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Comparison between ultrasound guided and landmark – based technique for superficial cervical plexus block in patients undergoing thyroid surgery

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Abstract

Background: The major advantage of ultrasound guided technique over the traditional landmark technique in bilateral superficial cervical plexus block is that, it helps to minimize the injury to cervical muscle, fascia and nerves. The study aimed to compare the effectiveness between landmark technique and ultrasound guided technique with respect to the post-operative analgesia, intra-operative hemodynamics and the complication rate of the procedure.

Methodology: A total of 100 patients were included as our study sample which was divided into two groups of 50 each. Group A patients received Superficial Cervical Plexus Block (SCPB) using the landmark based technique and Group B patients received SCPB under ultrasound guided technique. Parameters such as success of the procedure performance time, time of onset of action, block pain score, post-operative pain score, intra-operative hemodynamics and complication rate were compared between the two groups.

Results: The success rate of the block was found to be 72% in the landmark technique group compared to 90% in the ultrasound guided group. The onsite time of analgesia was found to be much earlier in ultrasound guided group (16.2 vs 11.1 mins). The hemodynamic parameters were found to be slightly higher among the landmark group compared to ultrasound guided group. Post-operative pain score was significantly better and the incidence of complication rate was nil among ultrasound guided group.

Conclusion: Ultrasound guided technique is a better alternate for landmark technique for providing bilateral superficial cervical plexus block while performing thyroidectomy surgery.

Keywords: cervical plexus block; landmark technique; ultrasound technique; thyroidectomy

Introduction

Thyroidectomy is a common surgery done for thyroid diseases which is normally performed under general anesthesia with controlled ventilation. Generally combination of general anaesthesia with regional anaesthesia is a preferred technique in order to have intra operative hemodynamic stability, good recovery and pain free post-operative period. Following thyroid surgery normally patients would experience a moderate intensity of pain for which they would be requiring Opioids analgesics or Nonsteroidal anti-inflammatory drugs (NSAIDs) [1]. NSAIDs are relatively well tolerated and does not have any known side effects except for the risk of post-operative bleeding and opioids can result in side effects like nausea, vomiting, sedation and urinary retention [2]. Recent studies have suggested that the modern concept of inducing post-operative

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analgesia is through regional nerve block, which has been reported to decrease mechanical hyperalgesia that is caused by inflammation [3]. Bilateral Superficial cervical plexus block is the commonest regional nerve block which is used as a supplementary regional block along with general anesthesia in thyroid surgeries. The superficial cervical nerve roots provide sensation to the skin and superficial structures of the ear auricle, acromioclavicular joint, clavicle and anterolateral part of the neck [4].

Superficial cervical plexus block is normally injected behind the lateral border of the sternocleidomastoid muscle, which induces surface anaesthesia to the neck. Two point injection technique or three point technique is adopted for the cervical plexus block, the advantage of following a three point injection technique is it blocks the transverse cervical branches of the plexus as well [5]. The common complications that has encountered in superficial cervical plexus blockade is e hoarseness, hematoma, and local anesthetic toxicity. BSCPB also showed increased analgesic quality when compared with local infiltration. Bilateral superficial cervical plexus block can be performed by using traditional landmark technique and the ultrasound guided technique [6]. Understanding the detailed configuration of the cervical fasciae is essential to a successful superficial cervical plexus blockade as it plays a substantial role in the diffusion of local anesthetic solution [7]. The major advantage of ultrasound guided technique over the traditional landmark technique is that under the ultrasound guidance various important landmarks such as the cervical muscles, cervical vertebrae, large vessels, nerves, and the cervical fascia could easily and more accurately be identified which would help in effective nerve blockade and also minimize the complications due to cervical regional block [8].

Few studies done in western countries had shown that ultrasound guided technique was more effective than landmark technique for providing superficial cervical block with respect to the pain score and the complication rate [2,4,5]. In India as such not much studies was conducted to compare the effectiveness between these two techniques and so the present study was undertaken to compare the effectiveness between landmark technique and ultrasound guided technique with respect to the post-operative analgesia, intra-operative hemodynamics and the complication rate of the procedure.

Methodology

A prospective randomized double blinded study was conducted for a period of one year from March 2021 to February 2022 at Govt Mohan Kumaramangalam Medical College Hospital, Salem to compare the efficacy between landmark technique and ultrasound guided technique for Bilateral Superficial Cervical Plexus among patients undergoing thyroid surgeries. The study was started after getting approval from the institutional ethics committee and the informed consent was obtained from all the subjects involved in the study.

A total of 100 patients were included as our study sample. A non-random purposive sampling was followed by the investigators to derive the sample size of 100 subjects. The entire sample was divided into two groups as group A and group B of 50 each. Patients aged 20 and above, BMI <30 kg/m^2, ASA grading I – III, Malampatti grade I and II and patients in euthyroid state were considered as inclusion criteria for selection of our study subjects. Pregnant female, patients with difficult airway, poor lung compliance and retrosternal goitre were excluded from the study. After the pre-anaesthesia work up the study subjects were randomly assigned into two groups by a closed envelope method. Group A patients received Superficial Cervical Plexus Block (SCPB) using the landmark based technique and Group B patients received SCPB under ultrasound guided technique. 10 ml of 0.25 % bupivacaine was used as a local anaesthetic for both the groups. All Patients were pre-medicated with inj glycopyrolate 10 ug/kg i.m after which the general anaesthesia was induced. The injection containing local anesthetic was given to Anesthesiologist who was performing the procedure The specific injections used for block was neither known to the patient, surgeon, Anesthesiologist nor the Doctor who was involved in the assessment of pain score at PACU.

In the landmark technique the patient was positioned supine, with head turned slightly toward the non operative side. Under full strict aseptic precaution, needle puncture site was identified as mid portion of the posterior border of the sternocleidomastoid muscle. 25 G block needle inserted at midpoint of the posterior border of the sternocleidomastoid muscle, 3 ml of 0. 25 % bupivacaine local anesthetic was injected. Needle was then directed upwards towards the mastoid process and 4 ml of local anaesthetic was injected while withdrawing the needle. The needle was then directed towards down to clavicle and another 4ml of local anesthetic was administered while withdrawing the needle. The same procedure was performed in the opposite side as well.

In the Ultrasound guided technique, patient was positioned lateral side with the operative side being upper most. Using Ultrasonogram high frequency linear probe (10 – 12 HZ), the mid portion of the

sternocleidomastoid muscle was scanned in a coronal section to identify the inter muscular plane between the sternocleidomastoid muscle and scalenus muscles. Using a in plane technique 25 G needle was inserted in the inter muscular plane and 10 ml of 0.25 % bupivacaine was injected.

The following parameters were assessed between the two groups: (a) Success of the procedure, (b) Performance time, (c) Time of onset of action, (d) Block pain score, (e) Post-operative pain score, (f) Intra-operative hemodynamics, (g) Complication rate.

At the end of surgery, patient was reversed with 50ug/kg of neostigmine with 10ug/kg of glycopyrolate. Patient was extubated after adequate neuromuscular recovery. Patient was shifted to PACU for observation. Pain score was assessed using VAS score for every 5 mins. For patient with VAS score > 4, rescue analgesia in the form of I.V Acetaminophan 10mg/kg i.v was administered. Patients were observed for complications related to procedure and were recorded.

All data were entered and analysed using SPSS version 24. Mean and SD were calculated for all continuous variables. Student "t" test and chi-square test were used to derive the statistical inference between the two groups.

Results

The study was conducted with 100 subjects which were divided into two groups of 50 each. Group I was the landmark group and group II was the ultrasound guided group. Demographic variables such as age and gender were almost similar among both the groups and similarly the anthropological variables like weight, height and BMI did not show significant difference between the two groups. This shows that the two groups were exactly matched before the start of the study (Table 1).

Table 1: Demographic and anthropological variables between the two groups.

Variable	*Group I (Landmark group) (n=50)*	*Group II (ultrasound guided group) (n=50)*	*P value*
Age (mean ± SD)	46.1 ± 9.3	41.7 ± 7.4	0.108#
Gender	M – 21 F – 29	M – 22 F – 28	0.790*
Weight (mean ± SD)	56.7 ± 7.7	57.9 ± 7.4	0.530#
Height (mean ± SD)	152.6 ± 10.6	154.6 ± 7.1	0.233#
BMI(mean ± SD)	24.6 ± 2.7	24.1 ± 1.8	0.675#

Abbreviations: # - P value derived by applying student t test; *- P value derived by applying Chi-square test.

All the subjects in our study have undergone either sub-total thyroidectomy or near total thyroidectomy and the duration of the surgery was between 90 and 100 mins which was almost similar among both the groups. The success of the superficial cervical plexus block was assessed based on the perseverance of the pain experienced by the patients after the block, and based on this the success of the block was 72% in the landmark technique group and it was 90% in the ultrasound guided group and this difference was found to be statistically significant (p<.05). The onsite time of analgesia was found to be much earlier in group II compared to group I (16.2 vs 11.1 mins) and the difference was statistically significant (p<.05). The incidence of complication in the form of vascular puncture was found to be 10% among the landmark group whereas in the ultrasound guided group there was no such complication reported (p<.05). The mean time taken for performing landmark procedure was less than one min whereas the ultrasound guided procedure took almost 2 mins (p<.05) (Table 2).

Table 2: Comparison of the various factors measured during the block between the two groups.

Factors	*Group I (Landmark group) (n=50)*	*Group II (ultrasound guided group) (n=50)*	*P value*
Duration of surgery (mins)	96.8 ± 15.5	97.5 ± 16.5	0.872#
Success of the technique	36/50	45/50	0.036*
Onsite time of analgesia (mins)	16.2 ± 2.2	11.1 ± 1.6	0.0013#
Procedure time (secs)	54.7 ± 9.4	109.8 ± 11.2	<.001#
Complication due to procedure – vascular puncture	5 (10%)	0	0.0315* (derived by applying Yates correction)

Abbreviations: # - P value derived by applying Student T test; *- P value derived by applying Chi-square test.

The hemodynamic parameters such as heart rate, systolic BP, diastolic BP and the mean arterial pressure were measured between the two groups at regular intervals after inducing the block. The baseline values of all these parameters were almost similar. The heart rate was found to be higher among the landmark group compared to ultrasound guided group from the time of induction of the block till 2 hrs after the block and the difference was statistically significant (p<.05). Systolic BP was almost similar among both the groups in the first one hour and at 90th and 120th min it was found to be higher in the landmark group compared to ultrasound guided group and the difference was statistically significant (p<.05), whereas the diastolic BP did not show any significant difference between the two groups throughout the entire two hrs after induction. Similarly the mean arterial pressure also did not show any significant difference between the values till the 90th min., the MAP was found to be high in the landmark group at the 120th min compared to the ultrasound guided group and the difference was found to be statistically significant (p<.05) (Table 3).

Table 3: Comparison of hemodynamic parameters between the two groups.

Group	*Parameter*	*Before induction*	*After induction*				
		Baseline	*10 mins*	*30 mins*	*60 mins*	*90 mins*	*120 mins*
Group I	Heart rate	100.3±13.4	87±13	83.5±15.2	82.4±15.7	82.1±14.7	84.9±14.1
Group II		100±11.8	75±8.5	73.5±8.6	73.8±9.8	72.4±8.6	73.5±9.8
P value		0.927	<.001	<.001	.0150	.004	0.002
Group I	Systolic BP	139±17	119±16	122±14	121±11	124±12	128±14
Group II		142±10	112±9	116±8	116±9	117±9	118±10
P value		0.293	0.061	0.060	0.058	0.036	0.009
Group I	Diastolic BP	89±8	82±13	82±10	81±8	83±9	83±8
Group II		90±8	79±8	78±9	79±7	78±9	79±8
P value		0.747	0.213	0.090	0.365	0.074	0.082
Group I	MAP	106±10	95±15	94±12	94±9	94±11	98±10
Group II		107±8	89±9	90±9	91±7	91±8	92±8
P value		0.679	0.076	0.103	0.123	0.282	0.015

Visual analogue scale was used to assess the pain score between the two groups after inducing the block. It was found that the pain score was relatively high among the patients in the landmark group compared to the patients in the ultrasound guided group from the time of induction of the block till 2 hrs after the block and the difference was found to be statistically significant (p<.05) (Table 4). So it can be inferred that the analgesic effect is good among the ultrasound guided group compared to that of landmark group.

Table 4: Comparison of pain scores at various time intervals between the two groups.

Groups	*Pain score*				
	10 mins	*30 mins*	*60 mins*	*90 mins*	*120 mins*
Group I	2.1±0.7	2.2±0.7	2.53±0.78	2.73±1.05	2.87±0.97
Group II	1.4±0.6	1.53±0.73	1.53±0.73	1.87±0.78	2.33±0.48
P value	<.0001	<.0001	<.0001	<.001	0.010

Discussion

Post-operative pain of mild to moderate intensity following thyroidectomy procedure is normally experienced by the patients. This pain usually last for a shorter duration of time for which opioids or other analgesics is required. In the recent years regional block had gained popularity for alleviating pain after the surgery. Studies done earlier had shown that combined superficial and deep cervical plexus block is the most effective method to reduce the post-operative pain after thyroidectomy procedure. But the recent studies had proven that superficial cervical plexus block is almost in par with the combined block for minimizing the post-operative pain as well as the requirement of analgesics

during intra-operative and post-operative period [9, 10]. For providing the bilateral superficial plexus block two different methods are followed, one is the traditional landmark approach and the other one is the ultrasound guided approach. Landmark technique is the traditional technique which was used for superficial cervical plexus block but because of certain limitations with respect to the effectiveness of the block and complications such as vascular puncture, a newer approach called ultrasound guided technique was followed for superficial cervical plexus block. As such in this part of the country not many studies have been conducted to compare the effectiveness between these two techniques and so the present study was undertaken. In the present study 100 patients were divided into two groups of 50 each. For group I patients landmark technique was performed and for group II ultrasound guided technique was done for inducing superficial cervical plexus block. The demographic profiles of the patients in both the groups were comparable with respect to age, BMI and ASA Physical status and also there was no difference in the duration of surgery between the two groups.

Studies done earlier on conventional LM technique concluded that bilateral superficial cervical plexus block during thyroidectomy procedure had significantly improved intraoperative analgesia and also reduced the requirement of general anesthetic agent during the procedure and lowered the severity of pain in the postoperative period [5, 6, 8]. Another study done by Messner et al in 2007 inferred that superficial cervical plexus block made by landmark technique was found to be safe, easy to perform, and was able to reduce the consumption of morphine and improve the pain relief in the post-operative period [11]. However a study done by Eti et al showed that bilateral superficial cervical plexus block did not decrease the dosage of analgesic requirement after thyroid surgery [12]. But all these studies were performed only with Landmark technique they did compared it with the ultrasound guided group to find the efficacy between the two groups. A study done by Gurkan et al studied the analgesic effect on ultrasound-guided bilateral superficial cervical plexus block and concluded that it had a significant analgesic effect during the post-operative period among patients undergoing thyroid surgery [13]. This study also did not compared the efficacy with land-mark technique. After in-depth search of literature we found only a single article which had compared the analgesic effect between landmark technique and ultrasound guided technique, it was the study done by Senapathi et al in 2017 which inferred that US guided technique is more preferred method than that of landmark technique as, as the earlier one helps in perfect nerve localization because of direct visualization of nerves and adjacent anatomical structures and it also allows to visualize the needle movement and the spread of anaesthetic agent which makes the procedure more safer and more effective when compared to LM technique [2]. The results were almost in par with our study with respect to the onsite time of analgesia and the better pain score during the post-operative period without any vascular complications and hemodynamic instability. The effectiveness of US-guided nerve block is achieved because of accurate deposition of LA in close proximity of nerve, resulting in faster and dense block of nerve. Few case series reports had shown shortened procedure time and faster onset of action compared to conventional technique [14-16]. But in our study we found the procedure time was longer in ultrasound guided technique compared to landmark technique whereas the onset of action was faster in ultrasound guided group. The only limitation of the present study is the smaller sample size.

Conclusion

Bilateral superficial cervical plexus block performed by Ultrasound guided technique resulted in higher success rate, with faster onset and longer duration of action, without any complications and with better hemodynamic stability when compared to landmark technique among patients who had thyroid surgery.

Conflicts of interest

Authors declare no conflicts of interest.

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