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Assessment of Analgesic Efficacy of Bilateral Superficial Cervical Plexus Block for Thyroid Surgeries under General Anaesthesia: A Routine Data Based Observational Study

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Abstract

Context: Thyroid surgeries done under general anaesthesia use intravenous (iv) drugs as analgesics. A simple superficial cervical plexus block can reduce dose of iv analgesics and provide excellent analgesia. This study evaluated the analgesic efficacy of ultrasound guided Bilateral Superficial Cervical Plexus Block (BSCPB) in thyroidectomies and its opioid sparing effect.

Aim: Evaluation of analgesic efficacy of BSCPB and its opioid sparing effect in thyroidectomies.

Settings and Design: Routine data based observational study conducted during March 2017 to January 2018 in a tertiary cancer institute in South India.

Materials and Methods: The study involved fifty adult ASA I and II patients who received BSCPB with 0.5% ropivacaine 10 ml for thyroidectomies along with general anaesthesia and fifty patients without BSCPB from routine database. Postoperative pain scores for 24 hours were compared and reduction in opioid requirement in BSCPB group was analysed.

Statistical analysis: Statistical analysis was done using Statistical package for social sciences package 11 software (SPSS Inc, Chicago). Quantitative data was analysed with Student's t test and categorical data with chi-square test. Friedman two-way ANOVA was used to test significance of pain at different times in BSCPB group. Mann Whitney U test was used to compare pain score between the two groups.

Results: There was statistically significant reduction in postoperative pain in the BSCPB group (p=0.0001). The total opioid requirement showed a statistically significant reduction in the BSCPB group (mean ± SD 2.6 ± 2 vs. 6.6 ± 1).

Conclusion: BSCPB provides excellent analgesia with a reduction in opioid consumption following thyroidectomies.

Keywords: Bilateral superficial cervical plexus block; Analgesic efficacy; Opioid sparing; Thyroidectomy; General anaesthesia

Introduction

Thyroidectomies are usually done under GA and post thyroidectomy pain is regarded as of moderate intensity [1]. BSCPB is reported to provide excellent analgesia with reduction in opioid consumption. In the present study, our aim was to evaluate the efficacy of BSCPB in reducing post-operative pain following thyroidectomies. Regional blocks with GA provide excellent postoperative analgesia in Head and neck surgeries [2-4]. In this study we utilized ultrasound guided BSCPB under GA with 0.5%Ropivacaine not exceeding the maximum recommended dose [3-13]. The primary objectives were evaluation of efficacy of BSCPB in reducing post-op pain after thyroid surgeries and reduction in opioid consumption.

Material and methods

This routine data based observational study was conducted during the period March 2017 to January 2018 in the Department of Anaesthesiology

Aim of the study

To evaluate the analgesic efficacy of Bilateral Superficial Cervical Plexus Block (BSCPB) and its opioid sparing effect in thyroidectomy patients

Objectives

Primary:

1. To evaluate the efficacy of bilateral superficial cervical plexus block in reducing post-op pain after thyroid surgeries.

2. To evaluate the efficacy of bilateral superficial cervical plexus block in reducing the opioid consumption during and after thyroid surgery (first 24 hrs).

Secondary:

To evaluate the reduction in incidence of Post-Operative Nausea and Vomiting (PONV). The study population included patients undergoing total thyroidectomy under GA. After obtaining the Institutional Review Board clearance (IRB 11/2016/04), informed consent was obtained from fifty patients satisfying the inclusion and exclusion criteria, scheduled for thyroidectomy. Patients aged 18 to 60 years of ASA PS I and II were included in the study. Those patients in whom endotracheal tube was retained after surgery, those with neck dissection along with thyroidectomy, those who couldn't comprehend numerical pain score, those with documented allergy to ropivacaine and with deranged liver function were excluded from the study. The study group patients received BSCPB with 10 ml of 0.5% ropivacaine for thyroidectomies along with GA. Analgesic efficacy of BSCPB was compared between the study group patients and fifty patients who underwent total thyroidectomy without BSCPB under GA during 2016 (historical control group).

Patients were educated regarding Numerical Rating Scale on preoperative day as done routinely in our institution. Patients were educated to rate their pain between zero and ten, with zero indicating no pain and ten indicating the worst possible pain. Standard anaesthesia protocol was followed for all patients. Premedication was given with Tablet (T) Alprazolam 0.25 mg, T. pantoprazole 40 mg, T. Domperidone 10 mg at night and morning of surgery. On receiving patients to operation theatre, iv glycopyrrolate 0.2 mg, iv midazolam 0.05 mg/kg and 2 µg/kg fentanyl iv were given as premedication. GA was induced with propofol (2 mg/kg) following which endotracheal intubation was facilitated with vecuronium (12 mg/kg) followed by 0.02 mg/kg every 15 min for muscle relaxation. For maintenance of anaesthesia we used oxygen, nitrous oxide and sevoflurane to maintain a minimum alveolar concentration of 1 and End Tidal Carbon Dioxide (ETCO2) tracing at 35-40 mm Hg.

An anaesthesiologist who was well-versed in regional anaesthesia technique performed the BSCPB under ultrasound guidance after induction of GA. After induction under strict asepsis 10 ml 0.5% ropivacaine was injected after aspiration using 23 Guage1½-inch needle under ultrasound guidance superficial to the midpoint of posterior border of sternocleidomastoid, bilaterally taking care not to exceed maximum recommended dose. Vitals (heart rate, Blood Pressure) were recorded at every 3 minutes interval along with electrocardiogram, Pulse oximetry, ETCO2 and temperature. When the heart rate and blood pressure increased more than 20% from baseline, additional doses of fentanyl were given at 20 µg increments to limit the total dose to three microgram per kg. An additional dose of propofol 20 mg iv was given to maintain the vitals 20% near baseline. After the procedure, the patient was reversed from non-depolarising muscle relaxant and trachea was extubated.

Postoperative analgesia was provided with iv paracetamol one gram eight hourly. Iv fentanyl 0.5 µg/kg or morphine 0.1 mg/kg was given if pain score was more than or equal to four till the pain score came down to three. A pain score of zero to three was considered mild, four to six as moderate and above seven as severe pain. For managing PONV iv Ondansetron four mg was given. For the first 24 hours numerical pain score was measured at 4 hrs, 8 hrs, 12 hrs, 16 hrs, 20 hrs and 24 hrs. The cumulative dose of opioid used during this period was calculated. For calculation purpose total opioid requirement in both groups was converted to morphine equivalence using an online equianalgesic opioid calculator [14]. Equianalgesic conversions used in this online calculator was based on the American Pain Society guidelines and critical review papers regarding equianalgesic dosing.

For the control group, the analgesic details as well as pain scores of 50 patients who underwent thyroidectomies under GA without BSCPB were retrieved from routinely collected data. The anaesthetic protocol for GA was similar to the study group. The details regarding Numerical pain score was available from the postoperative pain assessment chart of the control group patients.

Statistical analysis

The sample size was calculated as 100 with fifty in each group to get a power of 80% with 5% level of significance, based on the study by El-Galeel et.al [7]. Statistical analysis was done using Statistical package for social sciences package 11 software (SPSS Inc, Chicago). For summarizing categorical data, frequency and percentage was used and for summarizing quantitative data, mean and standard deviation was used. Student's t test was used for the analysis of quantitative data and chi-square test was used for the analysis of categorical data. Testing of significance of pain at different time in BSCPB was done using Friedman's two-way ANOVA.

Mann Whitney U test was used to compare pain score between patients undergoing thyroidectomy with and without superficial cervical plexus block. Comparison of incidence of PONV in both groups was done using Fischer's exact test. The data with P-value <0.05 was considered statistically significant.

Results

The demographic characteristics of both the groups were

comparable with no statistically significant difference between the gender and ASA status. Of the hundred patients, seventy-six were females and twenty-four were males. Fifty-one patients belonged to ASA I and forty-nine belonged to ASA II. Analysis of postoperative pain scores in the BSCPB group showed that at zero hours 36 percentage (%) patients had no pain at rest and 21% had no dynamic pain. Maximum pain (pain score three) was experienced at 12 hours with 44% experiencing pain and thereafter the pain was scored at one and two by most of the patients.

Comparison of pain scores between the two groups using Mann Whitney U test showed a statistically significant reduction in pain scores with a p value of 0.0001 **(Tables 1 and 2).**

Table 1: Post-operative pain score at rest.

Numerical Rating Score at Rest												
Hours	**0**		**1**		**2**		**3**		**4**		**5**	
	n	%	n	%	n	%	n	%	n	%	n	%
0 hrs	36	36	24	24	30	30	9	9	1	1	-	-
4 hrs	7	7	31	31	22	22	29	29	11	11	-	-
8 hrs	1	1	20	20	14	14	33	33	16	16	16	16
12 hrs	-	-	25	25	8	8	44	44	11	11	12	12
16 hrs	13	13	44	44	28	28	14	14	1	1	-	-
20 hrs	23	23	66	66	10	10	-	-	-	-	1	1
0-No pain, 1-3 mild pain, 4-6 moderate pain, 7-10 severe pain. n: number of patients; %:percentage; hrs: hours.												

Table 2: Post-operative dynamic pain score.

Dynamic Numerical Rating Score														
Hours	**0**		**1**		**2**		**3**		**4**		**5**		**6**	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
0 hrs	21	21	23	23	16	16	32	32	8	8	-	-	-	-
4 hrs	6	6	19	19	16	16	33	33	10	10	11	11	5	5
8 hrs	-	-	4	4	12	12	27	27	15	15	28	28	14	14
12 hrs	-	-	10	10	20	20	16	16	25	25	18	18	11	11
16 hrs		-	35	35	51	51	12	12	-	-	2	2	-	-
20 hrs	-	-	50	50	38	38	11	11	-	-	-	-	-	-
0-No pain, 1-3 mild pain, 4-6 moderate pain, 7-10 severe pain. n: number of patients; %: percentage; hrs: hours.														

Table 3: Comparison of pain scores between the study and control groups.

		0 hrs Pain score at rest		0 hrs dynamic pain score		4 hrs pain score at rest		4 hrs dynamic pain score		8 hrs pain score at rest		8 hrs dynamic pain score	
		With BSCP	Without BSCP	With BSCP	Without BSCP	With BSCP	Without BSCP	With BSCP	Without BSCP	With BSCP	Without BSCP	With BSCP	Without BSCP
Median		0	2	1	3	1	3	1.5	3	2	3	3	5
Interquartile range	Q1	0	1	0	2	1	2.75	1	3	1	3	2	4
	Q3	1	2	1	3	1.25	3	2	5	3	5	4	6
Mann-Whitney		181		121.5		111		175.5		402.5		495.5	
p-value		0.0001		0.0001		0.0001		0.0001		0.0001		0.0001	
		12 hrs pain score at rest		**12 hrs dynamic pain score**		**16 hrs pain score at rest**		**16 hrs dynamic pain score**		**20 hrs pain score at rest**		**20 hrs dynamic pain score**	
		With BSCPB	Without BSCPB	With BSCPB	Without BSCPB	With BSCPB	Without BSCPB	With BSCPB	Without BSCPB	With BSCPB	Without BSCPB	With BSCPB	Without BSCPB
Median		1.5	3	2	4.5	1	2	1.5	2	1	1	1	2
Interquartile range	Q1	1	3	2	3	0	2	1	2	0	1	1	2
	Q3	3	4.25	4	5	1	3	2	2	1	1	1	2
Mann-Whitney		364		469		251		808.5		837		376.5	
p-value		0.0001		0.0001		0.0001		0.001		0.001		0.0001	
BSCPB: bilateral Superficial Cervical Plexus Block, p-value <0.05 significant.													

The sub group analysis of significance of pain scores at different time points within the BSCPB group using Friedman's two way ANOVA showed a statistically significant p value (p=0.0001) **(Table 3).**

With regard to the intraoperative hemodynamic parameters there was statistically significant difference in heart rate after induction, at surgical incision, thirty minutes and one hour after surgical incision with p value of 0.0001 as analysed by Student's t test with 95% confidence interval. Regarding intraoperative systolic and diastolic blood pressure there was statistically significant difference with a p value of 0.0001 between the two groups at surgical incision, thirty minutes and one hour after surgical incision as analysed by Student's t test with 95% Confidence interval **(Table 4).**

Student's t test was used for the analysis of total opioid consumption during the first twenty-four hours post op and was found to have statistical significance with p value of 0.0001 with 95% Confidence interval. Total opioid consumption was much less when compared to the historical control group (**Table 5**).

The mean opioid consumption was 2.640 mg (SD 2.0678) in the BSCPB group whereas it was 6.60 mg (SD 1.2495) in the historical control group. Total four patients from both the groups together experienced nausea with no events of vomiting in either of the groups. There was no statistically significant difference in occurrence of PONV between the two groups as the p value was found to be 0.617 using Fischer's exact test (**Table 6**).

Table 4: Variation of heart rate in the study and control groups.

	Group	N	Mean (bpm)	Standard deviation	p-value
Intraoperative Baseline HR	With BSCPB	50	79.66	10.476	*0.0060
	Without BSCPB	50	73.48	11.352	
Intraoperative After Induction HR	With BSCPB	50	67.66	8.747	*0.0010
	Without BSCPB	50	61.92	8.696	
Intraoperative HR at Surgical Incision	With BSCPB	50	71.54	11.968	*0.0001
	Without BSCPB	50	95.34	8.973	
Intraoperative HR at 30 Minutes	With BSCPB	50	66.62	8.832	*0.0001
	Without BSCPB	50	96.26	8.171	
Intraoperative HR at 1 hour	With BSCPB	50	66.4	6.928	*0.0001
	Without BSCPB	50	93.44	6.949	

Abbreviations: N: Frequency; BSCPB: Bilateral Superficial Cervical Plexus Block; HR: Heart Rate; bpm: beats per minute; p-value <0.05 significant.

Table 5: Variation in systolic (SBP) and Diastolic Blood Pressure (DBP) in study and control groups.

	Group	N	Mean (mm Hg)	Standard deviation	p-value
Intraop Baseline SBP	With BSCPB	50	130.3	14.534	0.214
	Without BSCPB	50	126.24	17.768	
Intraop Baseline DBP	With BSCPB	50	78.88	9.086	0.09
	Without BSCPB	50	82.26	10.59	
Intraop SBP after induction	With BSCPB	50	113.58	13.737	0.998
	Without BSCPB	50	113.62	13.269	
Intraop DBP after induction	With BSCPB	50	67.06	6.199	*0.0300
	Without BSCPB	50	70.76	10.078	
Intraop SBP at surgical incision	With BSCPB	50	116.16	14.238	*0.0001
	Without BSCPB	50	137.74	13.155	
Intraop DBP at surgical incision	With BSCPB	50	70.3	12.425	*0.0001
	Without BSCPB	50	95.6	8.352	
Intraop SBP at 30 minutes.	With BSCPB	50	111.08	9.716	*0.0001
	Without BSCPB	50	132.36	10.532	
Intraop DBP at 30 minutes.	With BSCPB	50	68.26	8.79	*0.0001
	Without BSCPB	50	91.64	10.499	
Intraop SBP at 1 hour	With BSCPB	50	112.56	8.947	*0.0001
	Without BSCPB	50	127.06	10.261	
Intraop DBP at 1 hour	With BSCPB	50	69.48	9.577	*0.0001
	Without BSCPB	50	84.52	10.712	

Abbreviations: SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure, mmHg: millimetres mercury; BSCPB: Bilateral Superficial Cervical Plexus Block; N: frequency; p-value <0.05 significant.

Table 6: Total opioid requirement in the study and control groups.

	Group	N	Mean (mg)	Standard deviation	p-value
Total opioid requirement	With BSCPB	50	2.64	2.0678	*0.0001
	Without BSCPB	50	6.6	1.2495	

Abbreviations: N: frequency; BSCPB: Bilateral Superficial Cervical Plexus Block; mg: milligrams, p-value <0.05 significant.

Discussion

Like all other surgeries, thyroidectomies are also associated with significant pain and discomfort [9]. Pain control employing various modalities like nonsteroidal anti-inflammatory agents, opioids and regional blocks can improve the surgical outcomes. One of the indications for thyroidectomies is malignancy which demands more opioid analgesics with its resultant adverse effects. In this study, we performed BSCPB immediately after the induction of GA in patients undergoing thyroid surgery using Ropivacaine 0.5% under ultrasound guidance. BSCPB significantly reduced postoperative analgesic requirement and had beneficial effects on hemodynamic parameters intraoperatively. Despite the decreased incidence of complications and significant benefits the use of BSCPB for thyroid surgeries remains limited.

Bilateral Superficial Cervical Plexus Block: The superficial cervical plexus innervate the skin of the head and neck through its branches viz; lesser occipital, great auricular, transverse cutaneous nerve of neck and supraclavicular nerves [15,16]. Superficial cervical plexus are always easier to block by landmark technique as triple point injection technique [7,9,15]. Since the neck is rich in neurovascular bundles, it is safer to perform ultrasound guided superficial cervical plexus block. For performing the block under ultrasound guidance, the transducer is placed on the lateral neck, over the sternocleidomastoid muscle at its midpoint. Once the sternocleidomastoid muscle is identified, the transducer can be moved posteriorly until the tapering posterior edge of the muscle is positioned in the middle of the screen. For superficial block, the local anaesthetic is injected superficial to the posterior edge of the muscle. Depositing the local anaesthetic beneath the posterior edge of the sternocleidomastoid muscle by piercing the investing fascia of the neck, makes it an intermediate cervical plexus block.

In our study the comparison of pain scores between both groups using Mann Whitney U test revealed a significant difference (p value 0.0001). The results of our study supported the results of Dieudonne et al. [17] who pointed out efficacy of BSCPB after thyroidectomy. Pre-emptive analgesia has the potential to prevent chronic pain syndromes. Minimising opioid usage could have oncological benefits in terms of cancer recurrence.

Admasu et al. [5] and Shih et al. [18] also demonstrated that BSCPB helped in reducing the postoperative analgesic requirement after thyroidectomy. Another study done by El-Galeel et al. [7] also quoted a statistically significant result on analgesic efficacy, reduction in postoperative opioid requirement as well as decreased incidence of PONV in BSCPB group. A meta-analysis by Mayhew et al. [19] also confirmed the same.

Our study results also confirms the efficacy of bilateral superficial cervical plexus block in reducing the postoperative pain in thyroidectomies as well as reduced use of opioids in the postoperative period. This block can be utilized for effective pain relief after thyroidectomies in the general population. Statistical analysis revealed beneficial effect in intraoperative heart rate, systolic BP and diastolic BP which invariably points that BSCPB, like any other regional anaesthetic technique is efficient enough to reduce intraoperative stress response during thyroid surgeries [2,4].

Superficial cervical plexus block can be considered as an efficient regional anaesthetic technique when combined with GA for thyroid surgery as it is devoid of serious complications like phrenic nerve palsy [4]. The success rate of BSCPB performed under real time ultrasound guidance is also very high as we could visualize the spread of injectate [20].

The incidence of postoperative nausea and vomiting following thyroid surgery is high as demonstrated in study by Vari et al. [21] and Sonner et al. [22]. It was reported by El Galeel [7] that the incidence of PONV is less after BSCPB. But in our study we couldn't find a statistically significant reduction of PONV after BSCPB.

Limitations

Patient satisfaction score during follow up visits to assess the quality of post-operative pain management would have been beneficial [23]. Subjective perception of addressed pain by the patient varied from person to person. All patients did not have same rescue opioid especially in the historical control group. Hence morphine equivalence was taken into consideration.

Conclusion

BSCPB is a low risk simple intervention that can be used as an adjunct to General anaesthesia to reduce pain during and after surgery and to minimise haemodynamic variations and the use of opioids. The reduction in opioid consumption is more important in case of malignancies, where opioid sparing is the new dictum.

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Conflict of Interest

The authors declare that they have no conflict of interest.

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