Marinacci communication: an electrophysiological study

S. Meenakshi-Sundaram*†, Bharathi Sundar, M.J. Arunkumar

Department of Neurosciences, Apollo Speciality Hospitals, Lake View Road, K.K. Naga, Madurai, Tamil Nadu 625 020, India

Accepted 17 July 2003

Abstract

Objective: Prevalence of Martin-Gruber anastomosis, an anomalous median-to-ulnar forearm communication, is well reported in literature while Marinacci communication, the reverse of Martin-Gruber with a forearm ulnar-to-median communication is under-recognized. We systematically evaluated the presence of Marinacci communication in a series of patients referred for electrophysiological studies.

Methods: One hundred consecutive patients referred to the electrophysiological laboratory for various diagnoses were studied using standard techniques for motor, sensory and f wave studies.

Results: Of the 100 patients (200 arms) studied, electrophysiological features of Marinacci communication were observed in 4 patients (7 arms). Median stimulation with recording over abductor pollicis brevis (APB) revealed a pseudo-conduction block over the forearm segment while on ulnar stimulation and recording over abductor digiti minimi (ADM), the amplitude of the compound muscle action potential (CMAP) obtained on proximal stimulation was higher than that obtained on distal stimulation. Ulnar stimulation at the elbow but not at the wrist revealed CMAP from APB without initial positivity. Its amplitude was 50% of the amplitude obtained on median stimulation at the wrist.

Conclusions: Marinacci communication is not uncommon in the general population. A pseudo-conduction block on median stimulation and higher CMAP amplitude on proximal than distal stimulation provide valuable clues to its recognition.

q 2003 International Federation of Clinical Neurophysiology. Published by Elsevier Ireland Ltd. All rights reserved.

Keywords: Electrophysiology; Marinacci communication; Ulnar-to-median forearm anastomosis

1. Introduction

Anomalous communication between the nerves of the forearm is well recognized. The most frequent of these is one where a number of nerve fibers supplying ulnar-innervated muscles cross over from the median to the ulnar nerve in the forearm. Such a communication, described as Martin-Gruber anastomosis, occurs in 15–31% of subjects in an unselected population (Kimura, 1984). The reverse of such an anastomosis described as Marinacci communication (Stancic et al., 2000), is considered a rare variation and its exact prevalence is unknown. Kimura et al. (1983) reported the presence of such ulnar to median nerve communication in the forearm in only two out of 150 extremities (1.3%). In an unselected population of hundred consecutively referred patients to our electrophysiological laboratory we encountered 4 subjects with such an anastomosis, suggesting that this anomaly may have been under-reported earlier. We report the electrophysiological features of this rare anatomical variant in this communication.

2. Patients and methods

Data were collected from 100 consecutive patients referred to our electrophysiological laboratory for evaluation of various diagnoses which included polyneuropathy, radiculopathy, carpal tunnel syndrome and myopathy, or to ‘exclude abnormalities.’ Nerve conduction studies were performed using standard electromyographic equipment (Jaeger Tonnies, Neuroscreen plus) and standard techniques. For motor conduction median and ulnar nerves were stimulated at the wrist and elbow using supramaximal stimuli, and compound muscle action potentials (CMAPs) were recorded using surface electrodes over the abductor pollicis brevis (APB) and abductor digiti minimi (ADM) muscles. Recording and reference electrodes were placed...
using the standard belly-tendon arrangement. Amplitude, area and duration of the negative peak \((-p)\) of CMAPs from proximal and distal stimulation were measured. Conduction block was defined as a reduction of area and amplitude of proximal CMAP as compared to the distal with a 15% change in duration (Uncini et al., 1993). Sensory conduction studies were performed using stimulating ring electrodes applied to the index (median) and little (ulnar) fingers with the cathode over the proximal phalanx and the anode over the middle phalanx. Recording electrodes were placed on the wrist with the active electrode in the distal position and the ground electrode attached to the distal end of the wrist. F study was done using the standard technique (Panayiotopoulos and Chroni, 1996) with 10 supramaximal stimuli being delivered percutaneously. The minimal F latency and persistence were evaluated.

When unexpected and/or unexplained change in amplitude of CMAP between the proximal and distal site of stimulation was noted, the following technique was used. The ulnar nerve was stimulated over the wrist and below the elbow, and CMAPs were obtained from the abductor pollicis brevis. Care was taken to avoid volume conducted responses with initial positivity of the compound muscle action potential. Unconventional F studies were done by stimulating the ulnar additionally at the below-elbow site and potentials were picked up over the APB. Antidromic sensory potentials were obtained by stimulating the median and ulnar nerves at the wrist and recording the potentials using ring electrodes over digits 2 and 5, respectively.

3. Results

A total of 100 patients (200 arms) were evaluated prospectively. Abnormal forearm anastomosis consisting of fibers originating from the ulnar nerve and joining the median nerve was noted in 4 patients (7 arms). None of them had any symptoms or signs of neuropathy. Two patients were referred for evaluation of cervical radiculopathy and had mild disc prolapses in their cervical magnetic resonance images without significant pressure over the nerve roots or the cord. One patient had undergone lumbar laminectomy 2 years previously and was referred in view of recurrence of backache with pain radiating along the distribution of the left S1 radicle. One patient was evaluated for a possible acute inflammatory muscle disease. None of these patients had any skeletal abnormalities or muscle wasting. The electrophysiological features of these patients are presented in Table 1.

The abnormality was bilateral in 3 and present only in the right arm in one. In all, median conduction revealed an amplitude reduction of more than 50% on proximal stimulation (below the elbow) as compared to the amplitude obtained on distal stimulation (wrist), suggesting the presence of ‘conduction block’ (Uncini et al., 1993). On ulnar stimulation with pickup over the ADM, the amplitude of the CMAP thus obtained was 50% of the amplitude obtained on median stimulation at the wrist. F studies done on stimulating the conventional sites at the wrist for median and ulnar nerves were normal. However, on stimulating the ulnar at the elbow, F waves could be obtained over the APB. Sensory conduction studies were normal in all. Collision studies were performed in none.

4. Discussion

In contrast to the common occurrence of median-to-ulnar communication, that of ulnar-to-median communications is rare. Marinacci (1964) first reported a patient who,
following trauma to the median nerve at the forearm, had preservation of median innervated hand muscles despite denervation of forearm flexors. Motor axons supplying the thenar muscles could be stimulated in the median nerve at the level of the wrist and the ulnar nerve at the level of the elbow. Despite the reported rarity of such an anastomosis in the literature we documented the same in 4% of our patients, suggesting that the exact prevalence may have been under-reported earlier. Our patients were an unselected population referred for various reasons to the electrophysiology laboratory, and none of the 4 identified to have Marinacci communication had any features of neuropathy involving their upper limbs.

The electrophysiological observations in the present study deserve mention. Median conduction studies suggested the presence of conduction block. This results because on median stimulation at the wrist a larger number of fibers are stimulated, as this site is distal to the forearm anastomosis while below-elbow stimulation results in stimulation of relatively fewer fibers, this site being proximal to the site of the anastomosis. A conduction block of 50% thus observed suggests that at least 50% of the fibers of the median nerve travel in the ulnar prior to the communication before they reach the median nerve. In normal persons, the CMAP obtained on wrist (distal) stimulation is of higher amplitude than that obtained on below-elbow (proximal) stimulation over the median and ulnar nerves. This is due to the phenomenon of phase cancellation that occurs with a progressive increase of the distance to the recording point, resulting in a reduction of the amplitude of compound muscle action potential on proximal (below elbow) than on distal (wrist) stimulation. Ulnar stimulation in patients with Marinacci anomaly revealed higher amplitudes of the compound muscle action potentials at below-elbow than at wrist stimulation. This is because there are more fibers available for stimulation at the below-elbow site than at the wrist, since the proximal site also contains fibers destined to join the median nerve. In Martin-Gruber anastomosis a similar situation arises on stimulating the median nerve, where the higher amplitudes recorded over the APB reflect in part the volume-conducted responses from adjacent muscles, namely the first dorsal interosseus, adductor pollicis and thenar muscles, innervated by anomalous axons located in the ulnar nerve at the wrist. The exact reason for the higher amplitude noted on proximal as compared to distal stimulation of the ulnar nerve in the present study could not be exactly determined, as no muscle in the hypothenar eminence receives any supply from the median under normal circumstances. Streib reported a similar observation in his patient who had a compound muscle action potential that was 6.6 mV larger at the elbow than at the wrist on ulnar stimulation (Streib, 1979). While compound muscle action potentials of normal morphology and amplitude could be obtained over the APB on ulnar stimulation at the site below the elbow, no such potentials could be recorded or only volume-conducted responses were obtained over the same muscle, confirming that the site of such communication was indeed in the forearm.

F studies have not been previously reported on patients with these anomalous innervations. F studies were normal on distal stimulation. We obtained F waves over the APB on
stimulating the ulnar nerve at the below-elbow site, conforming to the expected observations. On sensory conduction study, the antidromic sensory nerve action potentials obtained over digit 5 on median stimulation at the wrist seen in one of our patients is intriguing. Ulnar-to-median communication involving only sensory fibers has only been rarely reported (Hopf, 1990). In the patient reported by Hopf (1990) the sensory nerve action potentials evoked by stimulation of the middle finger (ulnar side) and the ring finger (radial side) digital nerves were propagated with the median nerve at the wrist and the ulnar nerve at the elbow. Similar to these findings noted on orthodromic sensory study, we recorded antidromic sensory nerve action potentials from digit 5 on median stimulation at the wrist. Presumably these were due to anomalous ulnar fibers, which initially traveled in the median nerve and then joined the ulnar through the forearm communication. Pickup of sensory nerve action potentials from the proximal site (elbow) was, however, not done in this study.

In conclusion, Marinacci communication, although not as frequent as Martin-Gruber anastomosis, is not uncommon in electrophysiological practice. The importance of recognizing such anomalous anastomosis cannot be overemphasized. First, the changes noted over the median nerve may be interpreted as neuropraxia if one does not pay attention to the amplitude difference between the compound muscle action potential obtained on distal and proximal stimulation of the ulnar nerve. Second, ulnar nerve injuries at the elbow may be accompanied by denervation changes over median innervated thenar muscles such as the APB, which may receive these fibers through such a communication. Third, median nerve injuries at the elbow may not result in clinically significant effects on the thenar muscles, more importantly the APB.

References