

# Requests for electromyography in Rome: a critical evaluation

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## Summary

To date, there exist no data reporting the level of suitability of requests for electromyography examinations (EMGs) in Rome. The records of 1,220 consecutive patients (age: 57.6±15.0 years; 400 M, 820 F) in two neurophysiology laboratories were collected and analyzed. In total, 1,317 EMGs were requested, mainly by general practitioners (GPs) (57%) and orthopedic specialists (18%). The most common diagnoses were L4-L5 radiculopathy (22%) and carpal tunnel syndrome (21%); 332 examinations (25%) were normal. 68% of requests were not accompanied by any specific query. The concordance between initial hypothesis/final post-EMG diagnosis was low (<20%). When a specific query was indicated, the initial suspicion was confirmed by EMG in 54% of GP requests and 64% of requests by specialists ( $p=0.03$ ). No difference in diagnostic ability was found between specialists ( $p>0.05$ ). In 17% of cases, the EMG was deemed diagnostically useless by the neurophysiologist, which seems to indicate potentially suboptimal prescription of EMGs.

**KEY WORDS:** electromyography, diagnostic ability, requests, Rome.

## Introduction

Electromyography (EMG) is used to provide diagnostic support in neurological disorders of the peripheral nerv-

ous system and is commonly prescribed both by general practitioners (GPs) and by specialists (Lee et al., 2004). However, according to several studies, EMG is able to confirm the initial clinical diagnostic hypothesis in only 40-55% of cases referred to public facilities (Cocito et al., 2006; Mondelli et al., 1998; Podnar, 2005).

The importance of clinical evaluation as the main approach to diseases of the peripheral nervous system has been reduced by a combination of factors (i.e. the propensity of physicians to achieve rapid diagnoses through excessive simplification of diagnostic procedures and reliance mainly on instrumental evidence, and the pressing demand, in the medico-legal setting, for a quantifiable method capable of assessing the functional impairment of patients); this situation has contributed to an increase in the amount of EMG examinations performed.

If not prescribed to corroborate a clinical suspicion, EMG may be considered unnecessary in up to 33% (Johnsen et al., 1994) or 47% (Podnar, 2005) of patients.

Given the absence of available data reporting the level of appropriateness of requests for EMG examinations in central Italy, we carried out a survey of the referrals to two public facilities in Rome. Moreover, attention was paid specifically to the existence of radiological and clinical assessments carried out prior to EMG, in order to investigate whether these assessments might influence the specificity of EMG requests.

## Materials and methods

The study sample comprised 1,220 consecutive patients (mean age 57.6 ± 15.0 years, range 16-89 years, 400 M, 820 F) referred to two neurophysiology laboratories in Rome (Policlinico Casilino Hospital and ASL RM A) and undergoing a first-ever EMG examination. The patients were recruited from October to December 2012; outpatients accounted for 91% of the sample.

The following data were collected: patient's personal data, case history, general and clinical information indicated on the prescription, the type of physician prescribing the EMG, the diagnostic suspicion of the referring physician. The final diagnosis was made on the basis of the results of neurophysiological assessment, which included nerve conduction studies and EMG. Sensory and motor conduction studies were performed, namely bilateral recording of sensory and motor conduction and the F-waves of the median and ulnar nerves, sensory conduction of the sural nerve plus motor conduction, and F-wave of the peroneal and tibial nerves. The blink reflex test and nerve conduction

studies of the facial nerve were also performed, if appropriate. Moreover, repetitive stimulation was carried out when a disease involving the neuromuscular junction was suspected. When suitable, a concentric EMG needle was used to confirm the diagnosis.

The EMG request was considered appropriate when the physician who performed the examination (CC, MB, RDF) felt that the EMG would corroborate the suspected diagnosis and/or was useful for better interpreting the clinical signs, the radiological data, the symptoms and/or the medical history of the patient. EMG was considered useless when it gave normal findings in patients with symptoms or signs which clearly indicated diseases not involving the peripheral nervous system.

Non-parametric variables between the groups of prescribing physicians (GPs vs specialists) were compared using the chi-square test.

The variables that differed significantly between the two groups were regarded as predictors in a logistic regression model for dichotomous variables, considering the initial suspicion as the dependant variable. Moreover, the chi-square test was also used to compare referring physicians according to their medical qualification (GPs, orthopedic specialists, physiatrists, neurologists, neurosurgeons, rheumatologists, general surgeons, other physicians) with regard to the type of diagnosis made and the level of agreement between the initial and the post-EMG diagnosis; p-values <0.05 were considered statistically significant. Data were analyzed using STATA 5.0 statistical software (Stata Corp., College Station, TX, USA).

## Results

One thousand, three hundred and seventeen EMGs were performed (97 patients underwent both upper and lower limb EMGs).

The examinations were requested by GPs (57%), orthopedic specialists (18%), physiatrists (6%), neurologists (5%), neurosurgeons (5%), rheumatologists (2%), general surgeons (1%), and other physicians (6%).

The most recurrent diagnostic hypotheses were carpal tunnel syndrome (13%), upper or lower limb radiculopathy (10%), and polyneuropathy (4%).

In 430 of the 1,317 examinations (32%) a specific diagnostic suspicion had been formulated by the refer-

ring physician, while numerous requests were accompanied by a generic query (36%) or no query (32%). The most common diagnoses obtained by EMG were L4-L5 radiculopathy (22%), carpal tunnel syndrome (21%), and L5-S1 radiculopathy (13%). Three hundred thirty-two examinations (25%) were normal (Table I).

In 19% of cases the initial specific hypothesis matched the post-EMG diagnosis independently of which physician had prescribed the neurophysiological assessment ( $p>0.05$ ). When considering only the requests accompanied by a specific query, the initial suspicion was confirmed by EMG in 58% of cases (54% of those made by GPs and 64% of those made by specialists,  $p=0.03$ ).

Moreover, the requests reporting a precise diagnostic suspicion were associated with a higher degree of agreement with the final post-EMG diagnosis, whether or not radiological examinations ( $p=0.02$ ) or clinical assessments ( $p<0.01$ ) had been carried out beforehand. In a logistic model, radiological examinations ( $p=0.02$ ), but not clinical evaluation ( $p>0.05$ ), were capable of predicting the post-EMG diagnosis, regardless of the specialization of the physician who had requested the EMG ( $p>0.05$ ).

Compared with GPs, specialists more frequently examined patients and resorted to radiological examinations before deciding to request EMGs ( $p<0.01$ ).

Table II shows the diagnoses according to the categories of referring physicians.

In 229 cases (17%), the EMG was judged diagnostically useless by the neurophysiologist who performed the examination, regardless of the physician who had proposed it ( $p>0.05$ ).

## Discussion

In the present study, we investigated the degree of appropriateness of requests for EMG examinations submitted to two public facilities in Rome.

We found that the majority of EMG requests (68%) were made without any specific diagnostic suspicion, independently of the type of physicians referring the patients for EMG. As a result, the degree of agreement between the initial hypotheses and the final, post-EMG diagnoses was very low (19%).

Notwithstanding this large proportion of "generic" requests and the low concordance between the initial and the final diagnoses, the neurophysiologist who

Table I - Data regarding prescribed electromyography (EMG) examinations in two public facilities in Rome.

EMG (n=1,317)	Requested by GPs	Requested by specialists	p
Total requests, n (%)	753 (57%)	564 (43%)	-
Generic queries, n/tot (%)	505 (67%)	382 (68%)	>0.05*
Radiological examinations prior to EMG, n/tot (%)	244 (32%)	331 (59%)	<0.01*
Clinical examinations prior to EMG, n/tot (%)	67 (8%)	446 (79%)	<0.01*
Major suspicion, n/tot (%)	CTS, 132 (17%)	L4-L5 radiculopathy, 73 (13%)	-
Major diagnosis, n/tot (%)	CTS, 183 (24%)	L4-L5 radiculopathy, 142 (25%)	-
Normal EMGs, n/tot (%)	206 (27%)	126 (22%)	0.02*
Concordance between suspicion/final EMG diagnosis, n/tot (%)	133 (18%)	113 (20%)	>0.05*

\*chi-square CTS=carpal tunnel syndrome

performed the EMG judged the examination useful in most of the cases.

On analysis of the remaining requests, i.e. those with a clearly indicated diagnostic suspicion (32%), the degree of concordance between the initial suspicion and the final EMG-based diagnosis was found to be higher among specialists than among GPs.

Data from previous investigations showed a lower degree (<45%) of concordance between the initial hypothesis reported in the request and the final diagnosis made by EMG (Mondelli et al., 1998; Podnar, 2005; Johnsen et al., 1994). However, interpretation of these data should take into account the fact that several differences may exist between the various studies, reflecting the different settings where the investigations were carried out.

We did not find any differences between the specialists in terms of their diagnostic ability, taken to correspond to the degree of concordance between the specific queries accompanying the requests and the final diagnoses based on EMG (Mondelli et al., 1998). In our opinion, however, it is questionable that this level of agreement can be regarded as a valuable indicator of a physician's ability in correctly diagnosing diseases of the peripheral nervous system. In fact, we did not know whether the results of the previous examinations – for instance, radiological examinations – had been evaluated by the referring physicians prior to making a request for EMG. This information is not trivial, since the execution of radiological examinations prior to EMG was found to increase the level of appropriateness of requests in our population.

Moreover, it should be remarked that several EMGs were performed – in a manner perfectly fitting with the role of this tool in the diagnostic process – to exclude an impairment or a pathological involvement of the peripheral nervous system.

Therefore, we think that the low concordance between the initial hypotheses and the final diagnoses does not

necessarily reveal limited diagnostic competence on the part of the referring physicians.

In addition, in our population, the specialists, as a whole, were more likely than the GPs to examine patients and prescribe more radiological examinations before suggesting EMG. It should be observed that the requests with a precise query more frequently matched the final diagnosis when radiological examinations – but not clinical assessments – had previously been carried out. Hence, one could hypothesize that the clinical assessment itself had less impact than radiological examinations on the capacity to predict the EMG-based diagnosis. 58% of patients were informed in advance about the significance of EMG.

Hypothesizing a growing awareness of the usefulness of EMG among physicians over time, we expected to find, in our population, lower rates of non-specific requests, lower numbers of patients not informed about the type of examination they were facing, and a higher percentage of concordance between diagnostic suspicions and final diagnoses, compared to similar studies previously performed (Mondelli et al., 1998; Fulglsang-Fredriksen et al., 1995; Danner, 1990).

In conclusion, our study showed that EMGs are frequently prescribed by GPs and orthopedic specialists in two public facilities in Rome.

Compared with previous investigations, we found a high percentage of general requests; however, in our population, specific requests, when proposed, matched the final diagnosis more frequently than in other studies previously conducted in Europe.

Moreover, we found no difference between specialists in their diagnostic ability, measured as the degree of concordance between the specific queries in the prescriptions and the final diagnoses reached on the basis of EMG.

A greater awareness of the usefulness of EMG among physicians may allow an approximately 20% reduction in the amount of unnecessary EMGs performed each year in Rome.

Table II – The most common EMG-based diagnoses in two neurophysiology laboratories in Rome, according to the categories of physicians requesting the examination.

Requesting physicians, n examinations	Major diagnosis, n	Second diagnosis, n	Third diagnosis, n	p
General practitioners, 753	normal examination, 189 (27%)	carpal tunnel syndrome, 177 (25%)	L4-L5 radiculopathy, 131 (19%)	n.s
Orthopedic specialists, 246	L4-L5 radiculopathy, 62 (28%)	normal examination, 50 (22%)	carpal tunnel syndrome, 34 (15%)	n.s
Physiatrists, 76	L4-L5 radiculopathy, 18 (25%)	carpal tunnel syndrome, 16 (23%)	L5-S1 radiculopathy, 11 (16%)	n.s
Neurosurgeons, 71	L4-L5 radiculopathy, 15 (26%)	L5-S1 radiculopathy, 10 (18%)	carpal tunnel syndrome, 9 (16%)	n.s
Neurologists, 68	carpal tunnel syndrome, 18 (27%)	L4-L5 radiculopathy, 17 (25%)	L5-S1 radiculopathy, 9 (13%)	n.s
Rheumatologists, 27	normal examination, 9 (36%)	L4-L5 radiculopathy, 4 (16%)	L5-S1 radiculopathy, 4 (16%)	n.s
General surgeons, 7	carpal tunnel syndrome, 4 (57%)	normal examination, 2 (29%)	C5-C6 radiculopathy, 1 (14%)	n.s
Other physicians, 69	normal examination, 26 (38%)	L4-L5 radiculopathy, 15 (22%)	carpal tunnel syndrome, 7 (10%)	n.s

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