



## Methods of nerve localization during peripheral nerve block in some hospitals in Nigeria

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### Abstract

**Background:** The correct needle placement and deposition of the local anaesthetic agent in proximity to the intended nerve is the hallmark of a peripheral nerve block (PNB).

**Methods:** This questionnaire-based study investigated the various methods of nerve localization during peripheral nerve block by anaesthetists in Nigeria and the pattern of utilization. A total of 120 questionnaires were distributed to 6 tertiary hospitals in Nigeria to elicit responses on the approaches to nerve localization at PNB. The commonly practiced methods of nerve localization and reasons for the performance or non-performance of the various approaches were also interrogated.

**Results:** A total of one hundred and nine (109) of the one hundred and twenty (120) questionnaires were returned (response rate of 90.8%). The majority of respondents (71.6%) were male. The cadres of respondents were Registrar (49.5%), Senior Registrar (27.5%), and Consultant (23.0%). The Anatomical approach was the most utilized (45.9%) as compared to Peripheral Nerve Stimulation (24.8%), Ultrasound-guided blocks (12.8%), or combined Peripheral Nerve Stimulation and ultrasound-guided blocks (16.5%). Lack of skills (73.4%) and absence of appropriate technology (26.6%) were the major reasons for the non-performance of some methods of nerve localization.

**Conclusion:** This survey indicates that Anaesthesiologists in Nigeria use mainly the anatomical approach to peripheral nerve block. Emphasis should be on personnel development rather than over-reliance on hi-tech approaches to nerve localization as this will allow for widespread application of available methods.

Keywords: Nerve localization, peripheral nerve block

### Introduction

Peripheral nerve block requires the placement of a needle and local anaesthetic close to the target nerve or plane to achieve an effective block. The precise deposition of the local anaesthetic around the nerve is important for the success of an adequate nerve block. Traditionally, the approach to nerve block or plexus anaesthesia has been the anatomical landmark approach. Performing a blind needle placement is often guided by clicks, pops, or paraesthesia and these are unreliable indicators of needle tip location.<sup>1</sup> However, the success rate with the blind landmark approach to the localization of the nerve has been considered unsatisfactory. This shift in improving the identification of neural structures led to the

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development of neuro-stimulation, that peripheral nerve stimulation would improve outcomes. Other methods of nerve localization of the plexus or nerves include the ultrasound-guided approach as well as the combination of peripheral nerve stimulation and the ultrasound-guided method. Anecdotal evidence suggests that there has been an upsurge in the utilization of regional anaesthesia for

surgery or pain management in recent years. However, it is not clear how these techniques are performed in the various hospitals. A previous report on the use of regional anaesthesia in Nigeria indicates that only 2.9% deployed peripheral nerve block as against 92.9% in favour of neuraxial (spinal) anaesthesia.<sup>2</sup> Furthermore, a retrospective study<sup>3</sup> of upper limb procedures in 92 patients showed the anaesthetic techniques to be general anaesthesia (48.9%), brachial plexus block (45.7%), and others (5.4%). In addition, the methods of localization by these authors<sup>3</sup> were anatomical (95.2%) and neurostimulation (4.8%). A widespread use of neuraxial anaesthesia or general anaesthesia by these authors may mean an underutilization of peripheral nerve block in Nigeria. The reasons for the low utilization of peripheral blocks in these studies<sup>2,3</sup> are not well delineated. Perhaps, a scrutiny of the method of nerve localization may provide more insights into the underutilization of peripheral nerve blocks.

Comprehensive use of PNB may minimize the over-reliance on general anaesthesia or neuraxial anaesthesia. Specifically, neuraxial anaesthesia should be used cautiously or at best avoided in patients at risk of haematoma formation. The haemodynamic perturbations associated with spinal anaesthesia limit the proportion of patients that could be exposed to this technique of anaesthesia. Therefore, it is likely that an improvement in the utilization of PNB could expand the options for the pain management or surgical care of patients. This study, therefore, was undertaken to provide further understanding of the method of localization of peripheral nerves during peripheral nerve block.

## Methods

This cross-sectional study was conducted in 6 centres across Nigeria. The survey questionnaire was scrutinized for content and context by 4 senior consultants in active anaesthesiology practice to ensure validity. The survey addressed participants' demographic features, professional practice data (central neuraxial and peripheral nerve block practices), type of equipment available in the hospital for regional anaesthesia, level of education and training, and safety measures. Respondents were enquired about methods of localization of peripheral nerves and the use of peripheral nerve

stimulators or ultrasound-guided regional anaesthesia. The survey questionnaire was sent to 6 tertiary institutions in Nigeria having obtained the personnel capacity of each Department of Anaesthesiology.

The questionnaire consisted of 21 questions structured to elicit binary or closed responses. The questions further interrogated the various options for nerve localization, and reasons for the utilization or lack of utilization. The available technological support for nerve localization was also reviewed. The data were analyzed using the Statistical Package for Social Sciences (SPSS). All categorical data were expressed as frequencies and percentages.

## Results

A total of one hundred and twenty questionnaires were distributed over a month to the participating institutions based on the number of anaesthetists in each hospital, of which 109 were filled and returned accordingly with a response rate of 90.8%. The demographic characteristics as shown in Table 1. The majority of respondents (71.6%) were males with male to female ratio of 2.52: 1. The age range with the highest number of respondents was between 26-36 years (47.7%) with a mean ( $37.53 \pm 6.75$ yr). The Registrar cadre of the respondents was 49.5% and 27.5% were Senior Registrars.

Table 2 shows the options of approaches for regional blocks and the Anatomical approach was the most utilized approach (45.9%). The other methods included Peripheral Nerve Stimulation (24.8%), Ultrasound-guided blocks (12.8%), and combined Peripheral Nerve Stimulation and ultrasound-guided blocks (16.5%).

Table 3 shows the reasons for not performing peripheral nerve block for the upper limb. Lack of skills accounted for the major reason why peripheral

Table 1: Demographic characteristics of respondents

Features	Frequency (n)	Percentage (%)
Age (yr)	37.7 ± 6.75	N/A
Sex		
Male	78	71.6%
Female	31	28.4
Cadre		
Registrars	54	49.5
Senior Registrars	30	27.5
Consultants	25	23.0

NA; not applicable

Table 2: Options of approaches for regional blocks

Features	Frequency (n)	Percentage (%)
Anatomical	50	45.9
PNS	27	24.8
USS	14	12.8
PNS/USS	18	16.5
<b>TOTAL</b>	<b>109</b>	<b>100</b>

PNS = Peripheral Nerve Stimulator

USS = Ultra-Sound Scan

PNS/USS = Peripheral Nerve Stimulator/ Ultra-Sound Scan

Table 3: Reasons for not performing peripheral nerve block for upper limb

FEATURES	FREQUENCY (n)	PERCENTAGE
No skills	80	73.4
No PNS	20	18.3
No USS	9	8.3
	<b>109</b>	<b>100</b>

nerve blocks were not performed (73.4%) as compared to lack of equipment (26.6%).

## Discussion

The anatomical or landmark approach was the commonest method of identifying the peripheral nerve during the institution of peripheral nerve block. The combination of neurostimulation and ultrasound-guided approach was the least practiced method by the respondents and slightly behind the use of peripheral nerve stimulator or ultrasound-guided approach alone. Comparatively, the lack of appropriate skills is a major limitation for the performance of peripheral nerve block in the practice of respondents.

The success of peripheral nerve block could be dependent on the proximity of the needle tip to the target nerve, the dose of the local anaesthetic medication, and the skill of the operator.<sup>4</sup> The anatomical approach is still the commonest method of localization of the peripheral nerve. This method of nerve identification at peripheral nerve block appears to be limited to developing countries.<sup>2,5</sup> Indeed, the evolution of peripheral nerve block for anesthesia or analgesia started with the anatomical method of nerve localization or identification. Most practitioners of peripheral nerve block would need to learn through this anatomical approach before using other available methods of nerve identification. Although the anatomical approach is quite high among our respondents, the main limitation to its widespread use has been the success rate, variable outcomes, and safety profile. The

identification of nerve could be carried out using needle-to-nerve contact, deliberate paraesthesia, fascial clicks, and pops.<sup>1</sup> Nevertheless, none of these subsets of the landmark approach reliably defines the proximity of the needle tip and target nerve during the anatomical peripheral nerve block technique. Therefore, the success rate may be difficult to determine between different operators.

A clear understanding of the regional anatomy of the peripheral nerve is critical to successful outcomes irrespective of the approach. The major critique of the anatomical approach to nerve localization has been the variable outcomes due to anatomical variants with nerve distribution. Adebisi and Singh described the anomalous patterns of formation and distribution of the brachial plexus in Nigerians and this may have implications for a successful block of this plexus via the anatomical approach.<sup>6</sup> Furthermore, Vloka et al<sup>7</sup> demonstrated a better success rate in the localization of the femoral nerve via the femoral crease as against the femoral ligament in a study of 17 cadaveric femoral triangles. The authors argued that the predictable femoral-nerve-femoral-artery relationship may have prompted the successful rate of this anatomical approach to the femoral nerve block. Some studies<sup>3,8</sup> on brachial plexus block in tertiary centres in Nigeria showed that the primary block effectiveness (81.4%) and with supplementation 90.7%<sup>8</sup> and 88.1% by Etta and colleagues<sup>3</sup> and without any major complications.<sup>3,8</sup> Thus, the anatomical approach to peripheral nerve block could provide effective anaesthesia and analgesia, especially with the brachial plexus block.

The inability to correctly determine the definitive placement of the needle tip about the nerve gave room to the introduction of the peripheral nerve stimulator. Furthermore, the results from nerve localization with the blind approach are not encouraging especially with other methods with increased risk of trauma to surrounding structures. The use of peripheral nerve stimulators for the peripheral nerve block accounted for about a quarter of the respondents and appears as a small proportion. When using the peripheral nerve stimulator, its effectiveness is based on the relationship between the current to elicit a motor response and the distance between the needle tip and the nerve.<sup>9</sup> and the optimal threshold of current is 0.2

– 0.5mA without injury to the nerve.<sup>10</sup> The introduction of the local anaesthetic at a current less than 0.2mA may indicate intraneural needle tip location and beyond 0.5mA shows that the needle tip is far away from the nerve. Perhaps, the close deposition of the LA to the nerve may have led to the recommendation of neurostimulation as a component of the regional anaesthesia programme.<sup>5</sup> The determined search for the optimal technique for nerve localization was hinged on the deposition of the local anaesthetic close to the target nerve or under direct vision. In a twist, some practitioners have recommended the combination of neurostimulation and ultrasound-guided techniques for optimal localization of nerves, planes, or plexus (dual guidance).<sup>11,12</sup> These advantages notwithstanding, the technological advancement in neurostimulation or ultrasound-guided identification of peripheral nerves and plexus could be prohibitory for low-resource countries. This cost of the ultrasound machine may be responsible for the low utilization of this method of nerve localization by respondents. The shift from paraesthesia to peripheral nerve stimulation and now to ultrasound-guided peripheral nerve block notwithstanding, the incidence of neurological injury has not decreased,<sup>13,14</sup> minimizing safety concerns as the *raison d'être* for a paradigmatic shift in the methods of nerve localization. Indeed, Liguorri and colleagues<sup>15</sup> demonstrated that there was no difference in the incidence of postoperative neurologic symptoms (PONS) between electrical stimulation and paraesthesia methods of nerve localization for the interscalene brachial plexus block. In the light of the relative safety of the different methods of nerve localization, the contentious issue of effectiveness could be resolved. It may be necessary to encourage widespread utilization of the anatomical approach in resource-limited countries where ultrasound machines are not readily available in most hospitals. In doing this, a compromise should be reached on adding value to the highest number of patients and the potential for hi-tech PNB for a few privileged patients. The results of this survey should be interpreted with caution. First, these are the views of the anaesthesiologists and not necessarily the practice pattern in the respective hospitals. Furthermore, it is unclear how many of these respondents have the

means for the hi-tech identification of nerves in their practice. However, the observation that the anatomical method of localization of peripheral nerves in low-resource settings underscores the strength of this survey.

### Conclusion

This questionnaire survey shows that the anatomical or landmark is the commonest method of nerve localization during the conduct of peripheral nerve block. Poor access to appropriate technology may have been the reason for the low patronage of neurostimulation, ultrasound-guided approach, or a combination of both. Nevertheless, all approaches seem to have a similar safety profile. Therefore, a possible compromise on the adoption of the anatomical approach to reach a larger proportion of patients, especially in low-resource settings like ours, as against unnecessary reliance on hi-tech methods of identification of nerves.

### References

1. Helen L, O'Donnell, Moore E. Nerve localization techniques for peripheral nerve block and possible future directions. *Acta Anaesthesiologica Scandinavica* 2015; 59:962-974.
2. Rukewe A, Fatiregun A. The Use of regional anesthesia by anesthesiologists in Nigeria. *Anesth Analg* 2010; 110: 243-4.
3. Etta OE, Akpan SG, Eyo CS; Inyang CU. Brachial Plexus Block For Upper Limb Procedures: Experience At The University Of Uyo Teaching Hospital, Uyo, Akwa Ibom State, Nigeria *Journal Of The West African College Of Surgeons* 2015; 5: 76–87.
4. Bottomley T, Gadsden J, West S. The failed peripheral nerve block. *BJA Educ.* 2023; 23: 92-100.
5. Zaragoza-Lemus G, Mejía-Terrazas G, Sánchez-Velasco B. Neurostimulation and block of peripheral nerve in regional anesthesia. *Rev Mex Anest.* 2008;31(2):116-132.
6. Adebisi SS, Singh SP. Anomalous patterns of formation and distribution of the brachial plexus in Nigerians and the implication for brachial plexus block. *Nigerian Journal of Surgical Research* 2002; 4: 103-106.

7. Vloka JD, Hadzić A, Drobnik L, Ernest A, Reiss W, Thys DM. Anatomical landmarks for femoral nerve block: a comparison of four needle insertion sites. *Anesth Analg.* 1999; 89:1467-70.
8. Imarengiaye CO, Ogbemudia AO, Akpoduado DD, Akinmola A, Moin M. Transarterial Brachial Plexus Anaesthesia for Upper Limb Surgery: Safety and Efficacy without Nerve Stimulator. *Afr J Anesth Int Care* 2011; 11: 11 - 14.
9. Abdallah FW, Chan VW: Monitoring intraneural needle injection: work in progress. *Anesth Analg.* 2014, 118:504-6. 10.121.
10. Bigeleisen PE, Moayeri N, Groen GJ: Extraneural versus intraneural stimulation thresholds during the ultrasound-guided supraclavicular block. *Anesthesiology.* 2009, 110:1235-43.
11. Steinfeldt, T. Nerve localization for peripheral regional anesthesia. Recommendations of the German Society of Anaesthesiology and Intensive Care Medicine. *Anaesthesist* 2014; 63: 597–602.
12. Luedi MM, Upadek V, Vogt AP, Steinfeldt T, Eichenberger U, Sauter AR. A Swiss nationwide survey shows that dual guidance is the preferred approach for peripheral nerve blocks. *Sci Rep.* 2019; 6:1-8.
13. Jeng CL, Torrillo TM, Rosenblatt MA. Complications of peripheral nerve blocks. *Br J Anaesth.* 2010;105 Suppl 1: 97-107.
14. Neal JM. Ultrasound-Guided Regional Anesthesia and Patient Safety: Update of an Evidence-Based Analysis. *Reg Anesth Pain Med.* 2016; 41(2):195-204.
15. Liguori GA, Zayas VM, YaDeau JT, Kahn RL, Paroli L, Buschiazzo V, et al. Nerve localization techniques for interscalene brachial plexus blockade: a prospective, randomized comparison of mechanical paresthesia versus electrical stimulation. *Anesth Analg.* 2006;103(3):761-7.