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# Electrophysiological study of posterior antebrachial cutaneous nerve in a sample of normal subjects

Emmanuel Kamal Aziz Saba


## Abstract

**Backgrounds:** Posterior antebrachial cutaneous nerve sensory conduction study is clinically essential for the assessment of its integrity and for the localization of radial nerve lesions. The aim of the study was to assess posterior antebrachial cutaneous nerve sensory antidromic conduction technique and to obtain normal reference values for different sensory nerve action potential parameters of this nerve among a sample of Egyptian population.

**Results:** The current study included 120 upper limbs of 60 apparently healthy subjects [35 (58.3%) women]. Their mean age was 39.20 ± 11.95 years. The posterior antebrachial cutaneous nerve was recorded in all upper limbs (100%). The values (mean ± standard deviation) for the posterior antebrachial cutaneous nerve sensory nerve action potential onset latency were 2.05 ± 0.25 ms, peak latency was 2.63 ± 0.28 ms, conduction velocity was 60.50 ± 5.38 m/s, amplitude was 11.04 ± 4.26 μV, and inter-side sensory nerve action potential amplitude ratio was 0.69 ± 0.17. There were no statistically significant differences between men and women, as well as between right and left upper limbs regarding different posterior antebrachial cutaneous sensory nerve action potential parameters. There were no statistically significant correlations between participants' age and anthropometric measures (i.e., height, weight, and body mass index) with different posterior antebrachial cutaneous nerve sensory nerve action potential parameters. There were no statistically significant adjusted effects of age, gender, and anthropometric measures on different posterior antebrachial cutaneous nerve sensory nerve action potential parameters in multiple linear regression analysis by controlling all other physiologic factors.

**Conclusions:** This research provides an applicable electrophysiological technique and normal reference values for the posterior antebrachial cutaneous nerve sensory conduction study.


**Keywords:** Antidromic technique, Posterior antebrachial cutaneous nerve, Posterior cutaneous nerve of the forearm, Radial nerve, Sensory conduction study

## Backgrounds

Posterior antebrachial cutaneous (PABC) nerve is known as posterior cutaneous nerve of the forearm. It is a branch of the radial nerve [1–3].

The neurophysiological assessment of this nerve is clinically important. It assesses the integrity of PABC nerve, as well as the radial nerve in conditions associated with affection of these nerves [4–8]. Scanty studies assessed this nerve electrophysiologically [4–6, 9, 10].

The aim of this study was to assess PABC sensory antidromic conduction technique and to obtain normal reference values for different sensory nerve action potential (SNAP) parameters of this nerve among a sample of Egyptian population.

## Methods

The present study included 120 upper limbs of 60 apparently healthy subjects. All the participants had no risk

Correspondence: emadaziz55@yahoo.com
Physical Medicine, Rheumatology and Rehabilitation Department, Faculty of Medicine, Alexandria University, Alexandria, Alexandria Governorate 21131, Egypt

factors of neuropathy, no neurological symptoms, and with normal neurological examination of both upper limbs. The participants included hospital health care staff, hospital non-medical workers, their relatives, and relatives of patients attending the outpatient clinic of Physical Medicine, Rheumatology and Rehabilitation Department, Main University Hospital, Faculty of Medicine, Alexandria University. The investigator explained the study to the participants. An informed consent was given by each. The local Ethics Committee of Faculty of Medicine, Alexandria University, Egypt, approved the study.

Demographic data were collected. Anthropometric measures including height, weight, and body mass index (BMI) were measured [11]. Neurological examination was done for all studied subjects.

Sensory nerve conduction study of the PABC nerve was performed using an antidromic technique [4]. The electrophysiological study was performed using a Nihon Kohden Neuropack S1 MEB-9400 unit with a two-channel evoked potential/electromyography measuring system (Nihon Kohden Corporation, Tokyo, Japan). The skin temperature of the upper limb was maintained around 32–34 °C with infrared lamp. Adequate cleaning of the skin surface was done before placing the recording surface disc electrodes [12].

Surface electrical stimulation of the PABC nerve was done using a bipolar stimulator while the subject was sitting, extending the elbow, and pronating the forearm while relaxing the forearm muscles. The nerve was stimulated just proximal to the lateral epicondyle by 2 cm on the lateral aspect of the arm between the triceps and biceps brachii muscles antidromicaly. The active recording surface disc electrode was attached to the posterior surface of the forearm by about 12 cm distal to the cathode of the bipolar stimulator. It was located along a line extending from the stimulation point to the mid-dorsum of the wrist. The reference surface disc electrode was placed 3 cm distal to the active recording surface disc electrode along the same line. The ground electrode was placed between the recording electrodes distally and the bipolar stimulator proximally [4, 13]. Figure 1 is an illustration of the PABC nerve sensory conduction study technique. The conduction distance was measured with a precision of 1 mm using a measuring tape. The production current ability of the bipolar stimulator was 50 mA, with pulse duration of 0.1–0.2 ms. Supramaximal stimulation and signal averaging were done. The sweep speed was 2 ms/division while the sensitivity was 5–10 μV/division. The filter bandwidth was 20 Hz to 2 kHz. The obtained SNAP was recorded twice and they were superimposed to confirm reproducibility. The following SNAP parameters were measured: onset latency (OL), peak latency (PL), base-to-peak (baseline to negative peak) amplitude, and conduction velocity (CV) (using OL) [2]. Side-to-side differences in the OL, PL, and CV were calculated. The inter-side amplitude ratio (smaller amplitude/larger amplitude) was calculated [14].

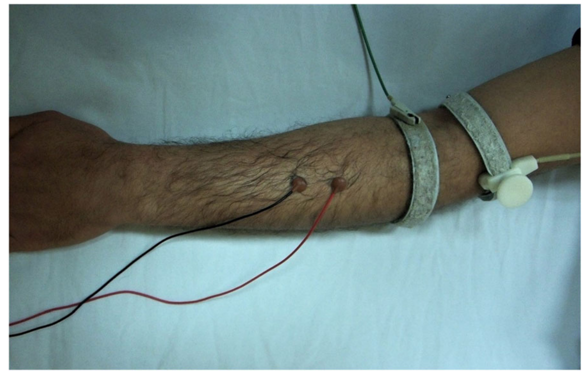


**Fig. 1** Technique of posterior antebrachial cutaneous nerve sensory conduction study showing the stimulation and recording positions

Statistical analysis of data was performed using the Statistical Package for the Social Sciences (SPSS, version 17) software (Statistical Package for the Social Sciences, version 17, London, UK: University of Cambridge Computing Service; 2007). Count, frequency, minimum, maximum, mean, and standard deviation (SD) were the descriptive measures used. Analytic measures (Student's *t* test, paired *t* test, and chi-square test) were used. Correlation was assessed using the Pearson's correlation test. Multiple linear regression analysis was done to assess the adjusted predictors' effects of age, gender, and anthropometric measures on PABC SNAP parameters. Statistical significance was assigned to any *P* value at less than 0.05. The reference cutoff values of the electrophysiological parameters were calculated by rounding the mean ± 2 SD to the nearest 10th to measure the upper limit of normal or the lower limit of normal, respectively.

## Results

The study included 120 upper limbs of 60 apparently healthy volunteers [25 (41.7%) men and 35 (58.3%) women]. Their mean age was 39.20 ± 11.95 years (range 20–64 years). Their mean height was 163.16 ± 5.65 cm, mean weight was 78.47 ± 17.12 kg, and mean BMI was 29.11 ± 5.61 kg/m$^2$. There were no statistically significant differences between men and women as regards age ($t$ = 0.432; $P$ = 0.666), height ($t$ = 1.672; $P$ = 0.097), weight ($t$ = 1.605; $P$ = 0.111), and BMI ($t$ = − 1.228; $P$ = 0.222). Also, there was no statistically significant difference between men and women regarding BMI categories ($X^2$ = 6.267; $P$ = 0.180).

Bilateral study was conducted on all participated healthy volunteers (100%). All participated subjects tolerated the PABC sensory nerve conduction study well. Table 1 demonstrates the reference values for the different parameters of the PABC SNAP. Figures 2 and 3 illustrate PABC SNAPs. There were no statistically significant differences between men and women, as well as between right and left upper limbs regarding different PABC SNAP parameters (Tables 2 and 3). The intra-subject side-to-side differences of the PABC SNAP parameters are tabulated in Table 4.

There were no statistically significant correlations between participants' age and anthropometric measures (i.e., height, weight, and BMI) with different PABC SNAP parameters (Table 5). There were no statistically significant adjusted effects of age, gender, and anthropometric measures (i.e., height, weight, and BMI) on different PABC SNAP parameters in multiple linear regression analysis by controlling all other physiologic factors (Table 6).

## Discussion

Posterior antebrachial cutaneous nerve is a pure sensory nerve. It is a branch of the radial nerve [1–3]. PABC nerve roots are the fifth to eighth cervical (C) nerve roots and mainly the seventh cervical nerve root [15]. The majority of the nerve fibers that form the PABC nerve travel through the middle trunk of brachial plexus, and then they travel through the posterior cord of brachial plexus. It branches from the radial nerve just proximal to the spiral groove before the mid-shaft of the humerus in the posterior compartment of the arm. It originates after the exit of motor branches to the triceps muscle. It descends in close relation with the radial nerve into the spiral groove and pierces the lateral head of triceps muscle [15, 16]. Then, it descends downwards along the lateral border of the arm then along the dorsal surface of the forearm to innervate the skin of the dorso-lateral forearm surface (Fig. 4) [17]. In the forearm, it is divided into lateral and medial branches which descend to the level of the wrist [4, 15]. The PABC nerve sensory territory covers the middle area of the posterior aspect of the forearm in-between the sensory territory of the medial antebrachial cutaneous nerve medially and the lateral antebrachial cutaneous nerve laterally (Fig. 5) [2, 3].

The radial nerve electrophysiological assessment includes the radial motor nerve conduction study and sensory nerve conduction study of the superficial radial branch of the radial nerve in association with needle electromyography of radial nerve supplied muscles [2, 18]. However, there is no well-standardized sensory conduction technique for directly evaluating the sensory conduction along PABC nerve.

All the subjects tolerated the PABC nerve conduction study well. The SNAP was easily obtainable in all participated subjects bilaterally. The sensory conduction antidromic technique was utilized in the current study for eliciting a SANP of a high amplitude [2].

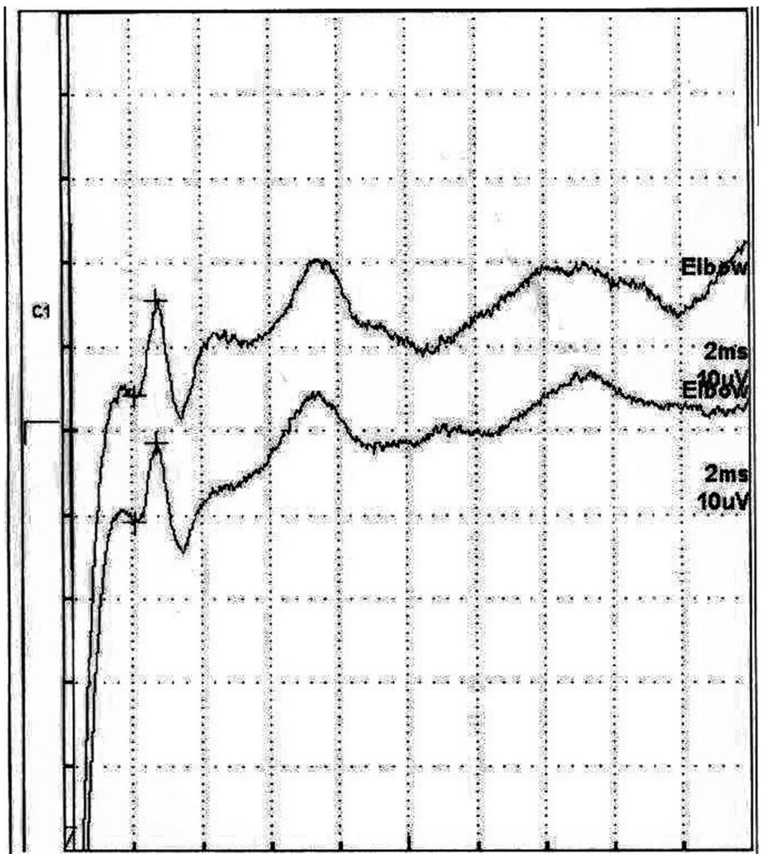
The recording of the PABC nerve was done on the dorsum of the forearm over the extensor forearm muscles. Subsequently, the PABC SNAP was followed by a volume-conducted motor potential with higher stimulus intensity (Figs. 2 and 3). This is due to the orthodromic spread of the excitation along the radial nerve motor fibers to the posterior interosseous nerve causing depolarization of the posterior compartment extensor forearm muscles. This potential immediately follows the PABC SNAP and it could obscure it. In this situation, decreasing the electrical pulse duration to 0.1 ms and increasing the stimulus intensity very gradually to record the SNAP at a stimulus intensity inadequate to stimulate the radial nerve motor fibers with the prevention of the volume-conducted motor potentials appearance [2, 14]. Stimulus artifact can be encountered and it can obscure the SNAP response which can be avoided by lowering the stimulus intensity and rotating the anode of the stimulator while maintaining the cathode position [2].

In the present study, there were no statistically significant differences between men and women regarding all PABC SNAP parameters as OL, PL, CV, and amplitude. Regression analysis showed that there was not a significant adjusted effect of gender on different SNAP parameters in multiple linear regression analysis by controlling the other assessed factors (i.e., age and different anthropometric measures). These were in accordance with previous studies [4, 6], as well as previous studies which assessed other nerves as ulnar palmar cutaneous nerve, medial antebrachial cutaneous nerve, and lateral antebrachial cutaneous nerve [14, 19, 20]. But, these were

**Table 1** Reference values of the posterior antebrachial cutaneous sensory nerve action potential parameters (120 upper limbs from 60 apparently healthy subjects)

| PABC SNAP parameters | Mean ± SD | Range | NL | Rounded NL |
|---|---|---|---|---|
| Onset latency (ms) | 2.05 ± 0.25 | 1.72–2.96 | 2.55 | 2.6 |
| Peak latency (ms) | 2.63 ± 0.28 | 1.98–3.34 | 3.19 | 3.2 |
| Conduction velocity (m/s) | 60.50 ± 5.38 | 48.30–69.80 | 49.74 | 49.7 |
| SNAP amplitude (μV) | 11.04 ± 4.26 | 4.40–24.20 | 2.52 | 2.5 |

*PABC* posterior antebrachial cutaneous nerve, *SNAP* sensory nerve action potential, *SD* standard deviation, *NL* upper (latency) or lower (conduction velocity and amplitude) limit of normal



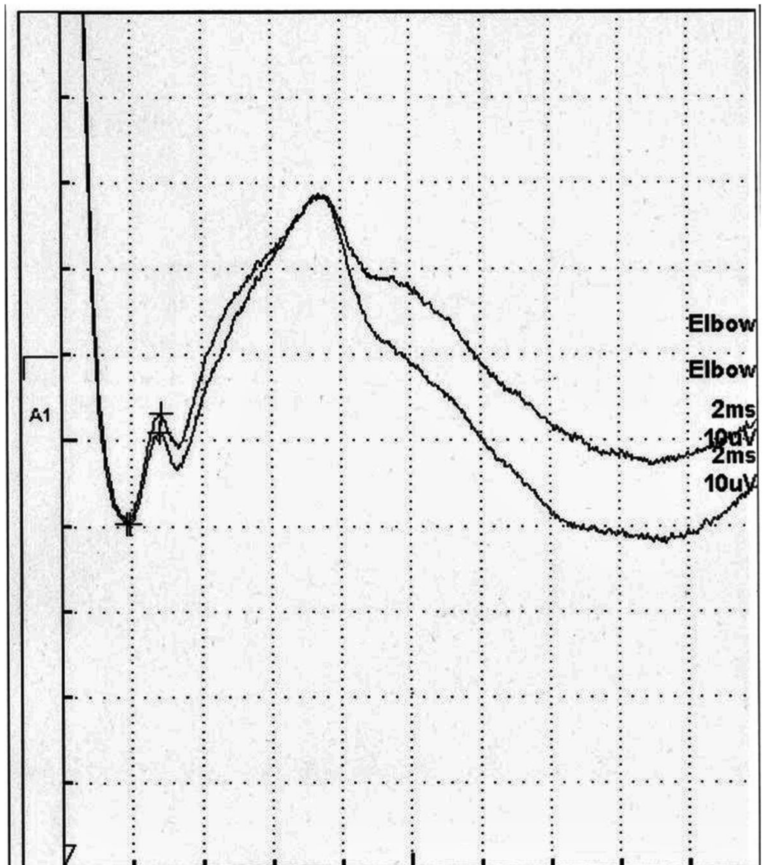

| No. | Site | Lat.1(ms) | Lat.2(ms) | Amp. |
|---|---|---|---|---|
| 1 | Elbow | 2.10 | 2.72 | 11.40uV |
| 2 | Elbow | 2.08 | 2.72 | 9.500uV |

| Segment | Dist.(mm) | Interval | NCV(m/s) |
|---|---|---|---|
| 1 | 120 | 2.10ms | 57.1 |
| 2 | 120 | 2.08ms | 57.7 |

**Fig. 2** Posterior antebrachial cutaneous sensory nerve action potentials (SNAP) of an apparently healthy man (the two potentials are separated from each other for proper illustration of the potentials). Each SNAP is followed by volume-conducted motor potential of the forearm extensor muscles

not in accordance with that reported in the literature [21–24]. It was reported that women had larger SNAP amplitude than men, as well as faster sensory CV than men [21–24]. These could be due to the following. First, previous studies assessed the effect of gender on the median and ulnar SNAPs recorded from the fingers antidromically and did not assess the PABC SNAP which was recorded from the dorsal aspect of the forearm [22, 24] Second, this could be due to the presence of racial differences between the studied participants in different researches and the current study as different studies were conducted on different racial groups [21–26]. Racial factor was reported to have an effect on nerve conduction study parameters [26]. Finally, this could be due to the presence of differences in methods and techniques, which include differences in the setting parameters used in recording the obtained potentials, as well as the differences in the used equipment and electrodes. All these factors could explain this variation [21]. Although gender is known to affect nerve conduction parameter values, individual correction is not required [27].

There were no statistically significant correlations between subject age and different SNAP parameters. Regression analysis showed that there was not a significant adjusted effect of age on different SNAP parameters in multiple linear regression analysis by controlling the other assessed factors (i.e., gender and anthropometric measures). These were not in agreement with Prakash




| No. | Site | Lat.1(ms) | Lat.2(ms) | Amp. |
|---|---|---|---|---|
| 1 | Elbow | 1.94 | 2.78 | 10.70uV |
| 2 | Elbow | 1.84 | 2.84 | 13.00uV |

| Segment | Dist.(mm) | Interval | NCV(m/s) |
|---|---|---|---|
| 1 | 120 | 1.94ms | 61.9 |
| 2 | 120 | 1.84ms | 65.2 |

**Fig. 3** Posterior antebrachial cutaneous sensory nerve action potentials (SNAP) of an apparently healthy woman (the two potentials are superimposed). Each SNAP is followed by a large volume-conducted motor potential of the forearm extensor muscles

**Table 2** Comparison between men and women regarding different posterior antebrachial cutaneous sensory nerve action potential parameters

| PABC SNAP parameters | Men subjects ($n$ = 50 upper limbs obtained from 25 men), mean ± SD | Women subjects ($n$ = 70 upper limbs obtained from 35 women), mean ± SD | Test of significant[†] | $P$ |
|---|---|---|---|---|
| Onset latency (ms) | 2.09 ± 0.29 | 2.02 ± 0.22 | 1.453 | 0.149 |
| Peak latency (ms) | 2.68 ± 0.31 | 2.60 ± 0.26 | 1.371 | 0.173 |
| Conduction velocity (m/s) | 60.16 ± 6.02 | 60.74 ± 4.90 | − 0.580 | 0.563 |
| SNAP amplitude (μV) | 10.60 ± 4.34 | 11.36 ± 4.21 | − 0.958 | 0.340 |

*PABC* posterior antebrachial cutaneous nerve, *SNAP* sensory nerve action potential, *SD* standard deviation
**P* is significant at < 0.05
[†]Value of Student's *t* test

**Table 3** Comparison between right upper limbs versus left upper limbs regarding different posterior antebrachial cutaneous sensory nerve action potential parameters

| PABC SNAP parameters | Right upper limbs (*n* = 60 right upper limbs obtained from 60 subjects), mean ± SD | Left upper limbs (*n* = 60 left upper limbs obtained from 60 subjects), mean ± SD | Test of significant† | *P* |
|---|---|---|---|---|
| Onset latency (ms) | 2.06 ± 0.27 | 2.04 ± 0.23 | 0.630 | 0.531 |
| Peak latency (ms) | 2.67 ± 0.29 | 2.60 ± 0.28 | 1.810 | 0.075 |
| Conduction velocity (m/s) | 60.23 ± 5.77 | 60.77 ± 4.98 | 1.792 | 0.078 |
| SNAP amplitude (μV) | 11.65 ± 4.67 | 10.40 ± 3.77 | − 0.678 | 0.501 |

*PABC* posterior antebrachial cutaneous nerve, *SNAP* sensory nerve action potential, *SD* standard deviation
* *P* is significant at < 0.05
†Value of paired *t* test

et al. and Sajadi et al. [4, 6]. This could be due to the differences in the gender distribution and the applied electrophysiological technique between these two studies and the current study [4, 6]. The influence of age usually appears at the extremity of age [2, 27].

There were no statistically significant correlations between height and different SNAP parameters. Regression analysis showed that there was not a significant adjusted effect of height on different SNAP parameters in multiple linear regression analysis by controlling the other assessed factors (i.e., age, gender, and other anthropometric measures). These were in accordance with Sajadi et al. and in agreement with previous studies [6, 14, 28, 29]. The SNAP CV is affected by the height of the subjects in the nerve conduction studies of the lower limbs [27]. The effect of height affects the lower limbs nerves rather than the upper limb nerves [28–30]. The relative short length of the upper limb in comparison to the lower limb length does not provide adequate distance to produce a significant effect on upper limb nerve conduction studies [30].

There were no statistically significant correlations between weight and different SNAP parameters. Also, this was applied for the BMI. Regression analysis showed that there was no significant adjusted effect of weight and BMI on different SNAP parameters in multiple linear regression analysis by controlling the other assessed factors (i.e., age, gender, and other anthropometric measures). These were in agreement with Sajadi et al. regarding the effect of BMI on SNAP OL, PL, and CV, but it was not in accordance with them regarding the SNAP amplitude [6]. This could be due to differences in demographic characters of their participated subjects who were older with a higher percentage of men than in the current study, as well as, the difference in the electrophysiological technique applied in the current study and that applied by Sajadi et al. [6]. They used a shorter conduction distance of 10 cm only [6]. Another cause of this difference could be the racial differences between the studied subjects in the current study and Sajadi et al study [6].

**Table 4** Intra-subject side-to-side differences in the posterior antebrachial cutaneous sensory nerve action potential parameters (60 pairs of upper limbs from 60 apparently healthy subjects)

| PABC SNAP parameters | S-S difference, mean ± SD | NL | Rounded NL |
|---|---|---|---|
| Onset latency (ms) | 0.18 ± 0.15 | 0.48 | 0.5 |
| Peak latency (ms) | 0.24 ± 0.16 | 0.56 | 0.6 |
| Conduction velocity (m/s) | 4.97 ± 3.63 | 12.23 | 12.2 |
| SNAP inter-side amplitude ratio | 0.69 ± 0.17 | 0.35 | 0.4 |

*PABC* posterior antebrachial cutaneous nerve, *SNAP* sensory nerve action potential, *S-S difference* intra-subject side-to-side difference, *SD* standard deviation, *NL* upper (latency and conduction velocity) or lower (inter-side amplitude ratio) limit of normal for side-to-side difference

There were no statistically significant differences between right upper limbs and left upper limbs regarding all PABC SNAP parameters as OL, PL, CV, and amplitude. These were in accordance with previous studies [4, 6].

The intra-subject side-to-side differences regarding PABC SNAP PL and CV were 0.6 ms and 12.2 m/s, respectively. The estimated rounded lower limit of SNAP inter-side amplitude ratio was 0.4. So, when the amplitude of the PABC SNAP of the affected side is less than 40% of the contralateral healthy side, it is an indication of axonopathic nerve lesion affecting the PABC nerve [2, 14]. This was not in agreement with previous studies [4–6]. Prakash et al. reported to be 0.59, Lo et al. reported to be 0.53, and Sajadi et al. reported to be 0.75 [4–6]. This could be due to the use of base-to-peak amplitude measurement in the current study, while other studies used peak-to-peak amplitude measurement [4–6].

The PABC SNAP parameters obtained in the current study were in agreement with Prakash et al., Lo et al., and Souayah et al. regarding the SNAP OL, PL, and CV [4, 5, 9]. But it was not in agreement with Sajadi et al. [6]. These could be due to the differences between the current study and Sajadi et al.'s study mentioned previously [6].

Regarding the PABC SNAP amplitude obtained in the current study, it was in agreement with Sajadi et al. [6]. However, it was not in accordance with Prakash et al.,

**Table 5** Correlation between participants' age and anthropometric measures with different posterior antebrachial cutaneous sensory nerve action potential parameters (120 upper limbs from 60 apparently healthy subjects)

| Age and anthropometric measures | PABC SNAP parameters | | | | | |
|---|---|---|---|---|---|---|
| | Peak latency (ms) | | Conduction velocity (m/s) | | SNAP amplitude (μV) | |
| | $r^{\dagger}$ | *P* | $r^{\dagger}$ | *P* | $r^{\dagger}$ | *P* |
| Age (years) | 0.032 | 0.731 | 0.057 | 0.539 | − 0.057 | 0.537 |
| Height (cm) | 0.090 | 0.326 | − 0.122 | 0.185 | − 0.107 | 0.245 |
| Weight (kg) | 0.052 | 0.571 | − 0.153 | 0.095 | 0.001 | 0.993 |
| BMI (kg/m$^2$) | 0.034 | 0.709 | − 0.109 | 0.237 | 0.049 | 0.595 |

*BMI* body mass index, *PABC* posterior antebrachial cutaneous nerve, *SNAP* sensory nerve action potential
**P* is significant at < 0.05
†Value of Pearson's correlation test

Lo et al., and Souayah et al. [4, 5, 9]. This could be due to the difference between the current study and these studies in the method of measuring the SNAP amplitude which was base-to-peak in the current study rather than peak-to-peak in the other studies [4, 5, 9].

The neurophysiological assessment of this nerve is clinically important. It assesses the integrity of PABC nerve and aims to increase the clinical awareness of PABC nerve injuries. This can be explained in the following conditions. Lesions affecting the PABC nerve may occur in isolation or in combination with the radial nerve. Focal PABC neuropathy is rare [31–33]. PABC neuropathy could be due to compression by a space-occupying lesion as subcutaneous cystic lesions along its course. PABC nerve traumatic injuries could be due to cut wounds or laceration along its anatomical course. Iatrogenic injuries could be due to surgical procedures as orthopedic surgeries in the lower arm segment and elbow region [6, 31–34]. However, it is assumed that several cases of PABC neuropathies remain undiagnosed because the physicians are not aware of the existence of

**Table 6** Multiple linear regression analysis for testing the adjusted predictors' effects of different physiologic factors on posterior antebrachial cutaneous sensory nerve action potential parameters (120 upper limbs from 60 apparently healthy subjects)

| Age, gender, and anthropometric measures | PABC SNAP parameters | | | | | |
|---|---|---|---|---|---|---|
| | Peak latency | | Conduction velocity | | SNAP amplitude | |
| | $\beta^{\dagger}$ | *P* | $\beta^{\dagger}$ | *P* | $\beta^{\dagger}$ | *P* |
| Age | 0.016 | 0.873 | 0.124 | 0.204 | − 0.061 | 0.536 |
| Gender | − 0.246 | 0.052 | 0.021 | 0.865 | 0.090 | 0.480 |
| Height | 0.251 | 0.097 | − 0.084 | 0.578 | − 0.122 | 0.422 |
| Weight | − 0.618 | 0.130 | − 0.165 | 0.684 | 0.117 | 0.775 |
| BMI | 0.613 | 0.113 | 0.001 | 0.999 | − 0.049 | 0.899 |
| $R^2$ | 0.043 | | 0.044 | | 0.022 | |
| $F^{\ddagger}$ | 1.017 | | 1.039 | | 0.515 | |
| *P*¶ | 0.411 | | 0.398 | | 0.765 | |

*BMI* body mass index, *PABC* posterior antebrachial cutaneous nerve, *SNAP* sensory nerve action potential, *β* standardized coefficient
**P* is significant at < 0.05
†Value of standardized coefficient of multiple linear regression analysis
‡Value of ANOVA test associated with multiple linear regression analysis
*P*¶ value of the probability of the ANOVA statistic for the overall regression relationship obtained by multiple linear regression analysis

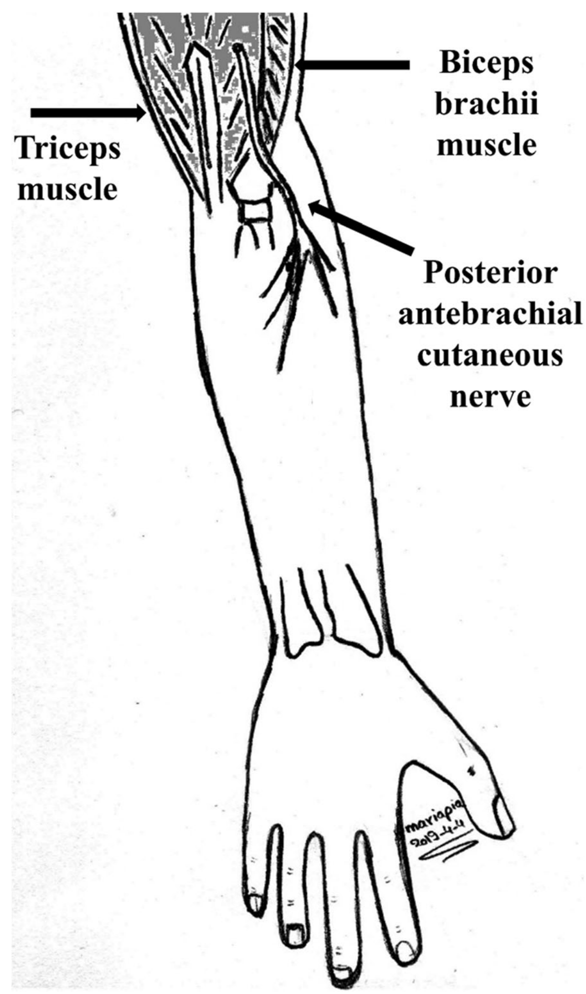



**Fig. 4** Terminal anatomical course of posterior antebrachial cutaneous nerve [3, 15, 17]

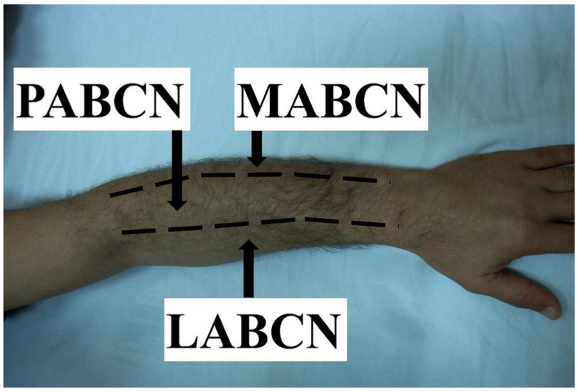



**Fig. 5** Sensory territory of the posterior antebrachial cutaneous nerve (PABCN) in relation to the sensory territory of the medial antebrachial cutaneous nerve (MABCN) and the sensory territory of the lateral antebrachial cutaneous nerve (LABCN)

focal PABC neuropathy. This might be because many textbooks of clinical neurophysiology do not discuss the PABC neuropathy diagnosis [2, 35].

In radial neuropathy, the PABC nerve sensory conduction study has a role in the localization of the site of neuropathy in addition with radial motor conduction study, superficial radial sensory conduction study, and needle electromyography [2, 5, 6]. Radial neuropathy in the spiral groove can be presented as paresthesia and numbness along the PABC nerve sensory territory [2, 5, 7, 36]. It is affected if the radial nerve lesion is at or proximal to its exit from the radial nerve [5]. It is useful in a certain condition in which the needle electromyography could not localize the radial neuropathy as in the coexistence of C7 radiculopathy [6].

It is also useful in the electrophysiological assessment of brachial plexopathy mainly the middle trunk and posterior cord of brachial plexus. The PABC nerve helps in the differentiation between C7 preganglionic lesion (radiculopathy) and postganglionic lesions [6]. In postganglionic lesions as proximal radial neuropathy and brachial plexopathy, the presence of abnormal PABC SNAP is an indicator of a postganglionic C7 root lesion [2, 6]. In preganglionic lesions as C7 radiculopathy, the PABC SNAP will be normal. It is helpful in the diagnosis of C7 radiculopathy in patients with associated severe carpal tunnel syndrome that makes the median sensory nerve conduction study from the third finger to be abnormal or unobtainable as in the case of double crush lesion [6].

It can be used in the evaluation of peripheral neuropathy in patients with finger or hand amputation and in patients with clinical conditions in their hands making the ulnar and median sensory conduction study technique difficult to be performed as in the case of massive hand and finger edema. It is for the assessment of the proximal extension of peripheral neuropathy in the upper limb [14].

The PABC sensory conduction study should be added to the other various available electrodiagnostic methods that evaluate the sensory and motor fibers of the radial nerve [2, 6].

## Conclusions

In conclusion, this research provides an applicable electrophysiological technique and normal reference values for the PABC nerve sensory conduction study.

### Abbreviations

BMI: Body mass index; C: Cervical; CV: Conduction velocity; OL: Onset latency; PABC: Posterior antebrachial cutaneous; PL: Peak latency; SD: Standard deviation; SNAP: Sensory nerve action potential

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### Author's contributions

The author (EKAS) is the only one who put the concepts, design, and definition of intellectual content and did literature search, clinical studies, data acquisition and analysis, manuscript preparation, editing, and revision.

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There were no sponsors or funders (other than the named author) played any role in study design, data collection and analysis, decision to publish, and preparation of the manuscript.
All research facilities are available in our department with no restrictions.

### Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

### Ethics approval and consent to participate

The local Ethics Committee of Faculty of Medicine, Alexandria University, Egypt (IRB NO:00007555-FWA NO: 00018699) approved the study.
Date of approval: January 17, 2019
Serial number: 0304202
A written informed consent was given to the participant.

### Consent for publication

Not applicable.

### Competing interests

The author declares that he has no competing interests.

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