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Italian multicentre study of peroneal mononeuropathy at the fibular head: study design and preliminary results

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Summary

Background. The most common entrapment in the lower extremity is peroneal mononeuropathy (PM) at the fibular head. Several studies of this condition have been published but, until now, no wide multicenter clinical-neurophysiological studies on PM are available. In recent years, multicenter studies have been suggested; moreover it is commonly accepted that a multiperspective approach provides more comprehensive results.

Method. The *Italian CTS and other entrapments Study Group* has designed a strict clinical and neurophysiological protocol to carry out a wide multicentre study on PM at the fibular head. In addition to traditional clinical-neurophysiological evaluation, the group has also adopted validated disability and patient-oriented measurements in order to obtain more comprehensive and reliable data about this entrapment. The study was designed: 1) to identify predisposing factors; 2) to better assess the clinical picture; 3) to evaluate relationships between etiological, clinical and neurophysiological findings; 4) to evaluate the natural evolution of the entrapment. Study design is described.

Findings. During the period from November 2002 to January 2004, 69 patients were enrolled consecutively in eleven Italian centres. Our preliminary data show that PM involves men more frequently than women (M : F = 3.9 : 1). With regard to the predisposing factors, PM is idiopathic (16%) or due to surgery (21.7%), prolonged posture (23.2%), weight loss (14.5%), external compression (5.8%), arthrogenic cyst at the fibula (1.4%), trauma (10.1%); it also occurred in bedridden patients (7.3%). Unexpectedly, peroneal nerve lesions were due not only to surgical operation close to the peroneal region, but were also associated with thoracic-abdominal surgery. Usually PM involves both terminal branches; patients complain of motor deficit in 99.5% of cases, sensory symptoms in 87.9% and pain in 19.7%.

Conclusions. Our preliminary results provide some interesting information and confirm the usefulness of multicentre and multiperspective studies to standardise the approach to nerve entrapment.

Keywords: Peroneal mononeuropathy; multicentre study; predisposing factor; patient-oriented; neurophysiology; group.

Introduction

The most common mononeuropathy in the lower extremity is of the peroneal nerve. The common peroneal nerve arises from the sciatic nerve at the popliteal fossa, winds around the fibular neck and then divides into two terminal branches. Both terminal branches may be impaired but the superficial peroneal nerve is usually less involved than the deep peroneal nerve [13].

Electrodiagnostic evaluation is extremely useful: 1) to confirm the clinical diagnosis, 2) to establish the site of the peroneal nerve lesion, 3) to assess the features of the neurophysiological damage and 4) to predict the prognosis and the expected course of recovery [13].

Several studies have described different predisposing factors of peroneal mononeuropathy (PM) [4, 5, 7–12, 15, 20–22] but few data are available on the correlation between the predisposing factors of the lesion

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and clinical-neurophysiological findings [3]. It is commonly accepted that multicentre studies provide a better representative population and, to our knowledge, until now no wide multicentre and multiperspective study on PM has been carried out. This kind of study can contribute useful data to the current attempt to standardise the approach to nerve entrapment [17, 18].

The *Italian CTS and other entrapments Study Group* designed a multiperspective protocol to perform a wide multicentric study on PM. In addition to the clinical-neurophysiological evaluation, the group also adopted a validated disability and patient-oriented measurements in order to obtain more comprehensive and reliable data on this entrapment.

The study was designed: 1) to identify predisposing factors; 2) to better assess the clinical picture; 3) to evaluate the relationships between the etiological, clinical, neurophysiological findings; 4) to investigate the natural evolution of the PM at the fibular head.

Study design

A careful review of the literature was made before developing the methodology plan. The collaboration of the group was carried out according to the recently proposed guidelines for multicentre collaboration and clinical research in neurology [6, 16].

Definition of cases and clinical diagnosis

According to previously reported clinical criteria [23], clinical diagnosis of a probable PM at the fibular head was made when there was weakness, with or without a sensory deficit, in any muscle supplied by the peroneal nerve, with no abnormalities in the distribution of other peripheral nerves in the limb and no historical evidence to suggest lumbosacral radiculopathy, plexopathy, or sciatic neuropathy. Patients with clinical or electrophysiologic evidence of a generalised peripheral neuropathy were excluded.

Definition of centre and data collection

Each centre consisted of a neurophysiological laboratory with the following characteristics:

1) *Staff*. At least one trained clinical neurophysiologist; when possible, a neurophysiology technician should be included in the staff.

2) *Neurophysiological instrumentation*. A commercially available electromyography (EMG) instrument with the following equipment: a) calibration signal output (motor and sensory); b) signal averager; c) electrical stimulator with isolation unit (constant current or constant voltage); d) internal cursor for latency and amplitude measurements; e) hard copy output.

Each centre had to provide at least 5 cases of peroneal mononeuropathy at the fibular head referred consecutively to the laboratory.

Diagnostic procedures and data collection were performed according to the following steps:

1. patient fills in two self-administered questionnaires (patient-oriented data)
2. investigator acquires the patient's personal data and history of pathology and completes a case form
3. clinical examination
4. electrodiagnostic examination
5. disability evaluation.

Patient-oriented evaluation

Two patient-oriented validated measurements, the SF-36 and the NASS, were used.

The *Medical Outcome Study 36-item Short Form (SF-36)* is the most widely used generic health tool [24]. The Official SF-36 Italian version [2] was administered to the patients in agreement with standardised methodologies [25]. SF-36 consists of 36 questions that inquire about the general health status of patients. This questionnaire provides eight specific categories of physical and emotional scores (Physical Function-PF, Role Physical-RP, Bodily Pain-BP, General Health-GH, Vitality-VT, Social Functioning-SF, Role Emotional-RE, Mental Health-MH) which are summed up in two main scores: Physical Composite Score (PCS) and Mental Composite Score (MCS). Very low PCS indicates severe physical dysfunction, distressful bodily pain, frequent tiredness and unfavourable evaluation of health status. Very low MCS indicates frequent psychological distress, and severe social and role disability due to emotional problems.

The *NASS questionnaire analyses* neurological symptom and function of inferior limbs and provides two specific scores: lumbar spine pain/disability (Lpain) and lumbar spine neurogenic symptoms (Lneur). Higher NASS scores (range 0–100) indicate better health. We used the Italian version of the American Academy of Orthopedic Surgeon (AAOS) [1] lumbar cluster self-administered questionnaire [19] which includes the NASS questionnaire (validated Italian version).

Personal data and patient history

Before examination, the neurophysiologist acquires data for each patient according to a case form.

The form includes the following clinical data: 1) name of the patient (this was immediately replaced with an identification code); 2) sex; 3) age; 4) potential predisposing factors (weight loss, habitual leg crossing or other prolonged posture, recent prolonged hospitalisation for a major illness, surgery operations, trauma or compression at the leg, etc.); 5) concomitant pathology (diabetes, metabolic or toxic diseases); 6) duration of symptoms; 7) type of onset; 8) trend of symptoms; and 9) therapies administered.

Clinical examination

Clinical examination included: muscle strength of knee flexor muscles (biceps femoris, semitendinosis, semimenbranosis), tibialis anterior, extensor hallucis, extensor digitorum, peroneus longus, gastrocnemius (graded using the Medical Research Council); trophysm of the tibio-fibular muscles; light touch and pinprick sensation were tested in the cutaneous distributions of the lateral cutaneous nerve of the calf and in the superficial and deep sensory branches of the common peroneal nerve; moreover, extended neurological examination is always performed.

Electrodiagnostic protocol and methods

Two different electrodiagnostic protocols could be adopted: a "standard electrodiagnostic protocol" and a "detailed electrodiagnostic protocol". The centres were given this choice of electrodiagnostic approach so as to include centres which otherwise would not have participated because they were unable to apply the more time consuming detailed protocol. This allowed us to have a larger number of participating centres.

The "*standard electrodiagnostic protocol*" included:

1) *Motor nerve conduction studies*: Surface recordings were made from two common peroneal-innervated muscles, the extensor digitorum brevis and tibialis anterior. Nerve conduction velocity from the popliteal fossa to the fibular head was always assessed. Moreover, latencies to initial deflection and amplitude (negative phase) of all compound motor action potentials (CMAP) were measured.
2) *Sensory nerve conduction studies*: Sural nerve conduction studies were performed using surface electrodes.
3) *Electromyographic evaluation*: tibialis anterior, peroneus longus and gastrocnemius muscles were examined with a concentric needle electrode. The muscles were examined at rest and during voluntary activation.

In the "*detailed electrodiagnostic protocol*", besides the standard electrodiagnostic evaluation, the following tests were also performed: motor nerve conduction study of the peroneal nerve from peroneus longus; sensory nerve conduction study of the superficial peroneal nerve (performed bilaterally); electromyographic evaluation of the short head of the biceps femoris, extensor hallucis longus and gluteus medius.

The following neurophysiological criteria for different pathophysiologic processes affecting the peroneal nerve were used: 1) *conduction blocking*: a drop in CMAP amplitude of more than 50% and in the CMAP area of more than 40% when recorded above or at the fibular neck compared with that recorded distally; 2) *axonal damage*: (a) denervation signs at rest (fibrillation potentials and/or positive sharp wave) and neurogenic recruitment during full effort in the needle EMG evaluation and/or (b) the amplitude of the peroneal CMAP (extensor digiti brevis, peroneus longus, tibialis anterior) was unelicitable, low compared with normal values for age, or relatively low (less than 50%) compared with the corresponding contralateral response; 3) *mixed involvement* (conduction block plus axonal damage): the nerve conduction studies and the electromyography results fulfilled both criteria.

Disability evaluation

To assess disability we used the Deambulation Index (DI).

The *Deambulation Index* is an adapted form (8-point scale) of the physical therapy portion of the Patient Evaluation Conference System.

The 8-point scale is: 0 = not assessed; 1 = needs maximal assistance from 2 people or an assistive device + 1 person; 2 = requires minimal assistance from another person with or without an assistive device; 3 = requires supervision and an assistive device; 4 = requires supervision for safety, no assistive device needed; 5 = independent but cannot walk at a reasonable rate and/or has poor endurance (i.e., 10 m or less with or without an assistive device). Difficulty ambulating outdoors; 6 = independent with assistive device. No supervision required. Person can ambulate indoors and outdoors under different conditions (i.e. ramp, carpet, curb, uneven surface, any season); 7 = within normal limits, functionally independent [16].

Statistical analysis

Statistical analysis will be performed by using the STAT-SOFT (OK-USA) package.

Kolmogorov-Smirnov and Liliefors probabilities tests are used to assess distribution.

In the case of a normal distribution and interval scale, the correlation is assessed by using Pearson's product-moment correlation coefficient, while the comparison of the groups is performed by using Student's T Test.

In the case of a non-normal distribution or measurement by ordinal or nominal scale, non-parametric analysis of the correlation is assessed by using Spearman's R test and the comparison of the groups is performed by using the U-Mann Whitney test.

In order to evaluate the relationship between two dichotomous variables and to evaluate the difference between two groups in the frequency of one dichotomous variable, the standard Pearson Chi-square test (2×2 table) is performed.

Results

Patient enrolment began in November 2002 and ended in January 2004. A total of 69 cases of PM at the fibular head (67 patients, of whom 2 were studied bilaterally) were consecutively studied in 11 centres distributed throughout Italy (see Fig. 1) with a mean of 6.3 cases per centre. Of the 67 patients, 20.9% were women and 79.1% were men. Age distribution was normal (mean 47.9, SD 20.6, range 11–80 (Kolmogorov-Smirnov $p < 0.10$, Lilliefors $p < 0.01$). The mean age at diagnosis in men (46.6 years) was significantly lower than in women (52.7 years) ($p < 0.000001$).

The patients presented motor deficit in 99.5%, sensory deficit in 87.9% and pain in 19.7% of cases.

An overall involvement of the common peroneal nerve was observed in 62 cases (89.9%), an involvement of deep peroneal nerve was observed in 6 cases

Fig. 1. Geographic distribution of the 11 participating centres of the Italian CTS and other entrapment study group

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(8.7%), and an exclusive involvement of the superficial peroneal nerve in 1 case (1.4%).

Thirty-four PM were right and 35 left.

As previously reported, in most cases (84%) a clear predisposing factor was identified [3].

With regard to the predisposing factors, PM was frequently perioperative (21.7%): 4 out of 15 cases underwent hip prothesis surgery, 3 cases tibia osteotomy, 3 cases coronarography, 2 cases abdominal surgery, 1 case thoracic surgery, 1 case thyroid surgery and 1 case prostate surgery. In all cases, on the basis of clinical history and examination, we could surely ascertain that the nerve impairment started immediately after surgery.

Prolonged posture preceded the onset of symptoms in 23.2% of cases, while PM was due to rapid weight loss in 14.5% of cases (we considered in this group patients with weight loss greater than 5 kg in 1 month). PM was due to trauma in 7 cases (10.1%), to prolonged bedridden state in 5 cases (7.3%), to external compression from casts in 4 cases (5.8%) and to arthrogenic cyst at the fibula in 1 case (1.4%).

Discussion

Several articles have described cases of peroneal mononeuropathy (PM) [4, 5, 7–12, 15, 20–22] but few data are available on the correlation between the predisposing factors of the lesion and clinical-neurophysiological findings [13] and no data are reported on multicentre studies. It is commonly accepted that multicentre studies provide a better representative population and can contribute useful data to the current attempt at standardising the approach to nerve entrapment.

The group designed a multiperspective protocol with clinical-neurophysiological, disability and patient-oriented measurements. The use of a patient-oriented evaluation made it possible to obtain a standardised clinical picture (standardisation is one of the most important advantages of this kind of measurement, which in turn facilitates wide and multicentric studies) and to compare clinical-instrumental objective findings with the "voice of the patient".

The preliminary results showed that PM is more frequent in men than women. As previously reported, sensory manifestations were common (87.9%) but pain was rare (19.7%) [12]. In most cases an overall involvement of the common peroneal nerve was observed (89.9%); an involvement of the deep peroneal branch alone (8.7%), or an exclusive involvement of the superficial peroneal nerve (1.4%) was rare.

With regard to the predisposing factors, this study confirms our data previously published: in most cases of peroneal mononeuropathy (84%) a clear predisposing factor can be identified. PM was frequently perioperative (21.7%). Unexpectedly, peroneal nerve lesions were due not only to surgical operation close to the peroneal region but were also associated with hip, cardiac or thoracic-abdominal surgery [3].

In conclusion our preliminary results provide some interesting information and confirm the usefulness of multicentre and multiperspective studies to standardise the approach to nerve entrapment.

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