

Acupuncture in the Treatment of Paralysis Due to Central Nervous System Damage

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This report includes a review of the literature on acupuncture in the treatment of paralysis due to central nervous system damage. The primary topic is paralysis due to stroke (Part I). Results from acupuncture research in the treatment of paralysis due to stroke are summarized in Tables 1 and 2. Results from acupuncture research in the treatment of other types of paralysis are also included, for example, paralysis due to head injury, multiple sclerosis, pseudobulbar palsy, cerebral palsy in babies and children, spinal cord injury, peripheral facial paralysis (Bell's palsy), and coma (Parts II-VIII). These are included as additional supportive data for the general positive effect of acupuncture in the treatment of paralysis due to central nervous system damage. Acupuncture is also used with other types of paralysis, such as polio, and post-polio syndrome; and amyotrophic lateral sclerosis (earlier stages). These are not included here due to limitations on time and space.

A few articles relevant to some possible mechanisms involved with mediating improvement in paralysis following acupuncture treatment (vasodilation and increased cerebral blood flow) are also included (Part IX).

PART I. ACUPUNCTURE IN THE TREATMENT OF PARALYSIS DUE TO STROKE

Stroke is the major cause of disability among adults in the United States (Weinfeld, 1981). Every day, over 1,200 Americans suffer a

stroke, and 400 of these patients are permanently disabled. Today, more than 2 million Americans suffer long-term disabilities from stroke; and stroke costs more than \$25 billion each year (NIH Report, NINDS, 1992).

Real versus Sham Acupuncture in the Treatment of Arm/Leg Paralysis in Acute Stroke

Naeser et al. (1992) conducted a study on the use of acupuncture (Acptr.) in the treatment (Tx.) of arm/leg paralysis in acute stroke patients starting at 1-3 months poststroke.

The design included real versus sham acupuncture. The study was randomized, and double-blind for pre- and postarm/leg motor evaluation by physical therapists. It was single-blind for the acupuncturists administering the real or sham acupuncture treatments.

The subjects included 10 cases who received real acupuncture (plus regular physical therapy); and 6 cases who received sham acupuncture (plus regular physical therapy); ages 44-74.

For real acupuncture, acupuncture needles were inserted into standard acupuncture points (decreased electrical resistance points) on the body (Pomeranz, Cheng, & Law, 1977; Hyvarinen & Karlsson, 1977). Acupuncture points on the scalp were also used, along "the motor cortex line" contralateral to the paralysis. Electrical stimulation (1-2 Hz) was used on the acupuncture needles at a comfortable level on selected pairs of points for 20 minutes.

For sham acupuncture, acupuncture needles

TABLE 1. SUMMARY FOR SIX STUDIES THAT USED CONTROLS IN ACUPUNCTURE RESEARCH FOR THE TREATMENT OF PARALYSIS DUE TO STROKE

Study	Number subjects real acupuncture	Number subjects sham acupuncture	Number subjects no acupuncture	Significance level for good response/markedly eff.
Naeser et al., 1992	10 acute arm/leg cases	6 acute arm/leg cases	—	$p < .013$ with CT scan lesion site as a variable
Naeser et al., 1994a	10 chronic arm/leg cases	—	3 chronic arm/leg cases	$p < .003$ with CT scan lesion site as a variable
Naeser et al., 1994b	3 acute hand cases 8 chronic hand cases	—	2 chronic hand cases	$p < .022$
Johansson et al., 1993	38 acute	—	40 acute	$p < .01$ and beyond
Hu et al., 1993	15 acute	—	15 acute	$p < .02$
Zhang et al., 1987	53 acute	—	41 acute and chronic	$p < .05$
Total number of subjects	137	6	101	

Note. A total of 137 stroke patients received acupuncture treatments across these six studies, and a total of 107 controls received either no acupuncture or sham acupuncture. Across all six of these studies, a significantly greater number of stroke patients who received acupuncture treatments were reported to have an outcome level of "Good Response/Markedly Effective," than the controls who received either no acupuncture or sham acupuncture.

were inserted into several areas of normal resistance (as measured with a Fluke ohm meter) on the nonparalyzed limbs, and left in place for 20 minutes. The patients were told that with acupuncture, needles are used on the nonpar-

alyzed side to treat the paralyzed side (which is sometimes the case). In addition, alligator clips attached to a thin insulated wire were attached to the needles. The patients were told that the clips attached to the wire were pro-

TABLE 2. SUMMARY FOR OUTCOME LEVELS IN EIGHT ACUPUNCTURE STUDIES WHERE STROKE PATIENTS WERE TREATED FOR PARALYSIS AT <3 MONTHS POSTSTROKE VERSUS >3 MONTHS POSTSTROKE

Study	Number subjects treated beginning <3 mo. poststroke	Outcome level good response/ markedly effective	Number subjects treated beginning >3 mo. poststroke	Outcome level good response/ markedly effective
Naeser et al., 1992	10 (arm/leg cases)	4/10 40%	—	—
Naeser et al., 1994a	—	—	10 (arm/leg cases)	3/10 30%
Naeser et al., 1994b	3 (hand cases)	3/3 100%	8 (hand cases)	8/8 100%
Zhang et al., 1987	40	37/40 92.5%	13	7/13 54% ($p < .01$)
Li et al., 1989	92	55/92 60%	—	—
Wen, 1977	304	145/304 47%	196	45/196 23%
Zheng, 1981	14	11/14 78.5%	177 (1-5 years poststroke)	107/177 60%
Wang, 1993	110	86/110 78%	—	—
Total number of subjects	573	341/573 60%	404	170/404 42%

Note. A total of 20 treatments (5 times per week, 4 weeks) was administered to the inpatients at the Veterans Affairs Medical Center, Boston. Brain CT scans were obtained at 2 or more months poststroke, and analyzed after the study was completed. CT scan must be obtained 2-3 months poststroke to visualize the complete borders of the area of infarction; acute CT scans cannot be used for detailed neuroanatomical analysis (Palumbo & Naeser, in prep.).

viding additional stimulation to the acupuncture points. They were further told that the stimulation was low level, and they would not feel anything. (The clips and wire were not attached to an electrical stimulation device, and the clips were only attached to the cord with string, which was not visible.) When 20 treatments had been completed, the patients were informed that they had received sham acupuncture, and real acupuncture treatments were offered at that time.

Good Response was defined as a 10% or greater increase in isolated active range of motion (ROM) for $\geq 2/7$ arm/leg tests (Hooklying hip Abduction/Adduction; Knee Flexion; Knee Extension; Ankle Dorsiflexion; Shoulder Abduc-

tion; Forearm Supination, Elbow Flexed; or Forearm Supination, Elbow Extended).

Results. A specific neuroanatomical lesion site pattern was identified on brain CT scan for Good Response to real acupuncture in the stroke patients, that is, cases with lesion in $< 1/2$ Motor Pathway areas on CT scan, with moderate-milder paralysis, had Good Response. A specific subcortical white matter area was isolated on CT scan, which is especially important to evaluate regarding extent of lesion (amount of brain damage) in this area, and response to acupuncture. This area, the periventricular white matter (PVWM) area, is located adjacent to the body of the lateral ventricle, and is shown in Figure 1.

Analysis of Data without Brain CT Scan Information

4/10 Good Response, Acute Cases, Real Acptr.

0/6 Good Response, Acute Cases, Sham Acptr. $p < .115$, *ns* (Fischer's exact test)

Analysis of Data with Brain CT Scan Information

(Real and Sham Groups are each subdivided into 2 lesion patterns: $< 1/2$ and $> 1/2$ Motor Pathways Lesion)

3/4 $< 1/2$ Motor Pathways Lesion Pattern, Good Response, Acute Cases, Real Acptr.

0/3 $< 1/2$ Motor Pathways Lesion Pattern, Good Response, Acute Cases, Sham Acptr. $p < .013$

Summary. This controlled study observed that significantly more acute stroke patients with arm/leg paralysis had Good Response following real acupuncture than sham acupuncture, if CT scan lesion site was a variable ($p < .013$). When there was lesion $\leq 1/2$ of the Motor Pathway areas on CT scan (especially the PVWM area as shown in Figure 1), acupuncture was effective. No patients who received sham acupuncture had Good Response, whatever the lesion.

Acupuncture in the Treatment of Arm/Leg Paralysis in Chronic and Acute Stroke

Naeser et al. (1994a) conducted a study on the use of acupuncture in the treatment of arm/leg paralysis in chronic and acute stroke patients. The chronic stroke patients received acupuncture treatment starting after 3 months poststroke; the acute stroke patients, starting at 1-3 months poststroke.

The design included real acupuncture versus no acupuncture. The study was randomized, and double-blind for pre- and postarm/leg motor evaluation by physical therapists. The chronic cases served as their own controls, be-

cause most spontaneous recovery from paralysis occurs before 3 months poststroke; also some chronic cases received no acupuncture treatment. The controls for the acute cases were the sham acupuncture treatments presented in the above study (Naeser et al., 1992).

The subjects included 10 chronic cases, who received real acupuncture (starting 4 months to 10 years poststroke); 3 chronic cases, who received no acupuncture (tested at approx. 6-mo. intervals; starting 2-11 yr. poststroke); and 10 acute cases, who received real acupuncture (starting 1-3 months poststroke); ages 42-74.

A total of 20-40 real acupuncture treatments (over a 2-3 month period) was administered with acupuncture needles and electrical stimulation, as described in the above study under "Real acupuncture" (Naeser et al., 1992). Chronic patients were treated on an outpatient basis. Brain CT scans were obtained at ≥ 2 months poststroke, and analyzed after the study was completed.

Good response was defined as a 10% or greater increase in isolated active range of motion for $\geq 2/7$ arm/leg tests as described in the above study (Naeser et al., 1992).

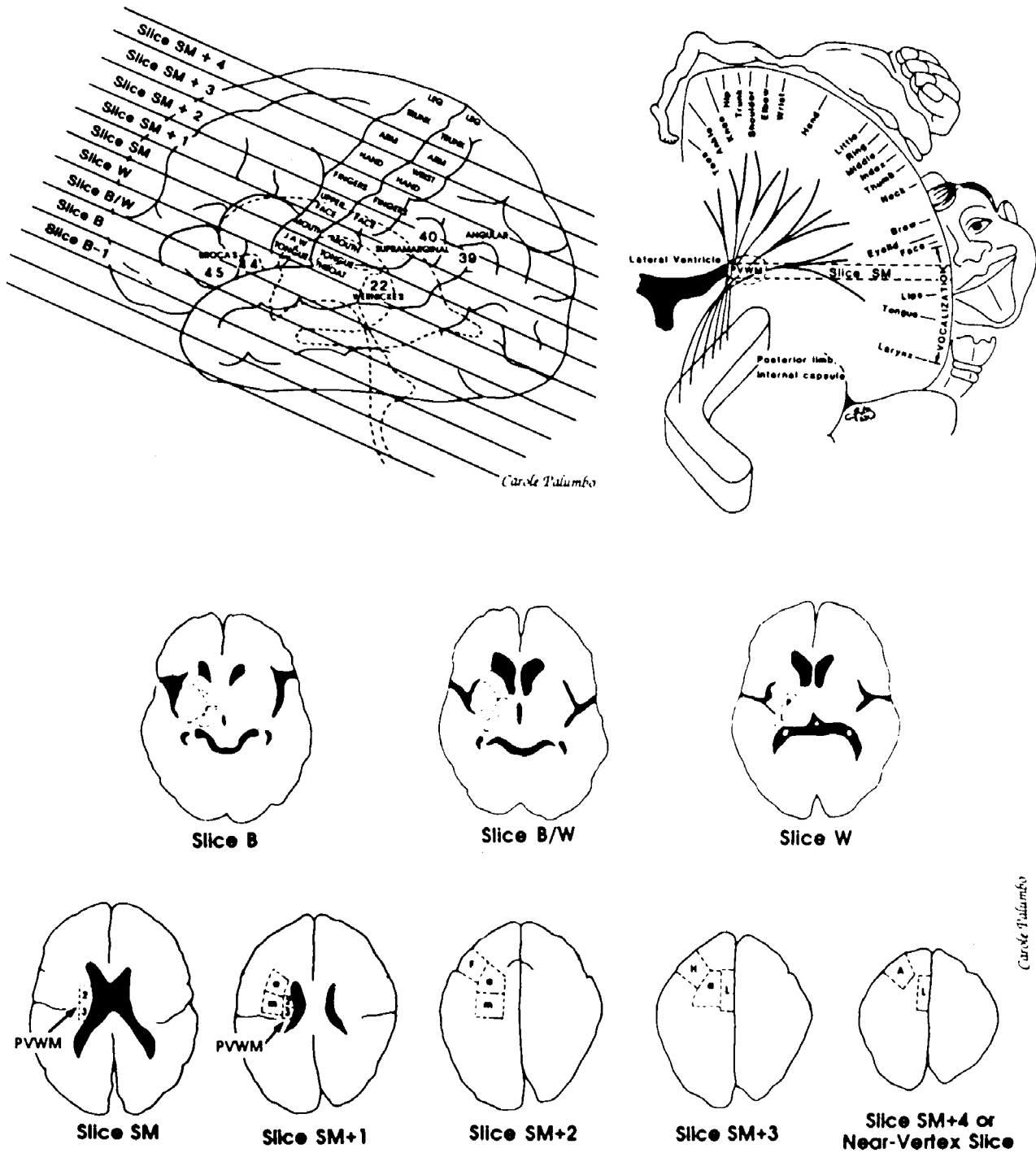


FIG. 1. Lateral, coronal, and cross-sectional diagrams showing location of neuroanatomical areas visually assessed for extent of lesion (amount of infarction) on CT scan, containing, in part, descending pyramidal tract pathways. The deep, subcortical periventricular white matter area (PVWM) is outlined in the upper right coronal diagram and shown on CT scan slices SM and SM + 1 (arrows). The total extent of lesion in the second and third quarters of the PVWM area was related to good response, versus poor response, following real acupuncture treatments. Key to abbreviations: L = leg cortex area; A = arm cortex area; H = hand cortex area; F = fingers cortex area; a = anterior white matter area; m = middle white matter area; 2 = second quarter PVWM; 3 = third quarter PVWM; PL = posterior limb, internal capsule (continues on slices B and B/W). The head of the caudate and putamen were also assessed for extent of lesion. (CT scan angle is approximately 15–20 degrees to the cantho-meatal line). Source: Naeser MA, Alexander MP, Stiassny-Eder D, Galler V, Hobbs J, Bachman D. Real vs. sham acupuncture in the treatment of paralysis in acute stroke patients—A CT scan lesion site study. *Journal of Neurologic Rehabilitation*, 1992;6:163–173.

Results. A specific neuroanatomical lesion site pattern was identified on brain CT scan for Good Response to real acupuncture, that is, stroke patients with lesion in <1/2 Motor Pathway areas, especially the PVWM area, on CT scan (moderate-milder paralysis) had Good Response.

Analysis of Data without Brain CT Scan Information

3/10 Good Response, Chronic Cases, Real Acptr.

0/3 Good Response, Chronic Cases, No Acptr. $p < .419$, *ns* (Fischer's exact test)

Analysis of Data with Brain CT scan Information

(Acptr. and No Acptr. Groups each subdivided into 2 lesion patterns: <1/2 vs. >1/2 Motor Pathways Lesion)

3/3 <1/2 Motor Pathways Lesion Pattern, Good Response, Chronic Cases, Real Acptr.

0/2 <1/2 Motor Pathways Lesion Pattern, Good Response, Chronic Cases, No Acptr. $p < .003$

7/7 <1/2 Motor Pathways Lesion Pattern, Good Response, Chronic & Acute Cases, Real Acptr.

12/13 >1/2 Motor Pathways Lesion Pattern, Poor Response, Chronic & Acute Cases, Real Acptr. $p < .001$

Specific Arm/Leg Tests with Improvement Following Real Acupuncture Treatments

(3 Chronic and 5 Acute Cases, All Good Response Cases, only; see Tables 3 and 4)

Knee Flexion— $p < .02$ (Post 20 Acptr. Tx.'s) $p < .03$ (Post 40 Acptr. Tx.'s)

Knee Extension— $p < .01$ (Post 40 Acptr. Tx.'s)

Shoulder Abduction— $p < .04$ (Post 20 Acptr. Tx.'s) $p < .04$ (Post 40 Acptr. Tx.'s)

Follow-up after Last Acptr. Tx. (n = 5 cases)

2 months post last Acptr. Tx: 83% of the improved tests were stable or again better.

4 months post last Acptr. Tx: 88% of the improved tests were stable or again better.

Summary. This controlled study observed that most Chronic or Acute stroke cases with lesion in <1/2 of Motor Pathways (especially the PVWM area) will have Good Response following 20–40 acupuncture treatments.

Upper Extremity—Acute and Chronic stroke cases with some isolated finger movement after 2 or 3 months poststroke tend to have "Good Response" with acupuncture for the upper extremity (especially shoulder abduction). See Table 3. Cases with no isolated finger movement and a "dead limb" type of upper extremity (after 2 or 3 months poststroke) tend to have "Poor Response" with acupuncture for the upper extremity.

Lower Extremity—Knee flexion and knee extension tend to show the most improvement for the lower extremity (+20% isolated ROM, post 20–40 acupuncture treatments). See Table 4. This is important for walking, stair climbing, and so on.

Acupuncture in the Treatment of Hand Paresis in Chronic and Acute Stroke

Naeser et al. (1994a) conducted a study on the use of acupuncture in the treatment of hand

paresis in chronic and acute stroke patients. The chronic stroke patients received acupuncture treatment starting after 3 months poststroke; the acute stroke patients, starting at 1–3 months poststroke.

The design included real acupuncture versus no acupuncture. The study was randomized, and double-blind for pre- and posthand motor evaluation by occupational therapists. The chronic cases served as their own controls, because most spontaneous recovery from paralysis occurs before 3 months poststroke; also some chronic cases received no acupuncture treatment. No sham acupuncture was performed on the hand, due to difficulty in locating sham points which could be easily needled (many of these points would be directly over bone).

The subjects included 8 chronic cases, who received real acupuncture (starting 6 months to 8.5 yrs. poststroke); 2 chronic cases, who received no acupuncture (tested at approximately 6-month interval, starting 4 yrs. & 12 yrs. poststroke); and 3 acute cases, who received real acupuncture (starting 2 months poststroke); ages 43–72.

A total of 20–40 real acupuncture treatments

TABLE 3. PAIRED *t* TEST RESULTS COMPARING PRE- AND POSTACUPUNCTURE UPPER EXTREMITY TEST SCORES FOR THREE CHRONIC AND FIVE ACUTE PATIENTS

		Pre acptr. tx.	Post 20 tx.'s	Change pre-20 tx.'s	Pre acptr. tx.	Post 40 tx.'s	Change pre-40 tx.'s	Change 20-40 tx.'s
	n	8	8	8	5	5	5	5
Shoulder Abduction	Mean %	32.9	39.5	6.6	39.4	51.0	11.6	3.4
	SD	36.6	42.4	9.8	38.4	47.3	11.9	4.98
	<i>p</i> value	—	—	*.04	—	—	*.04	.10
No. cases improved by at least 10%		—	—	2 of 8	—	—	3 of 5	1 of 5
Supinate Forearm, Elbow Flexed	Mean %	17.4	26.3	9.0	7.8	28.8	21.0	16.6
	SD	36.1	39.2	18.3	17.4	26.9	24.8	28.7
	<i>p</i> value	—	—	.10	—	—	.06	.13
No. cases improved by at least 10%		—	—	2 of 8	—	—	3 of 5	2 of 5

Note. Only patients with Good Response are included. Source: Naeser et al., 1994a.

*Significant at $p < 0.05$ level.

(over a 2-3-month period) were administered with acupuncture needles and electrical stimulation, as described in the above study (Naeser et al., 1992). Chronic patients were treated on an outpatient basis. Brain CT scans were obtained at ≥ 2 months poststroke, and analyzed after the study was completed.

Good Response was defined as improvement

on $\geq 4/6$ timed dexterity and/or finger/hand strength tests.

Results. All hand paresis cases (acupuncture or no acupuncture cases) had lesion in $< 1/2$ Motor Pathway areas on CT scan (milder paralysis), that is, appropriate lesion pattern for potentially "Good Response" to acupuncture

8/8 Good Response, Chronic Cases, Real Acptr.

0/2 Good Response, Chronic Cases, No Acptr. $p < .022$

3/3 Good Response, Acute Cases, Real Acptr.

TABLE 4. PAIRED *t* TEST RESULTS COMPARING PRE- AND POSTACUPUNCTURE LOWER EXTREMITY TEST SCORES FOR THREE CHRONIC AND FIVE ACUTE PATIENTS

		Pre acptr. tx.	Post 20 tx.'s	Change pre-20 tx.'s	Pre acptr. tx.	Post 40 tx.'s	Change pre-40 tx.'s	Change 20-40 tx.'s
	n	8	8	8	5	5	5	5
Knee Flexion	Mean %	16.9	35.5	18.6	22.4	44.6	22.2	4.8
	SD	19.8	34.9	21.3	22.2	40.0	19.6	15.7
	<i>p</i> value	—	—	*.02	—	—	*.03	<i>ns</i>
No. cases improved by at least 10%		—	—	5 of 8	—	—	3 of 5	1 of 5
Knee Extension	Mean %	47.9	65.8	18.9	53.2	81.0	27.8	18.2
	SD	37.8	31.2	32.4	24.3	14.5	17.1	21.8
	<i>p</i> value	—	—	.08	—	—	**01	.06
No. cases improved by at least 10%		—	—	5 of 8	—	—	5 of 5	3 of 5

Note. Only patients with Good Response are included. Source: Naeser et al., 1994a.

*Significant at $p < 0.05$ level.

**Significant at $p < 0.01$ level.

Specific Hand Tests With Improvement Following Real Acupuncture Treatments (See Tables 5 and 6 and Figure 2)

8 Chronic Cases Only

- Time to turn over 5 index cards— $p < .05$
- Time to pick up 6 small common objects— $p < .05$
- Finger Tip Pinch Strength— $p < .04$
- Three-Jaw Chuck Strength— $p < .01$
- Lateral Pinch Strength:
- Grip Strength:

8 Chronic Cases and 3 Acute Cases

- $p < .04$
- $p < .01$
- $p < .02$
- $p < .002$
- $p < .04$
- $p < .03$

Correlation between number of Acptr. treatments and number of improved hand tests: $r = 0.725, p < .01, n = 11.$

Follow-up After Last Acptr. Tx. (n = 6 cases)

- 2 months post last Acptr. Tx: 72% of the improved tests were stable or again better.
- 4 months post last Acptr. Tx: 47% of the improved tests were stable or again better.

treatment. All chronic and acute hand paresis cases who received acupuncture treatment had Good Response.

Summary. This controlled study observed that all stroke cases who had hand paresis had Good Response following 20–40 acupuncture treatments, even if the acupuncture treatments were started several years poststroke, including as late as 6–8 years poststroke. Stroke pa-

tients who have a weak and clumsy hand, with some preserved isolated finger movement poststroke, are the best candidates for acupuncture treatments. It is likely that most, if not all, of these patients will have Good Response.

Summary, Naeser et al., Three Acupuncture Studies (1992, 1994a, 1994b)

All stroke cases ($n = 18$) who had lesion on brain CT scan in $<1/2$ of the Motor Path-

TABLE 5. PAIRED *t* TEST RESULTS COMPARING PRE- AND POSTACUPUNCTURE TIMED DEXTERITY TEST SCORES FOR SEVEN CHRONIC STROKE PATIENTS WITH RIGHT-HAND PARESIS

		<i>Pre acptr. tx.</i>	<i>Post 20 tx.'s</i>	<i>Change pre-20 tx.'s</i>	<i>Pre acptr. tx.</i>	<i>Post 40 tx.'s</i>	<i>Change pre-40 tx.'s</i>	<i>Change 20-40 tx.'s</i>
	n	7	7	7	5	5	5	5
Turn, Over 5 Index Cards	Mean sec.	19.3	16.1	-3.1	19.0	12.0	-7.0	-2.2
	SD	15.7	13.4	5.2	16.4	9.9	7.1	2.8
	Min./Max.	5/47	6/36	1/-11	5/47	5/29	0/-18	0/-7
	<i>p</i> value			.08			*.05	4.19
No. cases improved by at least 1 sec.		4 of 7			4 of 5			4 of 5
Pick Up 6 Small Common Objects†	Mean Sec.	19.5	16.3	-3.2	15.8	12.0	-3.8	-2.0
	SD	12.1	9.1	3.7	9.7	7.4	6.5	3.9
	Min./Max.	7/39	7/31	2/-8	7/26	7/23	2/-13	2/-7
	<i>p</i> value			*.05			.17	.37
No. cases improved by at least 1 sec.		2 of 4			4 of 6			3 of 4

†Missing data for this test for one additional subject; thus, $n = 6$ for pre- versus post-20 Tx.'s, and $n = 4$ for pre- versus post-40 Tx.'s. Source: Naeser et al., 1994b.

*Significant at $p < 0.05$ level.

TABLE 6. PAIRED *t* TEST RESULTS COMPARING PRE- AND POSTACUPUNCTURE HAND STRENGTH TEST SCORES FOR EIGHT CHRONIC STROKE PATIENTS WITH RIGHT-HAND PARESIS

		<i>Pre</i> <i>acptr.</i> <i>tx.</i>	<i>Post</i> <i>20</i> <i>tx.'s</i>	<i>Change</i> <i>pre-20</i> <i>tx.'s</i>	<i>Pre</i> <i>acptr.</i> <i>tx.</i>	<i>Post</i> <i>40</i> <i>tx.'s</i>	<i>Change</i> <i>pre-40</i> <i>tx.'s</i>	<i>Change</i> <i>20-40</i> <i>tx.'s</i>
	n	8	8	8	5	5	5	5
Tip Pinch	Mean lbs.	6.4	8.3	1.9	9.2	12.2	3.0	2.4
	SD	4.1	3.7	3.5	1.1	1.9	2.7	2.7
	Min./Max.	0/10	0/12.1	-1.5/9	8/10	10/15	0/7	-2.1/5
	<i>p</i> value			.09			*.04	.06
No. cases improved by at least 1 lb.				4 of 8			4 of 5	4 of 5
3-Jaw Chuck	Mean lbs.	11.9	14.9	3.1	14.6	17.0	2.4	-0.2
	SD	6.3	5.1	2.9	8.0	2.2	3.4	3.6
	Min./Max.	0/21	0/22	0.9/9.5	8/21	14/20	-1/6	-4/5
	<i>p</i> value			**01			.09	.45
No. cases improved by at least 1 lb.				7 of 8			3 of 5	2 of 5
Lateral Pinch	Mean lbs.	15.8	16.6	0.73	19.4	19.9	0.5	0.8
	SD	7.2	5.3	2.5	6.5	4.2	2.7	1.4
	Min./Max.	6.5/24.5	10/23	-4/3.9	8.2/24.5	12.5/22	-2.5/4.3	-1/2.5
	<i>p</i> value			.22			.36	.13
No. cases improved by at least 1 lb.				4 of 8			4 of 5	4 of 5
Grip Strength	Mean lbs.	48.0	56.6	8.6	64.0	64.5	0.4	0.6
	SD	31.0	25.0	18.0	27.7	24.9	5.2	4.1
	Min./Max.	14.3/96.8	23.1/90	-6.8/51.7	24.2/96.8	27.5/88.7	-8.1/5.5	-6/5.5
	<i>p</i> value			.11			.43	.38
No. cases improved by at least 1 lb.				6 of 8			3 of 5	1 of 5

Source: Naeser et al., 1994b.

*Significant at $p < 0.05$ level; **significant at $p < 0.01$ level.

way areas (especially the PVWM area) who had (moderate-milder paralysis) had Good Response following 20-40 acupuncture treatments (i.e., 7/7 arm/leg cases with this lesion pattern; chronic and acute cases); and 11/11 hand paresis cases with this lesion pattern (chronic and acute) had Good Response. Almost all stroke cases (12/13) who had lesion on brain CT scan in $>1/2$ of the Motor Pathway areas (severe paralysis) had Poor Response following 20-40 acupuncture treatments. Across all 3 studies, a total of 31 cases were treated; 19/31 cases (61%) had Good Response.

Stroke patients who have lesion in $<1/2$ of the Motor Pathway areas on CT scan, with moderate-milder paralysis, are good candidates to show some improvement following 20-40 acupuncture treatments. Stroke patients who have no arm/leg paralysis, but only a weak and clumsy hand, with some preserved isolated finger movement poststroke, are the

best candidates for acupuncture treatment and will show the most dramatic improvement. A chronic CT scan obtained after 2 months post-stroke is helpful to evaluate which chronic stroke patients are likely to have improvement following acupuncture treatments.

Functional Outcome and Cost-Effectiveness of Acupuncture in the Treatment of Paralysis in Acute Stroke

Johansson et al. (1993) conducted a study on the use of acupuncture in the treatment of paralysis in acute stroke patients. The design included acupuncture versus no acupuncture. The study was randomized.

The subjects included 38 stroke patients in the acupuncture group (who received acupuncture plus physical therapy and occupational therapy), starting at 4-10 days poststroke, mean age 76; and 40 stroke patients in the no acupuncture

*By the poolside you see a basin of water by the side. The water
spilled over the sink. The lady is drying the bed.*

PRE- ACUPUNCTURE
2 MPO

*The lady is washing dishes. The sink
is overflowing. The boy is taking cookies from the cookie
jar, The girl is watching. The boy is falling from the chair*

POST- 20 REAL ACUPTR. TX.
3 MPO

*The boy and girl are stealing cookies. The lady is
washing dishes. The window is open. The water is spilling
on the floor.*

15 MONTHS POST LAST ACUPTR. TX.

FIG. 2 (top). Handwriting samples written with the right hand, pre- and post- 20 acupuncture treatments, and 15 months after the last acupuncture treatment, for case KL, age 60, who entered the study at 2 months poststroke. He was not receiving occupational therapy or physical therapy during, or after, the course of the acupuncture treatments.

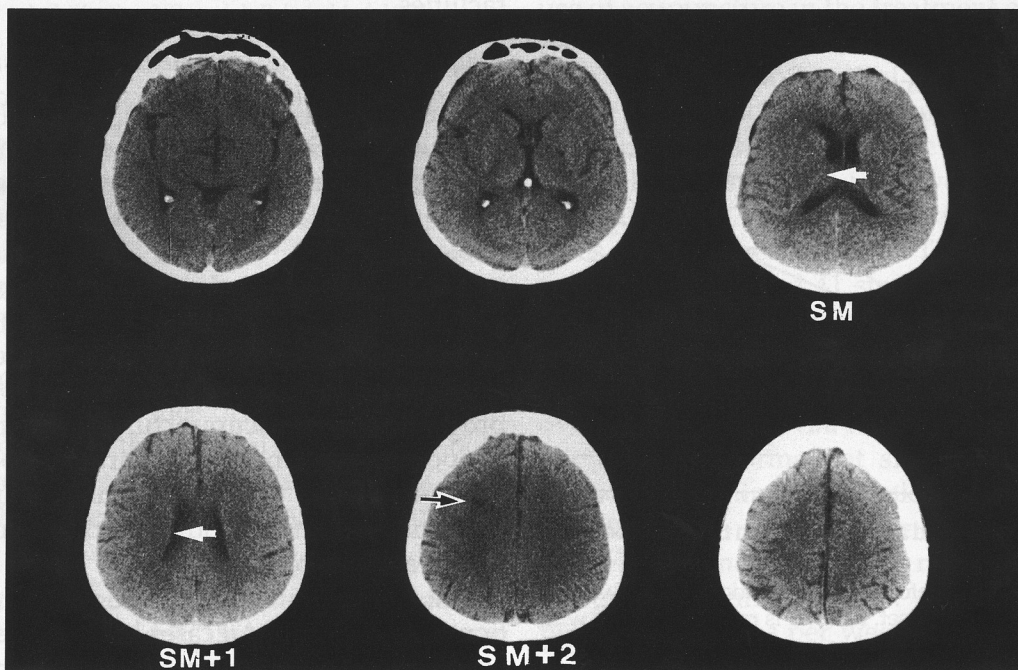


FIG. 2 (bottom). CT scan for case KL; lesion is present in the subcortical, anterior white matter area, on slice SM + 2 (black and white arrow); the PVWM area on slices SM and SM + 1 is completely spared (white arrows). CT scan is 3 months poststroke. Source: Naeser MA, Alexander MP, Stiassny-Eder D, Lannin LN, Bachman D. Acupuncture in the Treatment of Hand Paresis in Chronic and Acute Stroke Patients-Improvement Observed in All Cases. *Clinical Rehabilitation* 1994b;8:127-41.

group (who received only physical therapy and occupational therapy), starting at 4–10 days poststroke, mean age 75. The patients were tested at the same time intervals (baseline at 1 week; and at 1 and 3 months later).

A total of 20 acupuncture treatments (2 times per week, for 10 weeks) was administered to

the patients in the acupuncture group. Acupuncture needles and electrical stimulation on the needles was used.

Results. The acupuncture group recovered faster and to a larger extent than the no-acupuncture group:

Walking— $p < .01$ at 1 month and $p < .004$ at 3 months

Balance— $p < .001$ at 1 month and at 3 months (See Figure 3.)

Activities of Daily Living (ADL)— $p < .0001$ at 3 months and at 12 months

Quality of Life, Mobility and Emotion— $p < .01$ and beyond at 3, 6, and 12 months (See Figure 4.)

Percent living at home, 12 months poststroke, Acupuncture Group: 89%

Percent living at home, 12 months poststroke, No-Acupuncture Group: 66%

The acupuncture group had fewer days in nursing homes and rehabilitation facilities, with a savings of \$26,000 per patient treated with acupuncture. A mean of \$56,000 was spent per patient for the no-acupuncture group versus only \$30,000 for the acupuncture group.

Summary. This controlled study observed that when acupuncture is initiated at 4–10 days

poststroke, and continued twice a week for 10 weeks, there is significantly better outcome for these stroke patients at 1, 3, and 12 months later. Significantly better improvement was observed in walking, balance, activities of daily living and quality of life, mobility, and emotion. There was an estimated savings of \$26,000 per stroke patient treated with acupuncture beginning in the acute stage poststroke, due to fewer days in nursing homes and rehabilitation facilities.

Acupuncture in the Treatment of Paralysis in Acute Stroke (Within 36 Hours Poststroke)

Hu et al. (1993) conducted a study on the use of acupuncture in the treatment of paralysis in acute stroke patients (within 36 hours poststroke).

The design included acupuncture versus no acupuncture. It was a randomized study. The acupuncture group received acupuncture plus supportive treatment, standard rehabilitation program. The no acupuncture group received supportive treatment, standard rehabilitation program only. "No sham acupuncture was used on the control group for ethical and practical reasons" (p. 107).

The subjects included 30 acute stroke patients, 46–74 years. All cases had suffered a first stroke (ischemic); no acute hemorrhage cases were included. All patients had middle cerebral artery stroke only, with resulting limb weakness.

Acupuncture treatments were initiated

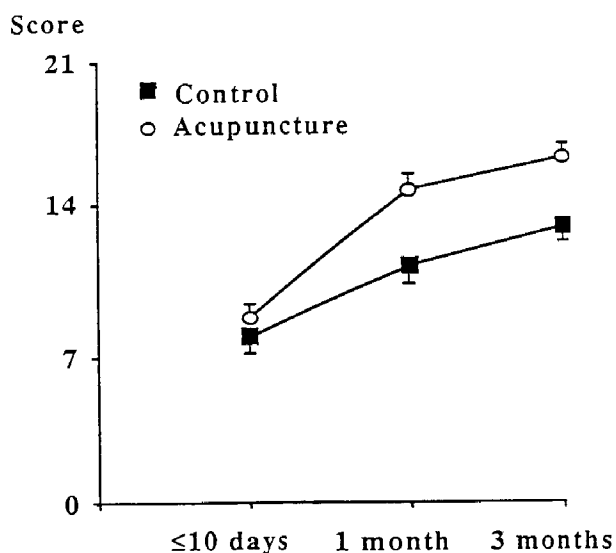


FIG. 3. Balance before randomization and 1 and 3 months after stroke onset. Balance is rated on 7 items with maximal score 21 = normal balance. Mean values \pm SEM. Controls $n = 40$, acupuncture group $n = 38$ at the start of the study; at 3 months $n = 37$ and 33, respectively. $p < 0.001$ for differences between the groups at 1 and 3 months (Mann-Whitney test). Source: Johansson BB. Has sensory stimulation a role in stroke rehabilitation? *Scand J Rehab Med* 1993, Suppl 29:87–96.

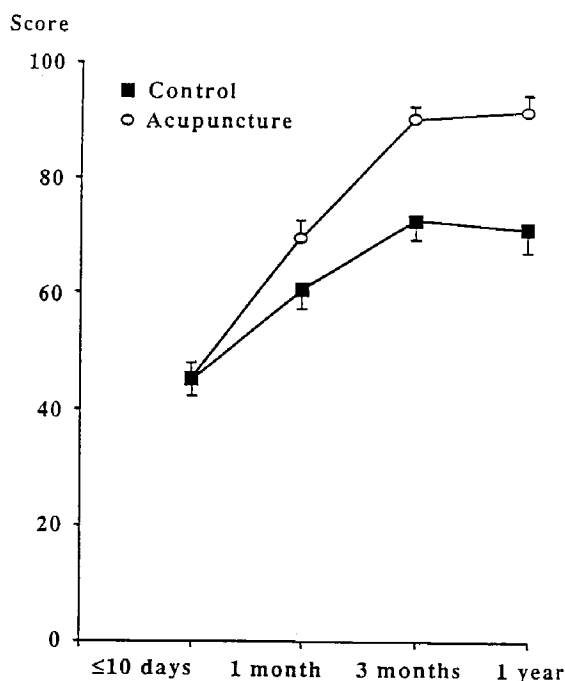


FIG. 4. Activity of daily living (Barthel's Index) in stroke patients (median age 76 years). A score of 100 means that the patient is completely independent in ADL activities: Mean values \pm SEM. $n = 40$ (controls) and 38 (acupuncture group) at the start of the study; corresponding number of patients at 12 months were 32 and 28, respectively. $p < 0.05$ for difference between groups at 1 month; $p < 0.0001$ for difference at 3 and 12 months (Mann-Whitney test). Source: Johansson BB. Has sensory stimulation a role in stroke rehabilitation? *Scand J Rehab Med* 1993, Suppl 29:87-96.

within 36 hours poststroke in the acupuncture group. Patients were treated 3 times a week, for 4 weeks. Patients were treated with acupuncture needles plus electrical stimulation applied to the needles. Needles were inserted into scalp acupuncture areas ("the motor cortex line") and body acupuncture points.

Evaluation measures. A neurological deficit score and an Activities of Daily Living (ADL) score based on the Barthel Index were both computed. Patients were tested at day 7 poststroke (Baseline); and at 1 month and 3 months later.

Results. A significantly better neurologic outcome was observed in the acupuncture group

(vs. the no acupuncture group), at 1 month poststroke ($p = .02$), and at 3 months poststroke ($p = .009$).

In addition, each group was subdivided into two subgroups—a Mild-Moderate Subgroup (neurological deficit scores >24); and a Severe Subgroup (neurologic deficit scores ≤ 24), with total paralysis of arm and/or hand and central-type of facial palsy.

Only the Severe Subgroup treated with acupuncture showed significantly better Neurologic deficit scores at 1 month ($p = .009$) and at 3 months ($p = .013$), than the Severe Subgroup not treated with acupuncture.

In addition, the Severe Subgroup treated with acupuncture showed significantly better ADL functional scores at 1 month ($p = .003$), and at 3 months (no p level provided, $p = .109$), than the Severe Subgroup not treated with acupuncture.

Summary. The authors observed that acupuncture is especially useful in the treatment of stroke patients who present with more severe paralysis in the acute phase of stroke (<36 hours poststroke).

Zhang et al. (1987) conducted a study on the use of acupuncture in the treatment of arm/leg paralysis in stroke patients at the Hua Shan Hospital, Shanghai Medical University, China.

The design included acupuncture versus no acupuncture. The acupuncture group included 53 stroke cases age 12 to 80 years (76%, >50 years of age); 38 cases cerebral infarction; 15 cases cerebral hemorrhage. The no acupuncture group included 41 stroke cases of similar ages and etiology admitted to the same hospital in 1978-80.

Muscle strength evaluation was carried out over a 4-week interval. Muscle strength evaluation was performed at six joints: shoulder, elbow, wrist, hip, knee, ankle. Mild deficit = ≥ 4 ; Moderate = 3; Severe = ≤ 2 .

The acupuncture group received 24 acupuncture treatments (with some electroacupuncture), 6 times per week, for 4 weeks.

Results.

	Acptr. Group	No Acptr. Group
Markedly Effective (Increased muscle strength 2 grades)	13/53 (25%)	12/41 (29%)
Effective (Increased muscle strength 1-2 grades)	31/53 (58%)	14/41 (34%)

Ineffective (Increased muscle strength < 1 grade)	9/53 (17%)	15/41 (37%)	$p < .05$
	<i>Time Poststroke When Acptr. Started</i>		
	<i><3 Months</i>	<i>3-12 Months</i>	
Markedly Effective and Effective	37/40 (92.5%)	7/13 (54%)	$p < .01$

Summary. The overall "Markedly Effective and Effective" rate was 83% in the acupuncture group, and 63% in the no acupuncture group ($p < .05$). The authors recommend that acupuncture treatment be started as soon as possible in the acute stage of stroke (after the patient is medically stable).

Acupuncture Treatment for Paralysis Due to Acute Cerebral Hemorrhage

Li et al. (1989) conducted a study on the use of acupuncture in the treatment of paralysis due to acute cerebral hemorrhage. The design was randomized for administering two different types of acupuncture. There were no controls who received sham acupuncture or no acupuncture. Group 1 patients ($n = 46$) were treated with acupuncture needles inserted into head acupuncture points, GV 16 and GV 15 (located on the midline at the base of the skull; the medulla is located deep to these points); plus body points. Group 2 patients ($n = 46$) were treated with acupuncture needles inserted into body points, only.

The subjects included 92 cases of acute stroke due to cerebral hemorrhage. The patients were

age 26-85 years. The diagnosis of acute cerebral hemorrhage was confirmed with bloody CSF, and/or presence of blood on brain CT scan. A total of 59 cases had complete hemiplegia when the study was initiated; and 33 cases had partial hemiplegia.

The duration of stroke when acupuncture treatment was initiated was the following:

- <24 hours: $n = 37$
- 1-2 days: $n = 23$
- 3-6 days: $n = 23$
- >6 days: $n = 9$

A total of 42-56 acupuncture treatments were administered on a daily basis; after 14 treatments, there was a 3-day respite. Group 1 received acupuncture treatment on two acupuncture points at the midline base of the skull (GV 16 and GV 15) on alternate days, plus 6-10 body points. Electrical stimulation was used on body points after the patient was stable. Group 2 received acupuncture treatment only on body points. Electrical stimulation was used on body points after the patient was stable.

Evaluation. Patients were rated using a 100-point total scale:

- Cured: 98 points = Practically complete recovery
- Essentially cured: 90-97 points = Able to manage own minor personal activities
- Markedly Effective: an increase of >30 points
- Effective: an increase of 15-19 points
- Ineffective: an increase of <15 points

Results.

	<i>Group 1 (Head Acptr. Points at Base of Skull, GV 16 and GV 15, Plus Body Points)</i>	<i>Group 2 (Body Points Only)</i>
Cured	15 (32.6%)	2 (4.4%)
Essentially Cured	8 (17.4%)	7 (15.2%)
Markedly Effective	15 (32.6%)	8 (17.4%)
Effective		5 (10.9%)
Ineffective		10 (21.7%)
Died	8 (17.4%)	14 (30.4%)
Cured and Essentially Cured	50%	19.6% $p < .01$

Summary. The authors suggest that early initiation of acupuncture at the base of the skull using acupuncture points GV 16 and GV 15, is helpful to shorten the course of treatment and enhance the therapeutic effect. In this series, 37 patients with acute cerebral hemorrhage had initiation of acupuncture within 24 hours of onset. Most bleeding is completed within 4 hours in acute cerebral hemorrhage cases. Therefore, acupuncture treatment is not likely to increase the bleeding after the first 4–6 hours in these cases. The authors of this study have needled GV 16 and GV 15, a total of 9,193 case times, without a single mishap and highly recommend their use in acute cerebral hemorrhage stroke cases.

Acupuncture in the Treatment of Chronic Quadriplegia Due to Brainstem Stroke

Dr. Toshikatsu Yamamoto (M.D., Ph.D.) has developed a new scalp acupuncture technique different from that used in China, the Yamamoto New Scalp Acupuncture (YNSA). In a book he has written (Yamamoto & Maric-Oehler, 1991), he has presented a well-described anecdotal case report (with MRI scan) of a woman treated with YNSA for chronic quadriplegia due to a brainstem stroke.

The patient is a 36-year-old woman who had suffered a stroke at the pons level of the brainstem, 6 years prior to initiation of Dr. Yamamoto's New Scalp Acupuncture (YNSA) treatments.

Dr. Yamamoto first observed this patient in a medical facility in Germany, 6 years following stroke onset. At that time, he decided to have her flown to his hospital in Japan, where he could treat her for several months, using his YNSA treatments.

The MRI scan was obtained in Japan, 6 years poststroke. The MRI scan showed extensive lesion in $>1/2$ of the left pons area; and only small, patchy lesion in $<1/2$ of the right pons area. Some MRI scan images are provided in the case summary. Figures 5 and 6.

During the 6 years following the stroke, and when the patient first arrived in Japan, she had quadriplegia (paralysis of all four limbs), and required total nursing care, including feeding, dressing, bathing, and so on.

Dr. Yamamoto treated the patient 6 days a week, for 9 months, using his YNSA technique.

Brief description of YNSA. The YNSA technique is completely different from the Chinese scalp acupuncture technique where needles are inserted along "the motor cortex line" contralateral to the hemiplegia. The YNSA technique makes use of small somatotopic homunculi which are represented on the forehead, and temple areas. Dr. Yamamoto has explained this technique in the above-mentioned book (in German). He is in the process of writing a new version of the book, in English.

The YNSA technique is somewhat faster and easier to use than the Chinese scalp needle technique, and is too complex to explain in detail here. The needles are inserted into the forehead or scalp region, and may be left in place for several hours (even all day), during which time the patient can take part in physical therapy, etc. (with the needles in place). The needles are very small (only 1/2 inch in length, Japanese type). Little manipulation is required, and electrical stimulation is optional.

If the needles have been inserted into the appropriate locations on the head, increased movement in a paralyzed limb may be evident within only a few minutes following insertion. Repeated treatments are necessary, however, to obtain lasting improvement. I have observed Dr. Yamamoto using the YNSA technique on stroke patients in Europe and in the United States. I have observed improvement in chronic stroke patients with paralysis treated with the YNSA technique.

Results. After 2 months of treatment by Dr. Yamamoto, using the YNSA technique, this patient was able to begin to move her left hand, arm and leg, for the first time in 6 years. A sample of her handwriting at that time is provided in the case summary. See Figure 5, Top.

After 9 months of treatments by Dr. Yamamoto, using the YNSA technique, the patient was able to feed herself with her left hand, and no longer required total nursing care. A sample of her handwriting at that time is also provided in the case summary. See Figure 5, Bottom. She then returned to her family in Germany, where she no longer required total nursing care.

Ich bin
 sehr
 dankbar
 für
 die
 Behandlung
 durch
 Sie
 und
 hoffe
 bald
 wieder
 nach
 Deutschland
 zu
 kommen

After 2 months of acupuncture treatments, the patient began to regain voluntary movement on the left side of her body. This is an example of her handwriting (left hand) after 2 months of acupuncture. Prior to the acupuncture, she could not write at all, for the 6 years poststroke.

When I came to Japan I could move nearly
 nothing. Now Doctor Yamamoto makes
 acupuncture every day, and I can move my
 feet ~~and~~ my left leg, my left hand and my
 left arm a little bit. In december I'll go
 back to Germany, because I want to see my children.
 I would like to come back to Japan in
 January, so that the acupuncture can go on.

Handwriting sample after 9 months of acupuncture treatments. At this time, the patient no longer required total nursing care, and was flown back to Germany.

FIG. 5. Case example of a stroke patient who had paralysis in all four limbs (quadriplegia) for 6 years following a stroke (pons level of the brainstem). Dr. Yamamoto brought the patient to his hospital in Japan, where he treated her with his Yamamoto New Scalp Acupuncture (YNSA). Source: Yamamoto T & Maric-Oehler W. *Yamamoto Neue Schadelakupunktur YNSA* 1991; Germany, Freiburg im Breisgau, CHUN-JO Verlag. (In German)

A stroke patient treated with Dr. Yamamoto's "New Scalp Acupuncture" (YNSA) technique.

The patient was 36 years old.

She lived in Germany.

For 6 years following the stroke, she had quadriplegia. She needed total nursing care, including feeding, dressing, bathing, etc.

Dr. Yamamoto flew her to his hospital in Japan. He treated her with his YNSA technique, for 9 months.

After the first two months of YNSA treatment, she was able to begin to move her left hand, arm and leg.

After 9 months of YNSA treatment, she was able to feed herself, and no longer required total nursing care. This dramatic improvement (after six years of requiring total nursing care) greatly reduced the cost of her future care and treatment back in Germany.

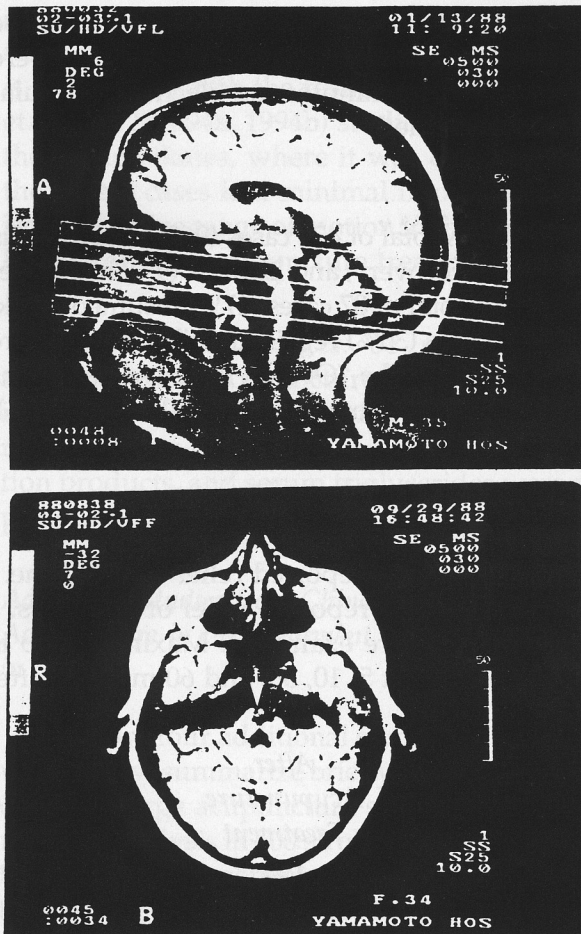


FIG. 6. T₁ MRI scan performed at 6 years poststroke, for the patient presented on the previous page.

TOP: Mid-sagittal view of the brain, showing an area of infarction at the pons level of the brainstem.

BOTTOM: Transaxial view, showing only small, patchy lesion in less than half of the right pons area (white arrow); and extensive lesion in more than half of the left pons area (black and white arrow).

The improvement the patient experienced on the left side of her body following acupuncture, was compatible with less extensive lesion in the right pons area (white arrow). The lack of improvement the patient experienced on the right side of her body following acupuncture, was compatible with more extensive lesion in the left pons area (black and white arrow).

These results are compatible with results of the Naeser, et al., acupuncture studies (1992, 1994a, and 1994b), where better response to acupuncture was observed in patients who had lesion in less than half of a Motor Pathway area. Source: Yamamoto T & Maric-Oehler W. *Yamamoto Neue Schadelakupunktur YNSA* 1991; Germany, Freiburg im Breisgau, CHUN-JO Verlag. (In German)

Although both sides of the body were treated using the YNSA technique, Dr. Yamamoto observed improvement only on the left side of the body. These acupuncture results are compati-

ble with the results of the CT scan lesion site studies by Naeser et al. (1992, 1994a, 1994b). Thus, there was some recovery of movement on the left side of the body, and only small, patchy lesion was present in $<1/2$ of the Motor Pathway areas of the right pons. There was no recovery of movement on the right side of the body, however, and extensive lesion was present in $>1/2$ of the Motor Pathway areas of the left pons. Thus, there was good response to acupuncture, on the side of the body where paralysis was due to lesion in $<1/2$ of the Motor Pathway areas; but there was poor response to acupuncture on the side of the body where paralysis was due to extensive lesion in $>1/2$ of the Motor Pathway areas.

In addition to showing that long-term YNSA treatment can be helpful in the treatment of paralysis in chronic stroke, these results support the notion that neuroanatomical information from chronic CT scan or MRI scan is helpful in understanding the outcome, when acupuncture is used to treat paralysis in stroke patients.

Summary. This anecdotal case report shows that a special scalp acupuncture technique from Japan (YNSA) was effective in improving the 6-year, severe paralysis of four limbs, in a patient who had had a brainstem stroke at the level of the pons. It required 9 months of almost daily YNSA treatments, but the outcome level of voluntary movement of one side of the body, totally changed the patient's needs for nursing care, by removing the need for total nursing care.

Acupuncture in the Treatment of Other Disorders Associated with Stroke

Sun et al. (1985) conducted a study on the use of acupuncture in the treatment of stroke patients. In addition to studying the effect of acupuncture treatment on paralysis, the authors studied its effect on the treatment of headache, dizziness, and hypertension in stroke patients, as well as its effect on some blood chemistries.

The design was anecdotal; there were no controls. The subjects included 500 stroke cases, all inpatients. The etiologies were as follows: is-

chemic CVA, $n = 362$; hemorrhagic CVA, $n = 104$; subarachnoid hemorrhage and cerebrovascular malformation, $n = 34$.

Acupuncture treatments were initiated within 2 hours poststroke, up to 6 months poststroke. Patients received 45 days of acupuncture treatments. No medication or other therapy was used during the course of acupuncture treatments.

Acupuncture needles were used only on the scalp (inserted in a straight line from GV 20 to GB 7; similar to, but not the same as "the mo-

tor cortex line" used frequently in Chinese scalp needle acupuncture). The needles were retained for 30 minutes; no electrical stimulation was applied.

Results. A total of 478 cases (96%) had various degrees of recovery; and 22 cases (4%) had no response. A total of 87 cases (17%) resumed work; and 151 cases (30%) regained ability to take care of themselves. The "Overall Effective Rate" was stated by the authors to be 238/500 cases (47%).

Additional Substudies

Treatment of Headache in Stroke Patients: 134/143 cases (94%) reported relief of headache.

Treatment of Dizziness in Stroke Patients: 117/131 cases (89%) reported relief of dizziness.

Treatment of Hypertension in Stroke Patients: 30 patients were examined. Maximal drop in blood pressure occurred 30 minutes after treatment (measured at 5, 10, 30, and 60 minutes after treatment).

	Before Acupuncture Treatment	After Acupuncture Treatment	Change (SD)
Mean Systolic Pressure	201	184	17 (2.7)
Mean Diastolic Pressure	110	106	4 (0.8)

Effect on Hemorrhology: 20 patients were examined. Significant reductions ($p < .01$ and $p < .05$) were observed in the following areas:

	Before Acupuncture Treatment (SD)	After Acupuncture Treatment (SD)
Hematocrit	50 (2.08)	40.72 (0.98)
Plasma Viscosity	5.21 (0.903)	3.99 (0.98)
Reduced Viscosity of Whole Blood	10.55 (2.59)	7.81 (0.28)

The authors suggest that acupuncture is helpful in the treatment of stroke patients in part, because it decreases blood viscosity and aggregation of cells.

Summary. This anecdotal study suggests that acupuncture is not only helpful in the treatment of paralysis in approximately 47% of stroke patients, but also helpful in the treatment of headache, dizziness, and hypertension in stroke patients, as well as having a positive effect on decreasing blood viscosity and aggregation of cells.

Qi et al. (1986) conducted an acupuncture study in the treatment of paralysis in stroke pa-

tients where blood chemistry studies were also performed on some of the patients before and after a series of acupuncture treatments.

The subjects included 100 stroke cases, age 25–80 years. The acupuncture treatments were started at <6 months poststroke in most cases ($n = 97$), and >6 months poststroke in 3 cases. The patients received 45–54 days of daily acupuncture treatments. Only body acupuncture points were used, without electrical stimulation.

Results. Overall, 51% of the cases were "Cured," and the "Overall Effective" rate was 97%. The "Cured" rate was 86% for 30 mild

cases; 49% for 49 moderate cases; and only 4.8% for 21 severe cases. The low rate for severe cases is compatible with the results from the Naeser et al. (1992, 1994a, 1994b) studies performed in the United States, where it was observed that the severe cases had minimal improvement in isolated active range of motion in the paralyzed limbs from the acupuncture treatments.

Hemorheological indices. 31 patients were studied before acupuncture treatments were initiated, and after 45 days of acupuncture treatments. Decreases in fibrinogen, fibrin degradation products, and serum triglycerides were reported ($p < .05$).

Additional Studies from China Using Acupuncture in the Treatment of Paralysis in Stroke

There are four additional studies from China, which I now summarize briefly. Wen (1977) conducted a large acupuncture study on the treatment of paralysis in 500 stroke patients (cerebral thrombosis). All patients received acupuncture treatments. Scalp needle Acupuncture on "the motor cortex line" was used; the number of acupuncture treatments was not specified.

Results.

	Cases Treated <3 Months Poststroke	Cases Treated >3 Months Poststroke
Achieved Functional Recovery	145/304 (47.6%)	45/196 (23%)

Summary. The overall rate of positive outcome was 47% when acupuncture treatment was initiated at <3 months poststroke; 23%, >3 months. The authors recommend starting acupuncture as soon as possible following stroke.

Zheng (1981) conducted an acupuncture study in the treatment of paralysis in stroke patients in China. (The article was published only in Chinese; it was translated by D.F. Bensky, D.O., O.M.D. and T. Kaptchuk, O.M.D., Lic., Ac., 1982.) A total of 316 stroke cases were treated; all patients received acupuncture treatment.

Two types of acupuncture treatments were administered. Group 1 patients received electro scalp needle acupuncture only, $n = 109$ cases. Group 2 patients received electro scalp needle acupuncture plus body acupuncture, $n = 207$ cases. The number of treatments was not specified.

Results.

	Tx. Started < 1 Month	Basically Recovered Cases			Overall
		1 Month-1 Year	1 Year-5 Years	>5 Years	
Group 1	3/4 (75%)	32/42 (76%)	22/46 (48%)	6/17 (35%)	58%
Group 2	8/10 (80%)	73/83 (88%)	61/85 (72%)	18/29 (62%)	77%

Summary. The authors recommend that scalp needle acupuncture plus body acupuncture be combined in the acupuncture treatments. They further recommend that acupuncture treatment should be used in addition to physical therapy.

Chen and Fang (1990) conducted an acupuncture study with 108 cases of hemiplegia due to stroke, using the same design and same stroke patients treated in Zhang et al. (1987). There were 53 cases in the acupuncture group, and 41 cases in the no-acupuncture group. This report differed from the previous report, because CT scans were included.

Results. The brain CT scan analysis was not appropriate, because no information was provided regarding exactly when poststroke the CT scans were obtained. Many were obtained during the acute phase poststroke. The exact borders of an area of brain infarction on CT scan are not stable and well visualized until 2-3 months poststroke. Acute CT scans cannot be used for exact lesion site analysis (Palumbo & Naeser, in prep.).

Wang et al. (1993) conducted an acupuncture study in the treatment of paralysis in stroke patients using Chinese scalp needle acupuncture at Shanxi College of Traditional

Chinese Medicine, China. CT scans were available.

The subjects included 110 cases, age 26–78 years; 76 cases, cerebral infarction, and 34 cases, cerebral hemorrhage.

Acupuncture treatment was started at 1–4 weeks poststroke. Daily acupuncture treatments were administered for 20 days, with 3 days respite after 10 acupuncture treatments. Scalp needle acupuncture was used on “the

motor cortex line”; plus body acupuncture points were used. After the patient was stable, electrical stimulation was used on the scalp needle acupuncture points (2.9 Hz) and on body acupuncture points (1.6 Hz).

The time poststroke when the CT scans were obtained was not included. Therefore, the CT scan data are not usable in terms of exact location of brain lesion. The CT scan lesion site information provided was only very general.

Evaluation.

Cured:	Limb mobility recovered, myodynamia restored to grade 5. Patients could take care of themselves and do light household chores.
Markedly Improved:	Hemiplegic and aphasic symptoms substantially relieved, myodynamia restored to grade 4. Patient could walk by himself and live without assistance, in spite of some functional disabilities.
Improved:	Definite amelioration in hemiplegia and aphasia. Myodynamia increased 1–2 grades.
Ineffective:	No improvement observed.

Results.

Cured:	29 cases (26.3%)
Markedly Improved:	57 cases (51.8%)
Improved:	19 cases (17.2%)
Ineffective:	5 cases (4.5%)

Summary. In this anecdotal study with 110 stroke patients, approximately 78% of the stroke patients had a “Cured or Markedly Improved” response following 20 acupuncture treatments which were initiated at 1–4 weeks poststroke.

Summary for Acupuncture in the Treatment of Paralysis Due to Stroke

1. In controlled studies, significantly more patients who received acupuncture treatments for paralysis due to stroke had an outcome level of “Good Response/Markedly Effective” than those patients who received no acupuncture or sham acupuncture (Table 1). Table 1 included 137 stroke patients who received acupuncture treatments, and 107 stroke patients who received either no acupuncture or sham acupuncture.
2. Significantly more stroke patients who received acupuncture treatments beginning within the first 3 months poststroke had a better outcome level (60% = Good Response/Markedly Effective, Table 2), than those who received acupuncture treatments beginning after the first 3 months poststroke (42% = Good Response/Markedly Effective, Table 2) ($p < .01$, Zhang et al., 1987).
3. Acupuncture treatments should be initiated as soon as possible poststroke, within 36 hours in ischemic infarct cases ($p = .02$ and beyond, Hu et al., 1993); and even within 24 hours in acute cerebral hemorrhage cases (Li et al., 1989). It is especially important to treat stroke patients with severe paralysis in the acute stage poststroke (Hu et al., 1993).
4. When acupuncture treatments were initiated within 4–10 days poststroke, there was a significantly better outcome at 1 month, 3 months and 12 months in those patients treated with acupuncture, than those patients who were not treated with acupuncture, especially in walking, balance, activities of daily living, and quality of life, mobility, and emotion ($p < .01$ and beyond, Johansson et al., 1993).
5. There was a savings of \$26,000 per acute stroke patient treated with acupuncture, due to fewer days in nursing homes and

- rehabilitation facilities (Johansson et al., 1993).
6. Significant improvement was observed in increased isolated active range of motion for Shoulder Abduction, Knee Flexion and Knee Extension, in acute and chronic stroke patients with arm/leg paralysis who were treated with acupuncture ($p < .04$ and beyond, Naeser et al., 1994a).
 7. Significant improvement was observed in Hand Dexterity and Finger/Hand Strength tests in acute and chronic stroke patients with hand paresis who were treated with acupuncture ($p < .05$ and beyond, Naeser et al., 1994b).
 8. Improvements gained following a series of 20–40 acupuncture treatments tended to be stable for at least a few months after the last acupuncture treatment. On follow-up testing in 11 stroke patients at 2 months after the last acupuncture treatment, 72–83% of the improved hand or arm/leg tests were stable, or again better (Naeser et al., 1994a, 1994b).
 9. Acupuncture is most effective with stroke patients who have a more moderate-milder paralysis, and who have lesion on CT scan which is located in $<1/2$ of the Motor Pathway areas, especially the periventricular white matter area (PVWM) adjacent to the body of the lateral ventricle (Naeser et al., 1992, 1994a, 1994b).
 10. CT scan lesion site analysis is helpful to predict which chronic stroke patients are likely to benefit from acupuncture treatments for arm/leg paralysis or hand paresis (Naeser et al., 1994a, 1994b). Acute CT scans or acute MRI scans cannot be used for this purpose. It is necessary to wait 3 months poststroke, for the complete borders of an area of infarction to be well visualized on CT scan (or MRI scan) (Alexander, Naeser, & Sweriduk, 1991; Palumbo & Naeser, in preparation). Therefore, analysis of lesion site on CT scan in relationship to probable response to acupuncture treatment is limited to chronic stroke patients at this time (Naeser et al., 1994a, 1994b).
 11. A special acupuncture treatment technique from Japan, Yamamoto New Scalp Acupuncture technique (YNSA) has been shown in a well-described anecdotal case report to be effective in the treatment of paralysis on one side of the body in a patient who had had quadriplegia for 6 years, following lesion at the level of the pons in the brainstem. Lesion was present in $<1/2$ of the Motor Pathway area for the side of the body that had positive response to the YNSA treatment (Yamamoto & Maric-Oehler, 1991). This patient no longer required total nursing care. A total of 9 months of almost daily acupuncture treatment was required.
 12. Studies from China have observed positive changes in other disorders associated with stroke, including successful treatment of headache, dizziness, and hypertension (lowered systolic pressure, 17 points [$SD = 2.7$]) and lowered diastolic pressure, 4 points [$SD = 0.8$]. In addition, significant reductions ($p < .05$ and beyond) were observed in hematocrit, plasma viscosity, and viscosity of whole blood (Sun et al., 1985), and significant decreases ($p < .05$) in fibrinogen, fibrin degradation products, and serum triglycerides (Qi et al., 1986). These studies were anecdotal, however, and without controls.
 13. The number of the acupuncture treatments administered varied across the 14 studies which were reviewed for acupuncture in the treatment of paralysis due to stroke, from 2 or 3 months, to 9 months.
 14. No adverse reactions were reported following the acupuncture treatments for the 1,756 stroke cases who were treated with acupuncture, across the 14 studies included in Part I of this report.

PART II. ACUPUNCTURE IN THE TREATMENT OF PARALYSIS DUE TO HEAD INJURY

In America, more than 2 million head injuries occur each year; and approximately 660,000 persons die or are hospitalized. For those who survive, there is long-term need for rehabilitation and reentry into society. The economic costs are estimated at more than \$25 billion per year. Because head injury is highest among

persons less than 45 years of age, the human loss in productivity and quality of life is incalculable (NIH Report, NINDS, 1992).

Li et al. (1993) reported the results from their anecdotal experience in the treatment of sequelae from head injury at the Shanxi College of Traditional Chinese Medicine, Taiyuan, China.

The subjects included 12 cases, age 11–51 years. The head trauma was due to traffic accidents, falling from a height, tumbling, or physical assault. The neurological diagnoses were as follows: cerebral concussion, $n = 1$;

cerebral contusion and laceration, $n = 11$; intracranial surgery, $n = 10$; repeat intracranial surgery, $n = 5$.

The acupuncture treatments were started 8 days to 2.5 years after head injury. A total of 29–47 Acptr. treatments were administered every other day, for 2 to 3 months. Two special acupuncture points were treated with needles at the midline base of the skull (GV 16 and GV 15), plus 4–10 additional body and Head points. The medulla is located beneath the acupuncture points GV 16 and GV 15.

Evaluation.

Cured:	Consciousness, speech ability, and bodily functions recovered. Symptoms of vertigo and headache vanished. Patients became completely independent.
Essentially Cured:	Consciousness recovered, speech and bodily functions essentially restored. Symptoms of vertigo and headache vanished. Patients largely able to take care of themselves.
Markedly Effective:	Consciousness clear; ability to express themselves with short phrases; bodily functions ameliorated. Symptoms of vertigo and headache vanished.
Improved:	Consciousness, speech and bodily functions showed changes for the better.

Results.

Cured:	4 cases (33.3%)
Essentially Cured:	2 cases (16.6%)
Markedly Effective:	4 cases (33.3%) Includes 2 cases who started as "human vegetables."
Improved:	2 cases (16.6%) Includes 1 case who started as "human vegetable."

Summary. The "Cured, Essentially Cured" rate for this anecdotal study was 49.9%; and if "Markedly Effective" cases are included, 83.2%. These rates are similar to those observed with the stroke patients, in Part I. It is likely that the better results were obtained from the moderate-milder cases of head injury, although no information is provided regarding the initial severity of head injury. It should be noted, however, that 2 cases who were considered to be "human vegetable" cases had "Markedly Effective" results.

Summary for Acupuncture in the Treatment of Paralysis Due to Head Injury

The above anecdotal study included 12 head injury cases. An outcome level of "Markedly

Effective or better" was observed in 83.2% of the cases, including 2 cases who started as "human vegetable" cases. It would appear from these data that acupuncture is an appropriate adjunctive therapy with acute and chronic head injury cases. Approximately 30–50 acupuncture treatments were administered in this study.

PART III. ACUPUNCTURE IN THE TREATMENT OF PARALYSIS DUE TO MULTIPLE SCLEROSIS

It is estimated there are 300,000 Americans with multiple sclerosis (M.S.). This is a lifelong disorder that often begins during young adulthood. People with M.S. have a normal life ex-

pectancy, but the symptoms of M.S. are often crippling because of the muscle weakness, rigidity, difficulty with balance, vision problems, and paralysis associated with M.S. The symptoms are unpredictable, and they often wax and wane. In some cases, the symptoms remain stable for years, but in other cases, the symptoms steadily progress. "Currently, there is no definitive diagnostic test, specific treatment, or means to prevent M.S." (NIH Report, NINDS, 1992). The health care costs associated with management of M.S. in America are estimated to be \$2.5 billion per year.

Smith and Rabinowitz (1986) presented two well-described anecdotal case reports of acupuncture in the treatment of paralysis in M.S. from the Lincoln Hospital, NY. The patients were treated with acupuncture 1 or 2 times per week, for 1 year or more.

Results. Age 60, Woman—32-year history of M.S. 15-year history unable to walk without assistance. After 1 year of acupuncture treatments, able to walk 100 feet, unassisted; no significant falls for 1 year after acupuncture treatments started; able to walk safely out of living quarters which caught fire; improved vision. Can now dress herself, wash dishes, pour coffee, sew, do hand laundry, and climb onto a high massage table.

Age 28, Man—Duration of M.S. not stated. After acupuncture treatments, improvement in numbness of both hands and feet.

Hoang (1981) presented anecdotal summary of treating paralysis in stroke patients and M.S. patients.

The subjects included 15 stroke patients and 40 M.S. patients. A total of 10–20 acupuncture treatments were administered.

Results. Stroke Patients—These patients showed "improvement" in walking. Some patients could then walk without a cane.

M.S. Patients—Even M.S. patients with a 15-year history of the disease showed "improvement" in walking, muscle spasms, vision, sleep, impotence, and/or bladder control.

The author states: "The sooner the patient is treated with acupuncture after onset of the disease state, the faster will be the recovery" (p. 137).

Summary for Acupuncture in the Treatment of Paralysis Due to M.S.

The results from the above two anecdotal studies with 42 patients with M.S., suggest that acupuncture treatments are helpful in the treatment of paralysis in M.S. patients, especially in the earlier stages. It should be noted, however, that in the Smith and Rabinowitz (1986) study, one patient who had positive response from the acupuncture treatments, had had a 32-year history of M.S., and before beginning the acupuncture treatments at age 60, had been unable to walk without assistance for 15 years. After acupuncture treatment for 1 year, she was able to walk 100 feet without assistance, and had no significant falls. Additional areas of improvement in M.S. following acupuncture treatments include reduction in muscle spasms and improvement in vision, sleep, impotence, and/or bladder control. Long-term acupuncture treatment is necessary (i.e., 1 year or more).

PART IV. ACUPUNCTURE IN THE TREATMENT OF PSEUDOBULBAR PALSY

Pseudobulbar palsy is defined as weakness of muscles involved with talking, swallowing, and pharyngeal and tongue movements; these muscles are supplied by the medulla oblongata portion of the brainstem. This disorder is caused by multiple lesions (often strokes) in both cerebral hemispheres. This is especially a problem with patients in nursing homes who have had multiple strokes where excessive drooling is present and there are problems swallowing food or liquid. These patients require special nursing care, due to the problems with swallowing.

Qu et al. (1991) reported their anecdotal experience in the treatment of pseudobulbar palsy, at the Tianjin College of Traditional Chinese Medicine, Tianjin, China.

Their subjects included 28 cases, age 51–72 years. The symptoms included the following: (1) dysphagia, dysphonia, dysphrasia; (2) absent or weakened soft palatal reflex; (3) possible involvement of inappropriate weeping or

laughing; and (4) two strokes of different laterality, or history of other upper neurone disease. The duration of illness when acupuncture treatment was initiated ranged from 1 month to 3 years.

Evaluation.

Cured: Recovery of swallowing, normal soft palatal activities; no choking when drinking or eating

Markedly Effective: Basic recovery of swallowing, some dysphonia, occasional choking

Results.

Cured: 19 cases (68%)

Markedly Effective: 9 cases (32%)

Summary. The "Cured" rate was 68% in this anecdotal study with 28 patients.

Summary for Acupuncture in the Treatment of Pseudobulbar Palsy

The above anecdotal study included 28 cases with pseudobulbar palsy. The authors reported an outcome level of "Markedly Effective or better" in 100% of the cases. These results suggest that acupuncture is helpful in the treatment of pseudobulbar palsy.

PART V. ACUPUNCTURE IN THE TREATMENT OF CEREBRAL PALSY IN BABIES AND CHILDREN

Cerebral palsy may be defined as a chronic disability of central nervous system origin characterized by aberrant control of movement or posture, appearing early in life and not the result of a progressive disease. It is estimated to occur in 0.1% of births (approximately 250,000 cases in the United States). It is more frequently observed in babies born with a low birthweight (less than 2500 g) (Cummins et al., 1993).

Filipowicz (1991) reported his anecdotal experience in the treatment of paralysis and spasticity with cerebral palsy, from Warsaw, Poland, and Toronto, Canada.

The subjects included 65 babies and children who were studied over a 5-year period.

The treatments included acupressure, needle acupuncture, electrostimulation, and low-energy laser acupuncture (2–10 mW, HeNe laser).

A total of 4–40 acupuncture treatments were administered. Scalp needle acupuncture was used on "the motor cortex line," and body acupuncture points were also used near the head and mouth (GB 20, CV 23, GV 26).

The treatments were administered 2 or 3 times per week (5 times per week in severe cases), beginning at 40 days to 4 years of age, over a 5-year period.

Results.

4/65 (6.2%) "Complete Recovery"

61/65 (93.8%) "Considerable Improvement"

The 4 children with "Complete Recovery" had spastic diplegia and acupuncture treatment was initiated before 6 months of age. The earlier the acupuncture treatments were started, the sooner the muscle spasms were reduced.

The author recommended that preventive therapy (acupressure or low-energy laser acupuncture) should be continued twice a month, after the spasticity has been reduced or has disappeared.

Some children who had received muscle relaxants (diazepam) were able to reduce or eliminate use of the drug, with these acupuncture treatments.

Laser acupuncture therapy was especially effective to treat contractures of the Achilles tendon; after 30–60 seconds of exposure, there was "considerable and immediate improvement."

Summary. This study with 65 babies and children, over a 5-year period, observed "Considerable Improvement or better" in 100% of the cases.

Lao (1992) presented a well-described anecdotal case report of a 10-month old baby treated for cerebral palsy, in New York. The mother of the baby is a physician in New York.

Subject. A 10-month-old boy with cerebral palsy, spastic diplegia (mild to moderate degree); 29-week pregnancy with preeclampsia and emergency cesarean section. The infant

was hospitalized for 2 months with many episodes of bradycardia and apnea.

A total of 50 needle acupuncture treatments was administered over a 5-month period.

Results.

Preacupuncture treatments: At 10 months of age, muscles of lower back and extremities were so rigid (hypertonic), he was unable to sit up, with or without support. Achilles tendons tight, bilaterally.

Post 3 needle acupuncture treatments: (After first week of acupuncture treatments) Able to sit unaided. Hypertonia alleviated.

Post 10 needle acupuncture treatments: Able to sit steadily and started to crawl.

Post 30 needle acupuncture treatments: Able to crawl nimbly.

Post 40 needle acupuncture treatments: Able to stand up supported with hands.

Post 50 needle acupuncture treatments: Able to stand independently, walk with support. Two weeks later, at age 15 months, able to walk independently, similar to children in his age group.

Summary. The results indicate that with this 10-month-old child (who was unable to even sit up before acupuncture treatments), after 5 months of acupuncture treatments, could sit up, and walk independently, similar to children in his age group. The acupuncture treatments were helpful in promoting the neurological development of this child, to a normal level for his chronological age. This progress required 5 months of consistent acupuncture treatments, beginning at an early age (10 months), 1 or 2 times per week.

Shi et al. (1992) presented their anecdotal experience with treating cerebral palsy with acupuncture at the Shanghai Medical University, Shanghai, China.

The subjects included 117 children (108 cases with limb paralysis). The acupuncture treatments were initiated at age 6 months to 10 years.

A total of 30 acupuncture treatments were administered every other day, over a 4–5 month period. Hydroacupuncture therapy (acupuncture point injection therapy) was used in the following manner:

Injections:	Head Points: 1–2 ml of acetyl-glutamine (100 mg/ampule)
Limb Points:	0.5–1 ml acetyl-glutamine compound Moschus solution with Chinese herbs (containing Moschus, Borneolum Syntheticum); or blood-activating injection with Chinese herbs (containing <i>Radix angelicae sinensis</i> , <i>Flos carthami</i> , <i>Rhizoma ligustici</i> Chuan Xiong, <i>Radix salviae miltiorrhizae</i>).

Evaluation.

Basically Cured:	Motor function basically recovered.
Markedly Improved:	Main symptoms and signs improved significantly. Patient could take care of himself, and walk independently, but below normal.
Improved:	Main symptoms and signs improved, but patient could only take care of himself partially, and could stand or walk with the help of others.
Ineffective:	No change in mentality or motor function.

Results.

Basically Cured:	15 cases (12.8%)
Markedly Improved:	48 cases (41%)
Improved:	49 cases (41.9%)
Ineffective:	5 cases (4.3%)

In addition, plasma cortisol (PC) levels were measured in 31 cases, before initiation of treatments, and after 30 treatments. In 24/31 cases (77.4%), PC levels increased by 10.28 $\mu\text{g}/\text{dl}$. In 7/31 cases (22.58%), PC levels decreased. No

comment was made regarding level of response to acupuncture treatments, and changes in PC levels.

<i>Plasma Cortisol before Acupuncture Treatments</i>	<i>Plasma Cortisol after Acupuncture Treatments</i>
17.35 (SD = 1.22)	27.63 (SD = 2.94) $p < .001$

Summary. This study with 117 children with cerebral palsy observed an outcome level of "Markedly Improved or better" for 53.8% of the babies and children treated with acupuncture.

Summary for Acupuncture in the Treatment of Cerebral Palsy in Babies and Children

The results from these three anecdotal studies with 183 babies and children with cerebral palsy indicate an outcome level of "Markedly Improved or better" following acupuncture treatments in 53.8% of the cases (Shi et al., 1992); to 100% of the cases (Filipowicz, 1991). The successful response rate was lower in the Shi et al., 1992, study (53.8%) versus the Filipowicz, 1991, study (100%), probably in part, because fewer acupuncture treatments were administered over a shorter period of time in the Shi et al., 1992, study (4–5 months), than in the Filipowicz, 1991, study (5 years).

Acupuncture appears to be especially helpful in reducing the spasticity associated with cerebral palsy, so that the children can make improvements in sitting, crawling, and walking.

Plasma cortisol levels were reported to be significantly increased in 77% of the children treated with acupuncture for cerebral palsy (Shi et al., 1992).

These results suggest that acupuncture is a helpful adjunctive therapy in the treatment of cerebral palsy in babies and children, especially when started very early (<1 year of age) (Lao, 1992).

PART VI. ACUPUNCTURE IN THE TREATMENT OF PARALYSIS DUE TO SPINAL CORD INJURY

In the United States, approximately 200,000 persons are now permanently confined to wheelchairs because of spinal cord injury. Each year, approximately 10,000 more people are injured, suffering paralysis and loss of sensation. Most of these people (two-thirds) are under 30 years of age. The specialized care which is required for these people costs approximately \$5 billion each year in the United States (NIH Report, NINDS, 1992).

Gao (1984) summarized his 24 years of anecdotal experience treating spinal cord injury cases (complete traumatic paraplegia) with acupuncture, at the Yuci City Institute of Paralysis, Shanxi Province, China.

The subjects included 17 inpatients, age 22–71 years. All patients had complete traumatic paraplegia. This diagnosis was based on clinical symptoms, as well as on physical exam, x-ray, and exploratory surgery. After gradual elimination of spinal cord shock, the lower extremities passed to a spasmodic state of paralysis or a prolonged slackened paralysis, and extensive muscular wasting developed. Urinary and/or fecal retention or incontinence developed. There was loss of sensation below the level of injury. Flexor reflexes could only elicit contraction, not extension.

Duration of Spinal Cord Injury Prior to Initiation of Acupuncture Treatments

5 years: $n = 1$
14–25 months: $n = 7$
6–10 months: $n = 3$
1–5 months: $n = 6$

Over a 2–3 year period, uninterrupted acupuncture treatments were administered. A comprehensive list of acupuncture points used on the body are presented in the article.

Evaluation.

- Near Normal Recovery: Can walk independently, without any supporting appliances. Bladder and bowel function return to normal.
- Obvious Progress: Sensation returns below level of injury, nervous system losses make

clear improvement; able to walk with help of crutches (no other supports). Reflexive bladder is formed.

Improvement: Function of nervous system partly returned; motor and/or excretory functions improved.

Results. The author summarizes the results as "Satisfactory" in 15/17 of the cases (88%).

Near Normal Recovery:	4 cases (23.5%)
Obvious Benefit:	6 cases (35.2%)
Certain Progress:	5 cases (29.4%)
No Change:	2 cases (11.7%)

Two Well-Described Case Histories

Case 1. 50-year-old man, sustained crushing injury from a massive steel plate.

11 days later, surgical exploration to debride the focus and fix the spine with steel plates.

Diagnosis: Compression fracture and dislocation of T-12 and L-1.

At 3 months postinjury, acupuncture treatments were initiated 2 times per week.

At this time, paraplegia was still slackened and complete, total loss of sensation below the injured spine.

Flexor reflexes elicited only contraction, but not extension. Atrophy of lower extremities.

Catheterization necessary, urinary tract infection (UTI) had persisted; high fever and constipation.

After 6 acupuncture treatments—UTI under control. Catheter removed and replaced with periodic massage for urination.

No fever.

After 36 acupuncture treatments—Able take a few steps forward with support.

After 2½ years of acupuncture treatments—Nearly recovered—i.e., recovery of nervous system function, elimination of muscular atrophy. Return of ability to walk independently, ability to squat for functional exercise and formation of voluntary bladder.

Case 2. 26-year-old man, injured when a section of a reservoir dam caved in.

20 days later, surgical exploration to

debride the focus and internal fixation of spine with steel plates.

Diagnosis: Compound compression fracture of T-12. Slackened paraplegia. Total loss of sensation below the level of the injury. Legs gradually wasted and urinary retention set in.

At 2 months postinjury, incontinent for bladder and bowel control.

Two bedsores developed and lasted for 1 year.

At 1½ years postinjury, acupuncture treatments were initiated.

At this time, both feet were in spasm, and there was complete paralysis and total lack of sensation in the legs. Flexor reflexes only elicited contraction, not extension. The lower limbs were wasted. There was urinary incontinence and stool retention. Edematous swelling was present in the lower limbs, and there were 2 bedsores.

After 2 months of acupuncture treatments—The 2 bedsores were healed.

After 2 years of acupuncture treatments—The level of sensation moved down 6 cm. The spasms disappeared. The patient was able to walk independently, with the help of crutches. There were no bedsores. The bladder was reflexive and bowel movements were normal.

Summary. The results from this anecdotal study with 17 cases of spinal cord injury (complete traumatic paraplegia) indicate an outcome level of "Certain Progress or better" in 15/17 (88%) of the cases. The author recommended starting acupuncture treatment even during the stage of spinal cord shock, in order to avoid the occurrence of spasms. The acupuncture needling is also effective in combatting shock, handling infection (including treatment of bedsores if they develop), and alleviating fever. The acupuncture treatments are helpful in improving bladder/bowel function. The earlier the

treatment, the greater ability the nerves may have for regrowth. Age factor is of importance, the younger the patient, the better the results.

Wang (1992) published a review article summarizing 30 years of anecdotal experience using acupuncture in the treatment of spinal cord injury cases at the Institute of Health Preservation, Beijing, China.

The subjects included 82 cases. All patients had sensory disturbance of the lower limbs, and loss of motor function of the lower limbs. Bladder and bowel dysfunction were present.

The patients were treated for an average of 5 months with acupuncture treatments. Electrical stimulation was used on the needles which were inserted into acupuncture points along the back, lateral to the spinal vertebrae (Bladder meridian).

Results. The author summarizes the results as "Effective" in 76 of the cases (93%). "The additional use of electric needling on the basis of traditional acupuncture produces marked therapeutic effect in the treatment of lower limb paralysis with urinary and fecal incontinence or anuensis" (p. 299).

Summary for Acupuncture in the Treatment of Paralysis Due to Spinal Cord Injury

The above two anecdotal studies included 99 spinal cord injury patients. Improvement following acupuncture treatments was observed in 88% of the cases (Gao, 1984), to 93% of the cases (Wang, 1992). The acupuncture treatments lasted from 5 months to 2 years. Improvements included increased level of sensation, reduction in muscle spasms, improved bladder and bowel function, and sometimes regained ability to walk (with crutches). The

acupuncture treatments were also helpful in the treatment of bedsores with these patients.

The high rate of improvement following acupuncture treatments with these spinal cord injury cases suggests that it is helpful as adjunctive therapy in the management of spinal cord injury. Long-term acupuncture treatments are required, however, up to 2 years.

PART VII. ACUPUNCTURE TREATMENT FOR PERIPHERAL FACIAL PARALYSIS (BELL'S PALSYP)

Bell's palsy is the most common disease of the facial nerve. It is presumably due to an inflammatory reaction in or around the facial nerve near the stylomastoid foramen. "Fully 80 percent of patients recover within a few weeks or in a month or two..." (Adams & Victor, 1977).

The anecdotal acupuncture studies which are reviewed below, indicate that a "Cured, Excellent or Markedly Improved" effect was observed in 90% to 93% of Bell's palsy cases treated with acupuncture. Even 80% of cases who were treated starting at >2 months duration, and 83% of Severe cases, also had "Excellent or Cured" effect. The majority of cases required 30 acupuncture treatments or less (1 month of acupuncture treatments).

Gao and Chen (1991) reported an anecdotal study with acupuncture treatment for peripheral facial paralysis (Bell's palsy), from the Beijing College of Traditional Chinese Medicine, China.

The subjects included 60 cases, age 3-70 years. The duration of facial paralysis and severity are summarized below:

Duration of Facial Paralysis Prior to Initiation of Acupuncture Treatments

≤2 months, n = 40 (minimum duration, 3 days)

>2 months, n = 20 (maximum duration, 30 years)

Severity of Facial Paralysis Prior to Initiation of Acupuncture Treatments

Mild, n = 30 (Slight deviation of mouth; palpebral fissure = <0.4 cm)

Serious, n = 30 (More serious symptoms; palpebral fissure = >0.5 cm; and pain in antrum auris.

The acupuncture treatments were administered every other day, with average of 10 treatments (range, 2 to >15 treatments). The nee-

dles were inserted into acupuncture points on the face and head with manual stimulation (no electricity).

Evaluation.

- Cured: All clinical symptoms disappear and the facial muscles function normally.
 Excellent: All clinical symptoms in the face are alleviated: there remains very slight deviation of the mouth during crying and laughing.
 Effective: The clinical facial symptoms are obviously improved; closure of the eyelid on the affected side is possible.
 Failed: No dramatic change is noticed after treatment.

Results. The authors summarize the "Overall Effective Rate" as 98.33%; cured: 49 cases (81.6%).

Excellent: 6 cases (10%)
 Improved: 4 cases (6.67%)
 Failed: 1 case (1.67%)

Duration of Disease and Therapeutic Effect

	≤ 2 Months, $n = 40$	> 2 Months, $n = 20$
Cured	37 cases (92.5%)	12 cases (60%)
Excellent	2 cases (5%)	4 cases (20%)
Improved	1 case (2.5%)	3 cases (15%)
Failed	0	1 case (5%)

Age and Therapeutic Effect

	≤ 30 Years of Age, $n = 29$	> 30 Years of Age, $n = 31$
Cured	24 cases (82.76%)	25 cases (80.65%)
Excellent	3 cases (10.34%)	3 cases (9.68%)
Improved	1 case (3.45%)	3 cases (9.68%)
Failed	1 case (3.45%)	0

Severity of Disease and Therapeutic Effect

	Mild Cases, $n = 30$	Severe Cases, $n = 30$
Cured	28 cases (93.33%)	21 cases (70%)
Excellent	2 cases (6.67%)	4 cases (13.33%)
Improved	0	4 cases (13.33%)
Failed	0	1 case (3.33%)

Summary. The best therapeutic effect was observed in mild cases with < 2 months duration. However, 80% of cases treated > 2 months duration, and 83% of Severe cases, also had "Excellent or Cured" effect. Age had no effect.

Cui (1992) reported anecdotal results from a study on the treatment of Bell's palsy from the Tangshan Hospital of Traditional Chinese Medicine, Hebei Province, China.

The subjects included 100 cases (9 were recurrent cases), age 1-78 years. The duration of the facial paralysis is summarized below:

Duration of Facial Paralysis Prior to Initiation of Acupuncture Treatments

1-5 days: $n = 62$
 6-30 days: $n = 3$
 1-6 months: $n = 6$
 > 6 months: $n = 2$

The acupuncture treatments were administered once per day (range, < 5 to 40 treatments). Scalp needle acupuncture was used on "the motor cortex line," ipsilateral to the side of facial paralysis, in "the mouth representation area." Needles only were used, no electrical

stimulation. The needles were manually manipulated and twirled, 3.3 Hz.

Summary. The majority of cases (90%) were "Cured or Markedly Improved"; and the majority of cases (94%) required 30 acupuncture treatments or less, to reach their maximum level of recovery in this study (1 month of acupuncture treatments).

Summary for Acupuncture in the Treatment of Peripheral Facial Paralysis (Bell's Palsy)

The above two anecdotal studies included 160 cases of peripheral facial paralysis (Bell's

palsy) treated with acupuncture. A "Cured or Excellent" effect was observed in 93% of the cases (Gao & Chen, 1991); and a "Cured or Markedly Improved" effect was observed in 90% of the cases (Cui, 1992). The majority of cases required 30 acupuncture treatments or less (1 month of acupuncture treatments).

The high rate of improvement following acupuncture treatments with these Bell's palsy cases suggests that acupuncture is helpful in the treatment of Bell's palsy.

Evaluation.

- Cured: Disappearance of mouth and eye deviation, shallowing of nasolabial groove, flattening of frontal wrinkles. Face becomes symmetrical.
- Markedly Improved: Basic disappearance of clinical symptoms, but slight deviation of mouth and eyes. Patients shows facial expression.
- Improved: Some improvement in clinical symptoms, but mouth and eye deviation is obvious.
- Unresponsive: No improvement in clinical symptoms.

Results. The author summarizes the "Cured and Markedly Improved Rate" as 90%.

- Cured: 71 cases (71%)
 Markedly Improved: 19 cases (19%)
 Improved: 9 cases (9%)
 Unresponsive: 1 case (1%)

Number of Acupuncture Treatments Required				
<5	6-10	11-19	20-30	31-40
14 cases	29 cases	37 cases	14 cases	6 cases

PART VIII. ACUPUNCTURE IN THE TREATMENT OF COMA

Frost (1976) conducted a study on the use of acupuncture stimulation to reverse deep coma, at the Department of Anesthesiology, Neurosurgical Intensive Care Unit, Albert Einstein College of Medicine, NY.

The design included acupuncture versus no acupuncture (historical controls, patients' records from the previous year, 1972, with similar levels of coma).

The subjects in the acupuncture group included 17 inpatients treated in 1973. They were all deeply comatose secondary to severe brain

injury, for a minimum of 5 days, despite intensive neurosurgical care. The subjects in the no-acupuncture group included 15 inpatients treated in 1972. They were also deeply comatose secondary to severe brain injury, for a minimum of 5 days, despite intensive neurosurgical care.

The acupuncture treatments were administered 2-3 times in a 24-hour period; or 4 treatments, at 12-hour intervals. Acupuncture needles were inserted into acupuncture points on the midline front of the head (GV 26 and GV 24), and on the soles of the feet (Kidney 1). Manual manipulation, and later, electrical stimulation, was used on the needles.

Results. Year	Percent Neurological Improvement after 3 Months					
	No. Patients	100%	75%	50%	0%	Dead
1972 (No Acptr.)	15	1	2	0	2	10
1973 (Acptr.)	17	2	5	3	4	3

Statistical Analysis of the Data, Using Fischer's Exact Test

(Analysis performed by M. Naeser, Ph.D., and E. Baker, Ph.D., for this NIH-OAM report)

Percent Neurological Improvement after 3 Months (Grouped Data From Above Table)

Year	50% to 100% Improvement	0% Improvement & Those Who Died
1972 (No Acptr.)	3	12
1973 (Acptr.)	10	7

p = .025

Respiratory Parameters. Six patients who were apneic preacupuncture treatments, showed immediate return to spontaneous ventilation, postacupuncture treatments.

Average increase in tidal volume, 100%
Average increase in minute volume, 300%

Average duration of effect: 1 hour (1/2 hour after cessation of acupuncture treatment)

EEG Monitoring. The EEG was monitored throughout acupuncture treatments in 3 cases. No changes were observed in rhythm, during insertion of needles or stimulation of needles, only generalized slowing. Even when the patients had become more conscious, 3 hours later, the EEG pattern still showed no changes, and specifically no increase in alpha rhythm was observed.

Needle Stimulation of Other Acupuncture Points and Nonacupuncture Points. The authors also tried strong needle stimulation of other acupuncture points, or random points, and "were unable to achieve significant respiratory improvement."

Case Reports

Case 1. 50-year-old woman, following clipping of a ruptured middle cerebral artery aneurysm.

Acupuncture treatment initiated at 10 days, deep coma—Acupuncture needles inserted at frontal midline head points, GV 26 and GV 24. Needles manually stimulated for 45 minutes.

1 Hour post first acupuncture treatment—Patient exhibited some purposeful movement and an approximate pain response.

2 Additional acupuncture treatments administered over the next 12 hours
Next day—Patient responding to verbal commands.

Two days later—decannulate her tracheostomy
Neurological recovery—80%

Case 2. 20-year-old girl, following clipping of a cerebral aneurysm
Acupuncture treatment initiated at 3 weeks, deep coma—Acupuncture needles inserted at frontal midline head points, GV 26 and GV 24. Needles manually stimulated for 30 minutes.

Immediately following first acupuncture treatment—

Improvement in ventilation.

3 Hours post first acupuncture

treatment—Patient exhibited marked improvement in consciousness.

3 Additional acupuncture treatments administered at 12-hour intervals

Patient became more responsive

Neurological recovery—80%

- Case 3.* 43-year-old man, following hemicraniectomy for massive subdural hematoma. Acupuncture treatment initiated at 7 days, comatose and apneic—Acupuncture needles inserted at frontal midline head points, GV 26 and GV 24, and points on soles of the feet, Kidney 1 (bilaterally). Electrical stimulation was used on the needles for 45 minutes. 2 Hours post first acupuncture treatment—Improvement began. 3 Additional acupuncture treatments administered at 12-hour intervals 3 Days later—Total recovery with no neurologic deficit and no pretrauma amnesia. Neurological recovery—100% (Patient discharged, neurologically intact.)

- Case 4.* 18 year-old boy, right temporoparietal depressed open skull fracture. Acupuncture treatment initiated at 5 days, apneic and unresponsive to deep pain with fixed, unresponsive pupils—Acupuncture needles inserted at frontal midline head points, GV 26 and GV 24, and points on soles of the feet, Kidney 1 (bilaterally). Treated 4 times that day, for 30 minutes, each time. Immediately following first acupuncture treatment—Neurological improvement, but continued improvement was slow. 4 Weeks later—Discharged, with some memory loss, and a slight left hemiparesis.

- 5 Cases.* Age 43–77 years. (Epidural hematoma, $n = 3$; Subdural hematoma, $n = 2$)

All patients had herniation of brain stem prior to surgery, and presented

with decerebrate and decorticate posturing.

Acupuncture treatments were administered as described above.

2 cases, posturing decreased

2 cases, some purposeful movements were elicited

No other improvements

1 case died after 2 months,

overwhelming sepsis

4 cases, no significant improvement for 6 months

- 3 Cases.* All patients had ruptured cerebral aneurysms. Acupuncture treatments were administered as described above. All showed initial improvement in level of consciousness 1 case died, 4 weeks later, pulmonary embolism 1 case discharged, 80% recovery 1 case still semi-comatose after 3 months
- 4 Cases.* All patients were postcraniotomy for removal of large subdural hematomas. Acupuncture treatments were administered as described above. 1 case (45-year-old woman), acupuncture treatments initiated at 2 weeks, coma. Discharged 3 weeks later, 75% neurological recovery. 1 case (69-year-old woman), acupuncture treatments initiated at 3 days, coma. Died 2 weeks later, intracranial abscess and septicemia. 1 case (16-year-old girl), acupuncture treatments initiated 1 week, coma, following car accident with two cardiopulmonary arrests. Immediately following first acupuncture treatment—Neurological improvement, but continued improvement was slow. Serious neurologic deficit, but can move all limbs and eyes. 1 case (40-year-old man), acupuncture treatments initiated at 1 week, deeply comatose

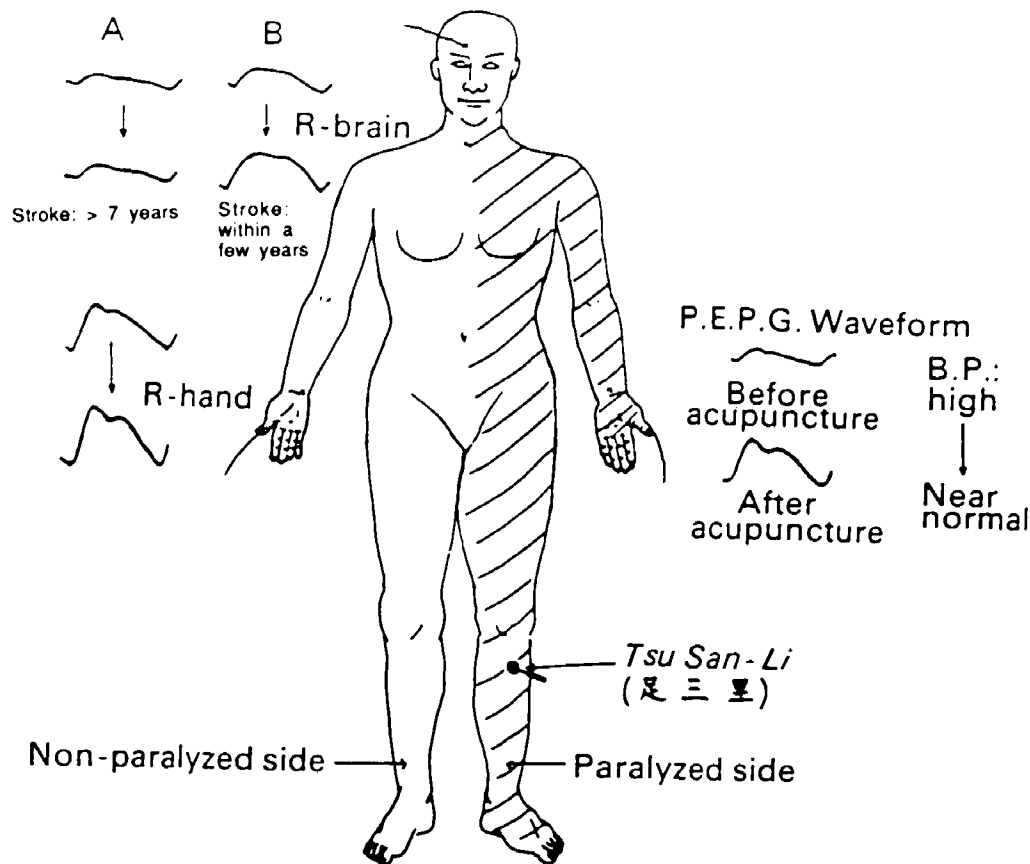


FIG. 7. The effects of acupuncture on stroke patients with paralysis of one side of the body. When acupuncture was given at *Tu San Li* point of the paralyzed side usually a significant vasodilation was observed at the paralyzed hand with slight increase in skin temperature. However, the less significant changes result in the hand of the non-paralyzed side. The brain circulation, studied from the supra-orbital artery and its branches, showed either response A which did not have a significant effect, or response B where there is an improvement in the circulation. Response A was more commonly seen in the patients who had had a stroke more than 7 years ago and response B was more commonly seen in the patients who had a stroke within the past few years. Source: Omura Y. Pathophysiology of acupuncture treatment: Effects of acupuncture on cardiovascular and nervous systems. *Acupuncture & Electro-therapeutics Research* 1975;1:51-141.

A few hours after the first acupuncture treatment—Purposeful movements were observed for the first time.
3 Days later—Consciousness returned
Neurologic improvement, but aphasic

Summary for Acupuncture in the Treatment of Coma

The above controlled study included 17 deeply comatose patients treated with acupuncture (and 15 patients not treated with acupuncture).

A significantly greater number of patients in

the acupuncture group (59%) had a $\geq 50\%$ neurological recovery, than the patients in the no-acupuncture group (20%) ($p = .025$). Only 4 acupuncture treatments were administered, at 12-hour intervals on acupuncture points located on the midline front of the head (GV 26 and GV 24), and on the soles of the feet (Kidney 1). Manual manipulation, and later, electrical stimulation, was used on the needles.

The author stated that, "We have had no complications from this treatment and we feel that it is reasonable to incorporate it along with all other therapeutic and supportive measures as indicated in the treatment of the comatose patient" (Frost, 1976, p. 48).

The results from this study with deeply comatose patients suggest that acupuncture is

helpful as adjunctive therapy in the treatment of deeply comatose patients.

PART IX. POSSIBLE MECHANISMS INVOLVED WITH IMPROVEMENT IN PARALYSIS FOLLOWING ACUPUNCTURE TREATMENT (VASODILATION AND INCREASED CEREBRAL BLOOD FLOW)

Omura (1975) studied the effects of acupuncture on peripheral and brain circulation at the Heart Disease Research Foundation, NY, and Department of Electrical Engineering, Manhattan College, NY.

The subjects included 400 patients, ages 5–85 years, with or without a variety of medical problems. In some patients, the study was repeated up to 10 times, with intervals of 1 day to 3 weeks.

Method. An ultraminiature reflection type photoelectric plethysmographic sensor with a very short response time was used to measure circulatory changes before, during, and after needle acupuncture stimulation of various acupuncture points. The loci where circulatory changes were measured were peripheral loci (hands) and brain loci (forehead).

Duration of circulatory measurements before acupuncture: 30–60 minutes

Duration of circulatory measurements after acupuncture: Minimum, continuously 30 minutes, to maximum of 12 hours; and intermittently up to 3 weeks.

Case Example of a Stroke Patient with Paralysis on the Left Side of the Body. An acupuncture needle was inserted into acupuncture point St 36, on the paralyzed (left) side of the body. (This acupuncture point is located on the leg, inferior to the knee, between the head of the tibia and the fibula.) See Figure 7. Strong manual manipulation was used.

Usually a significant vasodilation was observed in the paralyzed left hand, with a slight increase in skin temperature. (Less significant change was also observed in the nonparalyzed right hand.)

The brain circulation studied from the supra-orbital artery and its branches, showed an improvement in brain circulation on the side where the stroke had taken place, in stroke cases where the time poststroke was within a few years (p. 73). However, there was no significant effect in stroke cases where the time poststroke was >7 years.

Results. Immediate circulatory responses to the insertion and manipulation of the acupuncture needle were as follows:

1st Phase: Vasoconstriction—Usually lasts 15–30 seconds

2nd Phase: Quasi-control—Usually lasts 10 seconds–2 minutes

3rd Phase: Vasodilation—Usually lasts 2 minutes—2 or 3 weeks

Circulatory changes were found in the local area where acupuncture was performed, and in distant areas, including the brain.

Blood pressure often went down, particularly in those who had high blood pressure, but also it went down slightly in persons with near-normal blood pressure.

Immediately following the relief of pain or relaxation of spastic muscle from the shoulder, arm or hand, the maximum grasping force of the affected hand often increases significantly, particularly in patients who have low grasping force before acupuncture, although there are exceptions. (p. 70)

Summary. The results of this research by Omura, are compatible with and supportive of the results observed in the acupuncture research with stroke patients by Naeser et al. (1994b). In the later study, all hand paresis cases (including 8 chronic hand paresis cases), had significant improvement in 2 hand strength tests, and 2 hand dexterity tests, following 20–40 acupuncture treatments. The results from the Omura research suggest that at least one mechanism involved with this improvement in hand paresis following acupuncture treatment was likely to be increased circulation to the brain, as well as to the hand.

Chen and Erdmann (1977) conducted a controlled study on the effects of acupuncture on tissue-oxygenation of the rat brain at the Department of Anesthesiology, University of Alabama in Birmingham, School of Medicine in Birmingham. The purpose of their study was to investigate possible mechanisms to explain alleged acupuncture-induced arousal, which may include vasodilation, and thereby improve oxygen supply to the brain tissue. The design included stimulation of an appropriate Acupuncture Point (GV 26), versus an Inappropriate Acupuncture Point (inside thigh). The PO₂ levels in the frontal cortex of the rat brain were measured during acupuncture stimulation. The subjects included at least 16 (exact number not specified) albino rats (Wistar).

Method: The animals were initially sedated and tracheotomized and connected to a ventilator. Small bore holes of 1–2-mm diameter were drilled into the skullcap of the frontal part of the rat brain, and PO₂ electrodes were inserted into the brain cortex by means of stereotaxis.

Treatment using the appropriate acupuncture point: A 2½-inch-long 26-gauge hypodermic needle was inserted into acupuncture point GV 26 (located on midline of the face, between the upper lip and the nose). The needle was twisted manually, 10–30 seconds (or stimulated with electricity, 8 Hz).

Treatment using the Inappropriate acupuncture point: Same method as above, however, the needle was inserted into a point on the inside thigh.

Results. Appropriate Acupuncture Point Stimulation—After hand stimulation of the needle in acupuncture point GV 26, the PO₂ increased immediately. It took 15 minutes to reach maximum value, a 30% increase over the value before stimulation of the needle in acupuncture point GV 26.

The acupuncture stimulation of GV 26 causes PO₂ changes similar to the one observed after increase of arterial CO₂. The immediate increase of PO₂ caused by inspiratory CO₂ can be explained by the stimulation of cholinergic sympathetic nerve fiber and consequently di-

lation of blood vessels. Thus, it may be assumed that acupuncture treatment in this area stimulated the sympathetic system including excitation of the β-receptors of cerebral arterial vessels. Dilation of blood vessels would be the consequence and PO₂ increase due to increase of capillary blood flow would result. However, its effect is subsequently suppressed by an autoregulative mechanism and PO₂ gradually returns to normal. The value returned to normal, 0.5–3 minutes after stimulation.

Inappropriate Acupuncture Point Stimulation—After stimulation at the inside thigh, the PO₂ decreased, rather than increased.

Summary. In this controlled study, the authors state that stimulation of appropriate acupuncture point GV 26 causes dilation of the arterial system. This dilation increases capillary perfusion pressure. Acupuncture also seems to induce dilation in the form of increasing and decreasing waves. This contraction might serve as an additional mechanical force to dissolve the erythrocyte sludges and consequently restore capillary perfusion.

The Department of Neurology and Department of Physiology, Institute of Acupuncture and Moxibustion, Academy of Traditional Chinese Medicine, Beijing, China presented a paper in 1979 and published the abstract in 1980, where rheoencephalography (a type of cerebral blood flow study) was performed on stroke patients undergoing scalp needle acupuncture for treatment of paralysis in stroke.

There were two parts to the study: Part 1 examined the effectiveness of scalp needle acupuncture in the treatment of paralysis in stroke patients. Part 2 examined the effect of scalp needle acupuncture on cerebral blood flow in stroke patients and normal controls.

Part 1: Scalp Needle Acupuncture in the Treatment of Paralysis in Stroke Patients. The subjects included 209 stroke cases with paralysis due to cerebral thrombosis. The patients received a series of at least 10 scalp needle acupuncture treatments. One course of acupuncture treatments was equal to 10 treatments. The number of courses of acupuncture treatments was not specified.

 Results for Treatment of Paralysis:

Cases Treated <3 Months Poststroke

Basically Recovered
 or Greatly Improved 64/124 (52%)
 Improved 50/124 (40%)

Cases Treated >3 Months Poststroke

19/85 (22%)
 46/85 (54%) $p < .001$

The authors recommend that acupuncture treatment be started as soon as possible following stroke onset in cases of cerebral infarction.

Part 2: Effect of Scalp Needle Acupuncture on Cerebral Blood Flow. The subjects included 21 stroke cases (cerebral thrombosis), and 10 normal controls.

Method: Cerebral blood flow was measured using "Rheoencephalography" during scalp needle acupuncture treatment. No details of this procedure are provided.

Results for Cerebral Blood Flow Studies.

Normal Subjects: Scalp needle acupuncture treatment had no marked effects upon cerebral hemodynamics.

Stroke Cases: The effect of scalp needle acupuncture treatment on the cerebral blood flow of the hemiplegic patients was greater than that of the normal subjects. During the period of retaining the needle, the cerebral blood flow of the hemiplegic patients was increased and the peripheral resistance of the cerebral blood vessels was decreased.

After the withdrawal of the needle, the effect disappeared. Within 5 minutes after the withdrawal of the needle, the small vessel resistance was increased (the index of vascular resistance, $p < .01$; the inflow speed, $p < .05$).

Summary. The results of the cerebral blood flow part of this study suggest that scalp needle acupuncture temporarily increases cerebral blood flow during stimulation in stroke patients, but not normal controls.

The results of this study appear to have had an effect on how acupuncture was used with stroke patients in China during the mid-1980s. For example, when I was studying acupuncture at the Hua Shan Hospital, Shanghai Medical University, Shanghai, China, in 1985, I was told that "because of the possible effect of scalp needle acupuncture producing an increase in cerebral blood flow in stroke pa-

tients," acupuncture was withheld in acute cerebral hemorrhage patients until at least 2 weeks poststroke.

More recent research by Li et al. (1989) has shown, however, that acupuncture can be used on points GV 16 and GV 15 (located on the midline at the base of the skull) in acute cerebral hemorrhage cases, even less than 24 hours post-hemorrhage, and pose no problem with increased bleeding.

Summary for Possible Mechanisms Involved with Improvement in Paralysis Following Acupuncture Treatment (Vasodilation and Increased Cerebral Blood Flow)

The three studies mentioned above suggest that acupuncture may increase cerebral blood flow. The Omura (1975) study stimulated an acupuncture point on the left (paralyzed) leg (St 36) in stroke patients, and observed an increase in cerebral blood flow to the right forehead area (representing right cerebral hemisphere blood flow), ipsilateral to the hemisphere where the stroke had occurred. An increase in blood circulation to the left hand (and right hand) of the patients was also observed. The Chen and Erdmann (1977) study stimulated an acupuncture point on the midline face, above the upper lip (GV 26) in rats, and observed an increase in tissue oxygenation to the frontal cortex areas (bilaterally). The Chinese study (1979) inserted acupuncture needles along "the motor cortex line" during scalp needle acupuncture, and observed an increase in cerebral blood flow in stroke patients, but not normal controls.

Thus, results from these three studies suggest that insertion of acupuncture needles into different acupuncture points on the leg, face, or scalp, may all increase cerebral blood flow and circulation. It is possible that this increase in cerebral blood flow and circulation is one

mechanism that is involved with mediating the slow improvement in paralysis following acupuncture treatments in the above-mentioned studies, with patients who had central nervous system damage (stroke, head injury, multiple sclerosis, pseudobulbar palsy, cerebral palsy in babies and children, spinal cord injury, Bell's palsy, and coma).

These studies in the area of cerebral blood flow in relationship to needle stimulation of acupuncture points were conducted in the 1970s. In order to learn more about this topic, it would be important to study needle (or low-energy laser) stimulation of acupuncture points in stroke patients with modern neuroimaging techniques such as positron emission tomography (PET—Chollet et al., 1991; Weiller et al., 1992), or functional magnetic resonance imaging, (functional MRI—Belliveau et al., 1991). Unfortunately, at this time, these neuroimaging techniques are quite expensive.

There are likely other mechanisms, as well, which are involved with mediating slow improvement in paralysis following acupuncture treatments. This would include neurotransmitter release for example, such as, β -endorphins, especially when low-frequency electroacupuncture is used (Pomeranz & Chiu, 1976; Pomeranz et al., 1977; Pomeranz & Cheng, 1979; Cheng & Pomeranz, 1979; Cheng et al., 1980; Pomeranz, 1991).

In addition, acupuncture has been observed to increase blood cortisol levels (Cheng et al., 1980; Shi et al., 1992), and this may also have an effect on mediating slow improvement in paralysis following acupuncture treatments. In the stroke research studies which were reviewed for this report, the best outcome levels were observed when the acupuncture treatments were initiated less than 3 months post-stroke, (Table 2), and especially when the acupuncture treatments were initiated less than 24 hours and 36 hours poststroke (Li et al. 1989; Hu et al. 1993).

Thus, because brain swelling can be a major problem during the first few days poststroke, it is possible that the increase in cortisol levels following acupuncture has a positive effect on reducing the brain swelling, therefore, promoting a condition where there is less brain damage.

CONCLUSION

In controlled studies, significantly more patients who received acupuncture treatments for paralysis due to stroke had an outcome level of "Good Response/Markedly Effective," than those patients who received no acupuncture or sham acupuncture (Table 1). Acupuncture was helpful in a greater percentage of stroke cases when treatments are initiated as soon as possible, poststroke (Table 2).

In studies included in this report where acupuncture was used in the treatment of other types of paralysis due to central nervous system damage, acupuncture was observed to be helpful in the treatment of paralysis in the majority of cases (Parts II-VIII). These other types of paralysis included paralysis due to head injury, multiple sclerosis, pseudobulbar palsy, cerebral palsy in babies and children, spinal cord injury, peripheral facial paralysis (Bell's palsy), and coma.

The duration of acupuncture treatments varies according to the condition being treated, it may be only a few days in treating the comatose patient, or 1 month when treating Bell's palsy, or 2-3 months in treating stroke patients, or 1-2 years in treating spinal cord injury cases, or even 5 years or more in treating spasticity and paralysis in babies and children with cerebral palsy.

In most studies reviewed for this report, all patients had already received physical therapy or occupational therapy treatments for their current condition of paralysis. The results following the acupuncture treatments were above and beyond what the current physiotherapies could offer. For these patients with these various types of paralysis which were reviewed, there were no other modern Western medicine treatments which were available, or in widespread use. In the treatment of paralysis due to central nervous system damage, acupuncture should be included as a complementary, adjunctive treatment. It should be initiated as soon as possible following onset of the paralysis.

There were no adverse reactions reported following the acupuncture treatments for the 2,291 patients who were treated with acupuncture, across the 26 studies included in Parts I-VIII of this report.

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Addendum

Laser Acupuncture to Treat Paralysis in Stroke Patients

Since the early 1980's, low-energy (5-20 mW) laser stimulation of acupuncture points, instead of needle stimulation, has been used in other countries (China, Spain, Hungary, Czechoslovakia, Russia) (Naeser & Wei, 1994). In general, red beam lasers have a more shallow penetration (around 1mm); and infrared beam lasers have a deeper penetration (up to 5 cm) (Seitz & Kleinkort, 1986). Lasers used for laser acupuncture are usually less than 50 mW. Cutting laser used in surgery, for example, are 300 Watts. The low-energy lasers are termed cold lasers. The red-beam lasers appear to have many effects on the cellular level, including neurotransmitter release (acetylcholine), phagocytosis, Adenosine Tri Phosphate (ATP) synthesis and prostaglandin synthesis (Basford, 1989). Red-beam helium neon laser has also been observed to promote an increase in serotonin (Walker, 1983).

We have examined the effectiveness of infrared laser (gallium aluminum arsenide, 780 nm, 20 mW diode laser) to treat paralysis in seven stroke patients (6 chronic cases and 1 acute case) (Naeser et al., 1995). We used approximately 1 joule of energy to stimulate the same acupuncture points which were used in our needle acupuncture studies mentioned in this NIH-OAM report (Naeser et al., 1992; 1994a; 1994b). Similar results were observed for the 7 stroke patients treated with laser acupuncture, as had been observed for the stroke patients treated with needle acupuncture—i.e., those 5 patients who had lesion in less than half of the motor pathway areas on CT scan (mild-moderate paralysis) had a beneficial response following 20 or 40 laser acupuncture treatments over a 2 or 3-month period; the 2 patients who had lesion in more than

half of the motor pathway areas (severe paralysis) had no response. One of the latter patients who had no improvement in hand, arm, or leg paralysis following laser acupuncture, however, did have improvement in the facial paralysis and was able to control food and liquids on the left side of the mouth for the first time in four years following stroke onset.

The use of low-energy laser stimulation of acupuncture points is desirable because it is totally non-invasive, and there is no feeling whatsoever, no heat, no cold, no pain. This treatment technique is especially easy to use in treating children for a variety of disorders, including cerebral palsy (Filipowicz, 1991).

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**Written Presentation for
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**Articles relevant to Possible Mechanisms Involved with
Mediating Improvement in Paralysis following Acupuncture Treatment
(Vaso-dilation and Increased Cerebral Blood Flow)**

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