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ULTRASOUND GUIDED DISTAL PERIPHERAL NERVE BLOCKS IN PATIENTS UNDERGOING HAND SURGERY; THE CLOSER, THE BETTER?

Anaesthesiology

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ABSTRACT

Background Distal nerve blocks (DNBs) at the level of forearm for the hand surgery have not been very commonly in use till date for sole anesthesia technique for the hand surgery. But with the increasing use of ultrasound in the practice of anesthesia, they have attracted quite a good amount of interest and have potential to become popular means of anesthesia for the hand surgeries. At present there is paucity of data regarding their use as a sole technique of anesthesia. The purpose of this study was to compare these DNBs in the forearm with proximal nerve blocks (PNBs) for the surgical anesthesia of the patients undergoing hand surgeries. **Methods** In a retrospective study, the medical records of all the patients who underwent hand surgeries between January 2021 to December 2022 with peripheral nerve block were reviewed from the patient data base. The primary outcome was the ability to provide a primary anesthetic without the need for general anesthesia or local anesthetic supplementation by the surgical team. Secondary outcome measures included narcotic administration during the intraoperative procedures, block performance times, and the need for rescue analgesics. **Results** No significant statistical difference was observed in two groups in terms of conversion to general anesthesia, intraoperative opiate consumption rates, block performance time and need for rescue analgesia. **Conclusion** DNBs are effective means of primary anesthesia technique in patients undergoing hand surgeries and mostly a viable alternative to PNBs in such patient population. Compared to PNBs these blocks have better preservation of sensorimotor function of the limb, the ability to perform it bilaterally in same sitting, and no risk of any respiratory compromise.

KEYWORDS

peripheral nerve blocks, ultrasound guided, distal arm blocks, median nerve ulnar nerve radial nerve blocks.

INTRODUCTION

Plexus blocks for the anesthesia of upper extremity surgery have been in use for quite long time based on anatomical landmarks. The introduction of nerve stimulator later was a watershed in increasing the success of such blocks as they could be performed with more accuracy, precision and lower risk of nerve injury with the aid of the later. Then lately came the ultrasound the use of which kind of was a revolution in this field as these blocks could be performed under real time ultrasound guidance now with further more accuracy and lesser risk. Furthermore, the ability to visualize individual nerves like median, ulnar, and radial easily and reliably and block them by using relatively less volumes of local anesthetics (LA) solutions attracted a great interest in blocking in blocks like DABs. Mostly, DABs have been used as rescue analgesia technique to supplement more proximal inadequate or unsatisfactory PNB, but there are now studies available, albeit meagre, demonstrating the use of DABs as an efficient and safe option of sole anesthesia technique in patients undergoing hand surgeries such as fracture reduction and fixation, laceration repair including tendon injury repair, trigger finger and thumb release, incision drainage etc.

MATERIALAND METHODS

The medical records of all patients who underwent hand surgery under peripheral nerve blocks were reviewed from the patient data base of the Hospital. Each group consisted of 60 patients of ASA class I to III, aged 18 years and above. The exclusion criteria were the patients who received local infiltration with sedation or nerve block with general anesthesia as initial anesthesia technique.

The nerve blocks were administered using Sonosite- S Nerve ultrasound machine with a linear probe. The probe frequency and depth were adjusted as appropriate to the block performed. DNBs were performed with a 50mm stimuplex needle. The nerves blocked were median MN), ulnar (UN) and superficial branch of radial nerve (SRN) in the mid to proximal forearm. The comparison group received more proximal plexus blocks like axillary, infraclavicular or supraclavicular blocks. Mild sedation using midazolam and a narcotic like fentanyl was used during the block procedure. In the comparison group the site and type and total dose of the LA bore variability.

Under all aseptic precautions, with mandatory patient monitoring as per ASA monitoring Standards in supine position, and under mild intravenous sedation as described above, the individual nerves were blocked on anterior aspect of mid to proximal forearm using a high frequency linear (HFL) probe, at appropriate depth by in plane technique using a single puncture site in most of the patients after local anesthesia with 2 ml of 1% lidocaine at the puncture site. A 50 mm stimuplex 22 G needle connected to a 10 ml syringe via short plastic tubing, was used to inject 5 to 8 mL of 0.5 % Ropivacaine under real time ultrasound guidance around each

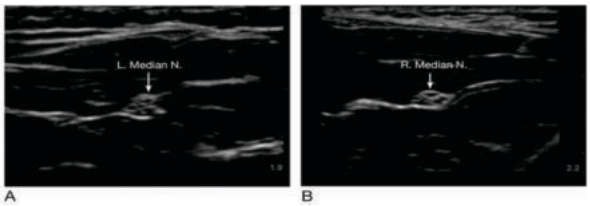

Fig 1.1 A. Left; B. Right, Median nerve

individual nerve. The median nerve was easily identified in the middle of the midarm in the anterior compartment between flexor digitorum profundus and digitorum superficialis muscles (Fig1.1). Moving the probe medially, the ulnar nerve can easily be recognized just lying medial to the ulnar artery (Fig 1.2). The identification of the Superficial branch of radial nerve (SRN) was a bit challenging and was located lateral to the radial artery in proximal to midarm but its distance from the radial artery was variable with different subjects (Fig 1.3). No complications like suspected nerve injury, or local anesthesia systemic toxicity (LAST) was reported in any of the patients.

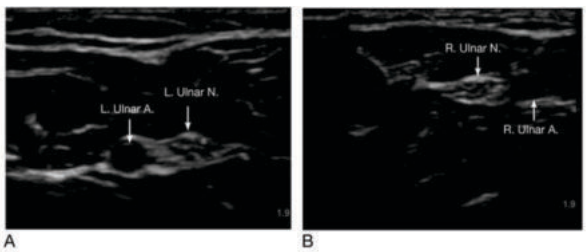

Fig 1.2. A. Left and B. Right Ulnar Nerve; Note the close medial relationship to corresponding ulnar artery

Statistical Analysis

Our aim was to compare DABs with PNBs in terms of efficacy, block performance time, the need of use of any narcotics intra operatively and overall patient satisfaction. Standard Statistical Tests like Fisher's exact test, chi- square test, Student's T Test were used for statistical analysis. Descriptive statistics were expressed as mean± Standard deviation (SD). P values <0.05 were taken statistically significant.

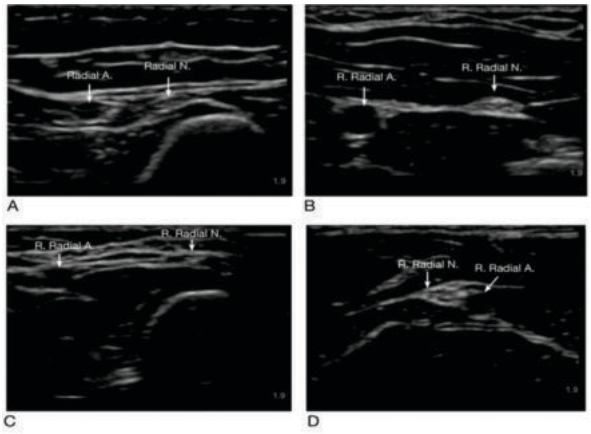

Fig 1.3. A-D. Superficial Radial nerve in four different subjects; Note the varied distance of the nerve from the radial artery on the medial side.

RESULTS

Sixty patients were included for the study in each group. Patient demographics were similar in the two groups. There were no statistically significant differences in the age and BMI and gender of the patients in two groups. DNB group consisted of 40 males and 20 females. PNB group consisted of 32 males and 28 female patients. Procedures performed with local infiltration with sedation and blocks with general anesthesia as a primary planned technique were excluded from the study.

Table 1.1 Demographics of control and forearm/distal block group

	Control group n=60	Forearm/distal arm block group n=60	P value
Age, years [IQR]	44.5 [28.75–62.5]	50 [34.5–67.25]	0.24
Gender, F (%)	28 (46.6 %)	20 (33.3 %)	0.29
BMI, kg/M2 [IQR]	26.1 [22.8–29.9]	28.4 [24.9–31.25]	0.1

Sixty patients received ultrasound guided DABs at the level of mid to proximal forearm. Plain ropivacaine 0.5 % was used in a volume of 5 to 8 ml around each individual nerve. The total average dose of anesthetic solution was 18ml to block all the nerves individually.

Out of 60 patients in DAB group, three were converted to general anesthesia due to unsatisfactory desirable surgical anesthesia despite administration of intravenous narcotic agents in mild to moderate doses. In two more patients

Chi-square was utilized for contingency analysis

Table 1.2 Characteristics of control and distal block group

	Control group n=60	Distal arm block group n=60	P value
Time to perform block procedure, min [IQR]	10 [7–13]	8 [6–12]	0.14
OR tourniquet time, min [IQR]	38 [19–68]	24 [18–39]	0.28
Surgical time, min [IQR]	48 [26–72]	42 [25–66]	0.41
Total fentanyl administration for block and procedure, mcg [IQR]	90 [50=100]	85[50–100]	0.48

supplemental local anesthetic was administered by the surgeon as the block was considered inadequate.

Another 60 patients posted for unilateral hand surgeries of various type, received PNBs. Among the PNBs, 27 were axillary blocks, 18 infraclavicular and 15 supraclavicular blocks. All the blocks were established in the operating room under aseptic technique with standard patient monitoring, and under ultrasound guidance using high frequency linear probe, using plain 0.5 % Ropivacine solution in a volume of 20 to 30 ml with average volume used as 25 ml just prior to the proposed surgical procedure. Out of all these PNBs two infraclavicular, one axillary and one supraclavicular block were considered as failed blocks as the patient either needed a rescue DAB or conversion to General anesthesia. Median time to perform these blocks were not statistically significantly different. No statistical significance was found comparing the surgical times between two groups. The need for intraoperative narcotics for supplemental mild to moderate sedation was not statistically different in two groups.

DISCUSSION

DABs were suggested as effective sole anesthesia technique as traditional more proximal plexus block techniques in terms of outcome of conversion to General anesthesia, the need for supplemental local anesthetic infiltration, and opioid consumption. However, it is important to be familiar about the surgical procedure for a successful use of DAB. These blocks are invariably successful and effective when the surgery is restricted to hand, as given the complex and overlapping nerve supply of wrist and forearm, it was very much possible that in patients where the incision or incisions extended beyond the hand into the wrist or forearm, these blocks need supplement local anesthesia. Moreover, while a more proximal blocks may be considered with prolonged expected torniquet time, DABs may work very well in the patients without surgical torniquets or with short torniquet time. Additionally, we did choose DABs where all three nerves, MN, UN and SRN were blocked to achieve standardization in our study, it is also possible to block selectively only one, or only two of these individual nerves depending upon the location and expected extent of the proposed surgery to further decreasing the extent of any sensorineural impairment. UN only block, or UN with MN block or MN with SRN block, wherever and whenever feasible, is now not so uncommon practice in our operating rooms.

Selective block of these distal nerves does not only reduce the sensorimotor impairment, but also decrease the risk of unnecessary nerve injury. There is no risk of any possibility of respiratory complications like pneumothorax or Horner's syndrome with DNBs. The later may be a valuable choice in patients where local infiltration is contraindication like in infection and suspected malignancy. They may also be administered safely for bilateral procedures at the same surgical setting as the average dose of DABs is lower than the PNBs as they obviate or significantly decrease the risk of local anesthesia systemic toxicity (LAST). DABs may be useful to preserve tissue anatomy and avoid any possible tissue edema due to local anesthetic infiltration as may be desirable by the surgeon for mor perfection and better surgical outcome.

CONCLUSION

In summary, DABs could be a simple and safe as a primary anesthesia technique for the patients undergoing hand surgery. They could provide an efficacious alternative to more proximal plexus blocks in such patient population. In the present era, with the aid of the ultrasound, they stand all the potential to transcend the territory of rescue blocks to become a technique of primary anesthesia of choice for patients posted for hand surgeries. And given their all advantages, as discussed above, it may now be time when we can surely say that “the Closer, the Better”.

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