Acupuncture for locomotor disabilities in a South American red-footed tortoise (*Geochelone carbonaria*) – a case report

Márcia Valéria Rizzo Scognamillo-Szabó, André Luiz Quagliatto Santos, Maria Marlene Martins Olegário, Mariana Batista Andrade

**Abstract**

The literature contains numerous reports of the effect of acupuncture on domestic or experimental animals, but only a few involving wild animals. This paper reports on acupuncture treatment for locomotor disabilities in a South American red-footed tortoise (*Geochelone carbonaria*, SPIX, 1824), an endangered land tortoise found in Brazil’s Cerrado region. The animal was captured and kept in an aquatic pen, subsequently developing respiratory symptoms and locomotor disabilities. The respiratory symptoms resolved in response to antibiotic treatment. However, despite the use of nutritional supplements, the motor symptoms remained unchanged. After 16 months, the tortoise was given six acupuncture sessions. No other changes were made to its environment or management. The location of the acupuncture points was transposed from canine charts. After acupuncture, the animal’s motor functions, which had remained unchanged during the preceding 16 months, were restored, enabling it to eat and walk unaided. The improvement persisted during 18 months follow up. The transposition of acupuncture points from canine charts is a viable alternative for chelonians.

**Keywords**

Acupuncture, Cerrado, chelonians, motor function.

**Description of the Case**

**History and Examination**

A young red-footed tortoise was captured in Brazil’s Cerrado region. Thought to be a turtle, it was kept in an aquarium for a week. The sick animal, donated to the Wild Animals Research Laboratory (WARL) of the Federal University of Uberlândia, showed pelvic limb paralysis, thoracic limb paresis, inability to take food, respiratory distress, bilateral mucous nasal discharge, raised head and apathy. A seven day treatment with 5mg/kg of intramuscular enrofloxacin 2.5% was given and the respiratory symptoms resolved, but its locomotor disabilities remained unchanged. For that reason, the animal was kept in an indoor terrarium and under forced feeding for 16 months. Using a gastric tube, it was fed with a liquid diet of water and industrial dry food for omnivorous fish, and leaves, fruits and a vitamin supplement for reptiles (Reptovit®, Labcon Ltda). During the 16 months, no other changes to the tortoise’s environment or management were made.

**Treatment**

After 16 months of unchanged symptoms, the tortoise was referred to the Veterinary Hospital Acupuncture Service, where it underwent six acupuncture sessions over a three week period. Manual acupuncture was applied using sterile disposable stainless steel acupuncture needles (30x0.25mm) for head acupuncture points and insulin hypodermic needles (29G, 0.5”) for limb acupuncture points. Mechanical restraint was applied by supporting the ventral surface of the shell on a plastic cylinder (a medicine bottle) while the limbs hung free and motionless (Figure 1). The location of the acupuncture points was transposed from canine acupuncture charts (Table 1, Figure 1). Table 1 describes the treatment protocol and acupuncture point indications. Based on...
### Table 1  Acupuncture treatment protocol and traditional indications for locomotor disabilities in a South American red-footed tortoise (*Geochelone carbonaria*)

<table>
<thead>
<tr>
<th>Session</th>
<th>Point</th>
<th>Point Location</th>
<th>Traditional indications</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>KI1 (Yong Quan)</td>
<td>Between the 2nd and 3rd metatarsus, proximal to the metatarsal-phalangeal junction</td>
<td>Emergency point. Resolves Dampness and treats paralysis of the hindfoot.</td>
</tr>
<tr>
<td></td>
<td>GV16 (Feng Fu)</td>
<td>On the dorsal midline, at the atlanto-occipital joint</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>GB1 (Tong Zi Liao)</td>
<td>Lateral to the lateral canthus.</td>
<td>Brightens the eyes, prevents lacrimation and also is a local point to move Qi and Blood in the head.</td>
</tr>
<tr>
<td></td>
<td>KI1</td>
<td>(as above)</td>
<td>(as above)</td>
</tr>
<tr>
<td></td>
<td>ST36 (Zu San Li)</td>
<td>Lateral to the tibial crest, in the belly of the tibialis cranialis</td>
<td>Nourishes Blood, tonifies and raises Qi. In addition, it regulates the Liver and calms the Mind, tonifies the Spleen and resolves Phlegm.</td>
</tr>
<tr>
<td>3</td>
<td>GB20 (Feng Shi)</td>
<td>Below the occipital bone, in the depression between the sternomastoid and sternoc-occipitalis</td>
<td>Releases the Exterior and resolves exterior Dampness. It is also a specific point for head problems.</td>
</tr>
<tr>
<td></td>
<td>ST36</td>
<td>(as above)</td>
<td>(as above)</td>
</tr>
<tr>
<td></td>
<td>KI1</td>
<td>(as above)</td>
<td>(as above)</td>
</tr>
<tr>
<td></td>
<td>GB20</td>
<td>(as above)</td>
<td>(as above)</td>
</tr>
<tr>
<td>5 and 6</td>
<td>GB34 (Yang Ling Quan)</td>
<td>Ventral to the head of the fibula, at the interosseous space</td>
<td>Promotes the free flow of Liver-Qi, moves Qi and helps to move Blood. Eliminates stagnation and resolves Dampness.</td>
</tr>
<tr>
<td></td>
<td>BL40 (Weizhong)</td>
<td>In the centre of the popliteal fossa</td>
<td>Expels Dampness. Local acupoint for hindlimb paralysis.</td>
</tr>
</tbody>
</table>

![Figure 1](http://www.acupunctureinmedicine.org.uk/volindex.php)
Traditional Chinese Medicine, the diagnosis was ‘Depletion of the Kidneys and obstruction of the clear orifices in the head’, plus ‘Kidney Deficiency leads to the rising of Liver Yang’ and ‘External Dampness affecting the head, and preventing the clear Yang from reaching the head and clearing the head’s orifices by lowering the turbid Yin’. The treatment principles were to ‘Tonify the Kidneys and release the Exterior’ and to ‘Resolve Dampness and remove obstruction from the channels’.

Outcome
The animal was discharged from the veterinary hospital after three weeks, having regained its ability to eat and walk unaided. The tortoise was then removed to an outdoor pen, and maintained its locomotor abilities during an 18 months follow up period. During this time, the animal had grown and developed a concave plastron (ventral shell), which is a characteristic of an adult male tortoise.

Discussion
Most of the information on veterinary acupuncture comes from the Zhou Dynasty (1027 to 221 BC), when a Chinese military general, Sun-Yang, wrote the ‘Canon of Veterinary Medicine’ (650 BC). However, only in 1825 was acupuncture first applied on a paralytic bitch at the Veterinary School of Alford.15,16,17,18 Despite abundant reports about the effect of acupuncture on domestic or experimental animals and humans, few reports involving wild animals are available.15

The red-footed tortoise (Geochelone carbonaria, Chelonia, Testudinidae) is an endangered land tortoise protected by the Brazilian Institute for the Environment and Natural Renewable Resources (Administrative rule no 1522/1989). It is found in Brazil’s rainforests and in the cerrado, a savanna-like ecosystem that favours the metabolism of ectothermic animals. The cerrado, a biodiversity hotspot rich in endemic species and threatened by human activities, is characterised by open grassland with a 15 to 40% cover of stunted trees 3m to 5m tall, providing the red-footed tortoise with fallen fruits, grasses, succulents and carrion.19 Tropical chelonians find in their natural habitat favourable conditions to keep a stable metabolism. The Geochelone carbonaria locomotor disabilities persisted during 16 months and could not be related to reduction in metabolism due to seasonal changes.

Apart from nutritional supplements and acupuncture, no other treatments or management changes were introduced for the young captive red-footed tortoise. Over a three week period the tortoise presented with recovery of motor functions. The neurological evaluation of chelonians is not well established and, in this case, the animal’s neurological deficits were identified by general clinical signs such as responses to the environment, muscle tonus and locomotion. Moreover, no neurological diagnostic aids, such as functional magnetic resonance imaging or electromyography, were available. Therefore, it was not possible to relate the neurological deficits to a focal anatomic lesion. Yet an attempt to establish a presumptive diagnosis was made. The absence of food apprehension could involve both the trigeminal nerve and medulla oblongata. Limb paresis or paralysis could be due to a generalised hypotonia associated with cerebral oedema and necrosis. Thus, a possible diagnosis of brain damage due to oxygen deprivation was based only on clinical data.

There are several studies on acupuncture antinociception mechanisms, while the precise mechanisms of therapeutic acupuncture remain unclear. Needle insertion, a noxious stimulus, induces counter-irritation through activation of a descending pain inhibition system known as diffuse noxious inhibitory control (DNIC). DNIC activation enhances pain threshold in an intensity-dependent manner and its effects are short lasting. Indeed, pain threshold elevation does not predict the clinical outcome when analgesia is not the goal of the treatment. We believe that the locomotor recovery of this tortoise was not related to DNIC activation or a general effect of needling.

Regarding the hypothesis of brain damage, the clinical improvement of the tortoise could indicate an enhancing effect of acupuncture on neuroplasticity, which is the brain’s ability to rearrange and form new connections among its neurons. It can be important in compensating for brain damage by enabling the brain to create new neuronal networks. Electrical stimuli to peripheral nerves are known to induce brain plasticity.20,21 Indeed, acupuncture, a somatosensory conditioning stimulus, can induce cortical plasticity in humans.22 Although some authors claim acupuncture’s efficacy in treating neurological...
lesions associated with disc disease in dogs,\textsuperscript{6,8,17} it is difficult to predict to what extent acupuncture can facilitate neuronal regeneration or plasticity in animals. Otherwise, experimental studies have demonstrated the positive effect of acupuncture on neuronal regeneration and plasticity.\textsuperscript{5,11,12,13,14,15} The positive clinical outcome in this case could be associated with handling the animal, including its suspension off the ground. However, the animal’s functional limitations would need exercises to enhance the strength, endurance and mobility of the muscles and the use of physical (kinesio) therapy was not possible since the animal could not move its limbs.

According to Traditional Chinese Medicine, the stress caused by being in a water medium could have led the tortoise into a prolonged state of anxiety and fear, inducing symptoms in the central nervous system, such as the inability to walk and to take food. The selection of acupuncture points took into account the anatomical particularities of chelonians. Therefore, only head and limb acupuncture points were stimulated. Acupuncture point location was transposed from canine charts and was the same for dogs and for the red-footed tortoise, except for KI1 (Tables 1, Figure 1). KI1 is located on the plantar surface of the paw, between the 2nd and 3rd metatarsal bones, proximal to the metatarsal-phalangeal joint. The sole of the South American red-footed tortoise’s hindfoot is circular and the KI1 location was deduced to be located in its centre.

The use of complementary and alternative medicine (CAM) is becoming widespread. Persistent symptoms and adverse effects of conventional treatments are the main reasons for choosing CAM. Acupuncture is one of the best known and accepted forms of CAM treatment. Veterinary acupuncture has shown positive results in treating cutaneous pain, diarrhea, spinal cord injury, Cushing’s syndrome, hepatitis, and rumen acidosis.\textsuperscript{3} The rational basis underpinning the use of acupuncture remains unclear. Greater knowledge of the effects of acupuncture is essential to validate it, since acupuncture is difficult to test under double blind and placebo controlled conditions. This is important, considering the therapeutic properties and low cost of acupuncture. In this context, case reports are the first step in understanding the effects of acupuncture, although not definitive in scientific terms.\textsuperscript{7}

The use of acupuncture on wild animals may be limited because of the need for physical restraint. In conventional acupuncture sessions, the needles should be left in place for about 30 minutes. In this case report, mechanical restraint was easy to apply (Figure 1). In chelonians, palpation of back points, tongue examination and pulse evaluation, which are important diagnostic steps in Traditional Chinese Medicine, are not possible.

The lack of conservation awareness of rural populations in developing countries may represent a threat to ecosystems. Indeed, it is not rare to find wild animals adopted as pets, leading to the maltreatment of captive animals, as in the case of this land tortoise, which was kept in an aquatic pen.

In conclusion, acupuncture treatment was associated with a positive effect on the red-footed tortoise’s locomotor disabilities, which had remained unchanged during the 16 months prior to the acupuncture sessions. The transposition of acupuncture points from canine charts seems to offer a viable alternative, since no acupuncture charts exist for chelonians.

Reference list
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