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Brachial Plexus Block, a Comparison of Nerve Locator versus Paresthesia Technique

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Abstract : *Brachial plexus block using local anaesthetics is used widely for upper limb surgery. Proper identification of the nerve bundle is very important to inject local anaesthetic. Methods like paresthesia technique, nerve locator technique and ultrasound is used to identify the nerve bundle. The oldest is the parestheia technique and it causes few complications like inadequate block, failed block, in-advertent puncture of the blood vessels and temporary damage of the nerve. Nerve locator is a simple instrument available to locate the nerve bundle. The present study is aimed at comparing the brachial plexus block using paresthesia technique versus nerve locator technique.*

Keywords: *Brachial plexus block, Paresthesia, Peripheral nerve stimulator.*

I. INTRODUCTION

Pain is as old as life. Man, as we think, as the highest developed organism, is the strongest feeler of pain. It has been man's endeavour to kill and lessen pain from the very early ages.

The term "Regional anaesthesia" is first used by Harvey Cushing in 1901 to describe pain relief by nerve block.[1] Regional nerve blocks are based on the concept that pain is conveyed by nerve fibres, which are amenable to interruption anywhere along their pathway.[2]

For the upper limb surgeries brachial plexus block has evolved into valuable and safe alternative to general anaesthesia. It is a great tool in the anaesthetic armamentarium for relief of pain preoperatively, perioperatively and post operatively. Since its introduction by William Steward Halsted in 1885, who performed the block by exposing the roots, it has undergone many modifications and changes to arrive at a better technique.

It is possible and desirable for the patient to remain ambulatory. Patient who arrive at the operation theatre with full stomach face less danger of aspiration, if they vomit. Post anaesthetic nausea, vomiting and other side effects of general anaesthesia such as atelectasis, hypotension, ileus, dehydration and deep vein thrombosis are reduced.[3]

In the new trend of day care surgeries, brachial plexus block seems to be a better alternative to general anaesthesia with minimal hospital stay and less financial burden on the patients.

Brachial plexus block is used widely today to provide anaesthesia for upper extremity. There are four usual sites of approach.

I. Interscalene, Supraclavicular, Infraclavicular, Axillary

The most complete limb block is provided by supraclavicular approach to brachial plexus.. The merits of brachial plexus block are it is very much helpful in emergency cases where general anaesthesia is contraindicated. Immediate post-operative analgesics can be avoided for pain relief due to prolonged duration of analgesia. However, success is highly dependent upon the precise localization of neural structures. This was accomplished through the elicitation of paresthesia historically. "No paresthesia, no anesthesia" became the mantra of many of our founding fathers. Clinicians in opposition to paresthesia techniques often cite an increased risk of neurologic complications postoperatively -"more the paresthesia, more the dysesthesia". There are no prospective, randomized clinical studies that are able to support definitively this hypothesis although the intentional elicitation of a paresthesia may represent direct needle trauma and theoretically increase the risk of neurologic injury. Paresthesia can indicate that the needle is in close proximity to the nerve and is a warning sign of impending mechanical contact should the needle be further advanced.

The nerve stimulation technique make use of electric current to elicit motor stimulation of nerves and confirm the proximity of the needle to the nerve. There are other advantages in this method, in addition to a good success rate. Motor fibers have a lower electrical threshold than sensory fibers so a patient need not be subjected to the discomfort of paresthesia when the nerve is stimulated to produce a motor twitch. A satisfactory block may be performed when the patient is uncooperative, or uncommunicative, as a result of a psychotic state, coma, or language barrier and in any position.

In children regional block with the aid of a nerve stimulator can also be performed under general anaesthesia. After the introduction of PNS in the practice of regional anesthesia there has been a debate over whether there are any advantages to its use over the paresthesia technique. So it is necessary to find out whether in fact there is any difference between the two techniques with respect to success and/or complication rate. Hence a study is required in this regard.

II. Methodology

2.1 Method Of Collection Of Data

2.1.1 Study Design

Prospective, randomised, comparative study.
The patients taken in this study were allocated into two groups, with each group containing 25 patients each, by closed envelop method.
Group N (Nerve stimulator group) – the block was administered using a peripheral nerve stimulator.
Group P (Paresthesia group) – block was administered after elicitation of paresthesia of the fingers.

2.2 PREOPERATIVE PREPARATION

Approval from the hospital ethical committee was attained for the study protocol. A thorough pre-anaesthetic evaluation was done for all the patients. Systemic examination was done including airway and the surface anatomy where the block was going to be given. The procedure was explained to the patient. All the patients were informed and educated about the development of paresthesia. All the patients were kept nil per oral overnight. All of them received Tab.lorazepam 2 mg and Tab.ranitidine150 mg night before the surgery and Tab.lorazepam 2mg two hours before the surgery.

2.3 INVESTIGATIONS

- Blood investigations: Hb%, TC, DC, ESR, BT, CT, Urea, Serum creatinine, blood sugar.
- Urine : Albumin, sugar and microscopy
- ECG and Chest x-ray PA view

2.4 LOCAL ANAESTHETIC USED

Ropivacaine 0.5% 20 ml was used to give the block.

2.5 TECHNIQUES

The technique employed in the present study is from upper extremity nerve block by Pramila Bajaj and hand book of Regional anaesthesia by P Prithvi Raj.

With head turned slightly to the opposite side patient was placed in supine position without a pillow. The arm was kept by the side of patient so that his fingers were in touch with his knee. Facing the foot of the table, the anaesthesiologist who was performing the block stood at the side of the patient to be blocked. Under aseptic conditions, the area was prepared and draped. 1 cm above the mid point of the clavicle, the subclavian artery pulsation was felt, the tip of the index finger was rested in the supraclavicular fossa directly over the arterial pulsations and the artery was retracted medially inwards and downward if possible.

Needle puncture: Using a 2cc syringe with 24G needle an intradermal wheal was raised just above the palpating finger. A 5 cm 22G short bevel needle connected to a 10 cm extension with 20 ml syringe with 20 ml 0.5% Ropivacaine was inserted through the skin wheal and advanced slowly Backwards (posteriorly),slightly Inward (Medially) and Downward (caudal) [BID] gradually towards first rib, so that the shaft of the needle and syringe were almost parallel to the patient's head. It was instructed to the patient to say "yes" when he/she was feeling a sensation of "tingle" or "electric shock" down the arm and tell verbally where he/she was feeling it. Paresthesia was sought in the digits of the hand or wrist. If paresthesia was elicited, then after negative aspiration for air and blood, 20 ml Ropivacaine 0.5% was injected. If needle was touching the first rib and paresthesia was not obtained, then the needle was walked slowly posteriorly and towards vertebra to elicit paresthesia. If not the procedure was repeated.

In the Nerve Stimulator group; the following setting was used

- Frequency was set at 1 Hz.
- Positive electrode connected to ECG lead.
- Negative electrode to a port in the needle.
- The needle – fully insulated except at tip, 50 mm size. The puncture site, direction of the needle and landmarks being the same as that used in the paresthesia group.

- Start with 2 mA current strength – observed for a twitch of the fingers.
- End motor response was taken as a clear motor twitch of all fingers.
- As soon as twitch was observed, with continued stimulation and observation of twitch, the current strength was decreased to 0.5 mA. If a satisfactory twitch was observed in all fingers even at 0.5 mA current, the stimulator was turned off, and the drug was injected with repeated aspiration for blood.
- On decreasing the current strength, if the finger twitch disappears, then the needle position was adjusted by one to two millimetres in such a way as to elicit the response and again the procedure was repeated.

III. Results

A prospective, randomized, comparative study was conducted in the Department of Anaesthesiology, Yenepoya Medical College, Mangalore on 50 patients aged between 25 – 65 years posted for upper limb surgeries to study the onset time and duration of block along with complications using a nerve locator for brachial plexus block as compared to the use of paresthesia technique.

There were no clinical or statistically significant differences in the demographic profile of patients in either group. We found that the onset of sensory block in radial, median and ulnar nerve distributions are significantly shorter in nerve stimulator group.

There is no statistically significant difference in motor blockade onset between the two groups.

There seems to be a significant higher percentage of GA conversion seen in case of paresthesia group.

IV. DISCUSSION

Peripheral nerve blocks are cost effective anaesthetic techniques used to provide anaesthesia and analgesia while avoiding hemodynamic consequences and airway instrumentation of general anaesthesia. Brachial plexus block is a relatively safe and an easy procedure for upper limb surgeries. Supraclavicular approach has been routinely used in our institution for upper limb surgeries and it has proven to be a safe technique as well. The block is usually given after eliciting paresthesia.

Paresthesia technique was used till recently and presently nerve stimulator is made available in our institution. Frequently cited disadvantages of paresthesia technique include mainly patient discomfort on eliciting paresthesia and that its success is highly dependent on the cooperation of the patient.

Initial seeking current we used was 2 mA and minimum stimulating current was 0.5 mA with which clear motor twitch of all fingers was elicited and local anaesthetic solution injected.

Onset of sensory block

To determine the onset of analgesia and anaesthesia we performed our assessment at the sensory areas of the median, ulnar, radial and musculocutaneous nerves and found that the onset of analgesia and anaesthesia in radial, median and ulnar nerve distributions were shorter in the nerve stimulator group than the paresthesia group. In paresthesia group it is 13.6 min and 11.08 min in nerve stimulator group in radial nerve distribution. In median nerve distribution it was 11.04 min in nerve stimulator group and 13.65 min for paresthesia group. Along the distribution of ulnar nerve paresthesia group showed an onset time of 14.95 min and nerve stimulator group 11.24 min. There is significant difference clinically as well as statistically as the p value is less than 0.001. Onset time of sensory block with use of nerve stimulator in our study was within 10-15 min which concurs with study conducted by Carlo D Franco[8] who found anaesthesia onset in all four major nerves to be within 10.9+5.4.

Onset of motor block

In our study the paresthesia group showed an onset time of 19.44 min and nerve stimulator group 17.72 min. There is statistically no significant difference.

Duration of blockade

The duration of analgesia has not been compared in many of the studies. Mean duration of sensory blockade in paresthesia group was about 4.79 hours and this corresponds to the results of Shrestha BR[51] and Kothari et al.[17]The mean duration of analgesia was around 5.04 hours in nerve stimulator group and corresponds to results of Carlo D Franco et al.[52]We found a longer duration of analgesia using nerve stimulator. This is probably due to the fact that nerve locator allowed more precise and closer deposition of local anaesthetic around the nerve. There was no neurological complications following peripheral nerve blocks i.e. post block neuralgia. Horlocker and colleagues[11] retrospectively reviewed 607 patients who underwent axillary blocks and found that there was not a statistically significant difference in postoperative "neurologic complications" between the transarterial and paresthesia techniques. However, in our study there was no incidence of acute nerve injury in the initial 48 hours postoperatively. Since most of our patients were discharged on fourth day of surgery, further follow up for any neurological sequelae was not possible. Fear of pneumothorax limits the use

of supraclavicular technique. The incidence of pneumothorax with the classic supraclavicular technique ranges from0.5% to 6%.[56]Many authors have studied the anatomy of brachial plexus and analysed methods to prevent pneumothorax. These include use of several modifications of supraclavicular block such as modified lateral technique[17] or plumb bob approach. No patients in our study showed any clinical evidence of pneumothorax. We believe that avoidance of supraclavicular block for fear of pneumothorax is detrimental to our patients because this technique provides an unrivaled rapid onset of predictable upper extremity anaesthesia, which is an advantage in a busy surgical practice.

In our study it was found that multiple puncture and conversion to general anaesthesia occurred more frequently in the paresthesia group. This finding is supported by a study by Niazi Gazani Masoud et al.[57] regarding the complications of supraclavicular block of brachial plexus using compound classic and perivascular techniques. He found that hematoma prevalence ratio in multiple insertions to single insertion was 14:1 and there was significant relationship between times of insertion and hematoma development.

V. Conclusion

From our study it was concluded that:

- Onset of sensory block was shorter in nerve stimulator group
- Onset of motor block was also shorter in nerve stimulator group.
- Duration of analgesia was longer with nerve stimulator group.
- Incidence of multiple puncture and conversion to general anaesthesia was significantly less with nerve stimulator group.

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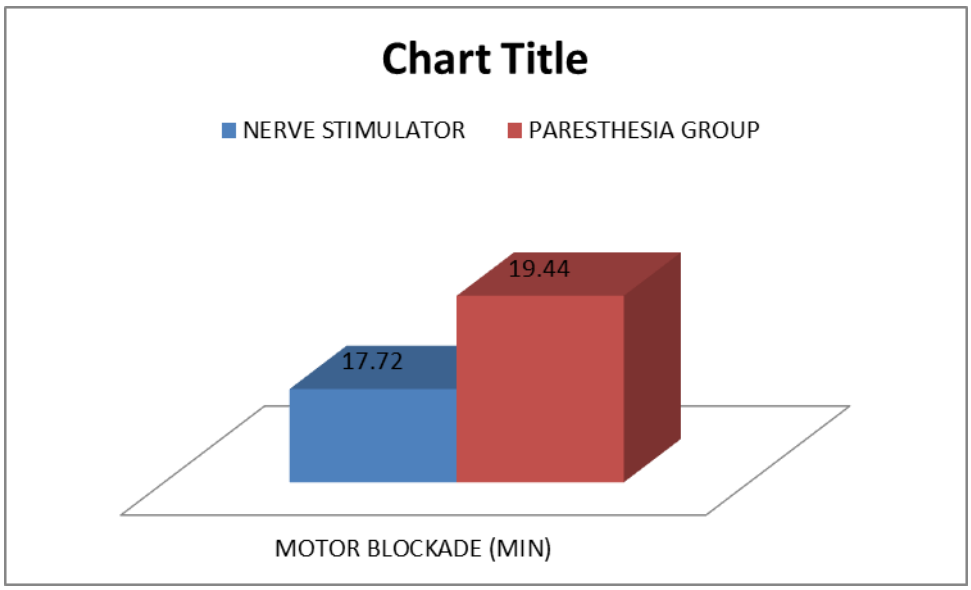
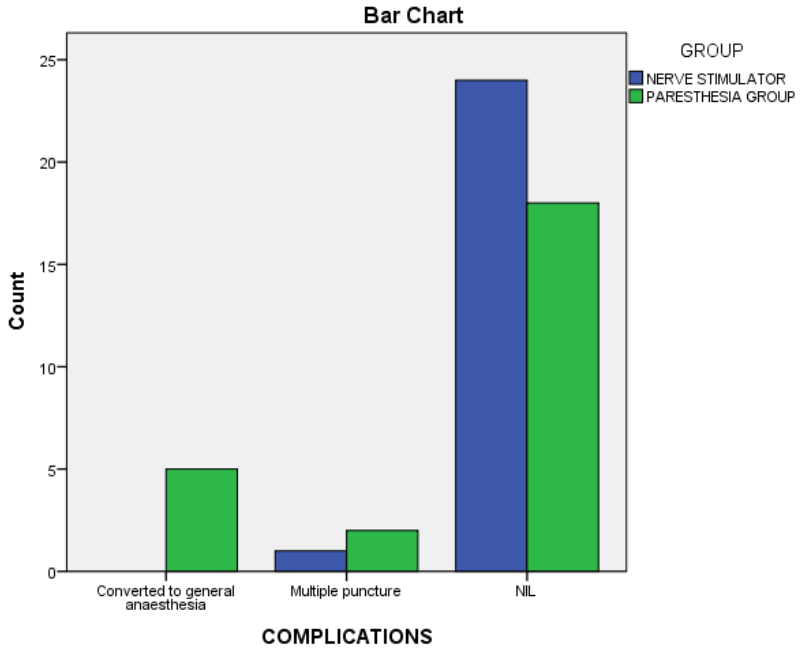
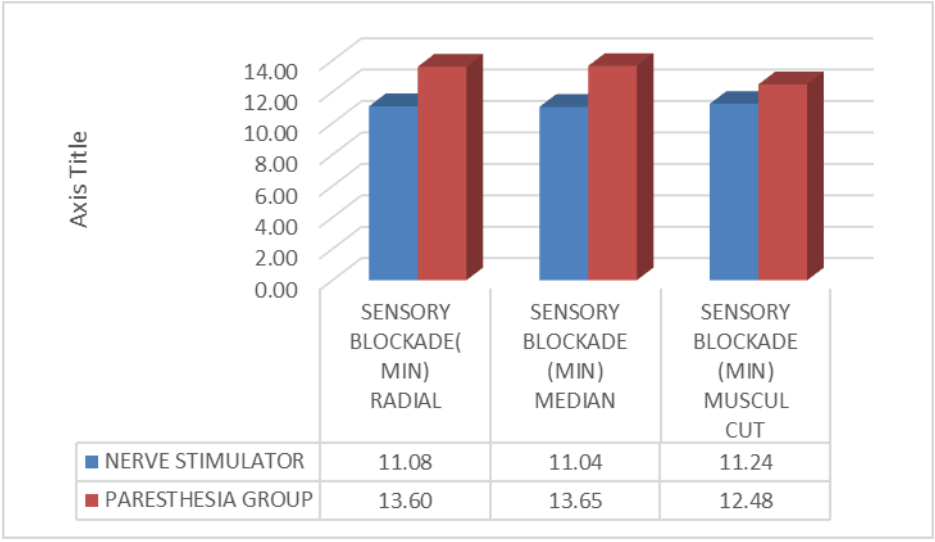


There is no statistically significant difference in motor blockade onset between the two groups.



There seems to be a significant higher percentage of GA convertion seen in case of paresthesia group. P value is 0.045 as seen in the sig column of the table above



	SENSORY BLOCKADE(MIN) RADIAL	SENSORY BLOCKADE (MIN) MEDIAN	SENSORY BLOCKADE (MIN) MUSCUL CUT
NERVE STIMULATOR	11.08	11.04	11.24
PARESTHESIA GROUP	13.60	13.65	12.48

Onset of sensory block