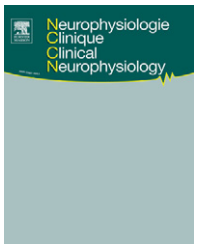
Neurophysiologie Clinique/Clinical Neurophysiology (2011) 41, 173—180

Disponible en ligne sur
ScienceDirect
www.sciencedirect.com

Elsevier Masson France
EM|consulte
www.em-consulte.com/en



ORIGINAL ARTICLE/ARTICLE ORIGINAL

A new electrode placement for recording the compound motor action potential of the first dorsal interosseous muscle

Un nouveau positionnement des électrodes pour enregistrer le potentiel d'action moteur du muscle premier interosseux dorsal

P. Seror*, T. Maisonobe, P. Bouche

Clinical Neurophysiology Federation, hôpital de la Salpetrière, Paris, France

Received 18 January 2011; accepted 13 June 2011
Available online 5 July 2011

KEYWORDS
Deep motor branch;
Distal motor latency;
First dorsal interosseous muscle;
Ulnar nerve conduction;
Wrist

Summary
Objective. — This paper describes a new electrode placement for recording compound muscle action potentials (CMAPs) of the first dorsal interosseous muscle (FDI) to determine the distal motor latency (DML) and study nerve conduction of the ulnar nerve across the wrist.
Methods. — The DML to the FDI was evaluated bilaterally in 90 subjects after stimulation 1 cm proximal to the distal wrist crease and at the palm. The CMAP was recorded with a pair of disposable surface electrodes fixed over the FDI and wrist.
Results. — The CMAP never exhibited a positive initial deflection, with a gain of 0.5 mV per division. DML to the FDI was 2.65 ± 0.26 ms (mean ± SD), and CMAP amplitude was 14.7 ± 3.3 mV. A prolonged DML was taken as 3.4 ms (mean + 3 standard deviation [SD]).
Conclusions. — This new electrode placement offers more reproducible results for determining the DML to the FDI as it provides the shortest DML, and the tightest SD values.
Significance. — This result is obtained through the respect of fundamental rules for CMAP recording, as it shows no positive wave at the onset of the CMAP of the FDI. Its use should improve the diagnosis of ulnar nerve lesions at the wrist and more especially of the deep motor branch.

* Corresponding author. 146, avenue Ledru-Rollin, 75011 Paris, France.
E-mail address: paulseror@gmail.com (P. Seror).

0987-7053/$ - see front matter
doi:10.1016/j.neucli.2011.06.003

MOTS CLÉS
Branche motrice profonde ;
Latence distale motrice ;
Muscle premier interosseux dorsal ;
Conduction nerf ulnaire ;
Poignet

Résumé
But de l'étude. — Cet article décrit un nouveau positionnement des électrodes pour enregistrer le potentiel d'action moteur (PAM) du premier interosseux dorsal (1IO) afin de déterminer la latence distale motrice (LDM) et d'étudier la conduction du nerf ulnaire dans la traversée du canal de Guyon.
Patients et méthodes. — La LDM a été étudiée de façon bilatérale chez 90 sujets normaux après stimulation 1 cm au-dessus du pli palmaire du poignet. Le PAM a été enregistré à l'aide d'une paire d'électrodes de surface monopolaires fixées sur le 1IO et la base du pouce.
Résultats. — Le PAM n'a jamais présenté d'onde initiale positive, même avec un gain de 0,5 mV par division. La LDM était 2,65 ± 0,26 ms (moyenne ± déviation standard [DS]), et l'amplitude du PAM était 14,69 ± 3,3 mV. La LDM est considérée comme anormale si elle est supérieure à 3,4 ms (moyenne + 3DS). L'étude de la conduction dans la traversée du canal de Guyon a toujours été possible.
Conclusions. — Ce nouveau positionnement des électrodes pour enregistrer le potentiel PAM du 1IO est le seul à ne jamais présenter d'onde positive initiale. Il procure la LDM la plus courte, la DS la plus petite et une bonne amplitude. Son utilisation devrait rendre plus fiable le diagnostic des lésions du nerf ulnaire au poignet et en particulier celles de la branche motrice profonde.

Ulnar nerve lesions at the wrist (UNLW) are difficult to diagnose because of their diverse clinical manifestations (sensory motor, purely motor with or without hypothenar muscle involvement or purely sensory) and because of frequent mild impairment of the distal motor latency (DML) to ulnar muscles with UNLW. Electrodiagnosis (EDX) of the UNLW is easy when motor and sensory conduction is impaired but difficult when sensory conduction remains normal and only the ulnar deep motor branch is impaired. Except for one study [10], most of the literature [2—4,7—9] demonstrates a wider variety of normal values for the DML to the first dorsal interosseous muscle (FDI) than to the abductor pollicis brevis (APB) and adductor digiti minimi (ADM) muscles. This paper describes a new electrode placement for recording the compound muscle action potential (CMAP) of the FDI after wrist stimulation, a technical advance of an earlier method [10], which is further improved by the use of disposable surface electrodes. The primary aim was to obtain normal data (mean and standard deviation [SD]) for DML and CMAP amplitude with this new electrode placement, secondary aims being to compare these normal data with those of previously described methods [3,9] and to determine some FDI-related data: the normal ulnar motor conduction across the wrist, and the ADM-FDI and APB-FDI latency differences.

Patients and methods

Ninety normal subjects (53 women and 37 men; mean age 43.3 years, range 17 to 84 years) underwent bilateral ulnar-nerve examination. Each subject was referred for EDX examination, for cervical root disorders ($n = 18$), shoulder or radial nerve trunk lesions ($n = 8$), upper brachial plexus lesions ($n = 2$), and functional complaints of upper limbs with normal EDX ($n = 62$). No patients had symptoms or signs related to ulnar nerve, median nerve, lower brachial plexus, C8/T1 root lesions or polyneuropathies. They all underwent standard EDX of the upper limb, including bilateral median and ulnar nerve conduction studies, and at least needle examination in C5 to T1 muscles in the symptomatic upper limb. All subjects gave their informed consent to the use of their EDX data for this study. The study was approved by the local committee on research ethics.

Skin temperature was measured on the dorsal aspect of the hand, and hands with temperatures below 32 °C were warmed in hot water prior to testing.

Motor conduction to the first dorsal interosseous muscles

The recording was made with a pair of disposable surface electrodes; the size of the surface electrodes was 19 mm × 15 mm. The active electrode was placed dorsally over the belly of the FDI at an equal distance to the metacarpo—phalangeal joints of digits 1 and 2, with the reference electrode on the dorsal aspect of the wrist over the trapezium bone (Fig. 1A; trace r1). This location was determined after searching the location of the reference electrode that provided the highest CMAP amplitude. This mapping, which compares three different inter-electrode distances: 2 cm (equal to the bar electrode [10]), 3.5 cm (basis of the first metacarpal bone) and 4.5 cm that correspond with the trapezium bone, was performed on 20 wrist controls. Supramaximal stimuli at the wrist (duration: 200 μs) were delivered, with a bar electrode (inter-electrode distance = 23 mm), 1 cm proximal to the palmar wrist crease on the ulnar nerve. Recording was continued while the ulnar nerve was also stimulated at the palm 4—7 cm distal to the wrist stimulation until a CMAP of the same shape and amplitude was obtained. The intensity of stimulation at wrist was rarely higher than 25 mAmp, but was much higher at the palm because of the thickness of the hypothenar muscles and palmar skin.

Conduction studies to the ADM and APB muscles were performed with standard methods. The ulnar nerve was stimulated 1 cm proximal to the palmar wrist crease, 6 cm below the medial epicondyle and 4 cm above the medial epicondyle to make sure that no asymptomatic ulnar nerve lesions at the elbow were included.

Latencies were measured to onset of the negative deflection of the CMAP, and the amplitude was measured from