

Magnetic stimulation of the radial nerve in dogs and cats with brachial plexus trauma: A report of 53 cases

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Accepted 9 May 2008

Abstract

Brachial plexus trauma is a common clinical entity in small animal practice and prognostic indicators are essential early in the course of the disease. Magnetic stimulation of the radial nerve and consequent recording of the magnetic motor evoked potential (MMEP) was examined in 36 dogs and 17 cats with unilateral brachial plexus trauma.

Absence of deep pain perception (DPP), ipsilateral loss of panniculus reflex, partial Horner's syndrome and a poor response to MMEP were related to the clinical outcome in 29 of the dogs and 13 of the cats. For all animals, a significant difference was found in MMEP between the normal and the affected limb. Absence of DPP and unilateral loss of the panniculus reflex were indicative of an unsuccessful outcome in dogs. Additionally, the inability to evoke a MMEP was associated with an unsuccessful outcome in all animals. It was concluded that magnetic stimulation of the radial nerve in dogs and cats with brachial plexus trauma may provide an additional diagnostic and prognostic tool.

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Keywords: Brachial plexus trauma; Dogs; Cats; Magnetic stimulation

Introduction

The brachial plexus is a complex anatomical structure originating from the 5th–8th cervical and the 1st and 2nd thoracic spinal nerves, and providing sensory and motor innervation to the thoracic limbs (Steinberg, 1979; Bailey et al., 1982). Pathological changes to the brachial plexus in small animal medicine include inflammatory, neoplastic and, most frequently, traumatic conditions, such as road traffic accidents (Wheeler et al., 1986). Brachial plexus trauma occurs when there is traction of the thoracic limb or severe abduction of the scapula (Griffiths, 1974; Stein-

berg, 1988). Typically, the nerve roots are more likely to be damaged than the plexus itself due to a lower capacity to stretch (Griffiths, 1974; Holtzer et al., 2002; Dewey, 2003).

Diagnosis of brachial plexus trauma is most commonly based on history, clinical signs, findings on neurological examination and results of electrodiagnostic testing. As early as 5 days after the initial peripheral nerve injury, spontaneous muscle activity on electromyography (EMG) will be found, although prior to this, muscle activity cannot normally be detected using this diagnostic approach (Griffiths and Duncan, 1974; Bowen, 1987). Since the roots of the radial nerve are commonly injured in brachial plexus trauma (Wheeler et al., 1986), electroneurography of the radial nerve may provide earlier diagnostic and prognostic

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information in comparison to EMG (Faissler et al., 2002). Electrical stimulation of the radial nerve, however, has some disadvantages, such as technical difficulties in stimulating the deeply situated nerve and unwanted stimulation of pain receptors. Magnetic stimulation of the radial nerve provides a more feasible and less painful method of stimulating peripheral nerves (Barker et al., 1987; Barker, 1991, 1999; Van Soens et al., 2007).

The primary objective of this study was to evaluate the use of magnetic stimulation of the radial nerve as an additional diagnostic tool in 36 dogs and 17 cats with unilateral brachial plexus trauma. Onset latencies and peak-to-peak amplitudes of magnetic motor evoked potentials (MMEP) of the radial nerve of the abnormal limb were compared with the normal limb. A secondary aim was to compare the relationship between MMEP findings and presenting neurological variables (absent deep pain perception [DPP], ipsilateral loss of the panniculus reflex, and presence of partial Horner's syndrome) to the clinical outcomes of the animals examined in this study.

Material and methods

Animals

Dogs and cats presented with a history or suspicion of trauma and clinical and neurological signs of a brachial plexus lesion were included in this study. All animals were presented at the Small Animal Department of the Ghent University from 1998 to 2007. Exclusion criteria were brachial plexus lesions with non-traumatic origin. Age, sex, bodyweight (BW), breed, side of the lesion and the time elapsed between the original trauma and the magnetic stimulation were reported for each animal.

Neurological assessment

For each animal, a complete neurological examination was performed on presentation and deficits were reported. Neurological status of the affected limb of each animal was graded from 0 to 4 (Table 1). Grade 0 was characterised by a normal use of the affected limb. Grade 1 animals had paresis but were still weight bearing on the affected limb. Grade 2 animals could not bear weight on the affected limb, although elbow and shoulder flexion were possible. With Grade 3, the animals could not bear weight on the affected limb or flex properly, but DPP remained intact. Grade 4 animals could not bear weight on the affected limb and the DPP was absent.

Table 1
Number of patients per category of neurological deficits

Grade	Symptoms	Type and localisation of the lesion	Dogs	Cats
0	Normal	Normal	0	0
1	Paresis with weight bearing	Mild injury	1 (3%)	0
2	No weight bearing, elbow and shoulder flexion possible	Caudal avulsion	6 (17%)	3 (17.5%)
3	No weight bearing, DPP present	Complete avulsion	20 (55%)	11 (65%)
4	No weight bearing, DPP absent	Complete avulsion with involvement of the dorsal roots	9 (25%)	3 (17.5%)

DPP, deep pain perception.

According to the neurological status of the affected limb, the localisation of the brachial plexus lesion was assigned to the different grades. Grade 1 corresponded to mild damage of the brachial plexus. Grade 2 corresponded to a caudal brachial plexus lesion (C7, C8, T1, T2 nerve roots), Grade 3 with a complete brachial plexus lesion (C5–T2 nerve roots) and Grade 4 with a complete brachial plexus lesion with involvement of the dorsal roots. Any ipsilateral loss of the panniculus reflex and/or presence of partial Horner's syndrome were also recorded.

Electrodiagnostic testing

Electromyography and magnetic stimulation of the radial nerve of both thoracic limbs were performed under general inhalation anaesthesia. Electromyography was performed by standard procedures (Cuddon, 2002) using a commercially available electromyograph (Sapphire, Meda). A concentric 37 mm needle electrode (Meda) was used for recording and consecutively placed in the interosseus muscle, carpal flexor muscles, carpal extensor muscles, triceps muscle, biceps muscle, infraspinatus muscle and supraspinatus muscle of the affected limb. The ground electrode was a subdermal needle electrode (Meda) placed over the olecranon. EMG was only performed if clinical symptoms were present for at least 5 days. The spatial distribution of spontaneous EMG activity was reported for each animal and related to the localisation of the lesion (Tables 2 and 3). In cranial lesions, spontaneous EMG activity was found in the supraspinatus, infraspinatus and sometimes biceps muscles. In caudal lesions, spontaneous activity was expected in all but the supraspinatus and infraspinatus muscles. In complete brachial plexus lesions, EMG activity was present in all muscles examined on the affected limb.

Magnetic stimulation was performed with a commercially available magnetic stimulator (Magstim Super Rapid; Meda) with a circular coil, 4.5 cm in diameter, capable of producing a peak magnetic field of 4.0 T at the coil surface. Maximal stimulator output was used in most of the patients, although the output was reduced to 75% in four of the cats because of a strong stimulus artefact. Magnetic stimulation of the radial nerve was done on both thoracic limbs.

The magnetic coil was placed in the axillary region, medial to the radial nerve and the flat surface of the coil was placed parallel to the skin surface of the limb with the cranial part of the circle on the coil held tangentially to the radial nerve. For both limbs, orthodromic nerve stimulation was performed (Van Soens et al., 2007). All recordings were made using the same commercially available electromyograph. The tip of the recording electrode (monopolar needle electrode, Meda) was placed in the extensor carpi radialis muscle of the forelimb, just in front of the lateral humeral epicondyle. The reference electrode was a subdermal needle electrode (Meda), positioned over the tendons of the extensor carpi radialis muscle, at the level of the carpal joint. The ground electrode was a subdermal needle electrode placed over the olecranon of the forelimb.

Sensitivity was set at 10 mV per division. Analysis time was 100 ms following the stimulus. The low and high frequency filters were set at 20 Hz and 10 kHz, respectively. Each recording resulted from a single stimulus and no signal averaging was undertaken. For each recording site, two individual stimulations were delivered and recorded to evaluate reproducibility. Onset latency (in ms) was measured as the shortest distance between the trigger point and the take-off of the initial phase (negative or positive). Peak-to-peak amplitude (in mV) was measured between the two largest peaks of opposite polarity.

Clinical outcome

Follow-up and information regarding the outcome of the patients was collected during follow-up examination at the Small Animal Department of the Ghent University or by contacting the referring veterinarian or owner. The minimal follow-up time was 1 month after the initial neurological examination at the Small Animal Department. For the purposes of this study, the outcome was considered 'unsuccessful' if no improvement in the grade of neurological status of the affected limb was recorded at least 1 one month after the initial examination. The outcome was also

Table 2

Neurological grade (Grade), EMG activity (EMG), time elapsed between injury and magnetic stimulation (Time to MS), ability to evoke magnetic motor evoked potential (MMEP) and outcome in dogs with brachial plexus injury (outcome)

Dog	Grade	EMG	Time to MS	MMEP	Outcome
1	3	C	6	No	<i>U</i>
2	3	P	6	Yes	?
3	3	C	7	Yes	?
4	2	P	83	Yes	?
5	3	C	10	Yes	?
6	3	C	30	No	?
7	2	C	365	Yes	<i>U</i>
8	2	P	66	No	<i>U</i>
9	3	C	121	No	<i>U</i>
10	4	NP	0.5	Yes	<i>U</i>
11	4	C	100	No	<i>U</i>
12	2	NP	3	Yes	<i>U</i>
13	4	NP	2	No	<i>U</i>
14	3	C	47	Yes	?
15	2	P	43	No	<i>U</i>
16	3	C	180	No	<i>U</i>
17	3	NP	1	Yes	<i>S</i> , Grade 0
18	3	NP	0.29	Yes	<i>S</i> , Grade 1
19	3	NP	3	Yes	<i>U</i>
20	3	C	180	Yes	?
21	1	P	17	Yes	<i>S</i> , Grade 0
22	3	C	14	Yes	<i>U</i>
23	3	P	42	Yes	<i>U</i>
24	3	C	16	No	<i>U</i>
25	4	P	15	Yes	<i>U</i>
26	4	C	11	Yes	<i>U</i>
27	3	C	7	No	<i>U</i>
28	4	C	10	No	<i>U</i>
29	2	NP	14	Yes	<i>U</i>
30	4	C	24	No	<i>U</i>
31	4	NP	18	No	<i>U</i>
32	3	NP	2	Yes	<i>U</i>
33	4	C	10	No	<i>U</i>
34	3	P	59	Yes	<i>S</i> , Grade 1
35	3	NP	2	Yes	<i>U</i>
36	3	NP	2	Yes	<i>U</i>

C, spontaneous EMG activity in all muscles of the affected limb; P, spontaneous EMG activity in all muscles but the supraspinatus and infraspinatus muscle; NP, EMG not performed; *U*, unsuccessful outcome; ?, unknown outcome; *S*, successful outcome.

considered unsuccessful if euthanasia of the animal or amputation of the affected limb was performed as a direct result of the brachial plexus trauma at least 1 month after the initial admission. Outcome was determined 'successful' when the grade of neurological status improved in comparison to the clinical status determined during magnetic stimulation.

Statistical analysis

Frequencies and descriptive statistics were derived for age, gender, weight, side of the lesion, neurological deficits and outcome. A paired Student's *t* test was used to determine whether there were significant differences in onset latencies and peak-to-peak amplitudes of the MMEP between the affected and the normal limb in both cats and dogs. The relation between outcome and absence of DPP, ipsilateral loss of the panniculus reflex and presence of partial Horner's syndrome was studied using Chi square tests or Fisher's exact tests. The Mann–Whitney test was used to compare onset latencies in animals with a successful and an unsuccessful outcome. This test was also used to compare differences in peak-to-peak amplitudes of dogs with a successful versus an unsuccessful

Table 3

Neurological grade (Grade), EMG activity (EMG), time elapsed between injury and magnetic stimulation (Time to MS), ability to evoke magnetic motor evoked potential (MMEP) and outcome in cats with brachial plexus injury (outcome)

Cat	Grade	EMG	Time to MS	MMEP	Outcome
1	3	NP	5	No	<i>U</i>
2	3	NP	2	Yes	<i>S</i> , Grade 0
3	4	P	35	No	<i>U</i>
4	2	P	24	No	<i>U</i>
5	4	C	24	Yes	<i>U</i>
6	2	P	60	Yes	?
7	3	P	11	Yes	<i>S</i> , Grade 1
8	2	NP	2	Yes	<i>S</i> , Grade 1
9	4	NP	2	Yes	<i>U</i>
10	3	C	10	Yes	<i>S</i> , Grade 0
11	3	NP	0.5	Yes	<i>S</i> , Grade 0
12	3	C	2	No	?
13	3	P	7	Yes	?
14	3	NP	1	No	<i>U</i>
15	3	NP	4	Yes	<i>S</i> , Grade 2
16	3	P	6	No	?
17	3	P	6	Yes	<i>S</i> , Grade 0

C, spontaneous EMG activity in all muscles of the affected limb; P, spontaneous EMG activity in all muscles but the supraspinatus and infraspinatus muscle; NP, EMG not performed; *U*, unsuccessful outcome; ?, unknown outcome; *S*, successful outcome.

outcome. An unpaired *t* test with Welch correction was used for the variable peak-to-peak amplitude in the comparison between a successful and an unsuccessful outcome in the cats. Statistical analyses were performed with Graph Pad Instat software. Differences were considered significant at the 5% probability level ($P < 0.05$).

Results

Animals

Thirty-six dogs and 17 cats met the criteria for inclusion in the study. The dog group consisted of 23 males (64%) and 13 females (36%) with a mean (\pm SD) age of 2.7 ± 2.6 years and a mean (\pm SD) BW of 22.6 ± 13.3 kg. The group comprised different breeds, particularly Rottweilers ($n = 4$), Jack Russell terriers ($n = 4$) and mixed breed dogs ($n = 7$). Twenty-four dogs (67%) had a left sided lesion and 12 (33%) had a right sided lesion. The median duration of clinical signs at admission was 14 days (range: 0.29–365 days) (Tables 2 and 3).

The cats had a mean age of 2.9 ± 2.7 years and mean BW of 3.7 ± 0.9 kg, with 12 males (70%) and five females (30%). All cats were European Shorthairs, with 65% (11/17) that presented with a left brachial plexus lesion and 35% (6/17) with a right brachial plexus lesion. In the cats, the median duration of clinical signs at admission was 6 days (range 0.5–60 days) (Tables 2 and 3).

Neurological assessment

The animals were categorised in four groups according to severity of neurological deficits on the affected limb (Table 1). Most animals (54% of the dogs and 65% of the cats) were

presented with symptoms of no weight bearing on the affected limb, but with an intact DPP (complete brachial plexus injury). None of the animals presented with clinical signs that corresponded to a cranial brachial plexus trauma.

In 28 dogs (78%) and 7 cats (41%), unilateral loss of the panniculus reflex was observed, while the presence of a normal panniculus response could not be elicited in three cats. Partial Horner's syndrome (miosis) was seen in 22 dogs (61%) and 8 cats (47%). In two cats, the presence of partial Horner's syndrome could not be evaluated.

Electrodiagnostic testing

An EMG examination was performed in 25 dogs and 10 cats and spontaneous EMG activity (fibrillation potentials and positive sharp waves) was recorded in the muscles of the affected limb of each animal (Tables 2 and 3). In 20 dogs and 5 cats, the spatial distribution of spontaneous EMG activity corresponded with the localisation of the lesion. In 5 dogs and 5 cats, however, the spatial distribution of EMG activity differed from the localisation of the lesion.

In 22 dogs and 12 cats, magnetic stimulation of the radial nerve resulted in biphasic to polyphasic potentials. However, in 14 dogs and 5 cats, no MMEP could be evoked in the affected thoracic limb (Tables 2 and 3). Mean onset latency (\pm SD) and mean peak-to-peak amplitude (\pm SD) of the MMEP of the normal and the affected thoracic limb of the dogs and the cats are shown in Table 4. Statistically significant differences in onset latencies and peak-to-peak amplitudes were found between the normal and the affected thoracic limb in all animals.

Clinical outcome

Twenty-nine dogs were available for follow-up (80%; Table 2). Twenty-five of these 29 dogs (86%) showed no improvement at all, with four euthanased (16%), 11 (44%) having the affected limb amputated and 10 (40%) showing no improvement. Improvement in the grade of neurological status was reported in four dogs (14%), two of which regained complete functional activity (Grade 0), while the other two showed mild improvement (improvement to Grade 3 and to Grade 1, respectively).

Table 4
Mean \pm SD onset latency and peak-to-peak amplitude of the normal (N) and the affected (A) thoracic limb in dogs and cats

	N	A
<i>Dogs</i>		
Onset latency (mean \pm SD)	2.33 \pm 0.61	2.89 \pm 0.92 ^a
Peak-to-peak amplitude (mean \pm SD)	24.19 \pm 8.37	5.60 \pm 7.03 ^a
<i>Cats</i>		
Onset latency (mean \pm SD)	1.51 \pm 1.28	2.54 \pm 1.63 ^a
Peak-to-peak amplitude (mean \pm SD)	31.47 \pm 11.90	6.07 \pm 8.07 ^a

^a Significantly different ($P < 0.05$) from values of the normal limb.

The time period between initial admission and follow-up ranged from 1 month to 8 years in dogs that had a successful outcome and from 1 month to 7 years and 9 months in dogs with an unsuccessful outcome.

Thirteen cats were available for follow-up (76%; Table 3), with 6/13 cats (46%) showing no improvement of the affected limb and three of these cats having the limb amputated. Seven of the 13 cats (54%) showed improvement in comparison to the initial presentation. Four of these cats became completely normal (Grade 0), two showed paresis with weight bearing (Grade 1) and one cat regained some motor activity (elbow flexion, Grade 2). The time period between initial admission and follow-up ranged from 20 days to 4 years in cats with a successful outcome and from 1 month to 5 years in cats with an unsuccessful outcome.

Relation outcome – absence of DPP, unilateral loss of the panniculus reflex or presence of partial Horner's syndrome

In dogs, absence of DPP and ipsilateral loss of the panniculus reflex were significantly related with an unsuccessful clinical outcome. No significant relation between clinical outcome and presence of partial Horner's syndrome could be shown.

Clinical outcome of the cats was not statistically related with one of the presenting neurological variables (i.e. absence of DPP, unilateral loss of the panniculus reflex or the presence of partial Horner's syndrome). However, although there was no statistically significant relationship demonstrated, we observed that all cats with absence of DPP (3/14) had an unsuccessful outcome.

Relation outcome – magnetic stimulation

In all animals, the inability to evoke a MMEP after magnetic stimulation in the affected limb resulted in an unsuccessful outcome. Mean onset latencies (\pm SD) and mean peak-to-peak amplitudes (\pm SD) of the MMEP of the affected limb of dogs and cats with a successful versus an unsuccessful outcome are noted in Table 5. Between affected limbs, a significant difference in peak-to-peak amplitude in dogs with an unsuccessful versus a successful outcome was found; i.e. peak-to-peak amplitude in dogs

Table 5
Mean \pm SD onset latency and peak-to-peak amplitude of the affected limb of dogs and cats with a successful (S) or an unsuccessful (U) outcome

	S	U
<i>Dogs</i>		
Onset latency (mean \pm SD)	2.74 \pm 1.23	3.00 \pm 0.84
Peak-to-peak amplitude (mean \pm SD)	13.71 \pm 4.66	2.96 \pm 4.98 ^a
<i>Cats</i>		
Onset latency (mean \pm SD)	2.72 \pm 1.92	1.50 \pm 0.20
Peak-to-peak amplitude (mean \pm SD)	11.57 \pm 10.39	3.17 \pm 3.47

^a Significantly different ($P < 0.05$) from values of a successful outcome.

with an unsuccessful outcome was significantly lower than peak-to-peak amplitude in dogs with a successful outcome.

Discussion

A traumatic insult to the brachial plexus usually disrupts the nerve roots rather than the plexus itself (Welch, 1996; Holtzer et al., 2002). Assessing the exact site of rupture in a clinical case setting was, however, extremely difficult and it was assumed that the injury was to the nerve roots, as has been reported in the literature (Welch, 1996).

Clinical signs of brachial plexus trauma depend on which nerve roots of the plexus are affected and are categorised as cranial (C5–7 roots), caudal (C8–T2 roots) or complete (C5–T2 roots) injuries (Griffiths et al., 1974). In the present study, all animals were presented with a caudal or complete lesion. Initial clinical signs and progress of clinical signs of brachial plexus injury, however, depend on the extent of nerve root damage. Nerve root injuries are classified by increased severity in three broad categories: neuropraxia, axonotmesis and neurotmesis (Seddon, 1943). In this study, a minority of animals was presented with neuropraxia and axonotmesis injury. Most animals, however, were presented with more severe injury and showed only mild or, frequently, no improvement (Welch, 1996; Friedman, 1991; Burnett and Zager, 2004).

Diagnosis of brachial plexus trauma is based on history, clinical signs and electrodiagnostic testing (Steinberg, 1979; van Nes, 1986; Wheeler et al., 1986). Spontaneous EMG activity was found in all animals that underwent EMG examination. In some animals, however, the spatial distribution of spontaneous activity did not corresponded with the clinical presentation. The subjective evaluation of the animals' clinical condition might explain this discrepancy in findings. These findings are similar to those described in other studies (Steinberg, 1979; van Nes, 1986; Wheeler et al., 1986).

Magnetic stimulation of the radial nerves was performed since all dogs and cats were presented with caudal or complete brachial plexus injuries, which indicated radial nerve damage. Similar to electrically evoked activity of a motor nerve, the peak-to-peak amplitude of the MMEP reflected the number and size of motor units innervating the muscle. Onset latency reflected the conduction along the axon and thus reflected the degree of myelination of the nerve fibres (Welch, 1996). Peripheral nerve injuries may therefore decrease peak-to-peak amplitudes and increase the onset latencies.

In the present study, statistically significant decreases in peak-to-peak amplitudes and increases in onset latencies of the MMEP in the affected limb were observed in all animals. Interestingly, even in the animals that were presented earlier than 5 days after the traumatic injury, statistically significant differences were found between the affected and the normal limb. These findings may indicate the value of magnetic stimulation as an early electrodiagnostic tool in comparison to electromyography. Electrical stimulation of the radial nerve to evaluate its neural integrity may be

difficult because of its relative inaccessibility. In addition, electrical stimulation causes unwanted stimulation of pain receptors so general anaesthesia is required to perform the technique. Conversely, magnetic stimulation provided a less painful method of peripheral nerve stimulation (Barker et al., 1987; Barker, 1991) and could therefore be performed under sedation in veterinary clinical practice.

Prognostic indicators for functional recovery of the affected limb in the early course of the disease would be beneficial. In general, the lack of DPP is an indicator for a poor prognosis. In a recent study, the presence of pain perception was the best predictor for complete functional recovery (Faissler et al., 2002). In the present study, absence of DPP and unilateral loss of the panniculus reflex were indicative of a negative outcome in the dogs. For the cats, no relation between absence of DPP, unilateral loss of the panniculus reflex or presence of partial Horner's syndrome was detected. However, none of the dogs and cats that presented with symptoms of absent DPP showed further improvement.

An early decreased radial nerve conduction velocity indicates a poor prognosis in brachial plexus injuries (Welch, 1996; Faissler et al., 2002). In this magnetic stimulation study, the inability to evoke a MMEP resulted in all animals of both species in a negative outcome. Even in an early stage of the clinical course of the injury (1 day for the cats and 2 days for the dogs), the inability to evoke a MMEP resulted in an unsuccessful outcome. Interestingly, lower peak-to-peak amplitudes were observed in dogs with an unsuccessful clinical outcome, in comparison to dogs with a successful outcome, which was unexpected and requires further investigation. It can, however, be assumed that the inability to evoke a MMEP indicates a severe nerve root injury and poor prognosis, while a positive MMEP has an uncertain prognostic value.

Some of the limitations in this study relate to the retrospective manner in gathering follow-up information in some animals, the subjective evaluations, and the perceptions of the owners, which could have influenced the clinical outcome. However, reasons for amputation or euthanasia were primarily based on lack of improvement in the affected limb and not on secondary complications, while all animals that underwent a complete functional recovery were examined at the Small Animal Department.

Also, the results of a successful outcome in the animals in this study could have been biased because the animals that only showed a mild degree of improvement were included in the successful groups. Their improvement might have been associated with compensatory signs and therefore not with recovery of the original brachial plexus lesion. In addition, the time that elapsed between the inciting injury and the magnetic stimulation differed between the animals and it might be expected that longer lasting injuries would give more abnormalities. For all animals in this study, however, statistically different results were found between the normal and the affected limb, even though they were presented at different times.

The failure to evoke a MMEP resulted in an unsuccessful outcome in all animals, even though they were presented at different times following injury. We consider that this indicates the diagnostic and prognostic value of magnetic stimulation. In serial stimulation studies, however, time elapsed between the traumatic injury and the performance of magnetic stimulation might be of greater importance; an improvement in the evoked responses in serial stimulations could indicate re-innervation and would provide additional prognostic information. Therefore, serial magnetic stimulation studies would be necessary to obtain more information on the prognostic value of magnetic stimulation of the radial nerve in brachial plexus injuries.

Conclusions

Magnetic stimulation of the radial nerve in dogs and cats with brachial plexus trauma may offer an early diagnostic and prognostic tool. To the authors' knowledge, this is the first report on the use of magnetic stimulation of the radial nerve in dogs and cats with traumatic brachial plexus avulsion.

Conflict of interest statement

None of the authors of this paper has a financial or personal relationship with other people or organisations that could inappropriately influence or bias the content of the paper.

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