

## The Studies on Treatment of Liver Disease Using Lasers and Acupuncture in Dogs

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### 개에서 Lasers 및 침술을 이용한 간장질환 치료에 관한 연구

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**초록:** 본 연구의 목적은 개에서 사염화탄소에 의하여 실험적으로 유발된 급성 간장질환에 대한 침술의 치료효과를 알아 보는데 있다. 잠종의 성견 24두를 실험에 사용하였다. 사염화탄소를 동량의 광유에 희석하고, 24두의 개에 kg당 2 ml을 피하로 주사 하였으며, 그리고 6두는 laserpuncture로 치료하였고, 6두는 침으로 치료하였으며, 6두는 전침으로 치료하였고, 6두는 대조군으로서 처치를 안 하였다. 치료는 매일 1회씩 4일동안 실시하였다. 적용된 경혈은 간유와 영태이었다. 침술의 치료효과는 임상증상, 혈액화학치 및 심전도에 의하여 측정되었다. 치료후에, laserpuncture군이 다른 군들에 비하여 임상증상, 혈액화학치 및 심전도에 있어서 비교적 빠른 회복을 나타내었다. 전침 및 침군은 대조군에 비하여 약간 빠른 회복을 나타내었다.

**Key words:** dog, liver, disease, carbon tetra-chloride, laserpuncture, electroacupuncture, acupuncture

### Introduction

Veterinary acupuncture, an integral part of oriental medicine, is a practical medicine, and is based on yin-yang principle, the five element cycles, and the concept of qui and blood flow.

In western concepts, it is based on a knowledge of the input/output terminals of a two-way system of data transmission between superficial reflex (reactive) points and the organs or parts which are related to these points via the neuro-endocrine system<sup>7</sup>. Veterinary acupuncture involve the examination and stimulation of specific points on the body of non human animals by use of acupuncture needles, moxibustion, injection, low-level lasers, magnets, and a variety of other

techniques for the diagnosis and treatment of numerous conditions in animals<sup>1</sup>. Numerous indications for veterinary acupuncture have been reported<sup>4,6,8</sup>.

However the therapeutic effect of acupuncture was not approved systematically and scientifically. The present study aims to investigate the effect of acupuncture after the induction of acute liver disease in dogs by carbon tetra-chloride.

### Materials and Methods

Twenty four mixed breed, adult dogs with a mean body weight of  $8.6 \pm 3.5$  kg were used in the experiment. They were determined to be in good health based on physical examination and biochemical and hematologic profile.

Carbon tetra-chloride diluted in same volume of mineral oil was administered subcutaneously at 2 ml/kg in 24 dogs, and then 6 dogs were treated by

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laserpuncture (21 mW, 670 nm, 50seconds), 6 dogs were treated by electroacupuncture (25 Hz, 2 Volt, 15 minutes), 6 dogs were treated by acupuncture (round-sharp needle, 0.5~5 cm deep, 15 minutes) and 6 dogs were not treated as a control group. Treatment was done once daily for 4 days. The acupoints used were Gan-shu (Liver Association Point, BL-18, +) and Ling-tai (Spiritual Platform, GV-10, -).

The effect of acupuncture was evaluated by daily measurement of clinical symptom, blood chemical values and electrocardiogram (ECG). Also, histopathological findings were examined at the 7th day after first acupuncture treatment.

The data was analyzed using t-test. A probability of  $p < 0.05$  was considered to be statistically significant.

## Results and Discussion

As shown in Table 1, laserpuncture group revealed relatively fast recovery compared with other groups, in clinical symptoms. Electroacupuncture and acupuncture group revealed slightly fast recovery compared with control group.

The results of the observation of the blood chemical values after laserpuncture, electroacupuncture and acupuncture treatment in dogs with experimentally induced liver disease, are summarized in Table 2. The values of alanine transaminase (ALT) and aspartate transaminase (AST) revealed remarkable increase after induction of liver disease, in all groups. After treatment, laserpuncture group showed relatively good

**Table 1.** Observation of clinical symptoms after laser, electroacupuncture and acupuncture treatment in dogs with experimentally induced liver disease (n=6)

Groups	Duration (days)						
	0	1	2	3	4	5	6
Control	Normal	Severe depression, loss of appetite, pain at injection area	Severe depression, inflammation at injection area	Moderate depression,	Decreased swelling at injection, normal water intake	Normal appetite, coma sign at one dog	Death of one dog, normal food and water intake
Laserpuncture	Normal	Severe depression, loss of appetite, pain at injection area	Severe depression, inflammation at injection area	Mild depression,	Decreased swelling at injection, normal water intake	Normal appetite	Normal, normal food and water intake
Electro-acupuncture	Normal	Severe depression, loss of appetite, pain at injection area	Severe depression, inflammation at injection area	Moderate depression,	Decreased swelling at injection, normal water intake	Normal appetite	Normal, normal food and water intake
Acupuncture	Normal	Severe depression, loss of appetite, pain at injection area	Severe depression, inflammation at injection area	Moderate depression,	Decreased swelling at injection, normal water intake	Normal appetite	Normal, normal food and water intake

**Table 2.** Observation of blood chemical values after laser, electroacupuncture and acupuncture treatment in dogs with experimentally induced liver disease (n=6)

Groups	Duration (days)							Mean $\pm$ SD
	0	1	2	3	4	5	6	
Albumin (g/dl)	Control	2.74 $\pm$ 0.17	2.59* $\pm$ 0.18	2.41* $\pm$ 0.26	2.35** $\pm$ 0.22	2.32* $\pm$ 0.15	2.31** $\pm$ 0.15	2.32** $\pm$ 0.21
	Laserpuncture	2.69 $\pm$ 0.03	2.63* $\pm$ 0.04	2.53* $\pm$ 0.10	2.39** $\pm$ 0.05	2.57 $\pm$ 0.10	2.55 $\pm$ 0.14	2.49* $\pm$ 0.09
	Electro-acupuncture	2.77 $\pm$ 0.21	2.76 $\pm$ 0.23	2.57 $\pm$ 0.19	2.49* $\pm$ 0.24	2.59 $\pm$ 0.30	2.53 $\pm$ 0.37	2.69 $\pm$ 0.35
	Acupuncture	2.75 $\pm$ 0.07	2.57 $\pm$ 0.14	2.45* $\pm$ 0.18	2.36* $\pm$ 0.12	2.33* $\pm$ 0.13	2.24* $\pm$ 0.19	2.30* $\pm$ 0.21
ALT (IU)	Control	26.32 $\pm$ 9.80	738.32 $\pm$ 571.43	827.56 $\pm$ 1034.76	779.32 $\pm$ 949.18	1432.65 $\pm$ 1302.84	1180.24 $\pm$ 1120.38	860.95 <sup>f</sup> $\pm$ 794.27
	Laserpuncture	26.98 $\pm$ 8.88	159.28 $\pm$ 188.92	793.29 $\pm$ 1026.65	751.25 $\pm$ 1127.27	559.54 $\pm$ 643.85	374.72 $\pm$ 397.38	261.53 $\pm$ 298.43
	Electro-acupuncture	34.87 $\pm$ 17.40	576.97 $\pm$ 602.35	763.26 $\pm$ 1234.76	667.73 $\pm$ 1140.59	1029.38 $\pm$ 1073.28	1056.35 $\pm$ 1208.37	808.29 $\pm$ 890.73
	Acupuncture	29.75 $\pm$ 6.83	558.84 $\pm$ 417.77	690.28 $\pm$ 1054.91	606.85 $\pm$ 981.72	1789.86* $\pm$ 941.65	973.38* $\pm$ 996.04	1092.61 $\pm$ 685.18
AST (IU)	Control	44.96 $\pm$ 4.15	306.09 $\pm$ 226.71	1712.86 $\pm$ 2152.68	189.28 $\pm$ 130.02	125.29 $\pm$ 103.82	65.21 $\pm$ 29.35	54.19 <sup>f</sup> $\pm$ 12.29
	Laserpuncture	41.18 $\pm$ 5.56	144.28 $\pm$ 175.82	68.82 $\pm$ 111.52	179.37 $\pm$ 241.72	93.81 $\pm$ 47.27	58.09 $\pm$ 21.02	47.29 $\pm$ 17.08
	Electro-acupuncture	39.72 $\pm$ 6.97	214.83 $\pm$ 193.28	696.27 $\pm$ 1050.09	273.07 $\pm$ 286.45	82.54* $\pm$ 16.29	118.72 $\pm$ 111.76	58.09 $\pm$ 37.49
	Acupuncture	41.90 $\pm$ 8.86	325.20 $\pm$ 195.42	641.09 $\pm$ 675.26	401.80 $\pm$ 274.08	115.27* $\pm$ 37.76	134.98 $\pm$ 117.28	66.25 $\pm$ 27.61
Total bilirubin (mg/dl)	Control	0.07 $\pm$ 0.01	0.13 $\pm$ 0.05	0.19 $\pm$ 0.06	0.18 $\pm$ 0.09	0.21 $\pm$ 0.09	0.10 $\pm$ 0.03	0.16 <sup>f</sup> $\pm$ 0.08
	Laserpuncture	0.11 $\pm$ 0.06	0.10 $\pm$ 0.03	0.15 $\pm$ 0.13	0.15 $\pm$ 0.17	0.12 $\pm$ 0.07	0.07 $\pm$ 0.04	0.09 $\pm$ 0.03
	Electro-acupuncture	0.09 $\pm$ 0.02	0.12 $\pm$ 0.05	0.15 $\pm$ 0.11	0.13 $\pm$ 0.08	0.18 $\pm$ 0.14	0.11 $\pm$ 0.05	0.12 $\pm$ 0.07
	Acupuncture	0.08 $\pm$ 0.03	0.15 $\pm$ 0.06	0.16 $\pm$ 0.08	0.19 $\pm$ 0.13	0.18 $\pm$ 0.17	0.08 $\pm$ 0.06	0.10 $\pm$ 0.12
Total protein (g/dl)	Control	5.97 $\pm$ 0.26	5.83* $\pm$ 0.28	5.56 $\pm$ 0.14	5.21 $\pm$ 0.36	5.66 $\pm$ 0.26	5.40* $\pm$ 0.22	5.51** <sup>f</sup> $\pm$ 0.20
	Laserpuncture	6.15 $\pm$ 0.29	5.92 $\pm$ 0.40	5.97 $\pm$ 0.25	5.24 $\pm$ 0.26	6.06 $\pm$ 0.36	5.88 $\pm$ 0.32	5.84* $\pm$ 0.41
	Electro-acupuncture	6.02 $\pm$ 0.56	6.11 $\pm$ 0.62	5.97 $\pm$ 0.73	6.24 $\pm$ 0.67	6.29 $\pm$ 1.01	6.02 $\pm$ 0.90	5.96 $\pm$ 0.78
	Acupuncture	6.19 $\pm$ 0.49	6.06 $\pm$ 0.21	5.89 $\pm$ 0.30	5.85 $\pm$ 0.33	5.89 $\pm$ 0.32	5.68 $\pm$ 0.22	5.69 $\pm$ 0.17

\*\*Significantly different from day 0 at  $p < 0.01$ . \*Significantly different from day 0 at  $p < 0.05$ . <sup>f</sup>n=5.

recovery in ALT and AST values, compared with other groups.

The great amounts of ALT are found in hepatocytes in the liver of dogs, cats, and primates, providing an enzyme that is specific for hepatocellular damage in these species. Also, liver necrosis causes increased values of AST in dogs and cats<sup>2</sup>. In the present study, it was considered that marked elevations of ALT and AST on day 1 after administration of carbon tetra-

chloride, was caused by hepatocellular necrosis induced by carbon tetra-chloride.

Albumin, total bilirubin and total protein revealed the changes within normal levels, in all groups.

The results of the observation of interval and amplitude of ECG waves (lead II) after laserpuncture, electroacupuncture and acupuncture treatment in dogs with experimentally induced liver disease, are summarized in Table 3 and 4. The width of the QRS

**Table 3.** Observation of interval of ECG waves (lead II) after laser, electroacupuncture and acupuncture treatment in dogs with experimentally induced liver disease (n=6) Mean  $\pm$  SD

Interval (Sec)	Groups	Duration (days)						
		0	1	2	3	4	5	6
PR	Control	0.083 $\pm 0.023$	0.084 $\pm 0.013$	0.094 $\pm 0.010$	0.092 $\pm 0.016$	0.088 $\pm 0.013$	0.094 $\pm 0.016$	0.090 $\pm 0.019$
	Laserpuncture	0.070 $\pm 0.016$	0.083 $\pm 0.009$	0.090 $\pm 0.005$	0.079 $\pm 0.010$	0.091 $\pm 0.017$	0.084 $\pm 0.013$	0.090 $\pm 0.017$
	Electro-acupuncture	0.085 $\pm 0.007$	0.086 $\pm 0.008$	0.087 $\pm 0.025$	0.093 $\pm 0.015$	0.087 $\pm 0.007$	0.094 $\pm 0.013$	0.107 $\pm 0.014$
	Acupuncture	0.092 $\pm 0.009$	0.095 $\pm 0.017$	0.093 $\pm 0.014$	0.091 $\pm 0.006$	0.096 $\pm 0.013$	0.087 $\pm 0.014$	0.192 $\pm 0.183$
QRS	Control	0.050 $\pm 0.016$	0.079* $\pm 0.009$	0.032 $\pm 0.006$	0.094* $\pm 0.029$	0.028* $\pm 0.002$	0.026* $\pm 0.002$	0.029 $\pm 0.004$
	Laserpuncture	0.036 $\pm 0.013$	0.085 $\pm 0.009$	0.059 $\pm 0.083$	0.038 $\pm 0.046$	0.049 $\pm 0.067$	0.024 $\pm 0.002$	0.028 $\pm 0.002$
	Electro-acupuncture	0.032 $\pm 0.011$	0.083 $\pm 0.007$	0.031 $\pm 0.002$	0.084* $\pm 0.020$	0.026 $\pm 0.002$	0.024* $\pm 0.001$	0.027 $\pm 0.002$
	Acupuncture	0.035 $\pm 0.006$	0.090* $\pm 0.017$	0.032 $\pm 0.003$	0.028* $\pm 0.002$	0.026* $\pm 0.001$	0.027* $\pm 0.002$	0.034 $\pm 0.007$
QT	Control	0.159 $\pm 0.017$	0.151 $\pm 0.013$	0.161 $\pm 0.009$	0.156 $\pm 0.017$	0.152 $\pm 0.018$	0.170 $\pm 0.025$	0.171 $\pm 0.001$
	Laserpuncture	0.166 $\pm 0.019$	0.132** $\pm 0.020$	0.153 $\pm 0.005$	0.172 $\pm 0.022$	0.153 $\pm 0.018$	0.152 $\pm 0.022$	0.172 $\pm 0.007$
	Electro-acupuncture	0.255 $\pm 0.195$	0.156 $\pm 0.008$	0.164 $\pm 0.009$	0.167 $\pm 0.012$	0.146 $\pm 0.010$	0.152 $\pm 0.011$	0.160 $\pm 0.010$
	Acupuncture	0.247 $\pm 0.037$	0.144** $\pm 0.014$	0.160* $\pm 0.016$	0.154** $\pm 0.015$	0.148* $\pm 0.014$	0.149** $\pm 0.015$	0.169* $\pm 0.019$

\*\*Significantly different from day 0 at  $p < 0.01$ .

\*Significantly different from day 0 at  $p < 0.05$ .

complex revealed distinguished increase after induction of liver disease, in all groups. After treatment, laserpuncture group and acupuncture group showed relatively good recovery in the width of the QRS complex, compared with electroacupuncture and control group.

The QRS complex of small breed dogs should not exceed 0.05 second. Increase in either width or height of the QRS complex beyond normal values usually indicate left ventricular enlargement. This may be either dilatation or hypertrophy<sup>3</sup>.

In the present study, it was considered that marked elevations in the width of QRS complex of on day 1 after administration of carbon tetra-chloride, meant the carbon tetra-chloride induce left ventricular enlargement. PR, QT, P, R and T revealed the changes within normal levels, in all groups.

The result of the histopathological findings of liver after laser, electroacupuncture and acupuncture treatment in dogs with experimentally induced liver

disease, are summarized in Table 5. In laserpuncture group, vacuolization of lipid drops in cells was not observed not like another groups. It was conformed that hepatic cells in laserpuncture group were in the process of normalization.

## Conclusion

The purpose of this study is to investigate the effect of acupuncture after the induction of acute liver disease in dogs by carbon tetra-chloride. Twenty four mixed breed, adult dogs were used in the experiment. Carbon tetra-chloride diluted in same volume of mineral oil was administered subcutaneously at 2 ml/kg in 24 dogs, and then 6 dogs were treated by laserpuncture, 6 dogs were treated by electroacupuncture, 6 dogs were treated by acupuncture and 6 dogs were not treated as a control group. Treatment was done once daily for 4 days. The acupoints used were Gan-shu and Ling-tai. The effect of acupuncture

**Table 4.** Observation of amplitude of ECG waves (lead II) after laser, electroacupuncture and acupuncture treatment in dogs with experimentally induced liver disease (n=6)

Amplitude (mV)	Groups	Duration (days)						
		0	1	2	3	4	5	6
P	Control	0.178 ±0.052	0.292* ±0.061	0.186 ±0.033	0.274 ±0.067	0.222 ±0.042	0.205 ±0.025	0.156 ±0.028
	Laserpuncture	0.181 ±0.084	0.219 ±0.122	0.212 ±0.040	0.273* ±0.062	0.257 ±0.046	0.210 ±0.070	0.205 ±0.111
	Electro-acupuncture	0.122 ±0.033	0.320* ±0.072	0.265 ±0.175	0.290 ±0.072	0.295 ±0.062	0.196 ±0.042	0.190 ±0.034
	Acupuncture	0.231 ±0.127	0.133 ±0.054	0.159 ±0.072	0.252 ±0.055	0.222 ±0.100	0.158 ±0.030	0.142 ±0.037
R	Control	1.021 ±0.189	2.012 ±0.631	1.631 ±0.640	1.841 ±0.799	1.983 ±0.534	1.722 ±0.599	1.485 ±0.187
	Laserpuncture	0.804 ±0.030	0.803 ±0.311	1.412 ±0.546	1.227 ±0.446	1.441 ±0.619	1.298 ±0.788	1.515 ±1.143
	Electro-acupuncture	0.810 ±0.170	1.967** ±0.544	2.230* ±0.817	1.739** ±0.233	2.089* ±0.785	1.386* ±0.438	1.137** ±0.144
	Acupuncture	1.023 ±0.344	0.828 ±0.308	1.360 ±0.517	1.503 ±0.355	1.666 ±0.470	1.425 ±0.327	1.084 ±0.388
T	Control	0.218 ±0.089	0.377* ±0.120	0.244 ±0.057	0.415* ±0.090	0.347 ±0.097	0.307 ±0.143	0.313 ±0.081
	Laserpuncture	0.208 ±0.114	0.206 ±0.113	0.226 ±0.052	0.337 ±0.036	0.301 ±0.106	0.188 ±0.075	0.270 ±0.213
	Electro-acupuncture	0.240 ±0.128	0.442 ±0.101	0.350 ±0.099	0.397 ±0.110	0.393 ±0.055	0.217 ±0.076	0.289 ±0.021
	Acupuncture	0.245 ±0.074	0.148 ±0.046	0.167 ±0.041	0.257 ±0.034	0.241 ±0.078	0.140** ±0.064	0.117* ±0.026

\*\*Significantly different from day 0 at p<0.01.

\*Significantly different from day 0 at p<0.05.

**Table 5.** Histopathological findings of liver after laser, electroacupuncture and acupuncture treatment in dogs with experimentally induced liver disease (n=6)

Groups	Histopathological findings
Control	Hemorrhage, vacuolization of lipid drops in cells around central vein
Laserpuncture*	Hemorrhage, normal findings of hepatic cell
Electroacupuncture	Hemorrhage, vacuolization of lipid drops in cells around central vein
Acupuncture	Hemorrhage, vacuolization of lipid drops in cells around central vein

\*Vacuolization of lipid drops in cells was not observed not like another groups. It was conformed that hepatic cells were in the process of normalization.

was evaluated by daily measurement of clinical symptom, blood chemical values and electrocardiogram (ECG).

After treatment, laserpuncture group revealed relatively fast recovery compared with other groups, in clinical symptoms, blood chemical values and ECG waves. Electroacupuncture and acupuncture group revealed slightly fast recovery compared with control group.

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