Characteristics of acupuncture meridians and acupoints in animals

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Summary: In recent years, an increasing number of studies has been conducted on the biophysical characteristics of the meridians and acupoints in humans and animals. The authors aim to further illustrate the objective existence and superficial locations of the meridians in various species of animals.

Twelve sheep, ten goats, thirteen pigs, eleven cats, eight rabbits and seven donkeys were used to measure low impedance lines (LILs) and high percussion sound lines (HPSLs) on the skin surface of the animals, along the vertical planes of the dorsal line, using electrical impulses and high percussion sound. The results of these studies are given.

KEYWORDS: Acupuncture – Biophysics – Meridian – Traditional medicine.

INTRODUCTION

The meridian theory, a principal element of both human and veterinary traditional Chinese medicine, has guided clinical work for thousands of years in China. Human meridians were first described during the Han Dynasty in the books Zu-bi Shi-yi-mai Jiu Jing (‘Classic of eleven channels on foot and arm’) and Huang-di Nei-jing (‘Yellow Emperor’s Classic of internal medicine’), both of which were written in Chinese in the 3rd century BC (1, 2). Only the names of twelve major channels in animals and twelve acupuncture points were listed in Si-mu An-ji Ji (‘Collections of equine care and treatment’), written in Chinese during the Tang Dynasty. The twelve major channels in oxen and horses were described in Yuan-Heng Liao-ma Ji (‘Yuan Heng’s Therapeutic treatise on horses’) written in Chinese during the Ming Dynasty (3, 4, 6, 10). However, these records of animal meridians are incomplete and ambiguous.

The existence of meridians is supported by various studies of their biophysical characteristics. Low electrical resistance of the skin was reported along the path of meridians (7, 8, 11) and, more recently, investigators were able to demonstrate meridians using a variety of biophysical methods, including acoustics, electricity, light, heat, magnetism and radioactive isotopes (5, 9, 12). However, the majority of these studies were related to human meridians. Studies on the meridians of domesticated animals have been limited.

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MATERIALS AND METHODS

Measurement of electricity and sound along the back region of the urinary bladder meridian

Animals

Twelve sheep, ten goats, three Beijing swine, ten miniature swine, eleven cats and seven donkeys were used in this study. The back of each animal was shaved and cleaned prior to the experiment. Studies were conducted in a quiet environment.

Measurement of the low impedance line

Measurements along the back of the animal were conducted using a Type 576-F30 meridian finder. A reference electrode was placed on the scapha of the left ear. The probing electrode was placed on the skin at the mid-sagittal plane of the back and was slid laterally along the skin for a distance of 7 cm. Measurements were taken randomly from the area of the cranial scapula to a point 3 cm caudal to the acupuncture point Bai-hui (in the depression between the spinous processes L6 and S1). A decrease of more than 4 µA in the reading was recorded as signalling a low impedance site (LIS). All LISs were marked and considered as forming a low impedance line (LIL).

Measurement of the high percussion sound line

This measurement was performed in the same area and in the same manner as the LIL experiment, except that the probing electrode was replaced by a tapping hammer designed by the authors. The acoustic emission generated by the hammer was detected by auscultation or by a four-channel cardiac monitor (Type BYS-14A). Positive sites were determined by listening (by skilled researcher), then marked and measured, and considered as forming a high percussion sound line (HPSL).

Measurement of LILs on the body surface along twelve major meridians

Three donkeys were used in this study. The body surface on one side of the trunk, and on the medial and lateral sides of all four limbs was shaved and cleaned prior to the experiment. When the body surface was thoroughly dry, measurement of the LILs was performed using a Type 576-F30 meridian finder with a frequency of 65±5 Hz. A reference electrode was coated with 0.9% NaCl solution and fixed on the scapha of the left ear. The probing electrode was placed perpendicularly on the skin and slid from one side to other. A drop in reading of more than 4 µA was taken as signalling an LIS. All LISs were marked and measured. One donkey was measured repeatedly four times.

Scanning diagram of electrical signal and percussion sound

Five miniature swine and five cats were used in this study. Measurement of the LIL was conducted using both the Type MA-1002A GRS BRIDGE and 576-F30 meridian finders. The probing electrode was placed on the skin surface at the mid-line of the back and was slid bilaterally. The measurement of the HPSL was performed following the method described above. The electrical signal and acoustic emission were detected and recorded by a four-channel physiological recorder (Type BYS-14A).

Measurement of LISs at the Qiang-feng acupoint and four adjacent sites

Eight rabbits were used in this study. The animals were kept in a room at a temperature of 22-28°C and 80-84% humidity. LIS measurement was conducted using a Type MA-1002A GSR BRIDGE meridian finder. A reference electrode was placed on
the scapha of the right ear. The probing electrode was slid perpendicularly on the skin at the Qiang-feng acupoint and four adjacent sites. These sites are situated as follows:

- **Qiang-feng:** in the large depression caudal to the shoulder joint
- Upper site: 1 cm dorsal to Qiang-feng
- Lower site: 1 cm ventral to Qiang-feng
- Cranial site: 1 cm cranial to Qiang-feng
- Caudal site: 1 cm caudal to Qiang-feng.

The measurement of LISs was performed continuously 32 times on each animal from 8 h prior to anaesthesia to 8 h following anaesthesia, with one measurement every half hour.

Each rabbit could be measured repeatedly after an interval of several days. A total of 684 measurements was made at Qiang-feng and 2,592 measurements at other sites.

**RESULTS AND DISCUSSION**

**Measurement of electricity and sound along the back region of the urinary bladder meridian in various species of animal**

In all animals tested, two LILs and two HPSLs were found on each side. The rate of LILs identified per random measurement ranged from 97.84% to 99.58%, and the rate of HPSLs ranged from 96.96% to 99.48% (Table I). The location of LILs was found to be largely coincident with the HPSLs (98.00-99.49% coincidence rate). Moreover, the location of both LILs and HPSLs is similar to the path of the back regions in the traditional urinary bladder meridian. These results demonstrate the existence of meridians in different species of animals.

**Measurement of LILs along twelve major meridians**

Twelve LILs were identified on the body surface of the trunk in all three donkeys. The location of the twelve LILs was relatively stable and was largely coincident with the path of the meridians described for horses (4).

**Table I**

Measurement and coincidence of low impedance lines (LILs) and high percussion sound lines (HPSLs) in various species of animals

<table>
<thead>
<tr>
<th>Species</th>
<th>No. of animals</th>
<th>Measurement of LILs</th>
<th>Measurement of HPSLs</th>
<th>Coincidence LIL/HPSL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>No. of lines measured *</td>
<td>Positive sites No. (%)</td>
<td>No. of lines measured *</td>
</tr>
<tr>
<td>Sheep</td>
<td>12</td>
<td>520</td>
<td>1,028</td>
<td>98.85</td>
</tr>
<tr>
<td>Goats</td>
<td>10</td>
<td>240</td>
<td>475</td>
<td>98.96</td>
</tr>
<tr>
<td>Beijing swine</td>
<td>3</td>
<td>374</td>
<td>739</td>
<td>98.80</td>
</tr>
<tr>
<td>Miniature swine</td>
<td>10</td>
<td>510</td>
<td>998</td>
<td>97.84</td>
</tr>
<tr>
<td>Cats</td>
<td>11</td>
<td>544</td>
<td>1,077</td>
<td>98.99</td>
</tr>
<tr>
<td>Donkeys</td>
<td>7</td>
<td>953</td>
<td>1,898</td>
<td>99.58</td>
</tr>
</tbody>
</table>

* lines were measured randomly
Scanning diagram of electrical signal for LILs and volume of percussion sound for HPSLs

Using a Type MA–1002A GRS BRIDGE meridian finder, 336 LISs (98.82%) were detected in five miniature swine, and 306 LISs (98.10%) were detected in five cats. Using a Type 576–F30 meridian finder, 338 LISs (99.40%) were detected in five swine, and 305 LISs (97.78%) in five cats. The difference in the numbers of LISs measured by the two methods was not significant ($P>0.05$).

Scanning diagrams of the electrical signal for LILs were recorded in a miniature swine and a cat (Figs 1 and 2). Strong acoustic signals obtained from HPSLs in a miniature swine and a cat are shown in Figures 3 and 4.

**FIG. 1**

Scanning diagram of electrical signal for a low impedance line in a miniature swine

The electrical signal was recorded by a four-channel physiological recorder, operating at 2.5 mm/s

**FIG. 2**

Scanning diagram of electrical signal for a low impedance line in a cat

The electrical signal was recorded by a four-channel physiological recorder, operating at 2.0 mm/s

Measurement of LISs at the Qiang-feng acupoint and four adjacent sites

In eight rabbits, a total of 648 acupoints and 2,592 non-acupoints was tested. The resistance value at 2,102 (81.1%) non-acupoints was greater than at acupoints, while resistance at 490 (18.9%) sites was equal to or less than resistance at acupoints. Thus, acupuncture points were characteristically of low impedance.

With regard to measurements both at Qiang-feng and at the four adjacent sites before anaesthesia, the highest and lowest values of electrical current were recorded at 5 pm and at 1 am, respectively. After anaesthesia, the value of electrical current decreased consistently over the 8 h period.
Strong acoustic signals obtained from a high percussion sound line in a miniature swine
The acoustic signal was recorded by a four-channel physiological recorder, operating at 2.5 mm/s

Strong acoustic signals obtained from a high percussion sound line in a cat
The acoustic signal was recorded by a four-channel physiological recorder, operating at 2.0 mm/s

CONCLUSION

Two LILs and two HPSLs were identified on each side of the back region of the urinary bladder meridian in sheep, goats, Beijing swine, miniature swine, cats and donkeys. The location of the HPSLs was basically coincident with that of the LILs. Both LILs and HPSLs were parallel and symmetrical to the mid-line of the back. The location of both LILs and HPSLs was relatively stable, and was similar to the path of traditional
meridians. These results demonstrate that the meridians in animals are characteristically of low impedance and high percussion sound.

Twelve LILs were identified on the body surface in donkeys. The location of the LILs was relatively stable and largely coincident with the path of the urinary bladder meridian described in horses.

Under normal conditions, the resistance value at the acupoint *Qiang-feng* in rabbits was lower than at non-acupoints. When the experimental rabbits were anaesthetised, the resistance value of both acupoints and non-acupoints decreased. However, during this period, the resistance value at acupoints remained lower than at non-acupoints.
REFERENCES


