

Posterior antebrachial cutaneous nerve conduction study technique

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ABSTRACT

PURPOSE: This paper describes an improved electrodiagnostic methodology for posterior antebrachial cutaneous nerve (PABC) neuropathy based on retrospective analysis. **METHODS:** Results of PABC nerve conduction studies in 14 control patients and 3 patients with left PABC neuropathy are included. Stimulation was performed 0.5 to 2.0 cm above the lateral epicondyle, and the recordings were acquired at 12 cm, 15 cm and 20 cm distally. Data was evaluated using the mean \pm standard deviation, calculated for descriptive analysis of continuous variables whereas frequencies and percentages were determined for categorical variables. Abnormal cutoff values including side-side comparison values were established so that all normal control values would fall within the normal range. **RESULTS:** PABC conduction studies with 20 cm recording distance demonstrated abnormal electrodiagnostic findings in all 3 patients, while more proximal recordings failed to document the neuropathy. **CONCLUSION:** The recording of PABC responses at 12 cm, 15 cm and 20 cm distal to the stimulating electrode offers a more comprehensive evaluation and may be a more sensitive test for evaluation of suspected PABC neuropathy, in comparison to traditional 12 cm recording.

Search Terms: Posterior Antebrachial Cutaneous Nerve, Nerve Conduction Study; Radial Neuropathy, Spiral Groove.

INTRODUCTION

The posterior antebrachial cutaneous nerve (PABC) is a sensory nerve that arises from the radial nerve at the spiral groove, perforates the lateral head of the triceps at its humeral attachment, continues lateral to the elbow, passes through the dorsal forearm to the wrist and innervates the lateral-dorsal forearm (Clement, 1985). Few cases of isolated PABC neuropathy with nerve conduction study corroboration have been reported (Chang, 1990; Doyle, 1993). These cases were studied with an electrodiagnostic method that used a 12 cm recording distance (MA, 1983). This paper describes a more comprehensive electrodiagnostic methodology for PABC neuropathy.

METHODS

Surface stimulation was performed 0.5 to 2 cm above the lateral epicondyle between the biceps and triceps. With the forearm pronated, 1 cm circular metal recording electrodes were placed 12 cm, 15 cm, and 20 cm distal to the stimulating electrode at a line extending from the stimulation point to the mid-dorsum of the wrist between the ulnar and the radial styloid processes. A ground electrode was placed between the stimulating and recording electrodes, closer to the recording electrode. The reference electrode was placed approximately 2 cm distal to the active electrode. A Nicolet Viking IV machine was used with filter settings of 20Hz - 5KHz. Skin temperature was maintained at least 32°C during the study. Bilateral PABC onset latencies, negative peak latencies, onset-peak amplitudes, peak-peak amplitudes, and onset conduction velocities were determined. The base line was maintained free of 60 cycle and motor artifacts. Four to eight averages of the PABC response were performed.

Normal data were obtained from 14 controls. Data were evaluated using the mean \pm standard deviation, calculated for descriptive analysis of continuous variables whereas frequencies and percentages were determined for categorical variables. Abnormal cut off values including side-side comparison values were established, so that all normal control values would fall within the normal range. Three patients with PABC neuropathy were also evaluated.

RESULTS

The mean age of the control group is 41.6 years (range: 25-80, median: 35). The abnormal cutoff values are included in Table 1. For side-side comparisons, a study is abnormal if the amplitude value is 50% or less than the contralateral side, or if the latency is 1 ms or more than the contralateral side. The values of peak-peak amplitude and onset to peak amplitude were similar in our study most likely related to the small amplitude of the PABC responses (Figure 1).

Three patients with clinical examinations suggesting left PABC neuropathy were studied. Patient 1 is a 36-year-old man with numbness and tingling over the distal dorsal aspect of left forearm for 6 months. Muscle strength was normal in left upper extremity. Sensory examination revealed normal sensation in the territory of left lateral antebrachial cutaneous nerve and left superficial distal radial nerves. Pin prick sensation was decreased in the distal territory of left PABC. Motor and sensory nerve conduction studies of the left median, ulnar, and radial nerve were normal. The PABC response with a traditional 12 cm recording distance was normal. However, a 20 cm recording demonstrated a side-side amplitude asymmetry (Right onset latency 3.7ms; Right onset-peak amplitude 6 μ V; Left onset latency 4ms; Left onset-peak amplitude 1 μ V). [Table 1, Figures 2 and 3].

Patient 2 is a 37-year-old man with left dorsal forearm numbness after trauma. Pinprick sensation was decreased over the distal PABC dorsal forearm territory. Nerve conduction studies 5 days after the trauma were normal. The PABC nerve was only evaluated with 15 cm recording distance and was normal. (Right onset latency 2.3ms; Right onset-peak amplitude 14 μ V; Left onset latency 2.5ms; Left onset-peak amplitude 14 μ V). However, 8 days later, there was a 50% PABC amplitude decrease (Left onset latency 2.4ms; Left onset-peak amplitude 7 μ V), in comparison to the initial study. [Figure 3]

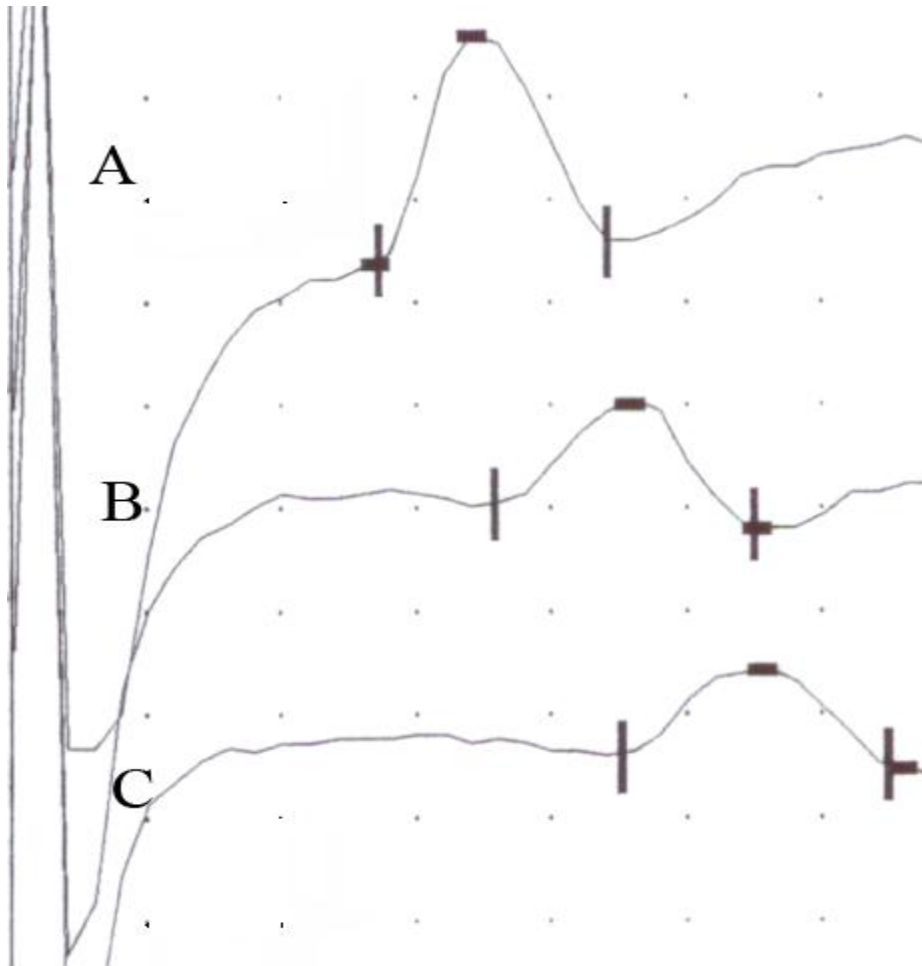
Patient 3 is a 30-year-old man that was initially recruited as a normal control. His neurological examination was normal. PABC testing revealed a sole finding of an absent left PABC response recording at 20cm. Upon further questioning he recalled a history of significant trauma in the remote past to the left elbow region, with numbness in the forearm at the time.

Table 1: PABC Nerve Conduction Studies in Controls and Patients with Normative Cutoff Values Included

	Onset latency (ms)	Negative Peak latency (ms)	Onset peak amplitude (μ v)	Peak to peak amplitude (μ v)	Conduction velocity (m/s)
NORMALS					
12 cm	1.9 \pm 0.2	2.5 \pm 0.3	7.4 \pm 2.6	7.4 \pm 2.6	62.8 \pm 11.6
12 cm Range: Minimum/Maximum	1.6 - 2.4	1.8 - 2.9	4 - 12	4 - 20	50 - 75
12 cm: Right - Left	0.1 \pm 0.2	0.1 \pm 0.2	1.2 \pm 3.5	1.2 \pm 3.5	6 \pm 8.1
ABNORMAL 12 CM CUTOFF VALUES	>2.5	>3	<3	<3	<49
15 cm	2.4 \pm 0.3	3. \pm 0.4	5.3 \pm 1.4	5.2 \pm 1.4	61 \pm 13
15 cm Range: Minimum/Maximum	1.9 - 3.2	2.4 - 3.6	3-8	3 - 8	46.8 - 77
15 cm: Right - Left	0.2 \pm 0.3	0.3 \pm 0.2	1.2 \pm 1.7	1.5 \pm 1.7	5.2 \pm 9
ABNORMAL 15 CM CUTOFF VALUES	>3.3	>3.7	<2	<2	<46
20 cm	3.3 \pm 0.4	3.6 \pm 0.7	3.3 \pm 1.3	3.3 \pm 1.3	60.6 \pm 10.8
20 cm Range: Minimum/Maximum	2.5 - 4.2	2.9-4.8	1.5 - 8	1.5 - 8	47.6 - 80
20 cm: Right - Left	0.1 \pm 0.2	0.1 \pm 0.2	1.6 \pm 1.5	1.6 \pm 1.5	2.5 \pm 5.7
ABNORMAL 20 CM CUTOFF VALUES	>4.3	>4.9	<1	<1	<46
PATIENTS					
Patient 1: 12 cm	L: 2.3; R: 2.3	L:2.8; R:2.7	L:6.8; R:8.1	L:6.8; R:8.1	L: 51; R:53
Patient 1: 20 cm	L: 4; R: 3.7	L::4.6 R: 4.3	L: 1.1; R: 6	L: 1.1; R: 6	L: 50; R: 52
Patient 2: 15 cm	L:2.5; R:2.3	L:2.9; R:2.8	L:14.4; R:14.4	L:14.4;R: 14.4	L:60; R:64
Patient 2: 15 cm - a week later	L:2.5	L:2.9	L: 7.1	L: 7.1	L:63
Patient 3: 12 cm	L:2.2; R:2.4	L:2.7; R:2.9	L: 4; R: 5	L:4; R:5	L: 54; R: 50
Patient 3: 15 cm	L:2.8; R:3	L:3.2; R:3.6	L:4; R 5	L:4; R 5	L:53.5; R: 50
Patient 3: 20 cm	L: Ab.; R:3.8	L:Ab.; R:4.2	L:Ab.; R: 4.8	L:Ab.; R:4.8	L:Ab.; R: 52

Ab. = Absent; Numbers reported are the mean +/- standard deviation.

Figure 1: PABC recordings in a normal control.



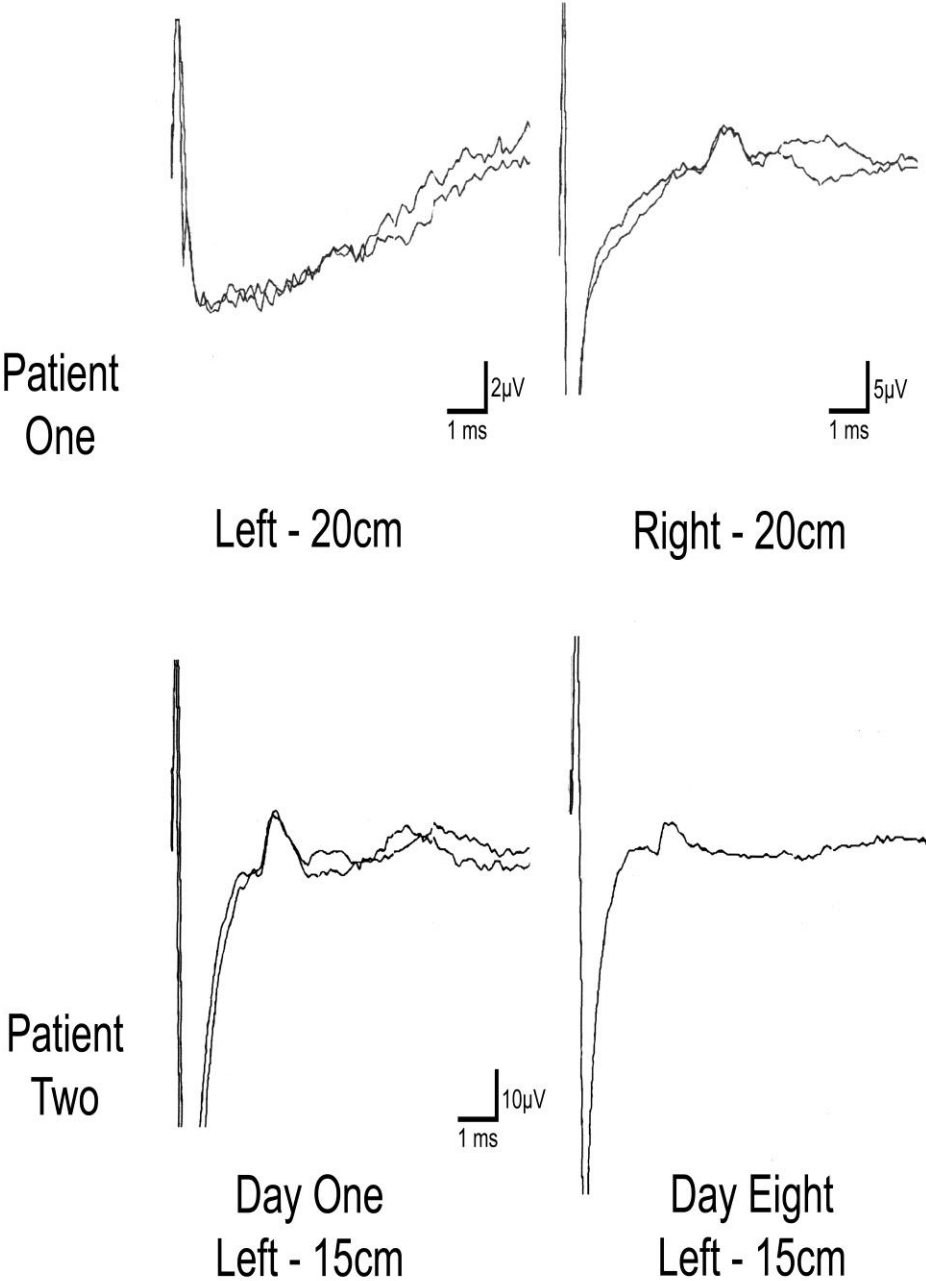
Note: A: 12 cm recording; B: 15 cm recording; C: 20 cm recording; The top two traces were recorded at 10 microvolts per vertical division. The bottom trace was recorded at 5 microvolts per vertical division. All traces were recorded at 0.5 milliseconds per horizontal division.

Figure 2: Left Upper Extremity of Patient One



Note: The symptomatic area is cross-hatched. The X to the right is at the 12 cm recording location. The X within the area of numbness is at the 20 cm recording location.

Figure 3: PABC Recording of Patients One and Two



DISCUSSION

Isolated PABC with electrophysiologic confirmation has rarely been reported (Chang, 1990). In the MA method, the recording site was 12 cm distal to a stimulating electrode located 0.5-2 cm above the lateral epicondyle (MA, 1983, Prakash 2004). The MA method was used in a series of controls to determine PABC normal values (Doyle, 1993, Prakash, 2004). It was also used in radial neuropathy to exclude C7 preganglionic radiculopathy and pure motor posterior interosseous syndrome, to aid early diagnosis of radial neuropathy at the spiral groove with normal radial nerve conduction studies, and in the prognosis of radial nerve dysfunction (Lo, 2004).

However, in our three patients, the M method failed to detect an abnormality. In patients 1 and 3, the M method failed to detect an abnormality. In these patients, the electrodiagnostic study was performed 6 months or years after symptoms onset. Partial axonal regeneration of some of the nerve fibers within the nerve may have allowed return of function in the proximal segments of the nerve. We observed this in patients 1 and 2, in whom we could only find a patch of anesthesia corresponding to the distal part of the PABC on clinical examination, which was distal to the 12 cm recording location.

As the normal PABC sensory nerve action potential amplitudes are relatively low in controls, there is a risk of false positive results. The history and physical examination should therefore guide the electromyographer as to the optimal choice of recording distance. Careful attention should also be given to technical considerations, such as ensuring that the baseline is free of 60 cycle and motor artifacts and that sufficient averaging is performed before considering that a response is absent. As the normal cutoff value at 20 cm recording distance is very low, care should be taken to combine this test with the clinical history and physical examination in formulating patient management.

CONCLUSION

The recording of PABC response at 12, 15 and 20 cm distal to the stimulating electrode offers a more comprehensive evaluation and may be more sensitive test for evaluation of suspected PABC neuropathy, in comparison to traditional 12 cm recording. This benefit is highlighted by the distribution of numbness in the first two of our patients, which was distal to the 12 cm recording site. Furthermore, the more distal recording sites would be expected to have a higher diagnostic sensitivity if electrodiagnosis is delayed following nerve injury, in which case axonal regrowth may have normalized findings at the more proximal recording locations.

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