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PERONEAL NERVE INJURIES AS A COMPLICATION OF INJECTION*

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SUMMARY: Kırdı N,Yakut E, Meriç A. (School of Physical Therapy and Rehabilitation, Hacettepe University, Ankara, Turkey). Peroneal nerve injuries as a complication of injection. Turk J Pediatr 1998; 40: 405-411.

Ten children (8 males, 2 females) diagnosed with peroneal nerve injury as a complication of injection were included in this study. The age of the children ranged between four to seven years (mean 6.5 ± 1.25 years). Physiotherapy and rehabilitation protocol included superficial heat, neuromuscular electrical stimulation (either galvanic or faradic current according to the response elicited), electromyographic biofeedback, exercises (passive, active-assistive and active), and orthotic support. Before treatment, foot-drop and steppage gait were observed in all the patients; both were remedied. The post-treatment muscle strength and electrodiagnostic test results showed statistically significant improvement when compared with pretreatment values ($p < 0.05$). We believe that our relatively favorable results in this study, manifested as shorter recovery time with no residual deficits, may be related to early intervention with an extensive physiotherapy program. *Key words: post-injection peripheral nerve injury, physiotherapy.*

The common peroneal nerve aries from the division of the sciatic nerve in the popliteal fossa. It bears a close relationship with the head of the fibula as it winds anteriorly. It divides into superficial and deep branches, as well as giving off a purely sensory branch which forms the sural nerve, mediating sensation from the dorsum and lateral aspect of the foot[1-3].

The anatomical and topographical situation of the common peroneal nerve is very important. As the area is frequently exposed to trauma, paralysis is not rare[3]. Disc herniations; fracture of the pelvis, femur or caput fibulae; hip dislocation; orthopedic surgery; injection of drugs into or close to the nerve; and toxic infections may cause paralysis[2,3].

A number of antibiotic, antifungal and antituberculous drugs have been known to cause peripheral neuropathy in a small percentage of cases. Chloramphenicol, for example, can cause a mild, primarily sensory, peripheral neuropathy after long-term use of the drug at relatively high doses[4,5].

Most drug-induced neuropathies are reversible after discontinuation of treatment but recovery may be slow, especially when intoxication was prolonged[5].

Symptoms that appear in the nerve paralysis change in respect to the place of the lesion[1-3]. Injury to the sciatic nerve is often the result of injections into

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the nerve or in its vicinity. Paralysis may affect the whole territory of the sciatic nerve or only one of its two main divisions, most commonly the peroneal nerve. Foot-drop, amyotrophy and growth disturbances of the leg are the most frequent manifestations[5].

If the lesion is just above the popliteal fossa, total paralysis becomes evident. Dorsiflexion and evertion of the foot and extension of the fingers are lost. The patient walks with a "steppage gait" (walking with exaggerated knee and hip flexion). Sensory loss involves the dorsum and outer aspect of the foot. Partial common peroneal nerve palsies are common with very selective muscle weakness[1].

In general, the physiotherapy and rehabilitation protocol for peripheral nerve injuries resulting from different causes include heat; electrotherapeutic modalities, such as neuromuscular electrical stimulatilon and electromyographic biofeedback; therapeutic exercises (passive, active-assistive, active and resistive), orthotic devices; and training of the patient to best perform functional activities. Modalities are commonly used with the aim of delaying atrophy, improving the circulation in the muscles and maintaining normal range of motion[6-10].

We found two studies in the literature related to post-injection neuropathy, but did not come across a study reporting a specific physiotherapy rehabilitation protocol for the treatment of peripheral nerve injuries due to complications of intramuscular injections.

This report was undertaken with the aim of discussing a detailed and sequential physiotherapy program which can be implemented in such cases. It is a case report on 10 patients and for ethical reasons lacks a control group. The efficacy of the treatment protocol is evaluated within this limitation.

Material and Methods

This study was performed on 10 children who were diagnosed as having peroneal nerve paralysis at the Department of Pediatric Neurology in Hacettepe University Faculty of Medicine between 1992-1996. In all 10 cases the peroneal nerve was affected as a complication of intragluteal injection. The EMG evaluations were done at the Neurology Department of Hacettepe University following the 30th day of injury to the nerve and showed severe axonal degeneratilon. The patients were referred to the Physiotherapy Department of the School of Physical Therapy and Rehabilitation.

The age of the children (8 males, 2 females) ranged between four to seven years (mean 6.5 ± years. The peroneal palsies began after multiple injections of medication (penicillin, semisynthetic penicillin) and were noted immediately after a buttock injection. In four cases penicillin was used and in the remaining children semisynthetic penicillin was used.

The rehabilitation program started two to six weeks (mean 4.00 ± 1.83 weeks) after foot-drop was observed during gait.

All patients were assessed before and after the physiotherapy program through range of motion, manual muscle testing, posture and gait analysis, electrodiagnostic tests and sensorial evaluation. Range of motion was determined by goniometric measurements[11]. Muscle strength was assessed by Dr. Lovett's[12] manual muscle test on a scale of zero to five. Five shows normal muscle strength where the patilent can perform the activity of the muscle against gravity and hold against resistance given at the end of the range. Zero shows absence of muscle contraction.

Postural faults were determined from anterior, posterior and lateral posture analysis while standing. Gait analysis was performed by observation[12, 13].

For electrodiagnostic evaluation, the faradic excitability test was applied to the motor points of m. tibialis anterior and m. peroneus longus. In this test, the response of these muscles, to the same intensity of faradic current, was compared with the sound side. If there was not even minimal contraction response to the faradic current, it showed inexcitability and total degeneration. If the response was less than the sound side, it showed hypoexcitability and regeneration. Eliciting a more obvious contraction on the affected side showed hyperexcitability and degeneration[7].

Control EMGs were conducted every month as required. The EMG results were in accordance with clinical manifestations showing reinnervation at the time improvement of muscle strength was observed.

None of the patients complained of pain; sensorial evaluation was performed for discrimination of light touch and temperature.

After this evaluation, patients were treated with superficial heat (infrared) for 20 minutes followed by electrical stimulatilon (either galvanic or faradic current according to the response elicited) and a possive range of motion exercises daily, for five days a week. In order to localize the current to the muscles, a small active electrode was applied to the motor point of the muscle, the circuit being completed with the same size dispersive electrode sited at a proximal area. The muscles were stimulated for a total of 20 minutes, with a rest of five minutes between two 10 minute periods.

These modalities are commonly used for improving the circulation, delaying atrophy in the muscles and maintaining the normal range of motion[6, 8, 9, 10, 13].

During the treatment, static foot-drop orthoses were used to maintain the foot in normal alignment and to improve function[14]. The static orthosis was used until active contraction was achieved. When the patient was able to actively contract his/her muscles, electrical stimulation was discontinued, and reeducation treatment was begun with electromyographic biofeedback and active-assistive and active exercises.

Electromyographic biofeedback was applied by the use of surface electrodes for 20 to 30 minutes, three days a week.

The outcome of treatment was considered successful when electrodiagnostic tests showed regeneration: the patients were able to dorsiflex and evert their foot against gravity and walk a distance of 50 meters without foot-drop or a compensating steppage gait.

The measurement of the pre-to post-treatment values were evaluated statistically by the Wilcoxon signed rank test.

Results

The physical features and treatment results of the children are shown in Table I. Clinical manifestations of peroneal nerve damage varied considerably. For this reason, total time of treatment sessions ranged between 14 to 47 sessions (mean 20.1 ± 10.25 sessions) (Table I). Recovery took place between two to six months (mean 4.00 ± 1.83 months). Range of motion and sensory assessments showed no limitations or loss before or after treatment.

Table I: Physical Features of Cases

Case No.	Age (Years)	Sex	Primary Disease	Neurological Sign at Time of Diagnosis	Time When Physiotherapy Started	Length of Treatment	Residual Signs	Recovery Time
1	6	M	Prophylactic antibiotics after appendectomy		4 weeks	43 sessions		6 months
2	4	M	Acute tonsillitis	..	2 "	29 "		5 "
3	7	M	Infection of upper part of the respiratory tract		2 "	21 "		3 "
4	7	M	"	Foot-drop	4 "	32 "	No	5 "
5	6	M	Acute tonsillitis	No sensory loss	2 "	14 "	residual	2 "
6	6	F	Cellulitis		2 "	22 "	signs	3 "
7	4	M	Bronchopneumonia		4 "	20 "		3 "
8	6	F	Infection of upper part of the respiratory tract		6 "	47 "		6 "
9	6	M	"		2 "	28 "		5 "
10	7	M	"		2 "	14 "		2 "

M: Male, F: Female.

An increase in muscle strength took place with therapy. The difference was significant in favor of post-treatment values ($p < 0.05$) (Table II).

Table II: Pre-and Post-Treatment Values of the Manual Muscle Testing Scores (n = 10)

	Pre-Treatment Values	Post-Treatment Values
Sound Side	4.70 ± 0.45	4.80 ± 0.40*
Affected Side	0.40 ± 0.66	3.30 ± 0.48**

Number are mean ± SD.
* not significant.
** $p < 0.05$.

Before treatment, foot-drop and steppage gait were observed in all the patients; both were remedied.

The post-treatment electrodiagnostic test results of faradic excitability values ranged from hyperexcitability to hypoexcitability, with treatment showing regeneration, and statistically significant improvement ($p < 0.05$) (Table III).

Table III: Pre-and Post-Treatment Values of the Electrodiagnostic Test Results (Faradic Excitability) (n = 10)

		Pre-Treatment Values (mA)	Post-Treatment Values (mA)
M. Tibialis Anterior	Sound Side	5.40 ± 0.79	5.17 ± 0.50*
	Affected Side	3.78 ± 5.32	11.68 ± 4.25**
M. Peroneus Longus	Sound Side	5.31 ± 1.28	5.03 ± 1.03*
	Affected Side	4.35 ± 3.12	12.15 ± 7.06**

Number are mean ± SD.
* not significant.
** $p < 0.05$.

Discussion

There are few studies in the literature concerning post-infection peripheral nerve injuries. Many pathogenic mechanisms have been postulated for the palsies appearing in infants, children and adults in cases of intramuscular injection therapy. These mechanisms include allergic peripheral neuritis, puncture of the nerve, ischemia of the nerve, and direct neural damage by drugs[15, 16].

It is well recognized that peripheral nerve paralysis may occasionally occur in nerves distant from the injection site, and an allergic mechanism has been postulated. In Gilles's and French's[15] study, their cases had no clinical evidence of hypersensitivity to the medication being used. They observed that the majority of 21 patients suffering from sciatic palsy were infants. In our cases, there was also no clinical evidence of hypersensitivity to the medication. All our patients were pediatric and had peroneal palsy.

In spite of the widespread parenteral use of penicillin in various situations and in various concentrations, there appears to be but one report suggesting a toxic effect on the peripheral nervous system[16].

Broadbent et al.[16] reported four cases in whom there developed one sciatic, one ulnar and two radial peripheral nerve lesions immediately following the administration of penicillin into or about a peripheral nerve. In our study, four of the 10 children had received penicillin and the remaining had received semisynthetic penicillin. The peroneal nerve lesion had developed immediately following the administration of the medication.

Casey et al.[17] recorded clinical and electrophysiological observations in seven patients treated with vincristine for between six months and two years, and in six patients treated for two to three months. Reflex loss occurred early, followed by mild sensory disorder. Mild weakness of finger and/or toe extensors then developed, which in some patients became severe. The neuropathy was largely reversible, either when the dose was reduced or the drug stopped. The recovery time was between five to 32 months in this study.

Gilles and French[15] reported the results of 21 patients in whom foot-drop developed after intragluteal injection. Fifteen of the patients recovered without being treated. Recovery time ranged between 24 hours and 13 months. The remaining six were with sequelae with permanent foot-drop and had to use foot-drop orthoses during gait.

Broadbent et al.[16] assessed degeneration and regeneration in affected muscles by means of response to faradic stimulation in four cases of intramuscular injection complications. No treatment was administered, recovery took place between 10 to 18 months, and only one out of four cases recovered without residual signs. We also utilized the faradic excitability test in our patients (Table III). Recovery time ranged from two to six months and all our patients recovered without residual deficits.

After injury to the peripheral nerve, it is important to maintain the functional integrity of muscles and joints. With this objective, an appropriate physiotherapy rehabilitation program should be implemented to shorten recovery time and to ensure recovery without residual impairment. Such a program should encompass muscle reeducation. Various research studies have reported electromyographic biofeedback as the most effective form of muscle reeducation[9, 10, 18, 19].

Although there are only a few studies in the literature with which we can compare our results, we believe that our relatively favorable results, manifested as shorter recovery time with no residual deficits, may be related to early intervention with an extensive physiotherapy program.

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