

## Case Reports

# An Integrative Approach for the Treatment of Suspected Fibrocartilaginous Embolism of the Spinal Cord in a Dog

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### ABSTRACT

An 8 year old, neutered male, Shar Pei dog was presented with a history of acute onset of paraplegia and severe pain after playing in the yard. A suspected fibrocartilaginous embolism (FCE) at the L2-L3 intervertebral disk space was diagnosed using magnetic resonance imaging. During the first 48 hours, he was treated with morphine, methyl prednisone sodium succinate and polyethylene glycol 30%. Then, he was treated with a tapering dose of prednisone, as well as famotidine, diazepam and tramadol. Six acupuncture treatments were performed one week apart. Dry needle acupuncture was used at BL-40, LIV-3, GV-20 and *Lui-feng*. Electro-acupuncture was used at BL-54 + KID-1, *Hua-tuo-jia-ji* at T13-L4, GV-14 + *Bai-hui* at 20Hz for 5 minutes and then 80-120Hz for 25minutes. During the first 6 treatments, the patient also received aqua-acupuncture (vitamin B12, 0.3ml per point) at BL-23, GV-1, LI-10 and *Lui-feng*. The dog progressively regained strength and function in his pelvic limbs. Then, he continued to receive acupuncture and started underwater treadmill therapy every 2 weeks for a total of 15 treatments. In addition to acupuncture, *Tui-na* and physical rehabilitation, he was also prescribed a modification of the herbal formula *Da Huo Luo Dan* called Double P II (2.5 grams PO BID for 6 weeks). Currently at 4 months since the onset of clinical signs, he is ambulatory with slightly decreased conscious proprioception. The purpose of this case report is to demonstrate the use of an integrative approach to successfully treat FCE of the spinal cord.

**Key words:** Canine, fibrocartilaginous embolism, acupuncture, Chinese herbal medicine, physical rehabilitation

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### ABBREVIATIONS

|       |                                                 |
|-------|-------------------------------------------------|
| CP    | Conscious proprioception                        |
| FCE   | Fibrocartilaginous embolism                     |
| MRI   | Magnetic resonance imaging                      |
| PRN   | <i>pro re nata</i> , as needed                  |
| UFVMC | University of Florida Veterinary Medical Center |

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An 8 year old, neutered male, Shar Pei dog was presented to the emergency service of the University of Florida Veterinary Medical Center (UFVMC) for acute onset of paraplegia and severe pain after playing in the yard. The dog was playing in the yard with another dog when suddenly the caretaker heard loud continuous yelps and found him in laterally recumbency crying in pain. Upon presentation, shortly thereafter, the patient was extremely painful, had complete loss of motor function in the pelvic limbs. There was no history of previous

illnesses.

On physical examination, he was quiet, alert and responsive. He weighed 26 kg with a body condition score of 5/9 (scale 1-9, 5 ideal, below 5 is underweight, above 5 overweight). His hydration was within normal limits with pink mucous membranes and a capillary refill time of less than 2 seconds (normal). His heart rate was 100 beats per minute with a synchronous pulse rate and character. His respiratory rate was 12 breaths per minute and the body temperature was 101.8°F (38.7°C). After initial assessment, the plan was to perform the following: neurology consult, thoracic and abdominal radiographs, packed cell volume (PCV), total protein (TP), complete blood count (CBC), serum biochemistry profile, coagulation panel and magnetic resonance imaging (MRI) of the vertebral column.

On neurological examination the patient was determined to have intact spinal reflexes in all four limbs, intact cranial nerves, evidence of deep pain in all four limbs, a cutaneous trunci response present cranial to L4, normal thoracic limbs and paralysis of the pelvic

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limbs. A spinal cord lesion between T2-L3 was suspected based on the integrity of the pelvic limb spinal reflexes. An elevated white blood cell (WBC) count ( $18.28 \times 10^3/\mu\text{l}$ ; normal range  $5-14.5 \times 10^3/\mu\text{l}$ ), with increased band cells (550; normal range 0-300/ $\mu\text{l}$ ), increased segmental neutrophils (16,100/ $\mu\text{l}$ ; normal range 3,000-11,500/ $\mu\text{l}$ ), decreased lymphocytes (270/ $\mu\text{l}$ ; normal range 1,000-4,800/ $\mu\text{l}$ ) and slightly increased monocytes (1,370/ $\mu\text{l}$ ; normal range 150-1,350/ $\mu\text{l}$ ) were found on the CBC. An increased aspartate aminotransferase (AST) (59 U/L; normal range 9-42 U/L) was the only abnormality found on the serum biochemistry profile. The coagulation panel was within normal limits.

A normal geriatric thorax with moderate to marked bilateral elbow and mild bilateral scapulohumeral degenerative joint disease were the only abnormalities found on thoracic radiographs. A focal mild splenomegaly was present on abdominal radiographs. A lumbar cerebrospinal fluid (CSF) analysis was performed and a macrophagic inflammation with acute hemorrhage was seen on microscopic examination. Serum and CSF immunoassays were performed and were negative for *Neospora caninum* IgG antibody, *Toxoplasma* IgG, IgM, IgG + IgM antibodies and canine distemper virus using a polymerase chain reaction (PCR) test. Routine multiplanar MRI sequences of the cervical, thoracic and lumbar vertebral column were obtained. Increased intramedullary spinal cord signal intensity at the level of L1-L2 spinal cord was present and fibrocartilaginous embolism (FCE) was considered the most likely diagnosis.

The patient was hospitalized in the intensive care unit for 3 days. The following treatment was instituted: morphine (7.8 mg IV q 6 hrs PRN for pain), methyl prednisone sodium succinate (780 mg IV over 10 minutes once, followed by 390 mg IV over 10 minutes q 8 hrs) and polyethylene glycol 30% (57 mls IV over 10 minutes q 8 hrs). On the third day, the medical management protocol was changed to a tapering dose of prednisone (10 mg PO BID for 5 days, then 5 mg PO QD for 5 days, then 5 mg PO every other day for 7 days), diazepam (5 mg PO q 8 hrs), tramadol (50 mg PO q 6-8 hrs PRN for pain) and famotidine (10 mg PO BID). The patient was discharged from the hospital 3 days after presentation.

Ten days after initial presentation, the patient was referred to the UFVMC Acupuncture Service for evaluation and treatment. The patient had paralysis of both pelvic limbs and a purple and wet tongue, deep and wiry pulses and his body temperature was normal to the touch. His personality was Earth as he was laid-back, easy-going and was eager to please people. The TCVM diagnosis was local Qi and Blood Stagnation leading to Kidney Qi Deficiency. FCE leads to infarction of small arteries and veins and blockage of the free flow of Blood

and Qi within the area. The primary clinical sign associated with Blood Stagnation is sharp localized pain. Blood Stagnation can lead to and perpetuate the severity of Qi Stagnation<sup>1</sup>. Qi Stagnation can also lead to Qi Deficiency. When the Qi stagnates in one area, it cannot flow throughout the body and leads to Qi Deficiency in another area. In this case, the Qi stagnated in the spinal cord and did not properly flow down to the pelvic limbs resulting in pelvic limb paralysis and signs of Kidney Qi Deficiency. Typical signs of Kidney Qi Deficiency include paresis, paralysis, ataxia, urinary incontinence and/or fecal incontinence. The TCVM treatment strategy for this case was to unblock the Qi and Blood Stagnation and tonify Kidney Qi.

Based upon the TCVM diagnosis and treatment strategy, the patient received six acupuncture treatments one week apart and then an additional four treatments, three weeks apart. A list of the acupuncture points used and their actions as well as the locations of the classical acupoints used are listed in Table 1.<sup>2</sup> The size of the needles used varied depending on the location of the points (*Tai Chi*<sup>a</sup> 0.25mm x 0.25mm with 1 inch depth insertion were used for points located on the back and limbs, *Tai Chi*<sup>a</sup> 0.25mm x 0.13mm with ½ inch depth insertion were used for points located on the feet). Dry needle acupuncture was performed at BL-40, LIV-3, GV-20 and *Lui-feng*. Electro-acupuncture<sup>b</sup> was performed at BL-54 + KID-1, *Hua-tuo-jia-ji* at T13-L4 (crossing the leads over the lesion in an "X" fashion), GV-14 + *Bai-hui* at 20Hz for 5 minutes and then 80-120Hz for 25 minutes (Figure 1). During the first six



**Figure 1:** An 8 year old, neutered male, Shar Pei with acute paraplegia from a suspected fibrocartilaginous embolism of the spinal cord receiving electro-acupuncture at *Bai-hui*, BL-54, *Hua-tuo-jia-ji* and BL-23

**Table 1:** Acupuncture points used to treat a dog with suspected fibrocartilaginous embolism

| Acupuncture Point     | Actions, Attributes and Indications                                                                                               |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| GV-20                 | Sedation and calming                                                                                                              |
| GV-14                 | Clears Heat, intervertebral disk disease                                                                                          |
| GV-1                  | Pelvic limb paresis or paralysis                                                                                                  |
| BL-23                 | Back- <i>shu</i> Association point for the Kidney, thoracolumbar intervertebral disk disease, pelvic limb weakness                |
| BL-40                 | Master point for the caudal back, thoracolumbar intervertebral disk disease, pelvic limb paresis or paralysis                     |
| BL-54                 | Master point for the pelvic limbs, pelvic limb paresis or paralysis                                                               |
| KID-1                 | Pelvic limb paresis or paralysis                                                                                                  |
| LI-10                 | <i>Qi</i> tonic                                                                                                                   |
| ST-36                 | <i>Qi</i> tonic, pelvic limb weakness                                                                                             |
| GB-34                 | Pelvic limb paresis or paralysis, influential point for tendons and ligaments, pain relief                                        |
| LIV-3                 | Pelvic limb paresis or paralysis, pain relief                                                                                     |
| <i>Bai-hui</i>        | Pelvic limb paresis or paralysis<br>(Location : L7-S1 midline)                                                                    |
| <i>Shen-shu</i>       | Kidney <i>Qi</i> Deficiency, thoracolumbar pain<br>(Location : 1 cun lateral to <i>Bai-hui</i> )                                  |
| <i>Shen-peng</i>      | Pelvic limb paresis or paralysis<br>(Location: 1.5 cun caudal to <i>Shen-shu</i> )                                                |
| <i>Shen-jiao</i>      | Pelvic limb paresis or paralysis<br>(Location: 1.5 cun caudal to <i>Shen-shu</i> )                                                |
| <i>Hua-tuo-jia-ji</i> | Intervertebral disk disease<br>(Location: 0.5 cun lateral to the dorsal spinous process of each vertebra from T1- L7)             |
| <i>Lui-feng</i>       | Pelvic limb paresis or paralysis<br>(Location: In the skin folds of the dorsal metatarsophalangeal joint of digits 2-3, 3-4, 3-5) |

treatments (six weeks), the patient also received aqua-acupuncture (vitamin B12 at 0.3ml per point) at BL-23, GV-1, LI-10 and *Lui-feng*.

In addition to the acupuncture, a modification of the Chinese herbal formula *Da Huo Luo Dan* called Double P II<sup>c</sup> (2.5 grams PO BID X 6 weeks) was prescribed (Table 2). The clients were also instructed to perform a few simple *Tui-na* techniques at home. They were to do *Nei-fa* from the neck to the back 10 times daily and *Yi-zhi-chan* at KID-1 for 10 minutes daily. A list of the *Tui-na* techniques and their actions are listed in Table 3.<sup>4</sup> After the third acupuncture treatment, twenty four days after the onset of the signs, the patient's right pelvic limb had regained strength and almost full use. The left pelvic limb was stronger but was still not able to support full weight and had conscious proprioception (CP) deficits.

Mild physical rehabilitation had been started 2 days after admission to the UFVMC which consisted of assisted standing exercises and assisted range of motion exercises every 6 hours. The patient also received four

additional aqua-acupuncture treatments every 3 weeks, after the 6 weekly acupuncture treatments, in conjunction with the underwater treadmill therapy (Figure 2). The acupuncture points that were stimulated using aqua-acupuncture (vitamin B12 at 0.3ml per point) at these times were BL-40, KID-1, LIV-3, LI-10, ST-36, GB-34, BL-23 *Shen shu*, *Shen-peng*, *Shen-jiao* and *Lui-feng*. Underwater treadmill therapy was started three weeks after initial presentation, twice a week for four weeks, then a three week break and then twice a week for another three weeks. The procedure for the underwater treadmill is outlined in Table 4.

A neurological re-examination was performed four months after the start of TCVM therapy. The neurologist concluded that the dog was ambulatory on the pelvic limbs with decreased CP on the left pelvic limb and very slightly slowed CP of the right pelvic limb. A slightly decreased hopping response was also noted on the left pelvic limb. During slow walks and sometimes during standing, the patient would stand with the toes knuckled over on the left pelvic limb. All other

**Table 2:** Ingredients of the Chinese herbal formula Double P II<sup>c</sup> and their actions

| <i>Pin Yin Name</i> | <i>English Name</i> | <i>Action</i>                                                |
|---------------------|---------------------|--------------------------------------------------------------|
| <i>Ba Ji Tian</i>   | Morinda             | Warms <i>Yang</i> and tonifies Kidney                        |
| <i>Bu Gu Zhi</i>    | Psoralea            | Tonifies Kidney <i>Yang</i> and strengthens bones            |
| <i>Chi Shao Yao</i> | Peony               | Cools Blood, resolves Stagnation                             |
| <i>Chuan Xiong</i>  | Ligusticum          | Activates Blood, resolves Stagnation                         |
| <i>Dang Gui</i>     | Angelica            | Nourishes Blood, activates Blood, relieves pain              |
| <i>Di Long</i>      | Lumbricus           | Clears internal Wind, detoxifies                             |
| <i>Du Zhong</i>     | Eucommia            | Strengthens back, tonifies Kidney <i>Yang</i>                |
| <i>Fu Zi</i>        | Aconite             | Warms <i>Yang</i> and Channels                               |
| <i>Gan Cao</i>      | Licorice            | Harmonizes                                                   |
| <i>Gou Ji</i>       | Cibotium            | Tonifies Kidney <i>Yang</i> and strengthens bones            |
| <i>Gu Sui Bu</i>    | Drynaria            | Strengthens bones and tonifies Kidney <i>Yang</i>            |
| <i>Hong Hua</i>     | Carthamus           | Moves Blood, resolves Stagnation and Stasis                  |
| <i>Huang Qi</i>     | Astragalus          | Tonifies <i>Qi</i>                                           |
| <i>Ma Qian Zi</i>   | Strychnos           | Activates Channels, relieves pain, clears Wind-Damp          |
| <i>Mo Yao</i>       | Myrrh               | Resolves Stagnation and relieves pain                        |
| <i>Niu Xi</i>       | Cyathula            | Tonifies Kidney <i>Yang</i> and strengthens the pelvic limbs |
| <i>Quan Xie</i>     | Scorpion            | Resolves Stagnation                                          |
| <i>Ru Xiang</i>     | Olibanum            | Resolves Stagnation and relieves pain                        |
| <i>Tian San Qi</i>  | Notoginseng         | Moves Blood, stops hemorrhage                                |
| <i>Wu Gong</i>      | Scolopendra         | Clears Internal Wind, detoxifies                             |
| <i>Wu Yao</i>       | Lindera             | Moves <i>Qi</i> and relieves pain                            |
| <i>Xu Duan</i>      | Dipsacus            | Strengthens bones and ligaments, tonifies Kidney <i>Yang</i> |
| <i>Xue Jie</i>      | Draconis            | Resolves Stagnation                                          |

**Table 3:** Tui-na techniques used in a dog with suspected fibrocartilaginous spinal cord embolism

| <i>Tui-na Technique</i>           | <i>Action</i>                                                    |
|-----------------------------------|------------------------------------------------------------------|
| <i>Yi-zhi-chan</i> (single thumb) | Promotes <i>Qi</i> flow and regulates <i>Zang-Fu</i>             |
| <i>Nie-fa</i> (pinching)          | Invigorates <i>Qi</i> and Blood and regulates Spleen and Stomach |

neurologic examination findings were within normal limits. The owners were pleased that their pet could walk, run and play like a normal dog and that he was no longer paralyzed.

FCE is a hemorrhagic infarct within the spinal cord that results in secondary and primary vascular embolization.<sup>5-10</sup> It is believed that herniation of the nucleus pulposus takes place either into the



**Figure 2:** An 8 year old, neutered male, Shar Pei with acute paraplegia from a suspected fibrocartilaginous embolism of the spinal cord receiving underwater treadmill therapy

vertebral body or the venous sinuses within the spinal canal. FCE can occur anywhere in the spinal cord, but it is most common in the caudal cervical and middle to lower lumbar spinal segments. The most common clinical features associated with this condition are acute onset after exercise or strenuous activity, ataxia that is non-progressive after the first 48 hours, asymmetrical spinal cord involvement and usually minimal or no signs of pain. Although these clinical signs are typical they are not pathognomonic for FCE.<sup>5,6</sup>

There is no definitive ante-mortem diagnostic test, therefore diagnosis is based on ruling out the presence of spinal cord compression. Definitive diagnosis requires post-mortem histological examination of the spinal cord. However, MRI is useful to support the diagnosis because it can rule out spinal cord compression and show evidence of spinal cord infarction.<sup>7</sup> The main goal of treatment is to reduce spinal cord edema and inflammation and prevent disuse muscle atrophy and tendon contracture with physiotherapy. Improvement should be noted within a few days, but functional recovery may require several weeks.<sup>6</sup>

One study compared the results of two treatment groups, one with physiotherapy alone and another with physiotherapy and corticosteroids.<sup>7</sup> Their results indicated that there was no statistical difference ( $p < 0.05$ ) between the treatment groups. The prognosis for functional recovery for dogs with FCE is extremely variable depending on the severity of the lesion.<sup>8</sup> Most commonly, patients with FCE are deemed to have a poor prognosis, if there is no improvement in clinical

**Table 4:** Underwater treadmill regime used in a dog with suspected fibrocartilaginous spinal cord embolism

| Treatment session | Duration (minutes) | Speed (miles/hr) | Distance (miles) | CP* deficits noted |
|-------------------|--------------------|------------------|------------------|--------------------|
| 1 <sup>st</sup>   | 2                  | 0.3              | 0.1              | Every other step   |
| 2 <sup>nd</sup>   | 4                  | 0.3              | 0.2              | Every other step   |
| 3 <sup>rd</sup>   | 6                  | 0.7              | 0.5              | 3 out of 4 steps   |
| 4 <sup>th</sup>   | 7                  | 0.7              | 0.6              | 4 out of 5 steps   |
| 5 <sup>th</sup>   | 7/2                | 0.3/0.7          | 0.1              | Every 18 steps     |
| 6 <sup>th</sup>   | 1.4/5              | 0.3/0.7          | 0.05             | Every 39 steps     |
| 7 <sup>th</sup>   | 5/5                | 1.0/0.7          | 0.13             | Every 59 steps     |
| 8 <sup>th</sup>   | 5/5                | 0.7/1.0          | 0.14             | No CP deficits     |
| 9 <sup>th</sup>   | 10                 | 1.0              | 0.14             | No CP deficits     |
| 10 <sup>th</sup>  | 12                 | 1.0              | 0.18             | No CP deficits     |
| 11 <sup>th</sup>  | 4/8                | 1/0.08           | 0.15             | No CP deficits     |
| 12 <sup>th</sup>  | 6/6                | 1.0/0.08         | 0.18             | No CP deficits     |
| 13 <sup>th</sup>  | 4/9                | 0.08/1.0         | 0.2              | No CP deficits     |
| 14 <sup>th</sup>  | 10                 | 0.08             | 0.13             | No CP deficits     |
| 15 <sup>th</sup>  | 10                 | 0.08             | 0.14             | No CP deficits     |

signs within two weeks of onset.<sup>9,10</sup> However, one study reported to have patients' clinical signs improve within three to four weeks after onset.<sup>11</sup> In another study of fifty dogs, 84% had successful outcomes and the median time to maximal neurological recovery was 3.75 months.<sup>8</sup>

Acupuncture increases blood flow.<sup>12-15</sup> In one study, a significant increase in blood flow to the sciatic nerve trunk was obtained by dry needle acupuncture to the lumbar muscles of rabbits.<sup>13</sup> Uchida and Hotta found that increased skeletal muscle blood flow occurred with electro-acupuncture and was regulated by reflex mechanisms via the central nervous system.<sup>14</sup> Studies have shown that acupuncture can induce vasodilation and increase cerebral blood flow for two minutes up to two to three weeks.<sup>15</sup> Circulatory changes can also occur local and distal to the acupuncture points stimulated.<sup>15</sup> It is believed that increased blood flow caused by acupuncture flushes out the algescic substances and therefore relieves pain.<sup>12</sup> In TCVM, this is interpreted as moving *Qi* and Blood Stagnation to provide pain relief.

In addition to pain relief, it is crucial to move stagnated *Qi* and Blood, because if it is allowed to accumulate for a prolonged period of time, it can lead to *Qi* and Blood Deficiency. Since FCE leads to infarction of small arteries and veins and blockage of the free flow of *Qi* and Blood within the area, the main treatment goal is to unblock the Stagnation. This is done by treating acupuncture points local, cranial and distal to the lesion. In addition there are specific points that resolve Stagnation such as LIV-3 and GB-34. In this case there were signs of *Qi* and Blood Stagnation in addition to signs of Kidney *Qi* Deficiency (pelvic limb paresis or paralysis). It is believed that the Stagnation lead to Deficiency in this case. Therefore the treatment principles were to clear the Stagnation and tonify *Qi*, specifically Kidney *Qi*, since the main signs of weakness were related to the hind quarters. These treatment principles were carried out by using a combination of acupuncture, Chinese herbal medicine, *Tui-na*, physiotherapy and corticosteroids. Since some dogs recover some degree of function with no specific treatment, the impact of the TCVM and other treatments on the recovery of this case is not known. However since acupuncture, herbal therapy and *Tui-na* have been shown to increase blood flow, the addition of these therapies to the treatment regime may reduce long-term residual damage in dogs with FCE. Further controlled prospective studies are needed to confirm their efficacy.

## FOOTNOTES

<sup>a</sup> Lhasa Medical Inc, Accord, MA 1-800-722-8775

<sup>b</sup> WQ-6F Electronic Acupunctoscope, Donghua, Electric Instrument Factory, Beijing, China

<sup>c</sup> Jing Tang Herbal, Reddick FL: [www.tcvn.com](http://www.tcvn.com)

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