821 [mean, 12.5 per patient]; sham acupuncture, 4590 [mean, 11.9 per patient]; conventional therapy, 4064 [mean, 10.5 per patient]). Mean ± SD treatment time per session was 30.5 ± 2.5 minutes in all groups. The number of patients who received the 5 additional sessions was 232 (59.9%) in the verum group, 209 (54.3%) in the sham group, and 192 (52.5%) in the conventional group. The therapies given in the conventional group were physiotherapy (n = 197; mean, 11.7 sessions per patient), massage (n = 180; mean, 9.5 sessions per patient), heat therapy (n = 157; mean, 9.7 sessions per patient), electrotherapy (n = 65; mean, 8.8 sessions per patient), back school (ie, a practical education in the management of back pain) (n = 36; mean, 8.1 sessions per patient), injections (n = 48; mean, 5.6 per patient), and guidance (n = 56; mean, 4.2 sessions per patient). In a few patients, therapies included infusions, yoga, hydrojet treatment, and swimming. Pharmacologic treatment in the conventional therapy group consisted of analgesics in 95% of patients (n = 183; mean, 16.2 per patient). At the end of the study, patients rated the credibility of both acupuncture forms positively. Blinding seems to have been maintained: most patients did not correctly identify or did not know which form they had received (**Table 3**). Primary outcome at 6 months could be assessed in 96.1% (1117 patients [377 received verum; 376 sham, and 364 standard treatment]) of all randomized patients.

Table 3. Assessment of Patient Blinding at End of Study[a]

Type of Acupuncture Received	Type of Acupuncture Patients Stated They Had Received	Level of Confidence of Patient Answers: Certain	Uncertain	Total
Verum (specific)	Specific	45 (42.5)	61 (57.5)	**106** (28.1)
	Nonspecific	48 (44.0)	61 (56.0)	**109** (28.9)
	Don't know			**126** (33.4)
	Missing			**36** (9.5)
				377
Sham (nonspecific)	Specific	26 (30.2)	60 (69.8)	**86** (22.9)
	Nonspecific	49 (39.5)	75 (60.5)	**124** (33.0)
	Don't know			**141** (37.5)
	Missing			**25** (6.6)
				376

[a] Data are given as number (percentage).

CLINICAL OUTCOMES

Table 4 gives the response rates and between-group differences at 6 months. Almost half of patients in the acupuncture groups but only one-fourth of patients in the conventional therapy group benefited. Because the *P* value of the comparison of verum acupuncture and conventional therapy is ≤2.5% and the *P* value of the comparison of sham acupuncture and conventional therapy is ≤5.0%, both differences are statistically significant according to the closed testing procedure.

Verum acupuncture was not superior to sham acupuncture, with an observed difference of 3.4% (*P* = .39). Before application of the nonresponder criterion, success rates were about 30% greater; that is, in any group, about 25% of pa-

Table 4. Primary Outcome: Pairwise Comparison of Treatment Response 6 Months After Randomization[a]

Treatment Response	Intergroup Difference	*P* Value[b]
Group 1 vs group 3		
47.6 (42.4 to 52.6) vs 27.4 (23.0 to 32.1)	20.2 (13.4 to 26.7)	<.001
Group 2 vs group 3		
44.2 (39.2 to 49.3) vs 27.4 (23.0 to 32.1)	16.8 (10.1 to 23.4)	<.001
Group 1 vs group 2		
47.6 (42.4 to 52.6) vs 44.2 (39.2 to 49.3)	3.4 (–3.7 to 10.3)	.39

[a] Each group comprised 387 patients. Values are given as percentage of patients (95% confidence interval). Group 1, verum acupuncture; group 2, sham acupuncture; group 3, conventional therapy.
[b] Unadjusted; Fisher exact test (intention-to-treat analysis).

Table 5. Treatment Response After 6 Months[a]

	Therapy		
Treatment Response	Conventional	Sham Acupuncture	Verum Acupuncture
CPGS			
Success[b]	132 (34.1)	197 (50.9)	229 (59.2)
HFAQ			
Success[c]	195 (50.4)	251 (64.9)	281 (72.6)
Combined CPGS and HFAQ			
Success[d]	223 (57.6)	277 (71.6)	304 (78.5)
Total No. of patients	387	387	387
Combined GCPS, HFAQ, and unblinded patients			
Nonresponders[e]	164 (42.4)	125 (32.3	112 (28.9)
Responders	223 (57.6)	262 (67.7)	275 (71.1)
Overall treatment response including proscribed rescue medication			
Nonresponders[f]	281 (72.6)	216 (55.8)	203 (52.4)
Responders	106 (27.4)	171 (44.2)	184 (47.6)
Total No. of Patients	**387**	**387**	**387**

Abbreviations: CPGS, Von Korff Chronic Pain Grade Scale; HFAQ, Hanover Functional Ability Questionnaire for measuring back pain–related functional limitations.
[a] Values are given as number of patients (percentage).
[b] Success was defined as 33% improvement or better on 3 pain-related items on the GCPS.
[c] Success was defined as 12% improvement or better on the back-specific HFAQ.
[d] Success was defined as 33% improvement or better on 3 pain-related items on the CPGS or as 12% improvement or better on the back-specific HFAQ.
[e] Patients who had no success in the combined CPGS, HFAQ, or unblinded groups.
[f] Patients who had no success in the combined CPGS, HFAQ, or unblinded groups; missed the 6-month assessment; or had recourse to other than permitted concomitant therapies during follow-up, regardless of symptom improvement.

tients were classified as nonresponders because they had recourse to additional therapies (**Table 5**). Patients in both acupuncture groups also had clinically meaningful better results for all secondary outcome measures, including medication use (**Table 6**). No center effects were found.

ADVERSE EVENTS

During the 6 months after randomization, 40 serious adverse events were documented, 12 each in the verum and sham acupuncture groups and 16 in the conventional therapy group. All were deemed unrelated to the intervention. The number of serious adverse events corresponds to the statistically expected frequency.[17] In addition, 476 clinically relevant adverse effects were reported by 257 patients (22.6%), with no significant difference between therapy groups ($P = .81$).

COMMENT

To our knowledge, the present study is the largest and most rigorous trial to investigate the efficacy of verum acupuncture for chronic low-back pain compared with sham acupuncture and guideline-based conventional therapy. The study yielded several surprising results. First, almost half of the patients in both acupuncture groups were responders. They experienced clinically relevant improvement in pain intensity or back-specific disability without having recourse to concomitant therapies. Second, only one-fourth of the patients receiving conventional therapy, consisting of a multimodal combination of pharmacologic and nonpharmacologic treatments, responded to treatment. Acupuncture, regardless of the technique, was significantly more effective than conventional therapy at all follow-up points. To our knowledge, this is the first time superiority of acupuncture over conventional treatment has been unequivocally demonstrated for the primary and secondary outcomes, including medication reduction, in contrast to studies with a usual-care group.[5,18] Third, there was essentially no difference between the results for verum and sham acupuncture.

What conclusions can be drawn from these findings? First, the unexpected finding of similar effectiveness of sham and verum acupuncture forces us to question the underlying action mechanism of acupuncture and to ask whether the emphasis placed on learning the traditional Chinese acupuncture points may be superfluous. Second, while all randomized trials and meta-analyses to date have failed to show a clear advantage of acupuncture over conventional therapy for chronic low back pain, our findings demonstrate significant superiority.

A recently published meta-analysis of acupuncture for low back pain[19] concluded that "Current preliminary data suggest that acupuncture may be more effective than ineffective controls for providing short-term relief of chronic low-back pain."[20(p692)] In contrast, we show superiority over an active control group. The nonsuperiority of verum over sham acupuncture found in our study is in agreement with a recently published study[21] that was conducted at the same time as ours.

The comparison of sham vs verum acupuncture was intended to differentiate the physiologic (specific) from the psychologic (nonspecific) effects of acupuncture. Among the nonspecific effects for both forms of acupuncture are positive patient expectations about acupuncture paired with negative expectations about conventional medicine, more intensive physician contact, and the experience of an invasive technique (needling). Given that the 2 forms of acupuncture are indistinguishable to the patient, any differences in outcomes between the 2 forms must be attributable to specific treatment effects. However, the 2 forms did not dif-

Table 6. Results for Secondary End Points in 3 Therapy Groups

Secondary End Point	Verum Acupuncture	Sham Acupuncture	Conventional Therapy
Treatment response			
6 wk[a]	60.7 (387)	59.2 (387)	56.1 (387)
3 mo[b]	55.0 (387)	51.9 (387)	41.9 (387)
Disability, HFAQ[b]			
Baseline	46.3 ± 14.7 (387)	46.3 ± 15.3 (387)	46.7 ± 14.5 (387)
6 wk	64.0 ± 21.1 (370)	61.3 ± 20.8 (375)	56.3 ± 20.8 (361)
3 mo	65.4 ± 22.9 (373)	61.3 ± 22.7 (376)	56.0 ± 22.0 (361)
6 mo	66.8 ± 23.1 (377)	62.2 ± 23.0 (376)	55.7 ± 22.7 (364)
Pain, CPGS[c]			
Baseline	67.7 ± 13.9 (387)	67.8 ± 13.2 (387)	67.8 ± 14.6 (387)
6 wk	48.6 ± 18.5 (370)	51.0 ± 18.7 (375)	57.1 ± 16.5 (361)
3 mo	45.4 ± 19.4 (373)	48.5 ± 19.5 (376)	54.8 ± 18.4 (361)
6 mo	40.2 ± 22.5 (377)	43.3 ± 23.0 (376)	52.3 ± 21.2 (364)
Quality of life, SF-12 physical score[d]			
Baseline	31.8 ± 6.8 (385)	31.5 ± 6.9 (386)	31.6 ± 6.8 (384)
3 mo	40.3 ± 10.1 (370)	39.2 ± 9.7 (372)	36.1 ± 8.9 (361)
6 mo	41.6 ± 10.5 (373)	39.5 ± 10.1 (372)	35.8 ± 9.5 (364)
Quality of life, SF-12 mental score[d]			
Baseline	46.6 ± 12.3 (385)	46.6 ± 11.5 (386)	47.1 ± 11.6 (384)
3 mo	50.5 ± 11.1 (370)	50.2 ± 11.0 (372)	48.6 ± 11.6 (361)
6 mo	50.7 ± 11.1 (373)	50.9 ± 10.8 (372)	49.2 ± 11.8 (364)
Patient global assessment[c]			
6 wk	2.8 ± 1.2 (369)	3.1 ± 1.4 (375)	3.5 ± 1.3 (360)
3 mo	2.8 ± 1.3 (371)	3.1 ± 1.4 (376)	3.6 ± 1.3 (359)
6 mo	2.8 ± 1.3 (376)	3.0 ± 1.4 (375)	3.5 ± 1.3 (362)
Study cessation, No. (%)	34 (8.8)	39 (10.1)	50 (12.9)

Abbreviations: CPGS, Von Korff Chronic Pain Grade Scale; HFAQ, Hanover Functional Ability Questionnaire; SF-12, 12-item Short-Form Health Survey.

[a] Treatment response after 6 weeks was defined as 33% improvement or better on 3 pain-related items on the CPGS or 12% improvement or better on the back-specific HFAQ. Patients in the acupuncture groups who had recourse to other than permitted concomitant therapies during the study were classified as nonresponders regardless of symptom improvement.

[b] Treatment response after 3 months was defined as 33% improvement or better on 3 pain-related items on the CPGS or 12% improvement or better on the back-specific HFAQ. Patients who had recourse to other than permitted concomitant therapies during the therapy and follow-up up to 3 months were classified as nonresponders regardless of symptom improvement.

[c] Low values better.

[d] High values better.

fer insofar as the primary outcome. This cannot be explained solely by positing the existence of additional, previously unknown acupuncture points or regions because in the sham acupuncture, needles were inserted only very shallowly and without elicitation of de Qi. Several other hypotheses must be considered instead: (1) there are no specific acupuncture effects at all; (2) the specific acupuncture effect is very small and is overlaid by nonspecific effects; and (3) there exist specific acupuncture effects, the nature of which is still unknown, that lead to symptom improvement independent of point selection and depth of needling.

The results for conventional therapy were significantly poorer than those in the 2 acupuncture groups. This raises questions about qualitative and quantitative aspects of conventional therapy. The number and duration of patient-therapist contacts were designed to be as similar as possible to those in the acupuncture groups. A comparison of the conventional therapy as delivered in our study with several studies of routine care in Germany (eg, Chenot et al[22]) shows that the treatment in this study was superior in both quality and quantity. We, therefore, assume an efficient level of care for the conventional therapy arm.

To minimize potential nocebo effects, participants had the opportunity to receive 10 acupuncture sessions after the completion of the study regardless of their assigned group. Furthermore, every patient had the alternative of participating in a cohort study designed to examine the adverse effects of acupuncture therapy.[17] The advantage of this was that patients with positive expectations of acupuncture and negative expectations of conventional therapy could be excluded at the outset.

The superiority of both forms of acupuncture suggests a common underlying mechanism that may act on pain generation, transmission of pain signals, or processing of pain signals by the central nervous system and that is stronger than the action mechanism of conventional therapy. The underlying mechanism may be a kind of superplacebo effect produced by placebo and all nonspecific factors working together. Nevertheless, the effectiveness of acupuncture cannot be attributed merely to a placebo effect because there is no reason to believe that the action mechanism of conventional therapy is the result solely of the placebo effect. Nor can the conditions of a randomized trial be responsible for the unexpected success because the same success rates after 3 and 6 months were measured under conditions of everyday practice.[23] Nevertheless, the effectiveness of sham acupuncture and the principle of nihil nocere suggest that a discussion is called for about the necessary depth of insertion of acupuncture needles.

The strengths of our study include an active multimodal conventional therapy control group, high-power, regular monitoring, assessment of blinding maintenance, structured telephone interviews, a clinically relevant primary outcome, and a low dropout rate. Potential limitations of the study were restricting acupuncture to needling only, restricting the number of sessions to 10 to 15, and inability to blind acupuncturists to the form of acupuncture. However, we believe that nonblinding of acupuncturists did not lead to major bias because patient blinding to type of acupuncture was maintained even for 6 months.

Acupuncture constitutes a strong therapy alternative to multimodal conventional therapy. Acupuncture gives physicians a promising and effective treatment option for chronic low back pain, with few adverse effects or contraindications. The improvements in all primary and secondary outcome measures were significant and lasted long after completion of treatment. Because they directly compared acupuncture and conventional therapy, the GERAC trials were the decisive trials on which the German Federal Joint Committee of Physicians and Health Insurance Plans, a body similar to the National Institute for Health and Clinical Excellence in the United Kingdom or the National Institutes of Health in the United States, based its decision to make acupuncture for chronic low back pain an insured benefit, for the first time putting acupuncture on an equal footing with conventional therapy.

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Correspondence: Heinz G. Endres, MD, Department of Medical Informatics, Statistics and Epidemiology, Ruhr-Universität Bochum, Universitaetsstrasse 150, D-44801 Bochum, Germany (heinz.endres@ruhr-uni-bochum.de).
Author Contributions: Dr Müller and Ms Schade-Brittinger had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. *Study concept and design:* Haake, Müller, Schade-Brittinger, Basler, Schäfer, Maier, Endres, Trampisch, and Molsberger. *Acquisition of data:* Schade-Brittinger and Maier. *Analysis and interpretation of data:* Haake, Müller, Schade-Brittinger, Endres, and Molsberger. *Drafting of the manuscript:* Haake, Müller, Schade-Brittinger, Basler, Schäfer, Maier, Endres, Trampisch, and Molsberger. *Critical revision of the manuscript for important intellectual content:* Haake, Müller, Schade-Brittinger, Basler, Schäfer, Maier, Endres, and Molsberger. *Statistical analysis:* Müller, Schäfer, and Trampisch. *Obtained funding:* Schäfer. *Administrative, technical, and material support:* Schade-Brittinger, Basler, Maier, and Molsberger. *Study supervision:* Molsberger.
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REFERENCES

1. Andersson GB. Epidemiological features of chronic low-back pain. *Lancet.* 1999; 354(9178):581-585.
2. Pai S, Sundaram LJ. Low back pain: an economic assessment in the United States. *Orthop Clin North Am.* 2004;35(1):1-5.
3. Deyo RA, Weinstein JN. Low back pain. *N Engl J Med.* 2001;344(5):363-370.
4. Carragee EJ. Clinical practice: persistent low back pain. *N Engl J Med.* 2005;352 (18):1891-1898.
5. Furlan AD, van Tulder MW, Cherkin DC, et al. Acupuncture and dry-needling for low back pain. *Cochrane Database Syst Rev.* 2005;(1):CD001351.
6. Haake M, Müller HH, Schade-Brittinger C, et al. The German multicenter, randomized, partially blinded, prospective trial of acupuncture for chronic low-back pain: a preliminary report on the rationale and design of the trial. *J Altern Complement Med.* 2003;9(5):763-770.
7. Farrar JT, Portenoy RK, Berlin JA, Kinman JL, Strom BL. Defining the clinically important difference in pain outcome measures. *Pain.* 2000;88(3):287-294.
8. Kohlmann T, Raspe H. The Hannover Functional Questionnaire fin ambulatory diagnosis of functional disability caused by backache [in German]. *Rehabilitation (Stuttg).* 1996;35(1):1-8.
9. Endres HG, Zenz M, Schaub C, et al. German Acupuncture Trials (GERAC) address problems of methodology associated with acupuncture studies. *Schmerz.* 2005;19(3):201-210.
10. Molsberger AF, Streitberger K, Kraemer J, et al. Designing an acupuncture study, II: the nationwide, randomized, controlled German acupuncture trials on low-back pain and gonarthrosis. *J Altern Complement Med.* 2006;12(8):733-742.
11. AKDÄ. *Empfehlungen zur Therapie von Kreuzschmerzen. 2 ed.* Düsseldorf, Germany: Nexus GmbH; 2000.
12. Gandek B, Ware JE, Aaronson NK, et al. Cross-validation of item selection and scoring for the SF-12 Health Survey in nine countries. *J Clin Epidemiol.* 1998; 51(11):1171-1178.
13. Collins SL, Edwards J, Moore RA, Smith LA, McQuay HJ. Seeking a simple measure of analgesia for mega-trials: is a single global assessment good enough? *Pain.* 2001;91(1-2):189-194.
14. Vincent C, Lewith G. Placebo controls for acupuncture studies. *J R Soc Med.* 1995;88(4):199-202.
15. Waddell G, Newton M, Henderson I, Somerville D, Main CJA. Fear-Avoidance Beliefs Questionnaire (FABQ) and the role of fear-avoidance beliefs in chronic low back pain and disability. *Pain.* 1993;52(2):157-168.
16. Kalauokalani D, Cherkin DC, Sherman KJ, Koepsell TD, Deyo RA. Lessons from a trial of acupuncture and massage for low back pain: patient expectations and treatment effects. *Spine.* 2001;26(13):1418-1424.
17. Endres HG, Molsberger A, Lungenhausen M, Trampisch HJ. An internal standard for verifying the accuracy of serious adverse event reporting: the example of an acupuncture study of 190,924 patients. *Eur J Med Res.* 2004;9(12):545-551.
18. Thomas KJ, MacPherson H, Ratcliffe J, et al. Longer term clinical and economic benefits of offering acupuncture care to patients with chronic low back pain. *Health Technol Assess.* 2005;9(32):1-109.
19. Manheimer E, White A, Berman B, Forys K, Ernst E. Meta-analysis: acupuncture for low back pain [published correction appears in *Ann Intern Med.* 2005;142 (11):950-951 and *Ann Intern Med.* 2005;143(9):691-693.]. *Ann Intern Med.* 2005; 142(8):651-663.
20. Shekelle P. Acupuncture for low back pain. *Ann Intern Med.* 2005;143(9):691-693.
21. Brinkhaus B, Witt CM, Jena S, et al. Acupuncture in patients with chronic low back pain: a randomized controlled trial. *Arch Intern Med.* 2006;166(4):450-457.
22. Chenot JF, Becker A, Leonhardt C, et al. Determinants for receiving acupuncture for LBP and associated treatments [published online ahead of print November 17, 2006]. *BMC Health Serv Res.* 2006;6:149. doi:10.1186/1472-6963-6-149.
23. Kukuk P, Lungenhausen M, Molsberger A, Endres HG. Long-term improvement in pain coping for cLBP and gonarthrosis patients following body needle acupuncture: a prospective cohort study. *Eur J Med Res.* 2005;10(6):263-272.

tericidal activity by common organic substances: an experimental study. *Surgery*. 1985;98(1):25-29.
17. Lowbury EJ, Lilly HA. The effect of blood on disinfection of surgeons' hands. *Br J Surg*. 1974;61(1):19-21.
18. Denton WG. Chlorhexidine. In: Block SS, ed. *Disinfection, Sterilization, and Preservation*. 4th ed. Philadelphia, PA: Lea & Febiger; 1991:274-289.
19. Smylie HG, Logie JR, Smith G. From Phisohex to Hibiscrub. *Br Med J*. 1973;4(5892): 586-589.
20. Oda T, Hamasaki J, Kanda N, Mikami K. Anaphylactic shock induced by an antiseptic-coated central venous catheter [published correction appears in *Anesthesiology*. 1998;88(2):560]. *Anesthesiology*. 1997;87(5):1242-1244.
21. Snellman E, Rantanen T. Severe anaphylaxis after a chlorhexidine bath. *J Am Acad Dermatol*. 1999;40(5, pt 1):771-772.
22. Barbaud A, Vigan M, Delrous JL, et al; Membres du Groupe du REVIDAL. Contact allergy to antiseptics: 75 cases analyzed by the dermato-allergovigilance network (Revidal) [in French]. *Ann Dermatol Venereol*. 2005;132(12 Pt 1):962-965.
23. Freney J, Husson MO, Gavini F, Madier S, Martra A, Izard D. Susceptibilities to antibiotics and antiseptics of new species of the family *Enterobacteriaceae*. *Antimicrob Agents Chemother*. 1988;32(6):873-876.
24. Kahan A, Philippon A, Paul G, et al. Nosocomial infections by chlorhexidine solution contaminated with *Pseudomonas pickettii* (Biovar VA-I). *J Infect*. 1983; 7(3):256-263.
25. Stickler DJ, Thomas B, Clayton CL, Chawla JC. Studies of the genetic basis of chlorhexidine resistance. *Br J Clin Pract*. 1983;25(symposium suppl):23-30.
26. Berkelman RL, Lewin S, Allen JR, et al. Pseudobacteremia attributed to contamination of povidone-iodine with *Pseudomonas cepacia*. *Ann Intern Med*. 1981; 95(1):32-36.
27. Rijnders BJ, Van Wijngaerden E, Peetermans WE. Catheter-tip colonization as a surrogate end point in clinical studies on catheter-related bloodstream infection: how strong is the evidence? *Clin Infect Dis*. 2002;35(9):1053-1058.
28. Pronovost P, Needham D, Berenholtz S, et al. An intervention to decrease catheter-related bloodstream infections in the ICU [published correction appears in *N Engl J Med*. 2007;356(25):2660]. *N Engl J Med*. 2006;355(26):2725-2732.

Correction

Mislabeling of the Flowchart in Figure 1. In the article titled "German Acupuncture Trials (GERAC) for Chronic Low Back Pain," by Haake et al published in the September 24th issue of the *Archives* (2007;167[17]:1892-1898), the first line of the third box mentioning the allocation of study participants (far right) in Figure 1 on page 1893 was mislabeled. It should have read: "388 Allocated to standard treatment." In the same figure, same column, the last entry of the last box should have read as follows: "23 Missed assessment."