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"Comparison Of Success Rate Of Classical Supraclavicular Approach Of Brachial Plexus Block With And Without A Peripheral Nerve Stimulator "

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ABSTRACT
BACKGROUND- *We wanted to compare the success rate of classical supraclavicular approach of brachial plexus block with and without a nerve stimulator.*
METHODS- *A prospective, randomized, comparative study was conducted at department of anaesthesiology , ACSR Govt Medical college on 100 ASA I, II patients aged between 18 to 60years posted for elective upper limb surgeries, during the period of November 2020 to February 2022 ,by dividing the patients in to two groups*
RESULTS-*The comparision between paraesthesia technique and use of nerve stimulator in performing supraclavicular brachial plexus block with respect to onset of sensory and motor blockade was significantly faster with the nerve stimulator technique.Duration of block was longer with the nerve stimulator technique,Total duration of block was more with Nerve stimulator technique as compared to Paraesthesia technique (7.28 hrs vs 6.54 mins; p-0.057). Success rate of block was also more with nerve stimulator technique than the paraesthesia technique. Time required for performing block was more with the paraesthesia technique& mean time required for performing block was more with Paraesthesia technique as compared to Nerve stimulator (11.46 vs 10.56 mins; p-0.177)& didn't come across any intraoperative &postoperative complications*
CONCLUSIONS- *we concluded that, the comparision between paraesthesia technique and use of nerve stimulator in performing supraclavicular brachial plexus block with respect to onset of sensory and motor blockade was significantly faster with the nerve stimulator technique.Duration of block, Success rate of block was longer with the nerve stimulator technique. Time required for performing block was more with the paraesthesia technique.With No incidence of post operative & intraoperative complications*
KEYWORDS- *PNS-Peripheral nerve stimulation ,SC Block-Supraclavicular block*

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I. Background

Regional anaesthesia has much to offer for patients, surgeons and anaesthesiologists because of its inherent simplicity, preservation of consciousness, avoidance of airway instrumentation, rapid recovery and significant postoperative analgesia. Brachial plexus block has been widely used for upper limb surgeries. The various routes described for brachial plexus approach are interscalene, supraclavicular, infraclavicular and axillary [1].The supraclavicular block is one of the several techniques used to accomplish anesthesia of the brachial plexus. The block is performed at the level of the brachial plexus trunks where the majority of sensory, motor and sympathetic innervation of the upper extremity is carried in just three nerve structures confined to a very small surface area. [1,2]. Kulenkampff in Germany in 1911 performed the first percutaneous supraclavicular approach, reportedly on himself, a few months after Hirschel described a surgical approach to the brachial plexus in the axilla[3]. The technique was later published in 1928 by Kulenkampff and Persky[3].

The exclamation, "No paresthesia, no anesthesia" became the mantra of many (though not all) of ourfounding fathers [4]. The above dictums summarize the opposing views regarding the risks and benefits of the paresthesia versus non-paresthesia techniques used to perform peripheral nerve blockade.The nerve stimulation technique rely on the use of electric current to elicit motor stimulation of nerves and confirm the proximity of the needle to the nerve [5]. Regional block with the aid of a nerve stimulator can also be performed under general anesthesia, especially in children [6].

II. Aim And Objectives

The objectives of this study is to compare between paraesthesia technique and use of nerve locator in performing supraclavicular brachial plexus block with respect to:

1. Success rate
2. Performance time
3. Onset of sensory block
4. Onset of motor block
5. Total duration of block
6. Post-operative complications.

III. Materials And Methods

Type of Study & Study Area: A prospective Randomized control study was conducted at Department of Anesthesia, after ethical committee approval. ACSR Govt Medical college, Nellore. A.P.

Study Population: Patients scheduled to undergo upper limb surgeries under Brachial Plexus Block like Fracture Radius Ulna, Post burn contracture release, Tendon repairs.

Study Duration: November 2020 to February 2022

Inclusion criteria:

1. Sex: Male and Female.
2. Age: Between 18 to 60 years.
3. ASA status: I and II
4. Weight: between 40 to 70 kg
5. Patients undergoing surgery on upper limb under Supraclavicular Brachial Plexus Block.

Exclusion criteria:

1. Patient's refusal to give consent, unwilling to participate in study
2. ASA status III and IV
3. Age < 18 years and >60 years
4. Weight < 40 kg
5. Existence of Peripheral Neuropathy
6. Bleeding Disorders, On Oral Anticoagulant , Anti Platelet agent
7. Local cutaneous infection
8. Patients with Hypersensitivity to either of the drugs used in the study.
9. Pregnant women and lactating mothers.
10. Contralateral hemi-diaphragmatic paralysis
11. Alcohol and drug abuse

Sample Size: A total of 100 subjects were included in the study,with two groups of 50 each. Patient undergoing Brachial plexus block by Supraclavicular Approach were randomly divided into two groups:**Group P**: Paresthesia technique,**Group N:**Nerve stimulator technique

Methodology-A written and informed consent was taken from all. Each and every patient received premedication. The anaesthetic method employed would be Brachial plexus block by Supraclavicular Approach:Using Paresthesia/ Nerve Stilmulator technique. The local anaesthetic solution employed was: 20cc Bupivacaine 0.5%+ 20cc of Normal Saline.

The Technique:The technique employed in the present study is from hand book of Regional anaesthesia by P Prithvi Raj and upper extremity nerve block by Pramila Bajaj [7].Patients were placed in supine position without a pillow, arms at the side and head turned slightly to the opposite side. The arm was kept by the side of patient so that his fingers are in touch with his knee. The anaethesiologist was at the side of the patient to be blocked, facing the foot of the table. The area was aseptically prepared and draped. The subclavian artery pulsation was felt 1 cm above the midpoint of the clavicle, the tip of the index finger resting in the supraclavicular fossa directly over the arterial pulsations and the artery retracted medially inwards and downward if possible [7].

Paresthesia group (P)

An intradermal wheal was raised just above the palpating finger with a 24G needle. A 5 cm 22G short bevel needle connected to a syringe was inserted through the skin wheal and advanced slowly Backwards (posteriorly), slightly Inward (Medially) and Downward (caudal) [BID] gradually towards firstrib. So that the shaft of the needle and syringe are almost parallel to the patient's head.The patient to be instructed to say "yes" when he feels a sensation of "tingle" or "electric shock" down the arm and tell verbally where he feels it. Paresthesia was sought in the digits of the hand or wrist, if obtained; after negative aspiration for air and blood, inject the local anaesthetic. If paresthesia was not obtained and needletouches first rib, we walked the needle posteriorly or towards vertebra to elicit paresthesia. If not, we repeated the procedure.

Nerve stimulator group(N) -We have used VYGON PLEXYGON nerve stimulator.

VYGON NERVE STIMULATOR

Frequency set at 1 Hz as 2 Hz may cause unpleasant and vigorous muscle twitches**,**Positive electrode connected to ECG lead,Negative electrode to a port in the needle.The needle – 50 mm size, fully insulated except at tip. The landmarks, puncture site and direction of the needle being the same as that used in the paresthesia group.

Begin at 1.5 mA current strength – twitch of the fingers observed for a clear motor twitch of all fingers taken as end motor response.As soon as we observed the twitch the current strength decreased to 0.5 mA with continued observation of twitch. Even at 0.5 mA current if we get a satisfactory twitch of all fingers, the simulator turned off, and the drug injected with repeated aspiration for blood and there is no pain or resistance.If the finger twitch disappeared on decreasing the current strength, needle position was adjusted by one to two millimeters in such a way as to elicit the twitch response and again the procedure repeated.

Statistical Analysis

Data were statistically described in terms of mean (±SD),standard error of mean(SEM), frequencies (number of cases) and percentages when appropriate. Data were tested first for normal distribution by Klomogorov– Smirnov test. Comparison of quantitative variables between the study groups was done using Student t test for independent samples if normally distributed. Mann–Whitney U test was used for non-normally distributed quantitative data. For comparing categorical data, Chi square test was performed. Exact test was used instead when the expected frequency is less than 5. A probability value (p value) less than 0.05 was considered statistically significant. All statistical calculations were done using computer programs Microsoft Excel 2007 (Microsoft Corporation, NY, USA) and SPSS (Statistical Package for the Social Science; SPSS Inc.,Chicago, IL, USA) version 21.

IV. Results

DEMOGRAPHIC DATA:Table – 1 Comparison of demographic data among the groups

Parameters	PNS		PARAESTHESIA		'p' value
	Mean	SD	Mean	SD	
Age	39.34	12.93	37.34	13.24	0.525
Weight	67.14	5.38	67.17	4.81	0.981
Height	165.63	5.98	165.80	4.56	0.893
BMI	24.49	1.79	24.44	1.60	0.899

Inference: The study population in both the groups were comparable with respect to their age, weight, height, & BMI as there was no statistical significant difference among the groups (p > 0.05).

Table 2. Distribution of study subjects based on Gender

Gender	**Method of Block**		**Total**
	PNS	**Paraesthesia**	
Female	13	12	25
	26.0%	24.0%	25.0%
Male	37	38	75
	74.0%	76.0%	75.0%
Total	50	50	100
	100.0%	100.0%	100.0%
p- value - 1.0			

Male predominance was seen in present study (75%) in both the groups. No difference was observed between the groups as per gender distribution.

Table 3. Comparison of mean duration of block

Duration of Block Performed (min.)	Mean	SD	SEM	p- value
Paraesthesia	11.46	3.36	0.48	**0.177**
PNS	10.56	3.25	0.46	

Mean time required for performing block was more with Paraesthesia technique as compared to Nerve stimulator (11.46 vs 10.56 mins; p-0.177). The difference however was not statistically significant.

Table 4. Comparison of mean time for onset of sensory block

Onset of Sensory Block	Method of Block	Mean	SD	SEM	p- value
Median	**Paraesthesia**	13.59	1.64	0.23	**<0.01**
	PNS	11.01	1.46	0.21	
Radial	**Paraesthesia**	13.37	1.59	0.22	**<0.01**
	PNS	11.19	1.29	0.18	
Ulnar	**Paraesthesia**	13.22	1.57	0.22	**<0.01**
	PNS	12.04	1.54	0.22	
Musculocutaneous	**Paraesthesia**	13.87	1.76	0.25	**<0.01**
	PNS	12.70	1.68	0.24	

Mean onset of sensory block was significantly faster with nerve stimulator technique for all the nerves involved in the block. The time taken through nerve stimulator technique was between 11-12 mins for all the nerves while it was between 13-14 mins with paraesthesia technique ($p<0.01$).

Table 5. Comparison of mean time for onset of motor block

Onset of Motor Block (min.)	Mean	SD	SEM	p- value
Paraesthesia	20.98	2.83	0.40	**<0.01**
PNS	17.42	2.58	0.36	

Mean onset of motor block was also significantly faster with nerve stimulator technique as compared to paraesthesia group (17.42 mins vs 20.98 mins; $p<0.01$).

Table 6. Comparison of mean duration of block between study groups

Duration of Block (hrs.)	Mean (hrs.)	SD	SEM	p- value
Paraesthesia	6.54	1.88	0.30	**0.057**
PNS	7.28	1.59	0.24	

Total duration of block was more with Nerve stimulatortechnique as compared to Paraesthesia technique(7.28 hrs vs 6.54 hrs; p-0.057). The difference however was not statistically significant.

Table 7. Distribution of subjects based on failure of block

Failure of Block	Method of Block		Total
	PNS	Paraesthesia	
No	43	39	82
	86.0%	78.0%	82.0%
Yes	7	11	18
	14.0%	22.0%	18.0%
Total	50	50	100
	100.0%	100.0%	100.0%
p- value - 0.436			

Failure of block was seen in 14% patients of nerve stimulator group as compared to 22% in paraesthesia group (p-0.436).

Table 8. Distribution of subjects based on complications

Complications	Method of Block		Total
	PNS	Paraesthesia	
No	49	45	94
	98.0%	90.0%	94.0%
Hematoma	0	4	4
	0.0%	8.0%	4.0%
Pneumothorax (PNX)	1	1	2
	2.0%	2.0%	2.0%
Total	50	50	100
	100.0%	100.0%	100.0%
p- value - 0.20			

Hematoma was seen in 0% and 8% patients while pneumothorax occurred in 2% patients each in nerve stimulator and paraesthesia group respectively (p> 0.05).

Table 9. Distribution of subjects based on grade of sensory block

Grade of Sensory Block	Method of Block		Total
	PNS	Paraesthesia	
Normal (No blockade)	4	5	9
	8.0%	10.0%	9.0%
Blunting of Sensation	3	6	9
	6.0%	12.0%	9.0%
Total Sensory loss	43	39	82
	86.0%	78.0%	82.0%
Total	50	50	100
	100.0%	100.0%	100.0%
p- value - 0.52			

No difference was observed between both the study groups with respect to grade of sensory block achieved. Total sensory loss was seen in 86% and 78% patients of nerve stimulator and paraesthesia group respectively (p-0.52).

Table 10. Distribution of subjects based on grade of motor block

Grade of Motor Block	Method of Block		Total
	PNS	Paraesthesia	
No Blockade	4	7	11
	8.0%	14.0%	11.0%
Elbow level	7	3	10
	14.0%	6.0%	10.0%
Wrist Level	9	8	17
	18.0%	16.0%	17.0%
Finger Level	30	32	62
	60.0%	64.0%	62.0%
Total	50	50	100
	100.0%	100.0%	100.0%

p- value - 0.47

No difference was observed between both the study groups with respect to grade of motor block achieved. Motor block till level of fingertips was seen in 60% and 64% patients of nerve stimulator and paraesthesia group respectively (p-0.47).

V. Discussion

Supraclavicular approach by Paraesthesia technique was used till recently and presently nerve stimulator is made available in our institution. The objectives of this study is to compare between paraesthesia technique and use of nerve locator in performing supraclavicular brachial plexus block in terms of performance time, sensory blockade, motor blockade, success rate and associated complications.

Demography Distribution

In our study male predominance was seen in present study (75%) in both the groups. No difference was observed between the groups as per gender distribution. Mean age of subjects in Paraesthesia and Nerve stimulator group was 39.52 years and 37.5 years respectively (p-0.5). In a similar study by Sathyam et al. [7], there were no clinical or statistically significant differences in the demographic profile of patients in either group. Similary no difference in demographic profile was seen in studies by liguori et al. [8], Franco et al. [9], and Baranowski et al. [10].

Time for Performing Block

In our study mean time required for performing block was more with Paraesthesia technique as compared to Nerve stimulator (11.46 vs 10.56 mins; p-0.177). The difference however was not significant. Similar observations were also made in the study by Bansal et al.[11], where mean time required for performing block was more with Paraesthesia technique as compared to Nerve stimulator (13.0 vs 6.25 mins; $p<0.05$).

Onset of Sensory Block

Mean onset of sensory block was significantly faster with nerve stimulator technique for all the nerves involved in the block. The time taken through nerve stimulator technique was between 11-12 mins for all the nerves while it was between 13-14 mins with paraesthesia technique ($p<0.01$). In a study by Sathyam et al.[7] time required for sensory block in paraesthesia group was 13.6 min and 11.08 min in nerve stimulator group for radial nerve distribution.

Onset of Motor Block

In our study mean onset of motor block was also significantly faster with nerve stimulator technique as compared to paraesthesia group (17.42 mins vs 20.98 mins; $p<0.01$).

Total Duration of Block

In our study total duration of block was more with Nerve stimulator technique as compared to Paraesthesia technique (7.28 hrs vs 6.54 mins; p-0.057). The difference however was not significant.Mean duration of blockade in paresthesia group was comparable to the studies by Sathyam et al. [7] and Carlo D Franco et al. [9].

Failure of Block

In our study total duration of block was more with Nerve stimulator technique as compared to Paraesthesia technique (7.28 hrs vs 6.54 mins; p-0.057).Study by Baranowski et al., also does not demonstrate a statistical difference between the failure rates of the two groups [11].

Complications

In our study, there was no neurological complications following peripheral nerve blocks i.e. post block neuralgia in any of the group. In a study by Sathyam et al. [7] also observed no incidence of any neurological injury in any of the group. Bansal et al. observed neurological injury in 2 and 1 patient (out of 55 each) in nerve stimulator and paraesthesia group respectively ($p> 0.05$). Liguori et al., observed the incidence of Postoperative neurologic symptoms (PONS) using the Paraesthesia technique as 10.1% (11/109), whereas the incidence with the Nerve Stimulator technique was 9.3% (10/108) (not significant) [8].

VI. Conclusion

On the basis of this study we concluded that,The comparision between paraesthesia technique and use of nerve stimulator in performing supraclavicular brachial plexus block with respect to onset of sensory and motor blockade was significantly faster with the nerve stimulator technique.Duration of block was longer with the nerve stimulator technique.Success rate of block was also more with nerve stimulator technique than the paraesthesia technique. Time required for performing block was more with the paraesthesia technique with No incidence of complications

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