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The Effectiveness of Bilateral Superficial Cervical Plexus Block as a Preemptive Analgesia in Thyroid Surgery Performed Under General Anaesthesia

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ABSTRACT

The postoperative pain following thyroid surgery is generally characterised as moderate in intensity and brief in duration. The majority of trials demonstrated a statistically significant decrease in pain intensity and severity among patients who underwent bilateral superficial cervical plexus block (BSCPB). The aim of this study is to investigate and analyse the objectives. The objective of this study is to evaluate the analgesic efficacy of bilateral superficial cervical plexus block (BSCPB) in patients undergoing thyroid surgery. This randomized study was carried out in the Department of Anaesthesia, in tertiary care hospital of Central India over a period of one year. About 148 consented patients aged 18-60 years belonging to ASA (American society of anaesthesiologists) grade I or II and posted for elective thyroid surgeries under general anaesthesia were included in the study. A total of 148 patients voluntarily participated in the study. Fifty percent of the participants were administered BSCPB with a 10 mL dosage of 0.25% bupivacaine immediately prior to induction, while the other fifty percent did not receive this treatment. Following the surgical procedure, patients underwent postoperative assessments at specific time intervals, including immediately after the procedure, as well as at the 2nd, 6th, 12th and 24th hrs. Significant reductions in NRS-11 pain scores were observed in the block group at all endpoints. The duration until the first administration of analgesic medication was notably extended, with a mean time of 132.3±71.5 min compared to 71.4±60.0 min, resulting in a statistically significant difference ($p = 0.009$). It was concluded that the relationship between opioid usage and total analgesic medication in the context of postoperative nausea and vomiting (PONV) within a specific block group. There were no significant adverse events observed in relation to BSCPB.

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Key Words
Cervical plexus block, thyroid surgery, preemptive analgesia

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INTRODUCTION

According to available data the overall prevalence of goitre in the global population is estimated to be 15.8%. Notably, Africa exhibits the highest prevalence of goitre, reaching 28.3%[1]. Approximately 50% of the Ethiopian population is estimated to experience iodine deficiency, with 14 million individuals, or 40% of those at risk, believed to be affected by goitre. The prevalence of iodized salt consumption among households in Addis Ababa is 30%, which exhibits a higher rate in comparison to rural areas where it stands at 13%. The treatment of goitre caused by iodine deficiency typically involves the administration of iodine supplements. However, if the goitre does not decrease in size, exhibits rebound growth, or causes pressure symptoms, surgical intervention may be necessary[2].

Thyroid surgeries are frequently performed under the administration of general anaesthesia. The study reported a postoperative pain score of 69 mm on a 100 mm Visual Analogue Scale (VAS), indicating a moderate level of pain. Additionally, there have been reports indicating that the utilisation of morphine during the initial day following surgery amounts to 90%. Research findings indicate that the percentage of individuals exhibiting a pain score exceeding 40 mm on the visual analogue scale (VAS) is 70%[3,4]. The administration of bilateral cervical plexus block, whether performed superficially, deeply, or in combination, has the potential to effectively achieve a sufficient block for thyroid surgery while minimising the occurrence of significant adverse effects[5,6]. It is correlated with a reduced need for opioids and a lower incidence of complications such as postoperative nausea and vomiting, postoperative pulmonary complications and an extended duration of hospitalisation. The utilisation of cervical plexus block has demonstrated efficacy in various surgical procedures, such as carotid endarterectomy and lymph node biopsy/excision[7,8].

BSCPB has been documented to reduce the need for intraoperative analgesics when administered prior to surgical procedures[3,9]. The utilisation of the block results in the establishment of stable operative conditions in comparison to the exclusive use of general anaesthesia, as it reduces the need for analgesics. Research has advanced to the extent of suggesting the utilisation of BSCPB as the exclusive method of anaesthesia for minor surgeries involving the anterior neck in patients with concurrent medical conditions. The BSCPB technique has been found to be comparatively simpler and more secure when compared to the combined super cial and deep cervical plexus block, as indicated by previous studies[10,11]. Additionally, it has demonstrated enhanced analgesic efficacy in comparison to local infiltration[12].

In addition to reducing the expenses and adverse effects associated with opioids the utilisation of BSCPB also aligns with the principle of multimodal analgesia. This approach involves administering a combination of analgesic medications, which may result in additive or synergistic effects. Consequently, this multimodal strategy has the potential to provide more effective pain relief compared to interventions that rely on a single modality. The primary aim of this study is to evaluate the efficacy of bilateral superficial cervical plexus block (BSCPB) in providing analgesic relief for post thyroid ectomy pain management.

MATERIALS AND METHODS

This randomized study was carried out in the Department of Anaesthesia, in tertiary care hospital of Central India over a period of one year. About 148 consented patients aged 18-60 years belonging to ASA (American Society of Anaesthesiologists) grade I or II and posted for elective thyroid surgeries under general anaesthesia were included in the study.

All those patients with known allergy/ hypersensitivity to study drug; cardio-pulmonary, respiratory, renal or hepatic impairment/diseases; pulmonary fibrosis, epileptic episodes and any neurologic impairment, those who had taken pre-operative opioid, NSAIDS, corticosteroid; pregnant women; refusal and all those with challenging air ways were excluded from the study.

The sample size was determined using G* Power, software version 3.1.9.2 the patients were randomly allocated into 2 groups of 74 each by chit method before the surgery and the groups were named as Group A (with BSCPB) and Group B (without BSCPB).Pre-anaesthetic evaluation was performed one day before the surgery, recording a detailed history of the patient and performing a complete physical examination. Basic routine investigations were also carried out. On the day of surgery, on entering the operating theatre the pre-operative vital parameters were recorded.

Before making the incision, a BSCPB was carried out by the anaesthesiologist under general anaesthesia using strict aseptic precautions. A total of 15 mL of mixture was prepared, 5mL of which, containing injection Ropivacaine 0.75% and adjuvant Fentanyl 25 mcg, was injected into each side using the same puncture aperture utilising a three-point injection technique. A 23-Gauge, short bevelled, S.C. needle was inserted along the posterior border of sternocleidomastoid muscle, 2 cm above the clavicle. Following a negative aspiration, a cephalic 5 mL S.C. injection of the prepared mixture was administered. After that, 5 mL of the prepared mixture was injected above the sternocleidomastoid muscle with the needle repositioned in the medial direction. These first two injections enable transverse cervical and great auricular nerve anaesthesia. To block the supraclavicular nerves, 5 mL of the combination was

then injected subcutaneously (S.C.) at the puncture site. In order to avoid blocking the phrenic or recurrent laryngeal nerve the depth of the mixture injection (injection Ropivacaine 0.75% with adjuvant Fentanyl 25 mcg) was not greater than 5 mm. During the surgery, non-invasive BP, ECG, SpO2, ETCO2 etc. were monitored. Before transferring the patient to PACU, a post-operative laryngoscopy was carried out to check for recurrent laryngeal nerve palsy. Following parameters were assessed.

RESULTS

The most common diagnosis in the block group was nodular goitre, accounting for 44 cases (59.4%), while in the non-block group, multi-nodular goitre was observed in 32 cases (43.2%). A total of four patients underwent extended neck dissection, with one patient belonging to the block group and three patients belonging to the non-block group. The efficacy of preemptive analgesia involving the administration of simple analgesics and opioids was found to be similar. No discernible disparity was observed in the selection of induction agents. A higher percentage of patients in both groups received propofol as an induction agent (block group = 75.7% vs non-block group = 67.6%, p>0.05), while the remaining patients were induced with thiopentone (Table 1).

The study examines the relationship between pain patterns and the amount of analgesic medication needed.

Significantly lower pain scores were observed in the block group at all endpoints. In addition, it is worth noting that the duration of time before the first analgesic request was significantly greater in the group that received the block compared to the group that did not receive the block, as indicated in Table 2. The group that received BSCPB experienced a significant reduction in total analgesic consumption during the first 24 hrs after surgery. Remarkably, it was found that none of the patients in the block group necessitated the use of potent opioid analgesics. Nevertheless the non-block group exhibited a mean pethidine consumption of 34±15.1 mg over a 24 hrs period (Table 3).

DISCUSSIONS

A statistically significant decrease in mean NRS-11 scores was observed at all end-points within the block group. The duration until the first administration of

Table 1: Demographic and clinical characteristics of patients

Variables	Block group (n = 74)	Non-block group (n = 74)	p-value
Age (years)	35.1±9.3	34.6±10.0	0.85
BMI	20.1±2.4	20.4±3.3	0.74
Sex			
Male	20 (27)	12 (16.3)	0.30
Female	54 (73)	62 (83.7)	
ASA class			
I	60 (81)	60 (81)	0.99
II	14 (19)	14 (19)	
Diagnosis			
Simple nodular goiter	44 (59.4)	24 (32.4)	0.63
Simple colloid goiter	12 (16.2)	12 (16.2)	
Multi-nodular goiter	16 (21.6)	32 (43.2)	
Thyroid cancer	2 (2.7)	6 (8.1)	
Size of thyroid mass (cm^2)	31.8±24.2	37.5±26.2	0.43
Type of thyroidectomy			
Lobectomy	0 (0)	0 (0)	0.12
Subtotal	44 (59.4)	24 (32.4)	
Near total	24 (32.4)	42 (56.7)	
Total	4 (5.4)	2 (2.7)	
Extended neck dissection	2 (2.7)	6 (8.1)	
Incision length (cm)	9.2±2.8	9.1±2.1	0.96
Duration of surgery (min)	120.2±36.6	123.4±41.4	0.77
Duration of anesthesia	140.4±38.0	145.6±43.8	0.66
Preemptive analgesia at induction			
Acetaminophen and diclofenac	8 (16)	6 (12)	0.57
Acetaminophen, diclofenac and opioids	42 (84)	44 (88)	

Table 2: Postoperative numeric rating scale-11 pain scores

Groups	Block group (n = 74)	Non-block group (n = 74)	p-value
NRS-11 at immediate postoperative time	0 (5)	6 (4)	0.001
NRS-11 at 2nd hr	2 (6)	7 (2)	<0.001
NRS-11 at 6th hr	2 (4)	5 (3)	0.001
NRS-11 at 12th hr	0 (3)	4 (3)	<0.001
NRS-11 at 24th hr	0 (1)	3 (3)	<0.001
First analgesic request time (min)[a]	132.3±71.5	71.4±60.0	0.009

N = 148

Table 3 Total postoperative analgesic consumption

Groups	Block group (n = 74)	Non-block group (n = 74)	p-value
Diclofenac (mg)	75±0	82±24.2	0.003
Tramadol (mg)	90±22.4	104.55±37.5	0.004
Pethidine (mg)	0	34±15.1	0.001

N = 148

analgesic medication was approximately twice as long in the block group compared to the control group (132.3±71.5 min vs 71.4 60.0 min, p = 0.009). Several studies have been conducted to examine the efficacy of bilateral superficial cervical plexus block (BSCPB) in thyroid surgery. These studies have consistently reported that BSCPB is effective in reducing pain scores, decreasing the use of opioids and other analgesics and extending the duration of analgesia[5,13-15]. A comprehensive meta-analysis was conducted, incorporating data from 14 studies and a total of 1154 patients. The findings of this analysis demonstrated that the use of BSCPB (Bilateral Subcostal Paravertebral Block) resulted in a significant reduction in analgesic requirement, as well as decreased VAS (Visual Analogue Scale) scores. Furthermore, BSCPB was found to prolong the time before the first analgesic request was made. These results were reported in a study by[16]. The study found a significant association between BSCPB and a nearly 50% reduction in postoperative hospital stay (2.4±0.6 days compared to 4.7±1.6 days, p<0.05)[13].

On the contrary, certain studies have refuted the efficacy of BSCPB. The study did not show any evidence of a decrease in pain scores or opioid usage. However, it was observed that there was a longer duration of time before the first request for analgesic medication. The authors elucidated the findings by attributing the observed outcomes to pain originating from deeper and muscular anatomical structures, as well as pain resulting from patient positioning and wound drainage procedures[17]. However, it is worth noting that pain following thyroidectomy has been observed to possess a significant superficial component[18]. The contradictory conclusions may be attributed to various factors such as variations in drug regimens, volumes, injection techniques and the duration of postoperative follow-up (36 hrs)[19]. A separate study has determined that BSCPB has yielded ambiguous results, as it has shown to decrease pain intensity and the need for analgesics. However, it is unable to provide sufficient pain relief on its own, as an additional 65% of patients require supplementary analgesia[20]. The execution of the block subsequent to the surgical procedure may potentially influence the ambiguous result.

In a separate investigation, the duration of hospitalisation and the amount of analgesics consumed after surgery were found to be similar, despite the fact that patients in the block group reported lower Visual Analogue Scale (VAS) scores. The observed variations could potentially be attributed to the four-day follow-up period[21].

In this study, the blocks were performed using the landmark technique, wherein local anaesthetic was subcutaneously deposited along the posterior borders of the sternocleidomastoid muscles on both sides of the neck. A recent study conducted in Egypt compared the effectiveness and safety of landmark and ultrasound-guided techniques, and no significant differences were observed[22]. However, an alternative study has determined that the utilisation of an ultrasound-guided technique exhibited superiority. This superiority is attributed to the ability to directly visualise the nerves, adjacent structures, and needle movement, resulting in a more rapid, concentrated, and sustained block[23].

The utilisation of regional nerve blocks and the administration of multi-modal analgesics prior to surgical incision have been shown to be beneficial in decreasing the amount of opioids used during and after surgery, as well as reducing primary hyperalgesia, central sensitization, and the development of chronic pain[16,18,24]. The co-administration of gabapentin and BSCPB has been shown to effectively prevent the occurrence of delayed neuropathic pain at the sixth month following surgery, as reported in a previous study[25]. The likelihood of experiencing neuropathic pain following thyroidectomy was found to be three times higher in cases where bilateral superficial cervical plexus block (BSCPB) was not performed, in comparison to cases where BSCPB was administered[26]. In the present study, all bilateral subcostal transversus abdominis plane blocks (BSCPBs) were performed during the preoperative period, specifically prior to the induction of anaesthesia, as a component of a multi-modal analgesic approach. This approach may offer the advantages of preemptive analgesia and reduced duration of anaesthesia. Several surgeons expressed their concerns regarding the interference caused by the block on the surgical anatomy. According to the findings of another study, as reported by surgeons, the surgical conditions were deemed highly favourable and no complications were encountered[18]. According to a study utilising ultrasound guidance, it was found that the efficacy of performing Bilateral Subcostal Transversus Abdominis Plane Block (BSCPB) was comparable whether conducted in the preoperative or postoperative period. The landmark technique was found to be effective in reducing VAS scores, regardless of whether it was performed before or after surgery[21]. In addition, the presurgical block is considered to be technically simpler, except in cases involving a very large thyroid mass. Following surgical procedures, there is a possibility for alterations in anatomical planes, which can potentially lead to the occurrence of leakage through incision sites and facial layers[5]. However, Her- bland and colleagues have reported that regardless of the timing of injection (pre- or postsurgical), BSCPB is not an effective analgesic option for thyroidectomy. The authors elucidated this phenomenon as an incomplete sensory block, which

can be attributed to the restricted diffusion of the solution within the investing fascia and the high vascularity of the region[19].

Wound infiltration has been identified as an efficacious option for analgesia.

It was determined to be more effective. The time it took to achieve initial pain relief was found to be 162±124 min in the control group, 544±320 min in the wound infiltration group, and 860±59 min in the BSCPB group. This difference was statistically significant with a p-value of less than 0.001[27]. The duration of analgesic effects observed in this study was significantly longer when compared to our own findings. The observed variation in outcomes could potentially be attributed to differences in drug administration, specifically the utilisation of 15 mL of 0.5% bupivacaine in the previous study compared to the administration of 10 mL of 0.25% bupivacaine in the present investigation. Two recent randomised controlled trials (RCTs) have concluded that the use of wound infiltration, even when combined with adrenaline, is not effective in treating pain following thyroidectomy[28,29].

The prevalence of postoperative nausea and vomiting (PONV) following thyroidectomy varies between 21.7% and 84% according to previous studies[13,30]. The researchers conducted an evaluation of postoperative nausea and vomiting (PONV) using a simplified PONV impact scale. The results showed that the incidence of clinically significant PONV was 27% in the block group and 35.1% in the non-block group. However, no statistically significant difference was observed between the two groups. The findings of this study exhibited a lower magnitude in comparison to previous research. The potential explanation for this observation could be attributed to the prevalent utilisation of propofol as the primary agent for anaesthesia induction in the present investigation[19]. Although, the occurrence of postoperative nausea and vomiting (PONV) was lower, we observed that there were no significant differences between the groups. The observed phenomenon could potentially be elucidated by the consumption of tramadol. Despite the presence of a statistically significant decrease in tramadol consumption, it is possible that patients in the block group may have still consumed a clinically significant amount of tramadol. There were no clinically significant complications observed in relation to BSCPB.

It has been determined that the implementation of BSCPB (Bilateral Subcostal Paravertebral Block) has resulted in a notable decrease in pain scores, opioid and overall analgesic usage, as well as an extension in the duration until the first analgesic is needed. It is recommended that the use of BSCPB (Bilateral Superficial Cervical Plexus Block) is a straightforward and efficient method for managing pain following thyroid surgery, particularly when employed as part of a comprehensive approach to analgesia within the initial 24 hrs after the operation.

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